Discovery Southeast

Curriculum and Resources

Created:
November 2019

Revisions:
March 2020

Purpose

This document serves as repository for all Discovery Southeast Nature Studies curriculum and informational resources. It is intended to be a living document, meaning that if and when new curriculum is created the designated curator will add it to this document. This document serves as a valuable resource for naturalists to use in developing and teaching Discovery Southeast programs.

Use

In this document you will find all Nature Studies curriculum developed as of March 31, 2020. Use the table of contents to locate lessons and resources by topic.

Directions for the Curator if using a Mac:

To add new lesson plans or curriculum to this document take the following steps:

1) Open DSE Curriculum.pdf in Adobe Acrobat
2) Click on 'Organize Pages' located on the right hand tool menu
3) Scroll to the section desired
4) Hover your mouse to the right of the last page shown
5) Click on the blue +
6) Choose 'insert from file'
7) Select desired file from your computer and click select
8) Your document should show up in the section you chose in the DSE curriculum.pdf now
9) Please add your lesson/document to the Chronological Table of Contents and Categorical Index, and link the new entry to the appropriate page using the "Link" option in Adobe. This may result inthe changing of page numbers beyond what you just added.

Directions for the Curator if using a PC:

To add new lesson plans or curriculum to this document take the following steps:

1) Open DSE Curriculum.pdf in Adobe Acrobat.
2) Change from 'View Mode' to 'Edit Mode' by clicking on 'Tools' located on the upper, right side of the screen.
3) Scroll to the section desired (selecting the 'Page Thumbnails' view is helpful).
4) Select 'Insert from File' to add a new document.
5) Select desired PDF file from your computer.
6) A screen will appear asking which page number to insert your document after.
7) Please add your lesson/document to the Chronological Table of Contents and Categorical Index, and link the new entry to the appropriate page using the "Link" option in Adobe. This may result in the changing of page numbers beyond what you just added.

Chronological Table of Contents

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Animal Tracking and Locomotion

Aquatic Biology

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Geology

Glaciology

Human Impact

Hydrology

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Jordan Creek Curriculum (Grade 5)

Mammals

Mapping and Topography

Naturalist Narratives

Ornithology

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Snow Studies

Succession

Sun, Moon, and Stars

The Five Senses

Alaska Discovery Foundation Curriculum (1990)

SEEDS
THIRD GRADE

GOALS

• Understanding of the major methods of seed distribution (wind, water, animals, "unspecialized").
• Familiarity with some of the common plants of SE AK.
• Confidence in the power of direct observation (versus books or "experts") to answer questions about seeds and other aspects of natural history.

SLIDES - DISPERSAL STRATEGIES

Wind dispersed *Three strategies are plumed or hairy seeds, winged seeds, and tiny or dust-like seeds.*
893806 pods, fireweed *showing various stages of opening to release the plumed seeds*
893720 seed, fireweed *supermacro showing hairs and seed against millimeter scale*
894823 licorice fern *underside of fertile fronds of ferns have sori, or clusters of sporangia*
894820 individual sporangia *can be seen in each sorus; each sporangium contains tiny individual spores*
893804 alder, spruce, hemlock cones *the hemlock at bottom shown in progressive stages of opening*
893718 seed from these *alder with two wings, spruce and hemlock with one*

Vegetative spread *Many plants can move quite effectively without relying on seed reproduction.*
894824 bunchberry runners *sometimes a large patch of bunchberry leaves is a single connected plant*

Water dispersed *Most plants of fresh and salt water wetlands have floating seeds*
893820 goosetongue *shown at high tide, seed heads about to be submerged*
894812 sedge drift *salt marsh seed is deposited in huge piles at the high tide line*
894509 pondweed *aquatic plants produce flowers and seed heads at the water surface, and the floating seeds can also become attached to the plumage of waterfowl*

Animal dispersed *Seeds may travel inside animals (berries eaten), or clinging to fur or feathers.*
893802 blueberry, strawberry, elderberry, devil's club & twisted stalk *travel inside animal stomachs*
893714 seed of these *seeds in berries have hard coats, surviving digestion*
902815 sectioned blueberry *super macro showing position of seeds in the berry*
881920 bear scat with devil's club *sometimes bears can rapidly create new devil's club thickets*
901805 forest seed cycle *stages in the life cycle of a red huckleberry plant.*
894802 sidewalk plantain *one of the few plants that survives in school yards*
894820 plantain seeds *when moistened get sticky coating which adheres to shoes*
894917 hitchhikers on pile *cottongrass, large-leaved avens, bedstraw, and squirreltail grass*

"Unspecialized" *These seeds may have sophisticated dispersal strategies, but I haven't figured them out!*
894822 bomb seeds *Beach pea, black lily, lupine, iris, and yellow rattle. Definitely not wind dispersed!*
894815 pods of these *In some cases heavy round seeds may be* needed *to penetrate moss layer, and find mineral soil in which to germinate. A large seed can also carry more food to get the seed started.*

PASS OUT SEEDS TO EACH TABLE AND DISSECT WITH HAND LENSES

Encourage students to guess how each type of seed is dispersed.

SEEDS
FOURTH GRADE

GOALS
- Reinforcement, major methods of seed distribution (see 3rd).
- Familiarity with the plant *communities* of SE AK.
- Recognition that seed distribution adaptations are responses to the community that each plant lives in.
- Willingness to speculate!

SLIDES - REVIEW OF DISPERSAL STRATEGIES
Wind dispersed *Three strategies are plumed or hairy seeds, winged seeds, and tiny or dust-like seeds.*
893806 pods, fireweed *showing various stages of opening to release the plumed seeds*
893720 seed, fireweed *supermacro showing hairs and seed against millimeter scale*
894823 licorice fern *underside of fertile fronds of ferns have sori, or clusters of sporangia*
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PASS OUT SEEDS TO EACH TABLE AND DISSECT WITH HAND LENSES
Encourage students to guess how each type of seed is dispersed.

STRATEGIES BY COMMUNITY
Duplicate table on board. Each student names a plant,and we put it in the appropriate place on the table. Summarize by deciding which strategies are most important in each community.

HOW DO SEEDS TRAVEL?

Richard Carstensen
DISCOVERY FOUNDATION

		WIND: WINGS	WIND: PLUMED	WIND: TINY	BALLISTIC	?	WATER	ANIMALS: INSIDE	ANIMALS: SURFACE
DRY MEADOW	COASTAL	cow parsnip; yellow rattle	tall fireweed		Nootka lupine; violet	iris; black lily; paint-brush		Nootka rose; nagoon berry	[illegible]
	SUBALPINE					starflower			
WETLAND	YOUNG		cotton sedge	bog orchid			marsh fivefinger; bog buckbean		
	OLD (BOG)							lowbush cranberry	
	SALT MARSH						goosetongue; Lyngbye sedge; arrow-grass		squirreltail grass
BARRENS	ALPINE						alpine sorrel		
	DISTURBED		dwarf fireweed	moss (*Pogonatum*)					common plantain; large-leaved avens
FOREST	THICKET	Sitka alder		one-sided wintergreen				red elderberry; stink currant	
	EVEN-AGED			club moss; moss (*Rhizomnium*)					
	OLD GROWTH	western hemlock; Sitka spruce	rattlesnake root	rusty menziesia	fern leaf goldthread		laceflower	highbush cranberry; bunch-berry; deerberry; Alaska blueberry; red huckle-berry; early blueberry	enchanter's nightshade

	WIND			?	WATER	ANIMAL	
	WINGS	PLUMED	TINY			INSIDE	SURFACE
MEADOW	cow parsnip	dandelion fireweed	lady fern orchids	ryegrass black lily lupine iris yarrow starflower		nagoonberry strawberry baneberry false hellebore	plantain bedstraw many grasses
WETLAND					pondweed goosetongue Lyngbye sedge		pondweed pond lily water milfoil squirreltail grass
THICKET	alder	willow	wintergreens			red elderberry salmonberry	
FOREST	Sitka spruce hemlock	cottonwood	wood fern shy maiden orchids	rusty menziesia fernleaf goldthread	laceflower?	blueberry trailing raspberry bunchberry deerberry devil's club twisted stalk highbush cranberry	large-leaved avens sweet cicely enchanters night- shade

ALASKA DISCOVERY FOUNDATION

Post Office Box 21867, Juneau, Alaska 99802 (907) 463-1500

TO Harborview 3rd to 5th grade teachers
FROM Richard Carstensen
SUBJECT Preparations for preparations (?!)

Wow! You people are *efficient!* I had no idea the schedule would emerge so quickly. And I'm extremely grateful for your patience and trust. Making a useful map with half of an elementary school class is like successfully orchestrating a 15 ring circus. It's probably no accident that Patrick, who was the first to point out the missing skills and concepts, is a practised showman. Thanks, Patrick (Gee, I'm glad nobody signed up for those first two weeks!)

So here are some things you can do with your classes to "introduce my introduction". This is just the first installment in what obviously needs to be a series of letters to you on the subject of mapping. I'll begin with the provocative questions of "What" and "Why", and later get to the "How". Further letters will also have suggestions on how to gear up for "seeds", and "landforms".

First, ask "What is a map?" (Hmmmmm... We're into philosophy *already*! My dictionary says "1. A representation, usually on a plane surface, of a region of the earth or heavens. 2. Something that suggests a map in clarity of representation." A good point to make, and you'll have to translate this for your students, is that "The map is not the territory." (Who said that? Gregory Bateson?) My favorite illustration of this concept was written in to CoEvolution Quarterly from a hospital by a cross-country bicyclist. He'd been pedalling through an unfamiliar city, staring at the map taped to his handlebars, when someone opened a car door just ahead of him.

So a map is always a *representation* of reality. If it's totally accurate, it isn't a map; it *is* reality. (Is a photograph a map? By both of the definitions above, yes. And like other kinds of maps, photos can *mis*represent reality, as well as provide information about it.)

Question #2: "But if maps are by definition inaccurate, why do we make and use them?" I'll give some of my own thoughts on this, but only as catalyts for you to throw into a discussion (again, translated into 3rd to 5th grade vocabulary) It's the discussion that counts[1].

Maybe the reason we tolerate the distortions and inaccuracies inherent in maps is that they allow us to either zoom in or zoom out on our object of study. The changed perspective is *always* valuable. We can study a photo (=map) of the earth from space, or a diagram (=map) of molecular bonds. The first example is an extremely small scale map; the second is extremely large scale. Both tell us things that our eyes normally miss.

Definition On a *large scale* map, objects appear large. On a *smaller scale* map, the same objects appear smaller. People have a tough time remembering this. Is the concept too confusing for your students? If so I should simply drop the terms large and small scale. Please give me feedback.

[1] I confess that this section of the letter is in part a *defense* of mapping. I probably spend over 50% of my professional time (in research *and* education) dealing with maps of one kind or another. I never go about without a pencil and 3x5 card in my pocket, because I can't seem to converse verbally for more than 5 minutes without pulling out the card and making a map on it. One of the things I do with maps is record the flights and trails of birds and mammals on overlays, to visualize the interrelations of species. I used to think that maps were a "whiteman's invention". When I discovered (in *Maps and Dreams* Hugh Brody, 1982) that the most sacred possession of the Alberta Athabascan people was a huge map, drawn on moosehide, of the interlacing trails to heaven, I began to understand what I was really trying to do.

Thoughts on "why make maps":

• Making a map is the quickest way to get to know certain things about a place. It's the first thing I do when beginning an environmental assessment (That is, after finding out if anyone else has made one already!)

• Making a map is making a committment to a place. We say "This place is important enough to me that I'm willing to spend time here, and produce a picture that is in some way "faithful" to these trees here, or these landforms (or these molecular bonds, or these sandpiper flyways). In otherwords, a map *imitates* reality, in a more disciplined way than most other kinds of art.

• But mapping *is* art. Good maps are beautiful, and the more faithful to nature they are, the more pleasing they are to look at. To me, mapping is the most exciting intersection of art and science, because there is room to be creative, in a way that doesn't clash with scientific objectivity. Maybe one difference between a map and a piece of art is that art (at least some kinds of art) can be considered "finished", but a map is never more than a draft. As art, I'm satisfied with my 1983 Natural Communities Map of Eagle Beach, but as a map it's flawed. Like scientific inquiry, a map is just one step in the search for "truth".

• Maps are excellent ways to share information with other people. A picture is worth a thousand words. That's one reason that making maps together is such a great teaching method.

• Maps are good ways to study change. Making a series of maps of a particular place helps us detect migrations of river channels, retreat of glaciers, and construction of roads. A single map suggests that nature is static; a map series (such as the stereogram historical sequences I'm preparing for each Juneau school) overcomes that limitation. It's worthwhile pointing out, or better yet soliciting from your class, that nature never sits still. We can't understand robins without archaeopteryx, or the Harborview playground without wave deposition and glacial rebound (the school site was intertidal in the 1929 air photos!). "History" is half of "Natural History".

I hope these meanderings are useful, and not too "out there". Please let me know what works, or fails to work, as you introduce mapping in your classrooms.

Oh yes.... The compiled schedule is now posted in the teachers' room. You can either make your corrections/additions directly on to that one, or put your own form in my box. Thanks!

MAPPING INTRO
THIRD GRADE

GOALS
- Intro to basic concepts in mapping
- Learn how fourth and fifth graders have made maps

WHAT IS NATURAL HISTORY? WHY MIGHT NATURALISTS NEED MAPS?
- Locating things.
- sharing info.
- noticing change.

EXPLANATION OF CEMETERY MAPPING PROJECT Each grade's role.

PIN MODEL BOUNDARY AND DIVIDER LINES ON BOARD
Conventions: North is up. N-S lines white. E-W lines gold. Review coordinates. Always start from SW corner. String out meter tape (or pace off) to show size of a 6 meter square. Plot is 9 times bigger.

LOOK AT MODEL Explained by fourth and fifth graders

TEACHER REVIEW Practise with blank map forms, use suggestions on exercise sheet.

Prep *Arrange for 4th and 5th grader model makers to come in for last 10 minutes of class*
Bring *30 blank map sheets, explanation and exercise sheets (1 each)*

MAPPING SUMMARY
THIRD GRADE

SLIDES

880417	mapping, upper Glacier Bay
881128	mapping, lower Glacier Bay
903521	Campground control plot
903522	profiles
891615	Vancouver map
903812	modern version
883314	Eagle Beach map
903529	air photo
902823	Juneau, 1929
903535	1962
903536	1984
903001	cemetery 1984
903534	1962
902819	1929
894924	cemetery ground shot, 1945
903731	1990 retake
90	cemetery map
904107	Campbell plot
904106	Campbell profile

TO fifth grade teachers
FROM Richard Carstensen
SUBJECT preparations for contour mapping

Dear Patrick, Linda, Vicki and Shelly,

Here we go! Mapping takes careful preparation and lots of help from volunteers and parents, but it's well worth it. Mapping is a wonderful way to get introduced to a place. It results in a sense of accomplishment, and builds knowledge and skills in many areas aside from just natural history (practise with metric, math, ability to think in three dimensions, etc.)

As with last year, we hope to produce maps of forested plots in the cemetery. These plots are 18 meters on a side. There are three plots in all. Fifth grade classes will measure ground elevations on the plots, and derive contours from these elevations. Fourth grade classes will use the same plots, and map the positions of tree trunks and foliage. Third graders will visit the plots mapped by the fourth and fifth graders, and learn to orient themselves using the coordinate system.

When the fourth and fifth grade classes finished their respective maps last fall, the classes who had shared plots reported to each other on their methods and findings. This seemed to be a valuable aspect of the project. This year I will also overlay the fourth and fifth grade maps for each plot (ideally I'd like to do this with the help of a few students from each class) and give the final results to everyone who worked on that plot. Here are my suggested class groupings, based on the order of your signups on the Fall Nature Studies Schedule. These groupings would be the simplest, but if you'd like to switch around, please let me know.

	plot 1	**plot 2**	**plot 3**
Fifth grade	Moore	Jackson/Szipsky	Augustine
Fourth grade	Kotyk	Banazak	Campbell
Third grade	Mitchell	Minge/Homan	Baxter

For each grade, I'll give an indoor talk preparing you and your students for field day. On field day the idea is to divide your class in half, sending half to the cemetery for 45 minutes of mapping, followed by the second half, for another 45 minutes. I hope to have enough Discovery Foundation volunteers on field day so that the 15 or so students can divide into four teams of 3 or 4 each. It would be good if you could join us in the field for at least one of the 45 minute sessions. Regardless of how many volunteers the Foundation can enlist, please invite parents. Last year we had lots, and they had fun, even on the day that rained. Parents help keep the focus. It helps if parents who lead field teams also come to the introductory talk, but that's not essential.

General goals of mapping, applicable to all three grades

Increased spatial awareness. Ability to think in 3D.
Practise with artistic skills, accurately portraying natural features.
Introduction to methods used by surveyors and foresters (simpler equipment, but same principles).
Familiarity with the cemetery, which we will use repeatedly for nature studies this year.

Goals of contour mapping

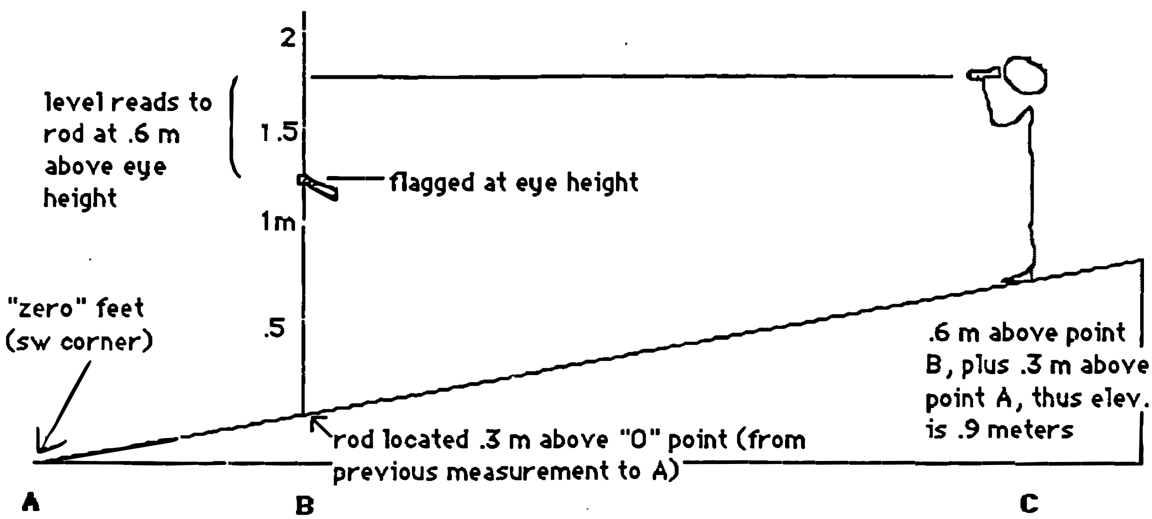
Increased attention to topographic maps, which we'll be using in our landform studies.
Realization that a superficially complicated task is not that difficult, if patiently taken apart into several simple steps.

Field Procedure

I'll string the plot boundary lines myself before each field session. Ideally the kids should do it, but last year we discovered this created a bottleneck, with most kids unable to get to their tasks until the lines were in place.

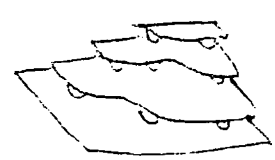
Each half-class divides into four teams. Tasks rotate within teams so that everyone gets to experience all aspects of the mapping work. One person reads the clinometer. Another person holds the survey rod, and assists the clinometer person in determining the height above or below their flagged eye height, as indicated on the clinometer. A third person records the measured spot elevations on the blank map form. I'll explain all this in the introductory session, but if you're curious, here's how it works:

Sighting with hand levels to survey rods, spot elevations are determined at each plot corner and line intersection, plus every 3 meters along the lines. For this project it's best to have 4 adult team leaders who understand the procedures, each overseeing the use of a survey rod and clinometer. There are 36 spot elevations to be measured on the plot, so each half-class needs to do about 20 (~5/group if we divide into 4 groups). Elevation of the point where the clinometer person is standing is plus or minus the distance up or down from his/her flagged eye hieght on the rod, plus or minus the previously determined elevation of that rod location from a specified "zero" elevation.



Summary class I'll transfer our field map, complete with the spot elevations measured by each team, onto the chalk board. We'll decide on a contour interval for our plot based on total plot relief (distance between highest and lowest points) which will give us about 5 or 6 contours. Student volunteers will come up and draw in each contour, between the appropriate spot elevations.

If we have time, another valuable excercize is to produce a vertical profile on graph paper through a section of the plot, say from 0/6 to 18/6. This helps students to visualize the actual plot relief, and will prepare them to understand profiles in our landform studies. Another follow-up which both Fred and Luann used last year is for each student to make a relief map of the plot, by cutting each contour out of paper, and stacking the contour sheets on balls of clay.



Concepts and physical skills

map reading

compass bearings (at least these: n, ne, e, se, s, sw, w, nw)
map coordinates (eg 9/9 = over [e] 9 m from sw corner, then up [n] 9 m. ie center of plot)
scale (eg. map scale is 1 cm = 1 m)
metric measurements (mm, cm, m)
decimals; survey rods are marked in tenths of a meter.

contour work
elevation (will be expressed in meters)
contours (will be expressed in meters)
contour interpolation (not as fancy as it sounds!)
clinometer and survey rod work (measuring spot elevations)
use of graph paper to produce scaled profiles of sections through map

Field Equipment

I will provide the plot boundary lines, 4 clinometers, 4 survey rods, 4 map forms on Rite-in-the-Rain paper, clipboards, pencils, and survey flagging for marking eye height.

You provide the kids and the raingear.

What you can do to prior to the introductory session

Review the above list of concepts and physical skills. If you feel your students are missing some of the basics, like metric units, or decimals, or how to use map coordinate systems, it would be great if you could practise a bit. An excercize sheet is attached, with sample coordinates.

If you'd like to meet sometime to go over these map sheets, put a note in my box.

Thanks!

Richard

CONTOUR MAPPING
FIFTH GRADE

GOALS
- Intro or reinforcement, coordinate system (about half of the 5th graders had this last year).
- Preparation for field measurements. Use of hand levels, survey rod to determine spot elevations.
- Practise thinking in 3D, understanding of contours

INTRODUCTION TO THE NATURE STUDIES PROGRAM First step is mapping.

WHY MAKE MAPS?
Best way to know a place really well. How would a map of the cemetery help us understand its natural history?
- Could use it to record bird observations.
- Could use for snow accumulation/canopy relationships.
- *Old* maps might tell us about changes in the area.

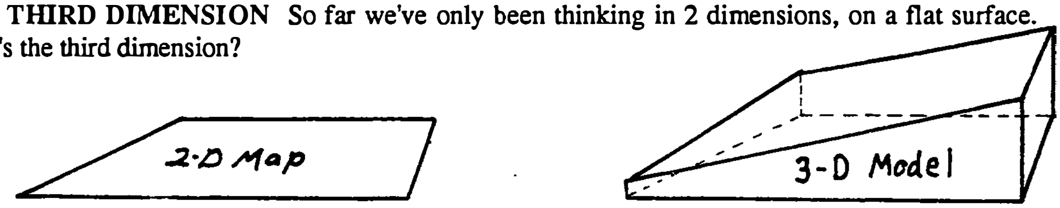
Aside from the value of maps to the people who make them, maps are the best ways to *communicate* certain kinds of information.

EXPLANATION OF CEMETERY MAPPING PROJECT Each grade's role.

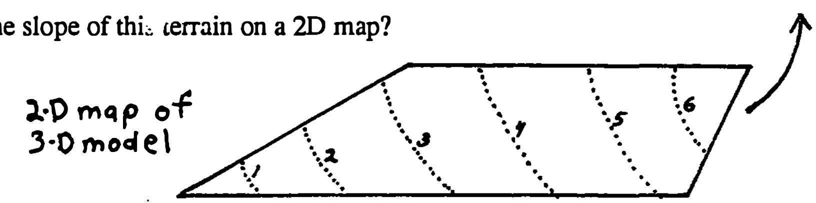
PIN MODEL BOUNDARY AND DIVIDER LINES ON BOARD
Conventions: North is up. N-S lines white. E-W lines gold. Review coordinates. Always start from SW corner. Scale can be expressed with a scale bar such as 

or as 1 cm = 1 m. String out meter tape to demonstrate size of a 6 meter square. Plot is 9 times as big.

THE THIRD DIMENSION So far we've only been thinking in 2 dimensions, on a flat surface. What's the third dimension?



How could we show the slope of thi… terrain on a 2D map?
With contours!

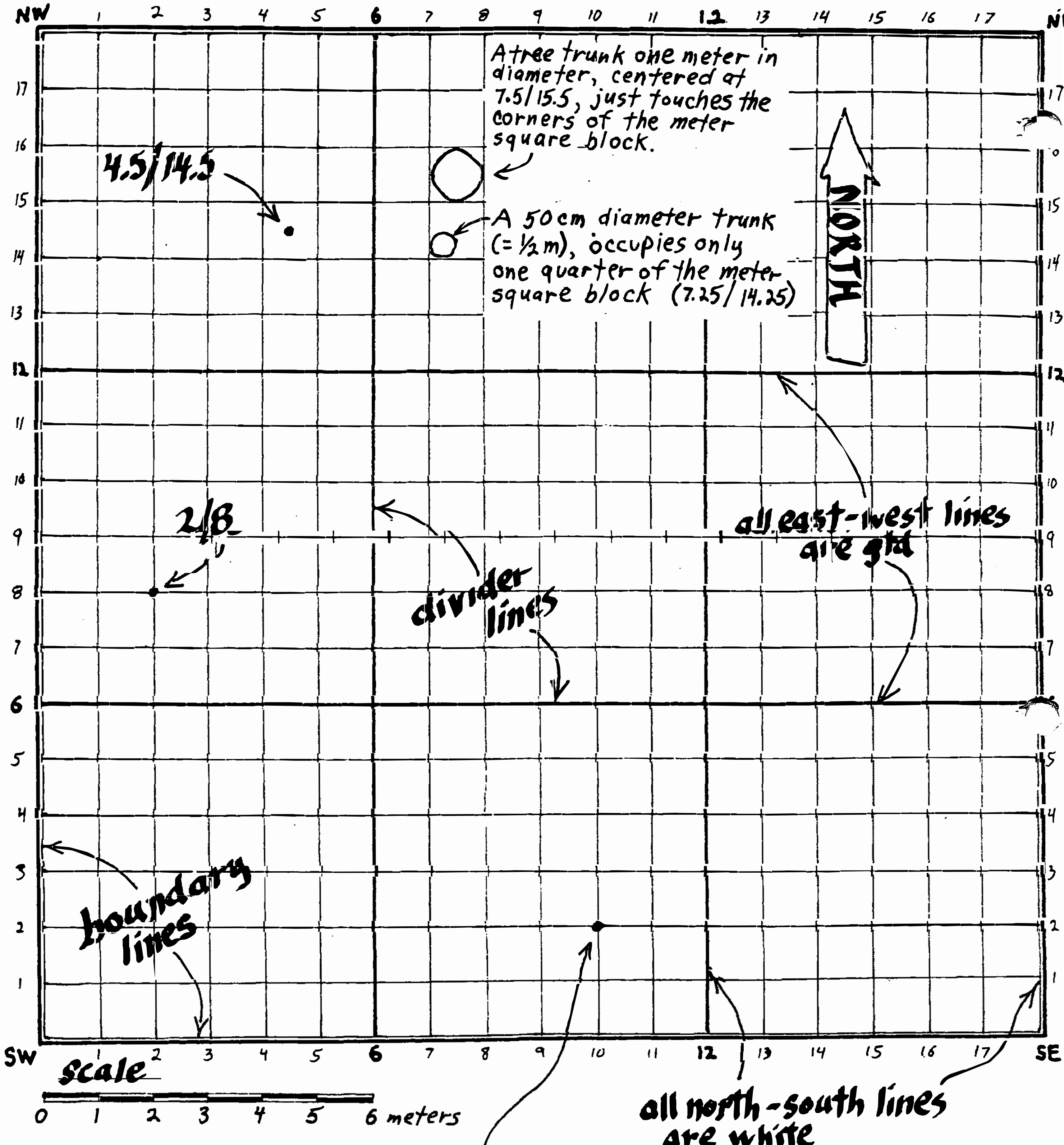


To draw contours, we first need to have a number of known elevations on our plot. These are called **spot elevations.**

DEMONSTRATE CLINOMETER/SURVEY ROD METHOD, USING TWO KIDS AND CHAIR

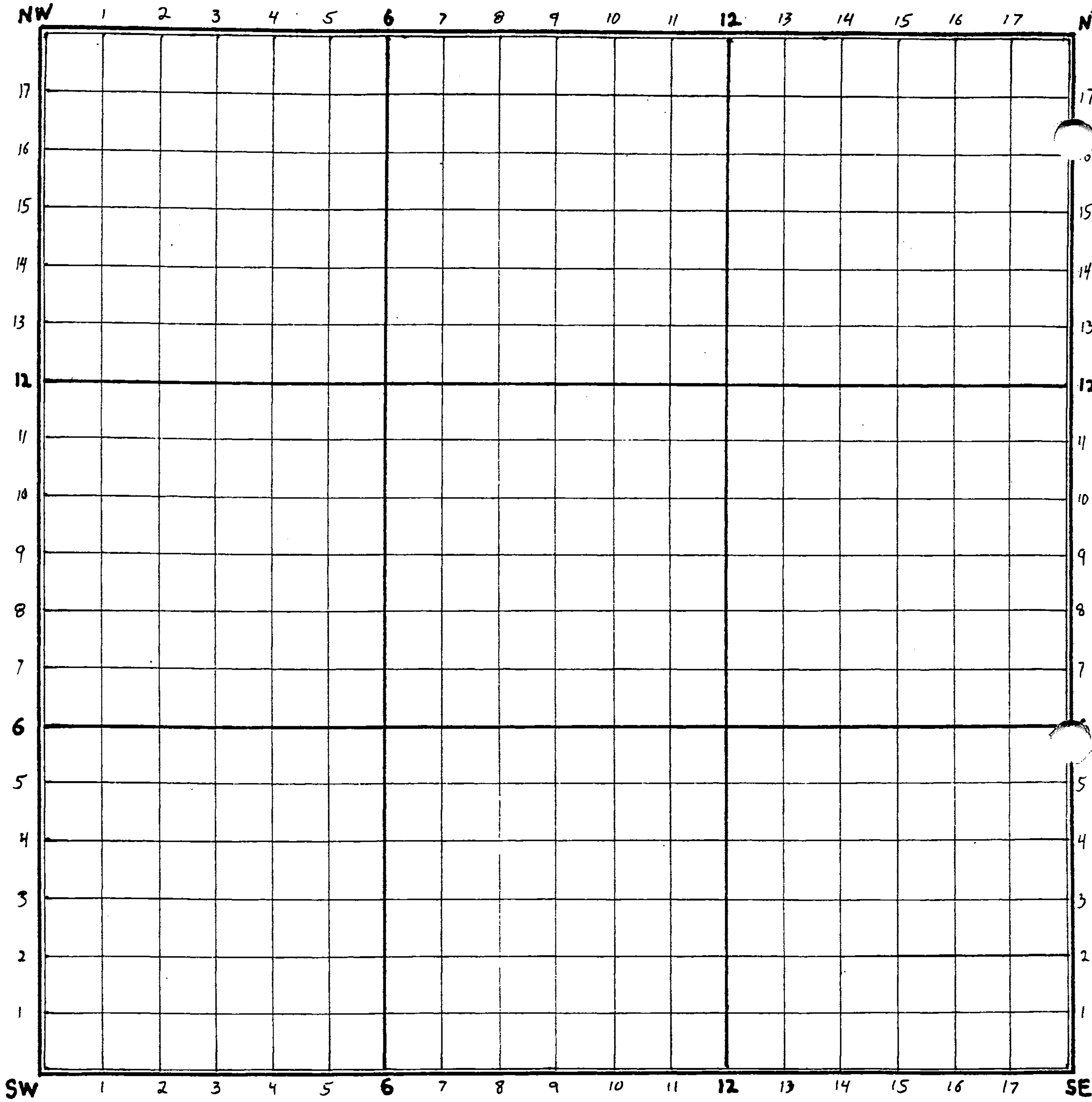
PASS OUT CONTOUR/PROFILE SHEETS
Project transparency. After examples, have each student interpolate contours on their own sheet, and then produce a profile through section A-B.

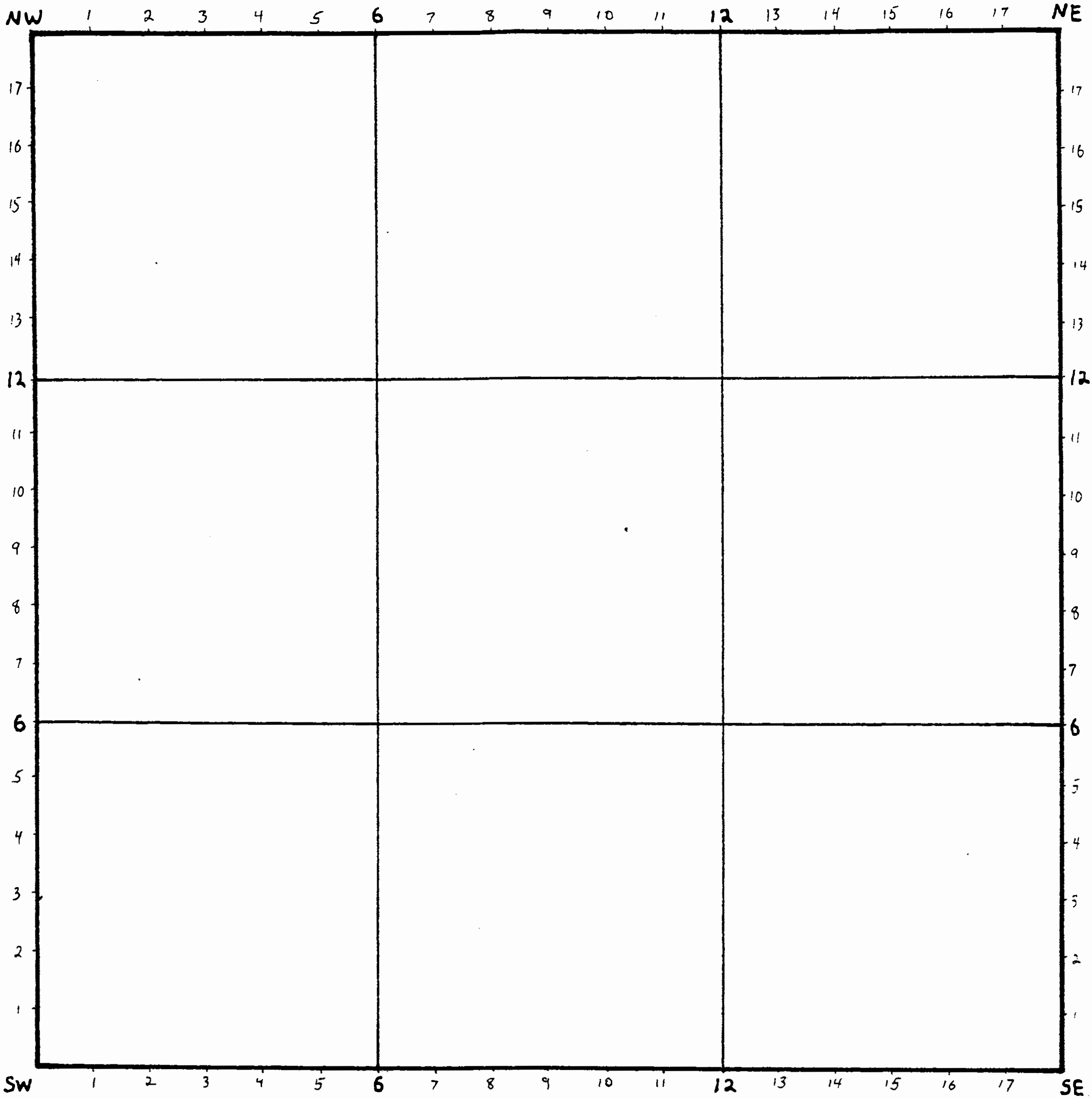
Prep Check on prior use of exercise sheets, and copy if needed. Also 30 copies of contour/profile sheet
Bring model lines, 30 m tape, clinometer, collapsing survey rod

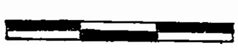


Coordinates of this point are expressed 10/2, with the southwest corner as reference point. Count over 10 meters from the sw corner (that is, east), then count up (north) 2 meters

EXPLANATION OF MAP SHEETS


NW
NE
SW
SE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

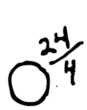




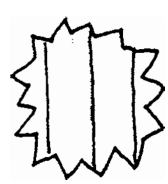
0 1 2 3 meters

contour interval .2m

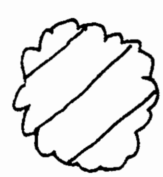
KEY



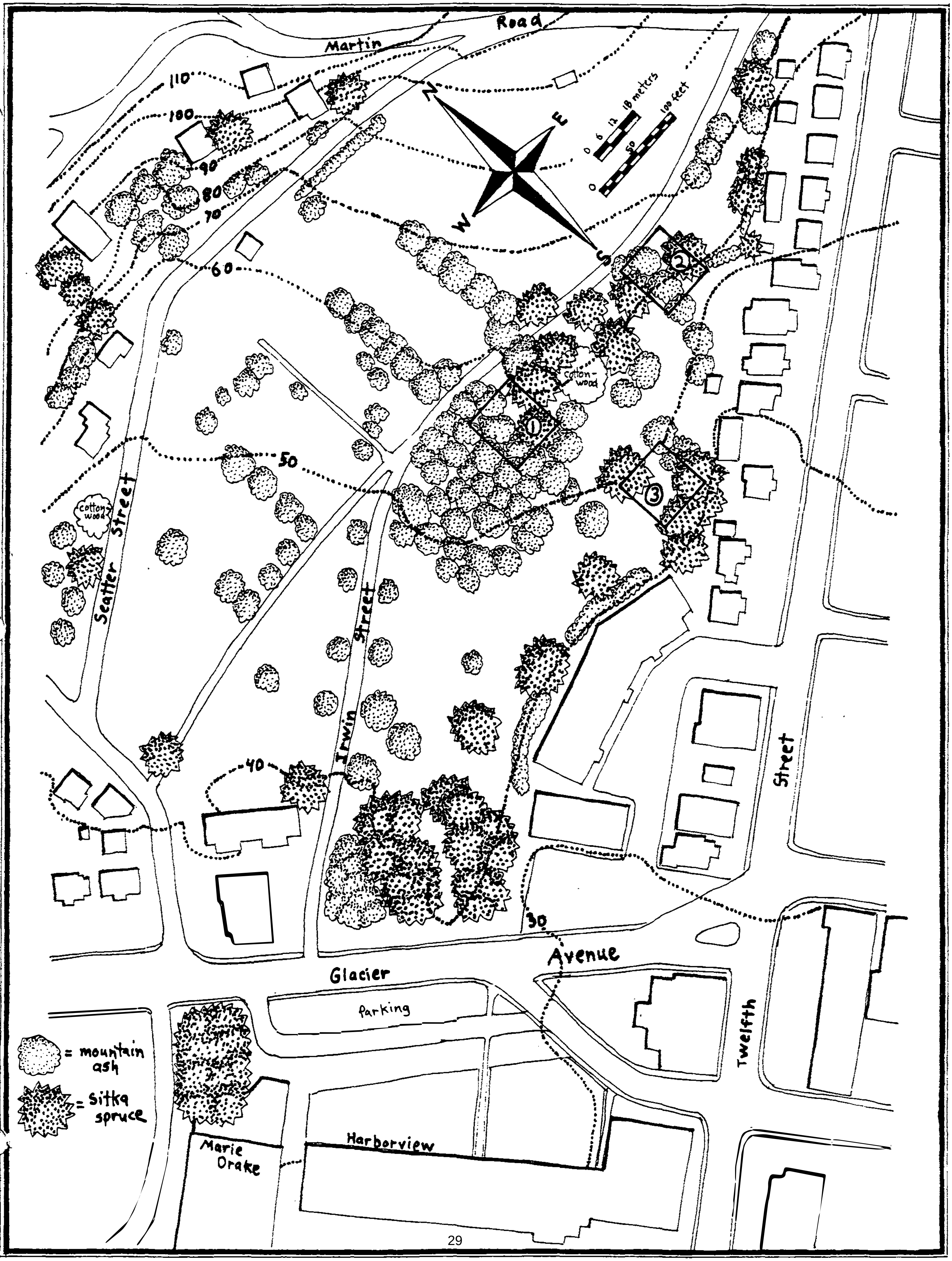
= spruce tree 70 cm diameter 24 m high crown 6 m to lowest branches

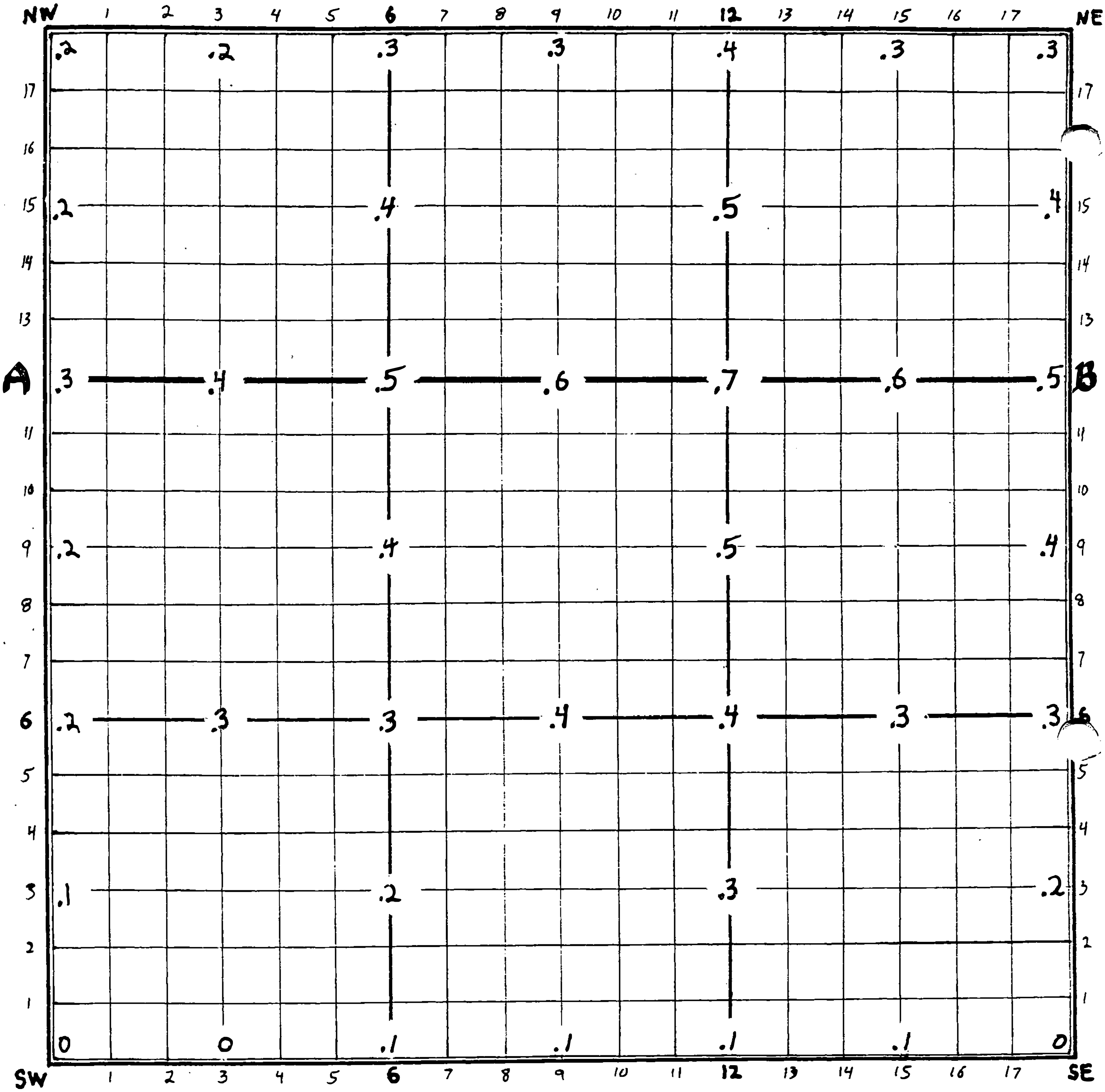


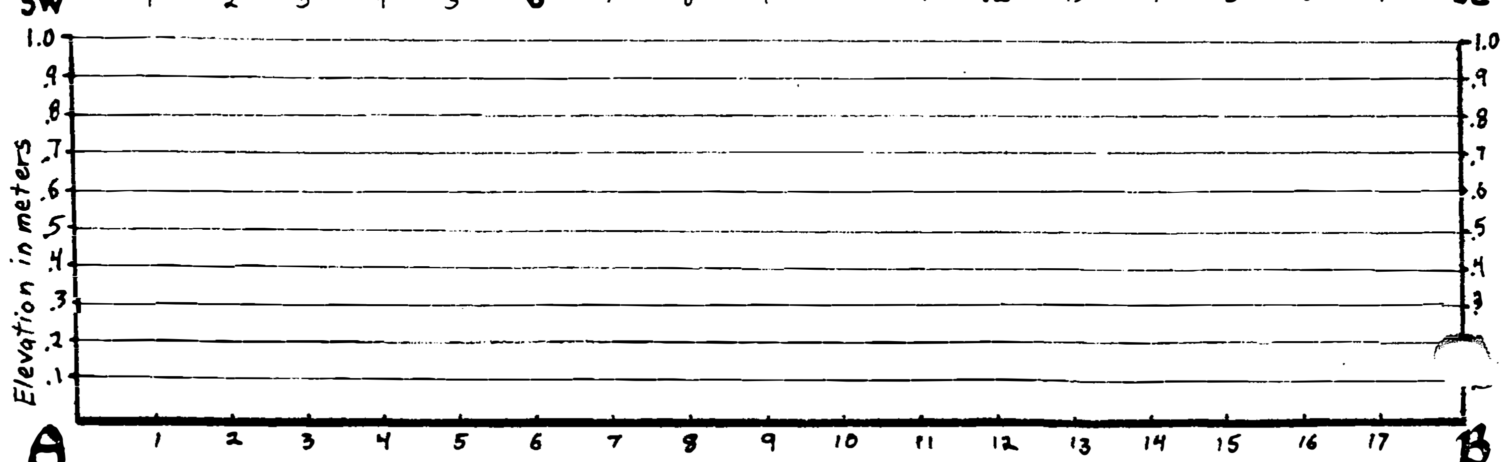
covered by spruce branches



covered by ash branches

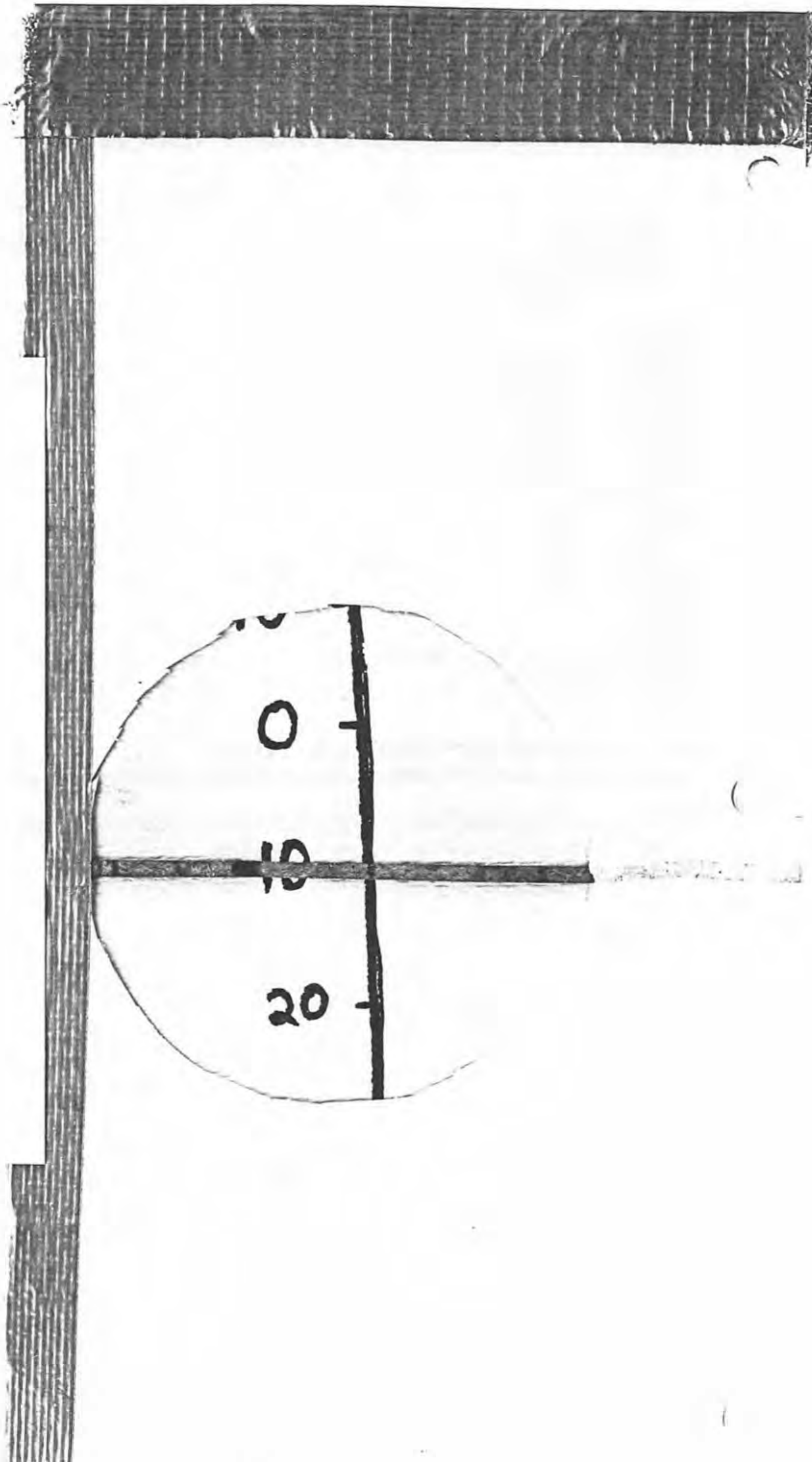

Martin Road
110
100
90
80
70
60
50
40
30
N
E
S
W
0 6 12 18 meters
0 50 100 feet
cotton-wood
cotton-wood
Seatter Street
Irwin Street
Glacier Avenue
Parking
Twelfth Street
Street
Harborview
Marie Drake
= mountain ash
= sitka spruce





Profile through section A-B
(vertical exaggeration 5x)

Clinometer
instructional
aid



MAPPING SUMMARY
FIFTH GRADE

GOALS
• Consider historical changes in Juneau, and see how maps and air photos aid interpretation
• Learn to make contour maps from spot elevations
• Practise thinking in 3D

SLIDES
880417	mapping, upper Glacier Bay
881128	mapping, lower Glacier Bay
891615	Vancouver map
903812	modern version
883314	Eagle Beach map
903529	air photo
902823	Juneau, 1929
903535	1962
903536	1984
903001	cemetery 1984
903534	1962
902819	1929
894924	cemetery ground shot, 1945
903731	1990 retake
90	cemetery map

PASS OUT MAPS WITH SPOT ELEVATIONS
Copy onto chalk board. After examples, have each student interpolate contours on their own sheet.

Prep *Compile "cleaned up" map form with all spot elevations measured in field.*
Bring *Projector, mapping slides, 30 copies of above map sheets.*

TO fourth grade teachers
FROM Richard Carstensen
SUBJECT preparations for tree mapping

Dear Shirley, Valerie and Ron

Here we go! Mapping takes careful preparation and lots of help from volunteers and parents, but it's well worth it. Mapping is a wonderful way to get introduced to a place. It results in a sense of accomplishment, and builds knowledge and skills in many areas aside from just natural history (practise with metric, math, ability to think in three dimensions, etc.)

As with last year, we hope to produce maps of forested plots in the cemetery. These plots are 18 meters on a side. There are three plots in all. Fifth grade classes will measure ground elevations on the plots, and derive contours from these elevations. Fourth grade classes will use the same plots, and map the positions of tree trunks and foliage. Third graders will visit the plots mapped by the fourth and fifth graders, and learn to orient themselves using the coordinate system.

When the fourth and fifth grade classes finished their respective maps last fall, the classes who had shared plots reported to each other on their methods and findings. This seemed to be a valuable aspect of the project. This year I will also overlay the fourth and fifth grade maps for each plot (ideally I'd like to do this with the help of a few students from each class) and give the final results to everyone who worked on that plot. Here are my suggested class groupings, based on the order of your signups on the Fall Nature Studies Schedule. These groupings would be the simplest, but if you'd like to switch around, please let me know.

	plot 1	plot 2	plot 3
Fifth grade	Moore	Jackson/Szipsky	Augustine
Fourth grade	Kotyk	Banazak	Campbell
Third grade	Mitchell	Minge/Homan	Baxter

For each grade, I'll give an indoor talk preparing you and your students for field day. On field day the idea is to divide your class in half, sending half to the cemetery for 45 minutes of mapping, followed by the second half, for another 45 minutes. I hope to have enough Discovery Foundation volunteers on field day so that the 15 or so students can divide into four teams of 3 or 4 each. It would be good if you could join us in the field for at least one of the 45 minute sessions. Regardless of how many volunteers the Foundation can enlist, please invite parents. Last year we had lots, and they had fun, even on the day that rained. Parents help keep the focus. It helps if parents who lead field teams also come to the introductory talk, but that's not essential.

General goals of mapping, applicable to all three grades

Increased spatial awareness. Ability to think in 3D.
Practise with artistic skills, accurately portraying natural features.
Introduction to methods used by surveyors and foresters (simpler equipment, but same principles).
Familiarity with the cemetery, which we will use repeatedly for nature studies this year.

Goals of tree mapping

Understanding of how trees grow, familiarity with the three species in the cemetery.
A sense of the history that trees can reveal.

Field Procedure

I'll string the plot boundary lines myself before each field session. Ideally the kids should do it, but last year we discovered this created a bottleneck, with most kids unable to get to their tasks until the lines were in place.

Each half-class divides into four teams. **Team one** uses coordinates (reading perimeter and transect lines) to plot the position of each tree on the contour map. Diameter is measured, and the tree is drawn in to scale. **Team two** measures height of tree top and lowest branches for each tree, and gives these heights to team one to enter on map. **Team three** maps canopy coverage of each spruce and ash as it projects over plot. **Team four** cores as many trees as possible. Cores are saved in sealed plastic straws, with coordinates of tree and other info written on straws.

Summary class I'll bring in a cleaned-up version of the field map, as a transparency for overhead projection. Using profile forms, each student produces a side view of the plot (from the south), showing trees, with foliage, to scale. Hopefully I'll also have glued the tree core samples onto boards, sanded them for easy ring visibility, and marked every tenth ring with ink. These you can keep in class for students to examine later.

Concepts and physical skills

map reading

compass bearings (at least these: n, ne, e, se, s, sw, w, nw)
map coordinates (eg 9/9 = over [e] 9 m from sw corner, then up [n] 9 m. ie center of plot)
scale (eg. map scale might be 1 cm = 1 m)
metric measurements (mm, cm, m)

tree work

how a tree grows
annual rings
height and diameter measurements ← (should distinguish diameter and circumference.)
mapping and profiling trees (creating color keys)
taking, mounting and reading cores
making and reading keys
plotting tree position (at correct scale)

Field Equipment

I will provide the plot boundary lines, 30 meter tape and diameter tape, "right angle rods", increment borer(s), plastic straws for tree core samples, cigarette lighter for sealing the straws, permanent marking pen. Also 4 map forms on Rite-in-the-Rain paper, clipboards, and pencils (some colored).

You provide the kids and the raingear.

What you can do to prior to the introductory session

Review the above list of concepts and physical skills. If you feel your students are missing some of the basics, like metric units, or how to use map coordinate systems, it would be great if you could practise a bit. An excercize sheet is attached, with sample tree trunks drawn in to scale. Using this as a guide, pass out blank map forms, and have the kids draw in a 50 cm diameter tree, centered at 16/10 (over [east] 16 meters from the southwest corner, then up [north] 10 meters). Give it a canopy whose outer limits pass through these points: 16/15, 13/10 and 16/7. Draw this perimeter as a jagged line to represent conifer foliage.

If you'd like to meet sometime to go over these map sheets, put a note in my box.

Thanks!

Richard

MAPPING TREES
FOURTH GRADE

GOALS
• Prepare to measure and map trees on plots established by the fifth graders.
• Learn about how trees grow, and gain a sense of the history told by trees.

INTRODUCTION TO THE NATURE STUDIES PROGRAM First step is mapping

WHY MAKE MAPS?
Best way to know a place really well. How would a map of the cemetery help us understand its natural history?
• Could use it to record bird observations.
• Could use for snow accumulation/canopy relationships.
• *Old* maps might tell us about changes in the area.
Aside from the value of maps to the people who make them, maps are the best ways to *communicate* certain kinds of information.

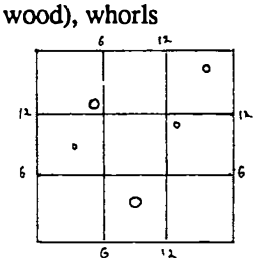
EXPLANATION OF CEMETERY MAPPING PROJECT Each grade's role.

PIN MODEL BOUNDARY AND DIVIDER LINES ON BOARD
Conventions: North is up. N-S lines white. E-W lines gold. Review coordinates. Always start from SW corner. Scale can be expressed with a scale bar such as 

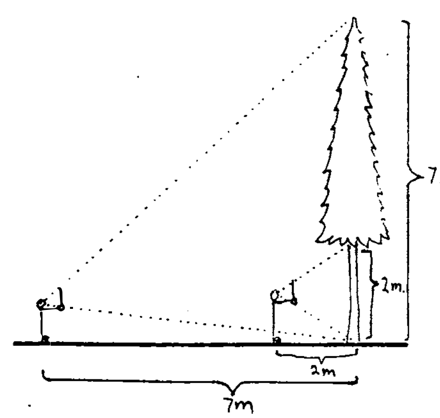
or as 1 cm = 1 m. String out meter tape to demonstrate size of a 6 meter square. Plot is 9 times as big.

TREES Types of trees on the plot. Spruce, ash, cottonwood. Coniferous vs deciduous. How a tree grows; bark, cambium, annual rings (early and late wood), whorls

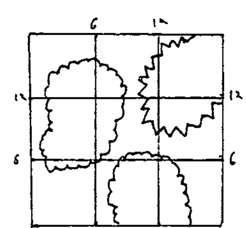
MAPPING TEAMS
Team one plots position of trees, and draws diameter to scale. Uses coordinate system and diameter tape.



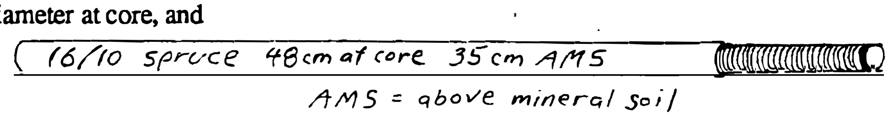
Team two measures height of tree tops and lowest branches.



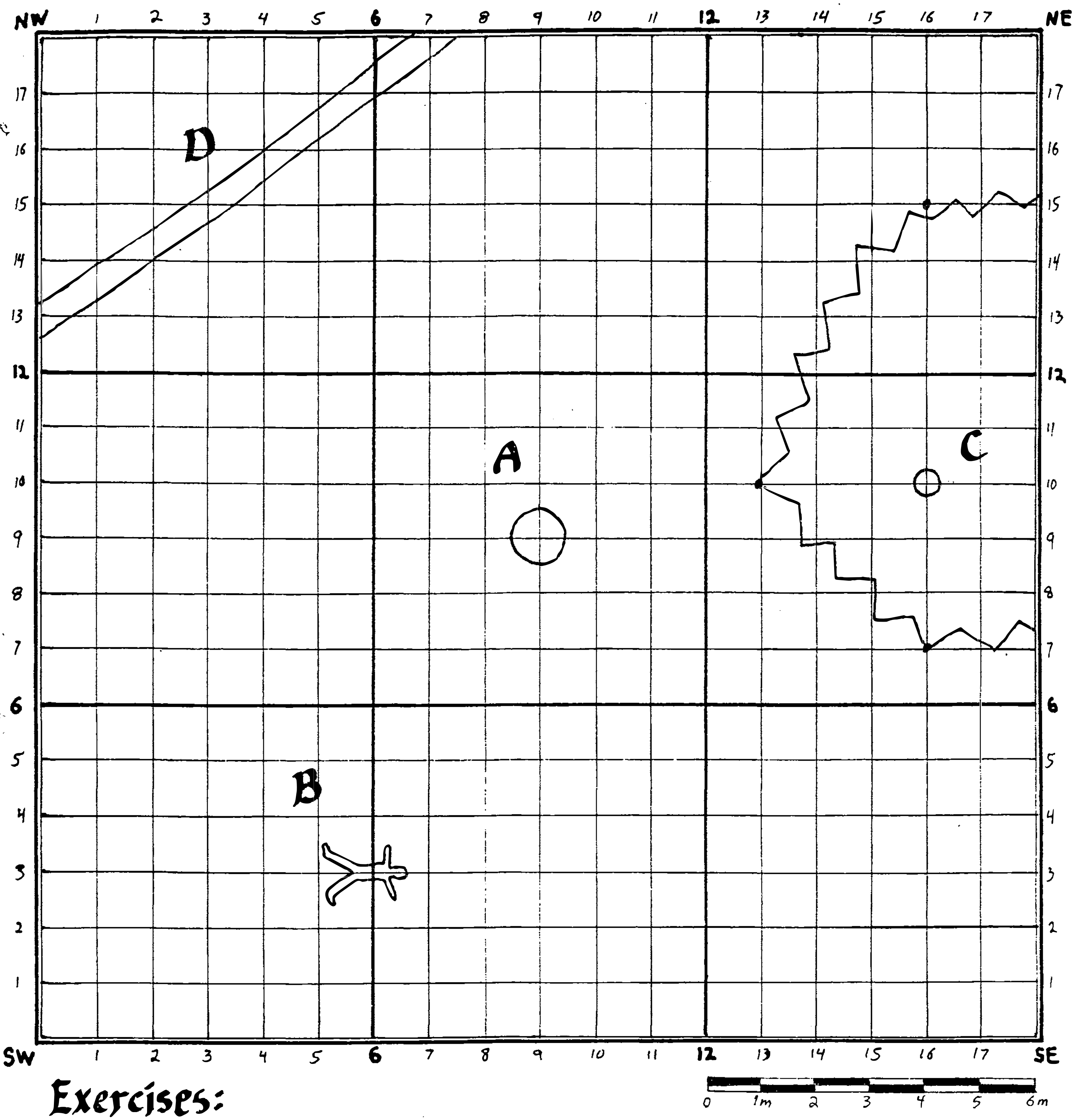
Team three maps edge of tree canopies.



Team four cores trees and stores samples in soda straws, records tree coordinates, diameter at core, and height above mineral soil



Prep *Check on prior use of exercise sheets, and copy if needed. Also 30 copies "How do trees grow?"*
Bring *model lines, borer, straws, lighter, D tape, 30 m tape, carpenter tape*



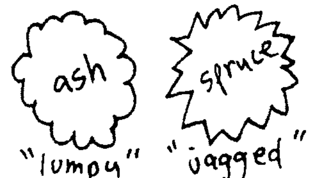
Exercises:

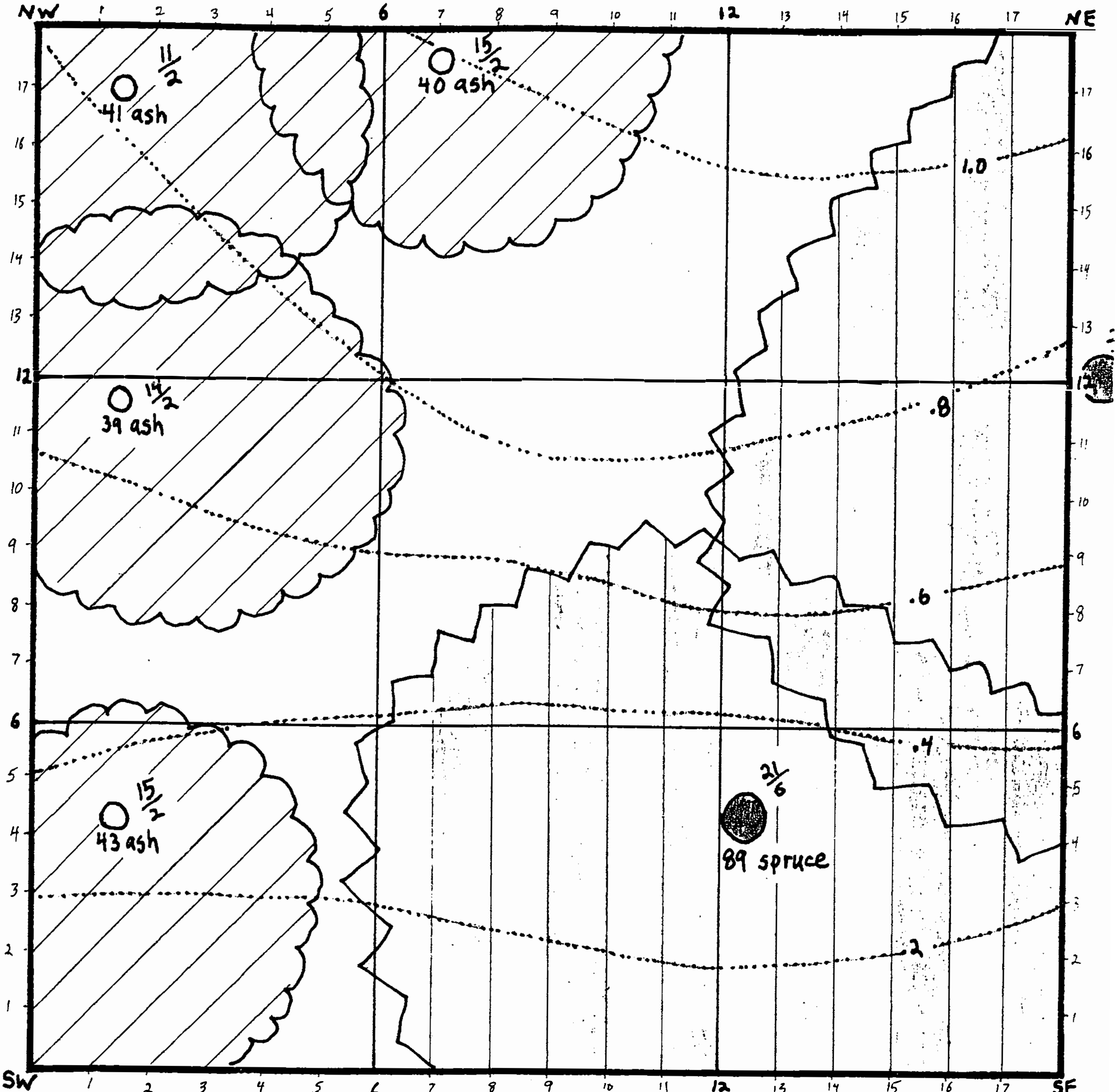
A Draw a tree trunk, one meter in diameter, centered at 9/9 (over 9 meters from the sw corner, then up 9 meters). (Helps to first put a dot at the center point, then the circle)

B Draw a person, lying down, with his/her head facing east, centered at 6/3 (over 6, up 3). An average fourth grader is about 4.5', or 1.3 m tall.

C Draw a tree, 50 cm diameter (= ½ m), at 16/10. Its foliage extends out to 16/15, 13/10 and 16/7. Mark these points with dots, and then connect them with a jagged line, representing conifer canopy.

D A fallen log crosses the plot (in the cemetery?!) It crosses the boundary lines at 0/13 and 7/18. It's 50 cm in diameter (= ½ m.)





① Augustine/Campbell/Baxter Plot – Fall 1990

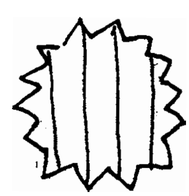
0 1 2 3 meters

contour interval 0.2 m

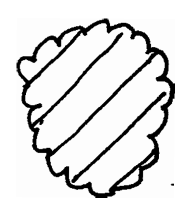
KEY

21/6 = spruce tree 89 cm diameter, 21 m high crown, 6 m to lowest branches

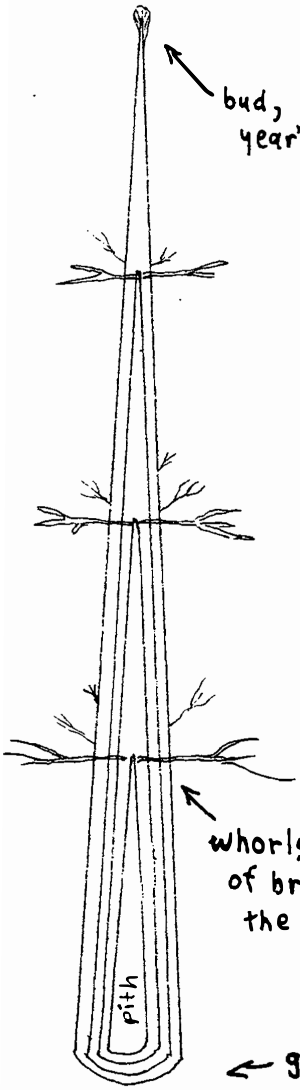
89 spruce



cover of spruce branches

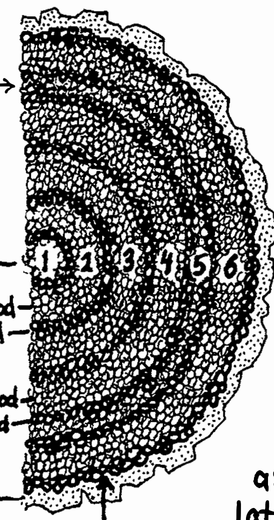


cover of ash branches



cross-section Sitka spruce

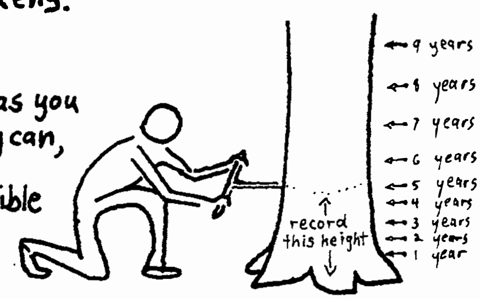
Sawed-off trunk of 6 year old Spruce



Every year a new ring is added. The first growth in spring is called early wood. Early wood is pale-colored. By June, growth slows down, and a darker ring, called late wood, begins to form.

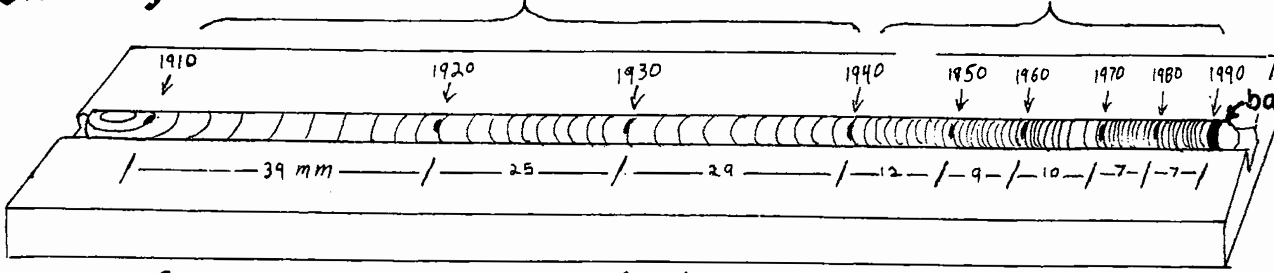
The cambium is a very thin growing layer just inside the bark. Each spring, the cambium makes more wood and bark, and the trunk thickens.

Core as low as you comfortably can, to get the earliest possible ring.



Rapid growth until about 1940

Slower growth in the last 50 yrs, maybe because of nearby trees also growing bigger and shading it. In 1967 a neighbor was chopped down, and for 2 years the spruce got more light.



core from spruce, glued to board and sanded

Sitka spruce

cottonwood

mountain ash

HOW DO TREES GROW?

Richard Carstensen
DISCOVERY FOUNDATION

MAPPING SUMMARY
FOURTH GRADE

GOALS

• Consider historical changes in Juneau, and see how maps and air photos aid interpretation
• Review field procedures, study resulting map

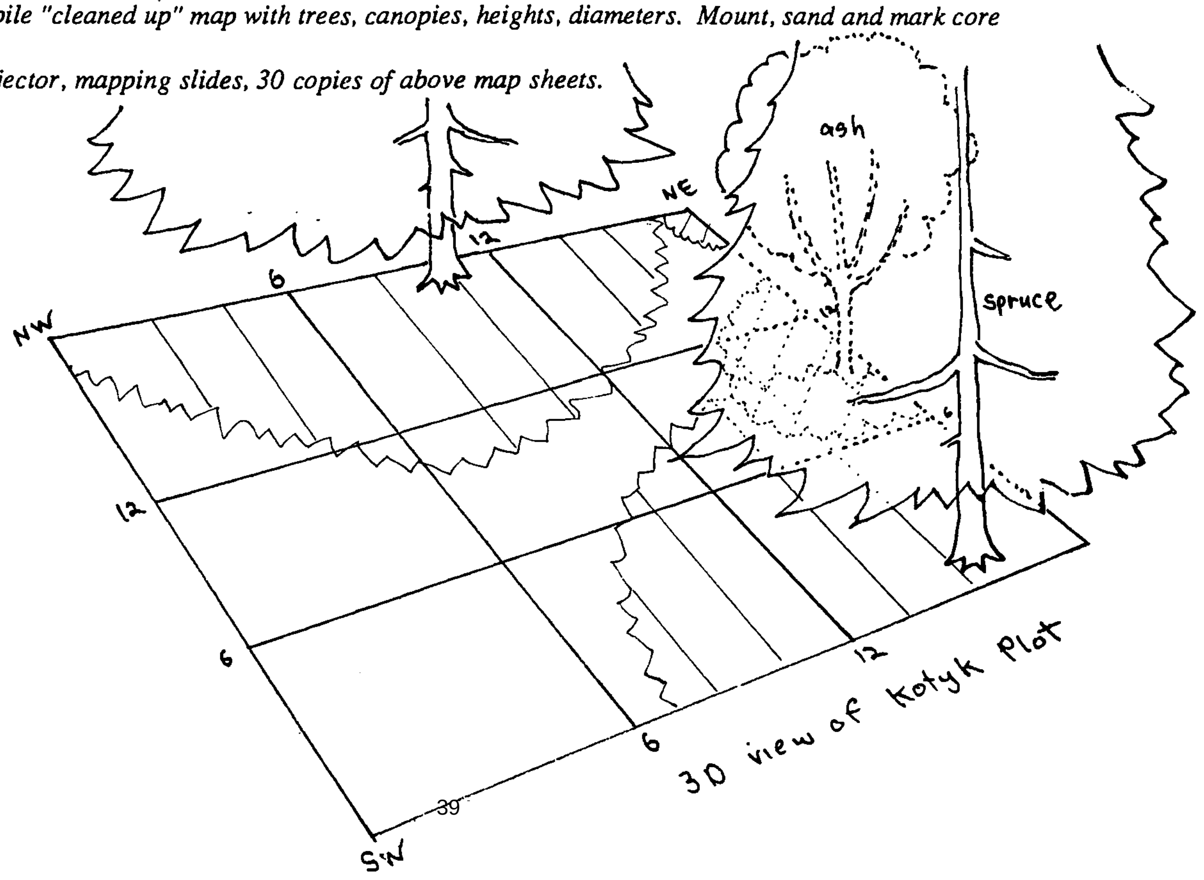
SLIDES

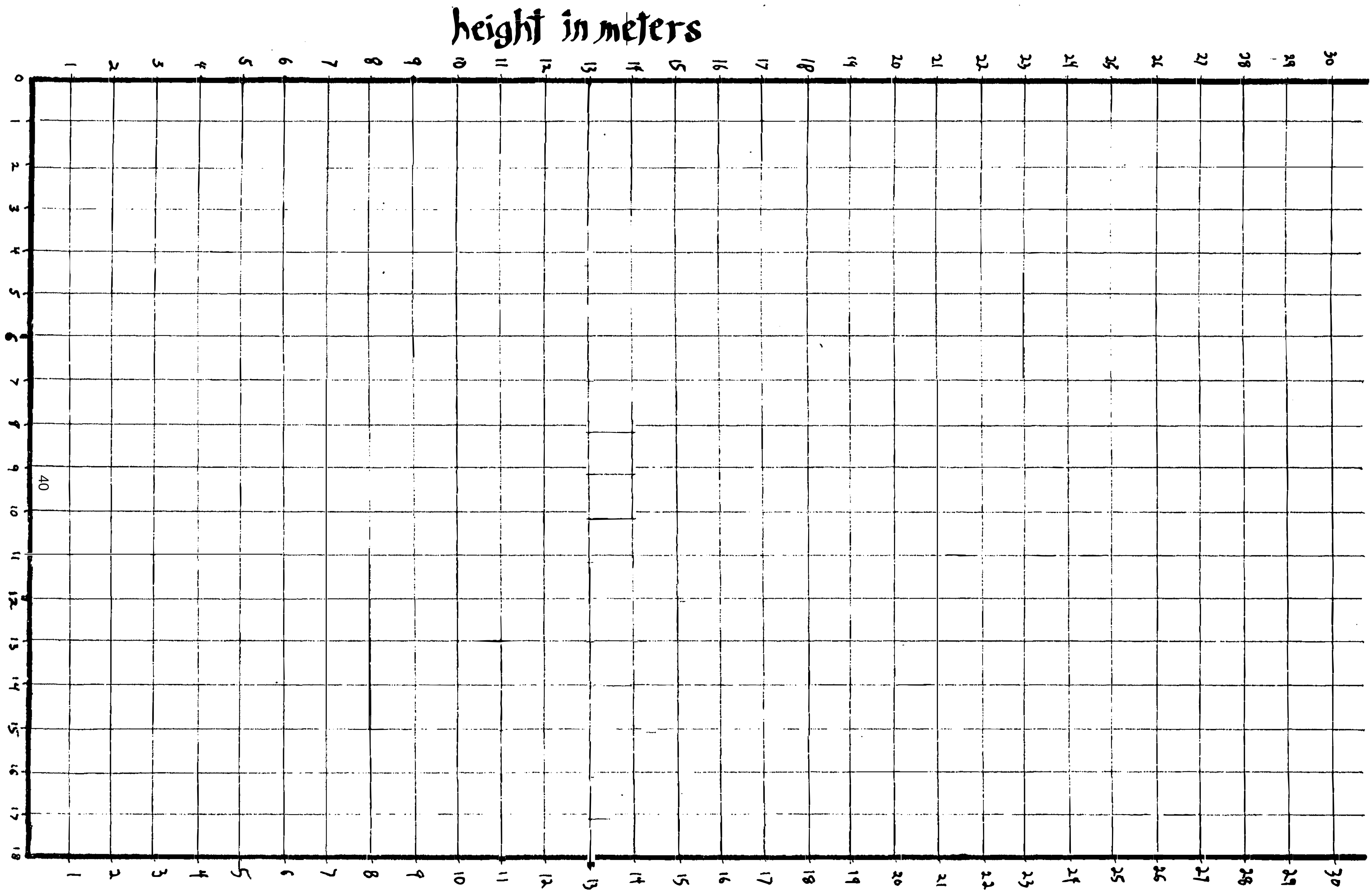
880417	mapping, upper Glacier Bay
881128	mapping, lower Glacier Bay
903521	Campground control plot
903522	profiles
891615	Vancouver map
903812	modern version
883314	Eagle Beach map
903529	air photo
902823	Juneau, 1929
903535	1962
903536	1984
903001	cemetery 1984
903534	1962
902819	1929
894924	cemetery ground shot, 1945
903731	1990 retake
90	cemetery map
904107	Campbell plot
904106	Campbell profile

PASS OUT MAPS

Show how to color in. Make keys for high and low canopy, spruce versus ash, etc.

Prep *Compile "cleaned up" map with trees, canopies, heights, diameters. Mount, sand and mark core samples.*
Bring *Projector, mapping slides, 30 copies of above map sheets.*





Cemetery Plot Tree Profiles (view from ________)

MAMMAL SIGN (OTHER THAN TRACKS)
FIFTH GRADE

GOALS

• Deductive skills for interpreting mammal sign other than actual footprints (4th grade is strictly tracks, 5th expands to include other kinds of sign like browse evidence, scat and burrows).

• Preparation for sign expected on the Fish Creek field trip.

INTRO QUESTIONS 1) Aside from actual footprints, what kinds of evidence do mammals and birds leave behind? **Try to solicit some of these answers:** Browse evidence (clipped plants, chewings, browseline), remains of prey, scat, regurgitated pellets, shed hair or feathers, worn pathways, nests, dens and burrows. 2) What critters in Southeast Alaska have the most pronounced influence on our environment? **Answers:** Probably deer and beaver are most obvious, although more subtle influence like that of birds and bears in seed distribution, and of insects in killing plants, may be just as important.

SLIDES

Browse evidence (clipped plants, chewings, browseline)

894219 tooth marks on mushroom
894220 potential culprits, squirrels, deer mouse, redbacked vole
891718 angelica scraping, black bear
893701 squirrel cache, spruce and alder cones, shroom stem
902112 lupine bit in bud
902432 vole stick
902113 vole girdled pine
890410 porky tree
894921 same, weathered, 8 months later
882704 beaver tree, weathered
902020 old and fresh beaver sticks
901812 sapsucker with holes

Remains of prey

890711 deer leg bone, crow-scavenged

Scat , regurgitated pellets

901504 porcupine turds
893809 mouse, squirrel, porky, moose and weasel, compared
902613 otter with greenling
900210 cottontail (hare identical)
882507 deer pellets
900222 bird dropping and regurgitation compared
903537 raven with chiton and barnacle

Shed hair or feathers (clings to trees, knocked off by bullets, ID in scats and pellets)

893805 hair of moose, deer, hare and marmot

Nests, dens and burrows

893617 squirrel nest, fine grass inside

Worn pathways

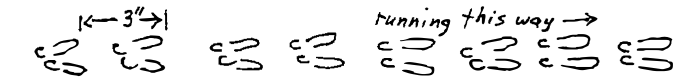
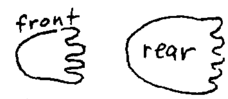
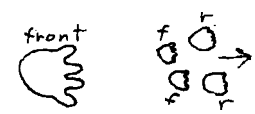
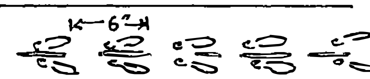
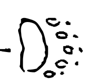
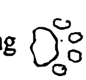
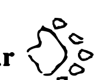
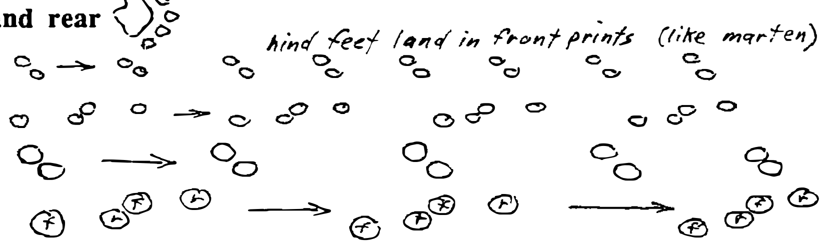
900229 vole path in snow, tunnel entry
901417 diggins
901434 mounds
882519 deer trails in forest

Transition to next show (tracking glaciers, etc.)

882402 active wave-cut face
880028 century old face

ANIMAL SIGNS

Mammals of Southeast Alaska that commonly leave tracks and other sign

insectivores		
shrews	tiniest tracks, only 3" stride	
rodents	**four toes on front foot, five on rear**	
hoary marmot	tracks like human hands, burrows in high meadows	
red squirrel	hind feet print ahead of front	
beaver	webbed feet, chewed trees and sticks	
deer mice	tiny prints, often with tail drag marks	
voles	tiny prints, usually without dragging tail	
porcupine	waddling, with dragging feet	
rabbits	**four toes on front and rear feet**	
snowshoe hare	hind feet print ahead of front	
carnivores	**wide variety**	
wolf	four toes, with claw marks showing	
black bear	five toes, claws about 1" in front of toes	
brown bear	five toes, claws often 2" in front of toes	
lynx	four toes, claws don't show, wider than long	
weasel family	**five toes, front and rear**	
short-tailed weasel	3/4" print width	
mink	1" print width	
marten	1 1/2 print width	
otter	3" print width	
hooved animals	**paired hooves**	
black-tailed deer	2 to 3" long, tapered	
mountain goat	2 to 3" long, "blockier"	
moose	about 6" long	

DRAFT!

MAMMAL TRACKS
FOURTH GRADE

GOALS
Deductive skills for interpreting mammal footprints. (4th grade is strictly tracks, 5th will expand to include other kinds of sign like browse evidence, scat and burrows)

INTRO QUESTION What are the best surfaces for tracking? Best snow conditions? Where are you likely to find bare sand and mud?

→ BOARD SKETCHES show tracks using family tree, then gaits

SLIDES (Note; This program directly follows the skull talk, so the first slides make the transition from skulls to tracks.)

Rodents
893808 skulls in owl pellets
893708 deer mouse molars
893706 meadow vole molars
~~891306 skeleton from pellet~~
~~894628 meadow vole~~ 901921 bog lemming
893710 bog lemming feet
890513 deer mouse tracks 900721 shrew drawing
break to show rodent hopping tracks on board, ground versus tree dwellers
891303 squirrel tracks
891310 red squirrel
891321 squirrel feet
~~892504 marmot tracks~~
~~892614 marmot~~
891714 porky tracks
891709 porky
891113 hare tracks
891115 hare
894701 hare foot
894637 hare foot spread

Carnivores
900216 ~~raccoon~~
890220 house cat
~~900116 dog track~~
900115 foot of ~~same~~ dog
890106 Jack
880519 wolf tracks
~~890216 fox tracks~~
880518 otter tracks
(3) **break** to draw gait patterns of weasel family on board, 2x, 1x2x1
(2) 892309 mink tracks, mud (1) 901925
~~882712 mink tracks, sand~~
890623 weasel tracks
900729 ermine w/ weasel

(dogs, cats, weasels, bears, rodents, carnivores, hooved)

~~894423 brownie,~~ human, yellowlegs
894424 brownie closeup
892902 blacky

Hooved mammals
870704 deer track
~~881414 does~~
883209 deer feet
~~883219 feet beside tracks~~
881112 moose tracks
894620 moose track
900228 ~~horse~~ hoof

Quiz
890715 heel, ski boot
890716 whole boot
890416 weasel tracks
870301 weasel
~~892901 blackie~~
~~882210 brownie~~
~~882219 porky~~
890608 hare in snow
894613 muskrat 901912 mystery tracks, 901913 answer
890624 ageing quiz: person, vole, crow

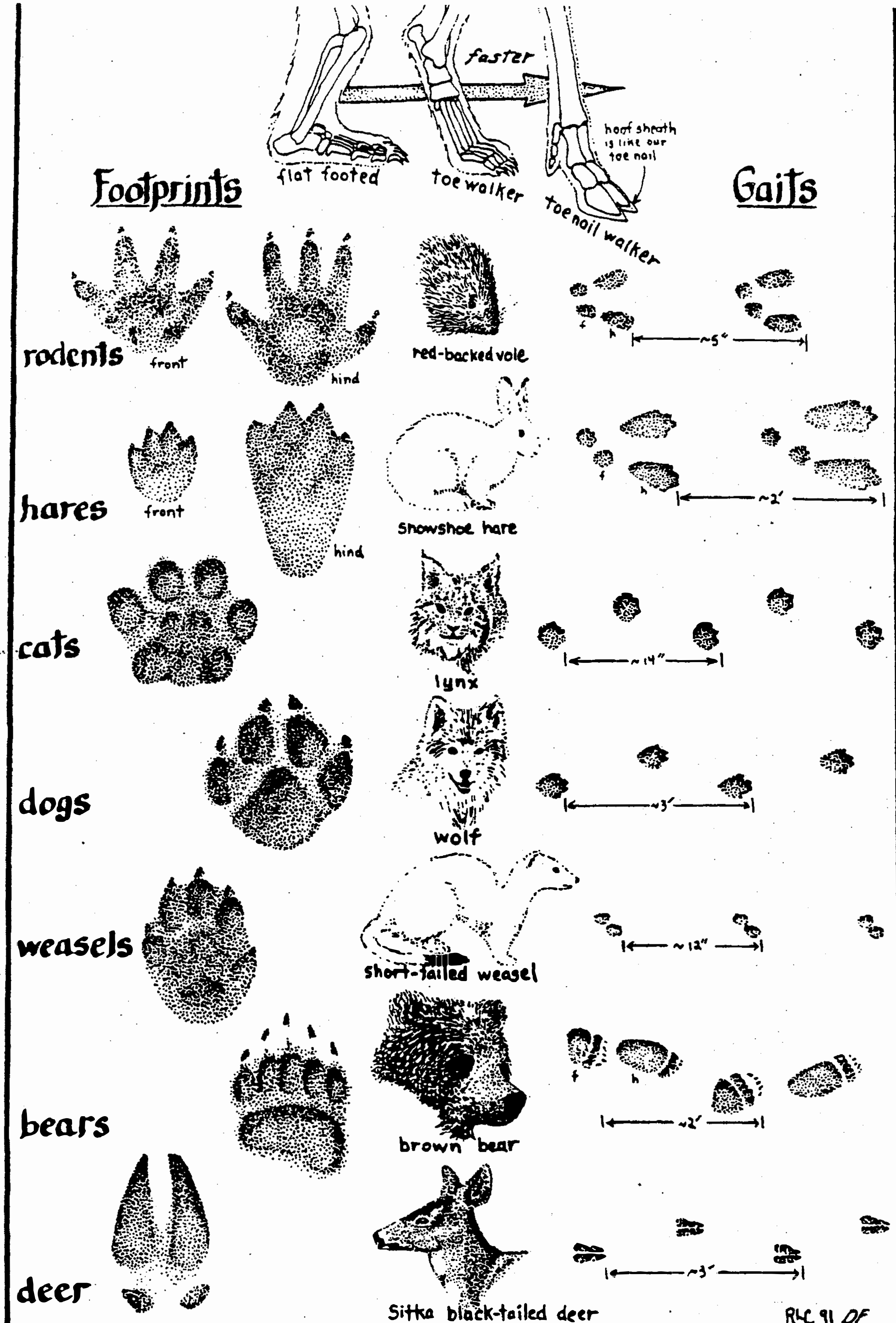
Summary (ha!)
If there's time, a chalkboard review Number of toes in families, gaits, etc.

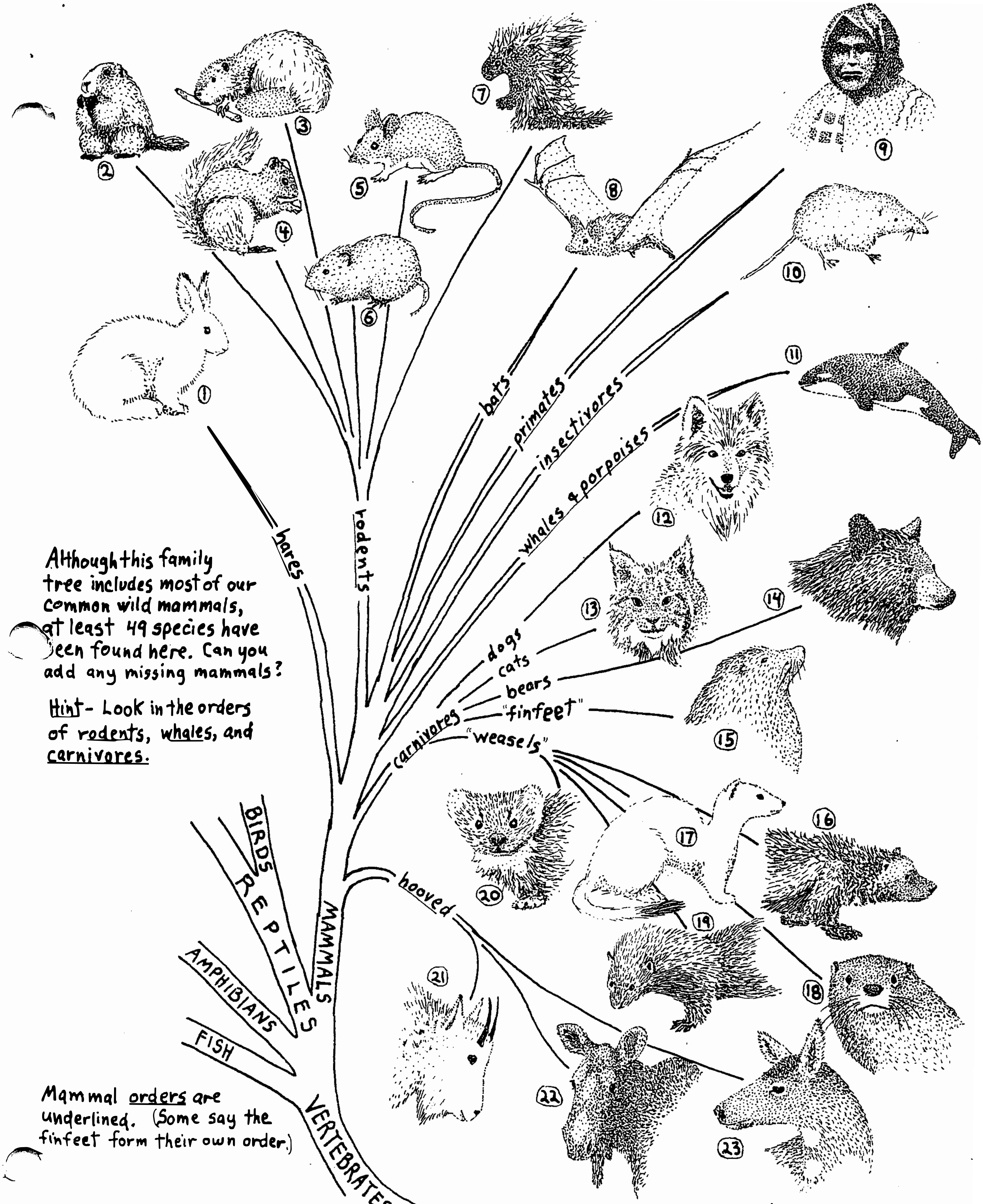
STILL NEEDED

– ... and out

4x ... or ... ou ... ?

– worksheets for review of both talks #1 skulls #2 tracks


Footprints
Gaits
faster
flat footed
toe walker
toe nail walker
hoof sheath is like our toe nail
rodents
front
hind
red-backed vole
~5"
hares
front
hind
snowshoe hare
~2'
cats
lynx
~14"
dogs
wolf
~3'
weasels
short-tailed weasel
~12"
bears
brown bear
~2'
deer
Sitka black-tailed deer
~3'
RLC 91 DF



Although this family tree includes most of our common wild mammals, at least 49 species have been found here. Can you add any missing mammals?

<u>Hint</u>- Look in the orders of <u>rodents</u>, <u>whales</u>, and <u>carnivores</u>.

Mammal <u>orders</u> are underlined. (Some say the finfeet form their own order.)

Native Mammals of Southeast Alaska

Richard Carstensen
Alaska Discovery Foundation

LANDFORMS AND INTRO TO STEREOSCOPES
FIFTH GRADE

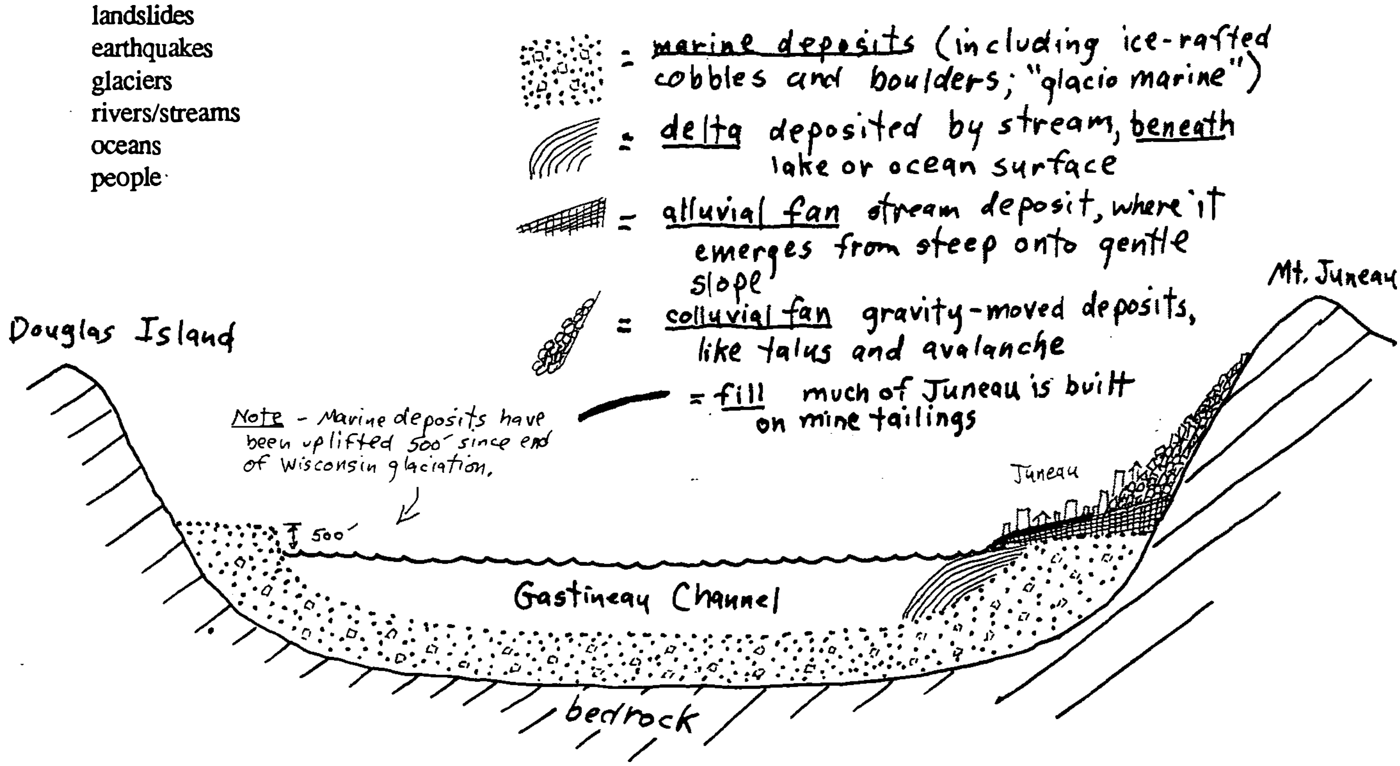
GOALS
- intro to surficial geology, its context within natural history
- consider Juneau area landforms
- first practise with stereoscopes

CONTEXT define these:

- NATURAL HISTORY
  - BIOLOGY
    - ZOOLOGY
    - BOTANY
  - GEOLOGY
    - BEDROCK
    - SURFICIAL

WHAT PROCESSES ERODE OR DUMP LOOSE MATERIAL ON BEDROCK?

landslides
earthquakes
glaciers
rivers/streams
oceans
people



PASS OUT STEREOGRAM SHEETS AND STEREOSCOPES Help kids individually to achieve 3-D images. (This is strictly an "oh wow" experience. Too early to get everyone focused enough to think about landform interpretation.)

Prep *Compile "cleaned up" map form with all spot elevations measured in field.*
Bring *30 copies Juneau stereograms, 30 stereoscopes*

LANDFORM STEREOGRAMS
FIFTH GRADE

GOALS

- Review of major non-glacial surficial landforms.
- New info on stream and marine landforms
- Proficiency with stereoscopes -- use in landform interpretation.
- Preparation for the field trip to Fish Creek.

CHALKBOARD REVIEW What is surficial geology? Prompt these examples of agents:

1 moving fresh water like streams and rivers (**alluvial**)
2 falling material (**colluvial**)
3 the ocean (**marine**)
4 people (**human**)

We'll look especially at alluvial and marine features before examining the Fish Creek stereograms. Repeat transect of Gastineau Channel through Juneau (see fall outline). Put Miller map on wall, explain.

Alluvium

"Young" or headwater streams	**"Old" or lowland streams**
smaller	larger
faster	slower
steeper slope	gentler slope
fairly straight channel	meandering channel
cutting (eroding)	dumping load (depositing)

Streams carve cutbanks into the outside of bends, and deposit bars on the inside. What does water-laid material look like? It's **sorted.** Fast waters deposit coarse material, and slow waters deposit fine material.

Marine features Like streams, the ocean leaves sorted materials. Also like streams, the ocean can erode (**wave-cut faces**), or deposit (**bars and spits**). At Fish Creek we'll see both active marine landforms, and old ones which have been uplifted by glacial rebound and covered by young trees. How can you recognize an old uplifted beach in the forest? Look for cut faces! Dig a hole!

STEREOGRAMS Pass out stereoscopes and Fish Creek stereograms and sketch maps. Students may want to label features on the maps as we identify them. Start with the small scale Color Infra Red, then the 1984, then the 1962 pair.

Color Infra Red Trace headwater tributaries, notice change in slope from gentle marine terrace to steep bedrock at about 500', check limits of Mendenhall River sediments. Is Fish Creek (over 4, up 3) still migrating over the terrace? (No. It's entrenched.)

1984 How did the ponds get there? Why were they dredged? Why do they exactly correspond to the alluvial fan ("f") on the Miller map? What made the ridges around the pond? Are they of the same origin as the longer, gently curving ridge (over 5, up 2) enclosing the estuary?

1962 What differences do you notice between the 1962 and 1984 photos? (Careful to note scale difference -- use the scale bar.) How many trees were on the spit in 1962?

NOTE Teachers are encouraged to use the stereoscopes and stereograms at greater length with students, as it takes time for many students to learn to see in stereo, and to use the coordinate system to communicate about location of landforms. There is a wealth of landform interpretation possibilities in the Fish Creek stereograms.

A valuable summary to the field trip is to have a team of students project the sketch map of Fish Creek onto a poster (make acetate copy for overhead projector), and trace it. Then more detail can be added by projecting my slides (1984, Miller map, 1962) onto the map with a slide projector, moved backward until the scale matches. The poster will have to be repositioned (rather than cocking the projector). Field teams can add observations to the poster from their Rite-in-the-Rain map sheets, and from memory. I'll be glad to help if you have problems with this. Good Luck!

LANDFORM SLIDES
FIFTH GRADE

GOALS

• Familiarity with the major non-glacial surficial landforms along the Juneau road system. (Glacial landforms will be discussed before the spring field trips.)
• Extension of the excitement of tracking into the realm of geology, which many kids find less appealing than critters.
• Confidence that many questions about local landforms are accessible to simple logic. Willingness to ask *why, how* and *when*, on confronting escarpments, on finding silt on top of gravel, etc.
• Preparation for the field trip to Fish Creek.

A note on the 5th grade science curriculum *At a 1989 in-service meeting on the science curriculum, I recommended that the section entitled "glaciers" under 5th grade geology be expanded to include marine and alluvial landforms as well as glacial ones, and that the "extended application" for that section be changed to read; "Students will observe landforms in the school vicinity, and determine if they are of marine, alluvial or glacial origin". The curriculum has incorporated this change. My reasoning was that: a) "glaciers" (along with "weathering and erosion") seems to be the only section of the geology curriculum devoted to surficial landforms, b) surficial landforms are right under our feet, and easier for 5th grade laypeople to handle and get excited about than bedrock geology, and c) while glacial landforms are certainly pervasive in S.E. AK, many local schools don't sit directly on till, but rather on uplifted beaches (Harborview) or alluvium (Glacier Valley).*

CHALKBOARD We'll talk about 4 kinds of non-glacial **surficial** (as opposed to bedrock) landforms today, those formed by:

1 moving fresh water like streams and rivers (**alluvial**)
2 falling material (**colluvial**)
3 the ocean (**marine**)
4 people (**human**)

SLIDES Project three slides to bridge from critter tracks:

Intro

892309 mink on fine sand, with wave ripples, Eagle River bars
882712 mink on coarse sand, with mystery craters, scout camp beach

Go through once just reviewing critter tracks, then repeat, considering substrate of the footprints as a track in itself.

901736 3 types of sediments
900907 drawing of Eagle River for tracking article.
900904 1979 aerial, same as above drawing
900905 1962 aerial, before beaver colonization or much vegetation of river bars
900906 closeup of 1979 beaver ponds

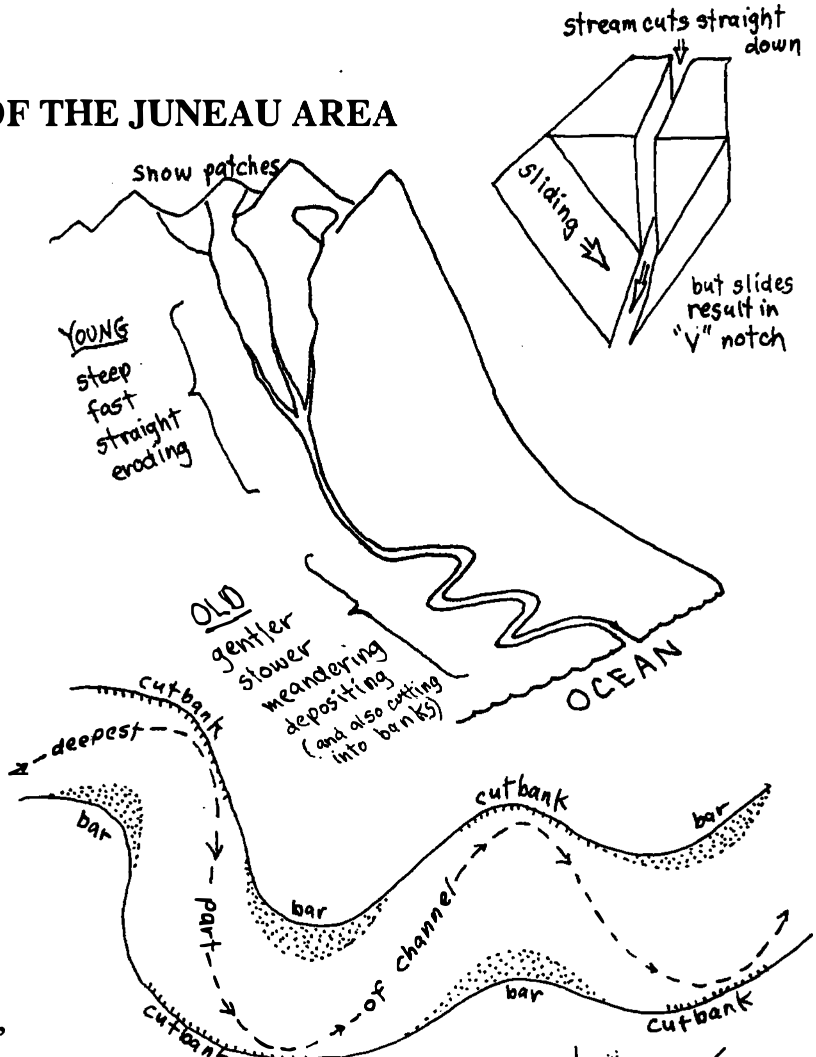
Alluvial

893411 steep creeks draining snow patches
900902 straight creeks on steep slopes above Eagle Lakes
900903 meandering lowland creek
882703 Herbert cutbank
891921 Herbert bar
880917 boulders in high energy stream at Herbert Glacier
880916 braids at Herbert
882207 clay on sand waves
900916 Bloom block drawing of river features

LANDFORMS OF THE JUNEAU AREA

ALLUVIAL LANDFORMS

Streams start out small, fast, steep, and straight, like kids going to recess. They often originate in snowpatches high in mountains. Stream erosion produces **"V"-shaped gullies**. (Glaciers carve **"U"-shaped gullies.**)

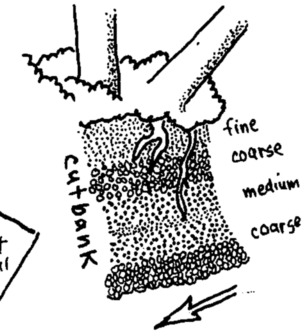


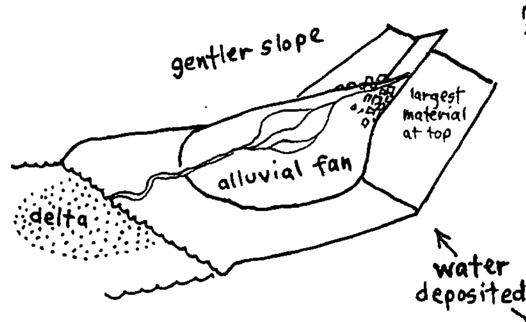
By the time streams reach the lowlands, they've leveled out, slowed down, and begun to deposit their load of sand and gravel. Now they **meander**, like kids *returning* from recess. They carve **cutbanks** into the outside of bends, and deposit **bars** on the inside. Meanders migrate over time, covering the entire river **floodplain**.

When a stream flows off of a steep bedrock hillside onto a more gently sloping **terrace** (see marine terraces, below), it deposits its load. This results in an **alluvial fan**. Fans are very common around Juneau.

When a stream enters the ocean or a lake, it also deposits, but the feature is called a **delta**.

Water deposited sediments are **sorted** (versus **unsorted,** as in glacial till and many human landforms). Particle size, in order from large to small is; **boulder, cobble, gravel, sand, silt, clay.** Often a cutbank or soil pit will show these sorted materials to **be stratified**, or arranged in layers.

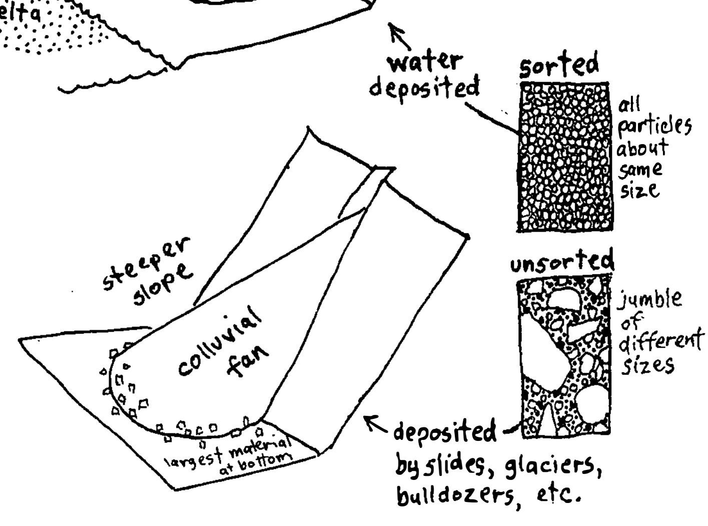


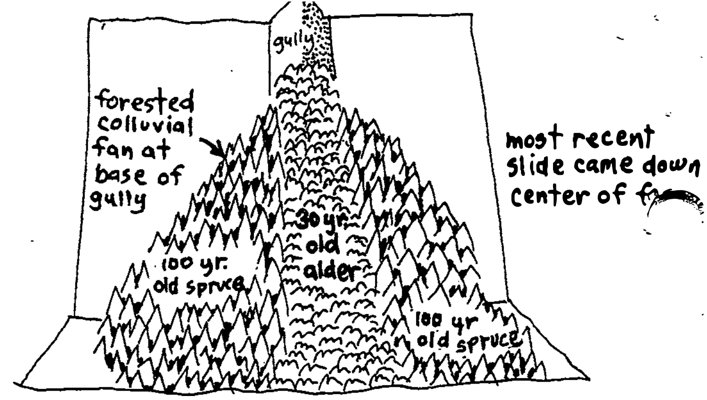


COLLUVIAL LANDFORMS

Falling materials, moved by gravity rather than water, form colluvial deposits. They may be fans, but are usually steeper than alluvial fans. Many homes in Juneau are built on **colluvial fans**!

These fans are usually at the bottom of landslide and snow avalanche tracks. You can tell how often slides happen in





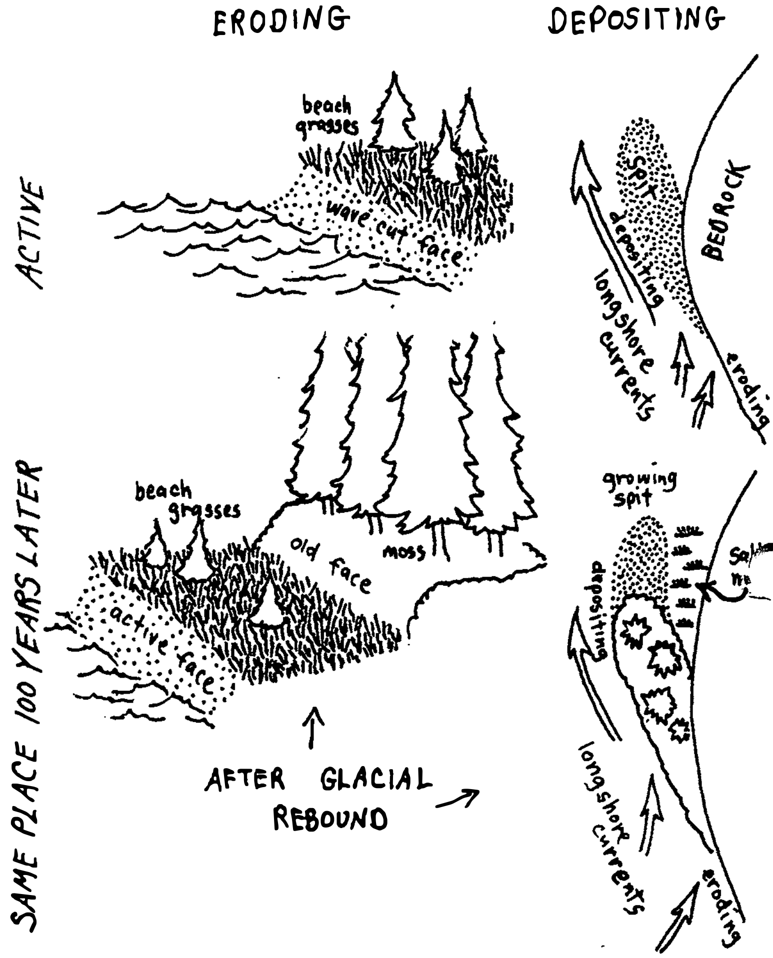
gullies and fans by looking at the vegetation. Very active gullies and fans have meadow herbs, fairly active ones have alder, and stable ones where slides are rare have conifer forest. Coring trees can date the last slide. Clearcutting during Juneau's early mining days probably increased the frequency of slides.

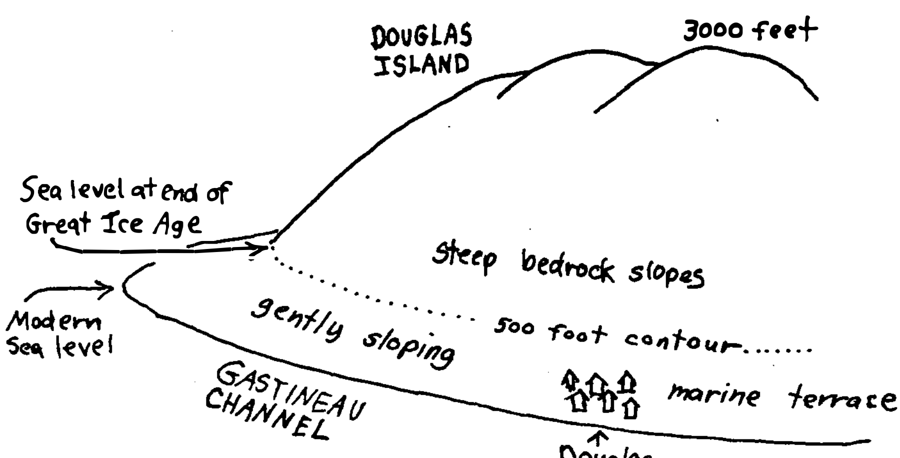
COASTAL LANDFORMS

Ocean waves can either carve out features like **wave-cut faces**, or deposit features like **bars** and **spits.** Longshore currents can also sweep sediments into bays, which then fill up to become shallow mudflats and **salt marshes.** Also see **deltas** (above).

In northern Southeast Alaska, the land is rising from **glacial rebound**. In downtown Juneau the rate is about .5"/yr. In Glacier Bay the rate is about 1.5"/yr. Since the end of the **Little Ice Age**, the coastline around Juneau has risen about 10 feet. In many places, coastal landforms have been lifted out of the intertidal and are now covered by forest.

In addition to Little Ice Age terraces, there are ancient marine terraces which date to the end of the **Great Ice Age**. These are about 12,000 years old and up to 500 feet high. They surround most of Douglas Island, and are obvious on contour maps.





Assorted Activities, Lessons and Worksheets (1990)

Mendenhall Glacier, The Mendenhall River, The Mendenhall River Estuary
By Cathy Connor with help from Maynard Miller, Scott Foster, and Robbert D. Miller
5/7/89 vers.

Geologists, people who study rocks and sediments, have mapped the rocks and glacially-deposited sediments near the Mendenhall River, up Montana Creek and along the shores of Gastineau Channel.

Glaciologists, people who study glaciers, have cored the ice and measured the glaciers in the Juneau Icefield. These studies tell us a lot about the glacial history around Gastineau Channel for the past 12,000 years (60 million years after the dinosaurs disappeared but before the end of the woolly mammoths!)

TIME TABLE

LAST MAJOR ICE ADVANCE
20,000 years ago- The last Great Ice Age (which may have begun in Alaska between 10 and 13 million years ago, began globally about 3 million years ago) reached its greatest maximum and began to retreat. At this time southeast Alaska was covered by an ice sheet almost 1 mile thick.

SEA LEVEL RISES
12,000 years ago-The earth warms up and ice begins to melt and retreat. The melted icewater flows to the sea and causes sea level to rise world-wide. The Mendenhall Valley is covered by 400 feet of sea water. Sediments made up of a mixture of glacial silt and rocks as well as marine mud and marine animals and plants, are dumped onto the bottom of Gastineau Channel, downtown Juneau, Douglas Island, and the flooded, valley floor ~~of~~ Mendenhall. ~~Glacier.~~ These sediments were probably dumped by melting icebergs, calved off the dying glaciers, and sea ice that formed along the beaches in the winter. They are called the Gastineau Channel Formation by geologists.

LAND RISES
6,500 years ago- The weight of the ice sheets had actually caused the land to sink during the very cold times of the Ice Age. Once the ice was removed, the land slowly "rebounded" back. The mixed up marine muds and glacial silt and boulders of the Gastineau Channel Formation are found today on the mountainsides around the channel at elevations between 500 and 700 feet above sea level. The land is still rising today at a rate of less than 1 inch each year. The rate is greater near Glacier Bay where ice began melting only about 200 years ago. The Mendenhall Valley filled up

with glacial sediments carried by the rivers and became an estuary at this time. Plants began to grow on the new land surface and some forests formed.

LITTLE ICE AGE

3,000 years ago- the earth's climite cooled off again slightly, and the glaciers of southeast Alaska began to move forward down their valleys. They ran over the forests that had begun to grow. Some of these run-over forests can be seen as stumps falling out of the banks along the Herbert River today. The Mendenhall Glacier is a remnant of this most recent advance.

RETREAT OF THE MENDENHALL GLACIER

240 years ago- When a glacier begins to melt faster than it advances, its icefront retreats up the valley. The clues to the history of the Mendenhall Glacier's melting were left in a series of tall arcuate ridges, called terminal moraines, by the melting ice, beginning about 1750. At that time the Mendenhall Glacier front was 2.5 miles further down the valley...much closer to Mendenhaven. As the retreating ice melted it dumped piles of rock, sand and silt. The moraine ecology trail is one of these ridges. Mendenhall Lake was formed as the ice retreated and a moraine dammed the upper portions of Mendenhall River. In the 1930's the rocks where the visitor center is now sited, were covered by the glacier.

PRESENT

The Mendenhall Glacier continues to melt back up the valley at a rate of about 30 feet each year. The silt and rocks released from the thawing ice are carried downstream by the Mendenhall River to its mouth at Gastineau Channel. The Mendenhall wetlands receive this new mineral material daily. The greatest "dump zones" for the fine-grained glacial silts and clays accur at the place in the Mendenhall River where the incoming high tide sea water, meets the down-stream, flowing fresh water of the river. This head-on collision of different density waters creates a zone of zero water velocity and the sediments carried in the water column are dumped. As the tide ebbs the sediments can move further down-river toward the river's mouth. The sea water flowing over the wetlands at high tide can then redistribute the sediment across the wetland surface, creating more substrate for wetland plants and animals to live on. Eventually Douglas Island will become a peninsula of the Mendenhall and Lemon Creek valleys as the rivers fill in Gastineau Channel.

Lesson 4

"HOW DOES THE MOON AFFECT THE TIDES?"

QUESTION
How does the moon's path affect the tides?

UNDERLYING CONCEPT

- Tides are caused by the gravitational pull among the sun, moon, and earth. The size of the tides depends on where the sun and moon are in relation to the earth.

SKILLS

- Observation

OBJECTIVES
Students will be able to:

- Students will experience with movement the relationship between the moon and the high and low tides.

TIME NEEDED

- 55 minutes

MATERIALS NEEDED

- None

VOCABULARY

Tide- The periodic rise and fall of the ocean's water level due to the pull of the gravity from the sun and the moon.
Low tide-The two points in the day when the ocean's level is lowest.
High tide-The two points of the day when the ocean's level is highest.

BACKGROUND INFORMATION

Tides are caused by a gravitational tug-of-war between the sun, moon, and earth. All objects exert gravitational pull on each other. The closer they are, or the larger they are, the greater the pull. All of the planets exert some gravitational pull on the earth. However, the pull of the moon and sun are most noticeable because the moon is so close to us and the sun is so big. It takes the earth 365 days to revolve around the sun. As it revolves around the sun, it spins, or rotates on its axis once every 24 hours. At the same time, the moon revolves around the earth once every 29 days. The gravitational pull of the sun holds the earth in orbit, while the gravitational pull of the earth keeps the moon in orbit.

As a result of this gravitational attraction between the earth and the moon, the side of the earth facing the moon is pulled towards it. Solid objects like the ground and buildings are not distorted as much as liquids like the ocean. A bulge of water occurs on the side of the earth facing the moon. As the earth rotates around the sun, centrifugal force causes an equal bulge of water on the opposite side of the earth. Water is pulled away from these two sides of the earth to form these bulges, or high tides. This leaves a depression, or low spot, in the oceans between. These are the areas of low tides.

Most areas of the earth have two high tides and low tides every day. These high and low tides are slightly more than 6 hours apart. In some areas, the high and the low tides are the same. However, the earth is tilted on its axis, so the bulges are sometimes unequal. Because of this, in the Southern California region, one of the high tides each day is higher and one of the low tides each day is lower than the other. It depends on where you are located in the earth's surface whether your high and low tides are semidiurnal (the same tide twice a day) or semi-diurnal mixed (different tides twice a day).

ACTIVITIES:

Into:

1. Teacher should begin with a discussion of high and low tides.
2. How many of you have been to the beach at high and low tides?
3. What did you notice about the seashore?
   (more rocks, area, and animals can be seen when the tide was 'out' or low, waves and water were further up on the beach when the tide was in or high)
4. Ask for students ideas on what high and low tides are, and why they occur.

Activity:

1. Have the class form a circle in a large area. This could be in the classroom, on a lawn, or if necessary, on the playground.
2. The ideal way for students to sit is crossed-legged with hands holding the next person's elbows to form a strong circle. If the class is reluctant to touch, have them kneel "knock-kneed" next to each other in a circle.
3. One person is the moon and moves around the outside of the circle. The circle is the waters of the earth. As the moon passes behind the students (water), the waters bulge (lean) toward the moon, and then into the center as the moon passes. As the moon moves, have the students that are opposite the moon lean away from the moon (this represents water bulging out on the opposite side of the earth) and then have them lean into the center as the moon passes.
4. Have the moon stop, and let the class see where the high tides are (next to the moon and at the opposite side of the circle). Then the moon continues to circle. Have the moon stop at several points in the circle and let the class see where the high and low tides are in relation to the orbit of the moon. (Low tide will be at the sides halfway between the high tide bulges.)
5. The moon can then circle the earth several times so the rhythm of the passing of the moon and the bulging of the waters is experienced by the class. Before ten minutes are up, even first and second graders have a feel for how the moon affects the tides.

Beyond/Extensions:

1. Have the students make suggestions as to other forms this activity can take.
2. Check out the daily tides in the newspaper or on the web and graph their heights for a month.

A.
B. Review of concepts, sensory awareness
C. Day/clearing or road
D. 6 or more
E. 5-13 years
F. None

Owls & Crows

THIS is an excellent game for reviewing newly-learned concepts. Divide the group into two equal teams, the Owls and the Crows. Line up the two teams facing each other, about two feet apart. About 15 feet behind each team, draw another line for Home Base. The leader makes a statement aloud, and if the statement is true the Owls chase the Crows, trying to catch them before they reach their Home Base. If the statement is false, the Crows chase the Owls. Anyone caught must join the other team.

If the answer isn't obvious to the players, you'll get some of the Owls and Crows running toward each other, and others running back to their Home Bases. During the pandemonium, the leader should remain silent and neutral. When the action has calmed down, he can reveal the correct answer.

Here are some sample statements: Sensory: *"The wind is coming from behind the Crows."* Conceptual: *"A deciduous tree keeps its leaves all year long."* Observational: (after showing them a leaf) *"The leaf had five points and five veins."* Identification: *"This seed comes from an oak tree."*

Earthball Games

Concepts:

Cooperation is essential in achieving results in this game. This is also a physical enactment of caring for and protecting our earth. Before the game begins, take some time to talk about how cooperation is necessary in our world to safely carry our planet with all it's living elements, plants, animals and humans through time.

Materials: Earthball (from Teen Club) and pump, playing field

How To:

Depending on the number of participants, numerous variations of this game can be played.

One method is to have the earthball in the center of the field. One team of players is going to try to pick up and get the earthball over one of the endlines on the field, without letting it touch the ground. To complicate their task, 3 or so other players try to knock the earth ball to the ground, without grabbing, holding or pushing other players. Regardless, this is a rather rowdy game.

Variations:

Try having two teams of players, attempting to get the earth to opposite sides. Then have them all work together to get it to one side. Emphasize the importance of cooperation.

Try making a circle with players positioned like spokes on a wheel. Players should be at least 3 per spoke. They represent the earth's orbit is space. The ball gets passed by each spoke on to the next, trying to carefully transport it through space without dropping it to the ground. Lots of cheering and encouragement are important. Successful orbits represent another day!

Clare

DRAGONFLY MASK

You will often find this brightly colored insect near fresh water. With their large, compound eyes and acrobatic flight they are a wonder to watch.

Did you know:

- Young dragonflies live in water. They hatch from an egg ~~into a nymph~~ and spend their life in the water before changing into an adult. The nymph's unusual mouth has a lower lip that reaches out to snatch its prey.
- Their ancestors had a wingspan of thirty inches.
- The adults powerful wing muscles help them to hover, fly for a long time and travel to far places. They can beat their wings twenty times a second.
- You can tell that you are looking at a dragonfly if its wings are stretched out to the side while it is resting. The damselfly holds its wings closed.
- Adults feed while flying by using their legs like a net to catch their food; mosquitoes are a favorite!
- They have special compound eyes made up of ten thousand to thirty thousand lenses.

ENERGY FLOW

GOAL: Through this activity the kids will see that as energy moves from the sun to plants and on to animals, much of it is lost. "Energy Flow" represents energy moving through food chains.

CONCEPT: Energy transfer.

TIME: 15 minutes

LOCATION: A place large enough for a relay race and a place that can stand to have water spilled on it.

EQUIPMENT:
1. Cans with holes punched in the bottom to serve as "energy carriers".
2. Large cans or containers for the water to be poured into.
3. Water source to serve as "energy source".

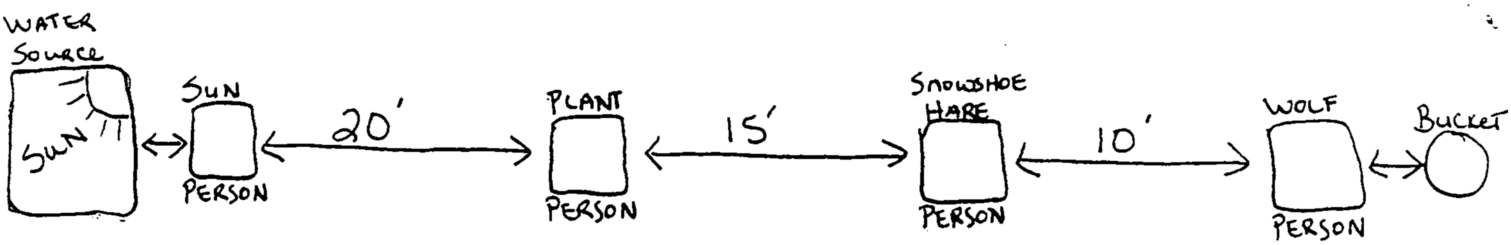
PROCEDURE:
Background: As energy moves along from the sun to plants and on to animals, much of it is lost. Before they are eaten, plants use up much of their energy just to grow. And a lot of sunlight energy is required just for animals to move around. Because of this energy loss, a lot more sun-energy is needed to feed a meat eater than to feed a plant eater.

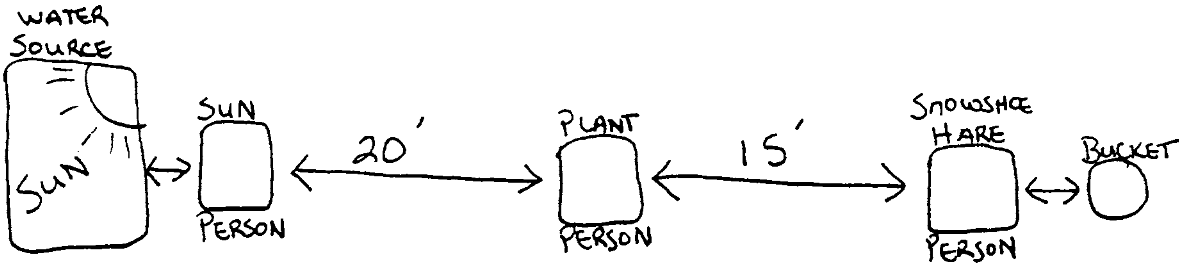
Divide the kids into two teams (or more if you have a lot of kids). One team will carry energy from the sun to a wolf (top level consumer), and the other will carry energy from the sun to a snowshoe hare (secondary consumer).

Water is used to represent energy - The water source will be the "sun". Both teams will get their energy from the sun. Place a tub for each team at the end of the course. For the one team the tub will stand for a snowshoe hare, and for the other team, it will be a wolf.

In each team, different people will be playing different positions in the food chain:
*Sun person - one for each team. The sun people stand by the water source.
*Plant person - they take energy right from the sun.
*Snowshoe hare person - they take energy from the plants.
*Wolf person - only the wolf team has this person. They take the energy from the snowshoe hare.

This is a relay race. Sun people get their energy from the sun (water source), then pass it on to the plant people, etc. Each team is attempting to fill up their tub first with the energy obtained from the sun-water. They do so by passing the water from can to can with holes in them. The holes represent the energy loss that is always happening in the natural world.





Since this race is a copy of what happens in nature, the students can only pass energy on to whoever gets energy from the role they are playing in the natural world. Also, since energy loss is always happening in the world, they should not try to cover the holes in their buckets while carrying energy along the food chain.

As soon as they have emptied their can into the next can in the chain, they can turn back and fill it up again.

Start the race. The action will be fast. Since the buckets are set at distances similar to that in a real food chain, the sun-people will do less work. It will soon become apparent that the Hare team has a definite edge over the Wolf team. The Hare team's bucket will fill up about twice as fast.

Shout "stop action". Everyone stops right where they are. It is a tough life carrying energy - it seems to escape just as fast as you get it. About nine-tenths of the work is wasted. Take a look to see what is happening. What team seems to be winning the race? Who seems to be doing the most work?

Start the race again and continue until there is a winner - the Hare team should fill their bucket first. Gather everyone together and talk about what actually happened during this race.

OH DEER

Concepts this game develops:

1. Good habitat is the key to wildlife survival.
2. A population will continue to increase in size until some limiting factors are imposed;
3. Limiting factors contribute to fluctuations in wildlife populations;
4. Nature is never "balanced" but is constantly changing.

Wildlife populations are not static. They continuously fluctuate in response to a variety of stimulating and limiting factors. Habitat components are the most limiting factors in most natural settings. The most fundamental of life's necessities for any animal are food, water, shelter and space in a suitable quantity.

Materials: playing field

How To:

The objective of the game is for the deer to find either, food, water or shelter each round of the game to survive.

For each of the life stimulating factors (food, water, shelter) there is a symbol: hands over mouth represent water, hands over stomach represent food, hands in a roof shape over head represent shelter.

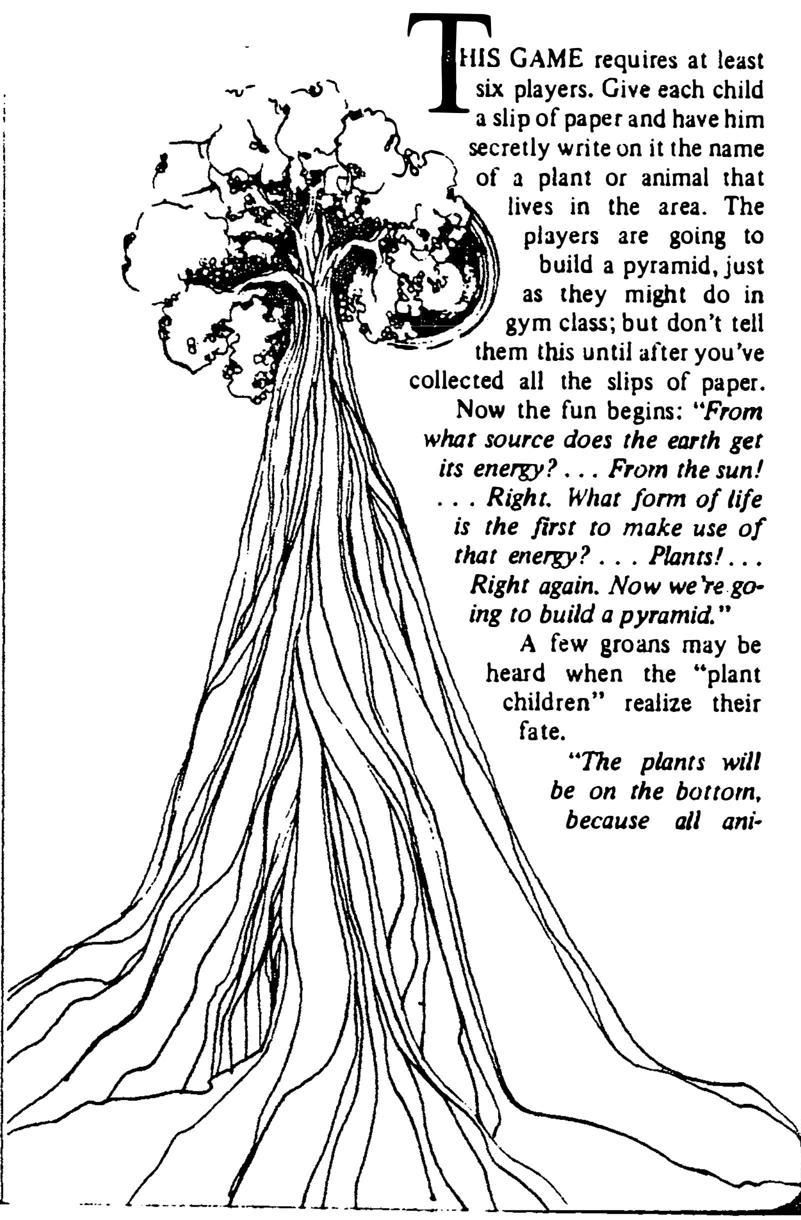
Divide the children into 2 teams. Each team lines up about 100 ft. apart. One side will be deer and the players on the other side will be the forest. Have all players turn their backs to the middle. The deer each decide which of the stimulating factors they will be looking for that season (food, water, shelter) and the forest players each decide which factor they will be. At this point it is important not to let the other team see what you are deciding. On the count of 3, both teams make their symbols and turn around. The deer quickly look for a person who has a matching symbol to theirs and run to the other side to claim them. There will be some deer who don't find a match and some forest players who don't get claimed by a deer. Deer who find what they need that season, take the player back to the deer side. Deer who don't find what they needed "die" and become a part of the forest.

This game repeats, but now the children are on different teams. The deer and forest sides remain the same though. As the game progresses it will become apparent that if there isn't enough of a stimulating factor, the deer will suffer. When there is an abundance, the deer increase.

SCAVERNGER HUNT!

- A seed
- Gravel
- A white rock (like quartz!)
- Point out erosion to an adult
- A feather
- Something made by people
- sand
- Animal scat, from a wild animal☺
- A berry
- Show an adult a boulder and a cobble
- Some fungus (like a mushroom!)
- Something that reminds you of yourself
- Show an adult an avalanche area
- A rock with lots of layers in it (like a sedimentary rock)
- Something stinky and smelly
- Something that makes noise
- Anything cool!

Pyramid of Life

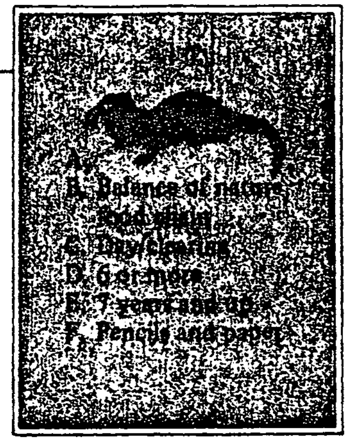


THIS GAME requires at least six players. Give each child a slip of paper and have him secretly write on it the name of a plant or animal that lives in the area. The players are going to build a pyramid, just as they might do in gym class; but don't tell them this until after you've collected all the slips of paper.

Now the fun begins: "*From what source does the earth get its energy? . . . From the sun! . . . Right. What form of life is the first to make use of that energy? . . . Plants! . . . Right again. Now we're going to build a pyramid.*"

A few groans may be heard when the "plant children" realize their fate.

"*The plants will be on the bottom, because all animals depend on them directly or indirectly for food. All the plants kneel down here on all fours, close together in a line. Now, as I read off the animals from the slips of paper, tell me whether they are plant-eaters or meat-eaters. All the plant-eaters (herbivores) stand in a line behind the plants. All the meat-eaters (carnivores) stand in another line behind the herbivores.*"



There will nearly always be more children in the upper-level groups than in the supporting plant levels; it's a lot more fun to be a bear or mountain lion than it is to be a dandelion or a muskrat. Humility, alas, seldom stimulates the imagination. With so many tops and so few bottoms, it will be impossible to build a stable pyramid. Some of the predators will just have to forfeit their exalted status. Challenge the children to reconstruct their own pyramid into one that will easily support all its members. (Tell them the bigger children can change to plants if they wish.) Clearly, the higher up in the food chain, the fewer the number of animals there are. Demonstrate the importance of plants by pretending to pull one of them out of the pyramid.

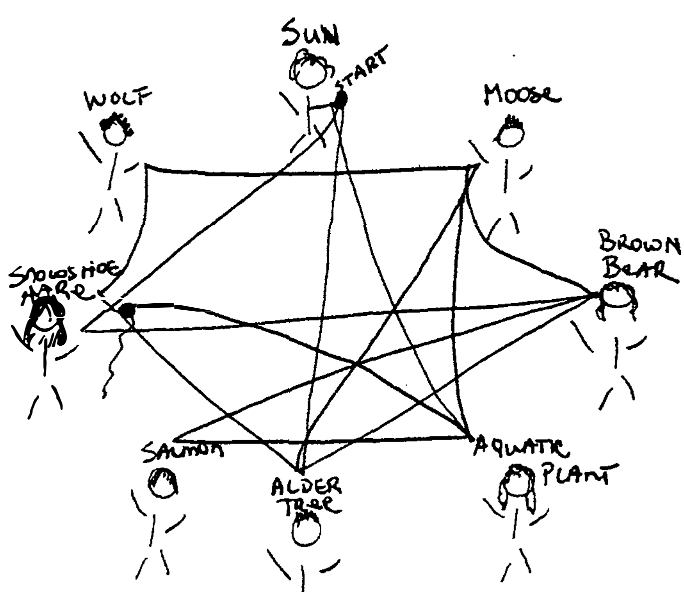
WEB OF LIFE

EQUIPMENT: Large ball of string.
Cards or labels of some kind that the kids can wear on their chest. These cards will each have the name of either a biotic factor or abiotic factor. Biotic - living organisms. Abiotic - sun, soil, air, and water. Enough cards so that each kid can assume the role of one factor. Examples: Sun, mosquito, deer, wolf, bear, fungi, etc.

PROCEDURE: Form the group into a circle. Start the ball of string at the sun (all energy comes from the sun). The sun passes the ball of string to a person they feel they are connected to. Each student should tell why they feel they are connected to the one they passed the string to. Each time a person has the ball of string passed to them, they should hang onto their section of string. As the game progresses, a complex web of string will be formed.

How do humans fit into this web?
What kinds of human activity can affect this balanced web?
What happens if one factor in the web gets hurt or their population is wiped out?

Have kids give an example of an activity that would hurt one of the factors - air pollution, water pollution, etc. Have that factor then tug on their portion of the web in their hand. Have everyone who felt the tug raise their hand. These are the factors that would be affected by the harm done to the other factor. Discuss the implications of this.



PREDATOR/PREY STALKING GAME

EQUIPMENT: A squirting utensil (I would suggest something other than a squirt gun.)
A blindfold for the prey.

PROCEDURE:
Have all but one kid get into a large circle - with each kid about 20 feet from the center of the circle. These kids will be the predators.

Have the one kid go into the center of the circle, blindfolded and armed with the squirter. S/he will be the prey.

This is a game of stalking. How predators need to not be heard in the stalk and how prey need extra special hearing in order to avoid the inevitable. You can talk about how sensitive hearing and quite movements is a form of camouflage. In the predator/prey world, camouflage is the key to the survival of both types of animals. How to eat and not be eaten!

With the prey blindfolded in the middle, s/he sits quietly, ready to hear any approached predators. When you say "begin", the predators will crawl towards the prey - trying their hardest to not be heard. The object for the predators is to not be heard and to tag the prey. If the prey is tagged, s/he has been eaten.

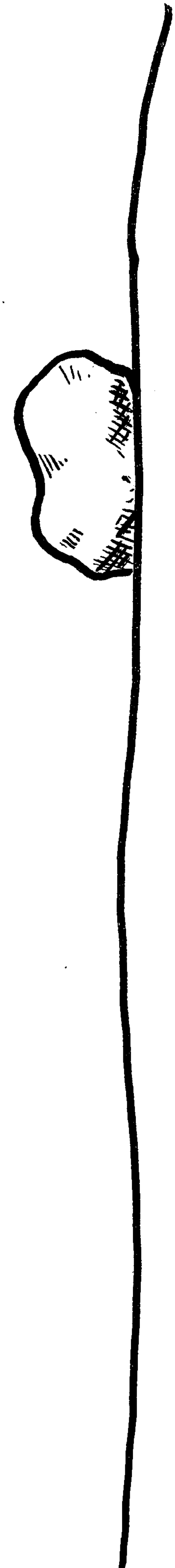
The object for the prey is to not get eaten. Their only defense is to hear predators. When a stalking predator is heard, the prey will squirt in the direction of the sound. If any predator is hit by the squirt, they have to return to the perimeter of the original circle - starting over again. If a predator does not get squirted, they can continue their stalk forward in pursuit of culinary delight.

The most important rules:
No talking, giggling, etc. This is a silent game.
No lunging forward on the predators' part. Any quick moves are disqualified. Their stalk must be slow.

It's up to you to be the referee of who actually got hit with a squirt and who actually lunged.

Discuss the type of camouflage and survival demonstrated. What worked and what didn't? What was difficult and what was easy? How well could the prey hear? How well could the predators stalk without being heard?

Keep switching people into the prey position.



MAMMAL FAMILY TREE
THIRD GRADE

GOALS
- Familiarity with the important wild mammals of Southeast Alaska
- Understanding of mammal taxonomic relationships, as revealed by skulls
- Recognition that we're all in it together (and that Juneau's presence excludes some native species).

INTRO QUESTION Of these three mammals -- sea lion, sea otter, skunk -- which two are the most closely related? Scientists in our culture judge family relationships among mammals by who their ancesters were, not necessarily by where they live or how they make their living. (Leave unanswered until end of session.)

SKULLS Draw skull of rodent, carnivore, and hooved mammal on board. Identify teeth. Use worksheets.

FAMILY TREE Pass out family tree, and construct one on board. Name some representatives of each family and order (but teachers can do this more thoroughly later, using the ID sheet). Emphasize skeletal clues. Discuss habitat and feeding diversification among rodents and weasel family.

SUMMARY What animals from our "tree" occur within the limits of downtown Juneau, that is on our streets and in our backyards? Probably the most dangerous thing for most local wild animals is people's dogs and cats. Here are the "city wild animals", and their defense strategies:

animal	defense
deer mouse	hides in holes
house mouse	hides in holes
shrew	hides in holes
red squirrel	climbs trees
porcupine	prickly
bat	flies
weasel	hides in holes
black bear	fights!

Other wild animals that are common in Southeast Alaska can't survive in the city of Juneau. This includes the Sitka deer, the snowshoe hare, the beaver, the wolf, and the otter.

Bring *30 copies of skull worksheets, 30 of family tree, rodent, deer and wolverine skull*

MAMMAL FAMILY TREE
IDENTIFICATIONS

1	snowshoe hare	*Lepus americanus*
2	hoary marmot	*Marmota caligata*
3	beaver	*Castor canadensis*
4	red squirrel	*Tamiasciurus hudsonicus*
5	deer mouse	*Peromyscus maniculatus*
6	northern red-backed vole	*Clethrionomys rutilus*
7	porcupine	*Erethizon dorsatum*
8	little brown bat	*Myotis lucifugans*
9	human	*Homo sapiens*
10	masked shrew	*Sorex cinereus*
11	orca	*Orcinus orca*
12	wolf	*Canis lupus*
13	lynx	*Felis lynx*
14	black bear	*Ursus americanus*
15	Steller's sea lion	*Eumetopias jubatus*
16	wolverine	*Gulo gulo*
17	short-tailed weasel	*Mustela erminea*
18	river otter	*Lutra canadensis*
19	mink	*Mustela vison*
20	marten	*Martes americana*
21	mountain goat	*Oreamnos americanus*
22	moose	*Alces alces*
23	black-tailed deer	*Odocoileus hemionus*

"Missing mammals"? How about rodents like the flying squirrel, muskrat, long-tailed vole, jumping mouse, bog lemming, Norway rat and house mouse? Two missing shrews are the wandering and water shrews. Aside from the little brown bat, five other species have been recorded in Southeast Alaska. Missing whales ("cetaceans") are of course the humpbacked and minke, and the Dall and harbor porpoises. Missing in the dog family are the coyote and red fox, in the bear family the brownie, in the finfeet (or "pinnipeds") the harbor seal, and in the weasel family the sea otter. And among the hooved mammals (order Artiodactyla), Roosevelt elk have been transplanted onto Etolin Island, and Dall Sheep sneak across the border from Canada north of Haines.

If you can *still* name missing wild mammals in Southeast Alaska, congratulations!

Third Grade Class 2
Mammal Skulls
Winter

Goals:

•familiarity w/ dentition
•familiarity w/ skull characteristics
•understanding of taxonomic relationships
•excitement about unraveling mystery and asking questions

Introduction: Pass out carrots and jerky to each student. (explain that we are going to wait until everyone has some, and let's figure out how we eat, what teeth do we use to bite and then chew this carrot? Jerky?

Skulls Worksheet: discuss dentition, eyes, z. arch, ear openings, palate etc. Pass around skulls as examples and ask questions about each. Get students thinking about size, shape, eye placement, dentition etc.

Skull Investigation: stations around the room, students make observations about individual skulls. What observations do you have? What order does it belong to? Family. Allow enough time for groups to share their discoveries.

Wrap-up: Between these three skulls, who is more closely related? (mink, marten, or coyote) How do you know? If animals that are related have similiar skulls, do you expect that there are other common charcteristics? What about their tracks? Next class, we'll see what we can figure out about their tracks?

4th Grade--Energy Connections Intro
(45 min.)

Goals: Students will recognize that energy is transferred from one organism to the next in a food chain.
Students will be able to describe the process of photosynthesis and state its importance.
Students will recognize the role of producers, consumers and decomposers in energy transfer.
Students will collect and organize items into producers, primary consumers and secondary consumers.
Students will look for decomposers on a fallen log.

I have a puzzle for you. I am going to do several things and I want you to figure out what they all have in common. What is the connection between them all?

Demonstration: Blow pinwheel, light candle, jump rope, use a magnet to move metal.

What is energy? (The ability to make things happen) How do we use it? Do plants and animals depend on energy?

Put yellow raincoat on student volunteer and tape on the sign that says "I am the source of energy for all living things". After students guess the sun, tell students that the sun's energy travels 93 million miles to reach the earth. Then pull out a small box with a lid and a sign taped to the bottom that says "the most valuable thing on earth". Let students guess what's in the box. Let them hold, shake and listen to the box. After they have made several guesses pull out the leaf inside, and ask them why they think I call this the most valuable thing on earth. Don't let them guess yet, tell them just to think about it and we'll come back to it. Have another student volunteer hold the leaf and stand next to the sun. How does this plant, who you said needs energy, get its energy? Give the sun a ball of yellow yarn and pass the end to the student holding the plant. Most students will guess that plants get their energy from the sun. But how? Have student volunteers perform the **Photosynthesis Play**. Once play is complete remind students that the process of photosynthesis allows plants to get energy from the sun. Ask students what a plant uses energy for? (Growing, reproducing, developing roots, healing wounds, etc.)
Next, show students an antler. Have them guess who it belonged to. Does a deer need energy? Where does it get its energy from? Take the end of the yarn from the plant and pass it to the deer, keeping the plant and sun connected. What does a deer need energy for? (Finding food, escaping from predators, bearing young).
Next show students a brown bear skull. What is this? Does a bear need energy? Where does the bear get his energy from? Take the end of the yarn and pass it to the student volunteer holding the skull. What does a bear need energy for?
With all student volunteers holding their yarn, ask students to tell you what they see. Most will say a food chain. Explain that a food chain is a pathway that energy takes through all living

things.

So, why is the leaf the most valuable thing on earth? They are the only living things that can capture the sun's energy and turn it into food for its self and others.

What happens when the bear dies? What happens to its energy? Does the chain stop? Introduce scavengers and decomposers. Introduce the FBI (fungus, bacteria and invertebrates) and their role in cycling energy.

Activity: Draw a triangle on the board. Introduce the terms producers, primary consumers, secondary consumers and decomposers. Divide triangle into 3 sections with the bottom being the largest and other segments progressively smaller. Write producers in the bottom. Also write the word sun muncher. Ask students why you might call plants producers or sun munchers. On next section write primary consumer and plant muncher. Why might you call things like a deer, primary consumers and plant munchers? On the third section write secondary consumers and animal munchers. Why might you call a bear a secondary consumer or an animal muncher?

Now, give students a picture of an animal, plant, insect, mushroom, tree, etc. Give a picture to each student. Have them place their picture in the proper section of the triangle. Review as a group to see if all were properly placed. Students with decomposers could decide where to place them. I like to draw a segment on 1 side of the triangle to show that consumers live off of dead producers, primary and secondary consumers.

Go over field trip–expectations, how to dress and what we plan on doing. Tell students that they need to bring in a piece of trash from their lunch or snack and bring it on the field trip as we will be doing a long term experiment with it.

Review: So what do all living things need to survive? What is the source of energy for all living things? Why are plants so important to all of us?

I also liked to bring in some examples of lichens to show kids that not everything in nature fits perfectly into one category. We examined the lichens and discussed how lichens consisted of a fungus and algae living together. Kids really liked the splash cups and the variety in lichens.

Fine tuning: This was a lot to do in 45 minutes. I might do 1 hour next time with a 30 minute wrap. There is a lot of listening and limited participation to the few students who volunteer. For that reason I felt that I needed to be very energetic and keep things moving. I struggle with how to make it more interactive. Also, the kids really liked the lichens and would have enjoyed having hand lenses for a more up close look.

4th Grade –Energy Connection Field Trip
(2 ½ hours)

Review expectations and behavior by way of a silly little skit. Students tell us what we did wrong and why it wasn't appropriate. Head out the door and up the hill.
Once at the flume house, gather in group and discuss the energy we burned to get up the hill. How can we tell we are burning energy? What are the signs?
Play a game of **Telephone** or a **Cooperation Lap Sit**. Split the group into two.
Use our **Muncher Trays** to collect and organize things we find. Before kids go out collecting we review the terms and the reasons they are considered various kinds of munchers. Students explore and collect for 15 minutes and then we regroup and discuss our findings. Students usually find that they have many producers and very few consumers. We discuss all of the possibilities to explain this. We also look to see if they have found any decomposers and where we would place them on the trays. Also, some kids collect lichens and so we have a discussion about that as well. Finally, everyone likes to share the "best" thing in their tray and say why it is the best.
We then take an **adventure hike** up the hill. Along the way I have volunteers be mice, deer, bear, porcupine and so forth (one creature at a time). As we wind our way up, the mouse is looking for and gathering food. After a distance we stop and notice what the mouse has collected and determine if she is fat and happy or lean and mean. Then we switch animals. As we do this we are reviewing plants that students learned about in 3rd grade and are now learning about the amount of energy they contain. Students learn that not all plants contains the same amount of energy. We also discuss why an animal might not eat a more nutritious plant and why it would eat those that contain very little energy.
We arrive at a large fallen log. Along the way we have learned about plants, rested under large spruce and found scat. At the log we **look for decomposers** using hand lenses. After examining the log and all of the growth on it, we discuss the energy flow we see happening on the log. Why is a dead, fallen log good for the forest?
Finally, the kids dig a hole and we bury their garbage. As we place in, kids eulogize their garbage, telling what it was and how it gave them energy. We bury and identify the site to uncover next spring. Kids have fun predicting what will become of their **garbage graveyard**. Regroup with the other group and walk down to the school. Once in the classroom we share our discoveries and favorite part of the trip, if time permits.

4^{th} Grade--Energy Connections Wrap Up
(45 min.)

Review the field trip if we didn't have an opportunity to do so before. What were the favorite parts? What do you remember most about the trip? What might you like to change? What did you learn?

Read Gary Larson's *There's a Hair in My Dirt*. After reading the book discuss some of the misconceptions that Harriet had about nature and why they were wrong. Share with kids our goal of getting kids to do more than just love nature. We want them to understand it and feel connected to it. Reiterate the work of naturalists–Observing, Thinking, Sharing.

4th Grade Intro--Winter Adaptations
(1 hour)

Objectives: Students will be able to give a simple definition for the term adaptation.
Students will be able to name the three choices mammals have for adapting to winter conditions.
Students will be able to name three ways that they adapt to winter conditions.
Students will name three animals that deal with winter conditions and describe their special adaptation.
Students recognize early stages of hypothermia.
Students will name the two ways our body can make heat.

Supplies: winter clothing mammal pelts (ADF&G)

Intro: I began this lesson by walking in way overdressed for winter---layer upon layer of stuff! I told students that I hope I wasn't late. I explained that I was just a mammal trying to adapt to winter.
As I removed the many layers in front of them I asked students to tell me what characteristics mammals have. I then asked them to name some of their favorite mammal and grouped them accordingly. They then tried to name the families and recall what the common traits were among family member.
Activity: Next I asked students to tell what I meant by adapting. Adaptations are any special body parts or skills that a plant or animal has that helps it survives. I told students that they had a very special adaptation that sets them apart from most of the animal world. I shared their thumb with them, explaining that the opposable thumb allowed them to do many things. They then tried to do a simple task of tying their shoes with a thumb that could only move side to side. They quickly became aware of the advantage of the opposable thumb.

We turned our focus back to mammals thinking about the challenges SE AK mammals were dealing with (adapting to) at this time of year. The list included freezing winds, snow, rain, less available food, ice and difficulty finding water, shortened days, freezing temps, deep snow, avalanches, and so on. I asked students how animals meet these challenges? They adapt!

Then I asked students if they had to face any of these challenges in the winter. Most agreed that they did and then they shared how they adapted---change from rubber boots to snow boots, eating less fresh fruit and more canned, turn up heaters, change to studded tires, and dress differently. Some kids however said that they wear basically the same clothing and this led us to Steve's warm box analogy. And most kids agreed that the heaters were on in the house, car and school more often.

Next, I told the kids Steve's story about Sammy the cool 5th grader. As I got to the point where Sammy was lying on the ground shivering with slurred speech I would look up at the clock and say we had to move on because we had more to do. Cliffhanger....they were really intrigued.

Activity: We then took our pulse to determine what our heart rate was. Then I told the kids to quickly join me in the hall and then outside. I didn't let anyone bring a coat, we just hustled out. Out at the playground we heard a story about how porcupine adapt to winter. Lots of complaining, teeth chattering, and general fidgeting (from the survivors!). Then we took our pulse again and noticed if our heart rate had gone up or down. Most noticed it went down. I then told kids that we could produce heat in only 2 ways--eating something or exercising. So, they ran a lap or two and then gathered quickly around me. I usually moved the coldest skinniest looking kid to the middle as we took our pulse again and discussed if we were any warmer. I then asked the kid in the middle if they were any warmer---usually yes. We discussed that this huddling up behavior was an adaptation of some mammals. Then we all ran back to the room to warm up.

The last part of the class involved sitting around in a sharing circle. I explained that mammals had 3 choices in the winter---hibernate, migrate or deal with it! I then brought out several pelts borrowed from ADF&G. Kids decided if the animal hibernated, migrated or dealt with it. Most dealt with it and the pelts gave us a wonderful hands on opportunity to discover these adaptations. Kids so loved this opportunity. Various means of dealing with it included increasing fat, water shedding hairs, dense fur layers, increasing activity, camouflaged, fur on feet, caching food, and burrowing.

Field Trip Prep: To prepare for the field trip I asked students to recall how they felt standing outside without jackets for 5 minutes. I asked if anyone wanted to be out there unprepared for 2 1/2 hours. Most said no! So, we revisited my bag of clothing and talked about the items they needed to bring, discussing if the item was providing insulation or shedding wind/rain.

4th Grade--Winter Adaptations
(2 ½ hours--Fish Creek)

Supplies: Prepared gelatin in thermos, scavenger hunt cards, 2 thermometers, film canisters, Coyote's choice activity cards

Once at Fish Creek we stopped at the porcupine-sign trees and looked for evidence of animals adapting to winter. We usually found scat and upon examination determined it to be porcupine. Kids usually found whole spruce needles in the scat and that afforded us an opportunity to think about how the porcupine's diet changes in the winter from the summer. Discussions began on where we usually see porcupine in summer vs winter (beach grasses vs forests) and then we tried to explain why. Discussions also occurred about the amount of nutrition the animal had likely gained from the needle and whether it was a great source of food.

Groups were usually split in two right away. On occasion we did a spiral to turn our focus away from each other and towards the place. In my group we talked about being a vole and what our fate was come winter. Could we migrate or hibernate? No, we had to deal with it. So we talked about what needs we needed to meet in order to survive the winter. Kids have a crazy idea that food comes first....I guess it is because they were usually hungry at that time. But, the need for shelter was in there. So, we began our vole activity in pairs. Students found a place where they thought their vole would be safe and warm knowing that we would check on them in about 50 minutes. Some strategies included burrowing in snow, sitting in the sun, huddling together in moss and hiding in other animal's holes. We returned to these at the end and looked at who had survived (remained liquid) and who had died (became jello!) and why.

From there I set up a trail where kids were able to walk alone for a while. On one side of their route were the Coyote adaptation cards. Kids read them, made a decision and then checked their results. In the near by area I hid a camouflaged (white, tan or black) animal that they were to find. Students walked the trail alone and after we all met up again we discussed what had happened to us as coyotes, finding the camouflaged critters, and what we had learned by walking alone.

From here we usually explored and looked for things on our scavenger hunt cards. We tried yarding up like deer when snow was around and otherwise looked at what deer might browse on in the area. After exploring we returned to our voles to see who had survived.

When the two groups met up we shared our findings and ended our day of learning about animal adaptations by playing Lynx and Snowshoe Hare.

Fine Tuning: An area that I need to work on is finding something for kids to do at the beginning and end of the lone walk. Some kids just couldn't explore close by or avoid bothering those who had yet to complete the walk. Also, we had a high survival rate of voles this winter with such warm temps. Kids were disappointed when no one froze!

4th Grade Wrap--Winter Adaptations
(30 minutes)

Supplies: Winter adaptation charade cards

We started out by discussing the field trip; findings, things we learned, things we enjoyed, if we survived as a vole, etc.

Students usually hounded me to tell them what happened to Sammy. This was helpful in managing the classroom because I told them I would get to the ending if time permitted. The key to time management was cooperation and participation.

Activity: On the board I wrote the following winter adaptation techniques; cache food, yarding, burrowing, migrating, color change, hibernate, increase of body fat, antler casting, and increase activity. We went over each technique, discussing what we knew about them. Then students broke up into 7 small groups, each group was given an adaptation charade card and we played charades. Groups were to act out the technique with whatever props they could find and no words. As a group acted out their card the rest of the class observed and then guessed the technique.

After charades, students wrote their own ending to the Sammy story deciding his fate. We then shared stories if time permitted. Otherwise, the stories were shared later in class.

Fine Tuning: A fun and light wrap that everyone enjoyed. I think it is a good combination of physical activity and creative writing. I will continue to do this as is next year.

Fifth Grade Class 1
Winter Physiology
Winter

Goals:

- Determine how the climate effects animals in winter
- Define adaptation and find examples
- Experiment w/ how cold effects our bodies
- Brainstorm mammals in SE, and decide who migrates, hibernates or remains active in winter.

Introduction

Review mammal characteristics and mammals of SE. These animals are out there, most of them right now. What kinds of changes are they dealing with this time of year?

wind, snow, rain, lower food supply, light

So, we've got it easy, How difficult do we really have it, How many of you have been able to get away with wearing your shorts to school in January? If we were out there like the rest of these mammals, would we face similar challenges.

Share story/skit about the "coolest 5th grader".

What was she experiencing? Hypothermia. Discuss what happens to body in cold temperatures.

Activity

Let's do a few experiments and see what happens to us if we really face the winter. Then we can better understand what happens to the mammals in SE.

- Take pulse, Go outside- share story about wintering mammal, let temp. drop and take pulse a second time. What can we do to keep warm?
- Run, Have students run lap around playground. Gather up in tight cluster. Take pulse one last time. Ask students in the center of the cluster if they are feeling warmer. Why? Have students on the outside of circle switch with those in the center.

Wrap Up

List the mammals of SE on board. Which of these animals are active for the entire winter? What do you think are the most significant factors that determine what mammals do to survive the winter? (Body size and food availability)
Divide them by their body size and winter food availability.

What animals do you think depend most on their activity and clustering for keeping warm? Small mammals, why do you think small mammals lose heat faster than large ones. Compare the size of a moose to a deer mouse.

Draw cross section on board. In the next class, we'll look more closely at the specific small and large mammals and figure out how and what they're doing to survive the winter.

Fifth Grade Class 2
Mammal Adaptations
Winter

Goals:
•Determine how animals of SE adapt to winter
•Review tracking

Introduction

What kinds of changes do animals make?

Behavioral-
yarding up, burrowing, cache, move, migrate, activity, hibernate, food, dens.

Physical-
camouflage, hibernation, types of fat, fur on feet, surface area (draw moose and mouse cross section to illustrate loss of body heat surface/volume.

Activity

Share pelts and slides. Include some tracks to refresh their memories.

Slideshow

1) Squirrel
2) Deer Mouse track
3) Deer Mouse
4) Red-backed Vole
5) Snowshoe Hare track]
6) Snowshoe Hare
7) Porcupine
8) Ermine winter pelage
9) Ermine summer pelage
10) Mink (rule of thumb)
11) Marten
12) Otter
13) Ermine tracks
14) Cat tracks
15) Lynx winter pelage
16) Summer pelage
17) Brown Bear
18) Black Bear
19) Brown Bear tracks
20) Deer

Animal Adaptations and Physiology

Adaptations- A change through time that allows an animal to survive in its habitat or environment.

I. Large mammals	**Behavioral**	**Physical**

Hooved-

1. Deer — yard up, move to forest — counter-current

2. Moose — lower elev. — flex legs, move in snow hooves, unsaturated fats

3. Mt. Goats — lower elev. — hair

Carnivores-

4. Ermine — active — camoflauge
high metabolism
Breeding time affected by light, enters eye, stimulate the pituitary gland to send hormone (FSH) to the body. It readies female and male for sexual activity.

5. otter, mink — active, efficient gatherers, high metabolism
eat 1/3 weight 2x a day.
delayed implantation, mating fall, birth spring

6. wolverine — hibernates

7. pine marten — arboreal

8. Wolves — gather in larger groups — unsaturated fats/pads

9. Lynx — territorial, snowshoe — color, foot pads w/ hair

10. Bears — store fat, dens, hibernate
will not defecate while in torpor.
cranberries for laxative to clear out intestine, then fleshy roots, which create a plug called a tappen.(mud, spruce, sedge, white color)
body temp. does not drop sig. 98 degrees normal winter 88-96
breathing remains same
nitrogenous waste- recycling don't know how? bone loss and calcium deposit at the same time. temp. and storms trigger hibernation, black bears do not usually return to the same den anually.

Small Mammals

11. Snowshoe Hare- extra hair on feet and nose.
When being chased they run in circles to remain in their home territory.
Capriphagy
Hypoglycemia occurs when pop. is crowded. stresses, stimulates adrenal gland, which triggers chemical reaction that lowers blood sugar
prefer willow (can reach 18")
will canabalize when food shortage
mating dance in moonlight in March
small ears, good hearing
run 25 mph, jump 10 ft. when really moving

12. Marmots- will hibernate up to 7 months
lose up to 1/2 body weight
they mate before they eat in spring
breathing changes 200/min. to 10/min
body temp. normals 100 degrees- to 5 or 40 degrees tolerate low 02 levels in den, high Co2

13. Red squirrels eats 40 lbs. seeds extra tufts of hair by ear
wrap tail around body to stay warm

14. vole runways, cache, congregate

15. mice use trees for nest, congregate, active

16. porcupine protected den, trails, diet- more spruce needles

17. beaver lodge in family groups, store food fat in tail

DISCOVERY SOUTHEAST

Nature Studies
Season: 5th Grade Spring

Naturalist: Steve Merli
Subject Area: Glacier Hike

Key Concepts

- Wind, water and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas.
- Landforms are the result of a combination of constructive and destructive forces.
- The number of organisms an ecosystem can support depends on the resources available and factors, such as light, temperature, and soil composition

Naturalist's Objective

- Students will touch the glacier, noting along the way what affects the glacial ice had on the landscape.
- Students will be appropriately prepared for a full day's hike and take responsibility for themselves ~~concerning food, water~~ and clothing needs.
- Students will participate at a level they are comfortable with.
- Students will journal their feelings and observations at 3 points along the way.
- Students will feel a sense of accomplishment and confidence in their skills and abilities as naturalists.
- Students will be responsible for their safety and accomplishments for the day.

Assessment Strategies

- Review students' journal entries.
- Notice how students are prepared for the field trip, from clothing, attitude to food and water.
- Listen to kids trail conversations and explanations to things they see, hear and find.
- Ask students to write about their explanations for the succession of plants and list all the evidence they observed of the glacier altering the landscape.

Cross Curricular Ideas

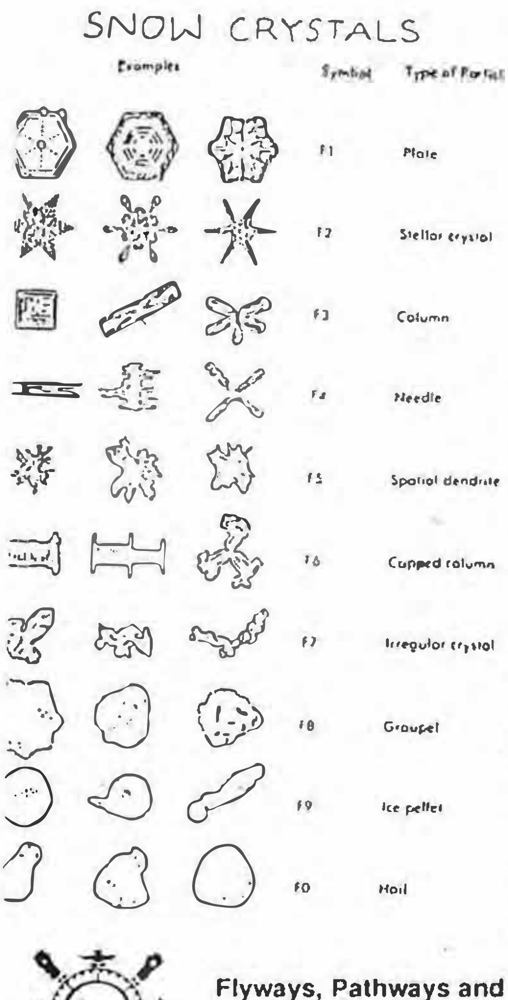
- Take a look at Trails of Juneau guidebook and read a few trail descriptions with your class. Then ask students to write a trail description for the hike, including degree of difficulty, recommendations for gear, highlights, time estimates, topography, elevation graph, etc.
- Using a map, determine the distance they traveled on the hike, how many miles the class hiked as a whole, etc.
- Consider a hot local issue….ask students to respond to how they felt when they heard helicopter noise. Take a poll, have panel discussions about the use of helicopters and the impact of tourism.

Winter, 1990 Volume 7, Number 2

Cathy Rezabeck, Editor

Exploring Winter !

Snow Study: Is It The Pits Or What!



Contributed by Chuck Lennox, Alaska Public Lands Information Center, Fairbanks, AK

Why do you study snow by digging a pit? (or as one student put it, why do YOU want US to study snow by digging a pit?)

Snow is an important component in the daily lives of those of us who live in the north. Snow effects our homes (insulation value, weight, damage when melting); our movement (avalanches, roadways, insulating river ice from freezing, depth-too little or much, recreation); our food sources (wildlife survival, vegetation for that wildlife); our economic climate (transportation, development of resources, hydroelectric power and drinking water sources); and our moods (wet mashed potato snow, moonlight on new snow, dog mushing over crunchy dry snow with the aurora overhead). Considering the length of winter in Alaska, it's important to understand more about the winter environment we find ourselves in.

One structured format to begin a study of winter is by analyzing the snow which has been accumulating all winter. What kind of a winter has it been? Let's dig and find the answers.

Divide the students up into several field study groups. Assign a different terrain or area to each group for snow pit study (eg. north slope, south slope, open flat field, forest edge, wind drifted etc.) These areas can then be compared later in the classroom when all the groups return with their data. Results can be surprising.

Each group must dig through the snow to ground level facing south. If the sun is shining, you don't want it to influence the temperature readings of the snow pack. Thus, the face of the snow pit should be in the shade. Dig the pit wide enough so that most group members can comfortably fit into the pit for data collection and analysis of the snow pack.

Measure the temperature of the snow pack in at least four places - very top surface of the snow pack (shade it from solar radiation to get an accurate reading), two readings within the snow pack (more if it is deep), and a reading at the

Pits continued on next page

Flyways, Pathways and Waterways is jointly produced by the Northwest Association of Marine Educators and the Alaska Natural Resource and Outdoor Education Association. Layout donated by Fernhollow Publishing, Kodiak.

Pits from page 1

ground/snow interface. (If you have ambitious students or you need to add some tasks, each snow layer identified or every ? cm. can be measured for temperature.) Indoor preparation before the field study could include some inferences as to where one might expect to find the warmest and coldest temperatures and why.

Measure the entire depth of the snow pack. Mark this depth on the data sheet. Count and identify on the data sheets the location and size of the snow layers. These layers represent the snowstorms that have occurred up until now in the area. You're a snow archeologist! Using the spatula, slice down through the snow pack - do you detect any resistance? Why or why not? (Ice layers may be present due to a previous freezing rainstorm, warming spell that melted and then refroze a layer etc.)

Using the snow crystal identification chart, ID cards and hand lenses, identify some of the crystal types in various layers of the snow pack. Why are some types found in certain layers? (Weight of the snow pack, temperatures, weather conditions at the time of snow fall.)

Using the plastic 1/2 Liter sample bottle, take an UNCOMPACTED sample of snow from the pit and bring it back to the classroom. Jot down the original amount of the snow sample and several hours later when it has all melted measure the amount of water now present. What percentage of the original snow sample does the water represent? This roughly gives you the water content of the snow (if the sample is UNCOMPACTED).

Once all measurements have been taken, fill the pits back up. Why? So that small animals that might be using this snowpack for shelter and warmth (yes, snow does provide insulation) won't be exposed to the cold and predators. Also, to protect people from breaking a leg by falling into a pit they didn't expect.

Once students are back inside and warmed up, each field group can graph their data on butcher paper big enough for the entire class to see. Depth and temperature can be the two variables. The terrain or area should be identified to distinguish the different groups. The water content readings can also be compared.

Snow pits can be dug at several points during the winter to compare the progress of the snowfall. If daily weather statistics have been kept in the classroom or are available from a nearby source (National Weather Service, local airport, local weather buff), students can compare the snowpack with the weather history of the winter. Further studies can include doing a small and large mammal inventory (tracks, animal signs) of your snow study plot areas, contacting the USDA Soil Conservation Service for information about their snow survey program and branching out into winter safety/survival with building snow structures (trenches, quinzhees, caves, igloos). Enjoy that white stuff!!

SNOW PROFILE DATA

Date: Pit Location:

Weather: ~ Vegetation:

LAYER NUMBER	TOP OF LAYER: DISTANCE FROM GROUND (CM)	TEMP. AT MIDDLE OF LAYER (°C)	DENSITY $\frac{g}{200cm}$ / $\frac{g}{cm^3}$	HARDNESS (very soft, soft, hard, very hard)	SNOW CRYSTAL TYPE	NOTES (Shear Test...)
SNOW SURFACE						

Snow Study Kit

One kit contains:

1. 1-2 plastic tape measures with standard and metric measurements (the cheap kind that curl up - won't rust like metal ones will)
2. 1 Pocket Dial Thermometer by Taylor (available from Carolina Biological Supply catalog, metal probe type with dial on the end - more durable, easier to handle with gloves/mittens)
3. 2 metal spatulas (metal can slice through ice layers)
4. 3-4 hand lenses (used to identify snow crystals)
5. 1 snow crystal identification chart (photocopy from Field Guide to Snow Crystals, Edward R. LaChapelle, Univ. of Washington Press, mount on tagboard and laminate, remember wetness!)
6. Data sheets (enough for all group members or a master one for entire group, what data do you want students to collect from the snow pack?)
7. Clipboards or field journals (zippered notebooks) to hold above sheets plus pencil to record data (pens will freeze)
8. 4 snow crystal ID squares (make from squares of black construction paper glued to pieces of scrap styrofoam - used to hold crystals insulated from body warmth for identification)
9. 1/2" wide paint brush (to gently brush snow pack face)
10. 1/2 Liter plastic cup (to take UNCOMPACTED snow sample from the snow pit back to the classroom)
11. 1-2 small shovels to dig the snow study pit

Place 1-10 in small drawstring stuff sack, add the shovels and carry everything into the field in a small daypack.

You could add:

- track field guide with winter mammal checklist
- sketching paper to draw the track picture
- bird field guide with winter birds checklist

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Environmental Education Bill

At last, a new bill will be introduced in the U.S. Congress sometime this fall, that is the first sign of federal commitment to environmental education under the Bush administration. The National Environmental Education Act (S.1076), championed by Senators Burdick (D-ND), Chafee (R-RI) , and Michell (D-ME) proposes $15 million annually for the establishment of an office of Environmental Education within EPA.

The purpose of this bill is to develop and support programs which improve understanding of the natural environment, develop curricula, and manage grant assistance programs that are established within the Act. Should the bill pass, the new Environmental Education Office will create national programs to provide classroom training and environmental education studies to professionals in the field as well as develop a library of environmental education materials and informational literature.

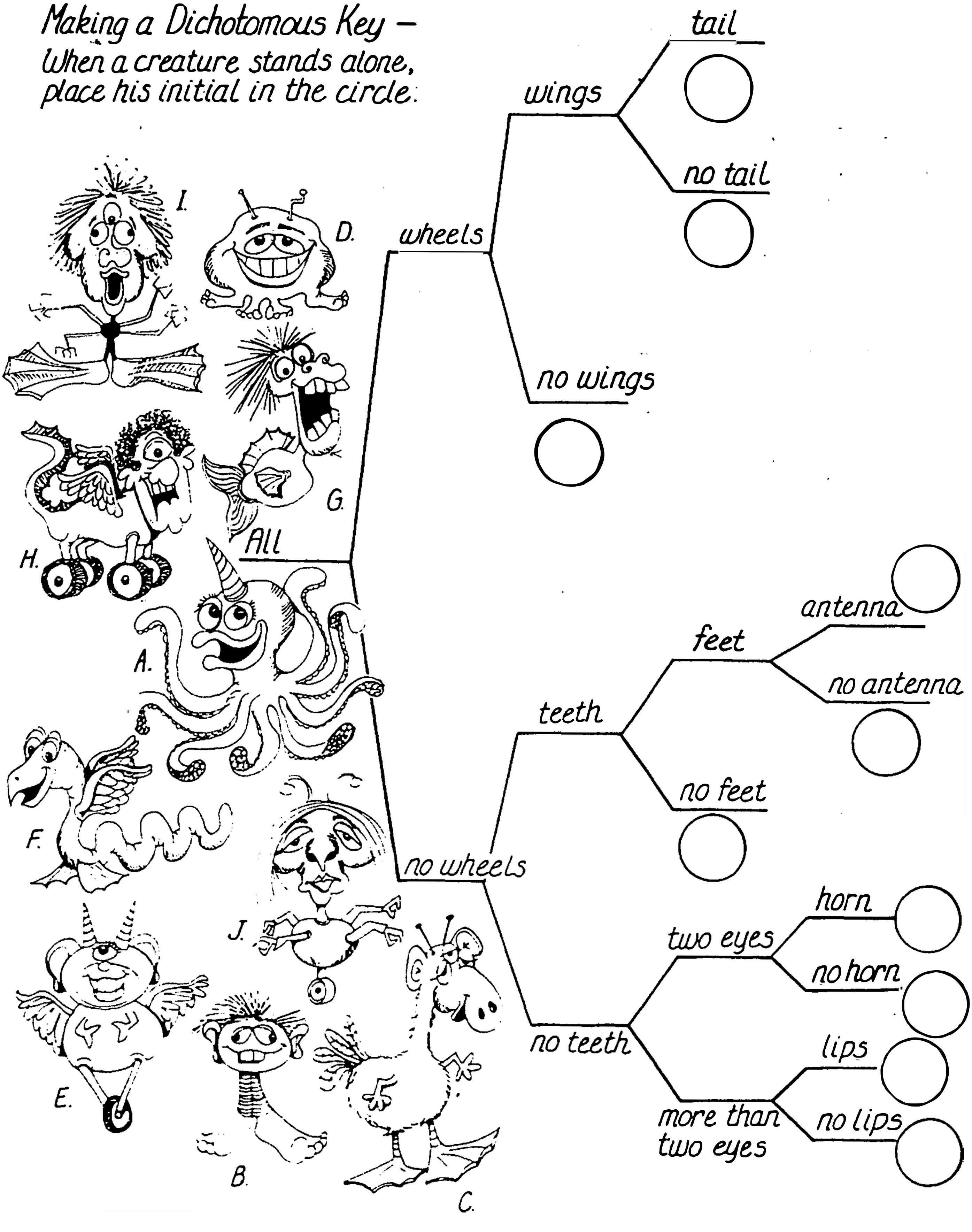
Other provisions of the bill provide at least 150 internships within government agencies, such as EPA or BLM, for college students who are studying the environmental sciences. The EPA will award grants to local education agencies, colleges and universities to developmental education programs or to improve current programs.

On February 1 Peggy Cowen will testify before Congress in Washington D.C. on behalf of the State of Alaska and the Western Regional Environmental Education Council. Should you wish to discuss the bill Peggy can be contacted at the Dept. of Education 465-2841.

Letters to Congress in support of the National Environmental Education Act (s.1076) are needed. Write your Congressman or President Bush. A flood of letters pouring into Washington D.C. will hopefully encourage the President and Capitol Hill to make environmental education a priority this year.

A Key for Creatures

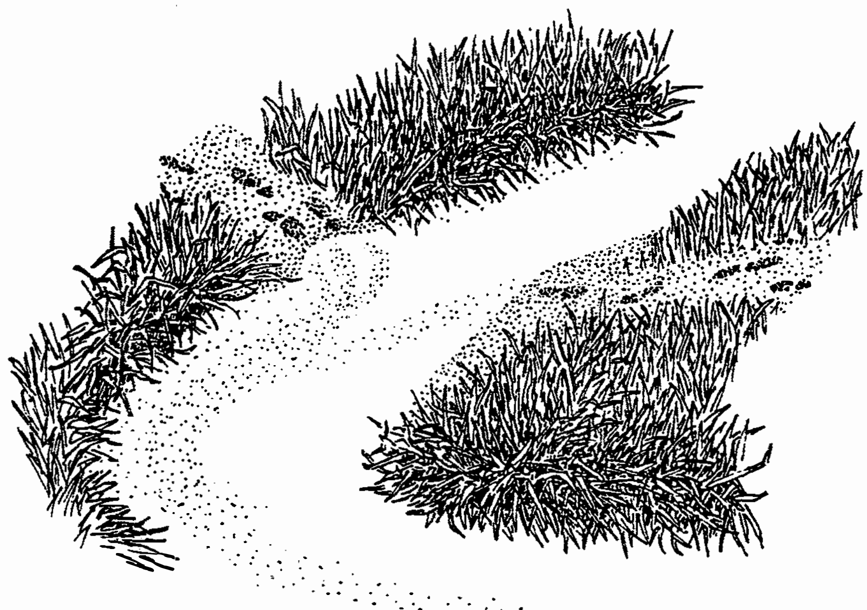
Making a Dichotomous Key –
When a creature stands alone, place his initial in the circle.



Jordan Creek Curriculum (1991)

THE DISCOVERY FOUNDATION'S

JORDAN CREEK DISCOVERY CURRICULUM



Funded through a partnership grant from
Alaska Department of Fish and Game - Sport Fish Division
and
The Glacier Valley Parent Group

Volume 2

Approximate 5th Grade Level

369 South Franklin Street • P.O. Box 21867 • Juneau • Alaska 99802 • (907) 463-1500

Dear Colleagues,

Welcome to the Jordan Creek Discovery Curriculum. This curriculum was created for the upper-elementary classes at Glacier Valley Elementary School in Juneau, Alaska, with lessons focusing on the natural history of the Jordan Creek wetlands surrounding the Jordan Creek trail.

Adapting the Curriculum to Your Locale

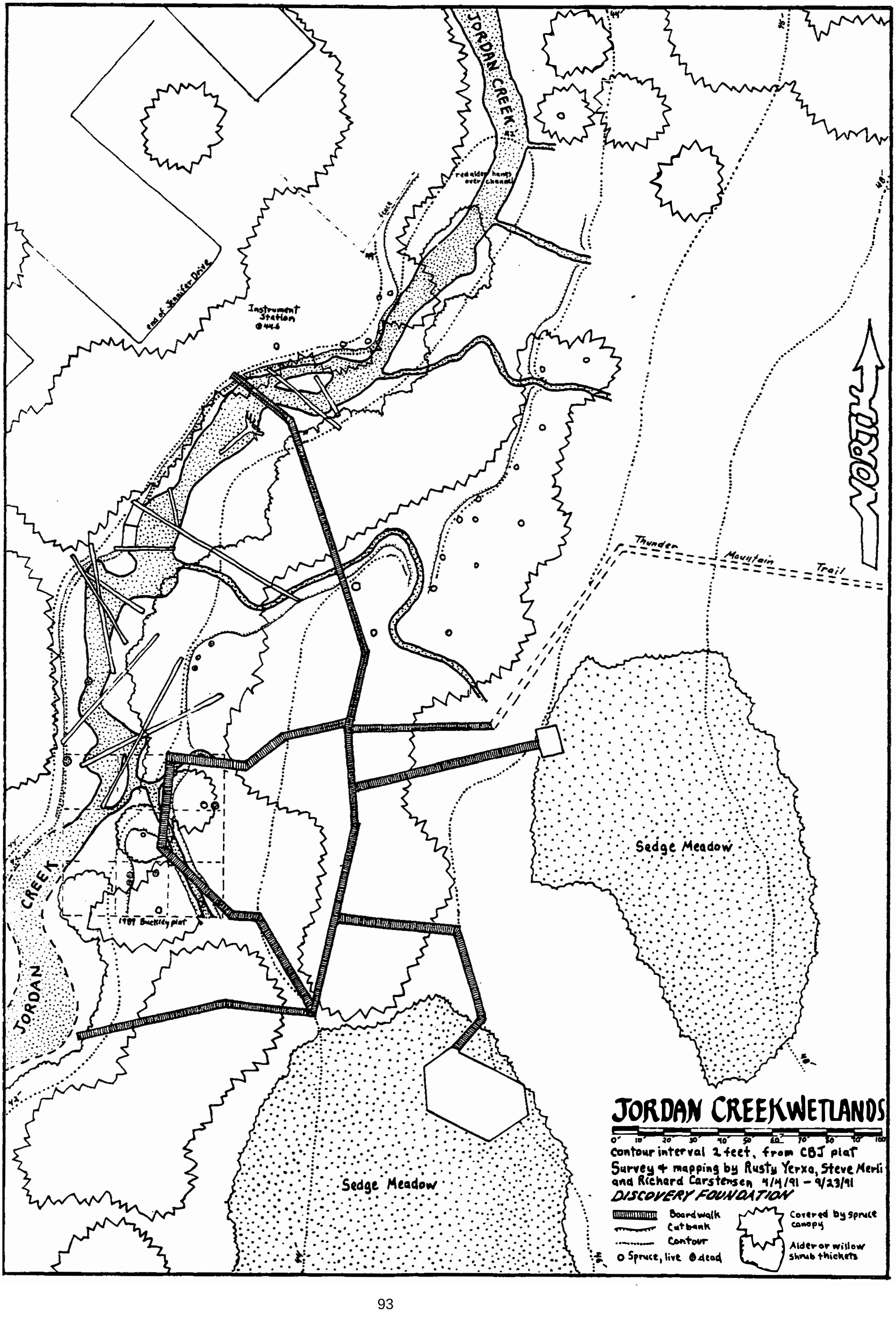
Although this curriculum was developed site-specifically, it may be easily adaptable to other locations. If you are outside the Juneau area, we strongly suggest, for the success and accuracy of implementation, that you contact a local agency such as Fish & Game or the Forest Service for accurate species lists of animals and plants native to your environment. With this information, you may be able to adapt the lesson plans and worksheets from our local species to yours. In addition, you should obtain detailed maps from the US Geological Survey or your area's planning office, to cover such lessons as finding your <u>own</u> watershed.

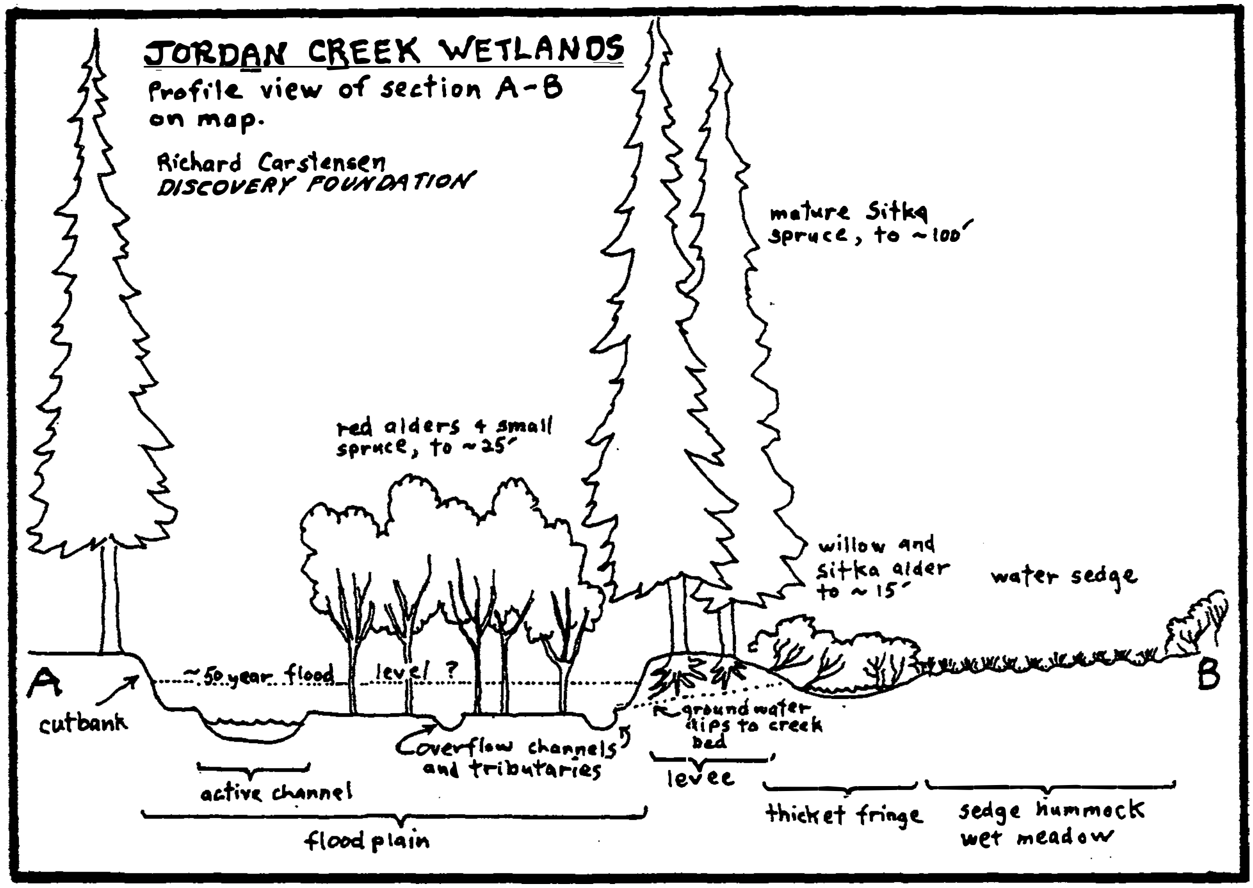
In bringing your locality into this curriculum, the lesson plans and worksheets can be utilized as guidelines for your own activities and, together with obtaining the information specific to your area, can be models into which you bring the fish, insects, birds, mammals, plants, geological and geographical features of your environment.

Copyrights

Please be aware that the entire curriculum has been copyrighted, and no part of it may be copied or used in any way beyond the classrooms for which it was purchased. All rights are reserved, and its use and distribution is limited to sales through the Discovery Foundation. We appreciate your respect of this copyright.

We hope that your experiences with the Jordan Creek Discovery Curriculum are exciting and rewarding ones!


JORDAN CREEK
end of Jennifer Drive
red alder hangs over channel
fence
Instrument Station
Thunder Mountain Trail
NORTH
1989 Buckley plot
Sedge Meadow
JORDAN CREEK
Sedge Meadow
JORDAN CREEK WETLANDS
0' 10' 20' 30' 40' 50' 60' 70' 80' 90' 100'
contour interval 2 feet, from CBJ plat
Survey & mapping by Rusty Yerxa, Steve Merli and Richard Carstensen 4/4/91 - 9/23/91
DISCOVERY FOUNDATION
Boardwalk
Cutbank
Contour
Spruce, live dead
Covered by spruce canopy
Alder or willow shrub thickets



Jordan Creek Wetlands

The **floodplain** is that portion of the profile bounded by **cutbanks**, which have been eroded during flood events. The presence of 25 foot tall red alder in the floodplain suggests that such floods are rare. However, many small **overflow channels** within the floodplain are filled during each annual high water period.

On the eastern edge of the flooplain are tall Sitka spruce which we estimate are 100 to 150 years old. There are two probable reasons for their distribution paralleling the creek. One is that they occupy a levee, or slight marginal ridge built by flood deposits. Another is that groundwater approaching the creek bed from the sedge meadows dips abruptly here, giving tree roots a drier environment.

Between Jordan Creek and the base of Thunder Mountain are elongated sedge **hummock wet meadows.** These are fairly young wetlands (*not* muskeg, which is ancient) at the foot of an **alluvial fan.** We presently interpret them as originating in old beaver ponds, which gradually silted in and were colonized by water sedge. But we'll have to dig some holes to prove that!

Unit #1

HABITAT HISTORY

Unit Introduction:

How has Jordan Creek and the area surrounding it changed in the past 60 years? Is it changing now? How might changes such as logging and development have affected the stream and its inhabitants?

Students explore such questions as they study Jordan Creek's geography and history. An introductory field trip focuses on evidence of change along the Jordan Creek Trail, closing with a visualization exercise. After the field trip, students decode the history of Jordan Creek using maps and aerial photographs.

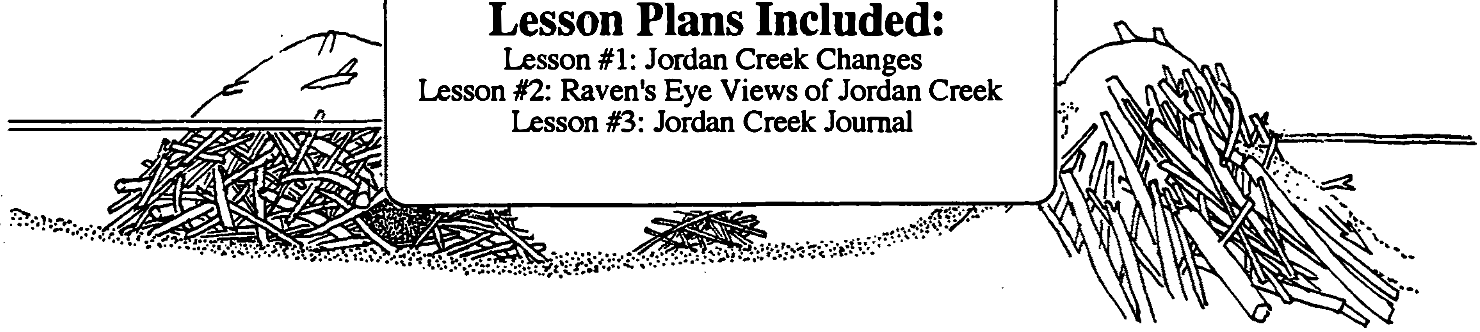
To expand upon their work with aerial photographs, students research Jordan Creek's past. They may begin to ask if logging and development near streams is handled differently today. As students discover the history of Jordan Creek, they will learn to care about the future of the stream that flows past their trail.

Related Curriculum:

- Science (geology, weather & climate, SeaWeek: fish habitat)
- Social Studies (history, landforms and geographic features, map scales, citizens' rights and responsibilities)
- Art (coloring)
- Language Arts (listening, writing)

Aquatic Education Goals:

A study of Jordan Creek watershed's history and geography provides a foundation for understanding and caring about stream habitat.



Lesson Plans Included:

Lesson #1: Jordan Creek Changes
Lesson #2: Raven's Eye Views of Jordan Creek
Lesson #3: Jordan Creek Journal

Lesson #1
JORDAN CREEK CHANGES

Season: Any season, but fall is best, since this unit is designed to introduce the trail

Setting: Classroom and trail

Time: 1 to 1 1/2 hours

Subjects:
- Science (observation, deductive reasoning, geology, weather & climate)
- Social Studies (history, map scales)
- Art (drawing, visualization)
- Language Arts (listening, writing)

Materials:

In The Kit

- 2 thermometers
- Jordan Creek wet-lands map master and colored copy
- visualization script
- basic stream data sheet master

Preparation:
- Copy habitat maps for each student or group
- Option: copy stream data sheet
- Option: copy visualization script

Teacher Background Information:
Although the focus of this trip is to figure out the history of Jordan Creek habitats, by looking for evidence of changes, it is important to be open to whatever is going on there. If fish are spawning, or you find berries, mushrooms or animal sign, take time to appreciate these things!

This field trip starts with measurements of temperature and water level. Try to keep a record of these things each time you go out to the trail. It doesn't take much time, is an enjoyable routine, and will yield valuable data which can be turned into charts and displays (--and contributed to interested agencies!).

The next lesson will pursue approximate answers to the questions raised in this lesson--such as when roads and houses were built and when parts of the drainage were logged. The details are left for your students to discover through their own research.

Vocabulary:

evidence - something that shows or proves what has happened

habitat - the place where something lives, where it finds the food, water and cover in the right arrangement to meet its needs

map scale - a line marked with measurements which indicates distances on a map

Lesson - Jordan Creek Changes

Purpose:
To become aware of changes people have made near Jordan Creek and possible affects on stream life, while having a pleasant introductory experience on the Jordan Creek Trail.

Objectives:
Students will:
- locate the stream, streamside habitats, roads and buildings on their Jordan Creek maps
- speculate about the history of the Jordan Creek Trail area
- predict and observe evidence for changes to the area

Focus:
Ask your students, "*How far is it to Jordan Creek from here?*" Pass out the maps and have them measure distance to trailhead, using the scale. Have them color in the school, parking lot, stream and trail on their map. Then have them color in the houses and roads right next to the stream.

Diagnose:
Ask your students: "*When do you think the roads and houses next to the stream were built?*" (have them guess) Then ask them, "*What do you think the trail area was like before the houses were built?*" Write down their answers, then ask, "*How do you think the area by the stream may be different now?*" List on the board the changes that they think may have occurred. Ask them, "*What clues to these changes could we look for near the trail?*" Next to each change, list a detail they could observe.

Example:

Before roads and houses:
lots of big trees? no trails? no trash? more fish?

After roads and houses:

CHANGE	CLUES
more people walking in the area?	worn trails, weed plants
tree and log cutting ?	stumps, cut logs
houses/yards next to stream?	constructions, bare soil, gardens
stream course changes?	old channels, dead trees, new thickets
erosion, dredging, filling, dumping?	worn away or filled banks, silt, trash?

Explain that the class is going out on the trail. One thing they will do is look for clues to the history of Jordan Creek. Lead them toward developing a 'clues' list like the one above. Have them write down their list to take into the field. You may want them to take along their maps, so they can relocate things of special interest, like stumps, in case you want to go back and count rings.

Explain that they are going to take notes on a few other things, too. They will read the water level, the temperature of the stream and take notes on any fish they see. Ask for (or assign!) 4 volunteers to be in charge of taking the readings and writing the data, so they will have good records on the stream for the future. Have those students prepare a data sheet with room to write a year's field trip data--or use the data sheet provided with the kit.

Hand out clipboards and head out to the trail with lists, thermometers and data sheets.

Activity:

At the Jordan Creek Trail, stop at the trailhead. Explain that they need to be quiet to sneak up on fish that may be spawing under the bridge! After the water level reading is taken, have students take the stream temperature at the gravel bar and the temperature of the little tributary nearby.

Have your students spread out on the trail to search for evidence that people have changed the trail area. Set a time limit and establish a signal for gathering on the platform. When their time is up (10 - 15 minutes), call them back to the platform.

Ask them to sit or lie down comfortably and close their eyes. Ask them to keep their eyes closed until you give the word to open them. Have them of think of their favorite place on the trail. What it is like today? Talk quietly about a few places along the trail. Here is an example of a visualization exercise you could lead:

> *"Maybe you're thinking of the bend in the stream where alders hang over and the water rushes past... or perhaps it is the bridge where you can see up the stream and down.... and watch reflections... and waves make moving patterns on the water..... Or maybe it is a green place behind a big tree, where you can smell spruce pitch and feel the moss. What does your favorite spot on the trail smell like?........ In your mind, look up-- what do you see overhead at your place?....... Look down. What do you see?....... Sitting quietly at your favorite part of the trail, can you hear the stream?*
>
> *You're still sitting quietly at your favorite place, but the time has changed. You don't hear any cars. A large, dark animal turns and disappears into deep woods.... What kind of animal was it? ... It is some time in the past. There are no houses nearby, no roads.....A big cutthroat trout rises for a fly on the surface of the stream--The little splash makes you jump. Then you relax and watch ripples circle outward from where the fish caught the fly....*
>
> *It's getting windy... What does wind sound like from your place?....... Would rain fall on you, or would the trees stop it?.....What does rain sound like, falling near your spot. Does it fall on bushes or spruce needles, does it splash into the stream?... Raindrops spread and gather into a tiny river that runs over the ground ....and down the bank to join the stream. You watch your 'piece 'of water disappear around the bend, carrying a dead leaf. The leaf slows down. It swirls around slowly in the beaver pond.... The sun comes out again and lights up the little leaf... But, where did it go? The leaf has disappeared... Or did a trout strike at it, thinking it was food.....Did it sink?... It is flowing slowly out to sea with the water of Jordan Creek........*
>
> *Now, slowly open your eyes.... and before you forget, think of your special place on the trail. What did you see in your mind--what did you hear or smell? How did you feel at your favorite spot? Take your clipboard and write five words to help you remember your thoughts and feelings."*

When everyone has finished, head back to class for the summary.

Summary:

Discuss the results of the search for Jordan Creek habitat history clues. What evidence of change caused by people did they find? Check off the clues that were found on the board. If cut trees were found, what do your students think they were used for? If they found discarded things (trash), how did they get there?... Any evidence of other change--caused by beaver, wind, growth or floods?

Ask them what other ways they could find out what the stream was like 20, 30 or 40 years ago. Possible ideas might be to ask older residents or find old photographs. Explain that you have some old photographs taken from an airplane, that they can use (in the next lesson!) to learn about Jordan Creek history.

Have them color in the habitat types on their maps, making a key to distinguish between forest, thicket and meadow. Use the colored map from the kit as a model.

Additional Activities:

You may want your students to write a short poem, description or story--or draw a picture--based on their chosen spot along the stream or some other part of the visualization exercise. Have them read the five words they wrote down to help them get started. (You could have half the class work with the "now" part of the visualization and half work with the "past" scenario and display them that way.)

Lesson #2

A RAVEN'S EYE VIEW OF JORDAN CREEK

Season: Any, but it's nice to do this in the fall after Lesson #1

Setting: Classroom

Time: 1 hour

Subjects:
- Science (geology, SeaWeek: fish habitat)
- Social Studies (history, landforms and geographic features, map scales, citizen's rights and responsibilities)
- Art (drawing)

Materials:

In The Kit
- 10 stereoscopes
- 15 copies of historical stereogram series
- B&W 8 1/2x11 metric topo map master
- Metric topographical map for display
- Stereogram worksheet master and key

Supplied By Teacher
- Colored pencils
- 5 additional stereoscopes from the Discovery Foundation Teacher Training Notebook

Preparation:

Copy the metric topographic map of Jordan Creek and the stereogram worksheet and practise using a stereoscope so you can help your students.

Teacher Background Information:

What can we learn from aerial photographs?

If a picture is worth a thousand words, an aerial photograph must be worth ten thousand. Aerial photographs give us the exhilarating perspective of a mountaintop view--without the climb! Once we learn to locate, identify and interpret objects on the ground as seen from the air, we can fully enjoy the privilege of sharing a raven's

Aerial photographs allow us to see the forest--and the trees! A good photograph reveals large-scale patterns of plant growth and human development, while preserving details. Sizes, shapes, tones, locations, textures, and context provide useful clues for "reading" photographs.

Once you have "read" a photograph, you can begin to interpret it. What activities have taken place--and why? What are the main habitat types? What controls patterns of vegetation, settlement and human activity? Interpretation skills develop with experience, both on the ground and using photographs. Map-makers, foresters and city planners depend on aerial photography to make decisions about large tracts of land. They also "ground-truth", frequently checking their interpretations on the ground.

Is this too difficult for my kids?
Some local teachers have found it helpful to leave aerial photographs (and a stereoscope) in their classroom so students can return to them as they develop experience and skill. Although spatial sense and visual ability varies, many students are delighted by aerial photographs, especially those of places they know well from the ground. A great deal depends on your presentation of the activity. If you are enthusiastic, they will be, too!

Why are there two of each photograph?
The two photographs are different. They were taken from different places as a plane flew over. When you look at one of the pictures with each eye, the effect is that you are way up in the sky with your eyes very far apart! This creates a sense of exaggerated perspective. Things seem taller and pointier than they really are. (They practically jump out at you!) Textures and shapes are suddenly vivid.

How do you use a stereoscope?
Although "getting" a stereo image can be tricky, you can usually tell when when it works. Students typically cry out, "*Awesome!!*" Eye separation and proper placement of the stereoscope are key factors. The stereogram worksheet starts your students at 60 mm. eye separation and illustrates correct placement of the stereoscope straddling the two photographic images. You see one image with each eye.

Moving slightly closer or away from the stereoscope and/or slightly shifting the angle of the 'scope on the page can snap an image into 3-D. Bear in mind that only those who can see clearly with both eyes will be able to see in stereo.

What aerial photographs are available for our area?
Although some aerial photos of Juneau were taken in 1929, the first good quality photographs are the 1948 black and whites. These aerial photographs were used to make the U. S. G. S. the topographic maps of our area. In fact, all local topo maps were based on the 1948 photography until recently. New metric series maps based on 1984 'true color' photography are now available for Juneau.

Photo flights were also shot in 1962 and 1979. The 1962's are black and white-- and very clear. The 1979's are color infra-red (CIR) photographs, taken by U-2's at great height. The CIR's are so detailed, they can be almost infinitely enlarged. On the CIR's, what most people see as green is red! Wetlands tend to be yellowish, while evergreen forests are dark red. Deciduous trees (alder, willow and cottonwood) are a brighter red, but meadows and alpine tundra are the brightest. There is also a striking difference in water color. Silty water reflects the infra-red, so it is bright blue, while clear lakes are black.

Government aerial photographs can be ordered from flight indices through the U.S. Soil Conservation and Stabilization Service in Salt Lake City. All that work has been done for you! A stereogram series for Jordan Creek has been selected, enlarged, and copied for your students.

Where is Jordan Creek?
Jordan Creek emerges from a Little Ice Age moraine, flowing through old braided glacial river channels,then quietly slipping between Coho Park and the rest of the Valley. Jordan Creek swoops around a fan-shaped pile of rubble that came down from Thunder Mountain, passing close to Floyd Dryden school before it reaches the Jennifer Street trailhead. Barely visible at times, it passes through beaver ponds before it crosses under the Egan Expressway and out into the Mendenhall flats near the airport crash station.

Most obvious is the change happening in the Jordan Creek area throughout the sequence. Roads, bridges and houses were built and forests were logged--right up to the streambanks! Glacier Valley changed from a forest to a filled site, to a school. Through all this, Jordan Creek has managed to maintain much of its salmon-producing power--an admirable feat for a road-system stream!

The best way to orient yourself to the photo series is to go through the student worksheet yourself before you teach the lesson. You will find it helpful to keep a map handy while you work with the photographs.

Vocabulary:

aerial photograph - a photograph taken looking down from an airplane

erosion - the wearing away of earth by water, ice or wind

clearcut - a logged area where all (or most) of the trees were cut down

siltation - when erosion brings fine sediments (silt) into a stream, these sediments are left (deposited) in the streambed. This plugs up spaces in the gravel used by salmon eggs and clogs the gills of fish.

stereogram - two photographs of the same subject, taken from different angles to create a 3-D image when viewed through a stereoscope

stereoscope - "glasses" with a lense for each eye which create a three dimensional effect when looking at a stereogram

Lesson - Raven's Eye View of Jordan Creek

Purpose:

To discover the history of development and logging near Jordan Creek using topographic maps and aerial photographs.

Objectives:

Students will:
- demonstrate the proper use of stereoscopes, coordinates and maps
- compare historical aerial photographs and maps of Jordan Creek
- identify vegetation types and changes in Jordan Creek habitats from aerial photos

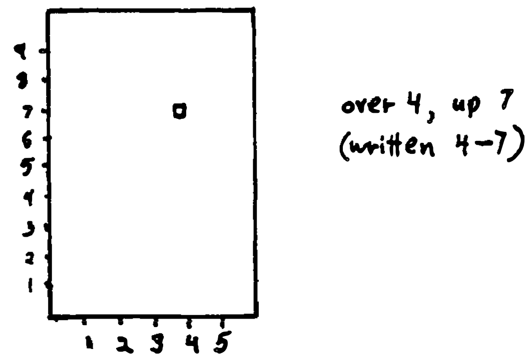
Focus:

Ask your students, *"How would Glacier Valley School look to a raven flying high above it?... How would Jordan Creek look to a raven?"* Bring out the enlarged aerial photograph of Jordan Creek and hold it up for them to see. Discuss it together, locating the schoolgrounds and the Jordan Creek trailhead.

Diagnose:

Post the metric topographic map of the Mendenhall Valley up on the board. Tell them what it is and ask them, *"How do you think this was made? How did the mapmakers know where to put roads, streams and mountains?"* Tell them that maps like that one are made by looking at rows of photographs shot from a plane as it moves over an area. *"What else can we learn from aerial photographs?"* Display the colored version of the Jordan Creek habitat map. The Jordan Creek habitat map was also made using aerial photographs!

Pass out the worksheets and stereograms and read through the first section with your students. The introductory explanations discuss aerial photographs and the use of coordinates. Draw a large rectangle on the board, marking and numbering the coordinates across and down:



Draw a building representing the school and have your students figure out its coordinates. Then have them look at the stereogram and worksheet and answer the question about coordinates.

Demonstrate how to use a stereoscope, as you continue to read through the worksheet with your students. First adjust the eye separation. It should be quite close for most students. Place a lense over each photo and adjust it until you see it "pop out at you".

Pass out the stereoscopes to each pair of students and have everyone try it!

Activity:

Have your students work in pairs, one reading the worksheet and coloring the topo map while the other one looks through the stereoscope. First they will look for their own house! They will locate the school, the Jordan Creek trailhead and wetlands, Duck Creek, Gastineau Channel, the airport and Thunder Mountain on the map or on the stereograms. Then they will look for changes between the different pictures in the historical series, such as logged areas, housing developments and changes in the drainage. They will pin down approximate dates for some of these changes.

Summary:

Review the answers to the stereogram worksheet, using your key. Ask several students to read the question they wrote for the worksheet and discuss possible answers to their questions.

Discuss the effects of logging and developments near the headwaters and mouth on Jordan Creek fish. What do your students think the effects might have been? Why? How do they think harmful changes could be prevented? These questions will be pursued further in the other units.

Additional Activities:

A group of your students could make an historical series of map overlays by projecting and tracing slides of the aerial photographs, available in the ADF Teacher Training Notebook.

Lesson #3

JORDAN CREEK JOURNAL

Season: Any

Setting: Classroom

Time: Flexible-- project may be scaled to fit your classrooms needs and interests

Subjects:
- SeaWeek (fish habitat)
- Social Studies (history, map scales, citizens' rights and responsibilities)
- Language Arts (interviews, research, writing)

Materials:

Supplied By Teacher

- Phone book to help locate agency and historical society people
- Option: tape recorders

Preparation:

Choose questions for research, prepare research outlines and initial sources, and enlist the aid of librarians, volunteers, historical society and agency people.

Teacher Background Information:

In this lesson, your students pursue questions about Jordan Creek history by conducting interviews with residents and agency people. They could contact the Gastineau Historical Society and the City Museum about available historical photos and other references. This type of research is an open-ended process. Once it is begun, who knows where it will lead!

Your students could study beaver activity by contacting local trappers and residents. The local Fish and Game office may have have information about the history of beaver activity. Jordan Creek beaver ponds have been important overwintering areas for cutthroat trout and Dolly Varden.

Logging has also been a very important influence on Jordan Creek fish habitat. Students could find out just when the large alluvial fan was logged, and how the wood was used. They could interview Fish and Game personnel for information on the recovery of stream habitat from the siltation and slash created by logging. (Mike Bethers of Fish and Game has suggested that much of the silt has been washed out by faster flow after changes in the beaver dams.)

The World War II army depot, the Knudsen's ranch (note: on 1910 map by A. Knopf) and the fur farms near the stream mouth may also be of special interest to your students. Or--your students could simply find out why the creek was named *Jordan* !

Vocabulary:
Additional vocabulary will depend on the subjects you choose:

etiquette - customary rules for behavior which help people remember how to treat each other with kindness and consideration

interview - a meeting in which a writer or reporter gains information from a person

research - a careful search for information

seminar - a group working together on original research under the guidance of a teacher

Lesson - Jordan Creek Journal

Purpose:
To find out more about the history of Jordan Creek, while practising interviewing and research skills

Objectives:
Students will:
- research a question concerning Jordan Creek watershed history
- practise interviewing, group work and planning skills
- communicate the results of their group's work to the rest of the class

Focus:
Choose a question for the class to address. It could involve a specific time period, area or type of activity affecting Jordan Creek. Ask your students what they think the answer(s) might be and how they might go about finding out. With your class, divide the question and research process into small steps. Together, flesh out a strategy for the class research project.

Diagnose:
Have your students practise interviewing each other! Assign them roles appropriate to the chosen subject of research. Have the class develop an interviewing outline to use as a guide. It should include interviewing etiquette. Discuss how the class will request and conduct interviews efficiently and respectfully--and how to thank the people who give them time and information.

Activity:
Assign parts of the project to groups of students and establish a project schedule. You may want to involve volunteers or the school librarian in the research process. Give each group an outline, a list of sources and checklist to record its progress. Have your student groups keep journals where they record everything they learn: new leads, ideas and problems.

When your students decide who they would like to interview, you should arrange the interview for them. An introductory letter on school stationary expressing appreciation and explaining the school project and its goals should be given to each person being interviewed by your students. People who do not want to help or be interviewed should also be thanked for their time. If your students are going to use a recorder, they need to ask permission in advance. All named quotes should be reviewed with the speaker before the class uses the information.

Summary:

Plan a 'Jordan Creek Seminar' day. When the groups have completed their work, have them present results to each other. These results could take the form of tapes, models, photographs, posters, drawings or writing!

Additional Activities:

Your students could turn the results of an interviewing or mapping project into a brochure or a book! (With Margie Beadle's assistance, Judy Maier's 5th grade students did that for Auke Bay in 1990. You may want to ask Margie Beadle for advice.)

Sources:

Project Wild Aquatic, interviewing guidelines, page 205

STEREOGRAM PUZZLERS

The Floyd Dryden/Glacier Valley Historical Sequence takes us through 60 years of changes, and has countless clues as to 'what makes Jordan Creek tick'.

1) Find Glacier Valley School on the 1984 photos. Its coordinates are 5--5 1/2. Now look for the school in 1962. At 6--5 are the letters 'GV.' No school! Now find 'GV' on the 1948's (4 1/2--6). What is different about the school site in 1948 and 1962? What type of vegetation grew on the school site before it was cleared?

2) Is your house on the 1984's? How about the 1962's? Do you know anybody whose house had already been built in 1962?

3) Using the school site to guide you, locate the small open wetland at the end of the Jordan Creek Nature Trail (5 1/2--8). Can you find it in 1962? (6--6 1/2) In 1948? (5--6 1/2) How about in 1929? This one is much trickier to read, but the Nature Trail wetland just barely shows, at 7--11!

4) Let's find some of the important features of Mendenhall Valley on the 1948 photos. At 4--11 1/2 there is a high ridge which forms the eastern side of the Valley. What is its name? Look on your map to find out. What is the large, snakey stream that crosses the bottom of the photos? Check your map.

At 1/2--7, a smoothly curved ridge enters the left edge of the photos. On your map this is shown as the "terminal moraine". This is a ridge left two centuries ago by the Mendenhall Glacier!

Jordan Creek begins where the ridge meets the base of Thunder Mountain. Find the "braided channels" at 2--8 1/2. Jordan Creek is divided into these braids at its headwaters. There are also many steep gullies with creeks coming off Thunder Mountain, which drain into Jordan Creek. Where is the biggest one? What are the coordinates where it gets to the base of Thunder Mountain?

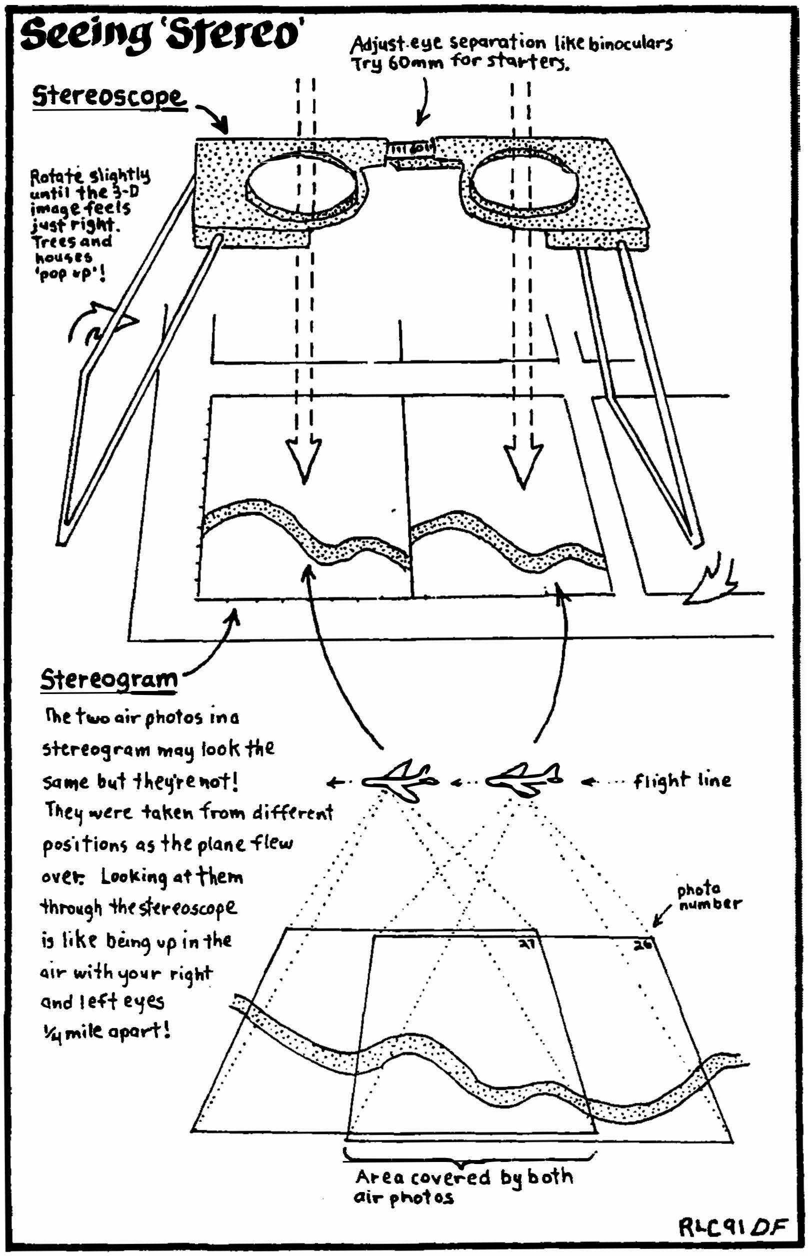
5) Now find the large bare patch (no forest!) centered at 3 1/2--7 1/2. In 1929 this area had the biggest trees on the photos (5--10). What do you think happened? Can you find any clues? Look for this patch in the 1962's (centered at 4 1/2--7 1/2). Trees are starting to grow back. What are the darker, twisting lines running through the open area? Finally, look for what used to be the bare patch in the 1948's. You can find it because the trees look smaller and more tightly packed, but it's now completely forested! How many years did it take to produce the young spruce forest?

6) Trace the path of Jordan Creek through the 1984 photos. It enters at 0--10, and passes under the Coho Park bridge at 2--8 1/2. From there it flows behind the Floyd Dryden track, past the backyards of six houses, and meets the end of Jennifer Street, where the nature trail begins. Then it continues to the right (south) between more houses and the open wetland (see question 3), and leaves the photo at 7 1/2--8. Notice the pale, whitish looking trees at the edge of the photo. These are dead spruce. What could have killed them?

USING THE STEREOSCOPES AND STEREOGRAMS

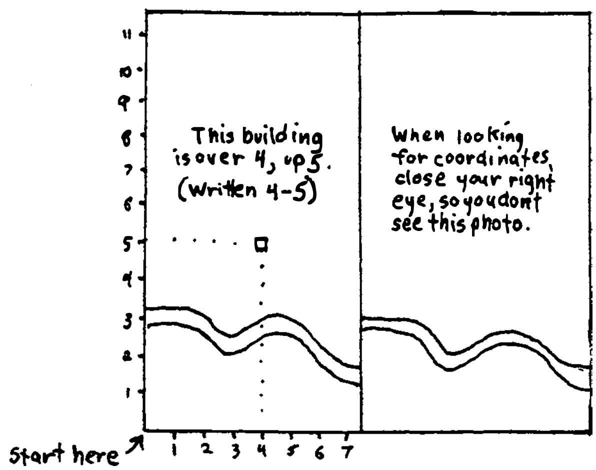
Stereoscopes allow you to see the land you live in as if it were a 3-D model. You can tell much more about landforms and vegetation and buildings than by looking at a single air photograph.

To use the stereoscope, place it over a stereogram so that you can look at the left photo through the left lens, and the right photo through the right lens. Adjust the eye separation of the lenses until they feel comfortable, just as you would binoculars. Rotate the legs just a little as shown in the drawing, until you can see the 'model' with no eye strain. If you're seeing two images, try to make your eyes bring them together....



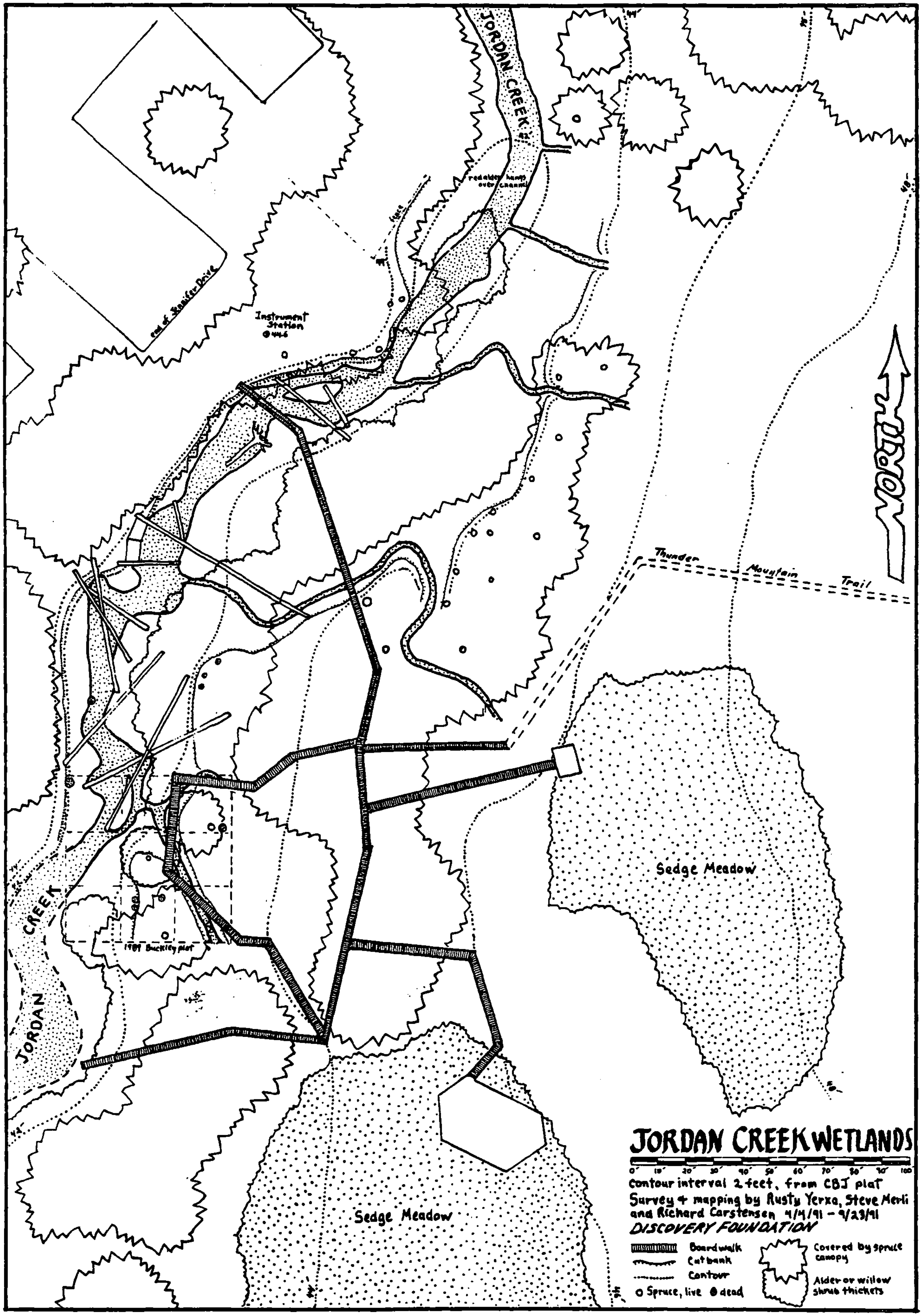
Don't be surprised if you don't see 3-D immediately. It takes some people 5 or 10 minutes to stop seeing double, but with practise, stereograms will pop up instantly whenever you view them. Keep trying; only about one person out of a hundred is truely unable to see in stereo. And if you *think* you're seeing in stereo, but aren't really sure, you're *not.* When it pops up, you'll *know* it.

Coordinates Along the edge of one photo in each stereogram are numbers, called coordinates. When several people are viewing stereograms together, they can tell each other where they're looking by using these coordinates. It helps to temporarily close the right eye when studying the numbers. Starting at the lower left corner, count over, then up, to your point of interest. For example, in the 1984 true color photo, Glacier Valley School is 'over five, up five and a half'. We like to write that as **5--5 1/2**. Floyd Dryden is **1 1/2--7.**



Scale bars and north arrow The stereogram sheet has photos of the same places, taken at different times. But the scale is not the same. The 1948 stereogram shows the largest area ('small scale'), and the 1984 shows the smallest area. ('Large scale') (Remember it this way: on a large scale map or photo, objects appear large.)

Also, notice that the north arrow points to the left in all photos except the 1929's. In these early photos the plane was flying to the northeast. In the more recent photos the flight line was north-south.


JORDAN CREEK WETLANDS
0' 10' 20' 30' 40' 50' 60' 70' 80' 90' 100'
contour interval 2 feet, from CBJ plat
Survey + mapping by Rusty Yerxa, Steve Merli
and Richard Carstensen 4/4/91 - 9/23/91
DISCOVERY FOUNDATION
Boardwalk
Cutbank
Contour
o Spruce, live ● dead
Covered by spruce canopy
Alder or willow shrub thickets
JORDAN CREEK #2
JORDAN CREEK
Instrument Station
end of Jennifer Drive
Thunder Mountain Trail
Sedge Meadow
Sedge Meadow
1989 Buckley plot
NORTH

BASIC STREAM DATA SHEET

DATE	AIR TEMP	WATER TEMP	WATER DEPTH	WEATHER	NOTES

Unit #2

JORDAN CREEK FISH

Unit Introduction:

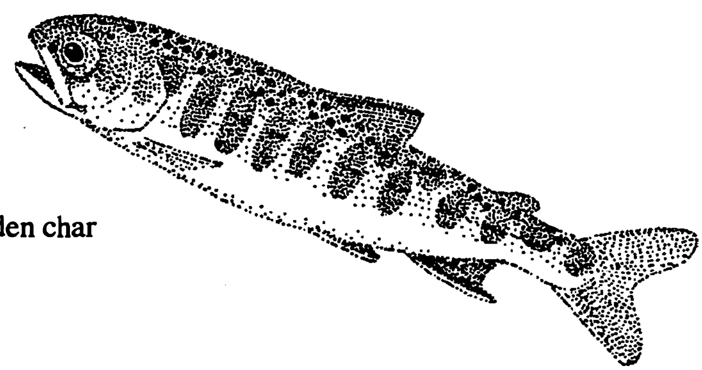
Jordan Creek is one of the richest salmon streams in the Juneau area. In July 1983, a population estimate on lower Jordan Creek showed the highest numbers of young coho salmon ever recorded for a stream in southeast Alaska. Your students may already have observed coho and pink salmon spawning spectacularly in the gravels near the Jordan Creek Trail, accompanied by Dolly Varden charr. Because of this richness the Jordan Creek Trail provides a wonderful natural laboratory for studying the ecology and behavior of local fish.

Perhaps most striking is the abundance of baby coho salmon found in Jordan Creek throughout the year. These feisty wild salmon defend their little territories, vying for the richest feeding areas with young Dolly Varden charr. In addition to the ocean-going cohos and dollies, Jordan Creek hosts a small population of sea-run cutthroat trout. It is also home to coast range sculpins and spiny sticklebacks, small freshwater fish with bizarre and entertaining habits.

To take advantage of this "natural laboratory" by your school, "Jordan Creek Fish" explores in some depth the behavior of Jordan Creek species, particularly those not emphasized in SeaWeek materials. Students learn how fish in different life stages use Jordan Creek. They observe spawning, study feeding and simulate territorial behavior and smolting of Jordan Creek salmonids. Students also discover the fascinating adaptations of sculpins and sticklebacks, common stream resident fish often overlooked in salmonid-focused curricula.

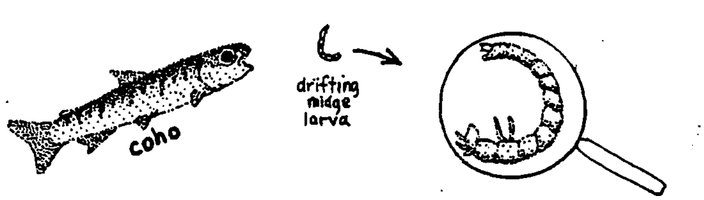
Objectives:

Students will:
- identify Jordan Creek fish species and life stages
- observe and discuss the behavior of Jordan Creek fish
- compare the diet and feeding strategies of juvenile fish
- simulate interactions of juvenile coho salmon and dolly varden char



Related Curriculum:

- Science (observation, classification, SeaWeek: fish life cycle, diet & behavior)
- Art (coloring)
- Physical Education (action game)
- Language Arts (reading and writing)



Aquatic Education Goals:

This unit builds on 4th grade aquatic food web studies ("Aquatic Adaptations" and "Fish and the Forest") and leads to the 5th grade habitat unit ("Fish Habitat"). Although focused on the behavior of the abundant rearing salmonids, cohos and dollies, it also addresses other species using Jordan Creek. The study of site-specific ecology of rearing and stream resident fish complements the more marine and "all-Alaska" emphasis of 5th grade SeaWeek materials.

Lesson Plans Included:

Lesson #1: Stream Nests - Spawning Fish
Lesson #2: Despot Dollies & Quick Cohos - Rearing Fish
Lesson #3: Silver for the Sea - Smolting Fish
Lesson #4: Sculpins and Sticklebacks - Resident Fish

Lesson #1
STREAM NESTS - SPAWNING FISH

Season: Fall

Setting: Classroom and Jordan Creek Trail

Time: 1 1/2 hours

Related Curriculum:
Science (observation, classification, SeaWeek: fish)
Art (drawing)

Materials:

In The Kit
- spawning fish posters
- Spawning Observations Data Sheet master
- 2 thermometers
- salmon life cycle handout
- option: "Salmon Life Cycle" slide show

Supplied By Teacher
- class stream data journal

Preparation:

copy worksheets
visit stream site to see if fish are spawning
review slide show script

Teacher Background Information:

What salmon do we see spawning by the Jordan Creek Trail in the fall?
You will want to refer to the kit's spawning fish posters to identify fish in spawning colors. In years of pink salmon abundance, pinks (or hump-backed salmon) are seen spawning near the trail in late summer and early fall, sometimes right under the bridge! Pink salmon are less precise in their homing behavior than other salmon, so there is some "wandering" of returning spawners. It is likely that some of the hatchery pinks released by DIPAC make their way into the Jordan Creek drainage, as a sort of "overflow" effect. Jordan Creek has also traditionally had a wild pink salmon run in its lower reaches.

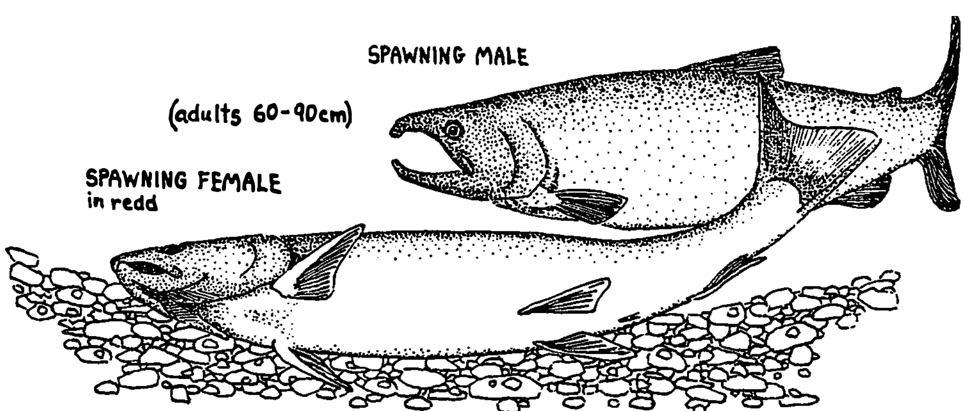
Pinks seem to be quite oblivious; they are not easily distracted from the task at hand. Cohos, however, are more secretive. In fact, Jordan Creek cohos are downright street-wise. In populated areas, they spawn in hidden places or even wait under undercut banks, logs or culverts to spawn under cover of darkness. Your students would have to be very lucky to catch cohos spawning in Jordan Creek! The large carcasses, however, may be easy to find through the fall and early winter, providing your students with vivid evidence of spawning activity in the stream.

Coho salmon enter spawning streams from July to November. The timing depends on the temperature of the water. Eggs develop more quickly in warmer water, allowing adult fish to spawn later in the fall. Jordan Creek originates in headwater springs and may also receive groundwater from the flanks of Thunder Mountain. Springs and groundwater can moderate stream water temperatures and may allow for somewhat late coho spawning on Jordan Creek.

How about the other Jordan Creek salmonid fish--when do they spawn?
Dolly Varden char also spawn in the fall. In addition to following spawning fish up streams to feed on eggs, they enter their home streams to spawn from mid-September to mid-October. Most dollies spawn each year after reaching sexual maturity at four years of age.

Your class may see Dolly Varden spawning near the trail, but they are unlikely to see cutthroat trout or chum salmon. Cutthroats spawn only at night during the months of April and May. Chum salmon are reported to spawn in Jordan Creek's lower reaches.

How can you tell if fish have spawned in an area?
Spawning salmonids dig shallow nests in the gravel, called *redds*, by turning on their sides and flipping their tails. They are usually somewhat longer than the spawning fish and about half as wide as long. Biologists sometimes count redds to monitor spawning activity. Dolly Varden redds are 30 cm long by 15-25 cm wide and 15 cm deep. Coho redds are slightly longer than the fish and 20-25 cm deep. Pink redds are variable. Although they can be as long as 92 cm and up to 45 cm deep, they are usually a little longer than the female and as deep as her body.

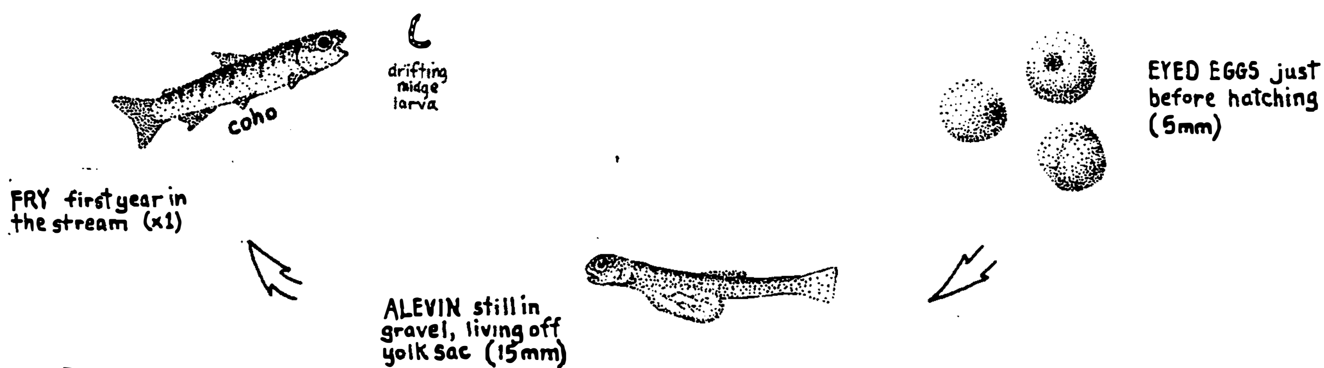


COHO SALMON

How does the spawning process work?
The suction created by flips of the female's tail loosens gravel, allowing it to be carried away by the current. A coho female digs in the same spot at intervals of two to five minutes. Pinks also dig repeatedly in the same spot. The males take no part in the digging, resting slightly downstream and to one side of the female when not driving off intruding males. Now and then the male gently nudges the female or quivers beside her.

When the pit is finished, the female drops into the deepest part of the nest, where the male joins her. The two fish erect their fins, open their mouths, and quiver, side by side in the bottom of the nest. The eggs drop into the pit, falling into the spaces in the gravel, and are fertilized by a cloud of milt from the male. The female then moves to the upstream side of the nest and starts digging a new pit. The gravel carried downstream covers the eggs she just deposited, as the proces begins again. Redd building and spawning continue until the female has expelled all her eggs. The male then leaves and may spawn with another fish. The spent female keeps digging weakly until she dies.

Pink salmon produce between 800 and 2000 eggs; cohos average 2500 to 3000. Coho eggs are .45 to .6 cm in diameter. Pink salmon eggs are also orange-red and about .6 cm in diameter. Development time depends on temperature. Coho egss hatch in about six or seven weeks, then the young (alevins) stay down in the gravel until they have used up their yolk sac. In two or three weeks, they emerge from the gravel as free-swimming fry and begin to feed. (The feeding behavior of these tough little fry and their older cousins is discussed in the next lesson.) Pinks, however, begin migrating downstream almost immediately when they emerge from the gravel.



Vocabulary:

alevin - a young salmon that has hatched from the egg but is still feeding off its yolk sac

coho salmon - an adaptable, valuable salmon found in both large and small streams, also known as the "silver" salmon (Jordan Creek is full of young cohos!)

cutthroat trout - a beautiful, brightly colored trout, often having a red streak on behing the lower jaw ("cut throat"). (A few live in Jordan Creek, using the ocean to feed during the summer.)

Dolly Varden char - named after a character from a book by Charles Dickens, who had a pink-spotted dress. Adult "dollies" who spend the summer in the sea are silvery trout-like fish with pink spots. Young "dollies" spend several years growing up in Jordan Creek.

escapement - the number of adults returning to a stream (having escaped the nets and hooks of fishermen)

fry - tiny fish recently emerged from the gravel

gravel - pea to fist-sized pieces of rock

milt - a milky fluid released by male fish to fertilize eggs

pink salmon - an abundant, small, short-lived salmon also known as "humpback" or "humpy" for the hump of the spawning male

redd - a salmon nest, a shallow depression dug in a gravel streambed in which eggs are deposited

spawn - to deposit (lay) and fertilize fish eggs

Lesson - Stream Nests

Purpose:
To study spawning behavior in the context of salmonid life cycles.

Objectives:
Students will:
- observe spawning behavior
- compare the spawning behavior of different species using Jordan Creek
- identify stages in the life cycle of salmon

Focus:
Ask your students if any have seen spawning fish, then ask if any have seen spawning fish in Jordan Creek. Discuss their experiences watching the fish.

Visualization Exercise

Ask your students to close their eyes and imagine that they are salmon, on their way to their home stream. Make your voice relaxed and impromptu, pausing now and then to ask a question which will make them use their imagination. Here is an example:

Somehow you know which way to go.... You keep swimming until you can smell the water of the stream where you were born... A large animal looms at you. Is it a seal ?...You dive and turn with a powerful burst of speed... Was it a sea lion? Or an orca?... The water is getting shallow, now. You are turning and going up a small streambed, but the water is still salty. It gets dark suddenly... Are you in a cave? There is a rumble of car overhead. You can smell the metal sides of a culvert.... You pause in the safety of the dark culvert and rest until it gets dark. Pushing upstream against the current, you come to a barrier. What now? Loggers have left a pile of logs in the stream... You find a deep place and squirm through...More logs! You find a deep place and with a burst of speed, power yourself over the beaver dam. Is the water too deep and slow here? You swim upstream til the current quickens...You hurry through open places and hide under logs... until you find the place where you will spawn. What does it look like?.... How big is the gravel? Is there a good place to hide nearby? Under a log?... or a place under the bank........

Ask them what animal they saw, and what their spawning place looks like, before they open their eyes. Then ask them to open their eyes and write down a few words, answering those questions. You may want them to discuss their experiences--or have them write and draw images later.

Diagnose:
Salmon Life Cycle Handout

To prepare for the field trip, pass out the "Salmon Life Cycle" handout and go through it with your class. Post the spawning fish posters, so students can see the spawning colors.

When they have finished, pass out the photocopied field data sheet and explain the field trip activity, or have your class prepare their own form in a field notebook.

Activity:

Spawning Behavior Observations

When you reach Jordan Creek, pause at the bridge to observe spawning there. Have students take the stream temperature and record the stream level. (It is recommended that you do this on each trip to the stream.) Explain that in order to see spawning behavior, you need to be quiet and patient and sneak up on the fish. Spread your class out along the trail, so they can make observations as groups or individuals. Their "Spawning Observations" data sheet has a checklist of behavior and nest site features to help them focus their observations.

Summary:

When you return to class, or on the platform of the trail (if the weather is nice), have the class share their observations. To help them put their observations into context, you may wish to show them the "Salmon Life Cycle" slide show fromthe kit, along with the script.

Additional Activities:

- Have your students write poems and stories or make drawings inspired by the salmon journey visualization session which introduced the unit.
- Take a trip to the viewing area at DIPAC if pink salmon are still returning.
- Take a trip to the mouth of the stream to see what areas salmon pass through to reach upper Jordan Creek.

Lesson #2
DESPOT DOLLIES AND QUICK COHOS - REARING FISH

Season: Fall or spring is best

Setting: Classroom, Jordan Creek Trail and gym or playing field

Time: 2 hours

Subjects: Science (observation, classification, SeaWeek)
Physical Education (action game)

Materials:

In The Kit
- "Dolly Varden--Egg to Fry" slide show
- "Food for Fish" handout
- "Rearing Fish Behavior Field Sheet" master
- Salmon, Trout and Char poster
- fish ID laminates

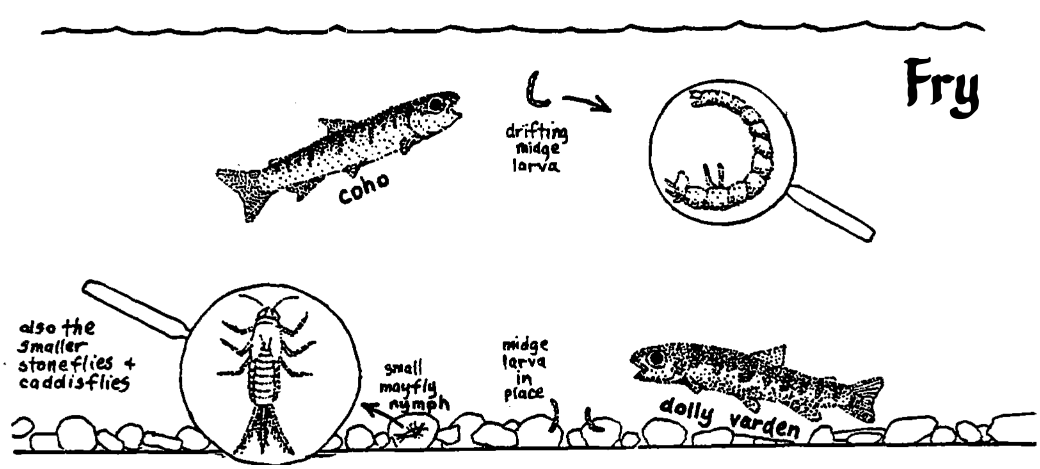
Supplied By Teacher
- bucket of balls and bean bags or other soft, easily handled objects

Preparation:
Copy worksheets, review slide show and find volunteers if you wish to split the class for better fish observation.

Teacher Background Information:

What do the young fish in Jordan Creek eat?
Coho and dolly fry in Southeast Alaskan streams both feed heavily on midge larvae and other aquatic and terrestrial insects. Chironomids, or midges, are tiny, non-biting flies whose larvae are the single most important food for young or "rearing" fish in streams like Jordan Creek. Dolly fry take them mainly from the bottom, while coho fry tend to feed more on drifting larvae.

The larger fish, or *fingerlings*, take stonefly and mayfly nymphs (wingless but like the adults) and caddis fly larvae (worm-like immature insects) as well as insects from the land which have fallen on the surface of the water. Both dollies and cohos will feed on pink salmon fry and eggs when they are available.



How do they feed?
Young coho salmon and Dolly Varden char eat the same kinds of food, but they tend to feed in different ways, particularly when they are together. Cohos tend to feed more from the surface, swimming 4-6 inches beneath the water surface and only rarely picking food off the stream bottom. In riffle areas where fast, rough water makes surface-feeding difficult, cohos may take only 20% of their food from the surface. In backwaters, pools and near stream banks, 60% of the coho diet may be made up of wasps, beetles and flies floating on the surface of the water.

Although young Dolly Varden will take food from the surface, or from the *drift,* they tend to spend more time on the bottom of the stream. With their low-slung mouths, they are very effective *benthic* predators, picking up mouthfuls of litter and sand. They somehow sort out the insect larvae and swallow it, spitting out the litter and sand! In an experiment, dolly fry fed 56% of the time from the stream bottom, 35% from drifting material below the surface and 9% of the time from the surface.

When young Dolly Varden have to compete with the more visually-oriented cohos and cutthroat trout, the dollies will spend even more time on the stream bottom. The cuttroats and cohos are fast and effective at grabbing surface and drifting food. Apparently, cohos and cutthroats are so effective that Dolly Varden rarely even try for these foods when the species are together. Instead, dollies concentrate even more on that at which they are best-- sifting through bottom litter to find food.

What is a feeding territory?
Young salmonids stake out and defend small feeding "territories" from use by other fish. They do this by nipping and chasing other fish that enter "their space". The typical territory of a dominant Dolly Varden will be about two feet square, extending in front of the fish. A fish of lesser status may only be able to defend a few inches of feeding space.

How do cohos and dollies interact?
Dolly Varden fry show little territorial behavior. They are dominated by the aggressively territorial coho fry, but the tables turn as the fish grow up! Dolly fingerlings are fiercely territorial and clearly dominate coho fingerlings. In fact, one very tough dolly (called a "despot dolly" by biologist Bob Armstrong) often dominates all the fish in a pool.

The "despot dolly" will position itself at the head of a pool, just below a riffle. From that station, the dolly has first crack at the "cafeteria line". Midge larvae, stonefly nymphs and mayfly nymphs that have lost their grip on the bottom come floating and drifting out of the riffle along with caddis fly larvae that have lost their cases and insects that have fallen from the trees. The "despot dolly" tries to feed from these tasty items, but is not terribly skilled at feeding "on the wing".

Now and then one of the other fish loitering about the edge of the despot's territory dashes in and grabs something. Since cohos are quick and accurate drift and surface feeders, they usually get what they are after. The dolly, of course, is not pleased by this assault on its territory. According to Bob Armstrong, the "despot dolly" chases out the intruder and then systematically moves about the edge of the pool, giving each subordinate fish a good nip!

Vocabulary:

benthic - bottom-dwelling, animals that live on the bottom of the stream bed

caddis fly - a moth-like flying insect whose wings form a "tent" over its body when it is at rest. The young (larva) live on the bottom of streams and lakes, some building little homes (cases) out of sand, bark, leaves or twigs.

drift - fish food that is carried within the stream by the current. It is made up of animals that have lost their grip on the bottom and moving debris.

fingerling - a young finger-sized salmonid (between a fry and a smolt), usually less than one year old

fry - a young fish which has used up its yolk sac and is finding food on its own

larva - a young insect which looks totally different from its adult parent and has to go through a special changing phase (pupate) before it can become an adult

mayfly - a graceful, short-lived flying insect whose winged do not fold up. The young are often found in clean fast-moving streams.

midge - a small non-biting fly with hairy antennae whose larva are the most important food for young salmon in southeast Alaska streams

naiad - an insect nymph that lives in the water (Greek for "spirit or goddess that gives life to a stream")

nip and chase - what young Dolly Varden and cohos do to defend their feeding territories

nymph - a young insect that looks almost like its adult form, but lacks wings (Greek for "nature spirit" or "goddess")

sampling - when a fish takes a piece of food into its mouth, the fish "samples" it, spitting it out or swallowing it if the food is what the fish wants to eat

stonefly - a flying insect whose wings fold flat on its back. The young (naiads) are often found in southeast Alaska streams.

territory - a feeding area defended by a young fish

Lesson - Dollies and Cohos

Purpose:
To study the ecology and behavior of rearing fish in Jordan Creek.

Objectives:
Students will:
- observe rearing fish behavior
- identify stages in the Dolly Varden life cycle
- compare the diet and feeding strategies of cohos and Dolly Varden
- simulate interactions of juvenile coho salmon and Dolly Varden char

Focus:
"Dolly Varden - Egg to Fry"

Ask your students what they know about Dolly Varden char. You may want to have a student find them on the "Salmon, Trout and Char" poster and point them out to the class. Explain that you are going to learn how baby dollies and coho salmon grow up in Jordan Creek, but first you are going to see amazing slides of young dollies developing in the egg!

Field Trip Preparation:

"Food for Fish" handout and worksheet

Ask your students what they think young fish eat in Jordan Creek. How do they get the energy to grow from fry to fingerlings? Write down their answers and guesses, then pass out the "Food for Fish" drawing and worksheet.

Go through the questions and vocabulary with your students.

To prepare for the field trip, pass out the rearing fish behavior field sheets to groups (or individuals) and go through the checklist of behaviors together, looking at the fish ID laminates.

Activity:

Rearing Fish Behavior Observations

Just before you reach the trailhead, review the importance of being quiet so that the fish will come back out and start to feed and "fight". Remind your students that it takes about ten minutes of quiet for the fish to calm down after they have been disturbed. Your students will be watching for "scatter and bunch" behavior, bottom, drift and surface feeding, and for interactions such as "nipping" and "chasing". Your students will try to figure out the territory size of a fingerling and distinguish between cohos and dollies. They will also shake the vegetation, to see if fish will feed on the insects that drop in the water.

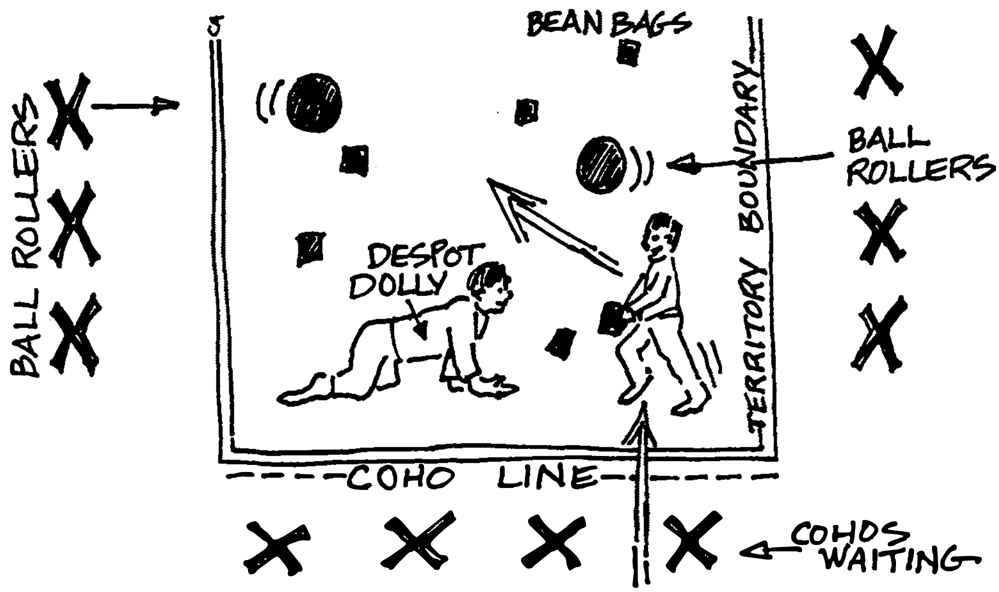
Summary:

Discuss Observations

You may want your students to discuss their observations after returning to class, or use the trail platform to gather and share observations outdoors (in good weather).

Dollies and Cohos Game

To review typical interactions between dollies and cohos, have your students play "Dollies and Cohos", an action game which simulates rearing fish behavior. Divide your class into groups of 10 or 12 and give each group several balls and bean bags. Divide each playing group into three smaller groups, selecting one person in each playing group to be the first "despot dolly". Each playing group will look like this:



The students on the sidelines roll balls back and forth to simulate drift and surface foods, for which the "dollies" and "cohos" will be competing. The beanbags scattered on the ground are foods on the bottom of the stream.

The "despot dolly" can use the whole playing area, but must move on his or her hands and feet--to represent the dolly's greater efficiency as a bottom feeder and its weaker drift feeding skills. The "cohos" are the students waiting behind the line. The line stands for the border of the "despot dolly" feeding territory, which it protects by tagging intruders, making them let go of any balls or beans they have picked up.

The cohos are to rush forward and try to catch a rolling ball, getting back behind the line before being tagged by the "despot dolly". The cohos can also try to rush forward and grab a beanbag to take behind the line, but they may find that it is hard to do that with the dolly standing guard. A coho can take only one "food item" at a time, returning with it behind the line (where items can be piled up, with balls going in a bucket). If tagged by the dolly, a coho must drop its food (if it has any) and go back behind the line. Balls can be recycled for play by the ball rollers, but when the bean bags are all removed from the floor (or ground) the round of the game is over. Play several rounds with different students being the "despot dolly".

After the game, discuss the strategies developed by students in the course of the game. Is it hard defending a territory? What are the advantages? Who were better at collecting the rolling "surface and drift foods" the cohos or the dolly?

Additional Activities:

Minnow Trapping

You could obtain a permit, procedures and traps from the regional office of the Alaska Fish and Game Department and trap fish with your students. The experience of closely observing live fish is matchless! However, if you are using "minnow traps", it is essential that the situation be tightly controlled so that the valuable young salmon are not stressed. You will need additional volunteers, and ideally, someone with fisheries experience to help in the field. You will also need bait. The best bait is fresh salmon roe--contact a cold storage plant or hatchery. (The canned roe in bait shops is not much good.)

The two main dangers for the young fish are damage to the sensitive mucous coating that protects the fish's skin and lack of oxygen. To avoid hurting the fish, you should pour your traps directly into a pail of water or field "viewing aquarium". Avoid handling the fish. However, if for some reason you must handle a fish, your hands should be wet, so they will not rub off the mucous layer. Give your fish plenty of water. Do not put several into a small container or they will suffocate. As the water warms up and time passes, the water will lose oxygen, so you must set a time limit on your observations and stick to it. Watch for signs of distress: color changes, gulping breaths.

The placement of traps will depend on your educational goal. You may wish to place traps both in good rearing areas, with plenty of depth and cover, and more shallow, exposed areas for a habitat comparison. If your emphasis is on behavior observations and species identification, then simply put a few traps in places you are likely to find fish.

Good observations of feeding behavior and species interactions can be made by putting a few fish in a clean, good-sized clear plastic aquarium. Have gravel in the bottom and a little bit of vegetation or debris for cover and drape one side with cloth to minimize stress on the fish. You could observe your fish in small groups on the trail platform, then release them into the stream.

Lesson #3

SILVER FOR THE SEA - SMOLTING FISH

Season: May is best

Setting: Classroom and Jordan Creek Trail

Subjects: Science (observation, classification, SeaWeek)
Art (coloring)
Language Arts (reading and writing)

Materials:

In The Kit
- colored, laminated smolt and rearing fish pictures
- "Silvery Smolts" worksheet master and key

Preparation:

Copy "Silvery Smolts" worksheets

Teacher Background Information:

What are *smolts*?
Each spring, some of Jordan Creek's developing young fish get ready for life in the ocean. To prepare for this move, the insides and outsides of their body change. After a year or two in fresh water, coho fingerlings become silvery, so they will blend in with the ocean water. When this happens, they are called *smolts*.

How do they prepare for ocean life?
Inside, their bodies prepare for the rigors of saltwater life; their kidneys must change in order to cope with the excess salts found in sea water. As their bodies change, so does their behavior. The smolts begin to avoid light, seeking deeper water. They move downstream, usually at night. Once out of Jordan Creek, they feed near the shores, then eventually move out to sea.

Why can't we just trap them to see the color change?
Although coho fingerlings are quite hardy, the smolts are somewhat fragile. This *smolting* transformation, like most changes, is very stressful for the little salmon. At this point in their lives, they are vulnerable to any additional stresses, so it is not a good time to trap and examine them.

So how do we study smolts?
In this lesson, your students compare the colors of rearing and smolting coho salmon and dolly varden. Outdoors, they test the value of these colors as camouflage in the waters of Jordan Creek, using colored "laminates". They will find that the simulated "smolts" show up in the stream, while the "rearing fish" disappear.

A fingerling's color automatically adjusts to the colors of its surrounding. If you put a dark young coho in a white pail, it will become lighter! This cameleon-like ability helps the fish blend in to the changing, darkly patterned environment of the stream. The dark pigments of fingerlings may also protect their sensitive skin from damage by light.

The smolt, however, doesn't need to blend in to a stream bottom. Instead, it needs to reflect the silvery colors of sea water, blending in with the muted blue light of the open ocean. The loss of its talent for stream-bottom camouflage is an outerward sign of the profound changes happening inside the fish.

What about the other Jordan Creek salmonids?
The study of smolting provides a good opportunity for comparisons of salmonid life histories, so a life cycle worksheet is included as a summary exercise. At one extreme, the pink salmon move out toward the estuary almost immediately upon emerging from the gravel in their first spring. At that point, they are only 30 to 45 mm long!

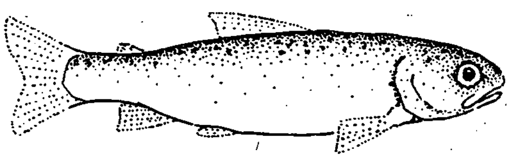
Coho stay in the stream for one, two or three years at a size of 80 - 105 mm (Crane & Bond, 1976). According to biologist Robert Armstrong, about 50% "smolt up" after one year in the stream. Dolly Varden, on the other hand, migrate to sea in the fall or the spring when they are 2 to 6 years old, although most go between the ages of 2 and 4. Their size ranges from 100 to 180 mm; the measurement is "fork length", or length from tip to the fork in the tail (Armstrong, 1970). Sea-run cutthroat outmigrate in May or June when they are 2 to 4 years old. 80% of cutthroats move out to sea at the age of 3 years, when they are about 180 mm long (Jones, 1976) (Morrow, 1980).

What are the advantages of stream and ocean life for young fish?
To answer this quesiton, let's take a look at the early sea life of pink salmon. Sea life is tough on tiny, tasty creatures. 2% to 4% of the young pink salmon die each day during the first forty days at sea. In fact, sea survival to maturity may be as low as 2% overall. If you compare early and late migrating cohos, you find that the longer fresh water life yields fewer, larger fish which seem to survive better in the ocean.

Food in the ocean is abundant, allowing the rapid growth for which salmon are famous. However, there is "no free lunch"; it is just as likely that a tiny fish will become food for something else! Food in freshwater streams is limited, but the small fish are safer from predators. It is a trade-off that nature makes in different ways for different fish. There does seem to be a trend, however, among salmon species. The newer, more recently evolved species, such as pink salmon, seem to be "choosing" the sea instead of rearing in streams.

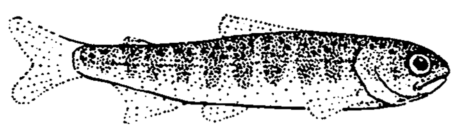
Vocabulary:

alevin - a young salmon that has hatched from the egg but is still feeding off its yolk sac

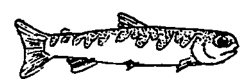


SMOLT

FINGERLING



FRY first year in the stream (x1)



anadromous - a fish that spends part of its life in the sea and part in fresh water

ALEVIN

fingerling - a young fish, larger than a fry

fry - a tiny young fish that has finished its yolk sac and is finding its own food

kidney - the filtering organ (or part) of an animal which removes wastes and excess salts from the blood. A smolt's kidneys must prepare to cope with the salts in seawater.

life cycle - the circle of life stages, from egg to adult to egg ....

outmigration - the downstream, seaward movement of smolts, usually occurring at night

marks - dark bars on the sides of most young salmonids

salmonids - salmon, trout and char

sea-run - a freshwater fish which spends part of its life in the sea

smolts - silvery juvenile salmonids which are preparing to live in the ocean

Lesson - Silver for the Sea

Purpose:
To study the smolting phase of Jordan Creek salmonid life cyles.

Objectives:
Students will:
- discuss the advantages of stream and sea life for young fish
- compare the camouflage value of smolt and rearing fish coloration in the stream
- compare the age and size at smolting of Jordan Creek salmonid species

Focus:
Ask your students what the baby salmon living in Jordan Creek look like. Have they seen any in the stream lately?

Ask your students if they know what the fish in Jordan Creek are doing at this time of year. Write down their ideas and guesses as to what the various fish are up to in the spring.

Diagnose:
Ask your students when salmon go out to sea and what they do to get ready. Define *smolt*, explaining that fish go through changes on the inside and outside as they prepare to go to sea. One change you can see is in their color. Explain that they turn silvery, losing their dark bars. Ask them why they think salmon would change color like that.

Break your class into working groups for the field trip. Give each group a set of laminates of silvery and dark fish. Ask each group to write ideas for experiments they could do in Jordan Creek to help them understand why salmon smolts are silvery.

Activity:
Check each group's "experimental design", offering help to firm up their procedures and put them in the form: "step 1, step 2, step 3, step 4". The experiments should be simple. The students should put the laminated "fish" under the water in various places and see what they look like. They should make comparisons to find out what water depth and bottom type makes it harder to see each fish.

Summary:
Discuss the results of the fish coloration experiments and the advantages of camouflage.

Pass out the "Silvery Smolts" worksheets and go through the questions with your students. The worksheet graphs out the early life of several Jordan Creek salmonids and illustrates adaptations for sea and stream life.

The last worksheet question asks your students whether they would rather be a pink salmon or a coho. Finish the lesson with a discussion of the advantages of sea vs. stream life for young fish.

Additional Activities:
Students could possibly be involved with outmigrant studies conducted by Fish and Game or Forest Service biologists. (Students should not be trapping smolts themselves. They could, however, look for pink salmon emerging from the gravel whenever they are near the stream in the spring.)

Lesson #4
SCULPINS AND STICKLEBACKS - RESIDENT FISH

Season: Any

Setting: Classroom

Time: 45 minutes

Subjects: Science (classification, comparison SeaWeek)
Language Arts (reading & writing)

Materials:

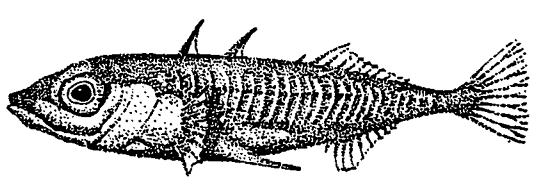
In The Kit
- sculpins & sticklebacks worksheet master and key

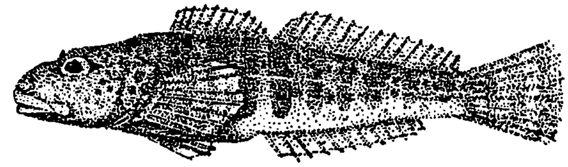
Supplied By Teacher
- poster-making supplies

Preparation:
Copy worksheet.

Teacher Background Information:
What is a *stream resident* fish--are any salmonids stream residents?
Fish that spend their whole lives in streams are considered stream residents. Most local salmon, trout and char spend a good part of their lives feeding at sea. In southeast Alaska, there are sometimes small populations of Dolly Varden which spend their whole lives within a stream. Resident fish may remain quite small, even as mature adults. They don't feed on the rich bounty of "sea food" enjoyed by their sea-run cousins, so they don't grow big! Although sea-run and resident fish may live in the same stream, it is not known if there are stream resident "dollies" in Jordan Creek. Cutthroat trout can also live as year-round residents of Alaskan streams and lakes. According to Mike Bethers of Alaska Fish and Game, Jordan Creek contains sea-run cutthroat trout. It may or may not also host "stream resident" cutthroats.

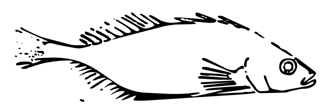
Are there other fish in Jordan Creek besides salmon, trout and char?
Minnow trapping by Alaska Fish and Game biologists captures mostly young coho salmon and Dolly Varden char, but sometime a "coast range sculpin" (also known locally as a "bullhead") appear in the trap. Although there are many species of saltwater sculpins in southeast Alaska (Irish Lords, etc.), the "coast range" is the only sculpin commonly found in a freshwater stream like Jordan Creek. Nocturnal, reclusive and often overlooked, sculpins can be quite numerous. One study estimates 10,000 sculpins in a half-mile section of a southeast Alaska stream!


threespine stickleback

coast range sculpin


The other common non-salmonid fish in southeast Alaskan streams is the three-spined stickleback. A fish made famous by naturalists studying its oddly choreographed behavior, the stickleback is named for the spines it erects to defend itself from predators. The spines can stick in a predator's throat, making it spit out the fish!

Our freshwater sticklebacks, however, may rely on camouflage for protection; motionless in the water, they look like sticks! Larger predators, such as mink, herons and kingfishers can swallow them. They can also be important prey for Dolly Varden.



Why are naturalists so charmed by stickleback behavior?
Naturalists have long been attracted to the plucky domestic habits of the male stickleback. Just before breeding in June and July, males become brightly colored and start to defend breeding territories with a head-down display, nipping and chasing intruding males. The breeding male builds a barrel-shaped nest out of sand or plants and a glue made by his kidney. The male tries to attract a female with a special zigzag dance, then points the way to the nest, posing above the entrance with his head angled down. After the female lays eggs inside the nest, the male forces her to leave by the exit; he won't let her back out!

He fertilizes the eggs, then guards the nest with an odd downward-angled posture, fanning water over the eggs with his front fins. In a week or two, the eggs, which may have come from several females, begin to hatch. After another week, the young emerge from the nest. Like a devoted and harried parent, the male dashes around catching them in his mouth and spitting them back into the nest. As they grow up, they school around him for a few days before they disperse and he is free--to start another brood.

Where do Jordan Creek sticklebacks breed?
Little seems to be known about Jordan Creek's sticklebacks. Some Alaskan sticklebacks are true stream residents, while others are "sea-run" fish. It is not known which form uses Jordan Creek, or where they breed.

Where do the coast range sculpins breed?
Adults migrate downstream to spawn in the lower reaches of streams, leaving egg clusters in crevices. The male guards his nest for about three weeks until the eggs hatch. The 1/4 inch long young float to the surface and are flushed downstream to the estuary.

The Mendenhall Wetland sloughs are a great place for a little fish to get fat. Coast range sculpins spend the summer alongside of staghorn sculpins and starry flounders, whose parents live in the ocean. But in the fall, when baby staghorn sculpins and starry flounders go out to sea, the inch-long coast range sculpins swim upstream to spend the winter in upper Jordan Creek.

What do coast range sculpins and threespine sticklebacks eat?
The sculpins eat much the same insect foods as young salmon and dollies--mayflies, stoneflies, caddisflies and midges. Larger coast range sculpins (4") may eat salmon fry. If sculpins are extremely abundant, they may also compete with young salmon for food.

Like salmonid fry and sculpins, sticklebacks feast on midge larvae. They also eat *zooplankton*, microscopic floating animals such as copepods and water fleas (tiny animals related to shrimp).

Vocabulary:

breeding territory - a defended area used to breed and raise young

brooding - guarding and tending eggs and young (like a male sculpin or stickleback!)

coast range sculpin - a small, mottled, prickly fish with a very large head and mouth, common in freshwater streams like Jordan Creek

stream resident - a fish that spends all its life in a stream

threespine stickeback - a small, spiny freshwater fish (there is also a saltwater form) famous for the dramatic courtship and "devoted" brooding behavior of the male

Lesson - Sculpins and Sticklebacks

Purpose:
To become aware of common and ecologically important freshwater fish.

Objectives:
Students will:
- identify sculpins and sticklebacks, connecting descriptions and drawings
- compare the life history and behavior of stream resident fish
- make posters illustrating the life cycle and behavior of sculpins and sticklebacks

Focus:
Tell your students that they are going to learn about two Jordan Creek fish whose fathers raise their young by themselves. One is the coast range sculpin and the other is the stickleback. Pass out the "Sticklebacks and Sculpins" worksheet.

Diagnose:
Ask your students if they know of any fish in Jordan Creek besides salmon, trout and char. Then ask them if any have caught "bullheads" or "Irish Lords" when fishing in the ocean. If they have, ask them what these fish looked like. Explain that there is a small cousin of the "bullhead" or sculpin that lives in Jordan Creek. They hide under rocks during the day, so they aren't often seen, but there are probably quite a few of them!

Activity:
After reading through the introductory text and question, have your students work alone, or in groups completing their "Sticklebacks and Sculpins" worksheets.

Summary:
Since parts of the Jordan Creek stickleback life cycle are unknown, have your students make a guess, or "hypothesis", about the Jordan Creek stickleback breeding area and life cycle. How could they find out if it was true? What would be the advantages to a young fish of going to sea? (This reviews the "smolting" lesson.) Why do so many other fish, such as cutthroat trout, Dolly Varden, and the salmon go to sea? *(To feed and get fat!)*

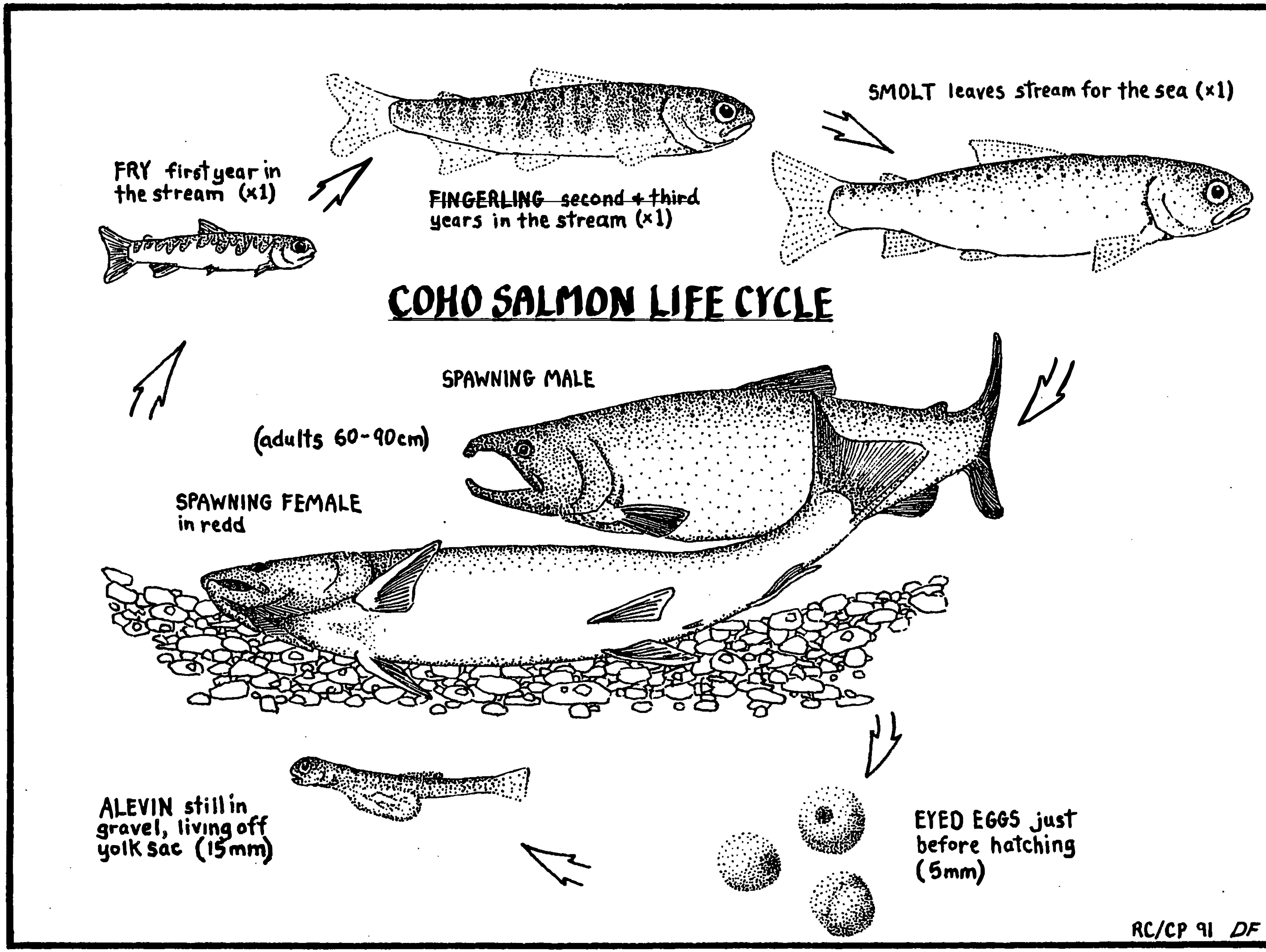
As a summary, have your students make colorful posters illustrating the life history and behavior of sticklebacks and sculpins.

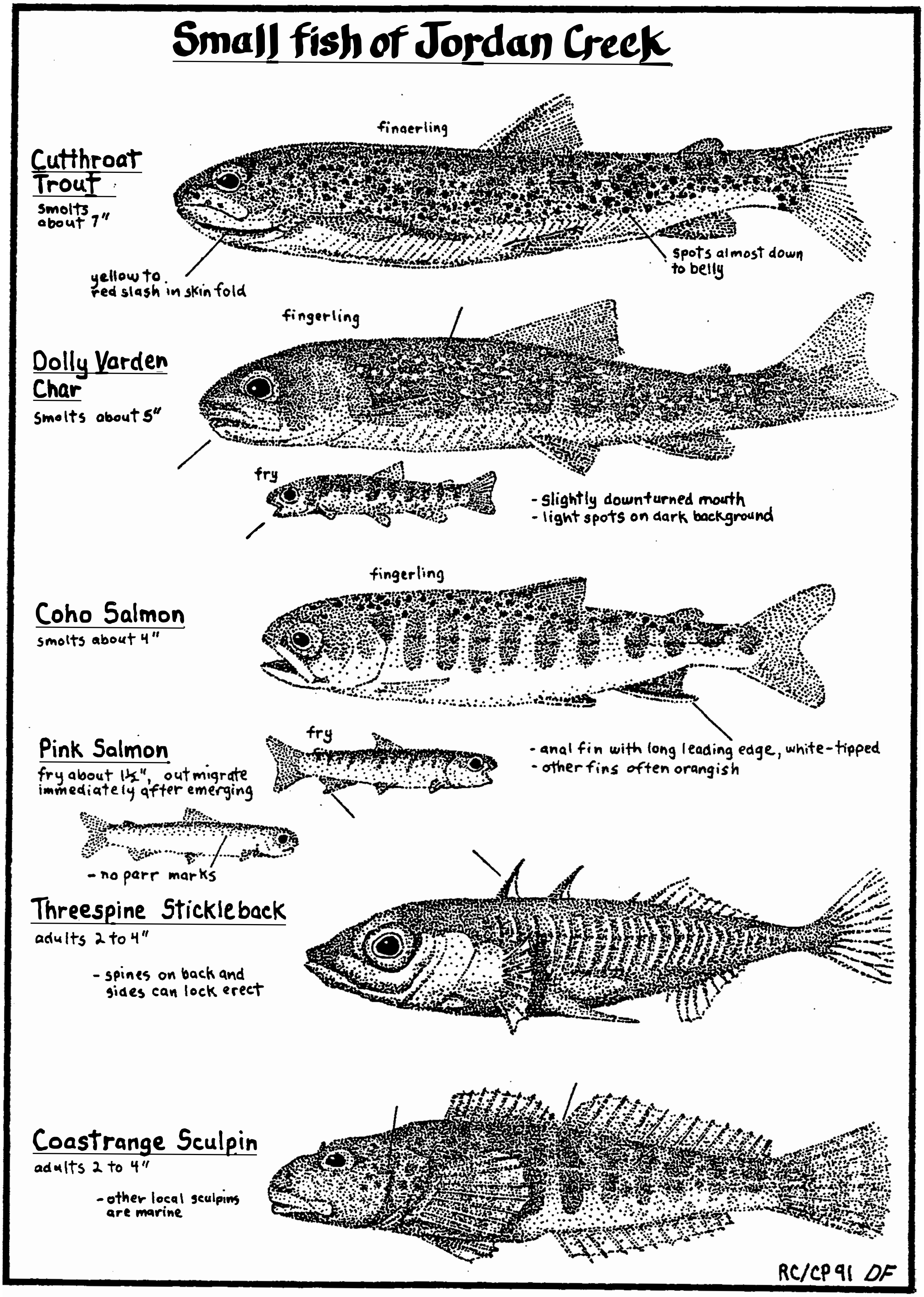
Additional Activities:
Your students could create stickleback costumes with spines and fins and put on a skit for the younger grades, illustrating the dancing and brooding behavior of male sticklebacks (or more likely help the younger students make costumes for their own skit).

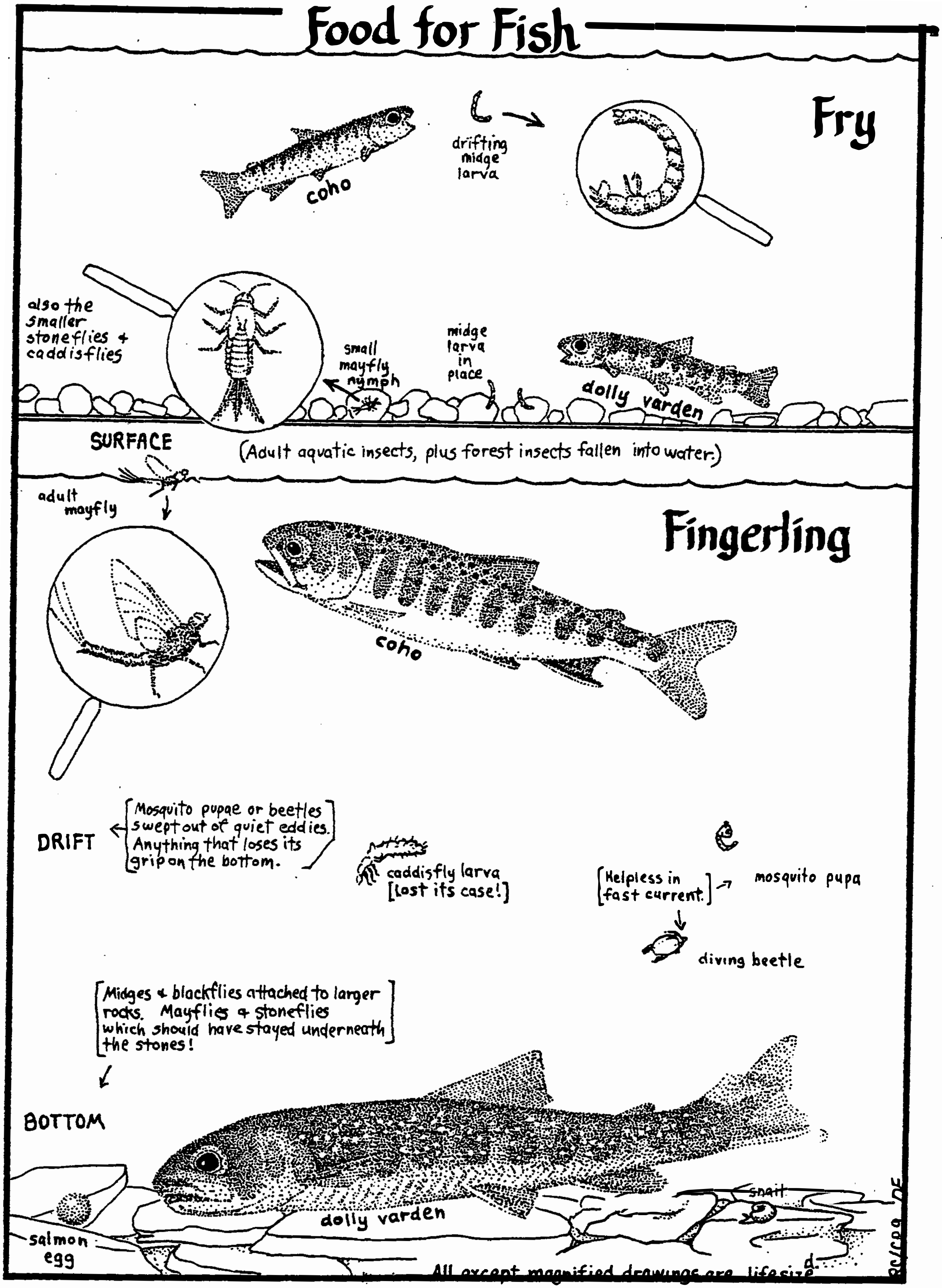
Your students could ask fisheries biologists about the possibility of trapping and observing sculpins or sticklebacks in Jordan Creek.

Sources:

Armstrong, Robert, "Southeast Naturalist" column article from the Southeast Log
Morrow, J. E., Freshwater Fishes of Alaska


SMOLT leaves stream for the sea (×1)
FRY first year in the stream (×1)
FINGERLING second + third years in the stream (×1)
COHO SALMON LIFE CYCLE
SPAWNING MALE
(adults 60-90cm)
SPAWNING FEMALE in redd
ALEVIN still in gravel, living off yolk sac (15mm)
EYED EGGS just before hatching (5mm)
RC/CP 91 DF


Small fish of Jordan Creek
Cutthroat Trout
smolts about 7"
fingerling
yellow to red slash in skin fold
spots almost down to belly
Dolly Varden Char
Smolts about 5"
fingerling
fry
- slightly downturned mouth
- light spots on dark background
Coho Salmon
smolts about 4"
fingerling
- anal fin with long leading edge, white-tipped
- other fins often orangish
Pink Salmon
fry about 1½", outmigrate immediately after emerging
fry
- no parr marks
Threespine Stickleback
adults 2 to 4"
- spines on back and sides can lock erect
Coastrange Sculpin
adults 2 to 4"
- other local sculpins are marine
RC/CP 91 DF


Food for Fish
Fry
coho
drifting midge larva
also the smaller stoneflies + caddisflies
small mayfly nymph
midge larva in place
dolly varden
SURFACE
(Adult aquatic insects, plus forest insects fallen into water.)
adult mayfly
Fingerling
coho
DRIFT
[Mosquito pupae or beetles swept out of quiet eddies. Anything that loses its grip on the bottom.]
caddisfly larva [Lost its case!]
[Helpless in fast current.]
mosquito pupa
diving beetle
[Midges + blackflies attached to larger rocks. Mayflies + stoneflies which should have stayed underneath the stones!]
BOTTOM
dolly varden
snail
salmon egg
All except magnified drawings are lifesize.

FOOD FOR FISH

Study the "Food for Fish" handout that goes along with this worksheet.
In the top part, it shows very small fry fish feeding in Jordan Creek.

If the small Dolly Varden feeds on the bottom, name one kind of food it is likely to find:_____________

How about the young coho? Where does it feed?_____________ What is it likely to eat?_____________

Now look at the lower part of your handout, showing the somewhat larger ***fingerlings.***

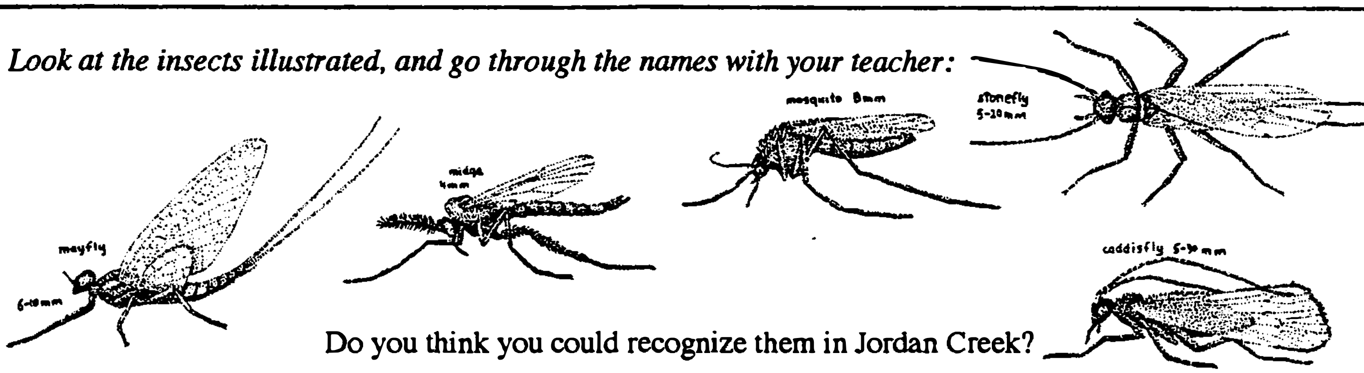
Which species feeds on the bottom?_________________
Notice that the Dolly has a downward-slanted mouth.
Do you think that would help it to feed near the bottom?_____________

Why?____

If you were to drop a bug on the surface of Jordan Creek, which species is most likely to get it?_________

Why?____

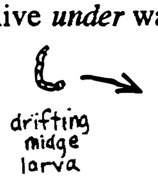
Look at the insects illustrated, and go through the names with your teacher:



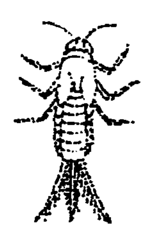
Do you think you could recognize them in Jordan Creek? ______

These are all adults, which means they can reproduce. Most adult insects live out of the water.

Many young insects live *under* water! They are given various names:



A ***larva*** is a young insect that is wormlike



A ***nymph*** is a young insect that looks like an adult, but without wings

FOOD FOR FISH

KEY

Study the "Food for Fish" handout that goes along with this worksheet.
In the top part, it shows very small fry fish feeding in Jordan Creek.

If the small Dolly Varden feeds on the bottom, name one kind of food it is likely to find: LARVA OR NYMPH

How about the young coho? Where does it feed? NEAR THE SURFACE What is it likely to eat? DRIFTING LARVA

Now look at the lower part of your handout, showing the somewhat larger fingerlings.

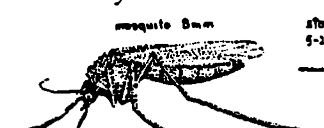
Which species feeds on the bottom? DOLLY VARDEN
Notice that the Dolly has a downward-slanted mouth.
Do you think that would help it to feed near the bottom? YES

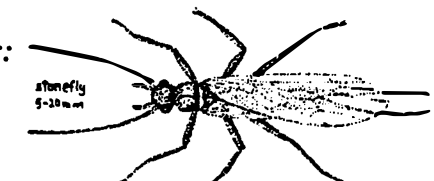
Why? EASIER TO PICK UP FOOD OFF BOTTOM

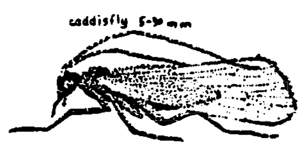
If you were to drop a bug on the surface of Jordan Creek, which species is most likely to get it? COHO

Why? THEY FEED NEAR THE SURFACE

Look at the insects illustrated, and go through the names with your teacher:







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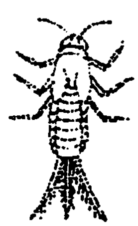
Many young insects live *under* water! They are given various names:

A ***larva*** is a young insect that is wormlike

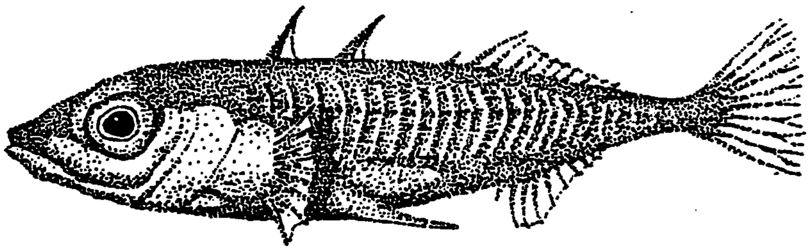


A ***nymph*** is a young insect that looks like an adult, but without wings

Sculpins & Sticklebacks

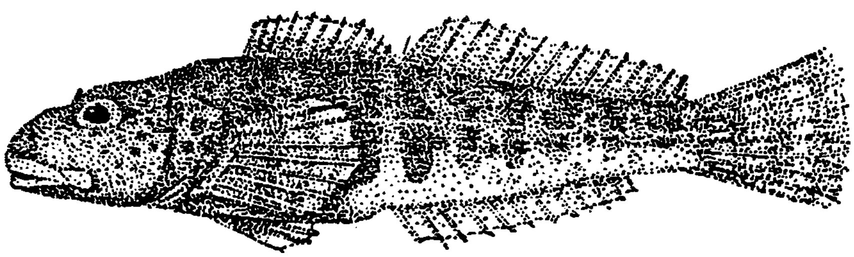
These two fish live in Jordan Creek for their entire lives -- they are "resident" there.

Threespine Stickleback
adults 2 to 4"
- spines on back and sides can lock erect



Which of these fish would be the hardest for another animal to eat?________________

Why?____



Coastrange Sculpin
adults 2 to 4"
-other local sculpins are marine

The other one is too delicious and hides under rocks during the day to avoid being eaten!

Which one has a mouth designed for feeding on the bottom?________________

What makes you think so?________________________________

Both these kinds of fish lay eggs in Jordan Creek. Then the male guards the eggs until the young hatch, whilethe female leaves. It is not usual for the male animals to raise the young!

Sticklebacks and sculpins eat insects and other tiny stream animals.
Do you know the names of any insects that live in Jordan Creek?________________________

Draw them here:

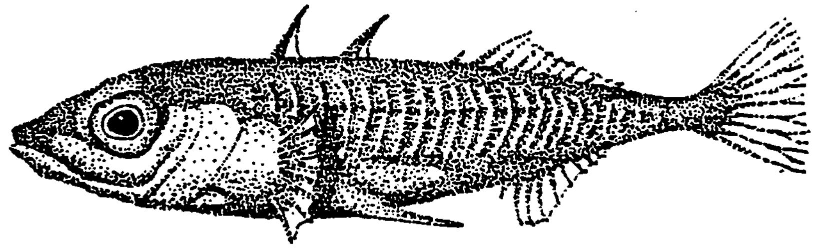
What animals do you think might eat sculpins and sticklebacks?________________________
(Remember, they are only 2 - 4 inches long!)

Sculpins & Sticklebacks

KEY

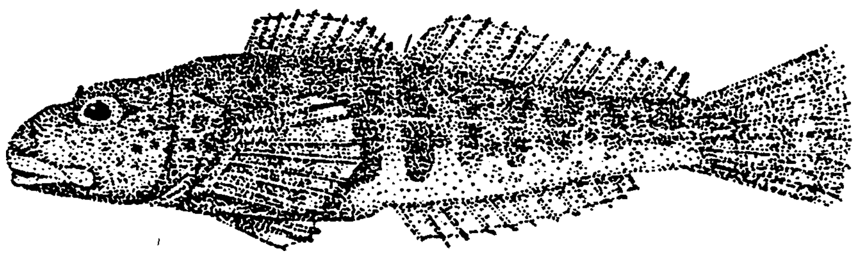
These two fish live in Jordan Creek for their entire lives -- they are "resident" there.

Threespine Stickleback
adults 2 to 4"
- spines on back and sides can lock erect



Which of these fish would be the hardest for another animal to eat? STICKLEBACK

Why? IT HAS SPINES ON ITS BACK AND SIDES



Coastrange Sculpin
adults 2 to 4"
- other local sculpins are marine

The other one is too delicious and hides under rocks during the day to avoid being eaten!

Which one has a mouth designed for feeding on the bottom? SCULPIN

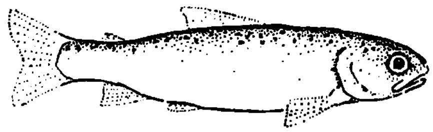
What makes you think so? IT IS TURNED DOWNWARD

Both these kinds of fish lay eggs in Jordan Creek. Then the male guards the eggs until the young hatch, whilethe female leaves. It is not usual for the male animals to raise the young!

Sticklebacks and sculpins eat insects and other tiny stream animals.
Do you know the names of any insects that live in Jordan Creek? MAYFLY, MOSQUITO, CADDISFLY, STONEFLY, MIDGE

Draw them here:

What animals do you think might eat sculpins and sticklebacks? MINK, HERONS, KINGFISHER
(Remember, they are only 2 - 4 inches long!)

SILVERY  SMOLTS

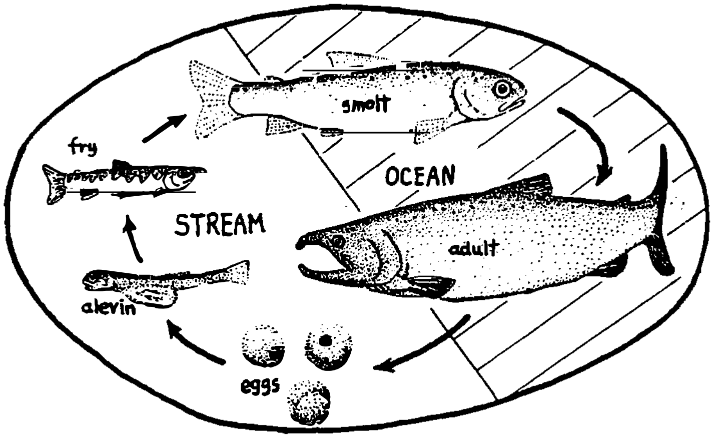
Dolly Vardens, cohos and pink salmon live part of their lives in Jordan Creek and part in the sea. For fish born in fresh water, it is very hard to live in the sea. So their bodies must make many changes as they prepare to leave Jordan Creek. This period of change is called the ***smolt*** stage.

1. Which 3 stages of a coho's life are spent in a stream?

____

____

____



2. When a fish smolts, it gradually loses its "baby stripes" and becomes a small, silvery copy of its parents. Based on what you have learnred studying fish models in Jordan Creek, do you think it would be better for a small fish growing up in Jordan Creek to be silvery or dark?

____

Why? ________________

3. Why do you think it's hard to switch from fresh to salt water? ________________
(Hint: What would happen to you if you drank a glassful of salt water?)

4. When a smolt goes out to sea, would its silvery color help to hide it there? ________________

	YEAR 1	YEAR 2	YEAR	YEAR 4
PINK	egg → fingerling smolt	→ adult		
COHO	egg → fingerling →	smolt	→	adult
DOLLY	egg → fingerling	→	→	smolt → adult

Each species lives for different lengths of time in Jordan Creek before it smolts.

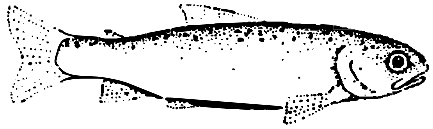
Can you tell which species spends the shortest time there? ________________

Which one stays the longest? ________________

What is a fish called just before it smolts? ________________ After smolting? ________________

A BRAIN TEASER: If it is so hard to be born in fresh water and then go to the sea, why don't fish just stay in Jordan Creek all their lives? (Think about which place has more things to eat...)

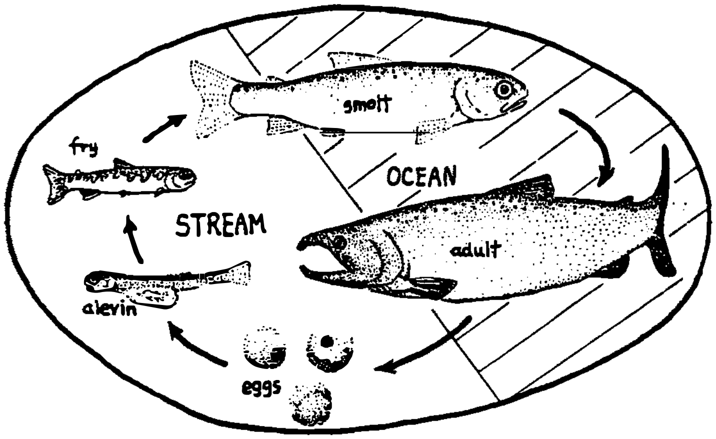
____

SILVERY  SMOLTS

KEY

Dolly Vardens, cohos and pink salmon live part of their lives in Jordan Creek and part in the s... ...sh born in fresh water, it is very hard to live in the sea. So their bodies must make many changes as ... prepare to leave Jordan Creek. This period of change is called the ***smolt*** stage.

1. Which 3 stages of a coho's life are spent in a stream?
   EGG
   ALEVIN
   FRY

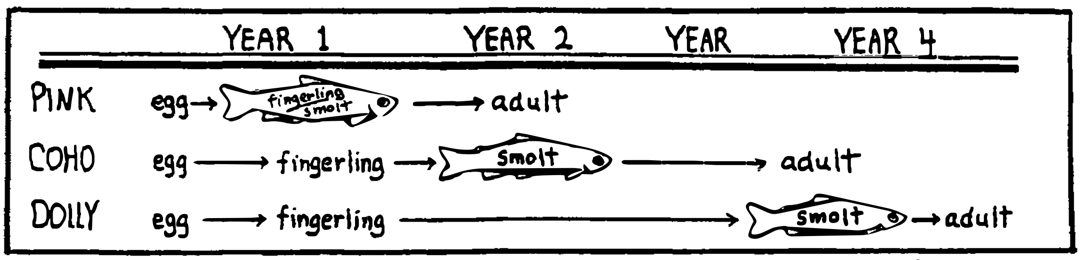


2. When a fish smolts, it gradually loses its "baby stripes" and becomes a small, silvery copy of its parents. Based on what you have learnred studying fish models in Jordan Creek, do you think it would be better for a small fish growing up in Jordan Creek to be silvery or dark?
   DARK

   Why? THEY BLEND INTO THE CREEK-BOTTOM

3. Why do you think it's hard to switch from fresh to salt water? THEIR BODIES HAVE TO ADJUST TO ALL THE SALT
(Hint: What would happen to you if you drank a glassful of salt water?)

4. When a smolt goes out to sea, would its silvery color help to hide it there? YES



Each species lives for different lengths of time in Jordan Creek before it smolts.

Can you tell which species spends the shortest time there? PINK

Which one stays the longest? DOLLY

What is a fish called just before it smolts? FINGERLING After smolting? ADULT

A BRAIN TEASER: If it is so hard to be born in fresh water and then go to the sea, why don't fish just stay in Jordan Creek all their lives? (Think about which place has more things to eat...)

THERE IS A GREATER VARIETY AND AMOUNT OF FOOD IN THE SEA.

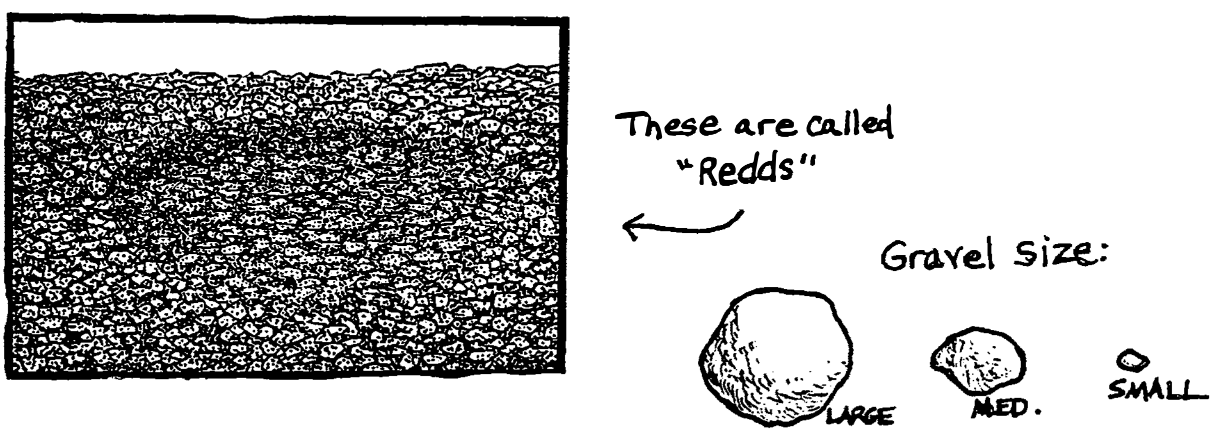
Spawning Observations
DATA SHEET

You will be visiting Jordan Creek to observe salmon laying eggs ***(spawning)***, but the first thing to do is record facts about where they spawn.

First, let's look at the water itself. How cold is it? How high is the water level? Record these things each time you visit Jordan Creek:

DATE					
STREAM TEMPERATURE					
WATER LEVEL					

Now, look for a dip in the stream bed that fish have hollowed out in which to spawn:



If you find one, record the water depth in the middle of it, whether there are undercut banks or logs near it for fish to hide by, and what size the gravel in it is:

	WATER DEPTH	LOGS OR BANKS?	GRAVEL SIZE
REDD #1			
REDD #2			

Just like people, fish are quite particular about where they put their babies. If we know the conditions they need, we can help keep Jordan Creek the kind of place to which they will keep coming back.

Spawning Observations
QUESTIONS

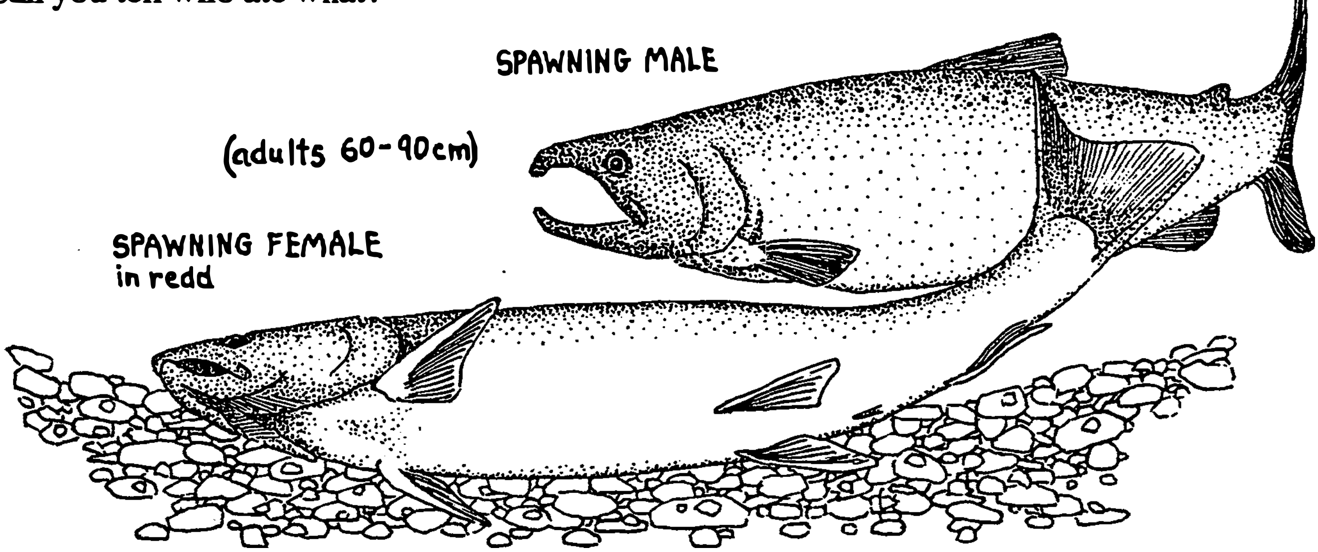
You've looked at fish spawning locations. You may see the fish as well, but they are easily frightened. You will have to sneak up on them patiently to watch them behave naturally.

See what you can tell by how they act and look:

- *If they are bright, quick-moving and in groups*-- they may not have spawned yet.
- *If they are in pairs near dips in the creek bottom*-- they may be spawning.
- *If they are dark red, skinny and weak*-- they may be done spawning.

Keep a record each time you visit the creek. How many fish in each of these three groups do you see each time? When did you see the first salmon? The last one? The time between these two dates is the ***spawning season.***

After the spawning season, they die. Has something eaten on them? Can you tell by tracks or bite marks? Which part(s) has been eaten? Different animals will eat different parts of the fish. Can you tell who ate what?



Rearing Fish Behavior
FIELD SHEET

You will be going to Jordan Creek to watch young fish. These fish are a tasty bite for many fish-eaters like mink, kingfishers and herons, and so they will hide at the first sign of danger. You will have to be very quiet and patient, or the fish will not stay out where you can watch them!

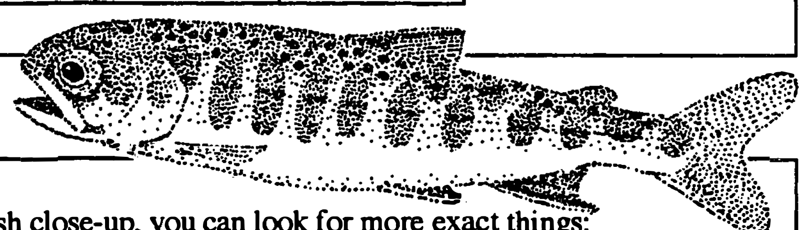
First of all, can you tell what kind they are? If they move in stiff jerks, they are probably sticklebacks. If they bend their whole body when they swim, they are a Dolly Varden or coho. (Dollies and cohos are hard to tell apart, but your teacher will show you pictures that can help.) Write down the kinds of fish you see:

____

Most of the time, small fish are RESTING.
When they do move, it is usually for one of three reasons:
to FEED, to CHASE another fish away, or to RUN AWAY from something.

Each time you see a fish doing one of these things, put a check mark in the correct box:

RESTING	FEEDING	CHASING	RUNNING AWAY

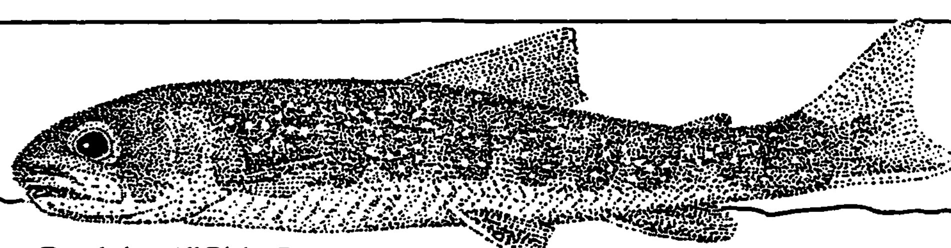


If you are lucky enough to see fish close-up, you can look for more exact things:
(Check the correct box each time you can decide)

Are the fish FEEDING on the **SURFACE** ☐, on the **BOTTOM** ☐ or on food **DRIFTING** ☐ between?

Or, when fish are CHASING, do you see them actually **NIPPING** ☐ each other?

If the fish are RUNNING AWAY, do they **BUNCH** ☐ into a group or **SCATTER** ☐ by themselves?



Unit #3

FISH HABITAT

Unit Introduction:

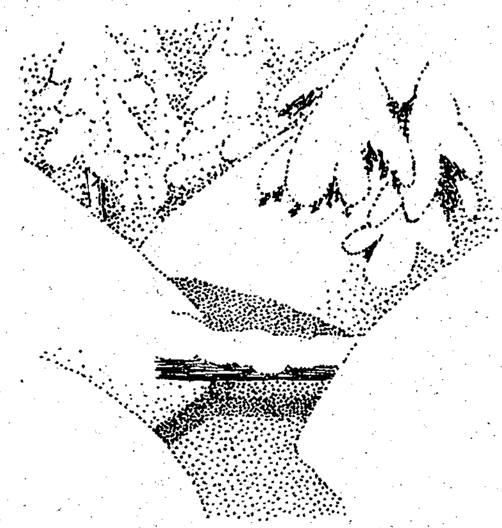
Jordan Creek is a great place for salmon. From 1981 to 1990, an average of 216 adult coho salmon returned each fall to spawn in Jordan Creek. In 1983, the lower reaches of the creek showed the highest numbers of young coho salmon ever noted for a southeast Alaskan stream. But why? Perhaps the answer is to be found in Jordan Creek's spring-fed headwaters or its beaver ponds. Or perhaps in the rich mix of thickets, forest and wetlands lining its banks.

What features are good for fish -- and what harms them? This unit takes a close look at the features that make Jordan Creek a salmon-rich stream, from overhanging vegetation and undercut banks to pools and riffles. As they experiment with siltation and identify key wintering areas, your students will learn to see Jordan Creek from the point of view of a developing fish.

In 10 years, will Jordan Creek still produce fish? Lower Jordan Creek is culverted and channelized, passing through highly developed areas. So far, it has maintained a healthly population of coho salmon, though it is now closed to cutthroat trout fishing. As your students become aware of the major threats to Jordan Creek, they can play a key role in its protection.

Objectives:

Students will:
- observe fish habitat features near the Jordan Creek Trail
- identify key overwintering areas used by Jordan Creek salmonids
- identify threats to Jordan Creek fish habitat
- choose and complete a habitat protection project



Related Curriculum:

Science (observation, SeaWeek)
Social Studies (citizens' rights and responsibilities, maps)
Art (drawing)
Phys. Ed. (hike)
Language Arts (project report)

Lesson Plans Included:

Lesson #1: Stream Features
Lesson #2: Winter Habitat
Lesson #3: Habitat Workshop

Lesson #1
STREAM FEATURES

Season: Fall is best (more vegetation), but spring is OK

Setting: Classroom and trail

Time: 2 hours

Subjects: Science (observation, SeaWeek), Art (drawing)

Materials:
In The Kit
- hip waders
- 4 long-handled aquatic insect nets
- small dip nets
- water buckets
- insect trays
- kick seine
- plants and insects ID laminates
- stop watches
- 2 balls
- 2 measuring tapes
- Jordan Creek wetlands map master
- 'Stream Features' worksheet master
- 'Habitat Survey' Task Cards
- 'Habitat Survey Data Sheet' master

Supplied By Teacher
- 2 rulers

Preparation:
Copy worksheets and maps.

Teacher Background Information:

What are *Stream Features*?
The stream illustration on the 'Stream Features' worksheet highlights important habitat features in the Jordan Creek Trail area. It shows the cover, resting places and food sources that make Jordan Creek a haven for rearing fish. Spawning habitat is touched upon only briefly; siltation will be demonstrated in 'Habitat Workshop'.

What do kind of streambed do fish need for spawning?
Salmon need clean, stable gravel in moving water for spawning, so the eggs are not smothered by silt. Salmon use current to help move and dislodge stones when making a nest. Current must reach the eggs and developing young within the gravel, bathing them in oxygen-rich water and carrying away wastes. The gravel must be 'stable', not frequently shoved around by floods. Cohos, especially, like to have plenty of 'cover' near their spawning areas. They like to hide out under logs and banks!

What makes good 'cover' for rearing fish?
Rearing fish also hide out below logs and 'undercut banks'. An undercut bank is a place where the stream has dug into the bank forming a 'cave' below the surface, protected overhead by roots or turf. Undercut banks are prime Dolly Varden territories, also favored by cohos and cutthroat trout.

Anything that makes it hard for a predator like a heron, kingfisher or mink to find and catch a fish is good 'cover'! Plants within the streambed, growing up out of the water or hanging over the water also help protect young fish from danger.

How do little fish keep from being washed away by the current?
Little fish need resting places within the stream. Slow places like eddies and backwaters near the side of the stream are found behind obstructions and curves. These places are great because they allow the growing fish to be close to the current which brings them food, without being overwhelmed or exhausted by it. The smallest fish use the edges of ponded areas, and find their way into small tributaries and side sloughs.

Where does fish food come from?

Pools and riffles

A combination of pools and riffles (shallow, rippling sections) is great for producing a variety of aquatic insects and making that food available to the young fish. Riffles are good for oxygen-loving insects like stonefly and mayfly nymphs. The currect occassionally dislodges them as they move from their resting to feeding areas, especially in the early morning and late evening. Once drifting, these insects are prime 'feed' for larger fingerlings. That is why a 'despot dolly' will stake out the top of a pool at the end of a riffle.

Water plants

Plants are the basis of the stream food chain. *Emergent plants*, or plants growing up out of the water, like marsh marigold, water sedge and forget-me-not, host whole microcosms on their stems and leaves. Microscopic plants, animals and decomposers form a rich film on emergent plants, attracting insects and fish.

Other plants, such as algae and a special grass (unidentified) grow on the stream bottom, completely covered by water. You will often find a slippery brownish gel on the rocks in Jordan Creek, consisting of freshwater diatoms and the goo within which their little one-celled shells glide around. Diatoms, the 'grass' of the northern seas, also turn light into energy for grazing stream insects like mayflies. Under the microscope, some diatoms look like little kayaks, with decoratively stippled surfaces!

Forest plants

In order to grow, diatoms need light. Patches free of forest canopy allow light to get to the stream. But the forest canopy, itself, is also good for a stream. The forest 'rains' leaves and forest insects into the stream and protects it from extreme weather. Each forest type hosts its own array of insects, so a mixed forest provides a varied diet for Jordan Creek fish.

Leaf litter

Leaf and needle litter is very important to stream food webs in southeast Alaskan. Nutrients are in short supply in our cool rainforest soils. Decomposers, and shredding insects like caddis and cranefly larvae, recycle the nutrients in leaves, passing on the richness of the forest to the fish. Deciduous leaf litter (especially alder, but also willow and cottonwood) is a bonanza for a southeast Alaska stream!

Vocabulary:

backwater - an eddy, or an area of a stream along a bank, side slough or near an obstruction where the water is slow, or even flowing 'upstream'

conifer - a tree that has its seeds in cones, (usually also has needles)

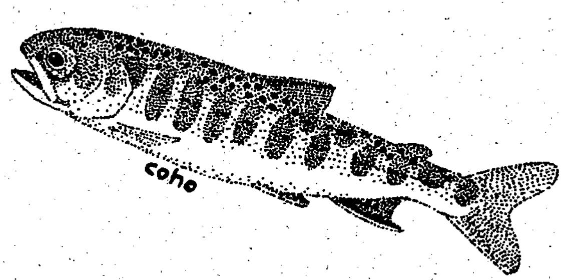
cover - objects that provide places for animals to rest or hide

deciduous tree - a tree, like an alder or cottonwood, that loses its leaves in the fall

diatoms - one-celled plants that live on rocks in streams

eddy - a backwater area

emergent plants - plants growing up out of the water



glide - a fast but smooth section of stream

gravel - a sediment made of pea- to fist-sized particles

overhanging vegetation - shrubs or trees hanging over a stream

pool - a calm, deeper section of a stream

riffle - a fast, wavy, shallow section of a stream

rivulet - a tiny tributary

silt - a sediment made of fine particles too small for you to see individual grains, but too big to roll and shape like clay

tributary - a small stream that joins another stream

undercut bank - a place where a stream has eaten into a bank, making a 'cave-like' area under the water, usually protected overhead by grassy turf or the roots of trees.

Lesson - Stream Features

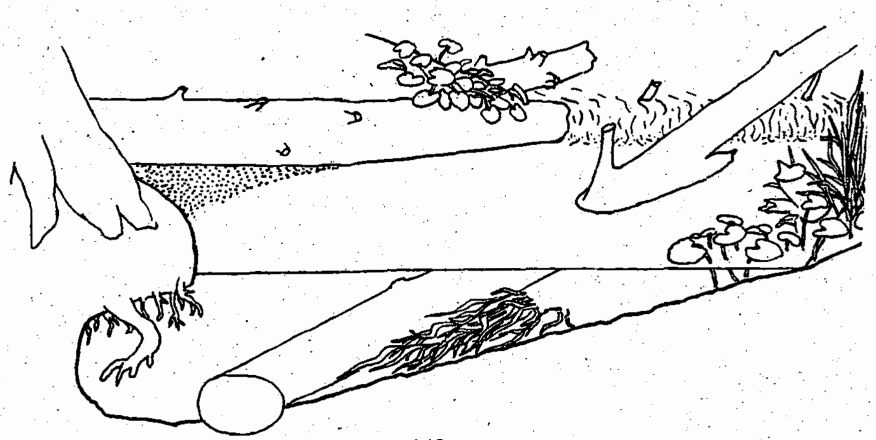
Purpose:
To show how Jordan Creek meets the needs of spawning and rearing fish.

Objectives:
Students will:
- identify and observe physical features important to fish in Jordan Creek
- identify vegetation providing food and cover for Jordan Creek fish
- compare pool and riffle insect populations

Focus:
Ask your students if they have seen fish in Jordan Creek. Ask them where the fish were seen. Was it deep or shallow, under trees or in the open, in fast or slow water?

Diagnose:
Ask your students what young salmon need in order to live. List their answers on the board *(food, oxygen, cover, resting places)*. Ask them where they find these things near the Jordan Creek Trail.

Activity:
Stream Features Worksheet
Pass out the "Stream Features" worksheet, illustrating aspects of the Jordan Creek Trail area which are important to fish. Have your students complete the worksheet together or in small groups.



Lesson #2
WINTER HABITAT

Season:	Winter
Setting:	Classroom and Jordan Creek beaver ponds
Time:	2 hours or more, depending on hike length
Subjects:	Science (observation, weather & climate, SeaWeek) Art (drawing) Physical Education (hike and personal safety)

Materials:
In The Kit
- compasses and thermometers for each group
- "Winter Habitat" handout

Supplied By Teacher
- Jordan Creek wetlands map copies and field notebooks for each group

Preparation:
Copy maps and, ideally, scout the beaver pond area with a friend (find appropriate routes, note ice and snow conditions & hazards), copy "Winter Habitat" handouts.

Teacher Background Information:
What factors limit the populations of Jordan Creek fish?
Winter habitat is probably the limiting factor on Jordan Creek fish populations, particularly in exposed, or heavily iced low-flow conditions. The stream simply holds more fish in the summer than it does in the winter! The stream itself gets smaller when the water is low, as it often is in the winter. Parts of the stream can ice up and food is scarce. This means that fewer have fish space for feeding territories. In fact, territoriality can break down under crowded overwintering conditions.

What do trout, char and young salmon do in the winter?
Salmonids cope with winter by slowing down activities so they need less food, and seeking warmer, ice-free or predator-free areas to spend the winter. Some young fish bury themselves in debris, practically 'hibernating'.

Where do Jordan Creek salmonids spend the winter?
Fish often move to spring-fed headwaters, because the water is warmer there and stays free of ice in cold conditions. Jordan Creek arises from braided springs flowing from the hilly moraine up valley from Floyd Dryden School. It is likely that cohos and dollies move upstream this area in the winter.

The Jordan Creek Trail area is also spring-fed! Water seeps from the big fan-shaped gravel deposit that sticks out into the valley from the side of Thunder Mountain. Ground water comes out of this porous deposit, seeping into the iron-stained (red/brown) tributaries and sloughs you can see from the trail. Young salmonids have been found hunkered down, buried in debris in these little sloughs in late fall; they may also spend the winter there. Perhaps the most important overwintering area is the system of beaver ponds in various stages of disrepair just below the Jordan Creek Trail. Sea-run cutthroat trout were known to winter in some of the beaver ponds. It is possible that sea-run Dolly Varden have used them. Rearing cohos and dollies may stay in some of the deeper areas of Jordan Creek for the winter, such as those created by the beaver.

The situation is more complicated for some Dolly Varden. In the late fall, sea-run dollies migrate from their home (spawning) stream, back out to sea and along the coast, then up another stream to a lake where they can spend the winter. Most Jordan Creek sea-run Dolly Varden probably spend the winter hunkered down in ice and predator-free places such as Mendenhall Lake.

Vocabulary:
(see previous lesson for fish species names)

groundwater - water flowing slowly through the spaces between pieces of underground soil and rock

limiting factor - something that limits the growth of a population

headwaters - where a stream begins

juvenile cohos - young coho salmon

population - all the individuals of one kind of animal (or plant) living in an area

spring-fed stream - a stream whose water comes from under the ground

wintering area - a place where fish or wildlife find refuge in the winter

Lesson - Winter Habitat

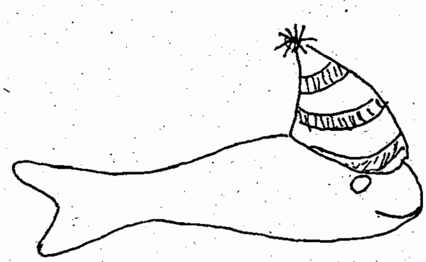
Purpose:
To find out where Jordan Creek fish spend the winter

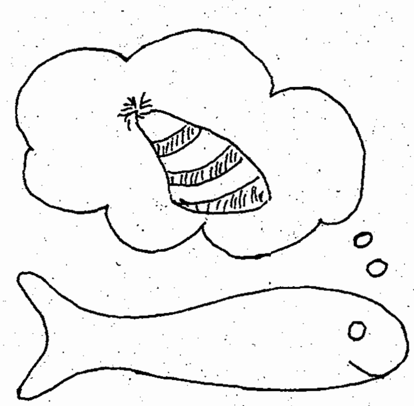
Objectives:
Students will:
- identify winter habitat needs of Jordan Creek fish
- identify features and locations of key wintering areas for Jordan Creek salmonids
- trace migrations of cohos, Dolly Varden and cutthroat trout to their wintering areas

Focus:
Ask your students if they have seen young fish near the Jordan Creek Trail in the winter and if they noticed what the fish were doing. Ask your students: "Where do the fish in Jordan Creek go in the winter?... What do they do?"

Preparatory Activity:
"Winter Habitat" handout

Pass out the "Winter Habitat" handout and discuss it with your students. Complete the section, "Cold Fish", which traces the migrations of overwintering fish on a simplified Jordan Creek/Mendenhall Valley map. The fish with knit caps are 'overwintering' fish, while the migrating fish have winter 'on their minds'.





Activity:

Winter Habitat Field Trip

Take your students on a hike to the Jordan Creek beaver ponds. You should have additional adults with you and should scout the area in advance. Winter is an excellent time for exploring this fascinating area. The sensitive wetlands are frozen over and protected from erosion. However, ice may be thin in places and the ponded stream is up to eight feet deep! Beavers like to keep breathing holes open, so you would be wise to stay off the beaver pond ice.

Divide into groups, assigning an adult to each group. Give each group a map, a compass, a thermometer and a field notebook.

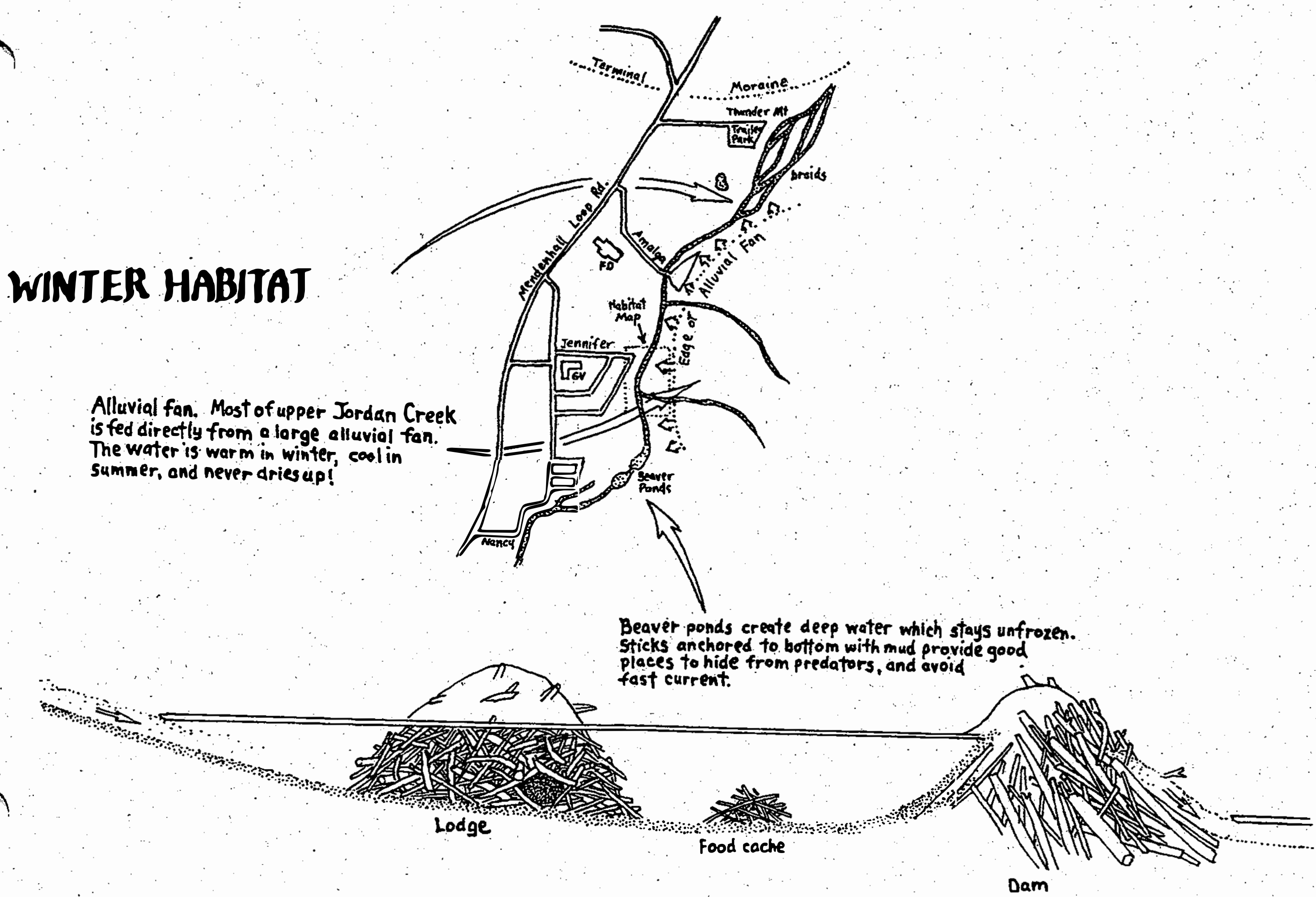
Look for beaver chewings, food caches and tracks, while you look for open places where you might find fish. The fish, however, are likely to be hunkered down. They are not very active in the winter.

Summary:

Summarize each group's temperature reading on a chart. Share and discuss observations on fish, beaver sign and other animal activity by the stream.

Additional Activities:

- Plan a field trip to the headwaters of Jordan Creek to look for rearing fish and evidence of springs (bring a thermometer).
- Research the beaver activity. Ask residents and biologists about the dams and about trapping. Discuss pros and cons of beaver dams for fish.



Lesson #3
HABITAT WORKSHOP

Season:	Any
Setting:	Classroom (project may involve field trip)
Time:	Flexible, depends on projet
Subjects:	Science (SeaWeek) Social Studies (citizens' rights and responsibilities, maps) Language Arts (project report)

Materials:

In The Kit
'Habitat Damage' hand-out

Enlarged aerial photograph of Jordan Creek

Teacher Background Information:

Your background for this unit will depend on which class project you choose. You may wish to supplement the information available in this unit with Fish and Game reports on Jordan Creek.

Toxics
A gravel pit near Thunder Mountain Trailer Park has been used for dumping. Most likely its contents are toxic. Although attempts at re-routing drainage and filling have been made, it is not clear if toxics are still leeching into Jordan Creek. The dump may need an artificial or natural filtering barrier.

Creosote
Creosote dripping and leeching off the Coho Park bridge has concerned some residents, who feel that it has caused die-off of stream plants. Creosote is a highly toxic substance and may be affecting Jordan Creek fish.

Cutthroats
Although the salmon population appears strong, Jordan Creek is now closed to cutthroat trout fishing. The relatively specific habitat requirements of cutthroat trout, and the extended amount of time they spend in fresh water both as juveniles and adults, makes cutthroat trout particularly vulnerable to habitat degradation and over-fishing. The recent destruction of beaver dams which provided cutthroat wintering areas may be affecting Jordan Creek cuttroats.

Stream Mouth
A great deal of superlative coho rearing habitat has been lost along lower Jordan Creek. There is a need to monitor additional development plans with an eye for alternative sites. Fish and Game biologists have recommended that a 'greenbelt', or natural area bordering the stream, be established.

Logging
Various parts of the drainage have been logged from the 40's to the 60's or 70's. Debris can still be seen clogging some parts of the creek, though it seems to have recovered from some of the siltation.

Roads and Bridges
There are occassionally plans for roads on the far side of Jordan Creek to relieve Mendenhall Valley congestion. Consideration of one of these plans would make a good social studies 'PMA' analysis.

Low Flow Conditions
Winter and summer low flow conditions are very stressful for young fish. Diversion of the upper drainage (to prevent contamination) and the use of groundwater by nearby homes may be making the low flow situation worse, limiting fish populations.

Vocabulary:

channelize - to force a stream to follow an artificial course

clearcut - a place where all (or most) of the trees have been cut down

creosote - a tarry wood preservative, with toxic effects

culvert - a large metal pipe allowing a stream to flow under a road

debris - 'junk', discarded material (can be natural, too, like leaves and logs!)

erosion - wearing away of earth caused by moving water (or wind)

perched culvert - a culvert that was built too high, creating a falls

siltation - filling in of a stream bed with silt (fine particles of sediment)

toxic dump - a place where harmful chemicals such as solvents (paint thinner) or used engine oil have been carelessly discarded

wintering area - a place where fish or wildlife find refuge in the winter

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Lesson - Habitat Workshop

Purpose:
To understand, assess, predict and prevent damage to Jordan Creek fish habitat.

Objectives:
Students will:
- discuss effects of erosion, siltation and logging on stream habitat
- identify threats to Jordan Creek fish habitat
- choose and complete a habitat protection project

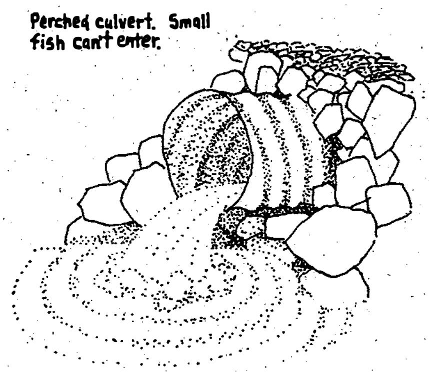
Focus:
Ask your students if they think there will still be lots of fish in Jordan Creek in ten years. Ask them why, listing the things they think might happen in the next ten years to harm the fish.

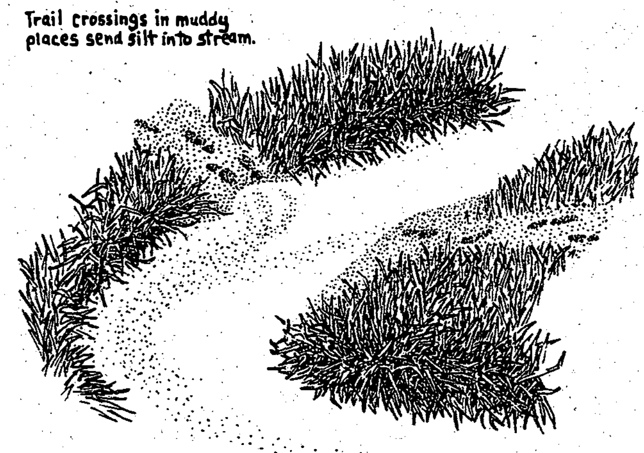
Diagnose:
Review with your students the habitat features needed by spawning, rearing and wintering fish. Make three columns on the board, listing the needs of spawning, rearing and wintering fish.

Discuss the impact on fish habitat made by trail construction and students using the Jordan Creek Trail. Ask them how they could tell if they are harming fish habitat.

Activity:
"Habitat Damage" worksheet

Pass out the "Habitat Damage" handout and discuss it with your students. Post the large aerial photograph and map of Jordan Creek and have students find places where there might be culverts, channelized sections, erosion





Habitat Protection Project
This is an open-ended project, which can be scaled to your class needs and time limits. *It is an excellent focus for an integrated curriculum or cooperative learning program.*

Have your class, or groups within it, decide on a habitat protection project. Projects could range from stream clean-up, to public information campaigns about erosion and groundwater withdrawl from wells near the stream. Possible research subjects are: greenbelts, logging and development near the stream, creosote and toxics that may be leeching into the stream near Coho park. A Fish and Game report on Jordan Creek is included for you and your class to use as a reference.

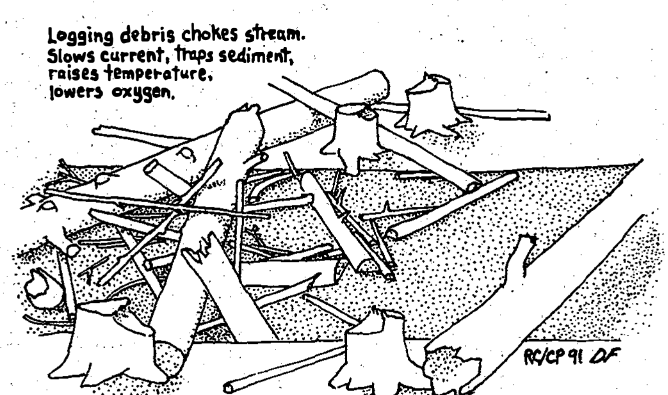
A field trip to a highly impacted section of the stream, such as the Coho Park area or the channelized mouth near the airport, to conduct a habitat survey similar to that of Lesson #2 would be a valuable project for your students. You could add minnow trapping to the project, with advice and permission of Alaska Fish and Game biologists.

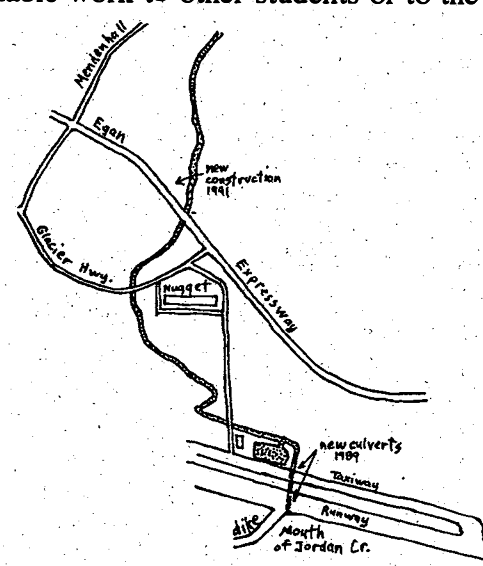
Your class could set up or be involved in a monitoring project, such as taking documentary photographs from permanent photo stations along the Jordan Creek Trail to assess the effect of student sampling activities on the banks of the stream.

Another good project would be to simply inform other students, or the public about the richness of Jordan Creek fish habitat and the Jordan Creek Trail itself, through displays and media contacts. Your students could prepare to give guided tours to younger students or to the public. You may want to invite a biologist to such an event, to help with a minnow trapping demonstration.

Summary:

Your summary, of course, will depend on the project you choose, but should include time to share results. It should incorporate visual displays or writing to communicate your valuable work to other students or to the public.

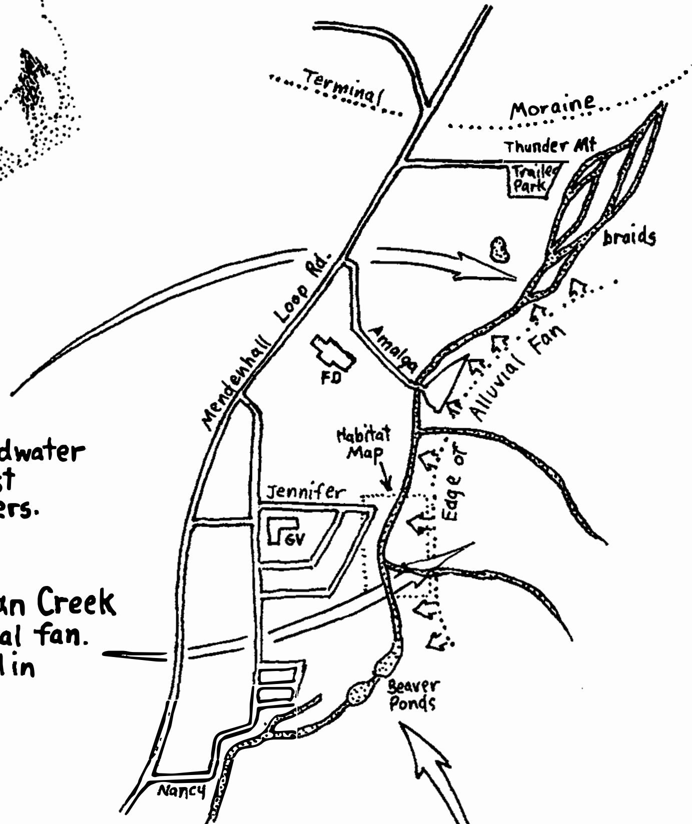


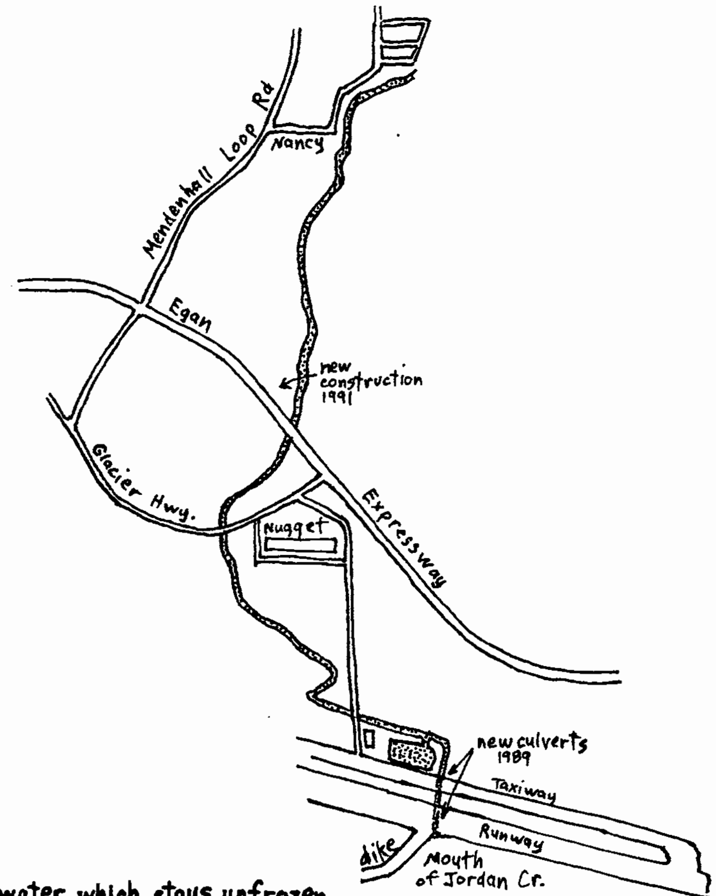


WINTER HABITAT

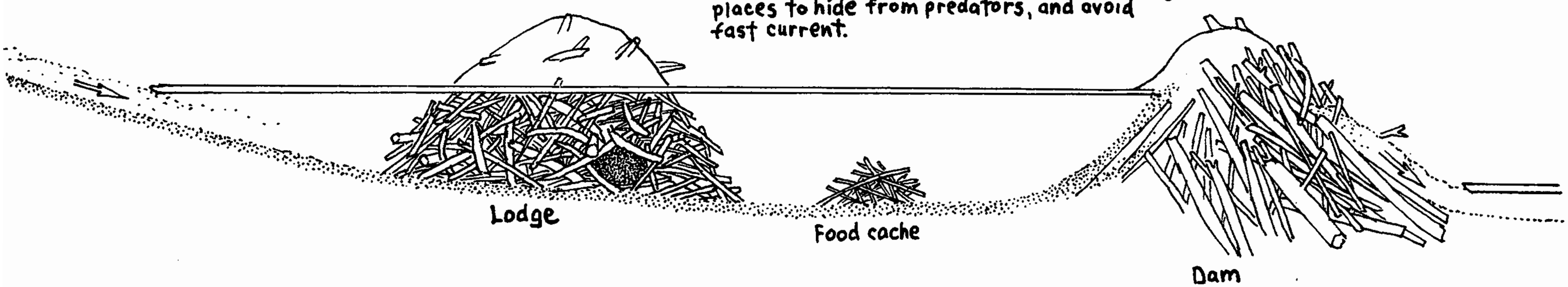
Spring-fed tributary. Warm groundwater stays unfrozen even during coldest weather. Fish move up to headwaters.

Alluvial fan. Most of upper Jordan Creek is fed directly from a large alluvial fan. The water is warm in winter, cool in summer, and never dries up!



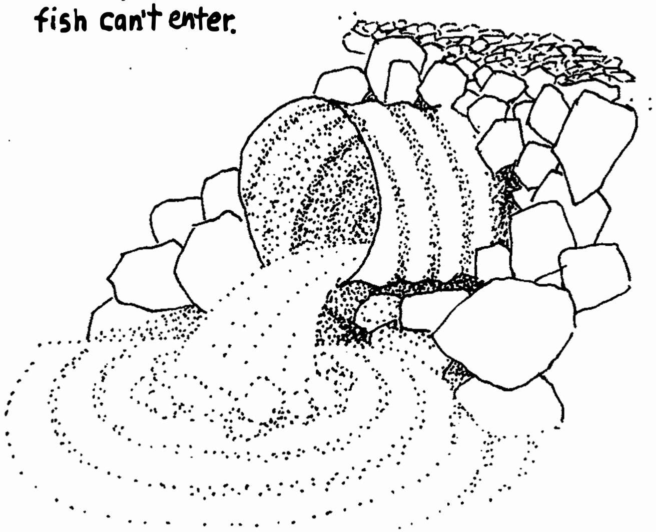


Beaver ponds create deep water which stays unfrozen. Sticks anchored to bottom with mud provide good places to hide from predators, and avoid fast current.

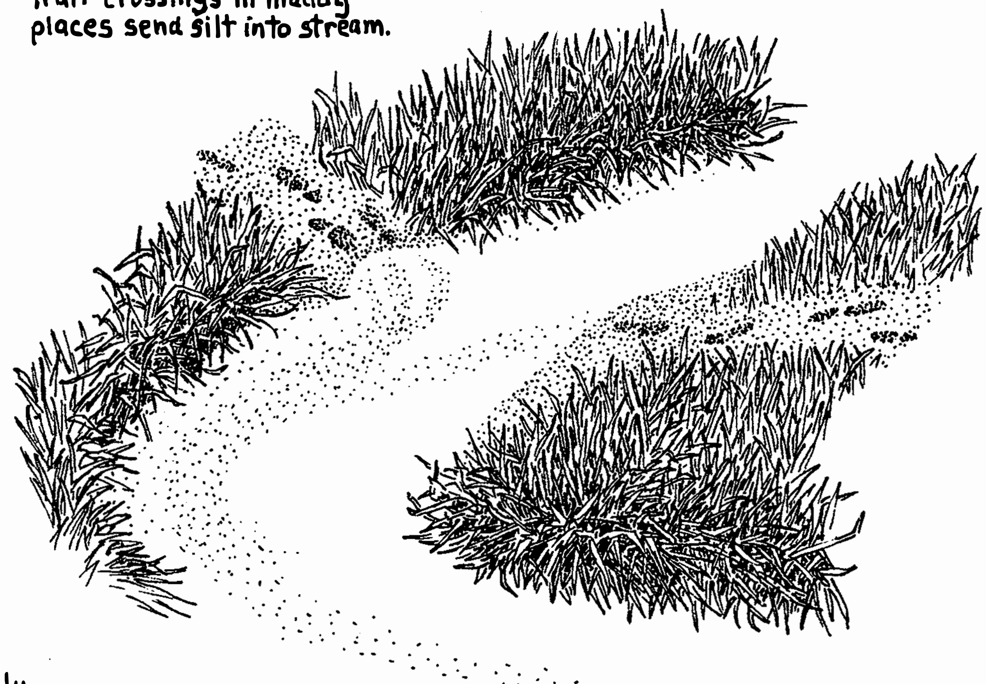


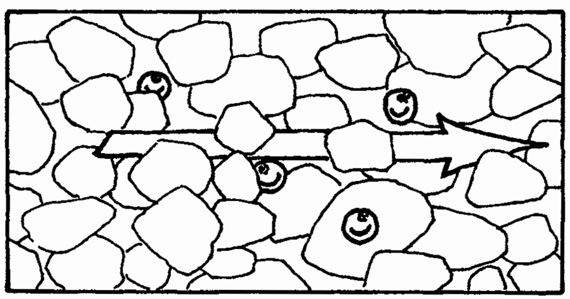
HABITAT DAMAGE

Perched culvert. Small fish can't enter.

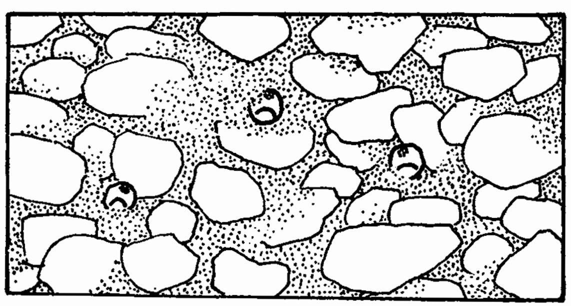


Trail crossings in muddy places send silt into stream.



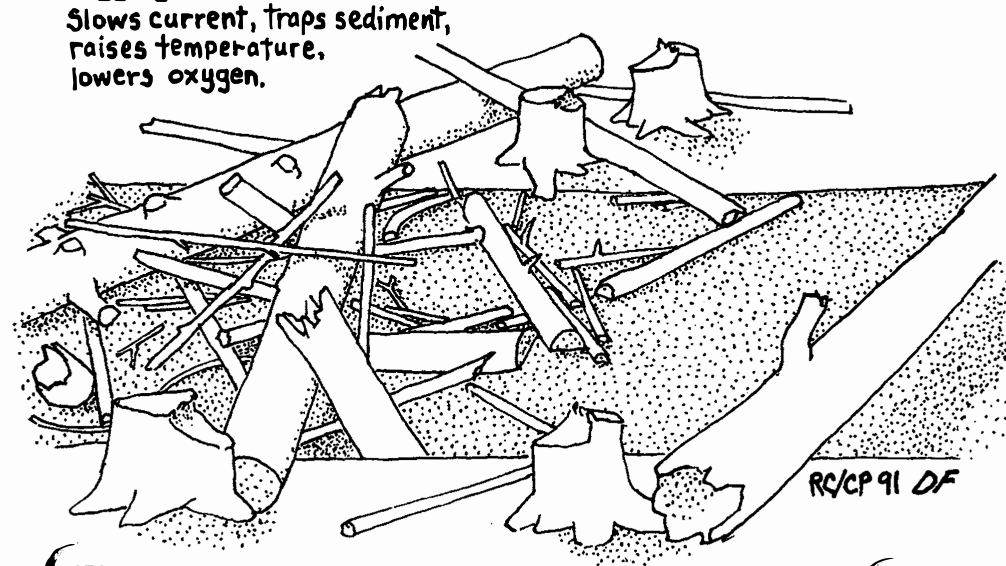


Water flows easily through clean gravels.

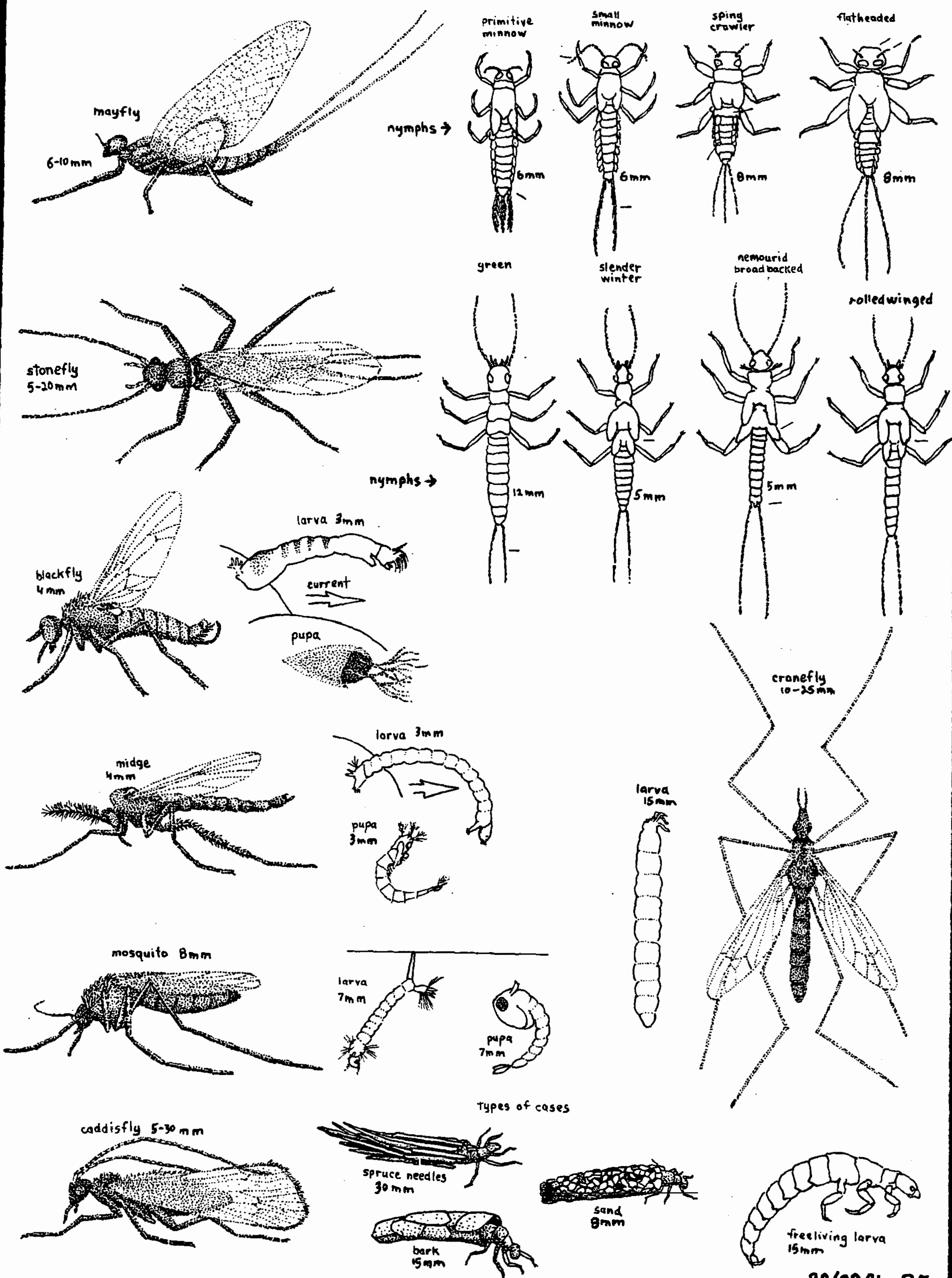


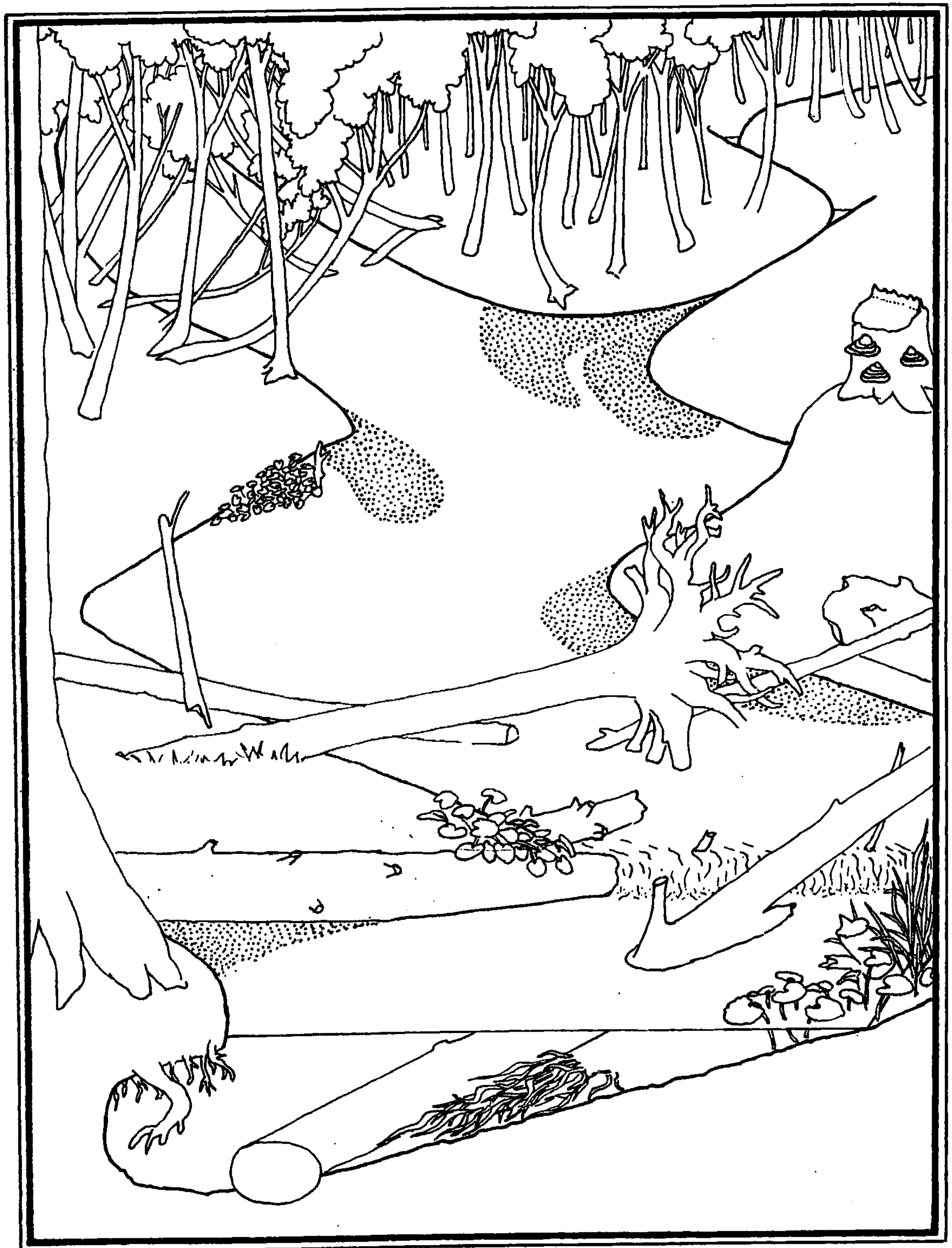
Eroded banks may send fine sediments into stream. This plugs the spawning gravels with silt.

Logging debris chokes stream. Slows current, traps sediment, raises temperature, lowers oxygen.



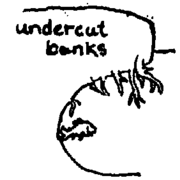
Aquatic insects of Jordan Creek



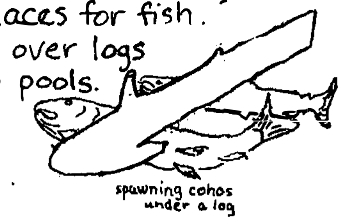


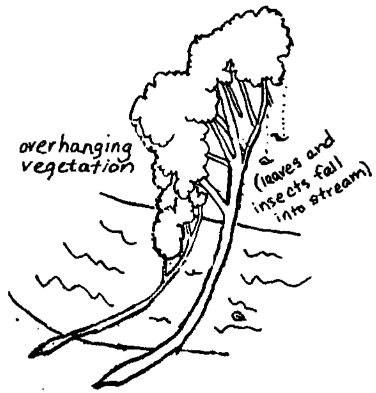
Stream Features

What makes Jordan Creek a special place for fish to live? **Find** and **color** the stream features that create a good home for fish. **Draw** tiny fish (🐟) in parts of the stream that fish would like best!

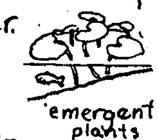


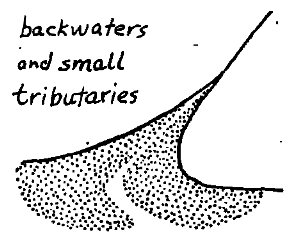
Fish like to hide and rest under banks and logs. Plant roots keep stream banks firm. Old trees fall into the stream, making safe hiding places for fish. Water flowing over logs digs nice deep pools.



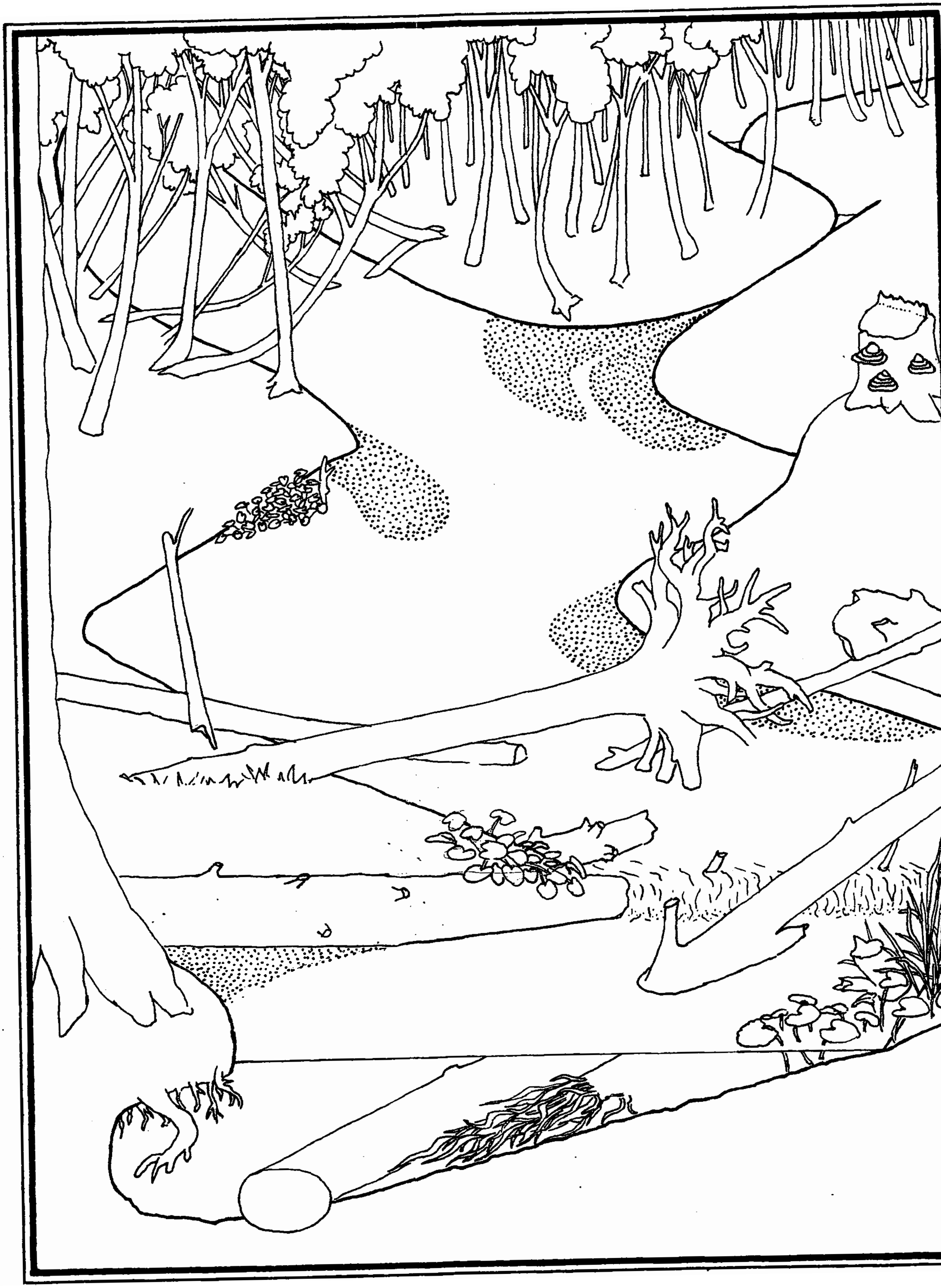


Plants that hang over or grow in the stream help small fish hide and find food. Insects live in these plants— food for fish! 'Emergent' plants like marsh marigold come up out of the water.

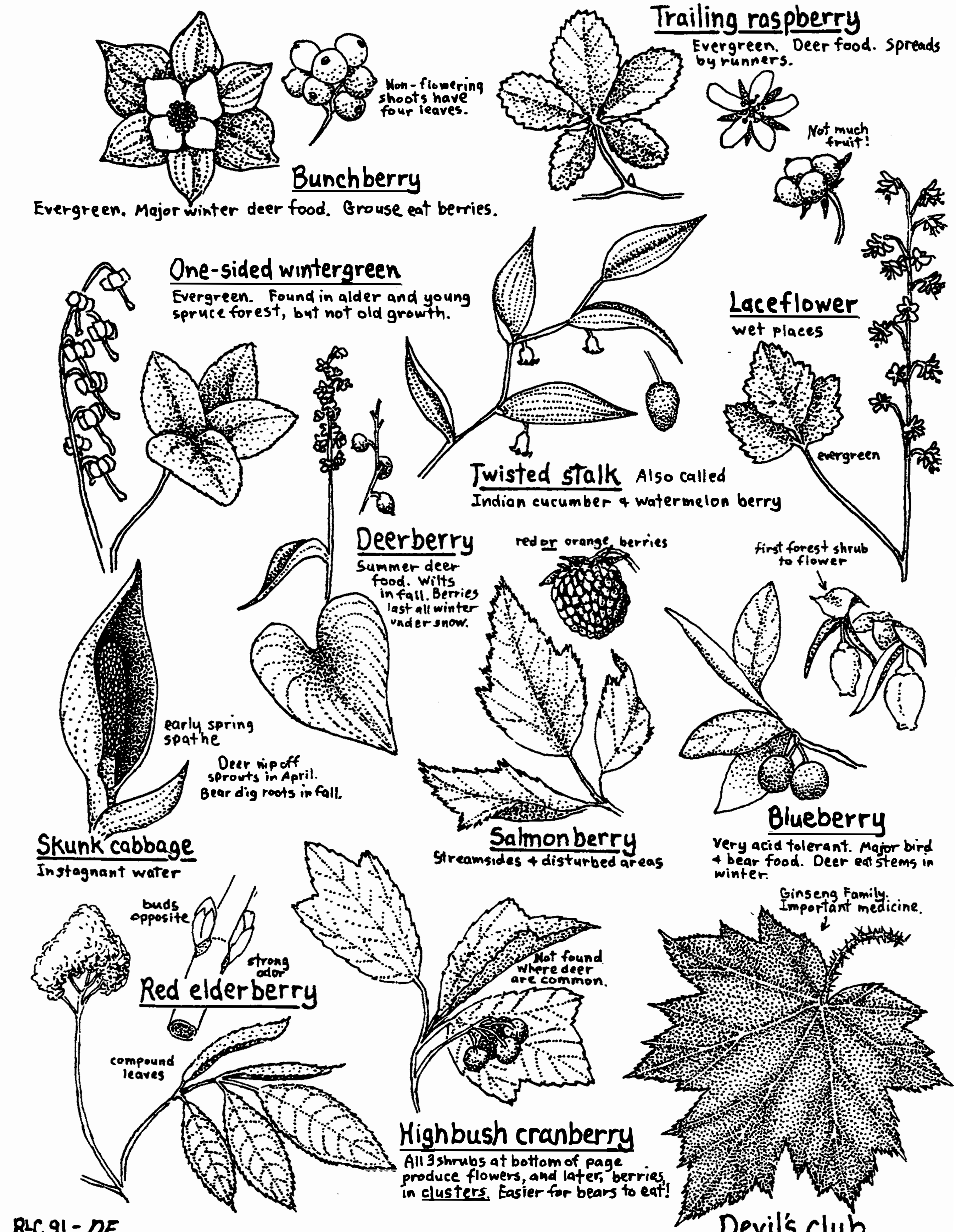




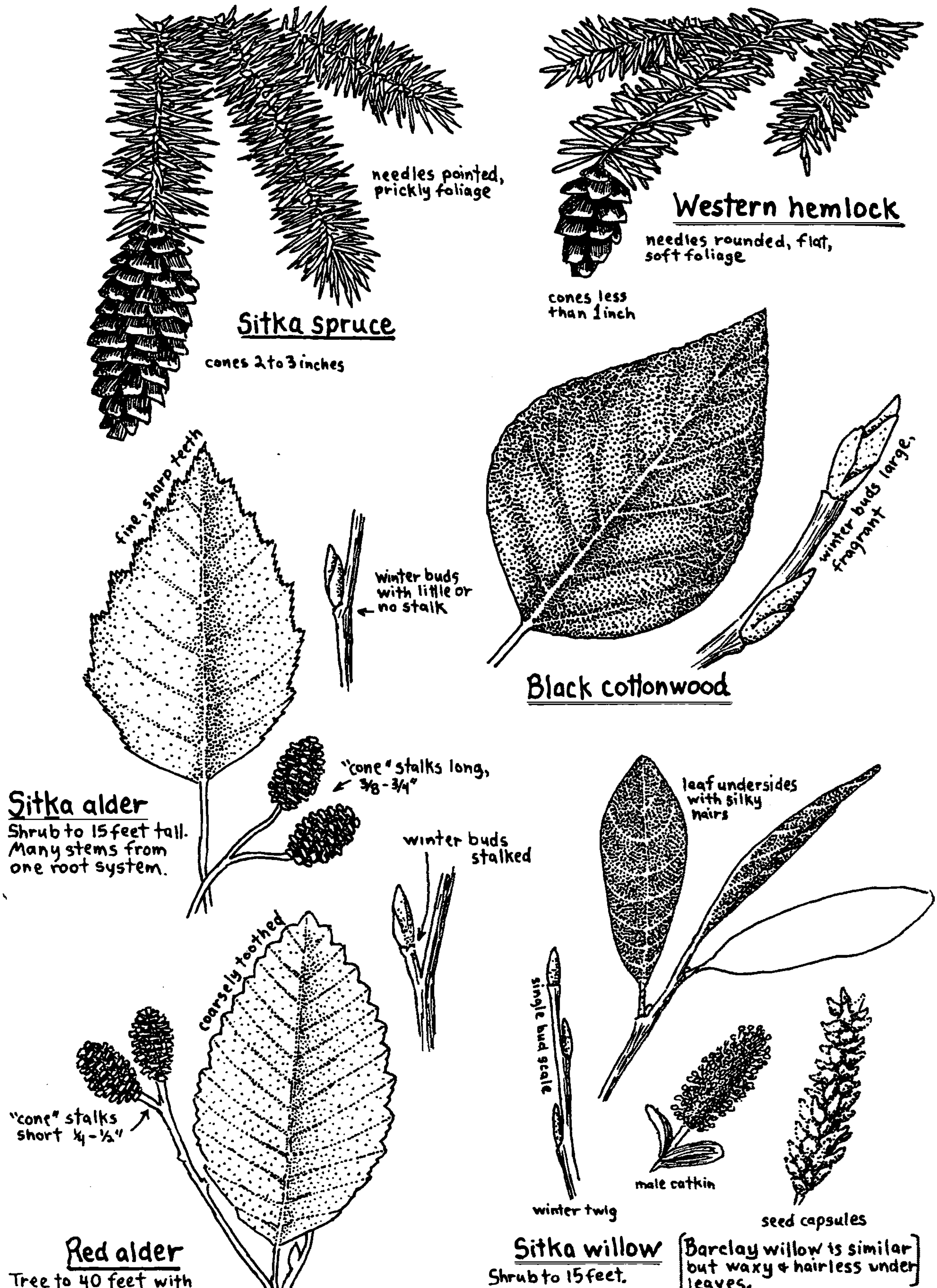
Some small fish use tiny streams that join the main stream. They also rest and feed in slow water on the outside of curves and behind objects.



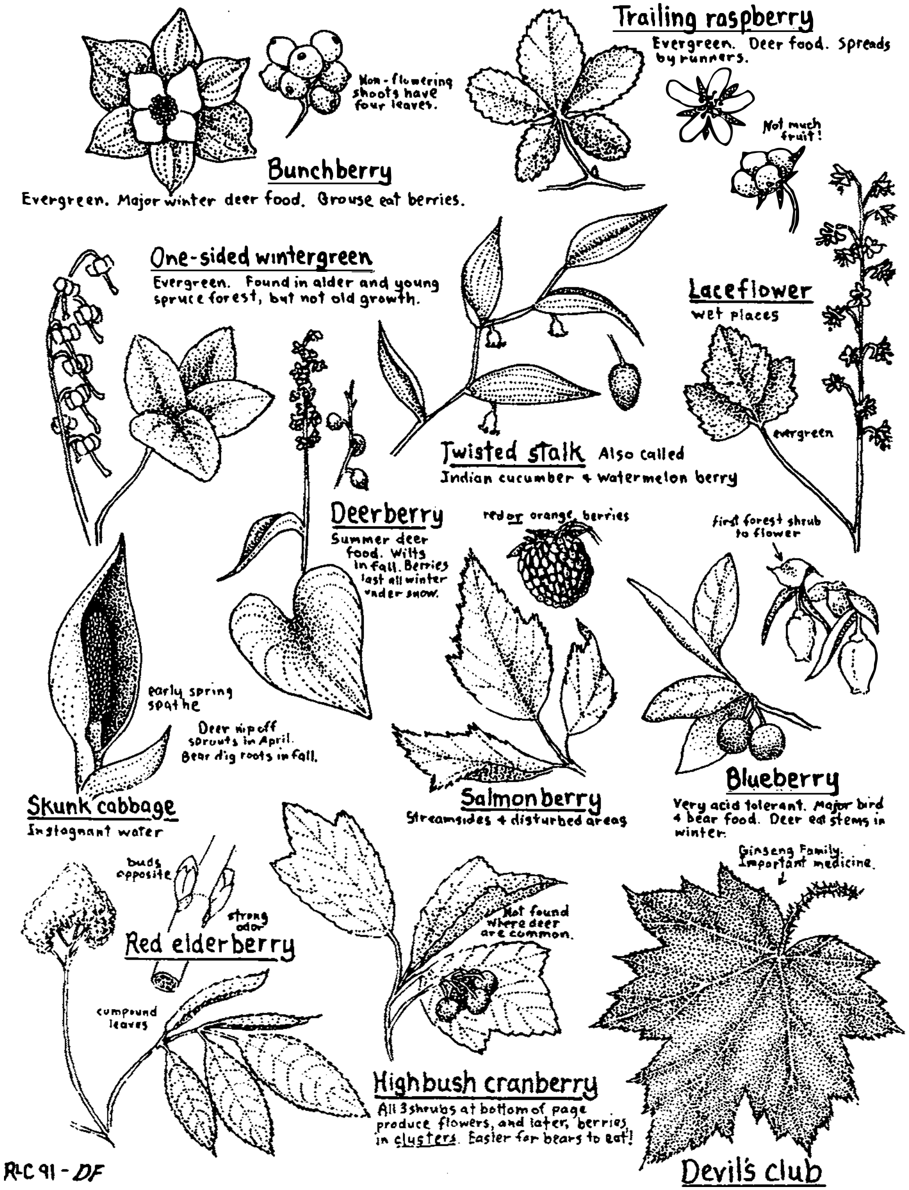
FOREST HERBS & SHRUBS



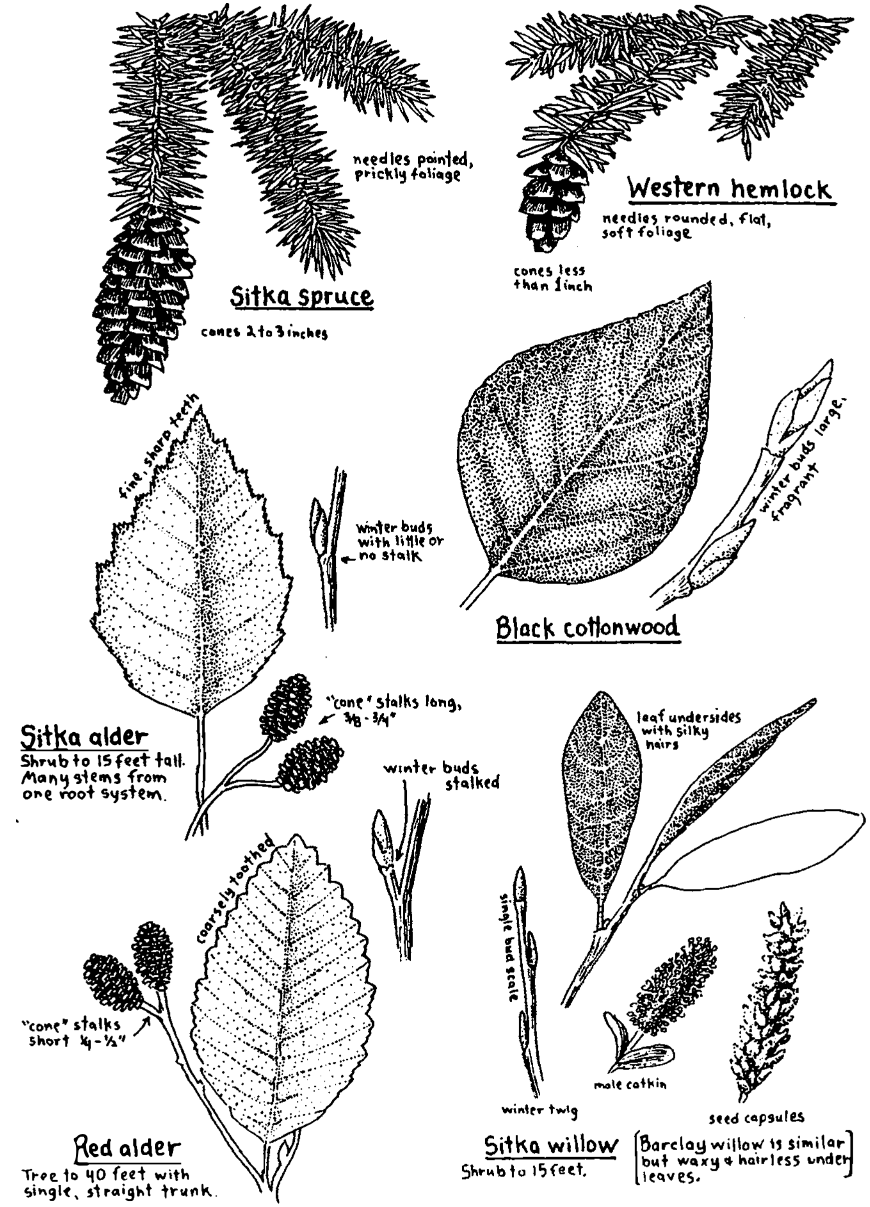
TREES & TALL SHRUBS 7.1



FOREST HERBS & SHRUBS



TREES & TALL SHRUBS



Unit #4

LET'S SNOW!

Unit Introduction:

Winter may seem to be a slow, quiet season, but this unit will give you plenty to investigate!

Snow Crystals

How closely have you looked at a snowflake? Did you know there are actually classifications of types of flakes despite the common perception that no two snowflakes are alike? So alluring were snow crystals to W. A. Bentley, that he spent nearly half a century researching and photographing them. The results can be seen in the book Snow Crystals, by W. A. Bentley and W. J. Humphreys, Dover Publications, Inc., NY, NY, 1962. This book is a fascinating collection of Bentley's plates of crystals which entices us to discover these microscopic intricacies on our own.

Snow Profiles

Not only are there classifications of snow crystals, but the fallen snow is broken into specific types by layers. Each with distinct characteristics, these layers tell a story of metamorphosis. Snow changes due to pressure and heat can be measured and observed through snow profiles cut into the snow.

Snow as an Insulator

Below the surface of the snow, life goes on. A variety of rodents are scurrying around in tunnels, content in their warm winter habitat. Man has traditionally used snow as an insulator and does still in certain conditions. The secret of snow's insulating property is the air trapped within it. You'll discover this first-hand in the activities to follow.

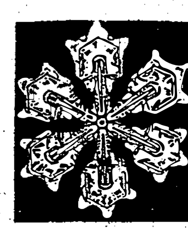
Objectives:

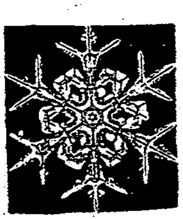
Students will:

- Observe and collect snowflakes, and identify specific attributes found in snow crystals
- Record and analyze temperature, water content, depth of layers and profiles of snow in four specific habitats
- Experiment and investigate the insulating properties of snow

Concepts:

- Diversity and patterns in nature
- Diversity between habitats
- Insulating quality of snow makes it a vital winter habitat





Lesson Plans Included:

Lesson #1: What a Flake!
Lesson #2: Snow Statistics
Lesson #3: 'S No Place Like Home

Lesson #1
WHAT A FLAKE!

Season: Winter

Setting: Classroom and Jordan Creek Aquatic Trail

Time: After or during a fresh snowfall. Plan for one 50 min. field trip and two 20 min. class periods to complete this lesson.

Subjects: Science: weather/climate, water cycle
Math: geometric shapes

Materials:

In The Kit
- Snowflake Classification Sheet
- master for transparency of Snowflake Classification Sheet
- student data sheet
- hand lenses - 1 per student
- 2 sheets 8.5x11 clear acetate
- 1 sheet 8.5x11 colored acetete
- 1 can clear acrylic spray
- metal probe thermometer

Supplied By Teacher
- overhead projector
- dry-erase markers

Preparation:

Copies of each student snowflake sheet and student data sheet for each student. Acetate sheets cut into 2x2" squares, one for each student. Acrylic spray set outside to cool several hours ahead of the lesson. Set the thermometer outside to check temperature later.

Teacher Background Information:

How Snowflakes Form
Snowflakes begin as water vapor which freezes around tiny, solid particles in the air, such as dust or salt, forming a crystal. The determining factors as to the kind of flake which is formed are: (1) temperature and (2) the amount of water vapor in the air. When the temperature is very low, the air holds less water vapor and thus crystal growth will be relatively slow. The high cirrus clouds are indicative of these conditions. Small simple crystals such as columns are formed in this weather.

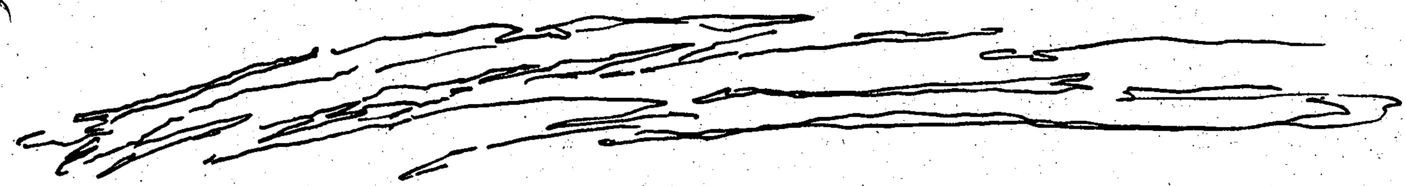
More common to our environment are the heavier, low lying cumulus clouds. With this cloud cover the temperature is warmer, so the air can hold more water vapor, and consequently faster crystal growth occurs. The more complex varieties of crystals, such as the stellar and spatial dendrites, develop with these conditions.

Snow Crystal Classification
Snowflakes, as we commonly refer to them, are actually snow crystals. Crystals are ice particles with a molecular arrangement of repeated symmetrical and three-dimensional patterns. Snow crystals are classified in the hexagonal crystal system because of their six-sided vertical or horizontal prisms. Within this system the snow crystals are grouped according to their particular hexagonal crystal growth and its modifications. The Snowflake Classification Sheet included in this unit is a broad classification of this system into which most snow crystals will fit.

Irregularity
Crystal forms are most often altered from their original state through a variety of forces: striking and attaching to other flakes, branches of a crystal breaking off, a coating of rime over the original shape, fragmentation through wind action, and compaction or settling of the crystal. Due to these alterations, categorizing snow crystals can be difficult, as they may no longer have the observable features of crystals. Usually, recognizable attributes of a particular crystal will still be present and identifiable, such as a plate, cylinder, branch or needle, especially with fresh snow.

Vocabulary:

cirrus clouds - high, thin, streamy, white clouds



cumulus clouds - low, thick, rounded mass of dark to light gray clouds

crystal - molecules arranged in a repeated pattern

hexagonal - having six sides

plate - smooth, flat and thin object

column - a cylindrical, slender structure

needle - a slender pointed piece

branch - a part or extension of the main body

rime - supercooled water droplets that are formed when they make contact with an object

attributes - a characteristic feature of something. In snow crystals, attributes would be: branches, cylindars, plates, columns, needles, etc.

Lesson - What A Flake!

Objective:
Students will observe and collect snowflakes and identify specific attributes found in snow crystals.

Purpose:
To promote recognition of diversity and patterns in nature, and as observed in snowflakes.

Student Arrangement:
For the field activity the class should be broken into groups of 3 - 4 students. Each group will need a person designated as the Data Recorder.

Focus:

Ask students how many have heard that no two snowflakes are alike? Do they think that is true? Confirm that may be so, but by closely examining snowflakes we can put them into groups. Display overhead transparency of snowflake classifications, with students following along on their handouts. Read the descriptions of the snowflakes, noting the various attributes, that is, their specific features, such as branches, cylinders, plates, etc., of each type and the weather conditions in which each crystal is formed.

Diagnose:

To assess students' comprehension and assist them in identifying attributes of actual snowflakes, have students draw and label on art or notebook paper: hexagon, cylinder, branch, plate, and needle.

Activity:

On The Trail

Proceed to the platform (or, if sufficient snow cover to protect the ground, the open meadow would be good). Note the weather conditions. Are the clouds cirrus or cumulus? What's the temperature? Check the thermometer. Have the Group Recorder note the data. Each student will transfer this information to their own data sheet when back in the room. In an open area, such as the Wet Meadow, have the groups catch falling snowflakes on their clothing. Observe the flakes through hand lenses to note the variety and differences.

While outside, pass out to each student a 2x2" piece of acetate. Being cautious to spray away from students, spray each acetate square with the acrylic spray (which has been pre-cooloed outside), until sticky but not runny. Have students wait 15 seconds or so, until spray is tacky, then either catch falling snow on the sheet, or scoop up and gently scatter a few freshly fallen snowflakes over the sheet.

Return to the classroom to let preserved flakes dry for a few minutes. A line strung up in the room to clip them to works well.

In The Classroom

Now it's showtime! Display preserved flake slides on the overhead projector, using the colored sheet of acetate for background. Take time for ooh's and aah's.

Select 10 or so preserved snow crystals with the most observable attributes: hexagons, columns, plates, needles and branches. Placing an overlay transparency over one of the crystals, outline the obvious attributes. Refer to the classification sheet and choose a likely category for the crystal, if possible. Now is a good time to stimulate ideas and discussion from the students and provide information about how irregularities in the crystals occur. Continue with the remaining selected snow crystals, guiding the students toward independent practice in their ability to recognize the attributes and categorize the crystals.

Summary:

Have students complete the Data Sheet individually, referring to their classification sheets if necessary. When completed, ask for and discuss responses.

Lesson #2
SNOW STATISTICS

Season: Winter

Setting: After a snowfall, and then a drop in temperature for a period of days would be the ideal time for this lesson. The low temperature is key for best test results.

The testing will be conducted at 4 sites along Jordan Creek Trail. These sites should be within a red alder and cottonwood forest area, a wet meadow, a spruce forest and alder/ willow thicket area See PREPARATION for more details on how to select these sites.

Time: 15-20 minute classroom introduction, 60 minute field trip, 15-20 minute summary.

Subjects: Science

Materials:

In The Kit
- 4 thermometers per group
- Snow Test Sheet for each student
- hand lenses for each student
- Jordan Creek wetlands map
- trowel for each group

Supplied By Teacher
- 1 meter stick per group
- 4-5 one-pound size cans with both ends removed
- 4-5 bread size plastic bags
- 4-5 measuring cups

Preparation:

Make copies of Snow Test Sheet for each student. You will also need to become familiar with the Jordan Creek wetlands map included in the kit, to identify and select the sites for the snow profiles. Decide where within the specific habitats listed in SETTING you will conduct tests so you can direct students to the sites.

Teacher Background Information:

Metamorphosed Snow
When snow stands long enough, it develops layers. The top layer is new sharp crystals lying loosely and slowly being compacted by additional falling snow. Just below the *new snow* will be a layer called *firn.* The firn consists of crystals that have lost their sharp edges due to freezing and compaction. They are now rounded into more sphere-like shapes, in time becoming particles of ice. This snow is dense and the grains are more closely bonded together, which increases the mechanical strength of the firn layer. Below the firn is the *depth hoar* layer. There is a temperature difference between this layer and those above, due to heat radiating up from the core of the earth. (This heat escape is evident in other locations such as hot springs and geysers.) This results in a temperature gradient which causes more complex crystals to develop and grow to a size much larger than the original snow crystals. The hoar frost layer is more weakly bonded together than the firn or new snow layers with a fragile structure that is easily collapsed. A large temperature gradient is necessary for this depth hoar layer to form and it occurs best when the snowfall is shallow and the temperature is cold. So, for the best definition of layers in your snow profiles, you should conduct this test when the temperature drops after a recent snowfall.

Both the firn and depth hoar layers are considered metamorphosed snow, due to the change in the snow crystals because of heat and compaction.

Habitat Differences
The depth, temperature, water content and profile will vary between habitat test sites. The most notable factor influencing these differences is the vegetation, which protects the ground from snowfall and helps to hold in the earth's radiant heat.

Vocabulary:

firn - a layer of snow crystals below the new snow which have lost their sharp edges and have become more rounded and sphere-like

depth hoar - closest to the ground, this layer consists of snow crystals which are loosely compacted and larger in size

metamorphose - a process of change through pressure and heat

snow profile - a vertical cut-away of snow, so all layers can be seen

snow core - a section of snow collected in a vertical tube

Lesson - Snow Statistics

Objectives:
Students will collect, record and analyze the temperature, water content, depth and profiles of snow in 4 specific habitats.

Purpose:
To develop the concept of diversity between habitats within the Jordan Creek watershed, represented through snow.

Student Arrangement:
"Cooperative" groups of 4-5.

Focus:

Introduce the word *metamorphose*. Talk about how this process condenses and reshapes snow. To demonstrate the firn layer, have students build a pyramid. They will become like metamorphosed snow as the weight and pressure from those above causes those below to collapse and condense! Those on the bottom will feel an increase in heat, although in this case it doesn't quite parallel the depth hoar conditions where the heat is radiating from below. Try not to get too carried away with metamorphosing the students. It probably won't result in positive changes!

Distribute the Test Sheets. Talk through the instructions with the class following along. Assign tasks to the students in their cooperative groups. You will need students to: cut the snow profile, measure depths, sketch the profile, take temperature, take water core sample and record the data.

Diagnose:

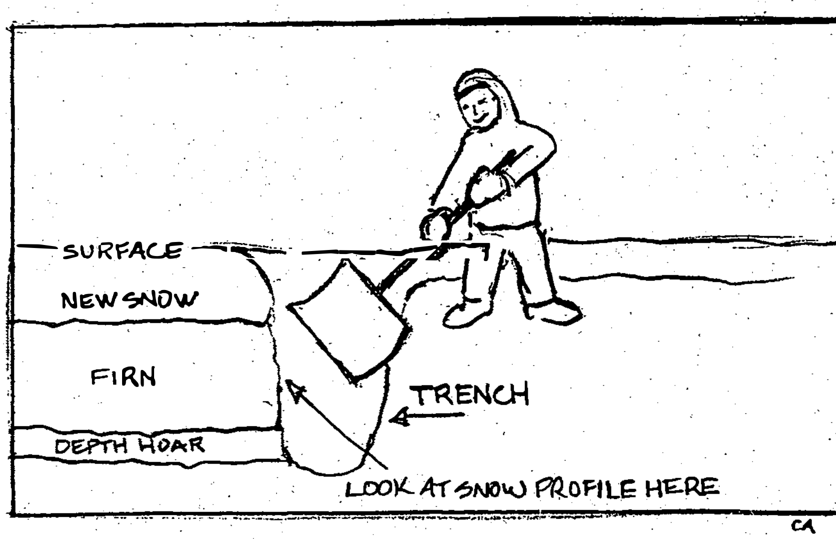
Ask individuals from various groups to reiterate their role in the group, to insure students know what to do when they begin their testing.

Activity:

<u>Guided Practice</u>
Proceed to the trail. With all students observing, demonstrate the testing proceedures.

TEST 1 - SNOW PROFILE:

1. Dig a trench in the snow. Then cut a vertical slice of snow with a trowel to see a profile of the layers.



A hand lens will help distinguish the sharper, loosely compacted new snow from the rounded sphere-like crystals of the firn layer and the larger crystals of the depth hoar. You can also feel the difference with your fingers or hands, between the light new snow, the dense compacted firn layer, and the more fragile and loose depth hoar. You should be able to determine the layers within an inch or so. In distinguishing the depth hoar from the firn, you may also want to gently scrape off the firn layer while listening for a change in the sound.

2. Next measure the depth of each of the layers. Record the measurements on the Snow Test Sheet.

3. Sketch the profile on the back of the Test Sheet.

TEST 2 - TEMPERATURE:

Insert one thermometer 12" from the top of the snow, in a bush preferably. The second thermometer is placed in the new snow layer, the third in the firn layer, and the last thermometer in the depth hoar. They should remain in place with only the head of the thermometer extending for at least two minutes to produce accurate readings.

TEST 3 - WATER CONTENT:

The water content will be determined by taking a core of snow with the open-ended cans. Thrust the can down through the snow, so that it passes through all layers. Slide a clipboard below the can and lift the sample from the snow. The core should be placed into a plastic bag and labeled for each of the 4 sites. The core will be taken back to the classroom where the bag is to be placed under hot water to melt the snow. It is important not to lose any of the collected snow or meltwater, and also not to allow any of the hot water into the plastic bag. Measure the meltwater in the measuring cups and record the volume of water in each core on the Snow Test Sheet.

On Their Own
Now it's time for the groups to disperse to the areas you have chosen that fit the habitat specifications. Each group of students will conduct all tests in all sites. Circulate and monitor their progress.

Summary:

When all the data is recorded, ask each group to report on the differences they discovered amoung the sites examined.

What generalizations about the results found by the whole class between the sites can they make on the depth, profiles, water content and temperature?

What differences or similarities did they find between habitats?

Sources:

LaChappell, Edward R., Field Guide to Snow Crystals, University of Washington Press, 1969

Environmental Learning Center, Snow Study, 230 Cranberry Road, Finland, Minnesota

Lesson #3
'S NO PLACE LIKE HOME

Season: Winter

Setting: Classroom and Jordan Creek Aquatic Trail

Time: 15 minute play and discussion
20 minutes for Activity 1
30 minutes for Activity 2 on first trip, 15 minutes on second.

Materials:

In The Kit:
- 10 film canisters

Supplied By Teacher:
- props for play (winter clothing, table)
- thermos filled with hot water
- mixing container and spoon
- 1 box of gelatin
- seeds or nuts
- snow shovels and buckets

Preparation:
Make copies of script for 3 students. Select students to put on play and allow one day's reading time to prepare. Gather materials for activities 1 and 2.

Teacher Background Information:
Most of us don't think of a frozen environment as a very inviting home, but to many animals, snow provides a cozy shelter. Much like the way insulation holds in the heat in our homes, or how layering our clothes in cold temperatures holds in our body heat, snow traps air in spaces between the snow granules, holding in the heat and blocking out the cold air temperature.

Snow provides a stable environment beneath it (the subnivean layer), in which temperatures range from about 20 degrees F to 30 degrees F, whereas air temperatures can fluctuate from -25 degrees F to 55 degrees F. Snow needs to be at least a foot deep to provide this insulating quality.

The snow provides a safe, warm, winter home for the Long-tailed Voles, Masked Shrews, and Deer Mice. This environment means survival for these small mammals that would freeze to death if exposed for too long. Their body surfaces are so great in proportion to their volume, that heat loss cannot be replaced quickly enough. As animals decrease in size, they are also less able to carry a thick enough coat to withstand continual exposure to cold. Down in the snow, radiant heat from the earth and body heat from these small critters is captured.

Snow caves, quinzees and igloos are examples of how humans have made use of the insulating properties of snow. Snow caves are generally dug into an existing bank or slope, and igloos require hard-packed snow conditions to cut blocks of snow. Quinzees are built in an open area by piling up snow then digging out a chamber.

Native Alaskan people in the Arctic regions used igloos as shelter in hunting camps which took them away from their homes for long periods. Mountaineers still rely on snow caves and igloos for protection and warmth in severe weather conditions on mountains.

Vocabulary:

subnivean - the layer of snow with a habitable temperature range

quinzee - A type of snow cave made by piling snow and digging out a sleeping chamber

Lesson - 'S No Place Like Home

Objectives:
Three students will perform a short play to present information to their classmates on how snow helps some animals in Winter.

Students will conduct an experiment, draw conclusions, and make inferences on how the observed conditions affect animals.

Students will investigate and explore an area to discover signs of animals living under the snow.

Purpose:
• To convey information on how snow helps some animals in Winter.

• To show how snow acts as an insulator, shielding animals from severe surface temperatures.

• To observe, first-hand, that there really are animals living comfortably during this season.

Student Arrangement:
Cooperative groups of 4-5 students.

Focus:

Select three students to put on the play, using the script provided. When completed, discuss the benefits of snow for the animals involved. Students should conclude that it is warm and there is a food supply under the snow. Why is it warmer under the snow? The snow traps warm air from the earth and the animals' bodies acting as an insulator against the cold.

Activity 1:

On The Trail
~~Divide the students~~ into cooperative groups of 4-5. Using one cup of hot water from the thermos bottle, mix with 1 tablespoon of gelatin until dissolved. Fill each groups' two film canisters half full. Have students choose an area that is exposed to weather and in a deep snow (at least 1 foot deep), but not in direct sunlight. They are to bury one canister, with the lid securely fastened, in the deep snow, and place the other canister, without the lid, on the surface of the exposed area. Be sure to mark the site of the burried canister.

Play a short active game in the open area while waiting for the jello. After a few minutes check for signs of jelling. When the surface containers begin to jell, students should dig up the buried containers and compare the progress of the two.

Summary:

1. Which container jelled first? Why? The surface container should jell first because it is exposed to the cold air temperature. It may not always be the first to jell, which could stimulate a good discussion. Was the bottom canister not buried deep enough to be insulated? Did the canister cool too long before it was buried in the deep snow?

2. Why might animals want to stay under the snow on a cold day? Students should be able to conclude that it is warmer below the surface from the play and the gelatin experiment.

Activity 2:

On The Trail

Now that we've convinced the students that animals do survive below the snow through the winter, see if they can find any signs to prove it! In the same groups, have students look for: small holes and/or tunnels, tracks across the snow from or to holes, seed hulls scattered around the tracks or holes, and droppings. Students can dig around the holes to verify they are tunnels. Let's see if these small mammals are still alive and active. Leave a few seeds or nuts in some of the tunnels. Drop them in deep enough so that some clever Stellers Jay or raven doesn't snatch the treats. Come back in a day or two to see if they have been eaten. Look for fresh tracks.

Summary:

Each group should list the evidence they found of animal life under the snow.

Optional Activity:

Building a Quinzee

Constructing a quinzee is wet, fun, and energy-exerting, and when completed, will allow the students to appreciate the insulating quality of snow first-hand.

To construct a quinzee, first outline the circumference in the snow. A workable diameter would be about 10 feet. If you want to make it big enough for more than 2-3 kids, go for it! Make the diameter about 20 feet! Trample the snow down within the area. Then a lot of kids with shovels begin shoveling snow into the circle. The snow should be piled in a dome shape about 4 feet high. Let the pile sit for at least 3 hours to half a day, to let the snow condense. If you don't wait long enough, the quinzee will likely collapse when you begin hollowing it out. Though if you wait a couple of days, it could become too solid to shovel.

Start by putting on rain gear - this gets pretty wet! The entry way is dug first, about 2 feet down into the snow in front of the pile. Make it about 2x4 feet in diameter. When about 2 feet down, begin digging into the mass of the snow pile, gently sloping upward. This is the entry way tunnel which should be about 3 feet long.

At this point, have someone gently climb to the top of the snow pile and plant some sticks 1 foot in through the top and sides. These will be your gauge for thickness when digging from the inside.

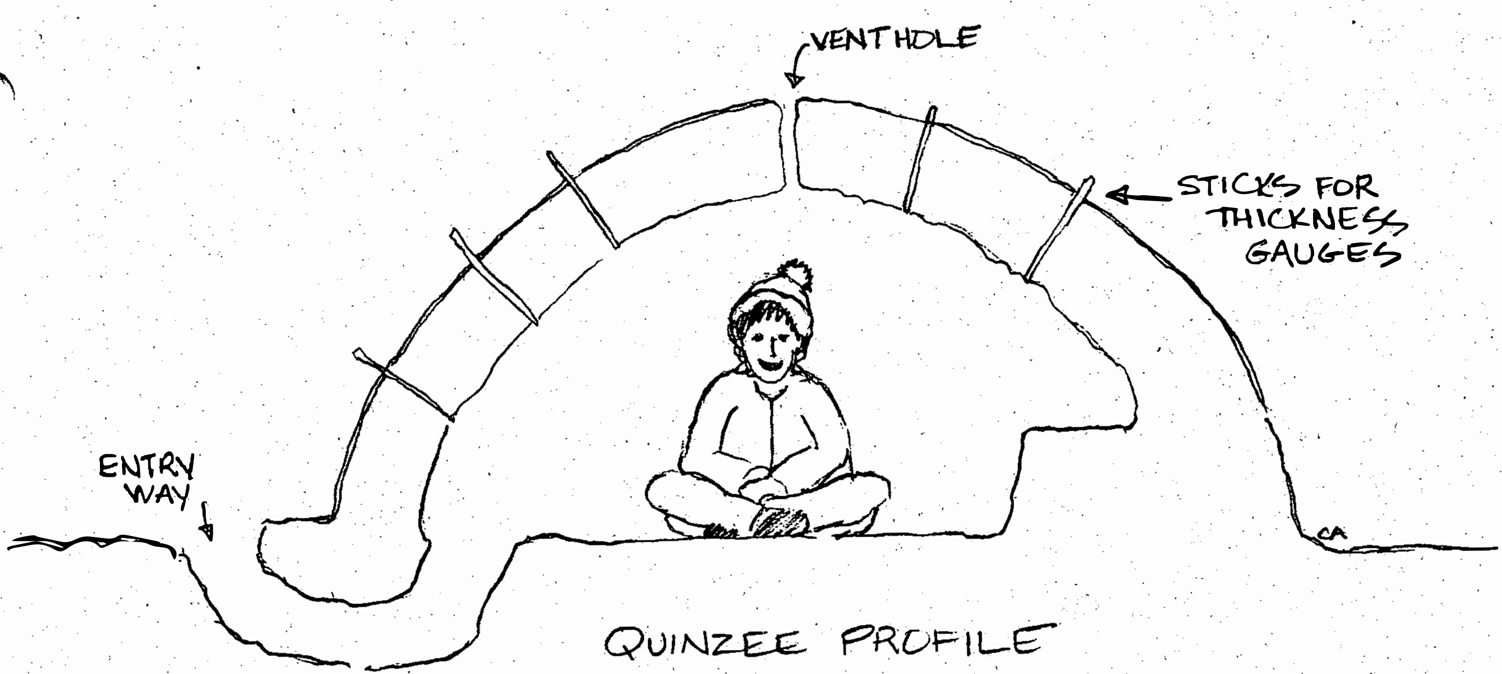
From the entry way, begin hollowing out the chamber. Try to make the ceiling as circular and symmetrical as possible. This will take several shifts of kids inside digging and scooping out the snow. The chamber should be slightly higher than your entrance, so the warm air stays trapped in.

When the chamber walls meet the poked-in stick gauges, smooth and pat down the walls. Make a golf ball size vent hole in the top for fresh air.

All sorts of fancy modifications can be made inside; sleeping benches around the walls, little cubbies in the walls, wall sculptures, etc.

Summary:

Let the students crawl inside to notice the difference in temperature. Have a small-mammal-snack inside the quinzee, of seeds, nuts, and dried fruit!



QUINZEE PROFILE

Sources:

Lingelbach, Jenepher, Hands-On Nature, Vermont Institute of Natural Science, 1986

Environmental Learning Center, Snow Study, 230 Cranberry Road, Finland, MN

"Snug In The Snow"

Adapted from "Snug in the Snow", Hands-On Nature Activities, Jenepher Lingelbach, Vermont Institute of Natural Science, 1986

Characters:
- Madonna Mouse
- Vince the Vole (wearing winter clothing: hats, gloves, scarfs, boots)
- Wally Weasel (in his white winter coat)

Stage:
The front of the class with a long table, tall enough to crawl about beneath it. This will represent the tunnel under the snow. At one end, scatter dried plants found outside and sunflower seeds.

MADONNA:
(on top of snow) Oh, I'm so excited! My favorite cousin, Vince the Vole, is coming all the way from Florida to visit me. He was a little scared about coming so far north in the cold winter, but I told him it was lots of fun. (She slides and rolls around as if playing on the snow)

VINCE:
(dressed warmly) Madonna, Madonna, is that you?!

MADONNA:
Vince! Is that you? What are you wearing? (she rolls her eyes, as if to say, 'what a nerd')

VINCE:
Well, I wasn't about to come and stay without my hat, scarf, earmuffs, mittens, coat and boots.

MADONNA:
But Vince, you don't need any of those winter clothes. You'll be plenty warm without them.

VINCE:
Oh no I won't... I'm used to warm Florida. Besides, I bet you all those people out there wear warm clothes in the winter. (Vince turns to the audience) Don't you?

MADONNA:
Yes, but that's because they stay above the snow. I bet you none of them bury themselves under the snow when they get cold!

VINCE:
Well, what does that have to do with anything?

MADONNA:
You'll see. Come with me. First take off all those hats and scarves and things! (Vince peels off all his extra winter clothes and both dive down under the table)

VINCE:
Hey! It's warm down here under the snow. I'm not cold at all!

MADONNA:
That's what I was trying to tell you, cuz. You see, the snow is full of air spaces which hold in the heat from the earth and from our bodies. It's like all those clothes that trap your body heat in between the layers and keep you warm when you're outside.

VINCE:
Wow Madonna, that's really cool! -- I mean warm! (he chuckles at his bad joke) (a low rumble sound is heard) What was that rumble I just heard? Maybe it's a snow avalanche! Let's get out of here!

MADONNA:
Relax Vince, that wasn't an avalanche, it was just my stomach. I'm starving. Come on, let's get something to eat.

VINCE:
(nervously) You mean we have to go back outside? Wait, let me get my things on.

MADONNA:
No, let me show you. There's all sorts of food down here. (they tunnel along to the weeds and sunflower seeds) See, there are enough seeds to eat all winter! (they eat some of the sunflower seeds)

VINCE:
Yum, you're right! There are lots of munchies down here. Do you have any hot chocolate?

MADONNA:
Look out Vince! Quick! Get back! (they scurry backwards into the main tunnel as WALLY WEASEL sniffs about above the snow, close to where they are below)

VINCE:
(trembling) What is it, Madonna? What's wrong?

MADONNA:
(quietly) It's Wally Weasel. Stay back and be quiet until he passes.

VINCE:
What was he doing here?

MADONNA:
The same thing we are: looking for a place to stay warm and find food. The only difference is, WE are his food!

VINCE:
Oh my, that was a close call! I feel sick. It must be my nerves.

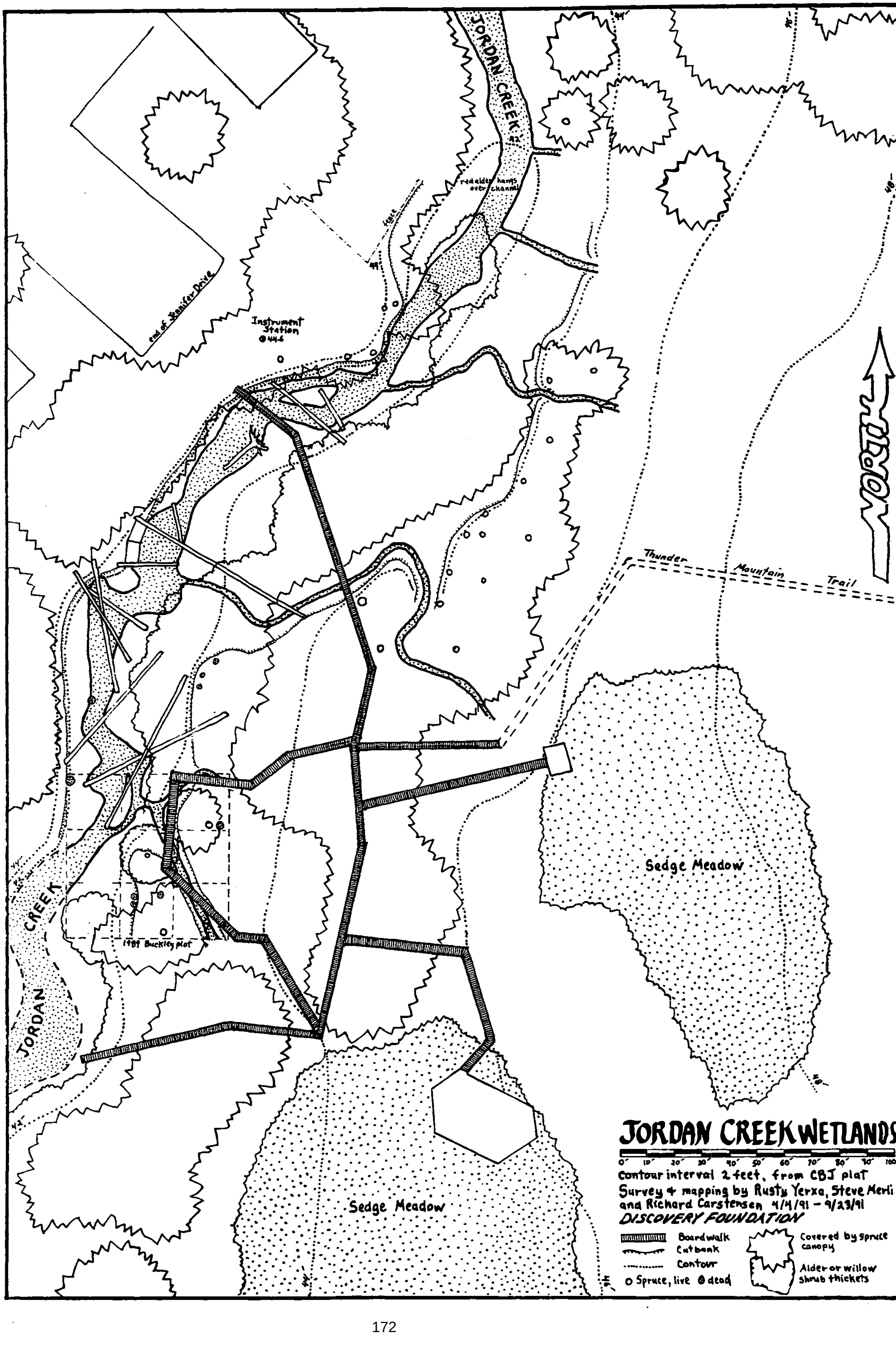
MADONNA:
No, you just need some fresh air. Sometimes it feels good to go up for a fresh breath. (they poke their heads out from under the table)

VINCE:
(takes a big breath) Ahhhh... you're so right. That's just what I needed! Wow, I can't believe how cold it's gotten out here!

MADONNA:
Let's go back under. No matter how cold it gets out here, it stays pretty warm under the snow. (they go back under the table)

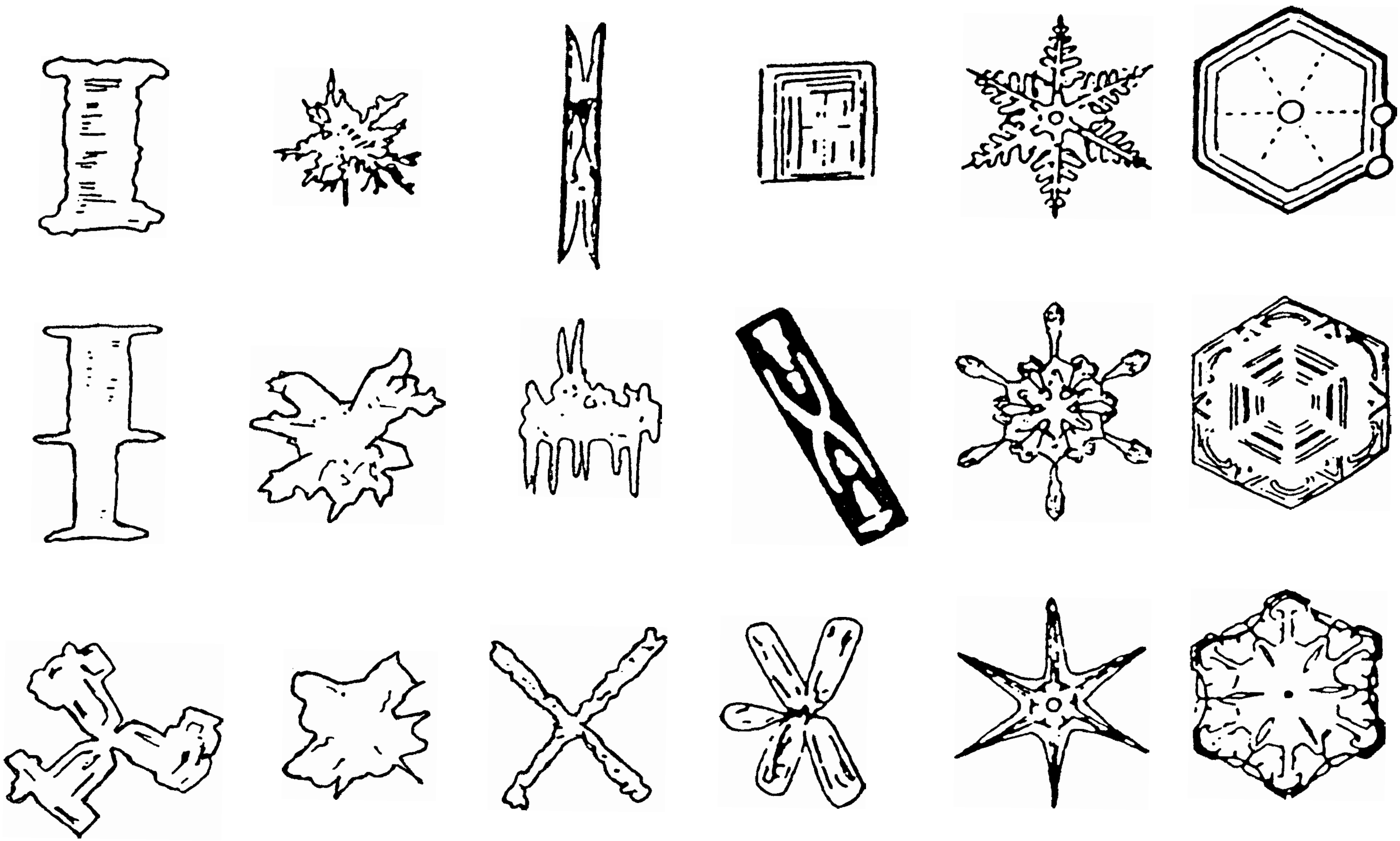
VINCE:
Mmm... this snow is great! It keeps you warm and you can tunnel through it to find food. I'm glad I came to visit. It's warmer under the snow than it is sometimes in Florida! Say, did you say you had some hot chocolate? (MADONNA gives him a sideways glance)

The End

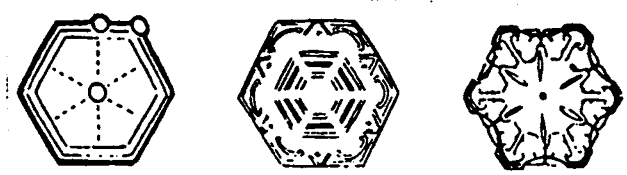
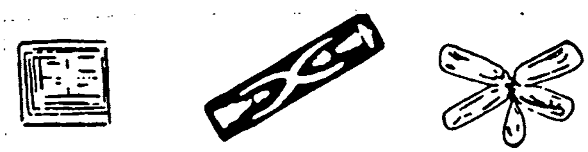
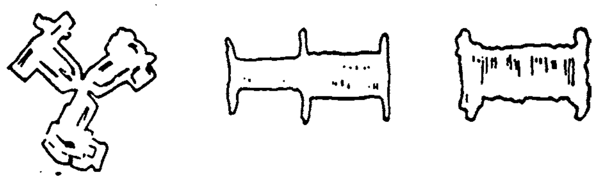
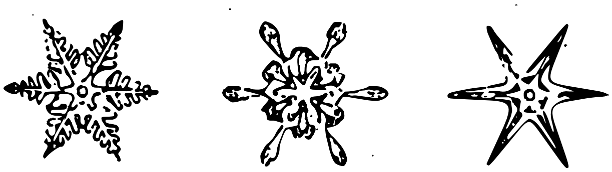

JORDAN CREEK
JORDAN CREEK
red alder hangs over channel
Instrument Station @44.6
end of Jennifer Drive
Thunder Mountain Trail
NORTH
Sedge Meadow
Sedge Meadow
1989 Buckley plot
JORDAN CREEK WETLANDS
0' 10' 20' 30' 40' 50' 60' 70' 80' 90' 100'
contour interval 2 feet, from CBJ plat
Survey & mapping by Rusty Yerxa, Steve Merli and Richard Carstensen 4/4/91 – 9/23/91
DISCOVERY FOUNDATION
Boardwalk
Cutbank
Contour
o Spruce, live ⊗ dead
Covered by spruce canopy
Alder or willow shrub thickets

(MASTER FOR OVERHEAD TRANSPARENCY)

Snowflake Classification Sheet



Snowflake Classification Sheet

Examples of Crystal	Type / Description	Weather
	Hexagonal Plates - six-sided flat crystals with varying internal designs	Low moisture,
	Columns - cylinder shapes with flat ends	cirrus clouds,
	Capped Columns - cylinder shapes with six-sided plates on either end	and colder temperature
	Needles - long slender six-sided columns looking like tiny bolts of lightning	
	Stellar Crystals - star-shaped with six branches having simple to complex designs shooting out from the center	High moisture, cumulus clouds,
	Spatial Dendrite - feathery stellar crystals with other branches projecting from each of the six original branches	and warmer temperature

Data Sheet

DATE:____________ CLOUD TYPE:______________ TEMP.:________

1. Did you find any snow crystals that looked the same? ______________

2. Write the attributes you found for each preserved snow crystal:

1. ______________ 6. ______________
2. ______________ 7. ______________
3. ______________ 8. ______________
4. ______________ 9. ______________
5. ______________ 10. ______________

3. What was the most common attribute found amoung the crystals? ______________

4. What attributes didn't you find at all? ______________

5. From the attributes you found, select a possible catagory for each of the snow crystals. Refer to your classification sheet.

1. ______________ 6. ______________
2. ______________ 7. ______________
3. ______________ 8. ______________
4. ______________ 9. ______________
5. ______________ 10. ______________

6. Are the catagories of snow crystals you found the kind you would expect for the weather you observed?_____

_____ Why or why not?______________

____

7. What are some possible influences on irregular shapes of the crystals? ______________

____

GROUP NAME:_______________________ DATE:___________________

Snow Test Sheet

Conduct all three tests in one site before moving on to the next three sites.

TEST #1 - SNOW PROFILE:

1. Dig a trench in the snow. Cut a vertical slice of snow with a trowel to see a profile of the layers.
2. Look with your hand lens and feel the snow to find the layers.
3. Measure each layer with the meter stick. Record the depths below.

	Red Alder / Cottonwood	Wet Meadow	Spruce Forest	Alder / Willow
Depth of New Snow				
Depth of Firn				
Depth of Depth Hoar				

4. Sketch each profile with its snow layers on the back of this page. Try to make you sketches an accurate, smaller version of each profile.

TEST #2 - TEMPERATURE:

1. Place one thermometer 12" above the snow, preferably in a bush.
2. The second thermometer is inserted all the way up to the dial in the new snow layer.
3. Stick the third thermometer up to its dial in the firn layer.
4. The last thermometer goes in the depth hoar layer.
5. Leave them in place for at least 2 minutes to produce accurate readings.
6. Record the temperature of each layer below.

(Continued...)

Snow Test Sheet
(page 2)

	Red Alder / Cottonwood	Wet Meadow	Spruce Forest	Alder / Willow
Air Temp.				
Temp. of New Snow				
Temp. of Firn				
Temp. of Depth Hoar				

TEST #3 - WATER CONTENT:

1. Push the open-ended can down through all the snow layers.
2. Slide a clipboard below the can to keep the snow from falling out, and lift the can from the snow.
3. Brush off any snow extending above the top of the can. Do not pack the snow down in the can!
4. Place the snow core into a plastic bag, tie it closed, and label the bag with the name of the site.
5. Back in the classroom, run the bag under hot water to melt the snow.
6. Pour out and measure the meltwater. Be careful not to lose any water.
7. Record the number of cups of meltwater from each snow core below.

	Red Alder / Cottonwood	Wet Meadow	Spruce Forest	Alder / Willow
Volume of Water in Snow Core				

Unit #5

STREAMING: THE HUMAN RELATIONSHIP TO WATER

Unit Introduction:

Since we share our need for water with all life, decisions we make about water use may have far-reaching consequences. When we use water--and develop a drainage--we change the quality and quantity of water available to other organisms.

People use a great deal of water; an average American uses about 100 gallons a day. Even in SE Alaska, where water is not in short supply, most settlements are found near streams. In this unit, students look at Jordan Creek as a water resource, determining the quantity and quality of its flowing water and exploring the potential uses and values of the stream.

Objectives:

Students will:
- Measure, record and calculate Jordan Creek's velocity and volume.
- Calculate the number of people Jordan Creek could support.
- Make value decisions on the distribution of water.
- Test the stream for purity and evidence of human pollution, and adopt a stewardship project.

Related Curriculum:

- Math (multiplication and division)
- Science (water cycle)
- Social Studies

Aquatic Education Concept:

Within a system, all elements affect each other. The volume, velocity, pH, temperature, dissolved oxygen and suspended particles in Jordan Creek are affected by humans and conversly affect our lives.

Lesson Plans Included:

Lesson #1: Volume and Velocity
Lesson #2: Pollution of Water

Lesson #1

VOLUME AND VELOCITY

Season:	Fall or Spring
Setting:	Along a 20 to 50 foot section of Jordan Creek
Time:	Activity 1: 30 minutes Activity 2: 15 minutes in classroom 55 minutes in field
Related Curriculum:	Math (multiplication and division) Science (water cycle) Social Studies
Preparation:	Make copies of volume and velocity worksheet and group discussion questions for all students. Distribute paper cups to all students.

Materials:

In The Kit

- hip boots
- tape measure - 1 per group
- Data Sheet - 1 per group
- stop watches - 1 per group
- rubber ball - 1/group
- Group Discussion Questions - 1 per student

Supplied By Teacher

- clipboards
- pencils
- yard/meter sticks - 1 per group
- water
- paper cups

Teacher Background Information:

Importance of Water
All living organisms on earth contain water in one form or another. They are composed mostly of water, whether they live in oceans, lakes, rivers or on land. Thus water is an important element in all organisms lives. The human body is over 97% water!

Inflow and Outflow of water in Jordan Creek
Stream flow is dependent on the amount of rainfall, snowmelt, glacier melt, evaporation and water content of the surrounding soils and vegetation in the watershed. The volume and velocity of water in Jordan Creek varies with fluctuations in the content of water from these locations, as they are all connected through the water cycle. (For more information of how the water cycle works, see the Watercycle unit.)

In nature, the fluctuation in the system is dependent on evaporation more than any other method of transport. High levels of evaporation from snow, glaciers, soil, and vegetation move the water into the atmosphere, before it may reach streams. With less evaporation, the water flows through more components of the water cycle, including the stream, which then maintains a higher level. These fluctuations are generally seasonal.

VOLUME AND VELOCITY WORKSHEET

Step 1.

Measure and mark a 20 to 50 foot distance along a relatively straight section of the creek. Insert sticks in the ground to mark both the top and bottom of the section. Be sure your section of creek is free of any obstacles that would stop the ball. Place the ball into the water above the upstream marker and record the number of seconds it takes to float downstream between the markers. Record the time in the space below. Divide the distance by the total seconds it took the float to travel between the markers. Do this three times to find the average time.

1st measurement _______ ÷ _______ = _______ ft. per second
distance total sec.

2nd measurement _______ ÷ _______ = _______ ft. per second
distance total sec.

3rd measurement _______ ÷ _______ = _______ ft. per second
distance total sec.

Total of three speeds ______ ÷3 = _______ft. per second (average speed)

Step 2.

For the next test measure across the creek. You will need to measure the width of the creek in 3 different spots within the marked length. Add the measures and divide the sum by three to get the average width.

1st width ____ft. + 2nd width ____ft. + 3rd width ____ft = ________ft

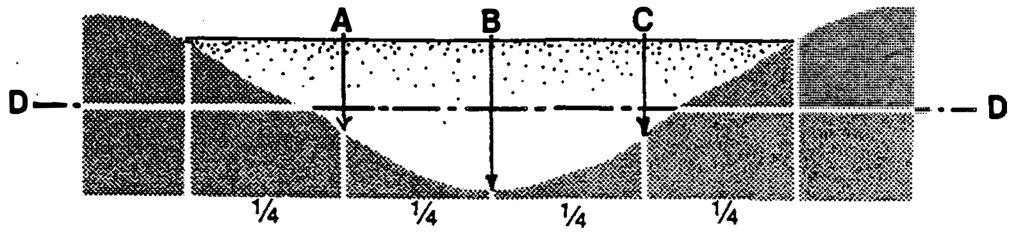
Total ______ft.÷3 = ________ft. (average width)

Step 3.

Find the average depth of your section of creek. Measure the depth of the creek at three points across the middle of the creek following a straight line. Divide the total by four to get the average creek depth.

1st depth _____ft. + 2nd depth_____ft. + 3rd depth_____ft. = ________ft.

Total depth _____ft.÷4 = _____ft. (average depth)



Note: the reason you take three depth measurements and then divide by four is to take into account the shallow area of the creek. This is explained in the drawing above. If the depths at points A, B, and C total 20 feet, and that number divided by three, the result would be 6.66 feet. However, the correct average depth, as shown by line D, is 5 feet, which is obtained by dividing the total depth measurement by four.

Step 4.

Find the volume of flow in cubic feet of water per second. Multiply the average width, average depth, and average rate of flow together.

______ft. x ______ft. x ______ft. per second = __________cubic ft.
width depth speed per second

Note: A cubic foot of water would fill a container one foot square and one foot deep, and it contains 7.48 gallons of water.

Step 5.

The average person in the United States uses 100 gallons of water per day for household use. Complete the following calculation to find out how many people could live on the water flowing in your creek section.

____________ x ___________ = ____________ gallons of water per second
creek flow in in cu. ft. per second | gallons in 1 cu. ft. of water

____________ x ___________ = ____________ gallons per minute
gallons per second | seconds in minute

100G
_________ x _________ = _________ _____ = ________people
gal. per min. min. per day gal. per day per person

VOLUME AND VELOCITY GROUP DISCUSSION QUESTIONS

As a group answer the following questions. Be prepared to discuss your reponses with the class.

1. How many people can your creek section support?

   Is that more or less than you thought?

2. If we decide to take the 100 gallons per day we need from these sections, where will the organisms in and around the creek get their water?

3. If we used 50 sections of Jordan Creek, do you think there would be enough water for the instream and surrounding plants and animals?

Why or why not?

Lesson #2

POLLUTION OF WATER

Season: Fall or Spring

Setting:
Classroom
Jordan Creek Trail
Urbanized area of Jordan Creek

Time:
30 minutes in class
One to one and a half hours outside
30 minute class summary

Related Curriculum:
Math
Social Studies

Preparation:

Set up display with four sample bottles. In bottle #1 add organic waste from a small animal. In bottle #2 add leaf debris from creek bottom. In bottle #3 add silt or fine sand and in bottle #4 add hot water. Make display sign as described in Activity #1.

Read through DO testing procedures to become familiar with them before conducting test. These are considered hazardous materials, be careful!

Arrange parent transportation to test site #2. You will want to select a section of Jordan Creek in an urbanized area before taking the class so you are familiar with the location.

Materials:

In The Kit

- Disolved Oxygen kit
- mid-range pH paper 2 strips/group
- thermometer-1/group
- Pollution Test Data sheets - 1/student
- 12 sample bottles - 4 for display and 2 per group

Supplied By Teacher

- clipboards - 1/student
- masking tape
- marker
- organic waste from school pet
- leaf debris from creek bottom
- silt or fine sand
- water
- pencils

Teacher Background Information:

Our Water Supply
Water from upland lakes and rivers is relatively uncontaminated. In lowlands where there is a more dense population, water is changed from its natural state, as it is used and reused many times. The amount of fresh water in remote locations would more than adequately supply populated areas, but transporting it is expensive, so it is easier to treat the used water before discharging it back to streams.

Commom Pollutants
The most common pollutants of water are high levels of organic matter, plant nutrients, suspended mineral particles, deoxygenating substances and heat. Also common are small quantities of poisons such as heavy metals.

Natural discharge of these pollutants occur somewhere in the world. The pollutants are detrimental to most living organisms, although very narrow range communities have evolved to tolerate them. Conditions of pollution created by human activity tend to be more extreme than those in nature, and thus even fewer living organisms can tolerate them.

Organic Pollutants
The discharge of raw sewage into a creek creates conditions paralleled in nature by animal droppings from a watering area. The main difference between natural organic input and human pollution by organic matter is that the natural matter tends to be large, like leaves and the human organic input is much more soluable, which distribute the pollutants widely throughout the water. The bacteria which immediately inhabit the organic matter need much oxygen to decompose this matter. So, with human organic pollutants, the oxygen level decreases rapidly over larger area than with the natural organic input. A dissolved oxygen test (DO) measures the availability of oxygen in the stream. A low level would indicate a nearby source of decaying organic pollution.

Suspended Mineral Particles
The suspension of fine particles washed from logged areas or other human erosive activities is a normal feature of streams draining mountian glaciers. The effect of both the natural and human form of this pollutant clogs the gills of fish with silt. Locally we have numerous natural sources of this pollutant.

Heat
Heat is also a form of pollution. Warm water dumping and removal of shade increases the temperature of the water. Warm water has less oxygen than cold, which makes it difficult for cold water fish and insects who need even more oxygen when their body temperature is warmer. Organisims can usually tolerate seasonal changes in temperature, but not the extreme or unexpected, such as dumping of effluent from factories and extreme heat in nature from thermal springs.

Acid/Alkalinity
In nature bog water, volcanic ash or coniferous forests can all increase the acidity of a stream. Humans increase it through industrial waste, effluent in pulp mills, or metals made available from the soil in large quantities from mine tailings. Too much acid (a pH of 5.5 or less), and most fish cannot live. They prefer a pH of about 7.

Metals
In nature we can see how metals leach into the soils. The rusty colored water in nearby tributaries is iron from the subsurface and is brought up through grounwater. At high levels this is toxic to the fish and other organisms. The iron leaching also changes the stream bed solidifying the materials.

Vocabulary:

clarity - how far one can see down into the water

effluent - waste water from factories and sewage plants

deoxygenating - to decrease the amount of oxygen

Lesson - Pollution Of Water

Objectives:

The students will test for pollutants in Jordan Creek, investigate their source and conduct a stewardship project.

Purpose:

To promote responsible use of our water resources.

Focus:

Set out the four bottles with the polluted water. Place a sign in front asking, "Which of these are polluted? Pick them up and have a closer look. Take the lids off and smell."

Ask students for a show of hands if they think the water in the bottle is polluted, while holding up the organic animal waste bottle.
Ask them why or why not? (Leave their responses unconfirmed to generate discussion)
Where do we find this in nature? *(Animal feeding and watering areas)*
How do humans contribute this kind of pollution? *(Through seeping septic tanks)*

Display the bottle with suspended (if settled, give it a shake) mineral particles.
Is this polluted?
Why or why not?
Where do we find this caused by nature? *(Glacier streams, and most streams after a heavy rainfall)*

Hold up the bottle with the decaying leaf debris.
Is this polluted?
Why or why not?
Where do we find this in nature? *(Creek beds and estuaries)*
How do humans add organic plant matter to water? *(sewage plant effluent)*

Display the final bottle of hot water.
Is this pollution?
Pass the jar around so all can feel that it is hot (warm).
Where does this occur in nature? *(Seasonal changes and thermal upwellings from the earth)*
How do humans contribute this kind of pollution? *(Effluent dumping from factories)*

Write on the board, "Pollution is . . .". As a class, come up with a definition that describes why all of the jars have polluted water. Your definition should be something close to *"Pollution is the altering of water from it's natural state"*.

Test the samples while the class observes, recording your results on a Pollution Test Data sheet.

Take the temperature.

Dip in pH paper and compare to the guide on the container to determine the reading.

Hold the jar up to light and look through it for sediments and color.

Determine the DO content, following procedures on DO kit.

Check for odor, take a good smell!

Diagnose:

What does each of the tests show us?

- Thermometer - temperature
- pH - Acid/alkalinity of the water
- Look for clarity - The amount of suspended minreal particles
- DO - The amount of oxygen available in the creek
- Smell - The lack of oxygen in the creek

Discuss plan for testing in the two sites; where you're going first, how you would like groups to work together and how much time you have, etc.

Activity:

Have the groups conduct the tests on their own at the two sites.

Conduct tests, in order, on the Pollution Data sheet.

View sediments immediately after scooping sample from the stream.

Record findings on Pollution Data sheet.

Cover and label water sample for DO test to be conducted back in class.

After tests are conducted, look around the area for possible causes and sources of any natural or human pollution.

Record findings on Data sheet.

Summary:

Compare and discuss group results.

Write the following questions for groups to consider and discuss first, then talk about it as a whole class:

1. Were there differences in the tests at the two sites?
2. Which tests?
3. What may be some reasons for the differences? *(different kinds of pollution)*
4. What evidence of possible sources of pollution did you find?
5. Do you think those sources influenced your test results?
   Why or why not? *(There may or may not be seepage through ground water or overflow from the upstream site into the tributary which feeds into Jordan Creek. Fluctuating flow levels may account for this.)*
6. How do these tests make a difference to living organisms? *(decreasing oxygen through temperature and excess decaying organic matter, change pH to more acid is less tolerable to fish, sediments clog gills.)*

Additional Activities:

Have students choose one of the following stewardship projects:

1. Are there state or federal agencies which enforce pollution laws?

   What are the regulating agencies doing about the polluted sites?

   Have students generate questions to ask agency officials.

   Arrange for a class visit for students to interview agency officials with prepared questions.

2. What can students do about the pollution?

   Are there areas of the creek that can be cleaned up without exposing themselves to hazardous substances?

3. How can students educate others about the hazards of polluting?

   Arrange to display a wall mural on how the pollutants affect living organisms at the local mall.

   Will local papers run free ads on keeping Jordan Creek clean?

   Write letters to the editor to contribute to the Juneau Empire.

Sources:

Ricklets, Robert E., Ecology, 2nd Edition, University of Pennsylvania, 1980

Moss, Brian, Ecology of Fresh Waters, Blackwell Science pub., 1980

Human use of water from the ground or surrounding tributaries which feed into Jordan Creek decrease the volume and velocity. There is less water flowing into the creek when there is a drain of the creek's sources. Wells directly drain Jordan Creek. Altering the land in the watershed is another way humans have impact. The quantities of water flowing directly into the stream increase when the vegetation from the stream banks and immediate area are removed. Clearcutting is an example of this kind of human impact. As a component in the water cycle, vegetation holds the water in both the soil and in their structures. When humans pave the soil, rainfall cannot penetrate and instead greater quantities of water flow over the surface and directly into the stream. Culverts and embankments prevent water in the stream from seeping into the surrounding soils, keeping the volume and velocity levels higher than normal.

How much water do we use?
Humans consume about 2 gallons of water per day. The average person uses about 100 gallons of water each day:
32 for bathing, laundry and dishes
25 for watering and swimming
5 gallons for toilets

We also indirectly consume water through energy, irrigation and industry.

A little information on testing
When water quantity is figured and allocated for human use, the average flow level of a river or creek is taken to calculate the number of people the stream could support.

Another point to consider when looking at the results of this test is the geometry of the stream bottom. When a stream's cross-section resembles a half-circle, its surface velocity approximates the average stream velocity. Streambed material can increase or decrease the "drag" on the water.

As a point to remember with any stream work, adding siltation to the creek through repeated tramplings on the soft soil creekbanks can hurt the stream organisms. Walk softly!

Vocabulary:

velocity - The rate at which something is moving; or speed.

Lesson - Volume and Velocity

Objectives:

Students will -
- Measure, record and calculate the stream volume and velocity.
- Calculate the number of people who could live on the water in their stream section.
- Make value decisions on how water is distributed between living organisms.

Purpose:

To develop an understanding of the importance of water for humans and other living organisms, and how to determine the quantities available.

Focus:

Have each student fill their glass with water. Tell them that is all they can have for the day.
Do they think they can live on it?
Ask them how much they think they need.

Write on board the quanities we really use.
How are we using that much water?
List their ideas on the board. Direct them towards any sources they miss.

So, now that we know how much we use, how much water do you think there is in our bodies? Emphasize that not only is it an important element to us, but to all living organisms. Make quesses on the amount of water in other organisms.

Where do we get this water we need?
Briefly talk about snow, tributaries and ice melt feeding the resevoir and creek from which Juneau gets its water. Ask: If Jordan creek was our only source of water, how could we figure the number of humans the creek could support? Tell them they are going to conduct a test to find the answer.

Diagnose:

Demonstrate procedures and use of equipment while in the class. Distribute Volume and Velocity worksheet to all students. Run through the tests with the class, discussing and answering any questions about procedures before leaving for the creek.

Emphasize the importance of stepping <u>over</u>, rather than <u>on</u>, the soft streambanks to prevent erosion of the banks and siltation of the creek.

Activity:

Divide class into cooperative groups of 4-5 students per group. In the field, assist each group in selecting a 20 to 50 foot length of a relatively straight section of Jordan Creek. Review the procedures as a whole class.

With their Volume and Velocity worksheet, each group should follow the testing procedures outlined and record their data.

Summary:

Still in cooperative group format, have each group answer the group discussion questions.

When all groups have completed the questions, discuss the test results and responses as a whole class.

The number of people who could be supported by each groups' section will vary. Stream profile, obstacles in the stream, curves, and sections of fast and slow moving water, will influence their results.

Ask one final question: How many still have their glass of water?

Sources:

Environmental Learning Center, 230 Cranberry Road, Finland, Minnesota

Unit #6

THE AMAZING WATER CYCLE AT JORDAN CREEK!!

Unit Introduction:

It's true, water is everywhere, even if we can't see it; we sometimes forget that there is more than meets the eye. Water has the ablility to takes many forms and move in various ways. Pretty mysterious sounding stuff isn't it? We're about to find water we can see *and* feel; see but *not* feel; and *neither* see *nor* feel!

Students will be actively involved in discovering just how water is getting from one place to another by conducting a variety of tests at study stations set up along the Jordan Creek Aquatic Trail.

So hold on, we're about to explore this amazing medium as it moves through the watercycle at Jordan Creek.

Objectives:

Students will:
Observe, discover, predict, measure, sketch, and draw conclusions about the water cycle, and the forms and uses of water at Jordan Creek.

Related Curriculum:

- Art (sketching)
- Science (water cycle, weather and climate)

Aquatic Educaton Goals:

To develop awareness and knowledge of the processes within the water cycle, the forms of water occuring within the Jordan Creek watershed and an awareness of the uses of water by plants and animals, to use in future use-decisions about water.

WATER CYCLE STUDY STATIONS

Season: Fall or Spring

Setting: Jordan Creek Aquatic Trail, best on a warm day.

Time: 1 week advance Preparation time; 50 min. Focus Activity; two 50 min. sessions for Station Activities; 30 min. Summary

Subjects: Science (water cycle)
Art (sketching)

Materials:

In The Kit

- Concept Cards - 1 set per student
- Station Cards
- Water Cycle master for transparency

EVAPORATION ACTIVITY
- plastic tub
- handkerchiefs - 2 per group
- 2 clothes lines
- clothes pins

CONDENSATION ACTIVITY
- 5 metal mirrors

PERCIPITATION ACTIVITY
- water gauge

PERCOLATION ACTIVITY
- timer

GROUNDWATER ACTIVITY
- PVC probes
- conductivity meter
- soil corer

Supplied By Teacher

- pencils

FOCUS ACTIVITY
- gallon-size glass jar or fish bowl
- rubber band
- plastic wrap
- 6 ice cubes
- 1 cup warm water
- desk lamp

EVAPORATON ACTIVITY
- water - to fill tub

TRANSPIRATION ACTIVITY
- small plastic bags - 1 per group
- twist ties

PRECIPITATION ACTIVITY
- 4-5' stake or stick
- tape

PERCOLATION ACTIVITY
- 2-4 coffee cans, both ends removed
- 2-4 water containers (quart size) to gather and pour water
- muscle power!
- rulers for each student

GROUNDWATER ACTIVITY
- mallet

Preparation:

Gather and prepare supplies. Copy on cardstock a set of concept cards for each student. Have students cut the cards, hole punch a corner and attach sets together with a binder ring.

This unit involves setting up stations for the students to move to along the trail. Some consideration will need to be made as to the location of these stations. These are described below. The activities have not been numbered to allow for students to begin at any point and move to the next - as the water cycle doesn't actually have a beginning or end point!

Set up the laminated station cards at each site.

Station - EVAPORATION
String one clothesline up in direct sunlight. The other should be in the shade, under a thick canopy of trees or any darker, cooler place. The 2 handkerchiefs are to be soaking in the tub of water. Clip clothes pins to the lines.

Station - TRANSPIRATION:
Select a site with shrubs; blueberry bushes, elderberry, young willow, in a sunny exposed area. These plants are more likely to hold up to this experiment than smaller, more tender plants. Set a container with the plastic bags and twist ties at this site.

Station - CONDENSATION:
This site should be in a shady area, so that the air is relatively cool. Set the metal mirrors at this site.

Station - PRECIPITATION:
This site requires the rain gauge to be placed 2-3 days in advance! The best location for this site would be in the open wet meadow, near the end of the platform. I recommend that the gauge be taped or tied to a long stake and inserted in the ground so it is about student eye level.

Station - PERCOLATION:
The gravel bar along the stream side would be ideal, as there are also nearby muddy areas for the 2nd percolation test. Select your site far enough back from the creek to avoid tapping into the creek water.

Station - GROUNDWATER FLOW:
The PVC pipes should be set up ahead of time - maybe a special trip with the class to get all involved in the work. First, use the soil corer to make a hole for the pipe. Insert the PVC pipe into this hole and make sure it reaches well below the water table. If the hole is greater than 3' deep, you may need to use a mallet to gently tap the pipe down, especially if you hit course sand or clay.

The meter wires should be taped together periodically and marked in inches from the probes up to the meter. Tape the probes together, with something between the tips so they are held 1/4" apart.

Set the probes in a row, about 10' apart, extending away from the creek. Once in, I don't recommend leaving these probes there permanently, due to possible vandalism.

Teacher Background Information:

CYCLE:
Water, air, light and soil are the four basic needs of life. The basic building materials for these needs are: hydrogen, carbon, oxygen, nitrogen, phosphorous, and sulfur. Because there is a limited amount of these materials available on the earth, they must be used over and over again by all living things. For this reason, the earth is considered a closed system, and the recycling of these building materials is referred to as a cycle.

PROCESSES OF THE WATER CYCLE:
The water cycle is the largest physical action on earth! Movements within the water cycle include: *evaporation, transpiration, condensation, precipitation, percolation,* and *groundwater flow.* Water molecules pass through all of these stages in different forms; liquid, solid, and gas.

HOW THESE PROCESSES WORK:
Water from the oceans, glaciers, freshwater lakes, rivers, inland seas and salt lakes and animals (their sweat and respiration) *evaporates.* Evaporation occurs when energy from the sun causes freely available water molecules to move around more rapidly. This motion of molecules is commonly know as heat. As we know, heat rises and so does all this water-laden warm air.

Vegetation also contributes water to the atmosphere, through the process of *transpiration.* Water molecules tend to move from an area where they are highly concentrated to an area of lesser concentration. Thus when the leaves on a plant contain more moisture than the air, the molecules will move from the leaves to the air in the form of water vapor. This most often occurs on warm days, when the water content of the air is low and the energy from the sun increases the motion in the water molecules of the plant.

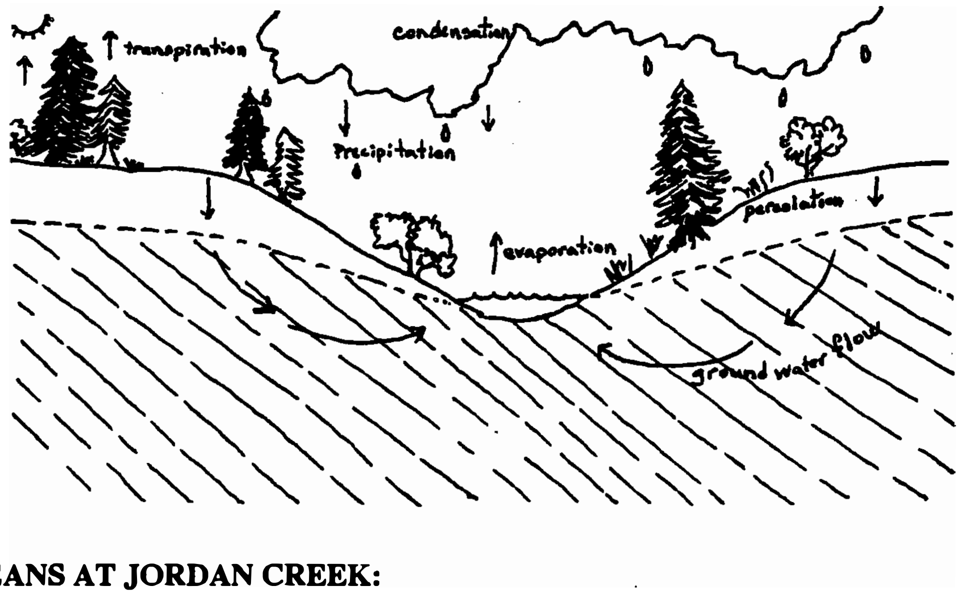
The water vapor in the air cools as it rises in the atmosphere. The cooling molecules are attracted to microscopic particles, which are the nuclei around which droplets form. This is the process of *condensation*. We here in Southeast are all familiar with large quantities of condensed water molecules, better known to us as clouds!

Water molecules continue to attract more and more molecules to themselves, growing larger and heaver. When they become too heavy to remain suspended in the air the water molecules fall back to the earth as *precipitation.* Precipitation, (rain, snow, etc.) resupplies the land and bodies of water with freshwater - some places receiving more of a supply than others!

We can trace the water cycle in several different directions from this point. Precipitation can become runoff and contribute to the lakes, oceans, and streams, fall directly into bodies of water, and at higher altitudes and colder climates, precipitation adds to the build up of the ice caps, and glaciers.

Depending on the permeability of the earth, precipitation may also contribute to another avenue in the cycle; *percolation.* Where the soil is loosely compacted, water can move downward rather than flowing over the surface. The water that percolates down through the soil goes through a zone of aeration where both air and moisture are found in the spaces between soil and rock particles. Water continues moving downward through this zone until it reaches the zone of saturation. Here every pore space between rock and soil particle is saturated with water.

In this zone the force of gravity causes *groundwater flow.* The top of the zone of saturation is referred to as the water table. Since this water can no longer seep down further into the soil, yet is still influenced by the pull of gravity, it flows along toward lower water tables. When it reaches a low area such as a streambed, river or pond, it seeps out from underground to join with the water in that area. This isn't an obvious process in the cycle, as most of this is occuring underground, but there are certain areas around Juneau were I've seen the ground water seeping out to join surface water. One place you can observe groundwater flow seepage is at the Auke Bay Recreation area on the beach at low tide. About half way down the beach, below the main shelter, there is a wide band of water flowing out from the gravelly ground, most likely fueled from the nearby stream. What we can do at Jordan Creek is determine the profile of the ground water table, which will show us the direction the groundwater flows. It is also obvious along the Jordan Creek Trail, where it emerges from the sediments at the base of Thunder Mountain.



WHAT THIS MEANS AT JORDAN CREEK:
Jordan Creek's water level changes with the amount of water available from precipitation and ground water flow. When the precipitation is low during periods of the year, the groundwater flow seeping into the creek prevents it from drying up. As discussed earlier, an alteration in one area of a cycle effects the whole cycle. If precipitation above the Jordan Creek watershed were to decrease, it would be pretty clear to us that there would be less water flowing into Jordan Creek, the same results would occur with a decrease in the groundwater seeping into Jordan Creek. Wells which are dug for the nearby residents, affect the balance of water available to recharge the creek. Too many, and they alter the necessary levels to maintain year round stream flow. Should the water levels drop it could cause intolerable conditions for salmonids and other aquatic inhabitants. A rise in water temperature and lowering of the dissolved oxygen content are two likely effects of lowering the creek level.

Vocabulary:

cycle - something that happens over and over again.

water molecule - the smallest particle of water possible.

evaporation - the process of changing from a liquid to a gas by exposure to the air and/or heat.

transpiration - the process of transferring water to the atmosphere from plants due to a change in the state of water from a liquid to a gas.

condensation - water changing from a gas to a liquid, as a result of cooling.

precipitation - water falling to the earth in various forms, rain, snow, hail, slush, etc.

percolation - the downward movement of water from the surface of the earth through layers of soil.

permeability - the ability of soil to allow water to flow through it.

saturation - all available space between particles have been filled with water.

groundwater flow - water underground that flows from the saturated soil toward lower areas such as stream beds, lakes, and oceans.

water table - the top of the saturated soil, where the water level can be found underground.

4. Display the water cycle sketch on the overhead projector. Label the arrows as you talk through this cycle. You will be introducing the words *percolation, permeability, groundwater flow, zone of aeration, zone of saturation,* and *water table.*

5. Have students read and complete "The Water Cycle" Concept Card after you have talked through the processes. (If you feel it's necessary, brainstorm on the 3 forms of water and where they might be found before they come up with their own ideas.)

Activities:

On The Trail

These are designed to be discovery style lessons, with little direct instruction other than that given during the demonstration. Explain to the students they will be moving from station to station, following the directions and completing the activities and Concept Cards as they go.

Below is an explanation of each of the activites at each of the stations, and the expected results.

Concept Card - EVAPORATION

Students will clip up two handerkerchiefs, one in the sun, and one in the shade. They will move on to the other stations and come back to this after completing the others. Expect the handkerchief in the sun to dry faster. The student's explanation should mention the water molecules changing from a liquid to a gas as heat from the sun warms the water in the handkerchief. Examples they might find could include water evaporating from the creek, a pond or their skin!

Concept Card - TRANSPIRATION

This activity asks students to gently cover the leaves of a plant with a plastic bag. Again, students move on to the next stations and come back to this after completing the others. Results should show moisture in the bag, due to water in the plant being heated by the sun and and escaping through the leaves as gas. This also demonstrates the process of condensation, as the water vapor (gas) that has left the plant condenses inside the bag - but that process is best demonstrated through the following activity.

Concept Card - CONDENSATION

Here the students change water from a gas to a liquid. Their breath on the mirror is warm , and the metal mirrors are cooler. When their breath hits the mirrors, the colder temperature causes the water in their breath to change from a gas to a liquid and form condensation on the mirrors.

Concept Card - PRECIPITATION

Students should accurately read the rain gauge, record the level and make a prediction on the possible amount in the gauge next week. You will need to arrange for the gauge to be check again in one weeks time. Have students check their predictions. While still out at the study station, students should find evidence of precipitation nearby and sketch it on their card.

Concept Card - PERCOLATION

This activity asks the students to discover the meaning of percolation by pouring water through a can into the soil, and timing how long it takes all the water to percolate down into the soil. The speed of percolation will depend on the permeability of the ground selected. The coffee cans should be inserted at least half way into the soil so the water that is poured in doesn't flow outward from the bottom of the can rather than downward. Students should find that the water doesn't percolate through the mud as fast as the gravelly ground, because of a lack of air space around the tiny particles and the high content of water in the mud.

Concept Card - GROUNDWATER FLOW

At each PVC pipe students will lower the conductivity meter down until the probes reach the water level. When the probes touch the water they will conduct an electrical current, which will register on the meter. As soon as the meter reacts, one student should check the depth marking on the wires and record in the appropriate place on the Concept Card. Be sure to subtract the length of wire in the PVC pipe, but still above ground level. Repeat with each pipe. After recording all levels, students will change the depth from feet to inches. (So 3 1/2 ' will now be 3 1/2 ") On the sketch, students will measure and mark the depth of the water level (in inches) at each pipe. To find the water table profile, they will connect the depth levels on the sketch. Expect the profiles to be sloping toward the creek. If they don't, it may be because the area is a flat flood plain, down slope from the higher ground water table of the Jordan Creek watershed, or the creek level may be so high it is flooding back into the water table.

Concept Card - SUMMARY

Responses on the summary card should be similar to the following:

1.What is an example of condensation? (Clouds, fog, foggy car windows, etc...)

2. Explain in your own words how clouds are formed. (Students should mention that when warm air which contains water molecules comes in contact with colder air, the water molecues contract and grow larger, turn from a gas to a liquid.)

3. How does transpiration work in the water cycle? (Heat causes water molecules in the plants to expand and change to a gas. As a gas they escape from the leaves of a plant into the atmosphere)

4. List as many natural forms of water you can think of. (Rain, snow, drizzle, ice, clouds, streams, lakes, sweat, etc...)

5. Where does the water that percolates down into the ground go? (It fills up the spaces between the particles of soil and rock.)

6. From what parts of the water cycle do humans get their fresh water? (Rain, streams, groundwater)

7. Which parts of the water cycle do the animals in and around Jordan Creek need? (The creek, rain, evaporation of sweat.)

8. Which parts do the plants need? (Rain, groundwater, transpiration)

9. Why is it important that Jordan Creek keep flowing year round? (To insure the inhabitants of Jordan Creek watershed have the conditions they need to survive.)

10. Check to see that the sketchs are labeled with the water moving in the correct direction.

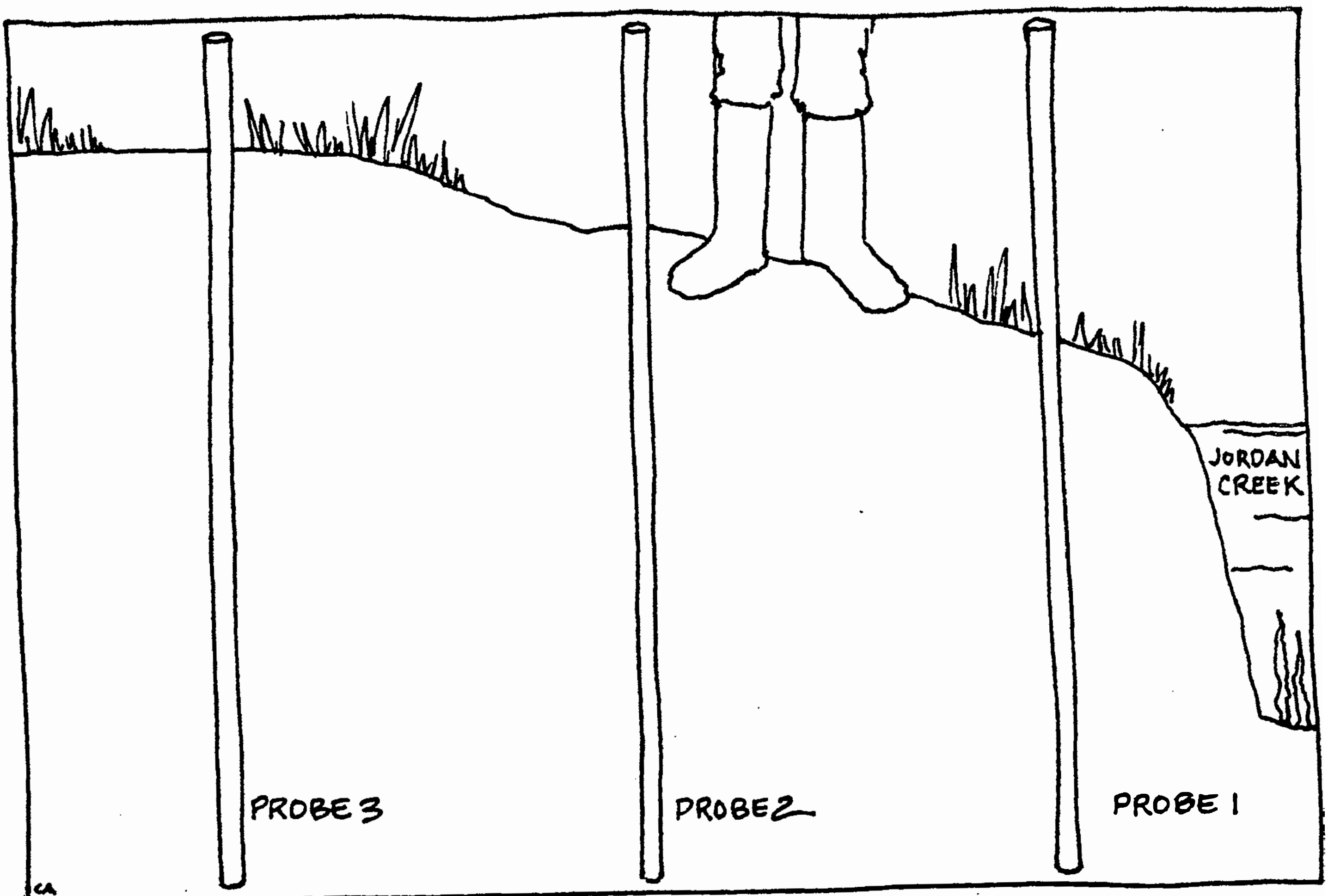
Sources:

Lingelbach, Jenepher, Hands-On Nature, Vermont Institute of Natural Science, Woodstock Vermont 05091

Van Matre, Steve, Sunship Earth, American Camping Association, Martinsville, Indiana

Galle, Janet R., Warren, Patricia A., Ecology Discovery Activities Kit, The Center for Applied Research in Education, West Nyack, NY 10995

COPY ON BACK OF CONCEPT CARD - GROUNDWATER FLOW



CONCEPT CARD
THE WATER CYCLE

Water is made up of many molecules. You might think of these molecules as very very tiny pieces. These molecules of water always exist, but depending on how fast they are moving, the form they are in can be a liquid, gas or solid.

Think of some examples of where you can find water in each of its forms and list them below :

Liquid:____

Gas: ____

Solid: ____

Water is always moving. It leaves an area, and it always comes back. We would soon run out of fresh water if our earth did not have a way of using it over and over. A ________________is something that happens over and over again.

Water is moved around our earth, from one place to another through: EVAPORATION, TRANSPIRATION, CONDENSATION, PRECIPITATION, PERCOLATION, and GROUNDWATER FLOW .

------- cut here ---------------------- cut here ----------------

CONCEPT CARD
EVAPORATION

As you stand here, the water is leaving Jordan Creek, and going into the air. This happens when the energy from the sun heats molecules of water, making them move faster. Some of them move fast enough to escape from the surface of the water and join the other gases in the air as *water vapor*. You could think of the water vapor as being in smaller pieces; it has changed from a liquid to a gas to become part of the atmosphere. This process is called ____________________. Lakes, oceans, rivers, soil and animals (including humans) all lose water in this method from their surfaces.

ACTIVITY:

Select 2 handkerchiefs; wring them both out. Hang one of the handkerchiefs on the clothesline in the sun and one in the shade. Which do you think will dry faster? __________________ Move on to the next station. Come back to check your towels after completing the other stations.

Explain how evaporation effected the towels:

____

____

Look around and find another example of evaporation. Sketch your example on the back of this card.

CONCEPT CARD
TRANSPIRATION

Like every living thing, plants also have water in them. Since we know water is always moving, it must have a way to leave the plants. This works much like evaporation, where the water molecules move into the air. On a warm, dry day the water molecules in the plants will move farther apart until they become a gas and escape into the air through the plant's leaves! The escape of water from plants and into the air is called: ______

______________________.

ACTIVITY:

Gently cover leaves of a plant with a small plastic bag. Wrap a twist tie around the opening to close off the bag. What do you think you will happen inside the bag?______________________________

____

Proceed on to the next station. You will check your plant after circulating through the other activities. Describe the results of covering the leaves:

____

____

-------- cut here ------------------------cut here ----------------

CONCEPT CARD
CONDENSATION

The warmed water which has evaporated from the surface of the earth begins to cool as it rises higher in the atmosphere. As it cools,the many molecules within the water come closer together and become attached to each other very tightly. This is the process of changing from a gas to a liquid. When this happens, millions of tiny water droplets are formed, which we can now see. All these tiny droplets together form clouds. This process is called ______________________.

ACTIVITY:
To form sort of a cloud in the same way that the clouds in the air are formed, take the metal mirror from the container. Breath out on the mirror. Everybody take a turn so you can see what is happening. What happened?

____

Think what the temperature is like up on a high mountain. How is the mirror similar to that? ___________

____

Remember how evaporation occurs. How is your breath like evaporation? ______________________

____

Explain in your own words how breathing on the mirror is like clouds forming in the air: _____________

____

CONCEPT CARD
PRECIPITATON

The water molecules in the clouds continue to attract more and more molecules to themselves. As they become larger and heavier they begin to fall as rain, or if it is cold enough in the clouds, they become snow, sleet, or hail. Rain, snow, sleet and hail are all types of ____________________, which is the method of returning water to the earth from the air.

Our most common form of ______________________ in Juneau is ____________________!

ACTIVITY:

Record the total inches of precipitation in the rain gauge: ____________________

How much do you think will be here at the end of the week? __________________

Find another sign of precipitation in this area, and sketch it on the back of this card.

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CONCEPT CARD
PERCOLATION

When the precipitation falls to the earth, we can follow it in several different directions. It may fall as snow and add to the Juneau Icefield, or it may fall over Jordan Creek and add to the water there. If rain falls on ground that is hard, or is already full of water it runs over the top of the ground. Only when the rain falls above ground that is permeable, will it ________________________ down through the soil and into the earth. In the ground, the water keeps moving downward as long as there is air space between the soil and rock particles for the water to move into.

ACTIVITY:

Firmly push the coffee can half way down into the ground. It will take some gentle twisting and turning to sink it in. Fill the container with water and pour it into the can. As soon as the water is in, begin the timer. Keep the timer going until all the water has peroclated out of the can.

How long did it take?____________________________________

Would it take less or more time in a muddy area? ________________ Try it and find out.

Which was it ? LESS or MORE?

Why do you think it took a different amount of time than when the can was in the gravel?

____

____

CONCEPT CARD
SUMMARY

Based on what you learned from the Concept Cards and the Activities, answer the following questions:

1.What are some examples of condensation?______________________________

____

2. Explain in your own words how clouds are formed:______________________________

____

3. How does transpiration work in the water cycle? ______________________________

____

4. List as many natural forms of water you can think of: ______________________________

____

5. Where does the water that percolates down into the ground go?______________________________

____

------------------cut here --------------cut here --------------

CONCEPT CARD
SUMMARY
(Activity - continued)

6. From what parts of the water cycle do humans get their fresh water? ______________________________

____

7. Which parts of the water cycle do the animals in and around Jordan Creek use? ______________________________

____

8. Which parts do the plants use? ______________________________

____

9. Why is it important that Jordan Creek keep flowing year round? ______________________________

____

10.Sketch your example of the water cycle on the back of this card. Label each part of the cycle and use arrows to show the direction the water is moving. Have Fun!!

Unit #7

JORDAN CREEK WATERSHED

Unit Introduction:

A stream's inhabitants are affected by everything that happens in the area drained by the stream. This area, called a *watershed*, is a geographic and ecological unit which has political importance.

Where does Jordan Creek come from and where does it go? Students first construct a model from a topographic map, then apply the watershed concept to Jordan Creek. They outline and measure the Jordan Creek watershed, calculating the total amount of precipitation it receives in a year.

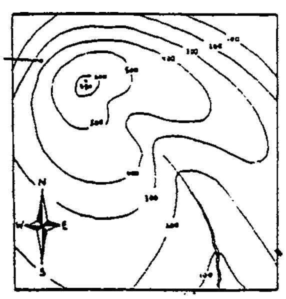
Who owns the Jordan Creek watershed--and what do they plan to do with their land? In the final lesson of the unit, students research land ownership and land use plans, building on the orientation provided by "Habitat History".

Related Curriculum:

- Science (geology, weather & climate, SeaWeek: fish habitat)
- Social Studies (landforms and geographic features, map scales, latitude and longitude, citizens' rights and responsibilities)
- Art (drawing)
- Math (area measurement)
- Language Arts (interviews, writing)

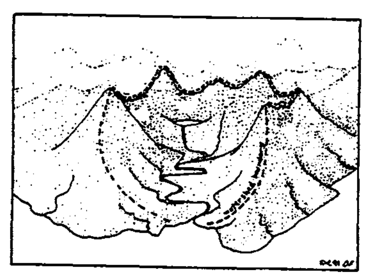
Aquatic Education Goals:

A mapping study of the Jordan Creek watershed provides a foundation for understanding and caring about stream habitat.



Lesson Plans Included:

Lesson #1: What's a Watershed?
Lesson #2: Jordan Creek Watershed
Lesson #3: Who Owns Jordan Creek?



Lesson #1
WHAT'S A WATERSHED?

Season: Any

Setting: Classroom

Time: 1 hour

Subjects: Science (geology, weather & climate, SeaWeek)
Social Studies (landforms and geographic features, map scales)
Art (drawing)

Materials:

In The Kit
- Metric topographic map for display
- Laminated model templates for building mountain and watershed models
- Contours worksheet master

Supplied By Teacher
- Clay for building the models

Teacher Background Information:

Why use topographic maps?
From hikes and fishing trips to fish habitat and forest plans, Alaskans work and play with maps. The southeast Alaska landscape is a powerful presence in our lives. Maps help us develop a sense of place and belonging. Perhaps "map-literacy" should be a goal for all Alaskans; maps are the language of our dreams and our plans.

The mysterious shapes of mountains and valleys unfold on the pages of good maps. The southeast Alaskan landscape is a book your students can read, but first they must train their eyes. This lesson uses large scale simplified maps and models to help your students see the mountains in maps. A topograhic map will come alive for a student who uses it to build a model.

Contour lines on a topographic map connect areas of the same elevation, or height above sea level. The contour interval on a topographic map is the change in elevation between contour lines. By cutting out shapes according to each contour line and layering them with balls of clay, you can build a model from a topographic map. Doing this will help your students to visualize landforms represented by contour lines on maps.

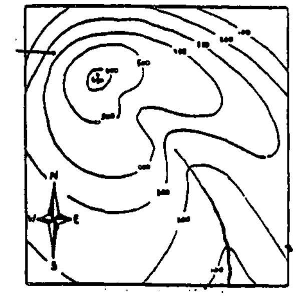
What is a watershed?
The commonest definition of a watershed is *the basin-shaped area drained by a stream.* A watershed includes tributary streams and area of surface runoff and groundwater flow reaching the stream. It is bounded by the high points and ridges that surround the drainage basin.

Why study watersheds?
Watersheds are nature's "counties". They divide land into discrete ecological units. Watersheds often define the home ranges of animals and used to be very important in defining the territories of human family, village and clan groups.

How about Glacier Valley and Mendenhall River. The eastern part of the valley is drained by Duck and Jordan Creeks, while the west (and now the glacier) is drained by the larger Mendenhall River. Our elementary school areas roughly correspond to watersheds!

Since nearly everything that happens in a watershed can affect its stream, watershed studies help us to see how stream life is influenced by our actions. Once your students are aware of the Jordan Creek watershed boundaries, they can help to protect the fish that live within their stream.

You can tell how steep the mountain is by the distance between the lines.....



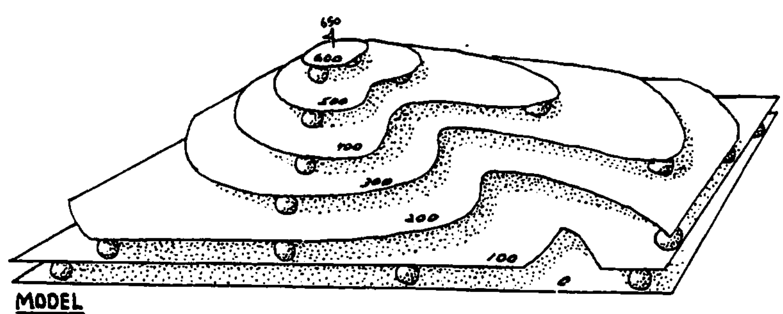
Maps that show mountains this way are called *topographic maps*. Lines that show the shape, or contours of the land are called *contour* lines.

Diagnose:

Put up a large format topographic map and ask: "How could you build a model of a mountain from its picture on a topographic map?" Write down their ideas.

Activity:

Make a mountain model from a contour map, using clay balls between layers of laminate, paper or cardboard. A template for cutting out your paper layers is included, along with a "map" of the imaginary mountain. Or you can use the laminated layers already cut to size (and deprive your students of part of the construction process!)



MODEL

Pass out worksheets and go through the introductory explanations and exercises together. Students will use the model and its map to answer questions on the first half of the worksheet. The worksheet defines *contour interval* and *elevation*.

Before completing the second half of the worksheet, pause to discuss the model with the students. Ask: "Where does rainwater go after it hits the ground?" Lead them to these answers: *Some runs over the surface until it enters the stream. Some soaks into the ground, then flows slowly downhill underground until it emptys into a stream or the ocean. Some evaporates into the air off the ground or off the stream. Some is drawn up into trees and let out through leaves into the air.*

Ask them to locate a stream on the mountain model. Point to the ridges flanking the *basin* on the model. Ask students: "Where does rainwater go when it falls on this side of the ridge? How about the other side of the ridge?" Then have someone point to various parts of the basin and ask the class if the rain that falls in each spot would enter the stream. Ask someone to outline with their hand all the spots where rainwater would flow into the stream. Explain that they have just outlined the *watershed* of the stream.

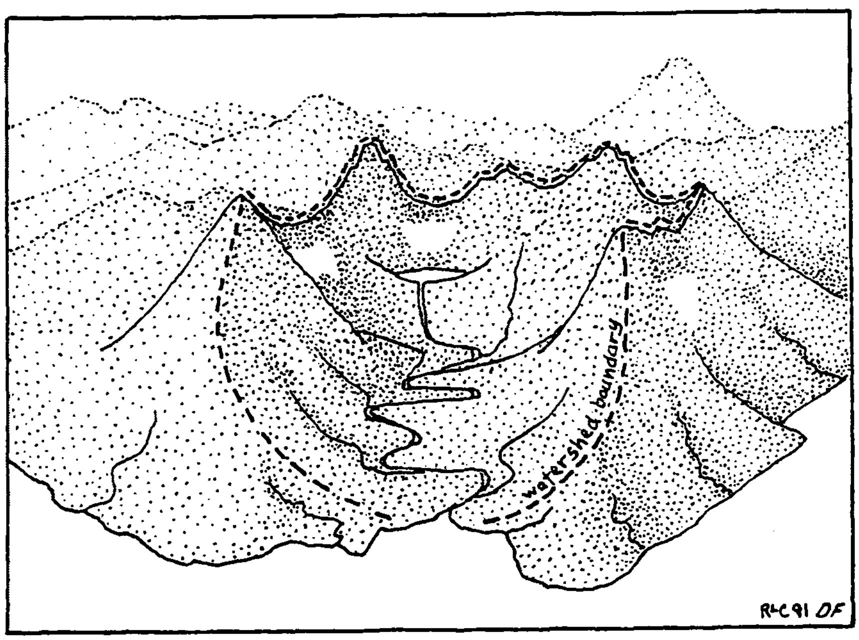
Have your students color and outline some simple watershed sketches on the worksheet.

Summary:

When your students have completed the watershed worksheet, review the questions together. Discuss how the stream and living things within it are affected by what happens throughout its "watershed" using your model. For example, point to a steep place on the mountain. Ask them what would happen to salmon eggs in the gravel if a landslide brought soil into the streamwater? (They would smother from the extra silt in the stream.)

Additional Activities:

Rig up your watershed to "shed" water by placing plastic wrap over your model and pouring water over it. (Make sure there is a tray underneath!) Where does the water go?



Lesson#2

JORDAN CREEK WATERSHED

Season: Any

Setting: Classroom

Time: 1 hour

Subjects: Science (weather & climate)
Social Studies (landforms & geographic features, map scales, latitude and longitude)
Art (drawing)

Materials:

In The Kit
- B&W 8 1/2x11 metric topographic map master
- Acetate grids to measure watershed area
- Jordan Creek watershed worksheet
- Metric topo key with watershed drawn in

Preparation:

Copy metric topo map and watershed worksheet.

Teacher Background Information:

How do we find the boundaries of the Jordan Creek watershed?
The watershed is clearly bounded on the east by the ridgetop of Thunder Mountain and on the north by a low ridge arching across the valley floor. Jordan Creek arises in the Mendenhall Glacier's Little Ice Age terminal moraine, a pile of rubble plowed up by the glacier! The braided headwaters are a relic of the time over 200 years ago when Jordan Creek carried water streaming from the melting Mendenhall Glacier.

It is trickier figuring just how far west the drainage extends. No doubt the watershed is closely interfingered with that of Duck Creek (to the west). Since much of the water is west of the creek is moving through the ground, it is difficult to judge. On our "key" map, we have drawn an estimated western boundary.

What human activities within the watershed have affected the stream?
Practically everything people do in the area may have some effect on the stream, but here are a few key effects for discussions:

Large parts of the watershed were logged in the 40's through the 60's, sometimes right up to the stream bank. This caused erosion. Silt sifted into the gravel used by spawning fish. Some areas were choked with logging debris, degrading fish rearing and spawning habitat.

Near Coho Park, a gravel pit has been used as a dump and is now being filled in. Contaminated water collects in the pit and probably leeches into the groundwater. There has been an attempt to divert water into nearby Duck Creek, to preserve the remaining valuable fish habitat found in Jordan Creek. However, it is likely that Jordan Creek is still affected by this dump.

The bridge to Coho Park has been treated with creosote, which forms an oily (and toxic) sheen on the surface of the water (as of Spring 1990). Other oils probably reach Jordan Creek from roads and driveways in the watershed.

A number of homes within the watershed draw water from wells. This reduces the amount of groundwater available to flow into the stream and may make it harder for fish to find warm spring-fed areas to spend the winter.

Cutthroat trout spend most of their lives in fresh water streams and are particularly sensitive to water quality problems (and over-fishing). Although Jordan Creek still produces good numbers of coho, the cutthroats are not abundant. Jordan Creek is now closed to cutthroat trout fishing.

Vocabulary:

The Lesson #1 list is also useful here.

area - length times width, total outside surface of something (in square units)

grid - a pattern made up of evenly spaced vertical (lengthwise) and horizontal (crosswise) lines, helpful for locating or measuring things

groundwater - water that has soaked into the ground, filling up the spaces in soil and rock, moving slowly downhill

latitude - a region's distance north or south from the equator, expressed in degrees

longitude - angular distance east or west on the globe from a north-south line (prime meridian) passing through Greenwich, England

map scale - part of a map key that shows how distances are represented on a map

metric - a measurement system based on the standard meter (a little more than three feet) in multiples of ten

precipitation - rainfall and snow, often expressed as total amount of water fallen in a certain place over a year's time

surface runoff - water from rain or melted snow flowing downhill over the surface of the ground (it has not yet found its way into a stream)

Lesson - Jordan Creek Watershed

Purpose:

To use map interpretion skills and apply the watershed concept to the Jordan Creek drainage.

Objectives:

Students will:
- draw the boundaries of the Jordan Creek watershed
- calculate the area and annual rainfall of the Jordan Creek watershed
- predict the effects on streamlife of watershed changes and events

Focus:

Ask: "Where does Jordan Creek water come from? How can we find out? If we poured water on the ground outside the school, where would it go, how would it reach the sea? How about from the highway--or halfway up Thunder Mountain? The top of Thunder Mountain?" Review the definition of watershed. *(A watershed is the area drained by a stream...)*

Ask: "How big is the Jordan Creek watershed? How much rain does it receive in a year?" Write down on the board their guesses and their ideas about how to find out these things.

Diagnose:

Pass out the worksheet and go through the introductory exercises as a class. The worksheet asks your students where a glass of water would go if it were poured in various parts of the Mendenhall Valley. For each Mendenhall Valley location, discuss their ideas about the path a glass of water would take flowing to the sea. Your students will color a simple watershed sketch to review the "watershed" concept.

The worksheet also reviews countour lines. It asks your students to find the summit of Thunder Mountain, then locate the headwaters and mouths of Duck and Jordan Creeks.

Activity:

After reviewing watershed and finding Jordan Creek on the map, your students will outline the Jordan Creek watershed. The worksheet helps them draw a line up the ridge of the mountain, across the Mendenhall Glacier's Little Ice Age terminal moraine and down between Jordan and Duck Creeks to the sea. Landmarks noted in the worksheet help them find these areas on their metric map.

Using map scale, your students will measure the length of Jordan Creek to tidewater. The worksheet demonstrates how to measure area using a grid and asks your students to place an acetate grid over the map. They will count squares to estimate the watershed area.

The next step is to calculate the rainfall received by the watershed, using the worksheet equations as a guide. Your students will select the appropriate rainfall data for Jordan Creek and multiply the area times the annual rainfall to get the volume of precipitation received by the watershed in one year.

Summary:

Review what happens to the water that falls inside the watershed line as they color in the arrows representing parts of the Jordan Creek water cycle on the worksheet. (Some runs over the surface until it enters the stream. Some soaks into the ground, then flows slowly downhill underground emptying into the stream or ocean. Some evaporates into the air off the ground or off the stream. Some is drawn up into trees and let out through leaves into the air.)

Discuss how changes in the watershed affect the stream and streamlife. For example, what if someone changes their car oil in the driveway and forgets to put a basin under it. The oil escapes and runs into a drainage ditch. Where does it go? Would it hurt the fish in Jordan Creek? What happens when a large parking lot is paved over? What if cans of poisonous paints and solvents were buried in a dump inside the watershed? Or pesticides were sprayed to kill mosquitos in a residential neighborhood? What if the mountainside forest were logged, and the soil in logged areas and roads started to wear away? Where would the soil and silt go? *(into the stream)* Would fish gills get clogged up? *(yes!)* What would happen to fish eggs in the gravel? *(they would be smothered!)*

You may want to briefly explain that most watersheds are protected from some of these dangers by regulations such as buffer strips and fill permit systems. However, in order for protective regulations to work, people need to keep track of what is happening and tell officials that they care about the health of the stream.

Lesson #3
WHO OWNS JORDAN CREEK?

Season: Any

Setting: Indoors, with optional field trips

Time: Flexible--research project

Subjects: Science (Geology, SeaWeek)
Social Studies (landforms & geographic features, map scales, citizens' rights and responsibilities)
Art (poster display)
Language Arts (interviews, writing)

Materials:

In The Kit
- CBJ property ownership maps
- Enlarged aerial photographs
- Topo maps (copies made from previous lesson)
- Jordan Creek wetlands map
- Option: stereograms and stereoscopes

Supplied By Teacher
- Additional materials pertinent to chosen research subjects

Preparation:

You should obtain additional copies of property ownership, wetlands classification and zoning maps for the Jordan Creek watershed. (Contact the city planning office at city hall. You may wish to involve students in this process.)

Teacher Background Information:

How do we learn about land ownership and land use near Jordan Creek?
You will need to obtain additional copies of property ownership, wetlands classification and zoning maps for the Jordan Creek watershed. To do this, contact the city planning office at city hall and tell them what you need. Your class could be involved in this process, writing letters asking for assistance--and thanking those who help them. Bring (or mail) your topographic map with the watershed outlined to the city planning office to help pick out the right maps for your class.

What do we do with these maps?
You may wish to focus on a particular part of the stream--perhaps near the school, the Coho Park area or the highly altered stream mouth areas. Use the maps keys to have your students color-code these maps for easier reading and effect display of these maps. Have your students create a color key and color in the various land categories, working in groups on map sections.

Once they are color-coded, you can more easily see patterns. These maps provide tools for protecting problem areas along the stream. Properly coded and researched, they will make a wonderful display and resource for the school and the community.

You will want to ask a CBJ or Fish & Game official to help your class interpret and simplify the maps and regulations for the Jordan Creek watershed. Your goal is to use these maps to understand and communicate to other people the wetlands protection and permit process for Jordan Creek. The Fish and Game Habitat Division (currently Janet Hall) may be of particular help in interpreting the land use outlook for the Jordan Creek watershed.

Vocabulary:

anadromous stream - a stream used by fish (such as salmon) which also live in the ocean during part of their life cycle

buffer strip - a border left in its natural state to surround and protect an environmentally sensitive and valuable area. Example: a protective strip of trees left along a stream bank in a logged area.

green belt - a narrow strip or "belt" left in a natural state, crossing through a developed area. Green belts provide "highways" and homes for animals and recreation for people

habitat protection - the saving of areas that are needed by fish and wildlife from harmful changes caused by logging, development and other human activities

permit - a document (official paper) granting permission to do something

land use management plan - rules and maps created to guide development and other activities in an area of land in a way that is fair to present and future residents

regulations - rules or systems of rules which control activities

wetland - a wet place, such as a marsh or streamside (floodplain) forest

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Lesson - Who Owns Jordan Creek?

Purpose:

To learn about land ownership and land use of the Jordan Creek watershed.

Objectives:

Students will:

- visualize possible futures of Jordan Creek
- identify land ownership and land use patterns in the Jordan Creek watershed
- discover aspects of land use regulations which are important to Jordan Creek habitat protection

Focus:

Post the enlarged aerial photograph of Jordan Creek. Ask your students: "What do you think Jordan Creek will be like in 10 years? How about 20 years? What do you think may happen in the future within the Jordan Creek watershed that may affect the stream life?" List their ideas.

Diagnose:

Ask: "Who owns the Jordan Creek watershed--and what do they plan to do with their land?" and "How can we find out who owns the land around Jordan Creek?" List their ideas.

"How can we find out answers to all these questions?" Help them develop and list ways to find answers to these questions. A good list would include looking at land ownership maps. City planning and tax maps are good sources of this information.

Activities:

You may wish to focus on one area of the drainage for these activities.

LAND OWNERSHIP

Have students color-code different sections of the city's large-scale land ownership maps of the Jordan Creek watershed, using different colors for private and public land. You may also want to code developed and undeveloped land, businesses and residences. Have them color in their homes, and put all the maps together to form a mosaic of the watershed. Have them pay special attention to undeveloped private lands near the stream.

LAND USE PLANS

Have students locate the watershed on wetlands planning and zoning maps obtained from the city planning office. Have student groups color in the wetlands and zoning categories for the drainage. Option: They could transfer some pertinent information from a part of the drainage from the planning maps onto the land ownership maps.

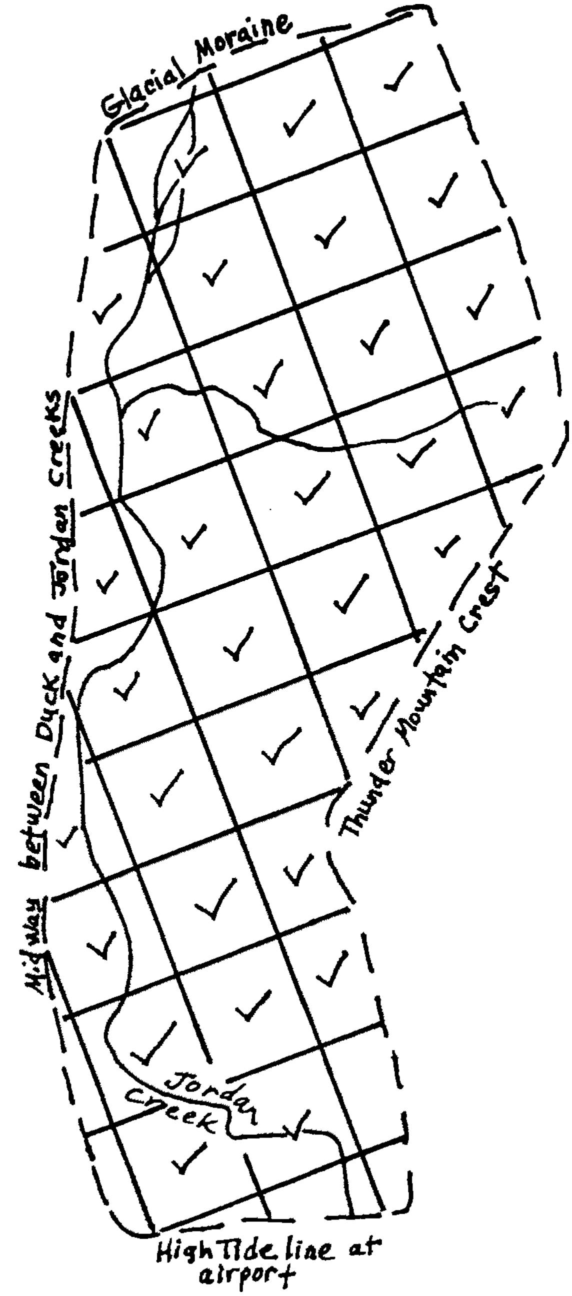
Summary:

Ask a planning official to help your class interpret and simplify these maps for the Jordan Creek watershed. Ask them to explain (in simplified form) the wetlands regulation process as it applies to the Jordan Creek watershed.

Additional Activities:

- Use your colored maps to make a display for the school or community.
- Use projectors to create traced overlays of different kinds of information for part of the watershed area.
- If your class have formed opinions or concerns about the watershed, have them express these ideas in writing. Have them carefully consider submitting them to officials or newspapers. Guide them toward being constructive and fair in their actions concerning the watershed. No point in alienating communitiy members!

Teacher's Guide to Watershed Worksheets

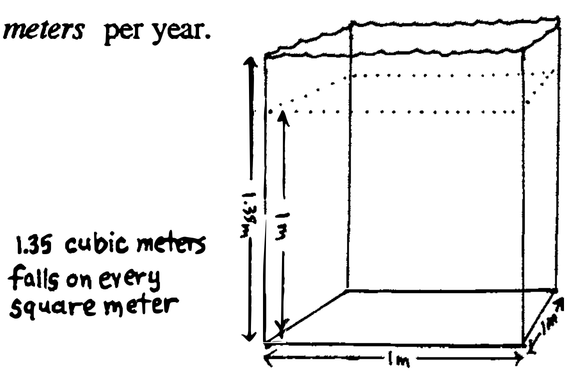


Watershed Area Calculation

Lay down the grid any way you wish over the watershed. Count all squares lying more than half within the watershed. Since each square is 1/4 km^2, multiply by 4 to get the answer in km^2. (We got 32 squares, or 32/4 = 8 km^2.)

Precipitation Calculation

Student should choose Airport data, since that station lies within the watershed. Then, since we must use the same units: 1 km^2 = 1000 m x 1000 m = 1,000,000 m^2. Therefore, 8 km^2 = 8 million square meters in the Jordan Creek watershed. So on each of these square meters falls, on average, 1.35 m (53 inches for airport, versus 92 inches for Downtown) of water every year, for a total of: 1.35 m x 8 million m^2 = 10.8 million *cubic meters* per year.

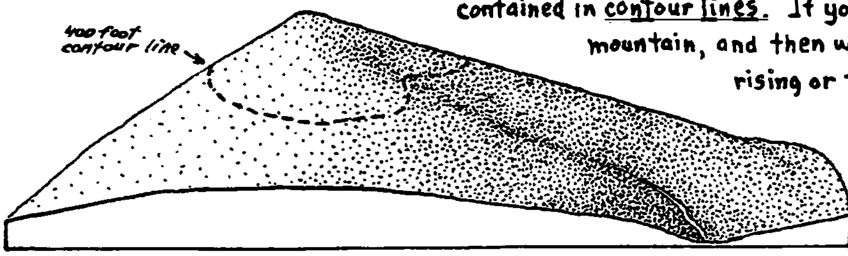


That's about a million dump truck loads!! About 2/5 of this is sent right back into the atmosphere by plants breathing and by evaporation. Another share seeps into the sea through the ground. But Jordan Creek, patiently carrying water day in and day out, transports a lot of it. The units Streaming (#5) and Water Cycle (#6) will give you further handles on the water volume moved by Jordan Creek.

CONTOURS

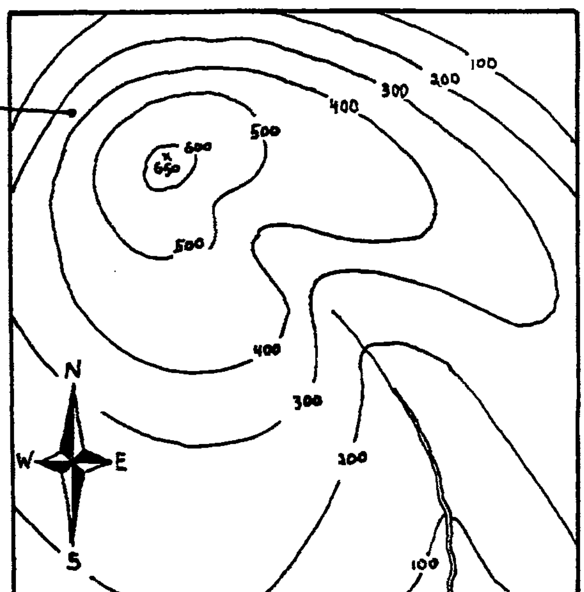
THE SHAPE OF THE LAND

How can we show the shape of this mountain on a map? How can we show that it is 650 feet high, and has a stream draining a valley on the southeast side? All of this information is contained in contour lines. If you climb 400 feet up on this mountain, and then walk around it, without rising or falling, you'd be walking the 400 foot contour line. Find the 400 foot contour on the map below.



MOUNTAIN

Contour lines packed close together show steep slopes. Draw in the gentlest route up the hill. Use a dashed line --- a common symbol for a trail.

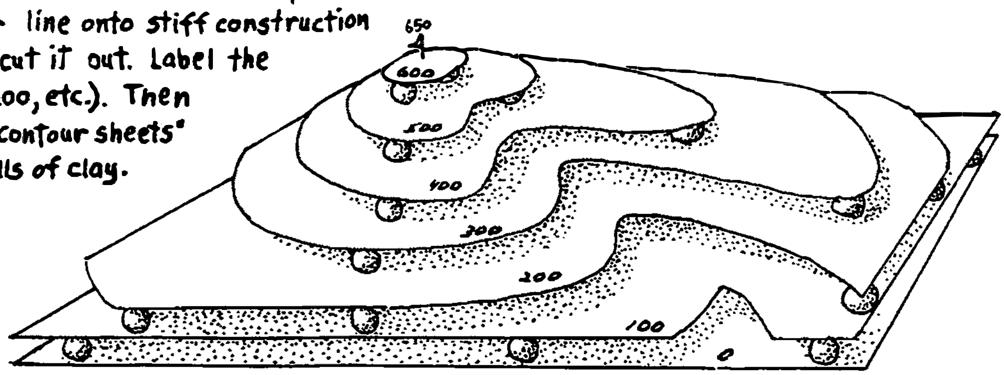


MAP Contour interval 100 feet

The contour interval is how much you climb or drop between contours. If the contour interval on this map were 50 feet instead of 100, how many contour lines would there be on the map? _____

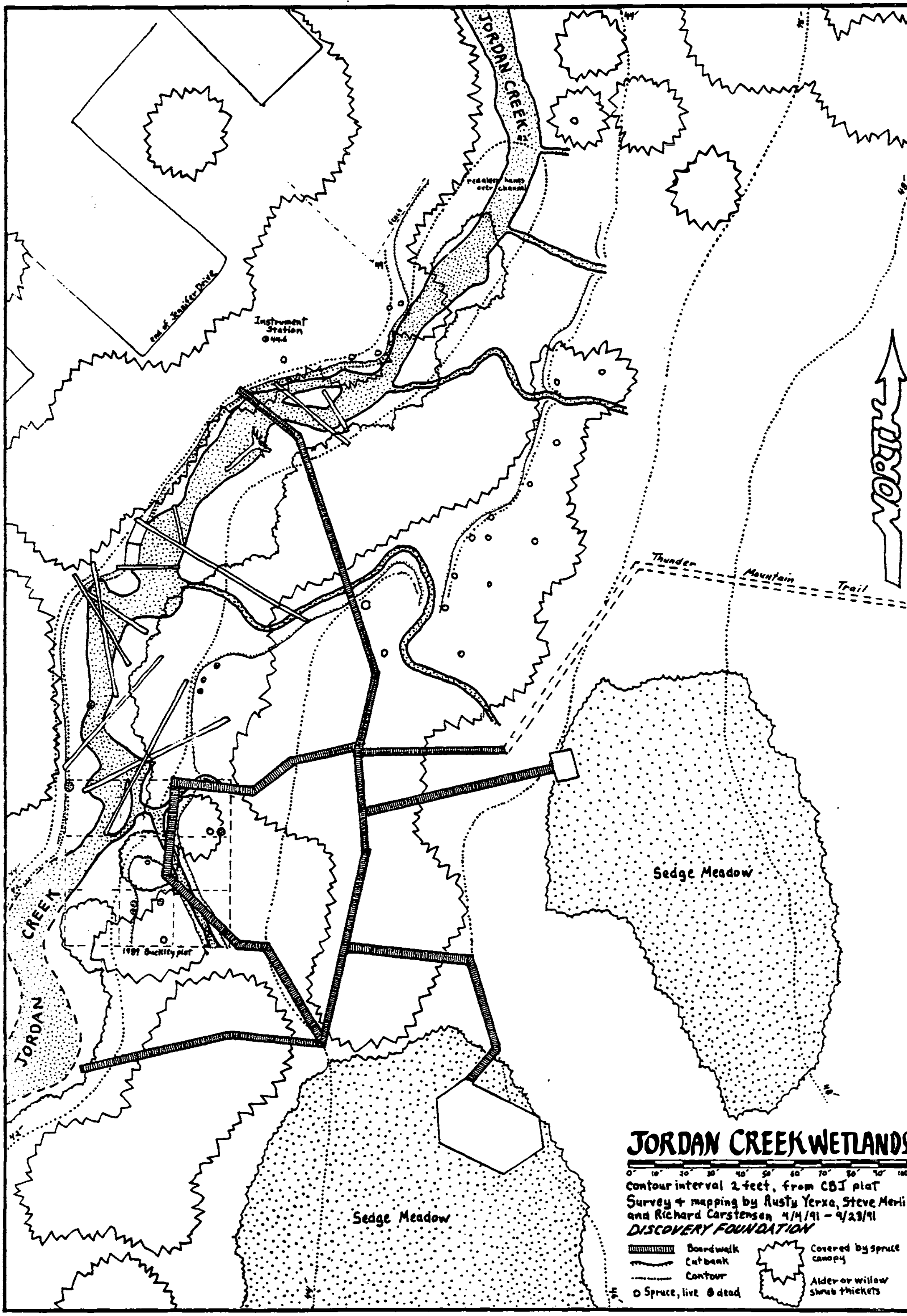
With practise, you can look at contour maps and see exactly how the land is shaped. One good way to learn to read contours is by making a model.

It's easy to make a model from a map. Trace each contour line onto stiff construction paper, and cut it out. Label the edge (100, 200, etc.). Then stack the "contour sheets" on small balls of clay.



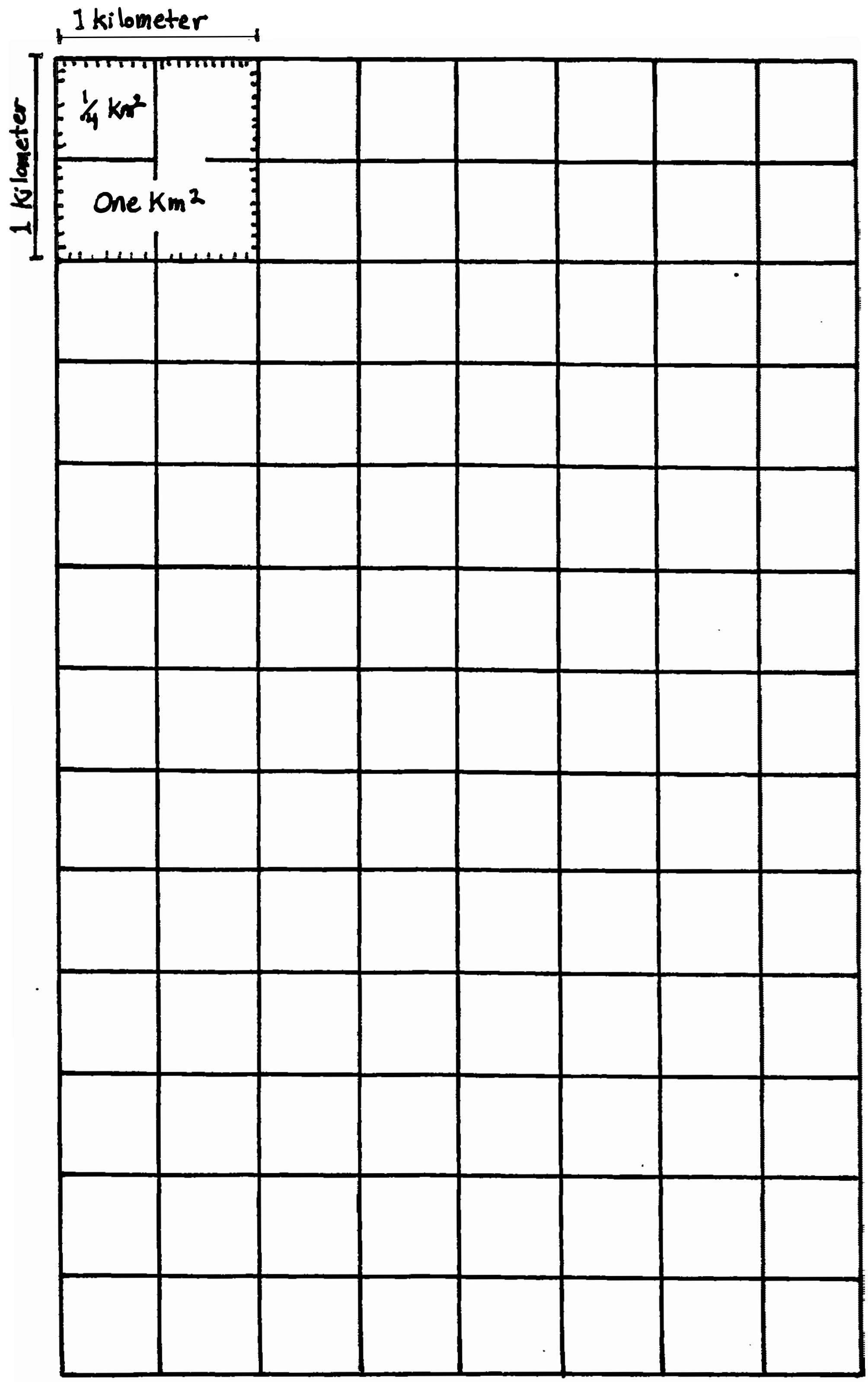
MODEL

RC/CP 91 DF



JORDAN CREEK WETLANDS
0' 10' 20' 30' 40' 50' 60' 70' 80' 90' 100'
Contour interval 2 feet, from CBJ plat
Survey + mapping by Rusty Yerxa, Steve Merli and Richard Carstensen 4/4/91 – 9/23/91
DISCOVERY FOUNDATION
Boardwalk
Cutbank
Contour
Spruce, live dead
Covered by spruce canopy
Alder or willow shrub thickets
JORDAN CREEK
JORDAN
CREEK
Instrument Station
Thunder Mountain Trail
Sedge Meadow
Sedge Meadow
1989 Buckley plot
NORTH

Grid to Measure Watershed Area



Watershed Worksheet #3
JORDAN CREEK WATERSHED

Imagine that you dumped a glass of water out in your yard. Some of that water would evaporate right back up into the air, like the water on your kitchen floor after you have mopped it. Some more of it would be used by plants and breathed into the air, too. But most of the water would flow downhill through or across the ground to Jordan Creek. And the creek would take it to the sea.

Look at your topographic map. What pathway do you think your glass of water would take if you dumped it out at:

- Mendenhall Lake?
- On Thunder Mountain?
- In the Floyd Dryden School grounds?

Draw these pathways on your map. *(Remember, water always flows downhill!)*

Did you notice that each glassful got to the sea by way of a different stream? Each spot is in a different ***watershed***. The valley has three watersheds: one brings water to Mendenhall River, another to Duck Creek, and a third to Jordan Creek.

Let's see if we can draw a line around the Jordan Creek watershed on your map.

It's easy! Just remember that everything uphill from Jordan Creek will be in its watershed, unless another creek gets in the way. And remember how to find the highest points by using contours.

Here's how:

Find the airport on your map. See how Jordan Creek goes under it and enters the sea? Put your pencil on the creek mouth and draw a line to the base of Thunder Mountain and up to the mountain's highest point (882 meters). Next, starting from the word "airport", draw a second line running up between Duck Creek and Jordan Creek. Keep going until your line hits the ***glacial moraine***. (This is a high point left by the Mendenhall Glacier about 200 years ago when it came a long way down the valley.) Then, draw a line to the right along the moraine and then up to the peak of Thunder Mountain.

There! You've now drawn a line around all spots that provide water to Jordan Creek: its **WATERSHED**.

Watershed Worksheet #4
WATERSHED SIZE

On the last worksheet, you mapped the boundaries of the Jordan Creek watershed. But, how big is it? Can you guess its length, for instance? Use this ruler. How many kilometers long is the watershed?_______________ About how wide is it?_______________

Now let's figure out its area. Do you remember from your math that an object's area is its length times its width? So, multiply the measurements you just made; what do you get?

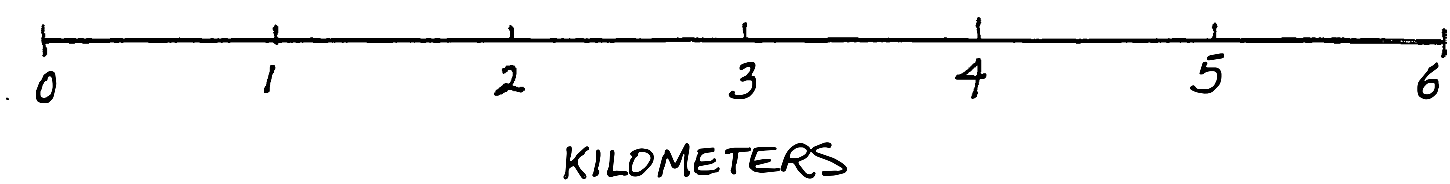
____________ x ____________ = ______________ SQUARE KILOMETERS
LENGTH   WIDTH   AREA

That is a rough estimate, because the watershed is not a tidy rectangle. So, let's get a more acurate figure by using the grid your teacher will give you.

Each square of the grid is one quarter of a square kilometer. Let's see how many of them fit within the watershed by laying the grid over it.

Any way you lay the grid is ok; just make sure the watershed is entirely covered. Now count up all the squares that lie completely or more than half within the watershed, and write this number down:_____________ Now multiply this total by 4 to get the number of square kilometers. What did you get?_______________ How close is this number to your rough estimate?_______________

This is the area that supplies water to Jordan Creek. See how useful it is to know some math?!



Watershed Worksheet #5

PRECIPITATION

(a challenge for good math students)

Do you remember what "**precipitation**" is? Write down a definition:____________________
____

The Weather Service gives us these figures for average annual precipitation:

- Juneau Airport - 1.35 meters
- Downtown Juneau - 2.34 meters

Which of these locations will be most useful for calculating the amount of precipitation for Jordan Creek?____________________ Why?______________________________

Taking the figure of your choice, let's calculate the amount of water that falls in an average year on the Jordan Creek watershed:

First, we have to make units the same. The precipitation figure is in **meters**, so let's put your watershed area figure (from worksheet #4) in meters, too. Each square kilometer is 1000 meters long by 1000 meters wide. Since area is length times width, we multiply these figures together and get: one square kilometer, or one million square meters! (1000 x 1000 = 1,000,000) So, to get the number of square meters in the watershed, multiply your watershed area figure by one million. What did you get?

____________________ x 1,000,000 = ____________________ SQUARE METERS
WATERSHED AREA

This is a figure for **area** of the watershed: length times width. The precipitation figure you chose is for the amount of water that would stack up on a square meter over a year's time. It is a height figure. So, if you multiply your area figure (length times width) by the precipitation figure (height), this gives us the **volume** of water that falls on the whole watershed over an average year, in cubic meters. What figure did you get?

________________ SQUARE METERS X ________________ METERS = ________________ CUBIC METERS
AREA PRECIPITATION VOLUME

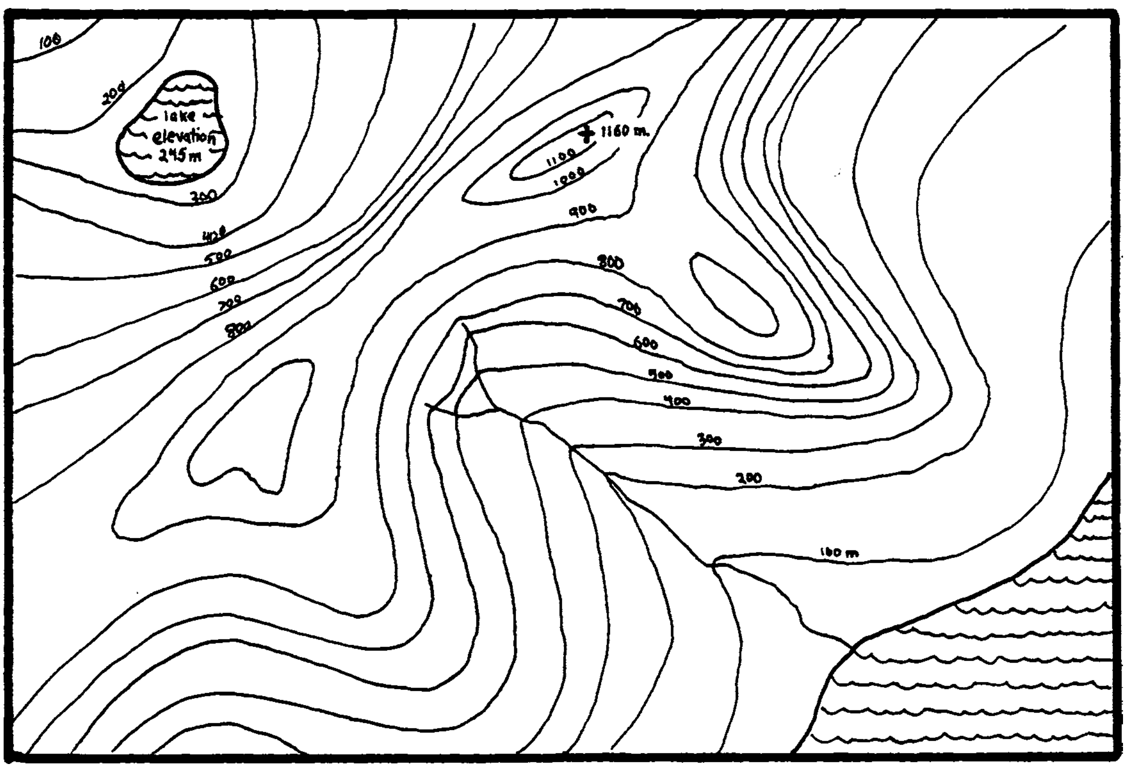
About 2/5 of this amount is put back into the atmosphere by evaporation and the breathing of organisms (including you!). Another part seeps to the sea through the ground. The rest, equal to millions of dumptruck loads, is patiently carried to the sea day after day by little Jordan Creek.

Watershed Worksheet #1
INTRODUCTION

Streams occupy low spots on a landscape. They collect water from a surrounding area, or ***watershed***, and carry it to the sea. Look at the countour map and model mountain you've made. From where on the mountain would your stream collect water? Carefully outline that area on your map. You have just circled the watershed of your stream.

When you study streams, it is very important to know what its watershed is, because anything that happens to the water in that whole area can affect the stream. Sometimes, for example, a stream itself will be well protected, but fish will not be able to live in it because it will get polluted from its watershed.

Here is another topographic map with a stream on it. Can you outline the stream's watershed?



Where would be some safe places to build a factory if you wanted to make sure it had as little effect as possible on the stream?

____

Watershed Worksheet #2
TOPOGRAPHIC MAPS

You've now made a model from flat sheets of paper. Can you see how the edge of each sheet is like a contour line on your topographic map? Maps like this are a great way of describing details of a 3-D mountain on flat paper, but it takes a little practice to understand them.

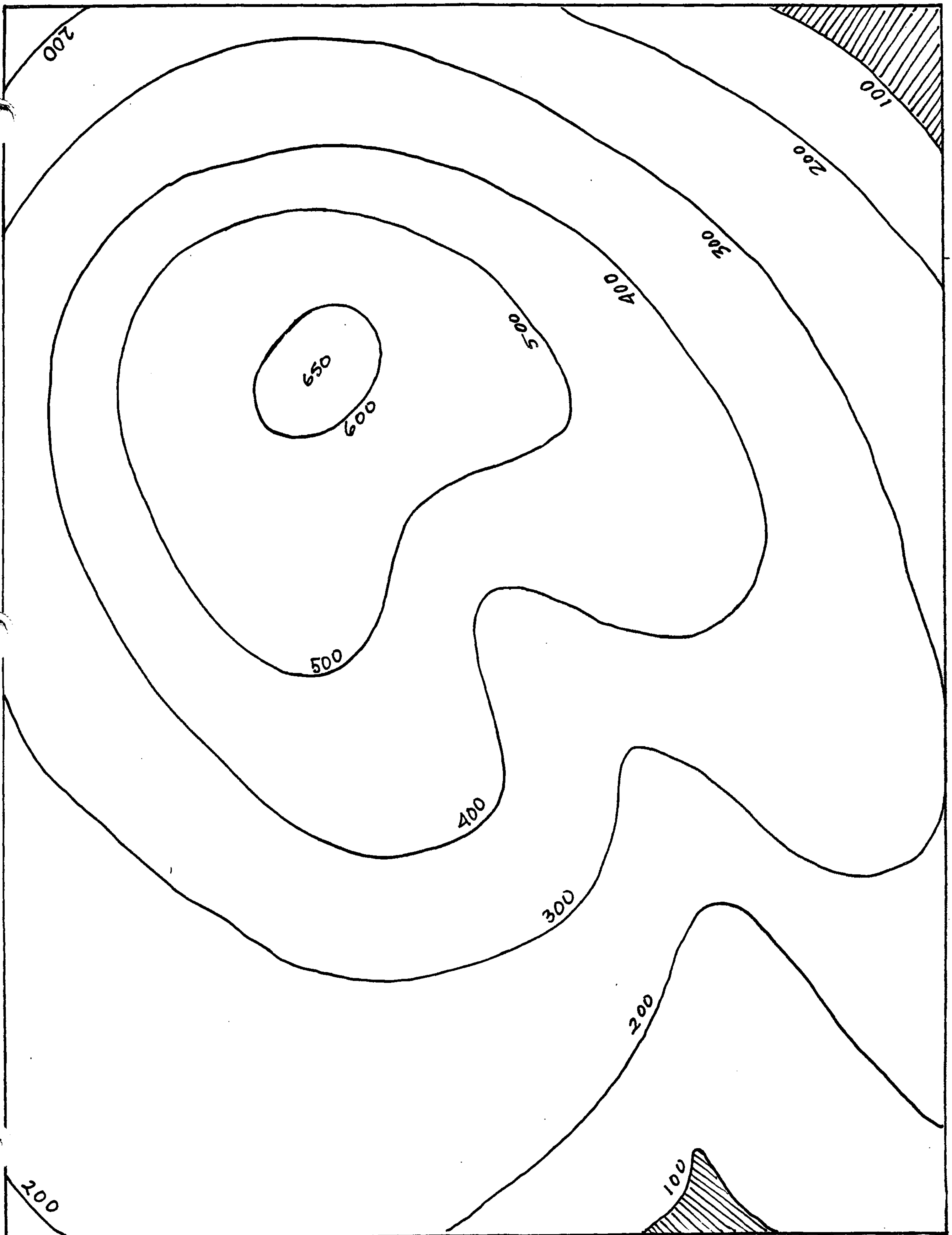
See the numbers on your map and on the model? They stand for the number of meters that particular slice of earth stands above sea level. "Height above sea level" has a special name: ***Elevation***. Sea level is considered to be zero elevation. So, how many meters above sea level is the contour line labeled "300"?______________
How high above sea level is the top of your mountain?_________________

Mapmakers will space contour lines a certain distance apart on a map. This distance is called the ***contour interval***. For instance, if contour lines are 50 meters apart, the contour interval is 50. What is the contour interval on your map?_____________

Look at your model and notice where the mountain is steepest. Can you find the place on the topographic map that represents that part of the mountain? Are the contour lines closer together or farther apart there?_________________________
If you were going to climb a real mountain and you wanted to avoid the steepest part, how could you locate that part from a topographic map? ___________________________________

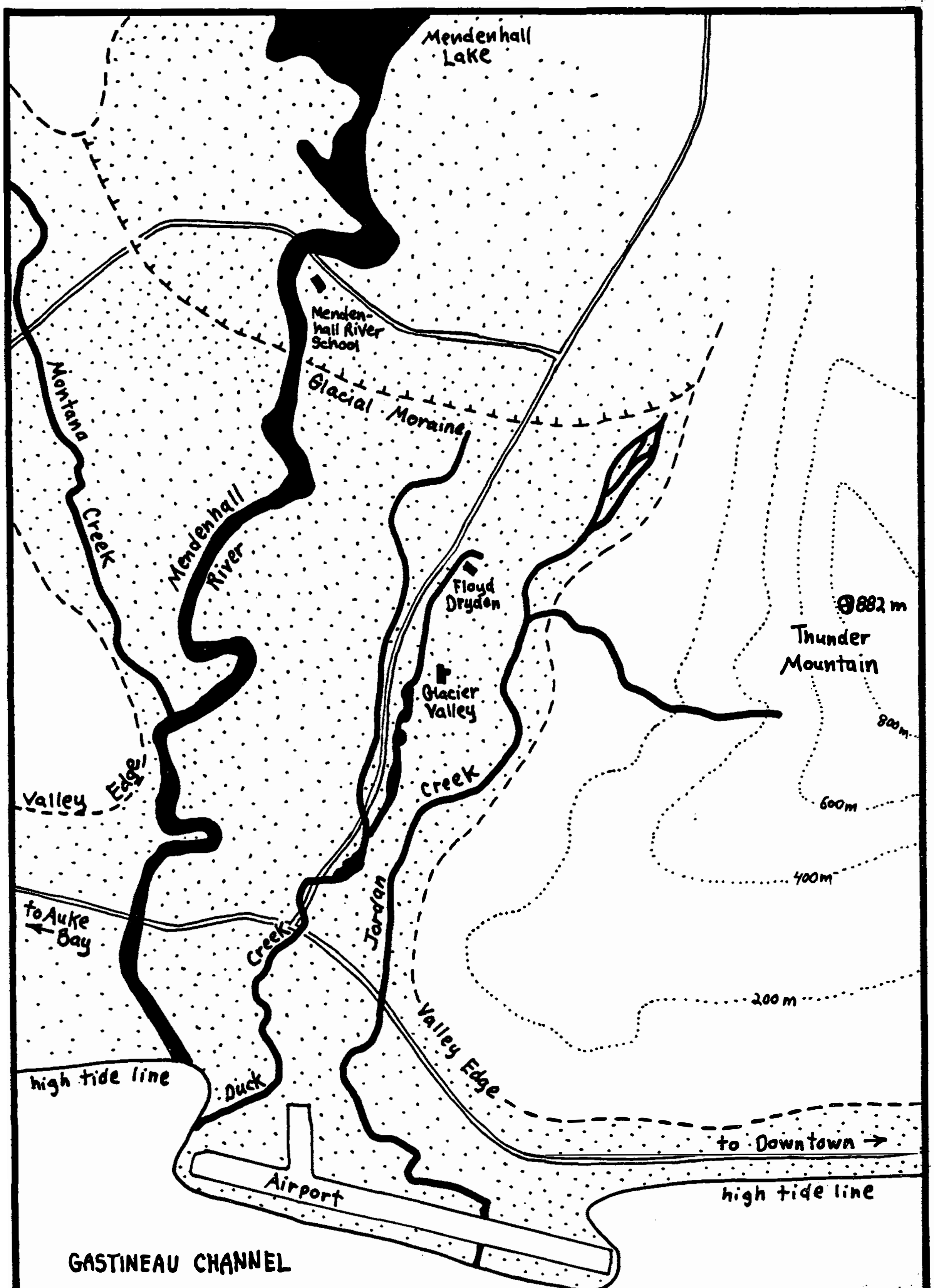
Study your model some more. Do you see that a notch in the contour lines indicates a valley?
Do streams most often occur in valleys?______________
Why?____

On your topographic map, draw in a stream in the place you think there would most likely be one.



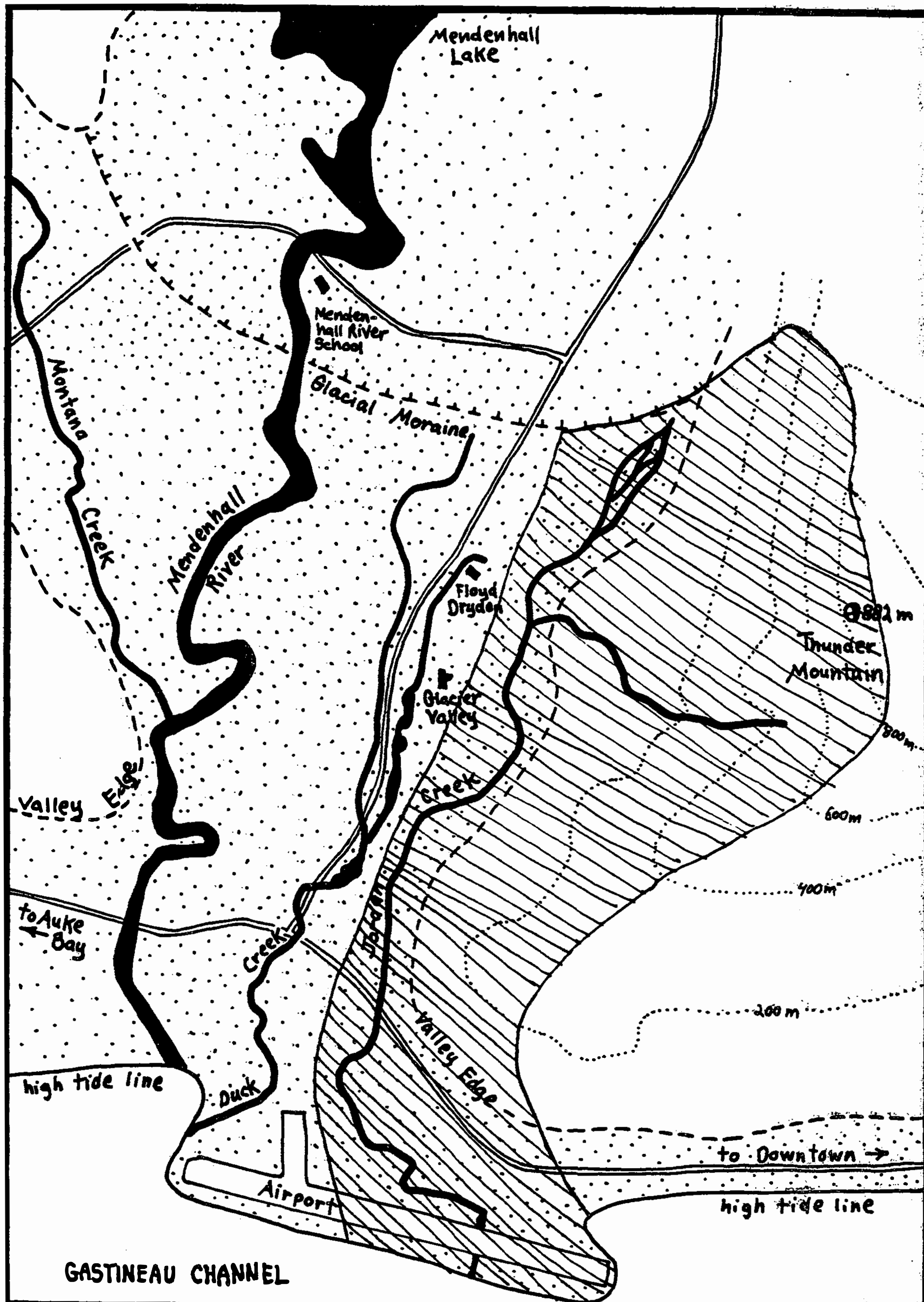
WATERSHED

Metric Topographic Map of Jordan Creek Watershed Area



Metric Topographic Map of Jordan Creek Watershed Area

KEY



Nature studies Curriculum 3-5 (1991)

DISCOVERY FOUNDATION
HARBORVIEW NATURE STUDIES SCHEDULE 1990-91

FALL		**Mapping, natural history of the cemetery area, seeds, surficial geology.**
3rd	**Indoor**	What's natural history? What are maps good for? History of cemetery.
	Field	Visit cemetery sites being mapped by 4th and 5th graders.
	Indoor	Slides; How has Juneau changed? Review field trip on maps.
	Indoor	Seed distribution slides, examine collected samples.
4th	**Indoor**	Introduction to tree mapping.
	Field	Map and measure trees on cemetery plots.
	Indoor	Summary slides - Juneau history, project and color in maps.
	Indoor	Seed distribution slides, strategies in our local plant communities.
5th	**Indoor**	Introduction to contour mapping, explain field methods, practice interpolation.
	Field	Contour mapping on cemetery plots.
	Indoor	Summary slides - Juneau history, interpolate contours.
	Indoor	Surficial geology, profile through Gastineau Channel, intro to stereoscopes.
WINTER		**Mammals, natural history detective work, tracks and sign, landforms.**
3rd	**Indoor**	Mammal skulls, family tree, who eats who, distribution in Juneau area.
	Indoor	Slides: deductions in nature.
	Field	Tracking trip to Fish Creek.
	Indoor	Summary session for field trip.
4th	**Indoor**	Mammal skulls, taxonomic relationships, diet/dentition, distribution in S.E. AK
	Indoor	Mammal tracks (footprints exclusively).
	Indoor	Gaits practice; students imitate animal walking patterns.
	Field	Overnight or day trip to Methodist Camp, combined skiing and tracking.
5th	**Indoor**	Mammal and bird sign (aside from footprints), other N. American relatives.
	Indoor	Fish Creek landforms, Stereogram preview.
	Indoor	Tracking rivers, landslides, beaches.
	Field	Field trip to Fish Creek estuary.
SPRING		**Birds, succession, glacial history of the Mendenhall and Herbert/Eagle.**
3rd	**Indoor**	Primary succession (post-glacial), distribution of glacial features in Juneau area.
	Indoor	Bird families, adaptations, feather games, (songs on tape).
	Field	Birding or succession trip during Methodist Camp overnight.
4th	**Indoor**	Secondary succession (logging, etc.), role of light, Tongass forest management.
	Indoor	Shore and sea bird habitats, (songs on tape).
	Field	Birding or succession trip during Methodist Camp overnight.
5th	**Indoor**	Glacial landforms, emphasis on chosen field site, N. American glaciation.
	Indoor	Terrestrial bird habitats, (songs on tape).
	Field	Birding or landform trip during Methodist Camp overnight.

Winter
missing 3rd Tracks
4th Skulls

TO Harborview Teachers, grades 3, 4 and 5
FROM Richard Carstensen
SUBJECT Fall wrap-up, and winter nature studies schedule

Fall Activities

We did it! The fall nature studies activities are finished. I'm very grateful for your interest and support. And I think we have a strong base for the winter and spring programs.

Attached is a copy of the latest version of the cemetery map, showing locations of plots 1, 2 and 3. Plot 1 is Augustine/Campell/Baxter's. Plot 2 is Jackson/Mercer/Banazak/Minge/Homan's. Plot 3 is Moore/Kotyk/Mitchell's. (Notice that two of these plot numbers have been reversed from those in the introductory letters I sent to fourth and fifth grade teachers at the beginning of the year.)

I originally intended to make models of each of the three plots with a few fourth and fifth graders from each class. We did this with Shirley and Linda's classes after school, but I've run out of steam on the model-making, and have decided to stop with Plot 1. It was extremely useful. Students from Shirley and Linda's classes came in to each third grade class and explained how the field measurements were taken, and turned into this final product. The model is available to any of you who'd like to have it in your classroom for awhile. It's fragile though, so please treat with care.

Also attached is a copy of your class's 18 x 18m plot. It's a compilation from both the fourth and fifth grade data taken on that plot. Please save this plot map and the cemetery map to use in further field studies (winter tracking and spring birding!). I encourage you to visit the cemetery with your class throughout the year. Check on your plot in different snow conditions. Notice raven and crow behavior, first robins, leaf unfurlings, etc.

Making a map is only the first step. Now we need to take advantage of it. Think of ways to use it for math and writing studies. Let me know about these activities.

Winter Schedule

The major subjects for winter nature study are mammals and tracking (all three grades), and landforms (fifth grade). There are three sessions for each grade; two indoor and one outdoor. Please give me a first *and second* choice time for each of the three sessions, in case of conflicts when I compile the schedules. Then, if there are still unresolved scheduling conflicts, I'll meet with you personally to choose another period.

A blank calendar is attached for your use in designating dates and times of winter nature study sessions. Select two 45 minute indoor class periods, and a single 2-hour field period* on any Wednesday, Thursday or Friday marked open (shaded days are holidays, inservices, etc.). I encourage all of you to arrange half-day bus or carpool trips to the following locations: fifth grade to Fish Creek estuary, fourth grade to the Methodist Camp (a Monday or Tuesday would be best here), and third grade to Fish Creek. Because the tracking trips are fairly "glamourous", I think we can hope to attract enthusiastic volunteers. Cinda and I are willing to work closely with you on trip logistics.

When you've designated 6 periods (first and second choice times three sessions), return the calendar to my box. I'll get the completed version back to you as soon as possible. We'll

*90 minutes for third grade

also mail a copy to the folks on our volunteer list, and give you however many copies you need to send home to parents who may be interested. We're shooting for an adult:student ratio of 1:5 for the field activities. Please make it clear to parents that they are welcome to come to class to view the tracking slides, etc., as it will better prepare them for the field.

Rather than trying to meet with all eleven teachers in third through fifth grades for scheduling, I'll be talking to you personally, or in grade-level groups, to further explain what I have in mind for winter, and to incorporate your ideas. Shirley for example has asked that I provide her with worksheets, for review of both the intro to mammals (4th grade talk #1) and tracking (talk #2). She suggests that she not only review the material in my talks, but *preview* it, by putting out animal skulls before I come in, and asking students to figure out what they ate, how big they were, etc. That kind of teacher involvement is wonderful. The kids will get 10 times as much out of the program!

Titles for your winter sessions: (field trips should follow the two intro sessions)

3rd
- indoor #1 mammals (45 min)
- #2 tracks (45 min)
- field #3 Fish Cr. (specify 90 minute period, Wed, Thurs or Fri.)

4th
- indoor #1 mammals (45 min)
- #2 tracks (45 min)
- #3 Camp (specify any 2-hour period on a Monday or Tuesday of the weeks listed on the winter schedule.)

5th
- indoor #1 mammal sign (45 min)
- #2 land forms (45 min)
- #3 Fish Cr. (specify 2 hour period Wed, Thurs or Fri.)

Third and Fifth grade teachers - Please try to coordinate with another teacher in your grade, to "share a field day" (ie, one in the morning, another in the afternoon.) This will make it much more convenient for our volunteers.

Fourth grades - A full day at Methodist Camp is recommended, because of time needed in transport. Remember to reserve skis.

TO Harborview Teachers, grades 3, 4 and 5
FROM Richard Carstensen and Cinda Stanek, DISCOVERY FOUNDATION

THE ALASKA DISCOVERY FOUNDATION

By May of last year, the Discovery Foundation had worked with nearly every third to fifth grade class at Harborview. Many of you are already familiar with our programs. But 4 out of 11 third to fifth grade teachers are new to the Harborview staff this year, so perhaps we should begin with the "Discovery Foundation in a nutshell -- past, present and future."

The past is easy, because we're such a recent development. The Discovery Foundation is a non-profit corporation, an outgrowth of Alaska Discovery Inc, dedicated to environmental education for youth. We're governed by a 14 member board of directors. We've just completed our first annual cycle of activities with kids, beginning last September with the Harborview pilot, and ending with a summer of Discovery Canoe Camps, which took five groups of 5th to 12th graders into wilderness waters accompanied by an educator, an Alaska Discovery guide, and a native tradition bearer.

Throughout the present school year, our main focus will again be at Harborview School. While last year's was a volunteer effort, we are partially funded this year (thanks to Sue Horton!) by Harborview itself, and partly by matching funds raised by the Foundation. The Harborview Nature Studies are described below.

Also during the 1990-91 school year, the Discovery Foundation will conduct a teacher training program, available at no cost (except $35 for an ED 593 credit if desired) to all teachers in the Juneau School District, and to prospective volunteers in our school nature studies projects. "Teaching the Natural History of Southeast Alaska" is supported by federal funds, administered through the State Department of Education. Six classes are scheduled in various aspects of natural history. These classes in most cases will be adult versions of the same subjects to be taught in Harborview grades 3 through 5. In addition to these classes for K-12 teachers, the Discovery Foundation staff will conduct a "site interpretation workshop" at each Juneau's public schools, applying our natural history sleuthing skills to the immediate environment of the school. We hope you'll consider both the classes and site workshops, as a step toward taking over part of the present Discovery Foundation curriculum, freeing us to develop *more* exciting classes (How bout a fifth grade excercise in coring peat bogs!).

Other Discovery Foundation activities tentatively planned for 1990-91 involve curriculum design for the Jordan Creek trail, and assistance for individual teachers in schools other than Harborview (such as Judy Maier, who we'd follow *anywhere!*).

Future plans include expanding (but not diluting!) our Discovery Canoe Camps, and eventually establishing a nature studies program in every Juneau school. As you can imagine, with Foundation board members from Sitka, Angoon and Gustavus, as well as from Juneau, we aren't simply thinking about the CBJ..... But enough of plans for now!

HARBORVIEW NATURE STUDIES

As we review last year's notes, and assemble our materials for the 1990-91 school year, it continually excites us to discover how much we've learned, thanks to *your* enthusiastic participation, and how much *more* we can do, with new information, new resources, and increased support from volunteers. The curriculum in its current form is a fertile blend resulting from (in order of importance): 1) our own backgrounds as naturalists, 2) Harborview's physical setting, and the seasonal cycle (seeds in fall, birds in spring etc.), 3) the interests expressed by teachers we worked with last year, and 4) the requirements outlined in the Juneau School District's curricula for Science, Social Studies, and Environmental Health.

The year-round Harborview program is designed to complement and vastly expand the excitement of Sea Week by building familiarity with our study sites in all seasons, from the dropping of leaves, to tracking on snow, to the first spring bird song. Many Foundation outings teach genuine field research techniques. Students help to gather information that will be passed on to future classes.

Busing and carpooling to distant sites is logistically demanding, especially on the scale of the current Harborview program, which involves about 300 children in 11 classes. So whenever possible we've chosen study sites within easy walking distance of the school. But this proximity is more than simply a matter of convenience. We feel that nature studies begin *where we live*, in the places where we spend the most time. Respect and appreciation for nature begins with a bonding to these specific places, visited often enough to thoroughly understand. Evergreen Cemetery has a rich natural history (albeit a somewhat impoverished understory), and is great for our field projects in mapping, landform interpretation, tracking, and bird song.

SUBJECTS BY SEASON AND GRADE

Fall **mapping, natural and human history of the cemetery area, seeds**
3rd maps, history of cemetery, seed distribution, dangerous plants
4th tree mapping, profiles, Juneau history, seed distribution, community dispersal strategies.
5th contour mapping, interpolation, vertical sections, Juneau history, landform interpretation with stereoscopes

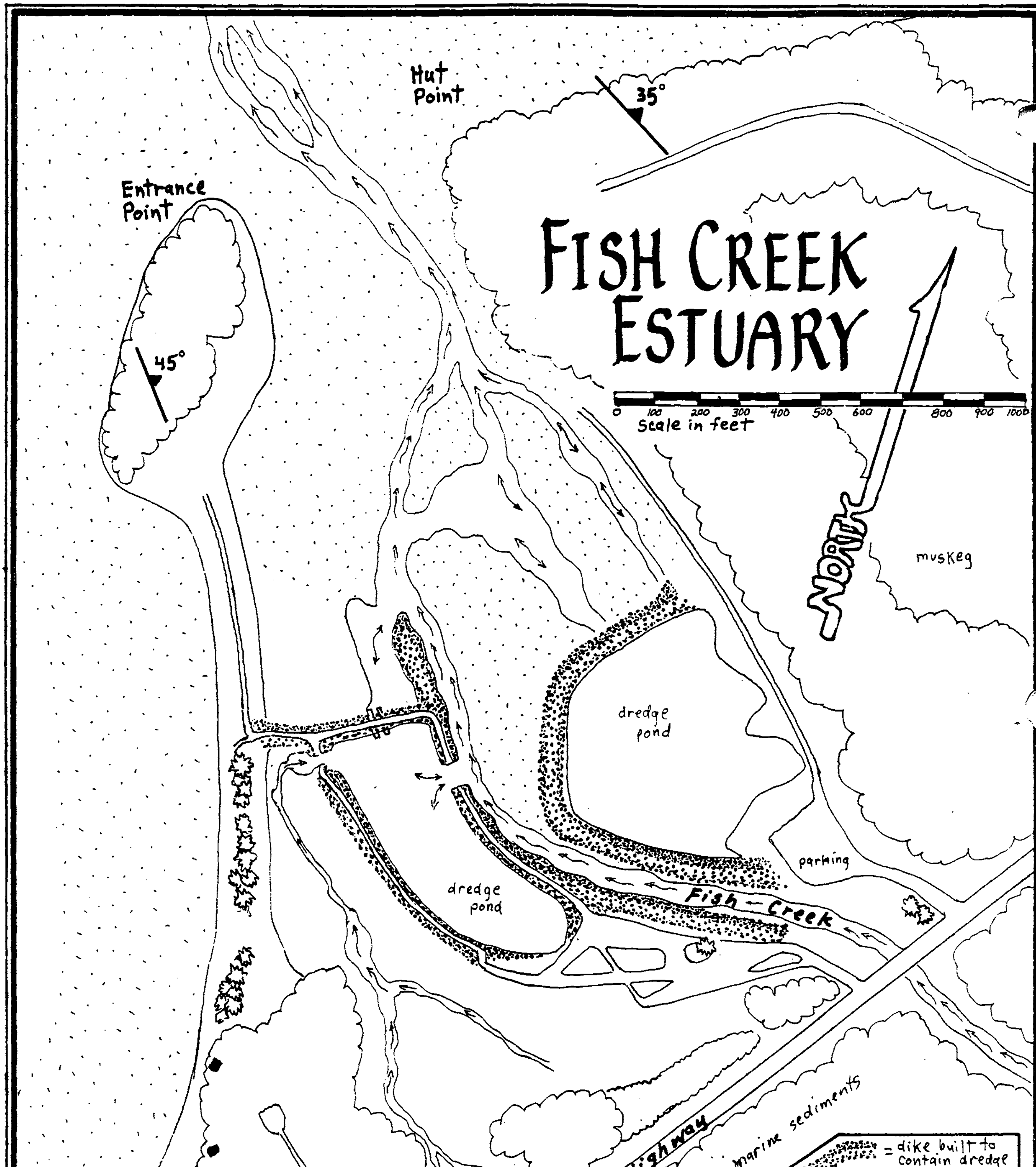
Winter **mammals, natural history detective work, tracks and sign, landforms**
3rd mammal skulls, family tree, who eats who, string web, distribution in Juneau area
4th mammal skulls, relationships, diet/dentition, distribution in S.E. AK, mammal tracks
5th mammal and bird sign, other N. American relatives, tracking rivers, landslides, beaches

Spring **birds, succession, glacial history of the Mendenhall and Herbert/Eagle**
3rd primary succession, glacial features in Juneau area, bird families, adaptations, feather games
4th secondary succession, the Tongass, shore and sea bird habitats
5th glacial landforms, stereograms, N. American glaciation, terrestrial bird habitats

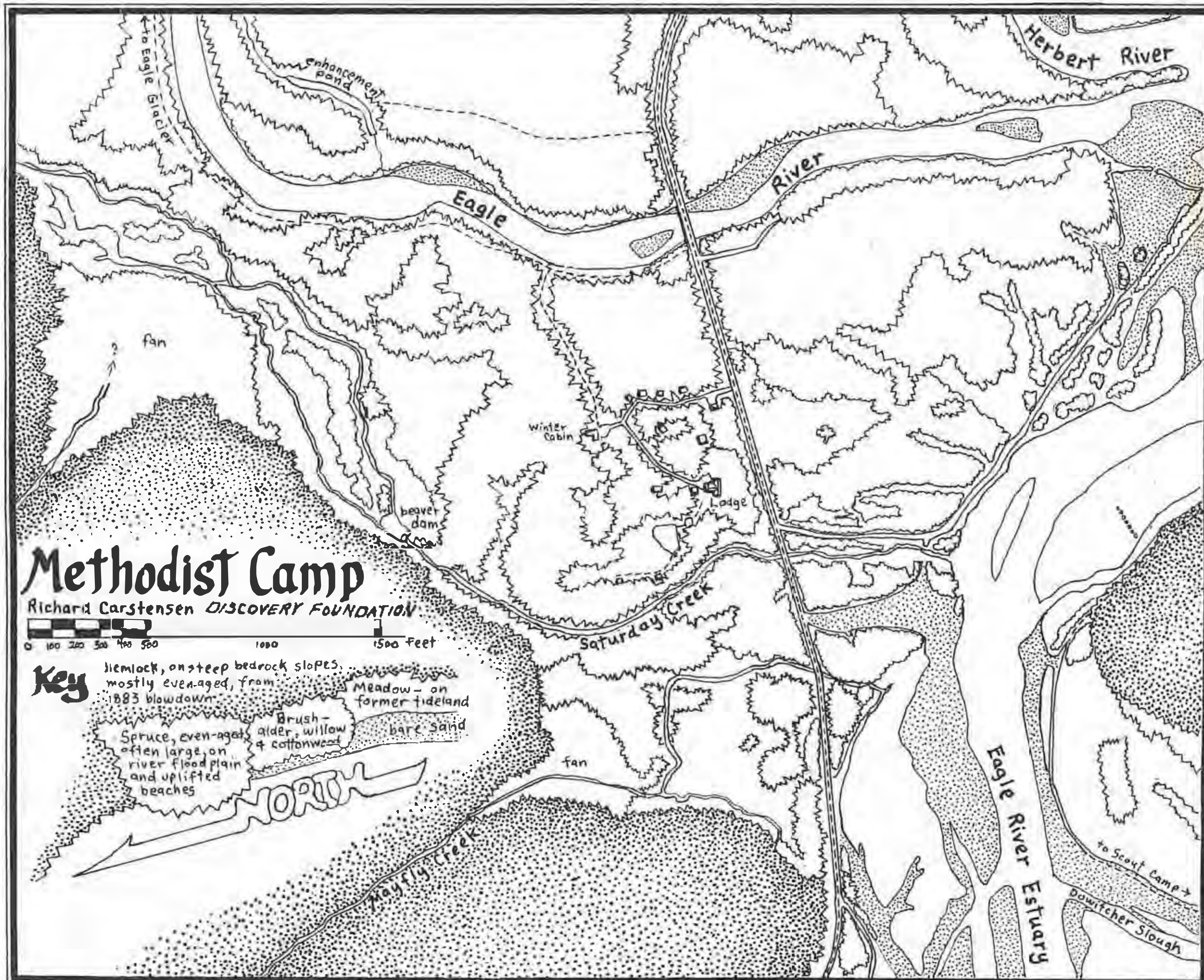
We introduce all field trips with a classroom talk, and often return to summarize what was learned, or to help process gathered data and observations. Meantime, teachers support the Discovery Foundation presentations with review and further excercises. The importance of your support cannot be overstated.

Discovery Foundation days at Harborview will be Wednesday, Thursday and Friday. We are at your service for class and field activities anytime on those days when you'd like to schedule us. For field and for hands-on indoor activities, we prefer to work with only one class at a time, but for some presentations it may work for classes to be combined. A regularly updated calendar will be posted in the teachers' room listing all of the scheduled Foundation classes. Please check this calendar and inform us of any mistakes or necessary changes.

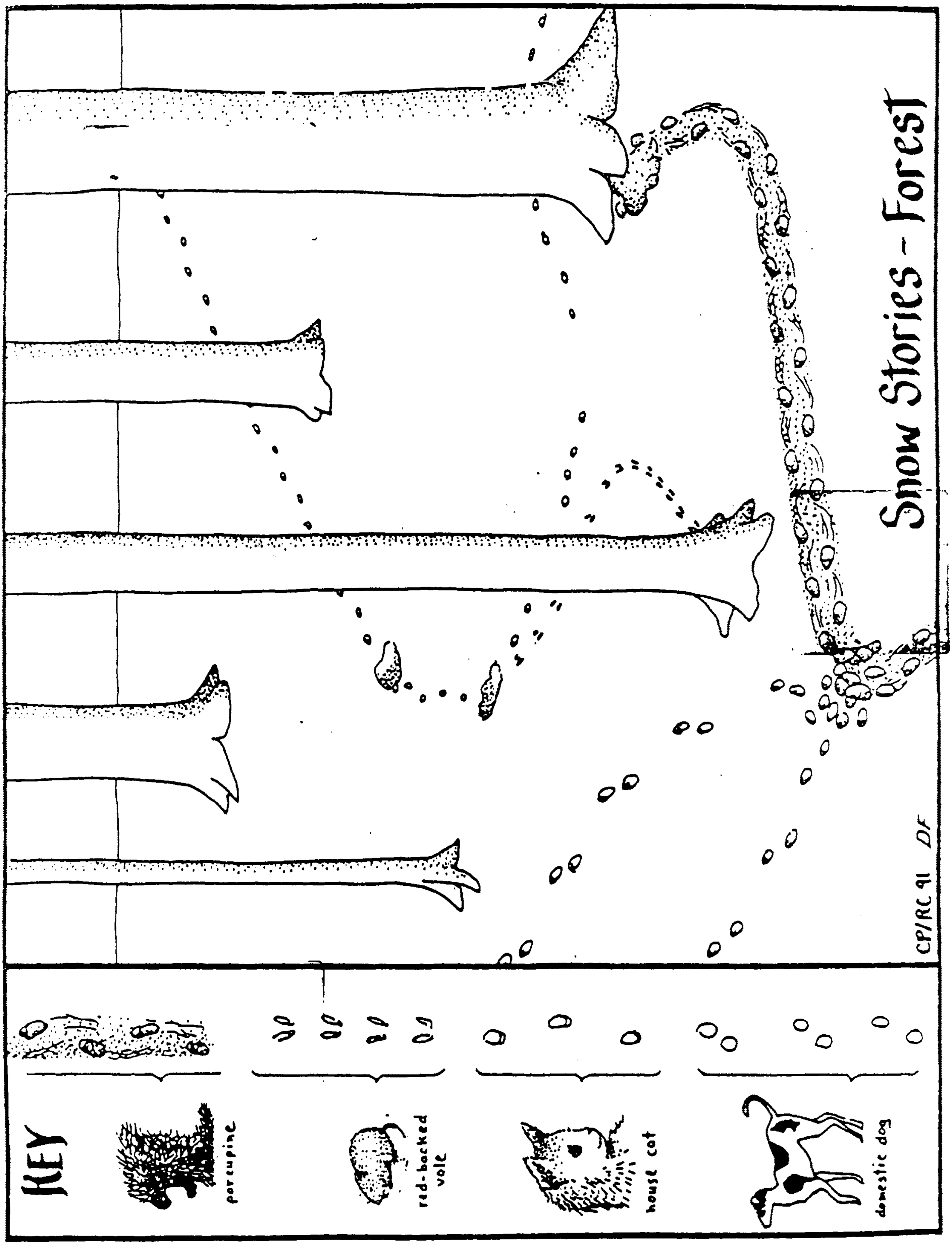
We regard it as a privilege to be able to work at Harborview. Thanks for your help!

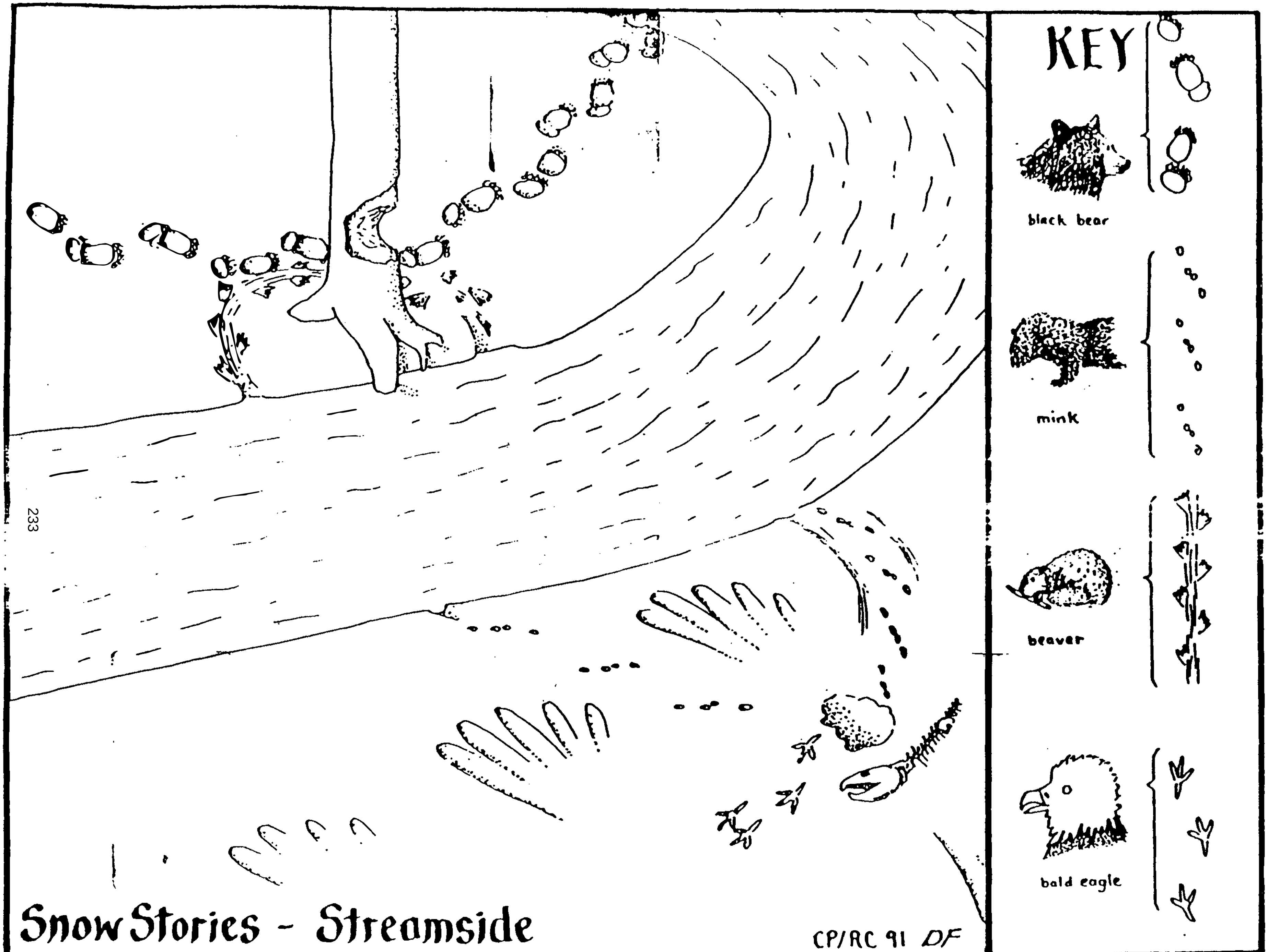


Hut Point
35°
Entrance Point
45°
FISH CREEK ESTUARY
0 100 200 300 400 500 600 800 900 1000
scale in feet
NORTH
muskeg
dredge pond
dredge pond
parking
Fish Creek
North Douglas Highway
hemlock dominated forest on ancient marine sediments
muskeg
= dike built to contain dredge ponds
= bare intertidal flats without salt marsh vegetation
= conifer forests
= young, open-grown spruce
= bedrock outcrop strike NW dip 45°
45°
= main channel of Fish Creek, and sloughs draining dredge ponds
Richard Carstensen DISCOVERY FOUNDATION Jan. 1991



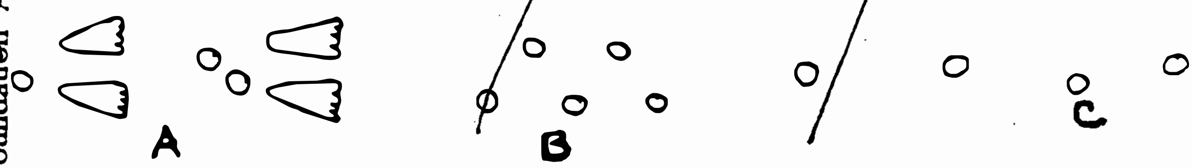
Methodist Camp
Richard Carstensen DISCOVERY FOUNDATION
0 100 200 300 400 500 1000 1500 Feet
Key
Hemlock, on steep bedrock slopes, mostly even-aged, from 1883 blowdown
Meadow – on former tideland
Brush – alder, willow & cottonwood
bare sand
Spruce, even-aged, often large, on river flood plain and uplifted beaches
NORTH
to Eagle Glacier
enhancement pond
Herbert River
Eagle River
fan
Winter Cabin
Lodge
beaver dam
Saturday Creek
fan
Mayfly Creek
Eagle River Estuary
to Scout Camp
Dowitcher Slough


Snow Stories - Forest
CP/RC 91 DF
KEY
porcupine
red-backed vole
house cat
domestic dog


Snow Stories - Streamside
CP/RC 91 DF
KEY
black bear
mink
beaver
bald eagle

How Do Animals Move?

Let's see what you already know about tracks!

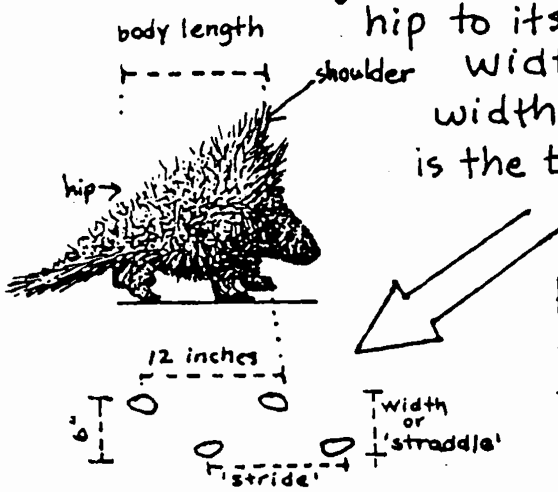


Here are 3 groups of tracks, or "animal trails".

Which animal was hopping? A, B or C (circle one)
Which way did it go? ⇦ ⇨
Which one was moving slowly? A, B or C
Which one has longer legs? B or C
Which walking animal has a wider body? B or C

Walking Animals

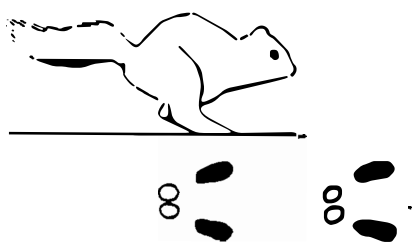
The distance covered by one step is called the **'stride'** of a walking animal. The stride equals the length of the animal from its hip to its shoulder. The **'straddle'**, or width, of a track group equals the width of the walking animal. Here is the trail of a porcupine:



How wide is the 'straddle'? ______
How long is the 'stride'? ______
How wide is the porcupine? ______
How long is the porcupine from shoulder to hip? ______

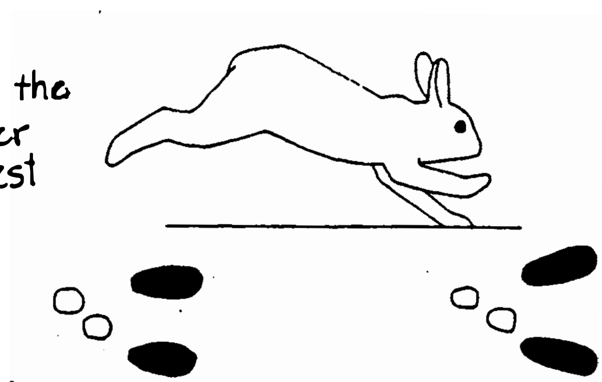
Hopping Animals

Squirrels, mice and hares all swing their hind feet around past their small front feet. Then they push off with their hind legs, like frogs! Here is a squirrel trail. Squirrels use their front feet together to grip trees. Like tracks of most tree-dwelling rodents, red squirrel tracks show front feet right next to each other. Fill in the rest of the squirrel's hopping trail as if it hopped across the page.



(hind feet are in black, front in white)

Hares are built for speed on the ground. Their front feet cover more ground. Fill in the rest of this trail.



Black-tailed deer jump with all 4 feet at once when they are frightened. Fill in the rest of the trail of this escaping deer.

This jump, called a '**stot**', confuses wolves. They don't know which way the deer will go! The different ways animals move are called '**gaits**'. The walk, the hop and the stot are all gaits.

5th Grade Intro--Animal Movement/Tracking
(1 hour)

Objectives: Students will be able to state 3 things that can be learned by examining an animal trackway.
Students will be able to describe the gait of a fast moving animal as it compares to a slow moving animal.
Students will be able to name an advantage of a wide straddle, as well as a disadvantage.
Students will be able to name an advantage of a long stride, as well as a disadvantage.
Students will experience moving like animals in a variety of ways, hopping, bounding, ambling and pacing.
Students will discover which gait their particular body shape is best designed for.

Supplies: tracking canvasses; How Do Animals Move handouts; skeleton comparison poster

I played around with this lesson quite a bit to see how doing the canvasses best worked for me. I will write about the way that I thought worked best.

Intro: I began with a test. Completing the How Do Animals Move? worksheet provided them an opportunity to review what they already knew and allowed them to read through new information once before we began discussing it and doing it. I found that students enjoyed the "test" and felt comfortable with the subject matter afterwards. As students completed the "test" we reviewed our answers and our reasoning.

As we began discussing the test section about straddle, we rolled out a canvass and took a look at a straddle. Kids were allowed to measure both straddle and stride and explained what knowledge we gained about the animal by examining the stride and straddle.
We discussed a wide straddle paired with a short stride meant that the animal was slow moving and that a long stride-narrow straddle meant that the animal moved fast. Then we discussed which was better----being fast with a long stride or slow with a wide straddle. There were many ideas but usually, for 5th graders, faster is better!

Then we discussed and demonstrated the implications of a wide/narrow straddle with various **demonstrations,** including having 2 students stand side by side, one with legs together and one apart, then pushing on the kids to see who lost balance first. They found that the wider straddle offered more stability.

Then we had 2 students be alligators and demonstrated that extremely wide straddle in their walk.

True, they were very stable. But then we asked one student to move faster and noted what they did. Kids recognized that the student closed the width of the straddle in order to move faster. They generally got this concept and we then related this to SE AK animals that we knew to be fast.

Next we took a look at how the feet played a part in how quickly an animal moves. We reviewed the skeleton comparison poster and noted the similarities and differences in the various animals. Students looked at how being plantigrade, digitigrade and unguligrade played a part in determining how quickly an animal moved. Usually I would demonstrate walking and running and ask students to describe what my feet were doing. We also came up with predictions of which SE AK animals were plantigrade and so on.

Activity: Lastly I rolled out the canvasses and did what I believe to be a typical tracking canvass lesson. Before kids tried out the canvasses we looked at one or two and reviewed what we had already learned....is the animal moving fast or slow.

While students were moving as animals across the canvasses I would stop them and have a student demonstrate if they were exceptional at a particular gait. Then, before we rolled the canvasses over to try the back side, students shared their observations on which animal moved quickest and why and which had the widest straddle. We also thought about how an animal could "get away" with being rather slow.

Field Trip Prep: Because students have already been on 2 winter field trips by the time they are in 5th grade I did not spend a lot of time on winter preparation. Instead, I drew a little stick figure 5th grader on the board and asked students to tell me what he needed to wear to be outside for 2 1/2 hour field trip. Then I drew the stuff on stick boy and they usually laughed at my pathetic drawing, but got the point.

5th Grade--Animal Movement/Tracking
(2 ½ hours--Fish Creek)

Supplies: Track ID sheets

Before leaving the classroom we reviewed animal tracks and what we learned in 3rd grade about identifying tracks--counting toes, looking at size of feet, claws, etc. We discussed how to track in the field and the importance of not stepping on tracks and losing them forever. We discussed that this year, by looking at the gaits, we would be looking at the complete story, not just identifying what animal, but what that animal was doing!

When the snow was good, we walked in trying to step in the track of the person in front of us. As the leader, I changed the movement some to mix it up.

We usually stopped at the porcupine-sign trees and looked for tracks. It was a good time to note that everything leaves a "track"---plops, drips, wind, cones, etc!

At the large spruce trees we reviewed animal movements and the various gaits. Then we held a **animal gait relay race** allowing kids to practice and revisit animal movements in a fun manner.

We split up into many small discovery groups (again, thanks to the many parent volunteers) and began our search for tracks and signs. Walt and I were usually able to split the groups into 2 bigger groups and head them out to two separate areas where they would likely find tracks or sign. As I spent time with a group we would examine ice crystals or look at the ice blocks near the edge of the estuary and discuss how they had arrived in their current location. We usually found bones, middens, tracks, skulls, shells and many other animal sign. We even had a decomposing porcupine for the last half of the winter. When we arrived on it the first few times its pads were in very good shape and the claws were impressive. Every part of it was there, hide to one side and skeleton to the other, with the exception of the head. Kids loved it....and so did we. Very cool! Lots of opportunity to learn from the porky and also to imagine what had happened to it.

With about 20 minutes to spare before our departure we would regroup at the large spruce trees and share our discoveries and eat our snack if we had not done so already. This was certainly an exciting time as the many small groups had usually made at least one great finding. There were many opportunities to share and I reinforced that this in what naturalist do...observe, think and share. Kids found that their questions were answered by another students who had first hand knowledge or prior experience with the object or situation. Other kids found themselves debating what they had seen and trying to explain. It was beautiful!!!

We usually ended our field trip with a **game of snowshoe hare and lynx** and then headed off to the cars.

Fine Tuning: Well, I stuck to a curriculum that was truly very difficult to do this winter with a lack of snow. I put a lot of unnecessary stress upon myself. I can only say that the kids were never disappointed if they didn't find tracks and in reality I wasn't either. I only dreaded it. I found that our findings of the various other animal signs presented so many more opportunities to learn and recall prior knowledge. I could see kids pulling from lessons presented in prior years. It is really amazing to see the level of naturalist participation from 3rd to 5th grade. In 5th, they know how to look, where to look and maybe more importantly why we look. They realized that there was something to be gained from being out there---knowledge and fun! My experiences with the 5th graders was a real tribute to the 2 naturalists who came before Walt and I. They really did a great job laid the foundation for these kids to be life long outdoor learners!

Next year I will be armed with lessons that will work well with a lack of snow so that I don't get stressed out. (So get your skis ready, I'm sure it will snow then!)

5th Grade Wrap--Animal Movement/Tracking
(Snow Stories--30 minutes)

Supplies: 3 Snow Stories and overheads
Animal Track Id Sheets

I began by asking students to think back to the field trip and what they had seen. I asked students if they had used their knowledge to decide what had happened earlier. They agreed that they did. Then, I asked them if they used anything else to explain what had occurred in that location. They thought about it and sometimes came up with imagination.

I shared with them that what they had seen in the snow were stories...events that had taken place before we arrived. Then I asked them to think about how recently those events had occurred. Were the tracks brand new, several days old, or had been made the night before. I asked them what clues they had examined to make this determination. We discussed ways of differentiating between old and new tracks.

Activity: Next, I put a snow story on the overhead. I asked them to imagine walking out into a thicket and coming across this scene. Could they figure out what happened? We discussed what steps they should take in reading the story....examine the habitat (which animals would you expect to find here), how many different animal tracks, which way were they moving, how were they moving, are there other clues present that tell us what the animal was doing. As a class we worked on the overhead, learning the process. Then I put students in groups of 3-4 to work on individual snow stories. Their jobs were to identify the tracks and interpret what had occurred. Students used knowledge and imagination to write a story about the scene presented to them. The parameters were that it had to be possible, meaning no aliens!

When groups completed their stories we read them aloud. Groups were given one of two snow stories to examine. As a group shared its story, I displayed the overhead for the rest of the class to follow along.

I left them with a hope that they would continue to use their imagination and knowledge to get out and read real snow stories.

MY TREE

EQUIPMENT: Blindfolds for half the number of kids.

PROCEDURE:
Have the kids pair up. This is a game involving trust and touching, so read the group as far as how best to pair up for the greatest benefit of the game.

In pairs, have one person in each pair put the blindfold on.

The other person, guiding them gently, takes their partner on a loop-de-loop course around the lawn. This is done to confuse the blindfolded partner as to where they actually are on the lawn. Have the kids be gentle with each other and don't let them twirl their partner around until they're dizzy - unless you want to clean up the results!

After about three minutes of a confusing blindfolded tour, have the sighted partner bring the blindfolded partner to a tree or bush. Let the blindfolded partner "get to know" their tree. Instruct them that this will mean completely feeling all reachable parts of the tree, finding any interesting characteristics about the tree, feeling what the immediate environment around the tree is, etc.

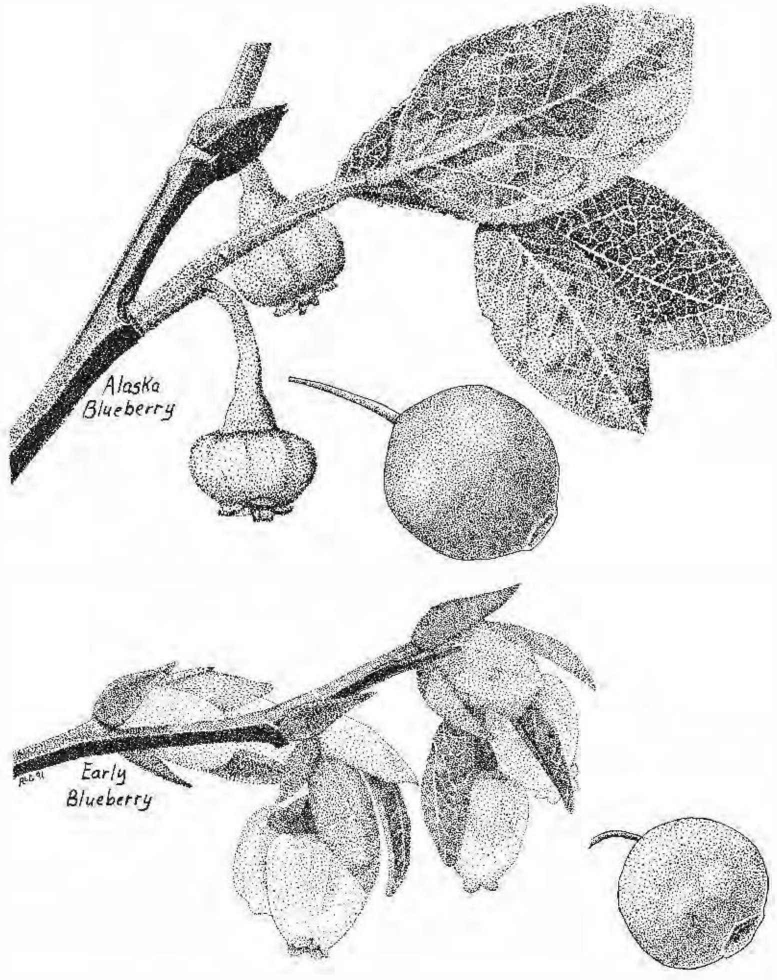
When the blindfolded person says to their partner they know their tree, the partner again leads them on a confusing course around the lawn and back to the original starting point.

Take the blindfolds off the partners. Their task is then to find "their tree" by sight. If they got to know their tree well by touch, then finding their tree by sight should not be difficult. They can also go up to a tree they think is theirs and touch it to see if it really is the one they know well.

This is a good activity to discuss observation skills, discuss what trees really are, and to wind down at a needed point in a session.

Nature Studies Curriculum 3-5 (1993-1999)

A NATURALIST'S LOOK AT SOUTHEAST ALASKA



GREG STREVELER
AND RICHARD CARSTENSEN

CARSTENSEN ILLUSTRATIONS

*DISCOVERY FOUNDATION** 1993

* *subsequently re-named Discovery Southeast*

This booklet was produced for a program entitled TEACHING THE NATURAL HISTORY OF SOUTHEAST ALASKA, ***a collaborative effort between:***

The Discovery Foundation
University of Alaska Southeast
Chatham School District
Haines Borough School District
Sitka School District
Petersburgh City Schools
Hoonah City Schools

with funding from
Dwight D. Eisenhower Mathematics and Science Education Act

administered by
Alaska Department of Education

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Postscript, 2012: Almost 2 decades have passed since Greg Streveler and I assembled this synopsis as a handout for teacher workshops in northern and central Southeast Alaska. While much has since been learned about Tongass natural history, *some* works are timeless. One such is the way "Strev"—my friend and mentor in matters ecological—whipped out this 16-page ode to the Archipelago.

In 1992 and 93, Greg and I hit the road in the puke-green 1969 Ford camper we called the *Naturemobile*, delivering teacher workshops to Haines, Hoonah, Angoon, Sitka and Petersburg. It was just after *The Nature of Southeast Alaska* came out, a book I'd written with Rita O'Clair and Bob Armstrong.

Nice job, Greg acknowledged. But a little weak in geology, glacial history, island biogeography, and marine ecology. Let's fill in some of those neglected disciplines, in a handout to field-worthy educators of the rebounding North Pacific.

Making handouts with Strev is like holding palettes for Picasso. Then a journeyman naturalist, what I mostly contributed was cut-&-paste craftmanship and a drawing or two. Reviewing Greg's prescient terrane-poem from a 20-year vantage, it's pretty obvious I need to resurrect this booklet.

The occasion for re-delivery was a gift from Michael Blackwell, who told me to radically enhance the Discovery Southeast website, and send him the bill. Those welcome marching orders directed me to the roots of our organization, when we were still called *Discovery Foundation*. What is most *foundational* to our mission—the connection of people to this rainy land?

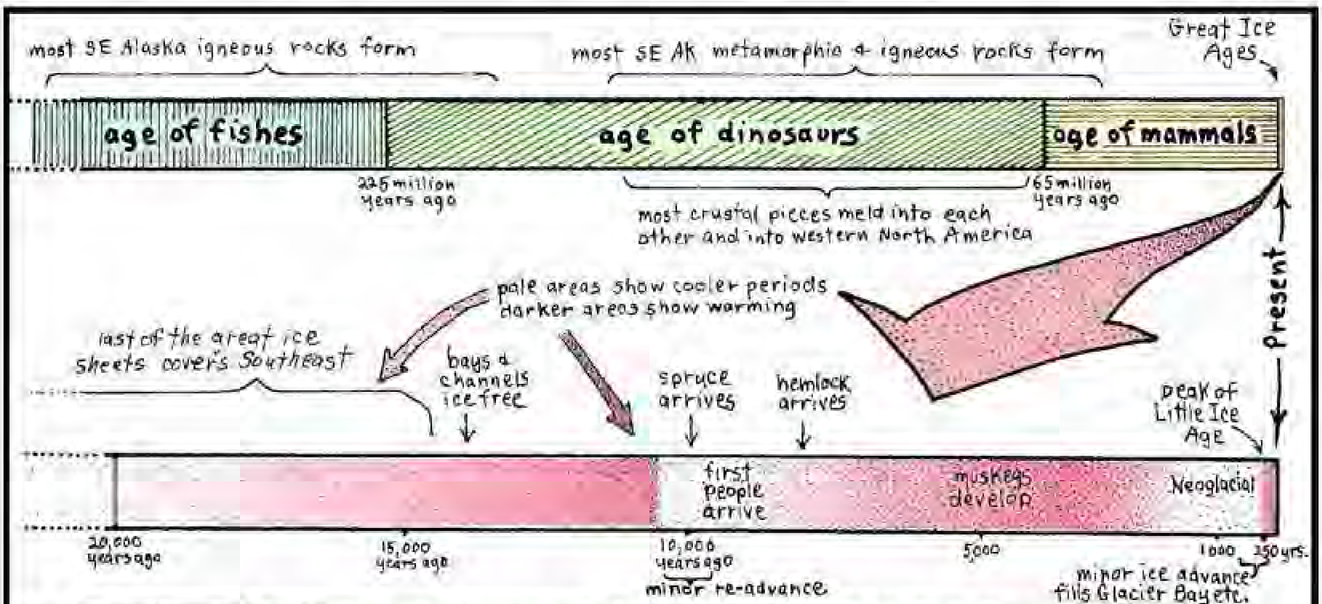
Maybe this naturalist's *look*. Four eyes: one rocky, fishy, spruce-enfolded shatter zone. One collaborative tribute to icemelt re-establishment. Richard Carstensen

Front cover: Comparison of our shrub-sized blueberries (*Vaccinium alaskaense* & *ovalifolium*)
Back cover: Alpine azalea, arctic willow and reindeer lichen colonize crack in exposed alpine outcrop.

Introduction

Westward of the Canadian Coast Range, the margin of North America stoops abruptly to interfinger with the Pacific in a maze of fjords, valleys, beaches, straits and islands, creating a landscape where no point of land or sea is more than 30 miles from a shore.

It's an austere place of big tides, strong currents, fall gales and frequent earthquakes, a landscape of great peaks and profound deeps, of somber blues, greens and grays occasionally relieved by pastels of grassy meadows or sunset skies. Yet there's verdance born of moisture, moderate temperature, nutrient abundance, profusion of life. The world's greatest temperate rain forest cloaks the land. Salmon abound in streams. Seas teem with halibut, crab, seal, diving birds. All presided over by large predators: orcas, brown bears, bald eagles, and wolves.

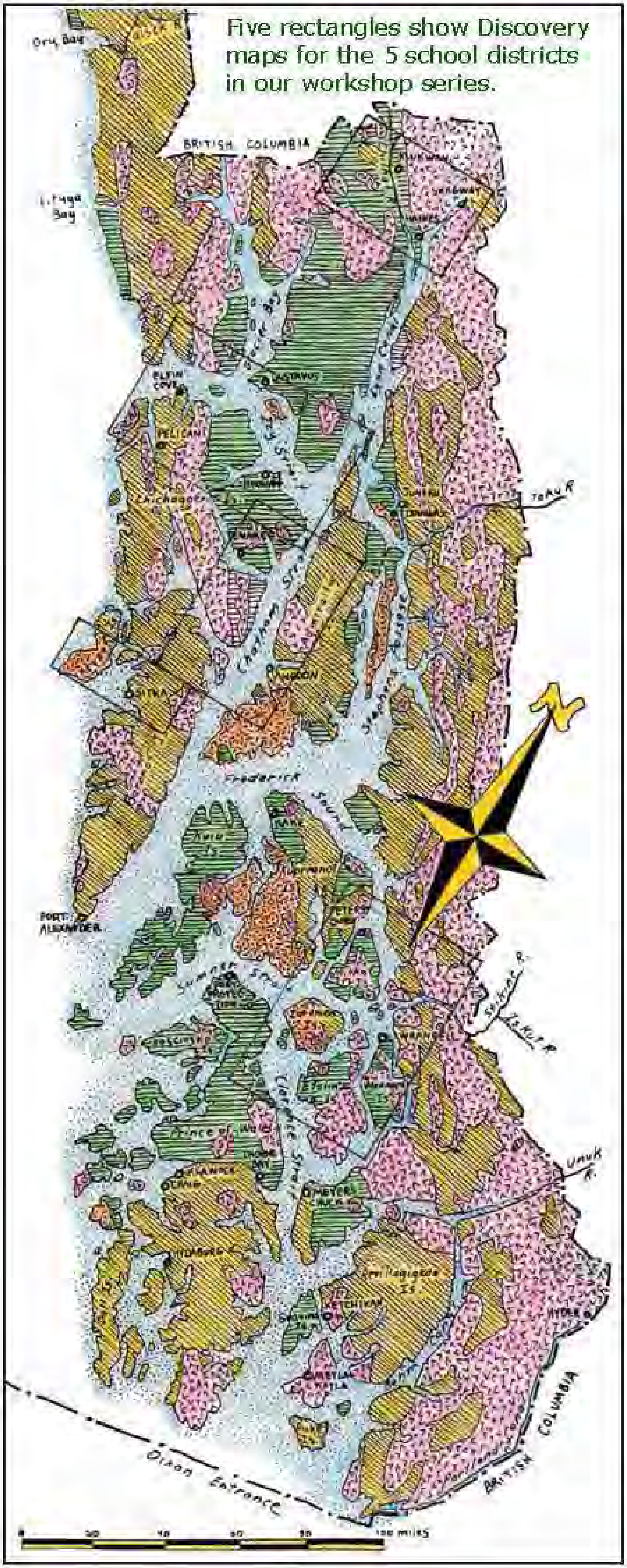


EXPANDING TIMELINE OF IMPORTANT EVENTS IN SOUTHEAST ALASKA

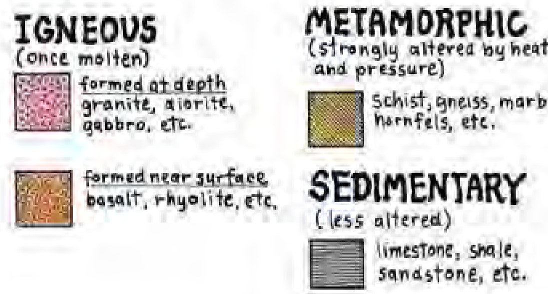
Geology

Southeast Alaska's extreme topography witnesses immense energies deriving from a position astride the active suture between the North American and Pacific crustal plates. Since the Age of Dinosaurs, North America has been plowing obliquely into the Pacific plate at several centimeters per year. Generally this plate has dived under North America. But occasional bits—island arcs, pieces of sea floor, fragments of continental margin—are scraped off and smeared along the leading edge. These scrapings accumulated in a NW-SE pattern reflecting shatter zones created as rocks accretted.

Frequent earthquakes suggest plate motions continue to this day. All the while, rocks are compressed. Some are forced upward to form mountain chains. Others are buckled



Five rectangles show Discovery maps for the 5 school districts in our workshop series.



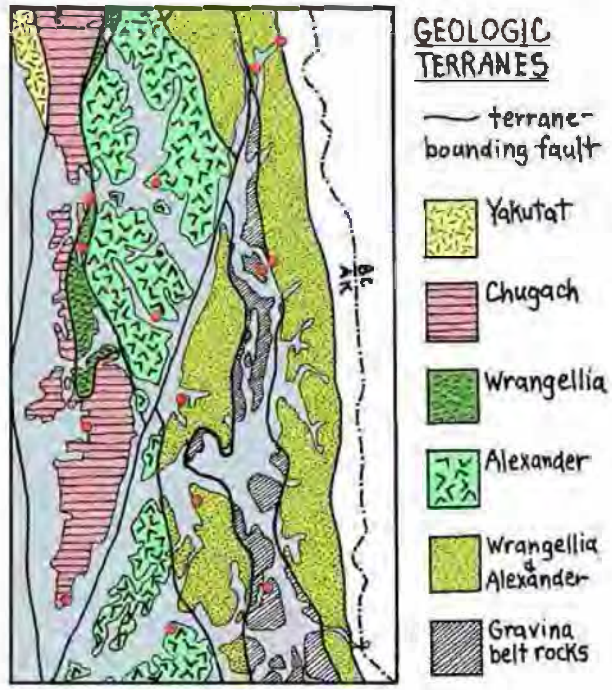
downward and melted. Molten rock then moves volcanically through the shatter zone, cooling and welding one of the world's most complex geological jigsaw puzzles.

Highlands formed by this process intercept predominantly onshore flow of Pacific air, wringing moisture as rain and snow. For several million years snows accumulated in uplands as glacial ice, repeatedly invading lowlands as climate periodically cooled.

During the height of the most recent of these Great Ice Ages about 20,000 years ago, an ice sheet covered all of Southeast except the highest peaks and certain headlands. Then one could have walked from present Sitka to Cape Cod, never leaving ice. Life was excluded. Aspect was reminiscent of modern-day Greenland or Antarctica.

Post ice-age history

By 13,000 years ago, retreating ice bared a landscape of rounded hills and deep, U-shaped valleys or fjords, presided over by precipitous peaks,



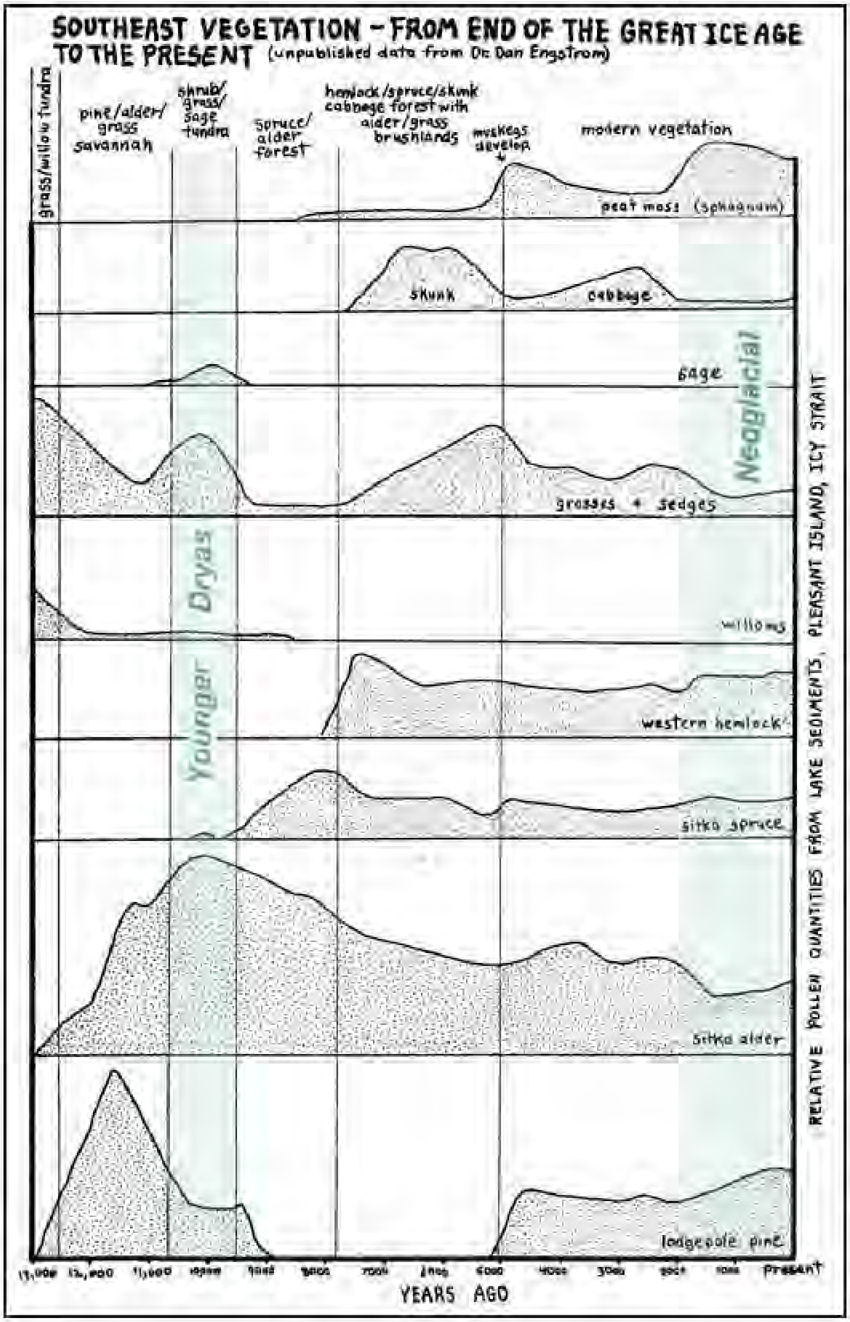
From Brew (1988). Terranes are wandering crustal fragments, each with its own geologic history.

projecting above the ice and escaping its erosion. Although sea level was 300 feet lower world-wide because of water still locked in ice, Southeast's crust was pressed down much farther under weight of ice. Several thousand years passed before land rebounded to earlier, pre-ice-age position. The ocean stood up to 500 feet higher than today, especially in Lynn Canal where ice was thickest. The archipelago was more insular than today, since higher sea divided what is now one island into several. But life returned, slowly surmounting physical barriers of saltwater, mountains and ice fields, and ecological barriers posed by still-harsh living conditions.

Pollen in lake-bottom and bog sediment records return of plants after ice. For several millennia, tundra and pine-alder scrub dominated the post-glacial landscape. By 8,000 years ago, spruce-hemlock forest predominated, suggesting climate was approaching today's wet and mild conditions. By 5,000 years ago peat bogs were forming. Foundations for modern vegetation were laid. A few thousand years later, climate worsened—a period called the Neoglacial, culminating in the Little Ice Age 2 centuries ago. Glaciers depressed the land again, especially around Glacier Bay. Snow-line descended, shifting vegetational belts. But conditions weren't severe enough to bring tundra back to the lowlands.

Post-glacial rebound and sediment brought down from mountains turned fjords into valley bottoms and connected islands to mainland. Streams etched glacially scoured hillsides, dumping fans at toe-slopes, where seas worked them into beaches. Land- and freshwater animals immigrated. Breeding sites for colonial birds and marine mammals probably became fewer. Salmon returned to streams. Deer and black bear increased, while puffins and sea lions diminished.

This story remains sketchy. But recently-discovered caves in southern Southeast have rich deposits of animal bones dating to the end of the last Great Ice Age. These will ultimately yield detailed records of mammal and bird re-occupation.



Climate

Glaciers spawn severe climate, but also reflect heat, generating cold high-pressure cells that hold warm oceanic air at bay. We live in a milder-than-average period compared to the last few million years. With glacial ice at a minimum, the great *lows* sweeping off the Gulf dominate our climate, bringing abundant moisture. Since the Gulf's oceanic currents are mostly from the south, we're bathed by warmer waters for our lattitude. Our temperatures are mild.

The sea pervades into every interstice, but especially along the outer coast. On the mainland, most obviously by interior passes, periodic incursions of continental air reduce average rainfall and bring more extreme seasonal temperature variations. Average annual temperatures are highest in the south.

Plants

(Common names follow O'Clair, Armstrong & Carstensen, 1992)
Plant communities reflect climate. Pine-birch and spruce-cottonwood forests near Skagway differ from hemlock-spruce-cedar forests near Ketchikan. Yellow-cedar, so pervasive in maritime lowlands around Sitka, is scarce at Juneau. High elevation tundra differs from low elevation bog, forest and brushland.

Modern Southeast vegetation is arrayed along a vertical gradient. At the shore, a few salt-tolerant species form productive salt marshes just below high tide. Above extreme

high water is a lush, diverse beach meadow dominated by grasses and large umbels such as cow parsnip. Uplift meadow abounds in northern Southeast, where high rates of post-glacial rebound cause the sea to recede faster than forest advances. Lowland forests host Sitka spruce, western hemlock, and cedars. Moss, ferns, evergreen herbs and brushy species such as blueberry, menziesia and devil's club cloak the ground, except where even-aged forest admits too little light to support undergrowth. With increasing elevation, mountain hemlock supplants western hemlock.

Forest generally forms an unbroken cloak on Southeast Alaskan landscapes unless interrupted by disturbance, wetness or altitude. Disturbance takes many forms: avalanche, snow creep. flooding, windthrow, disease, insect infestation, or logging. Infrequent or small scale disturbance doesn't erase the forest, but increases diversity by creating a mosaic of several different ages, admitting light to the forest floor, making some of our best wildlife habitat.

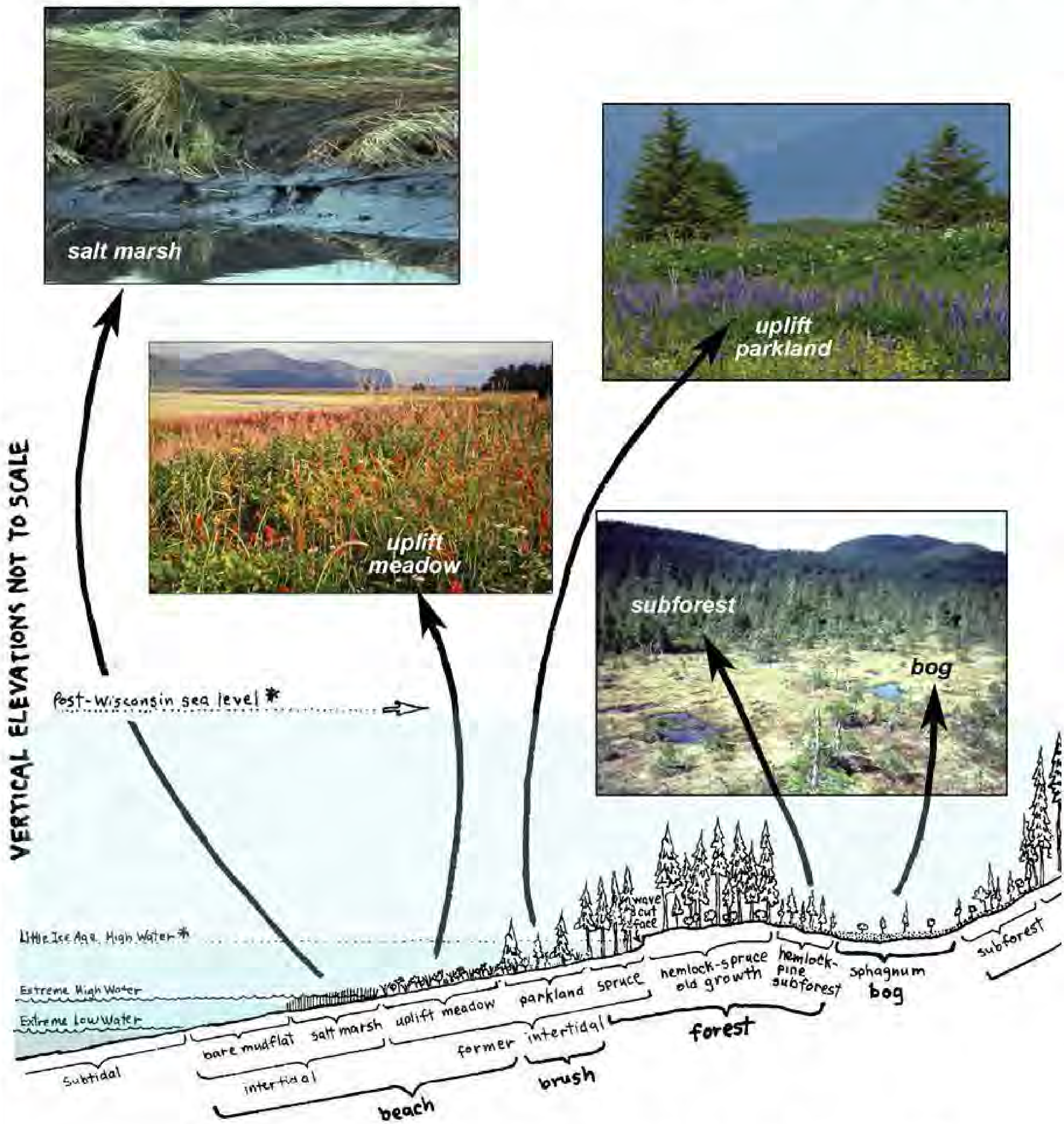
But trees take time to re-establish. Forest can't persist if disturbance is too frequent and severe. It's replaced by brush. which stands more punishment and bounces back faster if erased. Alder, salmonberry and copper bush withstand deep subalpine snow, and extend far downhill in avalanche chutes, joined by elderberry. devil's club and currant. Willow and alder are prominent in flooded river valleys.

On wet soil, forest gives way to bog. Poor drainage favors hardpan soils, keeping trees from rooting deeply enough to resist windthrow. It also favors peat moss, whose water retention and acid production further retards healthy tree growth, resulting in stunted trees and sparse heath shrubs on an ever-thickening mantle of peat. On more sloped terrain with high water table, sedge-dominated peatlands called fens may form.

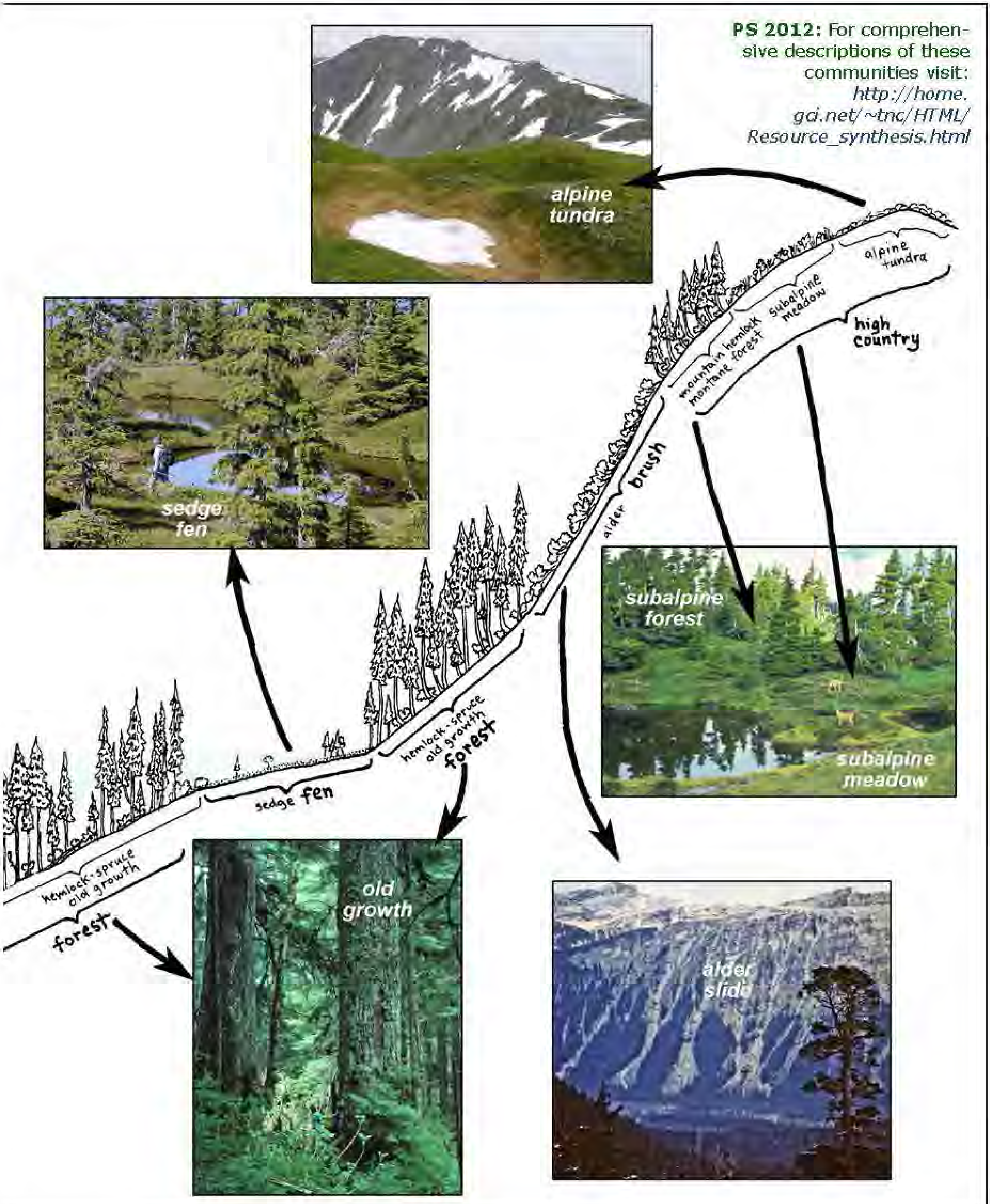
With increasing altitude, tree growth is first impeded then halted by low summer temperatures. Often a zone of brush interposes, but sometimes forest gives way directly to lush subalpine meadows much like those just above the tide. Farther up, where

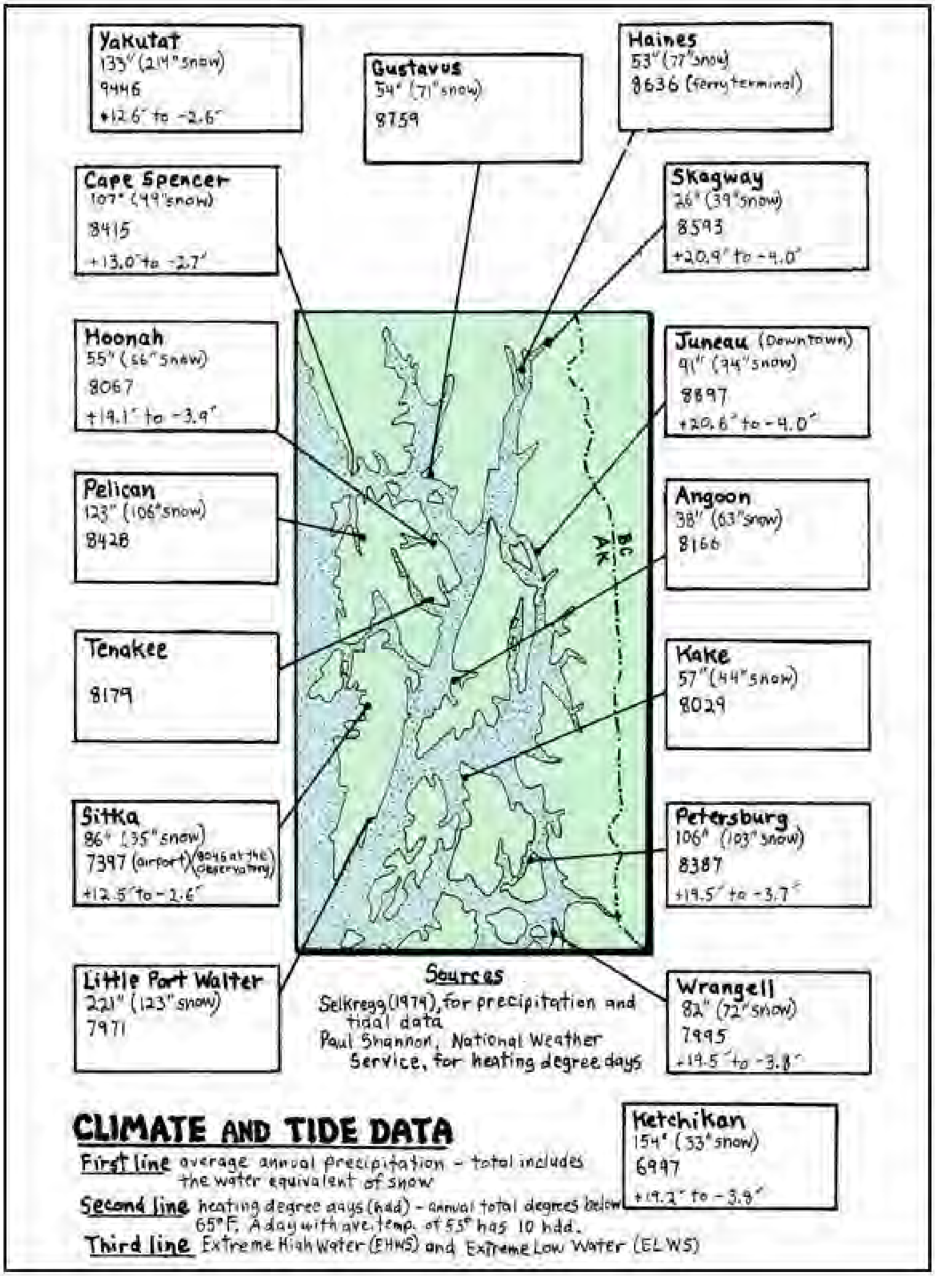
continued on page 10

PLANT COMMUNITIES ON A VERTICAL GRADIENT · NORTHERN SE ALASKA



* Elevations vary throughout northern Southeast. In Juneau, Little Ice Age high water was about ten feet higher, and Post Wisconsin sea level about 500 feet higher than today.

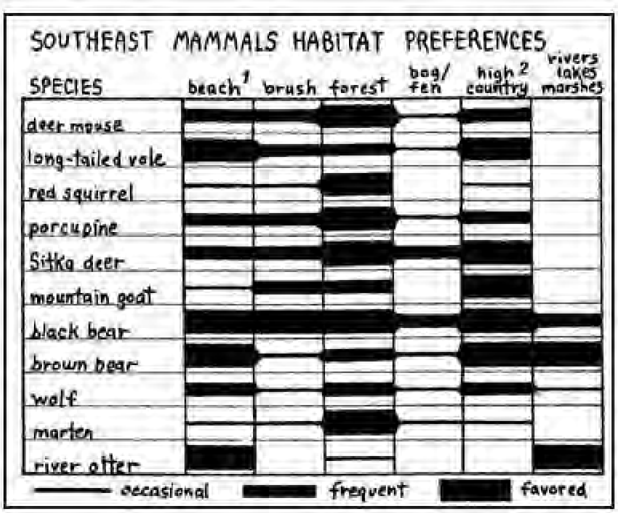

PS 2012: For comprehensive descriptions of these communities visit: http://home.gci.net/~tnc/HTML/Resource_synthesis.html
alpine tundra
sedge fen
subalpine forest
subalpine meadow
old growth
alder slide
alpine tundra
subalpine meadow
mountain hemlock montane forest
high country
alder brush
hemlock-spruce old growth forest
sedge fen
hemlock-spruce old growth
forest



summers are brief and winter wind blows away protective snow mantle, alpine tundra mats of prostrate shrubs, tiny herbs, mosses and lichens predominate. Even higher, bare rock and ice reign.

Animals

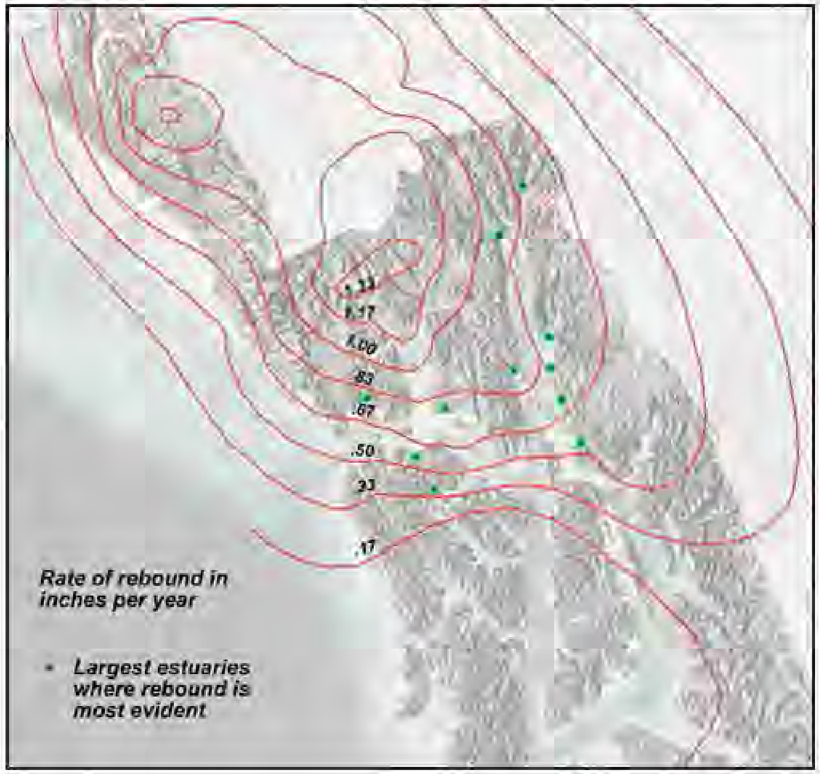
Distribution of land animals is more complex than that of plants. Birds and many flying insects are especially mobile, able to overcome most physical barriers. But they're choosey about habitat; most associate with a particular group of plant communities. Animals of this type are widely distributed, but are found in specific habitats.



The opposite is true for mammals. Especially the largest—bears, moose—use a variety of habitats from beach to alpine. Yet because many lack a dispersal phase in life history comparable to the mobile seeds or spores of plants, or the winged migrations of birds, their distribution is relatively incomplete.

1 "Beach" includes rocky intertidal, mudflats, and young meadows uplifted by glacial rebound.
2 "High country" includes alpine tundra, subalpine meadows, and elfinwood at tree limit.

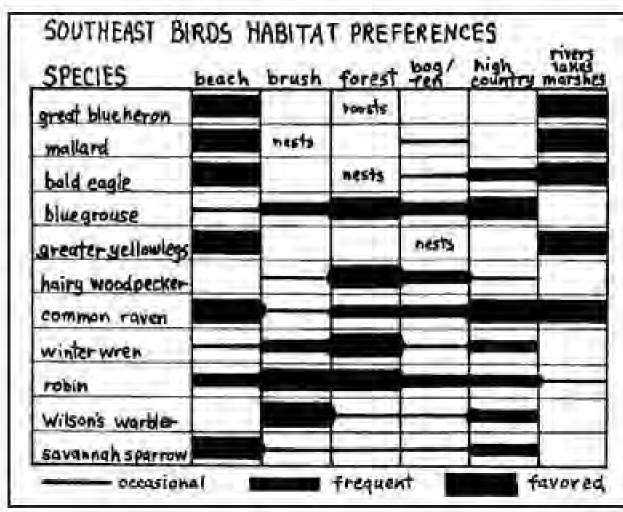
Most rapid uplift is in Glacier Bay where land was most depressed during the Little Ice Age, and where mountain-building is great. Rate declines away from major ice fields and uplifting mountains.



For instance, of the 48 species living in the interior of British Columbia with ranges bordering on our region, only 37 have made it across the mountain passes to mainland Southeast Alaska, and only about 10 of these—little brown bat, short-tailed weasel, mink, otter, brown bear, deer, deer mouse, tundra vole, dusky shrew, masked shrew—are known to have made it without the aid of people past the water barriers to Baranof Island.

Relatively few freshwater fishes have made it to Southeast Alaska. The bulk of these are salmon and char, which spend parts of their life cycles in salt water, and so can get past the mountains and marine channels that limit the distribution of strictly freshwater animals. Except for introduced species like grayling or brook trout, only 2 fishes with no connection to salt water—round whitefish in Chilkat Lake, northern pike in the pike lakes near Yakutat—have made it to the fringes of our region.

The relatively few land-based animals able to colonize our islands have have often attained large numbers. Among these are brown and black bears, Sitka black-tailed deer, mink, otter, bald eagle, blue grouse and salmon. Wildlife surveys show that most species reach maximum densities near marine shores. There's hardly an animal species in the region that has no direct connection to the sea.



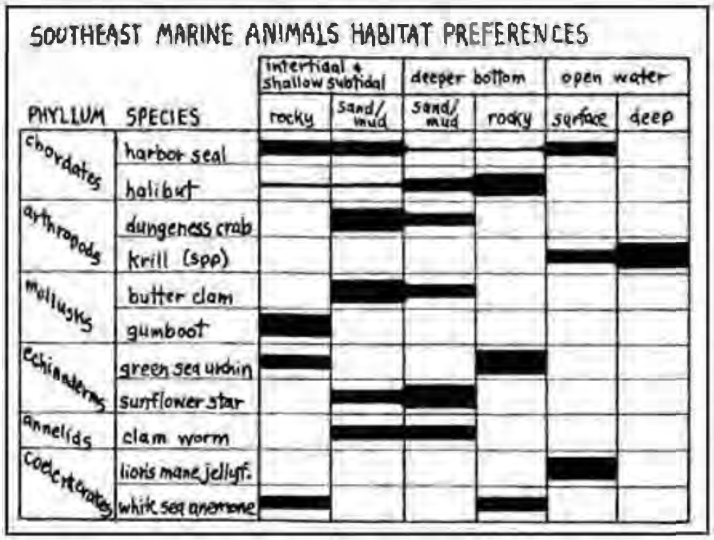
The sea

A fortunate combination of characteristics makes Southeast Alaskan seas immensely

PS, 2012: This is an updated, color version of the b&w original that appeared in A Naturalist's Look in 1993. It's now available in a 3-fold Discovery field laminate.

productive. The waters are warmed and enriched by the adjacent Pacific Ocean. Complicated shoreline and bottom topogaphy combine with exceptionally high tidal energy to produce strong currents that stir nutrients to the surface. Two other factors are necessary to translate nutrients into productivity—enough light for phytoplankton (plant plankton) to photosynthesize rapidly, and enough water-column stability to allow these tiny organisms to stay in the "photic zone" near the surface. All these factors come together in spring and early summer.

Then, for a few weeks, the concentrations of phytoplankton reach astronomical proportions. Many animal plankton (krill, copepods etc.), and bottom-dwelling invertebrates (starfish, sea urchins, worms, and clams), time their reproduction to coincide with this brief time of plenty. Vast shoals of small fishes such as herring, capelin and sand lance in turn feed upon this animal plankton. Salmon, sea lions, porpoises, cormorants, and murrelets forage on the fishes, while humpback whales come from Hawaii and Baja to harvest them, and the plankton, by the ton. Seaweed and salt-marsh vegetation also begins to grow again in early spring. These plants support an abundant crop of grazers, and upon decomposing produce detritus for bottom-dwelling worms and sand fleas. Moreover, they provide a substrate for microscopic algae, which are grazed by snails and other mollusks.



Summer in the upper waters is a brief but exuberant season. Most marine birds and mammals raise their young and then put on fat while the bounty lasts. Fishes exhibit a variety of reproductive strategies. Herring and cod release small (yolk-poor) eggs that fend for themselves as they hatch in the rich plankton soup. Skates produce large yolk-rich eggs produced from stored energy from the previous season. Ling cod males use stored energy reserves to defend their brood of eggs from predation.

As snows and gales of winter come, and the sun moves ever lower in the noon sky, much of the marine world goes "on hold". Many species leave for the south; a lot of the rest curtail their activity. Salmon eggs rest in creek gravels. Herring and rockfish school in a rocky deep to await the coming of spring when the drama will be replayed.

But the marine ecosystem does not grind to a halt over winter. A portion of the living matter from upper waters makes its way to the bottom in the form of detritus, where it is eaten by filter feeders like barnacles, anemones and clams. That which they miss is incorporated in sediment to be eaten through the year by tiny crustaceans and worms, which in turn feed flounders, crabs, cod and diving birds like scoters. Seals, sea otters and halibut provide the next link in this benthic food chain, which fluctuates much less through the seasons than that of the open waters, and thus becomes disproportionately important during winter.

Marine productivity comes ashore in numerous ways. Salmon carry it to the far corners of the region when they spawn; the young of some species remain in ponds and streams, where they are important food for mergansers and kingfishers. Predators such as eagles, otters and mink hunt at sea and carry their catch to land.

Most important, Southeast Alaskan shores provide hundreds of miles of interface between land and sea. Shores provide thoroughfares and den-sites; carcasses wash up on them; and they grow lush intertidal communities that are dry land when the tide is out A large array of predators and scavengers from bears to shrews and ravens patrol the beaches, eating flotsam and some of the intertidal invertebrates. Herbivores such as deer, moose, mountain goat, porcupine and voles graze on plants of the upper intertidal zone or eat kelp for salt. And have you noticed where most Southeast Alaskan towns are?

People

The list of Southeast Alaskan species has included people for at least 9000 years. In recent millennia our region has been home to the Tlingit, Haida and Tsimshian peoples, whose great villages and high culture bore testimony to the abundance of both natural and spiritual resources. These people were encountered (but not defeated) by the Russians during the 18th and 19th centuries, who pursued the sea otter and traded from their enclave in Sitka, then sold what they perhaps did not own to the United States in 1867.

Into this "last frontier" have come people drawn from more crowded lands. Yet Southeast Alaska's rugged terrain and difficult climate have conspired to hold the human population thus far to relatively modest levels. The natural fabric of our region remains largely intact.

Though our population is small, modern times have seen dramatic increases in the rates of resource harvest and landscape alteration. As people expect more from the natural world, wise stewardship will depend increasingly on our awareness of Southeast Alaska's particular natural fabric: how it came to be, its present components and interactions, and where the future would take it. Ultimately, stewardship demands willingness to live within the land's limits.

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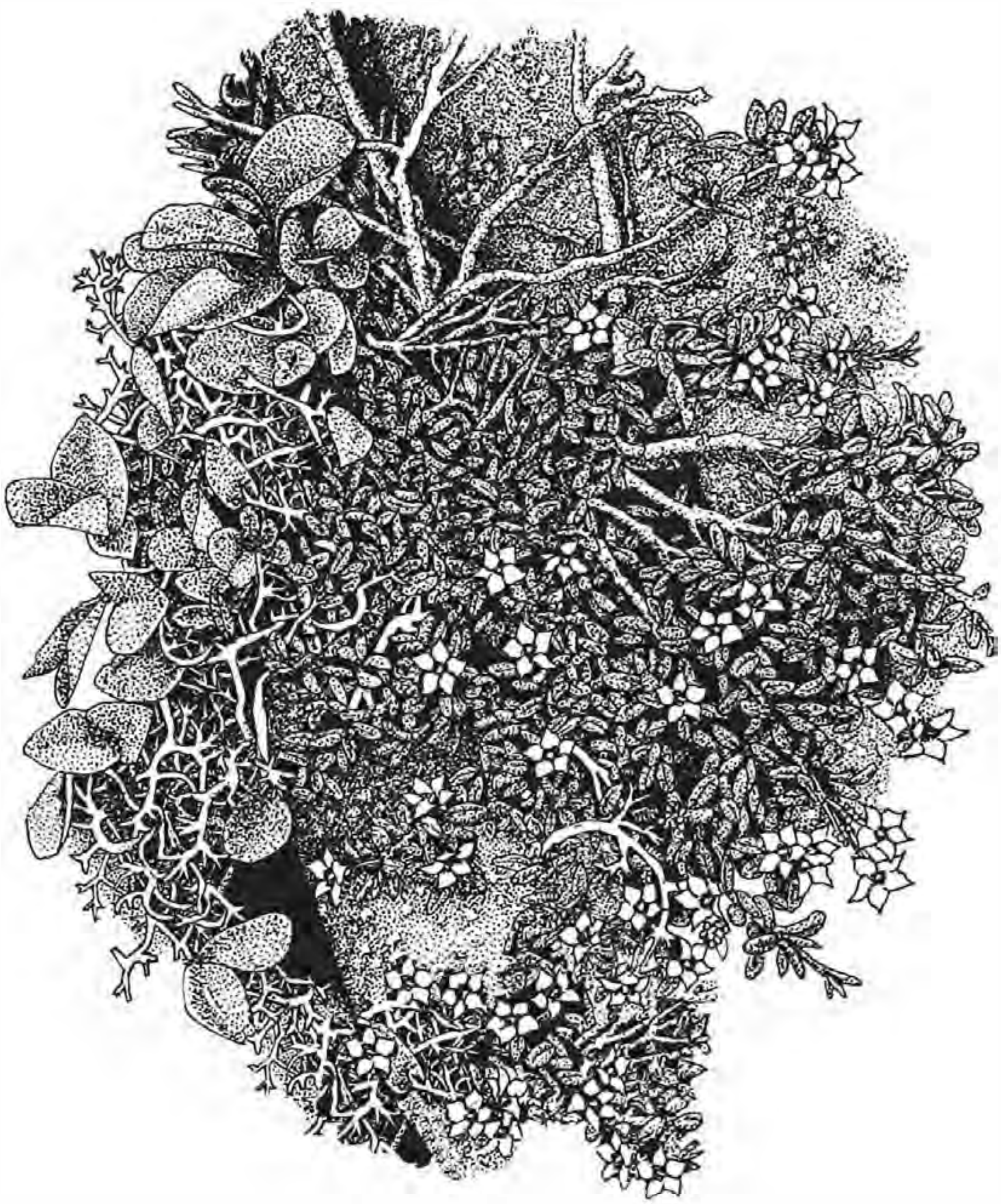


UNDER THE SNOW

The weasel bounds across the top of the snow next to some trees. Suddenly she catches a smell which stops her. She looks around and after a few minutes of exploring, she finds where the smell is coming from. It's a hole in the surface of the snowpack. The air pouring out of the hole feels warm to her face. She can smell dirt and she can also smell hair and blood. Quickly she dives into the hole. Sometimes she has to swim through the soft snow to work her way down to the ground. The light grows dimmer and dimmer the farther down she goes. But the temperature gets warmer under the snow. After a few minutes of swimming through the soft snow, the weasel finally bursts through the last few inches of the snow and reaches the ground. She finds she is in a little room at the base of the snowpack. Its floor is mossy and it has a low ceiling made up of millions of large, delicate ice crystals that break apart as she brushes against them. She doesn't find any food in this room so she moves down another tunnel. Suddenly she catches a strong smell. Quickly she pushes her way toward the smell and soon sees a clump of grass and fibers. She jumps forward and bursts through the side of a nest into another small room. The room is lined with grass and the down feathers of a bird. The nest is empty so she continues down one of the tunnels. The smell is getting stronger and she is beginning to feel very hungry now. She squeezes around a corner and a sharp smell causes her to stop. The animal she is chasing must have stopped here to catch and eat a spider, for she can smell the animal strongly now. She knows she is getting very close and she pauses to listen. Scratching sounds ahead of her tell her the animal is only a couple of feet away. She moves slowly forward until she is sure of the distance. And then she runs forward the last few inches and pounces upon her prey. Her front paws knock the animal over and in a moment before it can right itself, she catches it behind the head. With her extremely powerful jaws she breaks the animal's neck with one bite. Finally, at last she is able to eat a meal and calm her hunger. She eats the whole animal, its bones, skin and fur and afterwards licks the tunnel floor. Then she curls up to rest underneath the warmth of the snow and sleeps. In an hour she will probably wake up feeling hungry again and will have to continue her hunt beneath the snowpack.

Auke Bay, Spring 97 (Janice)

BIRD INTRO-FEATHERS AND FLIGHT

Materials:
overhead projector
overheads:
-parts of feather and how it grows
-different kinds of feathers
-human armbone comparison to wing bones
-flapping flight
-gliding/hovering flight
bags of feathers (one per group)
hand lenses (one per student)
feathers to show while discussing with whole group

Activities:

1. Ask students to guess how many feathers a small bird has? (usually 3500 to 5000)

2. Show drawings of parts of a feather on overhead: shaft, barbs and barbules. Discuss how interlocking system works. Briefly describe how a feather grows.

3. Put up overhead of different kinds of feathers. Give a few examples of how these feathers have different uses.

4. Discuss how owl feathers are different with their fringed edges. This helps them fly silently.

5. Discuss very briefly how feathers come in many different colors, but some of these colors can only be seen if you hold the feather to the light just right.

6. Hand out bags of feathers with examples of different types to each group of students. Give everyone a hand lens and ask them to take a closer look at their feathers. Have them try to find the barbules, look at the color and try to decide where it is found on the body.

7. Collect feathers and regroup. Discuss how birds care for their feathers. Most birds have an oil gland just above the base of the tail Birds take a bit of oil and mix it with their saliva and then draw the feather across the bill. This cleans and waterproofs the feathers. It also lines up the barbules, just like a zipper.

8. Tell students we will talk about bird flight next. Part of the reason birds can fly is that they have hollow bones, so that they are very lightweight. Birds also have some very big flight muscles which help move their wings up and down. Tell students we will be trying to imitate a bird's wing movements with our arms. Put up the overhead of an arm and wing bone comparison. Discuss which bones are similar.

9. Ask for volunteer to come up and demonstrate how they think a bird flaps its wings. Then demonstrate with that person how you would hold your arms and flap. Put up the overhead showing a sequence of flapping flight and go through the sequence.

10. Ask all students to stand up and try moving their arms like a bird's wing. Have them try to do this for 1 minute. Then discuss how fast birds move their wings per second. Give examples.

11. Discuss briefly how some birds soar on thermals and some birds can hover. (Show overheads if time).

12. Close by discussing what we will do on field trip.

Janice

ROCK INTRO 97
(Auke Bay kindergarten class)

Materials:
rock collection to share
picture of volcanoes and lava
container of sand
glass jar of water
jars of sand with tempera paint (2 colors)
clear plastic cup
play dough-3 layers of different colors
bag of rocks (enough for 1 student each)
handlens-1 per student
rock experiment sheets-2 per student
per table group:
- cup of water
-balance scale
-penny
book "Everybody Needs a Rock"

Activities:
1. Tell students we are going to be learning about how some rocks are formed today. Some are made by volcanoes, others are made deep down inside the earth and some are made underwater. They will also get a chance to perform some tests on rocks that I have brought in.

2. Begin with volcanic rocks. Show pictures of volcanoes and lava. Some rocks are formed by very hot material cooling. We call these "fire rocks". Rocks that cool on the surface often have lots of air bubbles in them, so they may be pretty lightweight. Show pumice and lava samples. Toss pumice to one student and ask them what it felt like (heavy or light).

3. Other fire rocks are formed underneath the ground, way down deep. These are called igneous rocks and they usually have crystals in them. Show basalt and granite from collection.

4. We have another type of rock that is made from little grains of sand or mud. Show sandstone collected in Utah along with the red sand. Next tell students we are going to find out how sandstones are made. Ask them to predict what will happen if you pour sand into water and shake it up. Where will the sand grains end up? (top, middle, bottom) Pour sand in a jar of water and shake it up.

5. Now let's imagine that we have a big river that's carrying sand grains. Let's pretend that my fingers are water in a river. The sand in my fingers (river) is going to fall to the bottom. Then maybe many years later, I drop a different

kind of sand (use one of the sands mixed with paint). And then when you are all grown up, I may dump some more sand. Over the years, all these different layers of sand grains get squeezed and become "glued" together kind of like this layered playdough. Then they eventually turn hard just like a rock. (could throw in fossil formation here if there was more time, but half hour is too short already for this lesson)

6. Show layers in shale and other rocks.

7. Explain to students that they will be given the chance to do some tests with different kinds of rocks. Demonstrate a rock experiment with one of the rocks. Go through the sheet and show them how to fill it out.
(students will feel the texture of the rock, look for layers, try scratching it with a penny, see if it floats in water, weigh it and draw a picture of it after studying the rock with a hand lens)

9. Ask students to go to their table groups. Have the teacher help you pass out the supplies. Besides the table supplies, hand each student 1 sheet, 1 rock and 1 hand lens. Have additional rocks and sheets at each table in case a student wants to do more than one. Allow about 10 minutes for exploring. (When students finish, have them trade with someone else and repeat experiment. Or give the kids time to look at the rock collection).

10. To close, gather students in a group or circle and allow time to share results.

11. If still time left -read "Everybody Needs a Rock" (there was never time, but ask teacher to read it before the field trip)

Notes:
It would have been nice to have had 45 minutes with this lesson. The kids were really engaged for the whole lesson and I ended up running over on every class.

Set up table supplies beforehand. Have teacher hand out lenses and sheets while you demo a rock experiment. Even doing this, it was hard to keep it at 30 minutes.

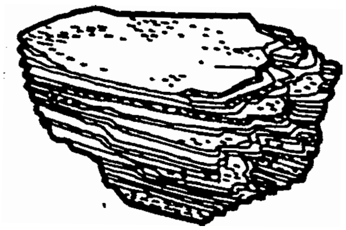
I tried talking about metamorphic rocks after showing the playdough layers, but I think it went right over their heads-I'd skip it.

Name ____________

MY ROCK

1) 

smooth? rough? sharp?

2) 

layers? yes no

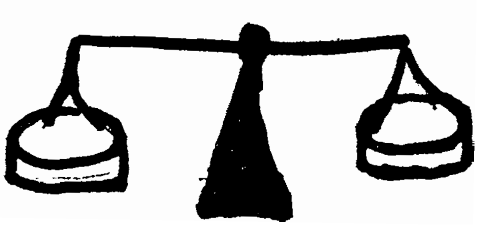
3) 

scratches

no scratch mark

4) 

Draw your rock here.

5) 

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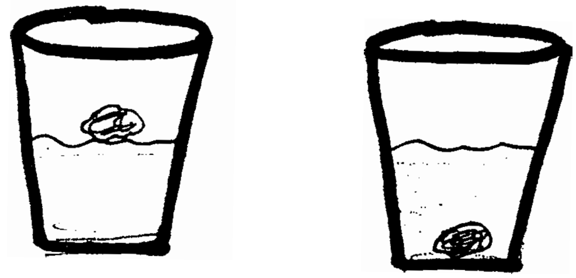
6) 

floats sinks

Janice

ROCK FIELD TRIP-97
(Auke Bay kindergarten classes)

Materials:
duck call
timer
Station 1: Rock Bingo
laminated bingo cards
laminated master rock cards for adult bingo caller
plastic container to hold cards
prizes for bingo (jelly beans)
write-up for parent volunteer on bingo game
Station 2: Special rocks
write-up for special rock station for teacher
one blindfold
Station 3: Rocks to soil
bucket of soil
Recipe for soil (with pictures) see "Magic School Bus -Inside the earth"
4 hammers or mallets
4 ziploc bags (for grinding rocks)
2 blue tubs
spray bottle with water
large jar with "air" label
1 trowel

Activities:
1. Divide class into 3 groups and walk to beach. Each group will go to a station. Stations will rotate about every 10 minutes. They are as follows:

Station 1-Rock sorting (rock bingo) with parent/volunteer
Give each student a laminated rock bingo card. Each will have 16 pictures of rocks. An adult will have a master card list of these rock types mixed up in some sort of container. The adult will choose one of the cards. Students will try to find this kind of rock and put it on their card. First student to get 4 in a row (up or down) yells bingo. Repeat until time at station is up.

Station 2-Special rocks
1.Allow students a few minutes to pick out their own special rock for this activity. They may choose whichever rock they want as long as it fits in the palm of their hand and them can wrap their fingers around it.
2. Regroup in circle formation and give students a couple of minutes to study their rock closely. Tell them they need to get to know their rock-does it have layers? any holes? does it feel smooth or rough? what shape is it? and so on. Let them know they will need to be able to identify their rock by touch alone!

3. When students are ready, the leader should blindfold one student. That student will be given a variety of rocks and he/she will have to identify their own. Teacher points to a student in the circle, and that student quietly gives the blindfolded student his/her rock. Eventually the teacher gives him/her their own rock.
4. Repeat with other students.

Station 3-Recipe for soil.
1.We're going to talk about dirt at this station! Show bucket of soil and ask students why dirt is important.
2.Ask students where dirt comes from. Well, I just happened to bring along a recipe for soil (which is another name for dirt). Pull out the recipe and read the first step: grind up some rocks.
3. Demonstrate how to grind up rocks with hammer and bag. Talk about safety with hammer. Hand out 1 bag and 1 hammer to each pair of students. Encourage them to take turns hammering.
4. Next have students dig for a handful of sand or clay.
5. Next have students collect dead plant material. Emphasize only collecting things that are on the ground-no live material!
6. Have them tear up the plant material in small pieces.
7. Last add air and water and voila!
8. Have the kids help you stir it up and then dramatically read the last step ("Wait one or two years!")
9. Then give students a chance to compare their soil with soil I brought. Talk about how long soil takes to form.
10. Some groups may want to dump their newly made soil in a secret spot where they can return next year to see what has happened to it!

If still time left after the 3 station rotation, could play Rock Charades. Divide class into same 3 groups. Ask teacher to walk away from the group. Give the students a rock to imitate in their group (ie. layers, flat, round, bumpy-use one of the rock bingo descriptions) Give groups 1 or 2 minutes to decide how they are going to become that kind of rock. They must form 1 rock between them. When groups are ready, bring the teacher back. Give her a list of possible rock types (bingo cards?) and see if she can guess which one they are. Repeat until kids tire of it.

Notes:
This trip was done on the beach across from Auke Bay school. We did not have time to play Rock Charades, but our trips were only about 65 minutes long. For a 90 minute trip, there should be time for some games at the end.

Directions for: **ROCK BINGO**

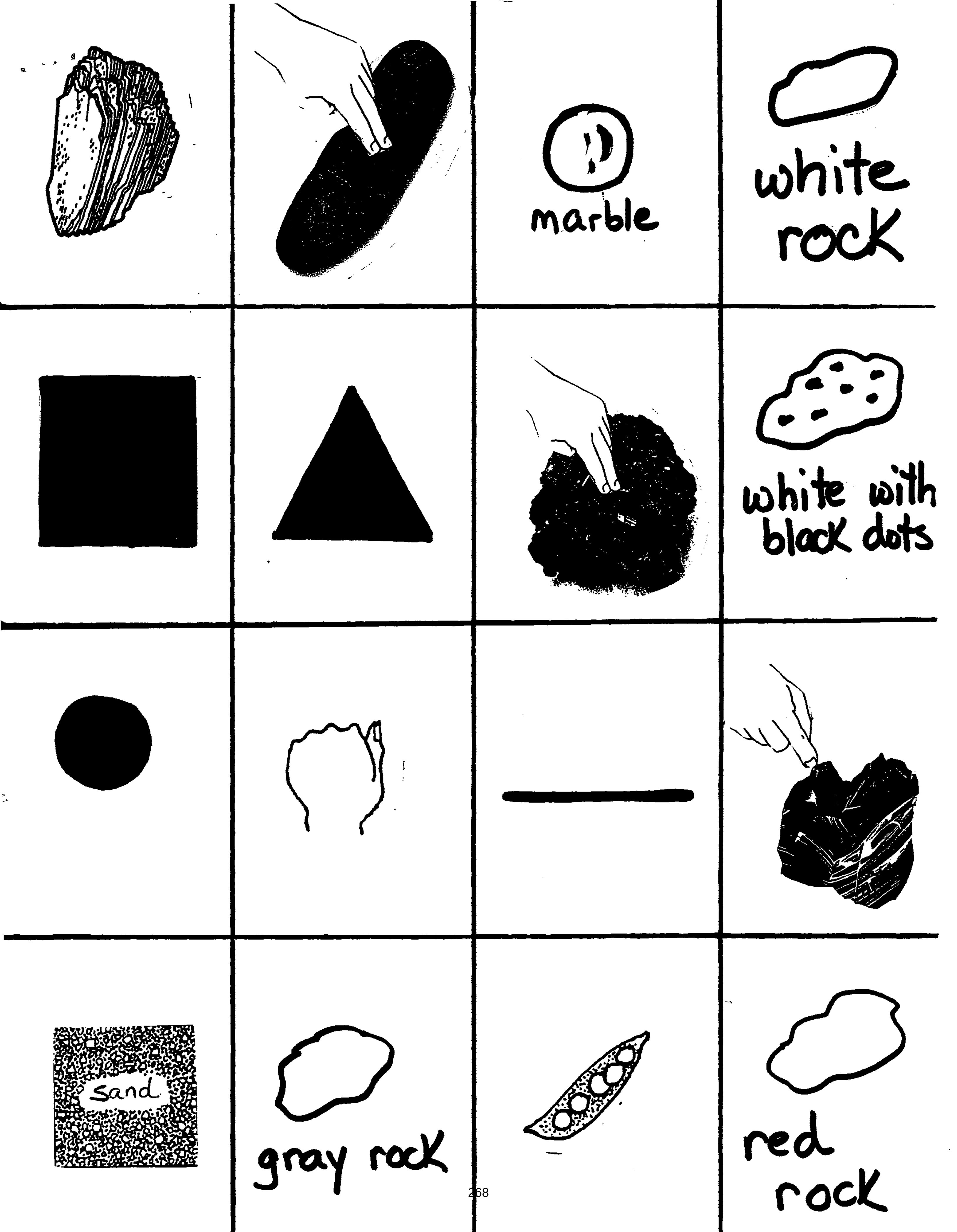
Give each student a laminated bingo card. Place the yellow cards of individual rocks in the plastic container. Draw out 1 card and read the back. Give students one minute to find the rock that is announced. (You may have to adjust the time depending on how the game goes.) Once they find the rock, have the students place it on their bingo card. (**Encourage collecting smaller rocks when possible so they will fit on the card**). Repeat until at least one student gets 4 rocks across or 4 rocks down. They should yell "bingo". Check their rocks and give them a jelly bean if they won.

If there is still time left, you could either leave the rocks on the card and continue until another student bingos or start all over.

Please give every participant one jelly bean before they move on to the next station so noone feels left out. Thanks for helping us out today!!

Directions for: **MY SPECIAL ROCK**

1)Tell students you will be giving them 2 or 3 minutes to find a very special rock. This rock has to fit in the palm of their hand and they have to be able to wrap their fingers around the rock.
2)Place students in a circle and give them a couple of minutes to study and get to know their rock. Encourage them to look for anything unusual about it: Does it have layers? Does it feel rough or smooth? Does it have any holes? and so on. Let them know they will need to be able to identify their rock by touch alone. Encourage them to close their eyes and see how it feels.
3)Next, explain that they will have to identify their special rock while blindfolded. Explain how the game works.
4)Ask each student to form a circle and place their rock in front of them. One of you will be blindfolded and will be asked to feel a few rocks and decide which one is yours. After blindfolding the student, the leader should point to kids in the circle. Without saying anything that student will place his/her rock in the blindfolded student's hand. Eventually place the blindfolded student's rock in his/her hand. Repeat until time at the station is over. (Note: you probably won't get to everyone in the alloted 10 minutes. You might want to warn kids about this ahead of time).


marble
white rock
white with black dots
sand
gray rock
red rock

Auke Bay - Kindergarten
Gastineau K-2
Winter 97)
(Janice)

SNOWFLAKES-K Class Winter Intro

Materials:
copy of Stella's story to read
3 pairs of sunglasses
signs for skit: 3 water droplets, 1 piece of dust (all on strings)
large cardboard snowflake
laminated snowcrystal cards (1 per student)
copy of weasel story
picture of a weasel
picture of Richard's drawing of a weasel

Activities: (form a circle)
1. Brainstorm with students how the winter season is different that spring, summer or fall. (short days, colder temps, snow) May want to have them come up with so many different ways.

2. Ask students if they know how a snowflake is formed. Ask for a few volunteers to demonstrate this process. Choose one student to be the snowflake and 3 other students to be the supercooled water droplets . Give the water droplets sunglasses. Read the story and ask the actors to act it out as I read.

3.Afterwards ask the actors to join the circle and very briefly review how a snowflake/crystal is formed. Discusss what would have happened to "Stella if there had been a strong wind. Also discuss how it was easier for the round balls to pack together rather than crystals.

4. Have everyone in room stand up and pretend they are all snowflakes. Have them float to the ground slowly, lose their points, become round balls in a snowpack. Towards the end try to talk quietly to calm them down for the story. Have them slowly sit up.

5. Tell students you will be reading them a story about a weasel. (Show a picture of a weasel). This weasel is hunting something under the snowpack and you are to guess what animal that is by listening for clues in the story. Read the story and have them make their guesses at the end. Discuss other animals that live under the snow in the winter (ie. porcupines/dens, etc.)

6. Tell students I will be handing them each a sheet with 2 snowcrystals. They will need to find at least one other student who has the same 2 snowcrystals as they do. Ask them to come back to the circle when they have found their match.

7. Hand out the sheets and give the students 5-7 minutes to share.

6. Reform circle and ask students to put their cards on the floor in front of them. Tell them I will be making statements about the snowflakes. If it is true of their snowflake they should stand up. (ie. Stand up if your snowflake has a star shape in the middle of it, if it has 6 points and so on).

7. End by briefly discussing what we will be doing on the field trip and what clothes to wear.

Stella's Story

Give Stella a dust sign. Give the super-cooled water droplets water droplet signs and sunglasses.

Once upon a time there was a tiny piece of dust named Stella. Stella floated on the wind way up in the sky. One day a big cloud of cooled water droplets passed near her and begin bumping into Stella-hundreds of them, thousands of them, millions of them!. She didn't know what to do! These water droplets bumped into her and began to attach themselves to her. After awhile she began to grow 6 beautiful points. *(Wrap Stella in a sheet and give her 6 point crystal).* Stella was becoming a snowflake. She was proud of her beautiful crystal shape. All around Stella were lots of other snowflakes forming, too, but noone else looked exactly like her. *(Hand former droplets pictures of snowflakes and have them join Stella).* Soon Stella and all the other snowflakes began to float to the earth very slowly. The wind was calm so Stella's 6 beautiful points were not broken as she floated to the ground.

After a few hours, Stella finally reached the ground and to her surprise something began to happen to her 6 points. They were melting! After a few days she became a little round ball. Stella was joined together with lots of other snowflakes that had turned into balls, too. *(Ask the droplets to roll up in a ball and join her).* Together these round balls made a snowpack which people could walk or ski across. But most of all Stella liked the animals that used her and her friends as homes in the snowpack they formed. She liked to hear them scurrying about in the tunnels below. She knew she was helping them keep warm!

(K) SNOW FIELD TRIP

Materials:
duck call
snowflake catchers (1 per student)
magnifying glasses (1 per student)
trowels (for digging in hard snow) (1 per group)
frisbee (1 per group)
bucket for collecting snow
shovel for collecting snow
plastic bag for bucket
snow ice cream recipe
snow ice cream ingredients: eggs, milk, sugar, salt, vanilla extract
bowl and large spoon to mix ingredients
measuring cup and spoons
medium sized serving spoon
trays to hold cups
paper cups to serve ice cream (1 per student)
plastic spoons (1 per student)
2 clear plastic cups for putting snow in to measure snowmelt

Activities:
1. Drive to site. Begin with a "wolf walk". Circle up and share observations.

2. If snowing, remind them about how snow crystals are formed, what happens when they hit the ground. Show a snowflake catcher and demonstrate how to use one. Tell them in small groups I am going to encourage them to explore the area and look at different types of snow-falling, on ground, underneath the surface, etc.

3. Remind them about the weasel story I read them. Tell students you want them to think about what animals live in this area and where. Have them imagine that they are an animal living under the snow. What would they eat? Where would they stay if there was a storm? Pull out a frisbee. Tell them this is a "treasure finder" and it will help them discover what treasures are underneath the snow. They use it by throwing it and then uncovering what is underneath it. Encourage them to go slow and use all their senses to explore the world under the snow.

4. Divide class into groups with 1 adult each if not already divided. Hand out supplies. Give groups 15-20 minutes to explore.

5. Regroup and share observations. Teach Camouflage game.

6. While kids are playing game, make snow ice-cream and serve!

7. Bring back a couple of cups of snow to school and have kids make predictions about how fast they will melt. Leave this experiment in the class. (Try to have 1 cup full of loose snow and 1 cup packed) You could also have them predict how much water each cup will produce.

Gastmeaw Winter 96

K-2 Winter Unit Class 2

Materials:
3 plastic containers filled with a scent(try orange, cinnamon, mint)
2 sets of 15 different film cannisters that have a different scent in each (the lids and bottoms will need to be marked with a secret code)
(good scents include: *vanilla, vinegar, soy sauce, mint almond extract*)
cookie sheet
5 stations made of egg cartons
-each with a scented film cannister and attached animal clue
5 or 10 scent jars for each group (mystery animal activity)

(Note for next time, suggest making clues a little harder-may want to consider dividing groups in half, each with their own scent)

Activities:
1. Tell students we will be discussing sense of smell today. Let's start with a warm-up activity. Tell students you will be walking around with a jar that has a special smell. They need to close their eyes and take a whiff. Emphasize they should not shout out their answer. Do for all 3 jars starting at a different place in the group each time.

2. Ask students if they can think of any animals that have a better sense of smell than we do. Discuss how animals use their sense of smell for communication: finding food, smelling prey, smelling their enemies, recognizing family members or mates, recognizing their home, etc.

3. Tell students we are going to do something similar to the hearing activities we did last week. This time we will have half the class be "parents" and half the class "babies". The object will be for the babies to find their parents by smell. Each parent will be given a film cannister with a different smell to it. They need to place themselves somewhere in the room. Give the lids to the "babies". Tell those students in order to survive they will need to find at least one of their parents. Divide the class in half and hand out the bottome part of the cannisters. (Shake cannisters before handing them out). Send the parents off to the other side of the room. Hand out the lids to the babies. Students should come up to the front of the room and I will check their match. May want to put a time limit on this activity (about 5 minutes) and see how many survived.

4. Ask students who have dogs or cats if they have ever watched their pets when they take them for a walk how they go around smelling everything. Discuss that their pets are using their sense of smell to pick up clues as to what has happened in the area they are exploring. We will be using our sense of smell to find clues to a mystery animal.

5. Give directions for the final activity. Demonstrate with one of the stations how to match the smell in a cannister with one of the cannisters on the station and then show a clue card. Tell students there will be 5 stations with 5 clues for their mystery animal. Points to talk about. I will be giving your group one cannister. That's your smell for all the stations, so don't give up your cannister. May also want to discuss how they can work in groups.

6. Divide class into 5 groups and assign them to a table. Hand out the group clues and while they are smelling their clues, place one station at each table. After it seems everyone has had a chance to find their first clue, rotate the stations (kids stay put). Repeat until all stations have been around once. Collect materials and form a group at the front for closure.

7. Discuss the animals each group had and the clues. Discuss how easy or hard this activity was.

Fall 97 Fifth grade Intro-Landforms

I started with Steve's paper idea. Hold up a piece of paper. What is it? What do you use it for? Where did it come from? Burn it? Where is it? Is it still here? What happpened to it? Change. Though we tend to view things like paper, desks, rocks, etc. as static, they are constantly changing. Geology the study of how the earth changes. We'll be looking at landforms, how they got that way, how they continue to change. What is a landform? Write it on the board in the shape of a mountain.

Show overhead showing bedrock and surficial deposits. What is bedrock? We're going to look primarily at the materials on top of bedrock. The sediments. What are some of the ways that rocks and soil get moved around? Brainstorm this-Rivers, avalanches, glaciers, oceans, gravity, earthquakes, people, landslides, etc. Which of these forces create sorted deposits, unsorted deposits. Think about the different kinds of sediment you have seen-on beaches, along roads and trails. If you had to sort them into different categories what would be some of the categories you could use? Show sediment size chart. Demonstrate mnemonic for remembering these categories.

Activity: Go outside and collect different sizes of sediments. Put them into piles that correspond with the way geologists classify sediments. Be able to tell which is which. Put fist-sized and smaller sediments into a bucket. Pour these materials down a hill. What happens? Is this a sorted deposit? What is the force moving these sediments? Slowly pour a five gallon bucket of water down through one of these deposits. What happens? Are the sediments being sorted? What are the forces moving these sediments?

Back inside show them the overhead of colluvial and alluvial deposits the two landforsm we modeled. How was each created, and how are they different? We'll be looking for examples of each of these on our field trip. Field trip prep- what we'll be doing, what to wear. Show picture of the muskeg area we'll be heading through.

What is bedrock?
What are sediments?
Give some examples of landforms.
What are some of the ways that sediments get moved around and landforms change?

Grade Field Trip- Landforms

Brief discussion of expectations. Answer questions. Quick review of bedrock-surficial deposits, kinds of sediments. Students make predictions on sediment shake. Which sediments will settle first? Why? Pass around several sediment shake jars for students to look at. Do sediment drainage experiments with them. Discuss.

Split into two groups once we get up to Crow Hill Rd. One group will go up above Quarry first while the other heads into the muskeg. Both groups will eventually hike up to the Treadwell Ditch trail to the place where a landslide took out part of the trail just before Lawson Creek. Students will be looking for different kinds of sediments, different landforms, places where bedrock is exposed, evidence of some of the ways the landscape they are walking through has changed and is changing. Some of the things we looked at and did include:

1. What are some human caused changes you noticed on the way up? What effect have these had or could they have on local landforms?
2. Look at colluvial and alluvial fans on Mt. Roberts. What were the agents that caused these landforms? What would you guess about the history of landslides and avalanches here from the vegetation you see here? Rounded mountain tops evidence of glaciation.
3. Walk up above Quarry. Crow Hill is a bedrock knob of slate. How do you think this rock was formed? What else do you notice from up here? Point out mining deposits at Sandy Beach. Dig pit in woods at top to see soil horizon. What kind of soil do you go through? What kinds of sediments? Discuss sorted vs unsorted . How did these deposits get here? (Have sediment size charts ready for use.) Do you get down to bedrock? How deep is the soil? What do you notice about the forest? (Even-aged, cut around the turn of the century.) Point out the shallowness of soil layer in spots aound the top of the quarry. Does anyone see a glacier?
4. Stop at edge of quarry where peat layer is exposed. Examine. What is this stuff? Is this a muskeg? Why or why not? What is below the peat? What is growing above?
5. Look at deep ruts in muskeg. What made them ? What do you see underneath the surface? Compare to other peat area.
6. Walk into forest briefly to get a feel for what it is like. What is growing there?
7. Walk into muskeg. What's different here from the forest? Why forest on one side of the road and muskeg on the other?
8. Point out upper parts of Bear Creek drainage, where Lawson Creek drainage is. U-shaped valleys vs. V-shaped valleys.
9. Treadwell Ditch-used to bring water to the mines. Stretches from Eaglecrest to south of Douglas.
10. Landslide. Look at soil horizon. What do they notice? Sorted or unsorted? What is likely source of this deposit? Grab chunk of clay, have students examine it. Marine deposits from when sea level was 500 feet higher, 8-12 thousand years ago. Marine terraces. Why did this land slide? Collect some clay to build a muskeg with.
11. Is the Lawson Creek Valley U-shaped or v-shaped?

Back at class students share some of the things they observed and learned. What did they enjoy most? What was most interesting? Most surprising? Why do they think some areas were forested and others muskeg? Next time we're going to try to figure that out with the help of some special 3-D glasses called stereoscopes.

Fifth Grade -Wrap Up

Today we're going to try to solve the muskeg mystery. I'm going to give you a series of clues, first with slides and then a short demonstration, and then we,re going to look at the area with the special 3-D glasses I told you about.

Slides- View of S. Douglas Island from Mt. Roberts. Where is this? What do you notice? Why is that flat area there? Marine terraces.

Drawing of Mendenhall Valley showing changes in sea level with retreat of glacier and isostatic rebound.

Graph showing isostatic rebound - Demonstrate with pan of water and block of wood. Discuss sea level changes.

Demonstration-Show muskeg in a jar, different layers including clay layer. No drainage has happened in two weeks. Where would you get deposits of clay? Pour water into another jar with alluvial deposits of sand and gravel-no clay. What happens? Remember this when we use the stereoscopes.

Stereoscopes-How to use. Coordinate System. Different techniques for getting the trees to "pop out" at you.

1. Find Gastineau School. 3-5
2. Look at 1962 photo. Compare to 1984 photo. What differences do you note?
3. Different forest types. Where are the biggest trees?
4. Find areas of biggest trees on surficial geology map. What are they labeled? What kind of sediments would you expect to find in these deposits? Do they drain well?
5. What does the surficial geology map tell you about the muskeg areas?
6. Any conclusions?

If time :

7. Find the rock quarry. How different is it from what you saw? What is it labeled on the surficial map? How old is the quarry?
8. Notice the "bulges" on the infrared map. What kind of deposits? (Look at geology map)

Handed out brief assessment to get feedback on what they liked and what they learned.

Comments: There obviously wasn't enough time to cover all this adequately in 45 minutes. I left the stereoscopes with the teachers and they had another opportunity to use them later on. Assessments were also done at a different time.

What are some of the ways that landforms change?
What are some of the ways that the area we hiked through has changed over time?
What evidence did you see of this change?
What kind of sediments drain best, worst? What effect can the kind of sediment deposit have on the landscape?
How are sediments moved around?
What forces or agents of change have had the most effect on landscapes around Juneau?

Third-Fourth Grade   Fall 98   Gastineau School
Class #1 (one hour)

Objectives:
-Familiarize students with nature studies
-Become acquainted with students
-Understand how a dichotomous key works
-identify characteristics of plants
-Become more familiar with local plants

Introduction

What is a naturalist? What do they do? Why?
Name Game

Activity

You can tell me your name. One way that naturalists learn the names of plants is by using a dichotomous key. Define.
Create a dichotomous key with students using the friend key.

In making the key we used different characteristics. What are some characteristics that plants have that could be used to distinguish them from one another? List on board

Hand out plant samples to each student. Study for one to two minutes, put out of sight and do a drawing from memory. Do a contour drawing of the plant (Draw it without looking paper and without lifting pen from paper concentrating on getting the outlines of the plant.)

Review some terminology used in plant keys-bud, bud scale, evergreen, deciduous. Do opposite, alternate, whorled dance.

Practice using plant key, first as a group and then in pairs if their is time.

Discuss preparation for field trip.

Field Trip

Objectives:
Practice using a plant key
Become more familiar with local plants
Gain more understanding of what a natural community is and how it works

What is a community? What is a natural community? What do we give to and receive from our communities? What do animals and plants give to and receive from their natural communities?

Walk to site and divide into two groups. Review how to key out plants. Students split into groups of two to three and key out 4-8 plants. Remind them to find several other plants of the same species after they figure out a name. What helps them recognize the plant? What else do they know about it besides its name?

Play plant id game.

Find solo spot, observe for a few minutes and then draw a plant or plants. Place students in at least two different plant communities for this activity.

Plant community walk . Explore the area some more with the focus of noticing what is different about the two different areas where students did their drawings. Who lives here? What are they giving to and receiving from their communities? Are the non-living things an important part of the community? Sometimes I did this activity by having students play the game camera, and then discussing the pictures they took.

Return to class to share experiences and discoveries.

Wrap up-Plants
(half hour)

Activity: Mapping

Students look at and help complete a partially drawn map of the areas we explored on the field trip. They help me retrace the route we took . They each are given one or two pictures of the plants we keyed out on the field trip. Using their memories, their field drawings and discussion with each other they tape the plants to the map in the areas where they saw them growing. We discuss any patterns noted and share observations about the different plant communities we explored.

They share any difficulties they had with using the keys, and I show them a few resources for learning more about local plants.

FIELD TRIP FALL 1998
Fourth Grade

Teachers: split into two working groups beforehand;

10 mins:	Class ready to go
15 mins	Walk to site and divide
20 mins	Activity: Soil recipes
10 mins	Snack time.
20 mins	Activity: Micro trail/ explore a rotten log
20 mins	Activity: dig and explore soil and label and bury items to decompose, flag
15 mins	Return to school
20 mins Game	
10mins	Discussion, share recipes, discoveries

Activity: Visit avalanche site. Explore, what different than forest (focus on soil, decomposers, vegetation type)
20 mins Game: race to the sun (soil, water, co2)
Soil profile forest vs avalanche slope
Wrap: in cemetery if nice, classroom if chilled.
Whole class discussion:
What were your discoveries in the field.

Fillers: Journals (if chilly camera focus on decomposers/soil)

Supplies:

- Rope to mark game line
- 2 Recipe card and markers (1/group)
- *Decomposer ID sheet ?*
- 30 hand lenses, 2 discovery scopes
- flagging
- shovels, trowels
- permanent markers

Fall 4th grade

5 Plans for the fall. Meet today, field trip ___ to the forest near the flume. We will talk more about the field trip at the end.

Gather in a circle

(5+)*Activity*: Hide and think. related items on tray, 15 seconds to observe, write on slip of paper what observed.

items: porky skull, scat, spruce branch, soil, worm,, fungus, cone, stone

slips of paper and pencils to kids

list on board as they recall. Are any of these items important to the others? List. Let's see if we can answer this question.

cycle of porcupine, starting with death

10 hold up skull and tell how found, hiking along treadwell ditch trail got off the trail and found quills, than a lump of quills, dug around and found this skull. No tissue blood hanging brain, nothing!. Where did it go? Draw a circle of decay.

What habitat does a porcupine live in? forest, *how is a porcupine a benfit to the habitat it lives in? help create and maintain soil and the habitat they live in* help create and maintain, food for others, plant energy to body, scat, decompose scat and body energy for animals, plants, and build soil

Who can think of other habitats? Select one and a tree that grows there.

15 give them picture of log they fill in Here is a poster of a dead tree what's missing? OK lets make it look like a real dead tree. Who can think of something to add? As they say, have them come up and tack on picture, or card with name on it. Have someone come up and open cut away.

what do you think this tree would look like in one year, 5, 25?

why soil important?

make colorful drawings

Water? (from the soil, travels through the roots to rest of plant, excess transpired

Shelter? (soil keeps roots warm, protected and support. Location also shelters such as: under other plant, behind rock, etc..

10 Food? Just like you and me a plant can not survive on sugar alone. What else does our body need? (minerals, etc.) A plant needs some of these same nutrients. You and I simply eat food and digest, for plants it is trickier they get them from soil. We know that decomposers take the nutrients from a dead porcupine and return them to soil.What else is soil made of?

fall 4th

Mushrooms ancient Greeks believed they came fromZeus's lightning because they appeared after rains and grew inexplicably. Middle ages, circular patterns fromed by some dubbed fairy rings, thought to be the work of littel people who danced at midnight performing magic rites.

Mushroom fruiting body of a plant, typical part of fungus above ground are the reproductive units - spores. Fungi: Plant Kingdom - Eumycota division which splits to 3 each subdivision into class etc. Subdivisions: Ascomycotina (ascomycetes): Basidiomycotina (Basidiomycetes); Myxomycotina (slime molds).

WRAP

10 Activity: plants are important in this cycle. they benefit from the death of the porky, here are 3 cannisters each containing something important for the survival of plants Cannisters: each table gets. one with soil, water, air They guess what is in there and look inside.

What does a plant need to survive? food, water shelter/room to grow. Where does a plant get these?

Close your eyes and you will visit a different habitat.

Imagine you are walking along a trail. The sun is dancing in and out of the clouds. It is bright out because there are no giant trees towering overhead. As you stroll along you find huge boulder and decide would be a good spot to sit and enjoy your surroundings..

Fall 4th

Organic vs Inorganic. Plate of organics what is common (from living). Plate of inorganics what common, (never alive) add minerals. pass around circle, one each way Bag of soil: how does this stuff turn in this?? these decompose, break down overtime mixing, creating soil.

Soil is important stuff!

5 Are any of these items important to the others?
What if there were no decomposers in the world?
does the death one thing support the life of another?

5 Field prep bring in item you eat, write on and won't decompose 3x3" prepare for a rotten time, I mean a rotting time. Look for deomposers in action.

Supplies:
plate of organics
plate inorganics
bag of soil
hide and think tray and items
paper slips and pencils
colored chalk
skull

Animal movement- Fourth Grade Winter 1998- Intro 1

hop, 4x lope, dance twirl, stalk-I've just been demonstrating what we will beinvestigating today- How animals move

last year in the winter you spent some time learning how to recognize animal tracks in the snow. This year we're going to build on that knowledge and do some more sophisticated tracking, looking not just at what is moving but at why and how. We're going to focus on mammal gaits.

Close your eyes- All of you have many pictures of animals moving in your head and we're going to call some of them up. a dog walking, a cat stalking and pouncing, a horse galloping, Ravens walking around the parking lot at Foodland.

How do animals move? Muscles, bones, brain, etc.
Why are some faster then others?
Why so some mainly run, wlk, hop?

Skeletal Posters-

Let's look at some of the basic scaffolding of animal movement
With partner look at poster and tell each other everything you notice about them.
Similarities? Differences
What do the colors represent?
Where are the Knees, Ankles?
Which is most like human?
Which is most different?
What bones are each walking on?

Activity 2-Balance/Stance

Partners. Stand with feet shoulder width apart, feet together, on one foot. Try to knock partner off balance by pushing gently on shoulder.
Straddle. What kind of straddle is most stable? What changes straddle?

Activity 3-Stability/Speed-Bear/deer race

Bear races on hands and knees but with them spread far apart, deer puts them close together. Which is faster? Which is more stable? Why don't animals with smaller straddle fall over? Bicycle analogy.
Demo relationship between stride and speed.
What animals here move quickly.

Foot position- Volunteer to walk, jog, run. Notice feet. What was different? Compare feet on posters. Is it easier to run fast with heavy boots or light sneakers?

Wrap-up. Stand up. With your legs show me straddle. Show me stride. Use the canvases to show straddle and stride.

Winter 98-Animal Movement_Gaits

Today we are going to try out some different animal gaits- the pattern of movement used by an animal. When tracking you can often tell a great deal about an animal by its gait. Can often identify an animal track from a distance just by looking at the pattern of its tracks.

What gaits are there? Have students draw what they think a walk, hop, run, trot will look like.

Review stride. Straddle. Walking stride shows distance from hip to shoulder. Straddle- how wide-bodied. Is it moving slow or fast?

Gait canvases-3 groups Which was easiest to do, which hardest?

Tracking slide show. Sign slide show.

Field trip preparation

Winter Fourth grade-Wrap up 1998

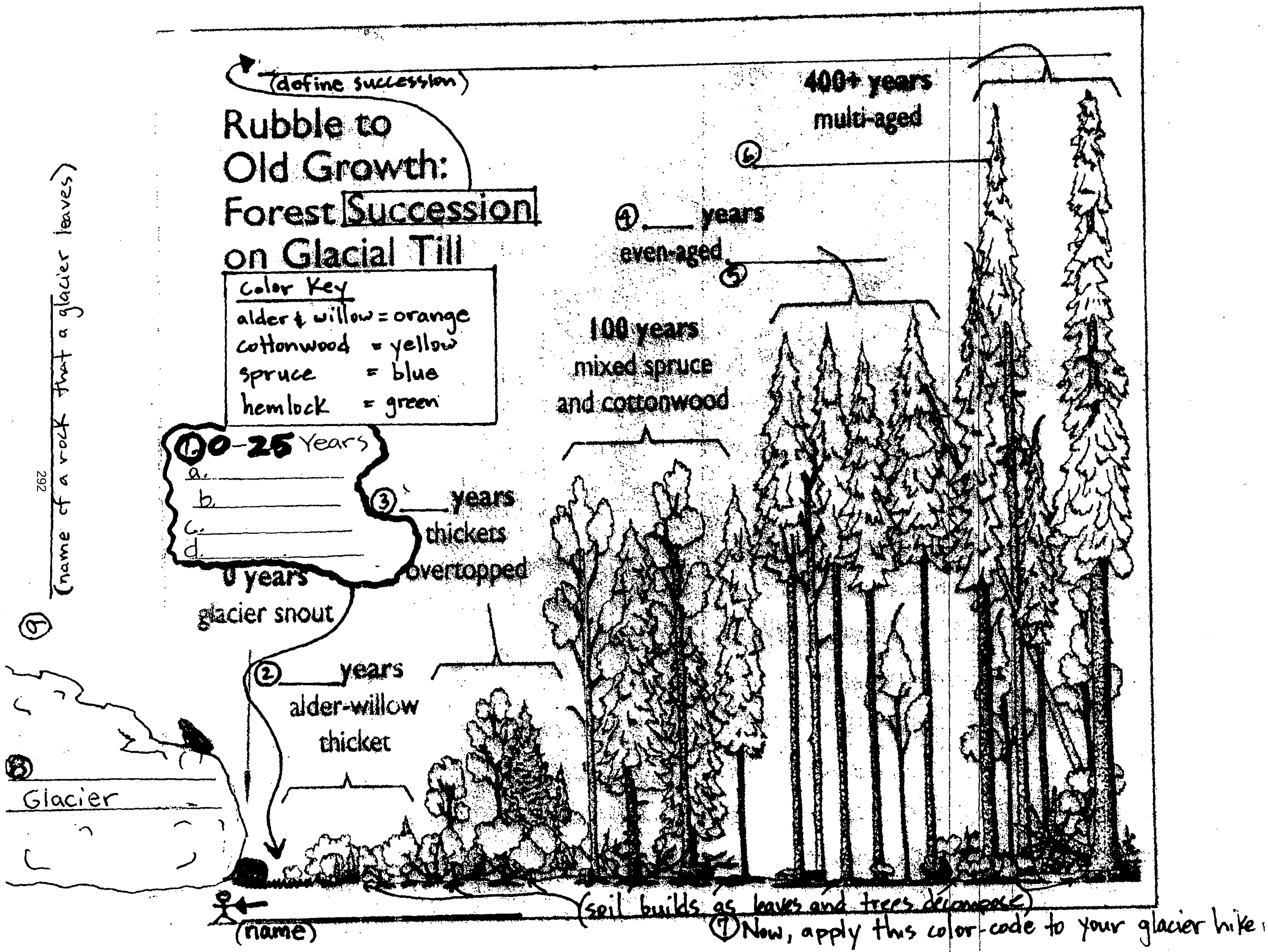
Snow stories

Use overheads or poster with potato tracks to introduce the idea of a snow story. Can simplify tracks. Remember to use gait sheet and tracking booklets to get track patterns right. Remember what changes in stride can tell you about how the animal is moving.

Have students work in groups of three to make potato print snow stories. Those who prefer to draw them have the option of doing that also.

Can be done in 45 minutes. An hour would be preferable, than students would have the chance to read each others stories. Also helpful to have students draw a snow story a head of time before they do the potato print ones.

Materials: Potato prints- At least two per group
paint, brushes, paint dishes
paper
newspaper
overheads
tracking booklets


(define succession)
Rubble to Old Growth: Forest Succession on Glacial Till
Color Key
alder & willow = orange
cottonwood = yellow
spruce = blue
hemlock = green
① 0-25 Years
a. ____
b. ____
c. ____
d. ____
0 years
glacier snout
② ____ years
alder-willow
thicket
③ ____ years
thickets
overtopped
100 years
mixed spruce
and cottonwood
④ ____ years
even-aged
⑤
⑥
400+ years
multi-aged
⑧
Glacier
⑨ ____ (name of a rock that a glacier leaves)
(name)
(soil builds as leaves and trees decompose)
⑦ Now, apply this color-code to your glacier hike.

FROZEN, WET, and WILD

Introduction: I moved to Juneau, AK in the summer of 1999 and began working for the University of Alaska Southeast. I had visited Southeast Alaska the two previous summers, during relatively nice weather, and decided I had fallen in love with the landscape and wanted to live year round. So I moved from Denver, CO where I was going to graduate school to Juneau, AK.

Denver

FROZEN:

Glaciers cover about 75,000 square kilometers (about 28,957 square miles) of Alaska, or more than 5% of the State. They occur on about a dozen different mountain ranges and on three island areas. The number of Alaskan glaciers is unknown, having never been systematically counted, but probably exceeds 100,000. About 2,000 are valley glaciers that descend to elevations below a mile. Since the 1890s, about 700 glaciers have been officially named by the U.S. Board on Geographic Names.

Alaska's glaciers range in size from tiny cirque glaciers (< one square kilometer or about 0.6 square miles) to massive piedmont glaciers such as Bering Glacier and Malaspina Glacier (each > 5,000 square kilometers or about 1,931 square miles), each larger than the State of Rhode Island.

The area of Alaska's glaciers is:

- ~ 1/3 the glacier area of Canada
- ~ 1/2 the glacier area of Asia
- ~ the same glacier area as Russia
- ~ 2.5 times the glacier area of China and Tibet
- ~ 3 times the glacier area of South America
- ~ 6 times the glacier area of Iceland
- ~ 12 times the glacier area of Europe
- ~ 75 times the glacier area of New Zealand
- ~ 100 times the glacier area of the rest of the US
- ~ 1,000 times the glacier area of Africa

14 glaciated regions in Alaska, we are traveling along the Coast Mountains and the Alexander Archipelago geographic regions. Others include:
St. Elias Mountains
Chugach Mountains

Kenai Mountains
Kodiak Island
Aleutian Range
Aleutian Islands
Wrangell Mountains
Talkeetna Mountains
Alaska Range
Wood River Mountains
Kigluaik Mountains
Brooks Range

The Coast Mountains, which form the mainland portion of southeastern Alaska, extend for about 700 km from Portland Canal in the south to Mount Foster north-northwest of Skagway. From east to west, the glacierized area of the Coast Mountains is as much as 130 km wide (fig. 71). Included in the Coast Mountains are a number of individual ranges: Peabody Mountains, Rousseau Range, Halleck Range, Seward Mountains, Lincoln Mountains, Buddington Range, Kakuhan Range, Chilkoot Range, Sawtooth Range, and Takshanuk Mountains, all of which support glaciers. The southern most glaciated area is at the entrance of Portland Canal and is an unnamed glacier.

The greatest concentration of Coast Mountain glaciers are in two ice fields, the Stikine Icefield and the Juneau Icefield. The total area of glaciers in the Coast Mountains is 10,500km2 The LeConte Glacier is the southern most glacier in the Stikine icefield as well as the southernmost tidewater glacier in the Northern Hemisphere. As we enter into Tracy Arm and view Sawyer Glacier, part of the Stikine Icefield, we really are entering the edges of the Northern Hemisphere's Frozen Zone.

THE FOREST from americansalmonforest.org

At nearly 17 million acres, the Tongass National Forest in Southeast Alaska is our country's largest and most unique national forest. This magnificent landscape of western hemlock, Sitka spruce, western red cedar and yellow cedar trees is part of the world's largest remaining intact temperate rain forest – and hosts some of the rarest ecosystems on the planet. The Tongass comprises thousands of mist-covered islands, deep fjords, tidewater glaciers and soggy muskegs that provide ideal habitat for a vast array of wild plant and animal species, including healthy salmon and trout populations. According to the U.S. Forest Service, the Tongass includes roughly 17,000 miles of clean, undammed creeks, rivers and lakes that provide optimal spawning and rearing conditions for the region's copious wild Pacific salmon and trout. Each year, abundant wild salmon runs return from the ocean to Tongass streams to spawn and die. In this process, these fish bring nutrients from the productive North Pacific Ocean to the much less nutrient-rich land. Because Tongass ecosystems are sustained by the annual salmon returns, the Tongass is literally a "salmon forest."

THE FISH

According to the U.S. Forest Service, the Tongass includes roughly 17,000 miles of clean, undammed creeks, rivers and lakes that provide optimal spawning and rearing conditions for the region's copious wild Pacific salmon and trout.

All five of North America's Pacifc salmon species are found in the Tongass National Forest: Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), pink (*O. gorbuscha*), sockeye (*O. nerka*) and chum (*O. keta*). In addition to the salmon, the Tongass supports healthy populations of both the resident and anadromous forms of rainbow trout (*O. mykiss*), cutthroat trout (*O. clarkii*), and Dolly Varden (*Salvelinus malma*).

Southeast Alaska salmon and trout provide an important source of employment and income for thousands of fishermen and fishing business owners. According to a study commissioned by Trout Unlimited, Southeast Alaska salmon and trout in 2007 provided close to 11% of regional jobs and supported almost a $1 billion industry that includes local commercial, sport, hatchery and subsistence fisheries (full study available here). In 2011, Southeast Alaska produced the largest salmon harvest in the state, with fishermen hauling in a total of 73.5 million fish worth in excess of $200 million dollars

The wild salmon spawned and reared in the Tongass National Forest represent approximately 70 percent of all wild salmon harvested from our national forests, roughly 24 percent of Alaska's overall salmon catch, about 30 percent of the salmon caught on the West Coast of the United States and close to 13 percent of the salmon harvested on the Pacific Rim.

THE WILDLIFE

The watersheds of the Tongass National Forest support abundant and diverse populations of wildlife, including some species that are found nowhere else in the world and several species that have experienced population declines in the southern portion of their ranges. Over 70 species of mammals large and small are found in the Tongass, including more brown bears than the entire Lower 48 states combined, as well as black bears, wolves, squirrels, and martens. The watersheds of the Tongass also play host to moose, mountain goats, and Sitka black-tailed deer.

In addition to the mammals, over 275 bird species (including 150+ breeding species) utilize the watersheds and coastlines of the tongass national forest. The Tongass is home to the highest nesting density of bald eagles in the world, with some 7000 adult eagles inhabiting the tongass year-round and another 5000+ non-breeding and juvenile eagles migrating south to Washington and Oregon for the winter.

THE PEOPLE

Southeast Alaska's panhandle stretches about 500 miles from Annette Island in the southern reaches, near the border of British Columbia, up to Yakutat on the mouth of the Gulf of Alaska. This rugged region of coastal mountains boasts few roads. Most of Southeast Alaska can only be accessed by boat or plane, including Juneau, the state capital and the region's population center.

About 70,000 people live in Southeast Alaska, a region encompassing about 23

million acres. Southeast Alaska includes 23 incorporated communities and 21 unincorporated villages, according to the Juneau Economic Development Council.

Three Alaska Native tribes make their home in Southeast Alaska: the Tlingit, Haida and Tsimshians. Major industries of Southeast Alaska include government, fishing and seafood processing, tourism, education, construction, mining, transportation and forest products, according to the Alaska Department of Labor. More than one in three Southeast Alaskans count on some form of government-related work for income. But many are also employed by the fishing and seafood industries. According to research commissioned by Trout Unlimited, salmon and trout fishing contribute some $1 billion to the regional economy annually and account for more than 7,300 jobs directly or indirectly.

THE HISTORY

The Tongass National Forest's origins date to 1902 when President Theodore Roosevelt, an avid hunter and naturalist, issued a proclamation declaring it the Alexander Archipelago Forest Reserve. Five years later, Roosevelt signed another proclamation, creating a separate Tongass National Forest. Both areas were combined officially combined on July 1, 1908. An additional proclamation, signed in 1909, added more Southeast lands and islands, bringing the total area of the Tongass National Forest to what it is today: 16. 8 million acres.

In the late 1880s, less than a dozen saw mills operated in Southeast Alaska. Until the 1950s, most of the logging that occurred in the Tongass was small-scale. But in 1954, a large pulp mill in Ketchikan opened with a Forest Service contract to supply it with 50 years of Tongass timber. The Ketchikan Pulp Company obtained the right to log approximately 8.25 billion board feet of timber on the north half of Prince of Wales Island and the northwest portion of Revillagigedo Island, according to the Alaska Division of Economic Development. A second big pulp mill opened in Sitka in 1959. Like the Ketchikan mill, the Alaska Lumber and Pulp Co. mill in Sitka received a 50-year contract from the Forest Service, committing 5.25 billion board feet of Tongass timber.

The massive scale of logging on the Tongass that took place from the 1950s until the mills closed in the 1990s due to changing market conditions and other factors resulted in numerous lawsuits from environmental groups, sportsmen and others concerned about impacts on fish and wildlife. The Tongass came to be known as a place of seemingly endless litigation and bitter conflict. But in May 2010, the Forest Service announced a major course correction. The agency pledged to no longer focus on old-growth logging in roadless areas but rather to prioritize second-growth management, fisheries, tourism, aquaculture and other emerging and renewable industries. Trout Unlimited and other sportsmen's groups hailed the announcement and have been working with the Forest Service to aid its transition and to make fish

habitat conservation and watershed restoration a priority. Read more about TU's work in the Tongass.

From "The Stikeen River" by John Muir

The Stickeen was, perhaps, the best known of the rivers that cross the Coast Range, because it was the best way to the Mackenzie River Cassiar gold-mines. It is about three hundred and fifty miles long, and is navigable for small steamers a hundred and fifty miles to Glenora, and sometimes to Telehraph Creak, fifteen miles farther. It first pursues a westerly course through grassy plains darkened here and there with groves of spruce and pine; then, curving southward and receiving numerous tributaries from the north, it enters the Coast Range, and sweeps across it through a magnificent hundred miles long. The majestic cliffs and mountains forming are wonderfully adorned and enlivened with glaciers and waterfalls, while throughout almost its whole extent the floor is a flowery landscape garden, like Yosemite. The most striking features are the glaciers, hanging over the cliffs, descending the side canons and pushing forward to the river, greatly enhancing the wild beauty of all the others.

Merli Fall '99

Fourth Grade

Decomposition and the FBI: This class starts with death. Which is the opposite of how most science classes begin. Mostly we begin by talking about plants and animals and their life processes. But this one cuts to the chase and goes after one of our fundamental fears; what happens to life after it isn't? FBI: Fungus, Bacteria, Insects are the focus of this exploration. Several samples are placed around the room. Four questions are asked; What is it? Is it alive or dead? What is it doing? What will it become? Some of the samples are pretty well gone and not very recognizable so the students aren't required to know what each sample is but can take a quess.

I find this a good time to check in with the background noise in our everyday lives. Ones in which we are going so fast and unaware, that any thing that pulls us up short like rotting stuff, we tend to try and dismiss as gross or dissgusting. Kids haven't yet learned (thank god) to shut up around things that effect them. It's fun to say, " well, are you going to use that mold as toothpaste, or lipbalm? Now that's really gross. So if you're not going to put it on your sandwich ,what is that reason for that mold"? This line helps in a couple of ways. First it calls attention to the often distracting tendency of people of all ages to overreact and make a big drama out of things they don't understand. Secondly, it cuts to the real question of why the mold is there in the first place. A voice comes up saying it must be there for a reason. We can do amazing things sometimes with our imaginations. So much so that, often as not, we tend to stop looking at what it is and believe what we've imagined. This awareness is a fundamental step in becoming a good observer.

The idea in this lesson is to help kids toward understanding a deeper connection with life and death. That all life depends on that something else dies. So I invite kids to look not just at the rotting stuff but the living thing that is making its body out of it. This reenforces the previous years lesson where they learned that all living things are hunting nutrients.

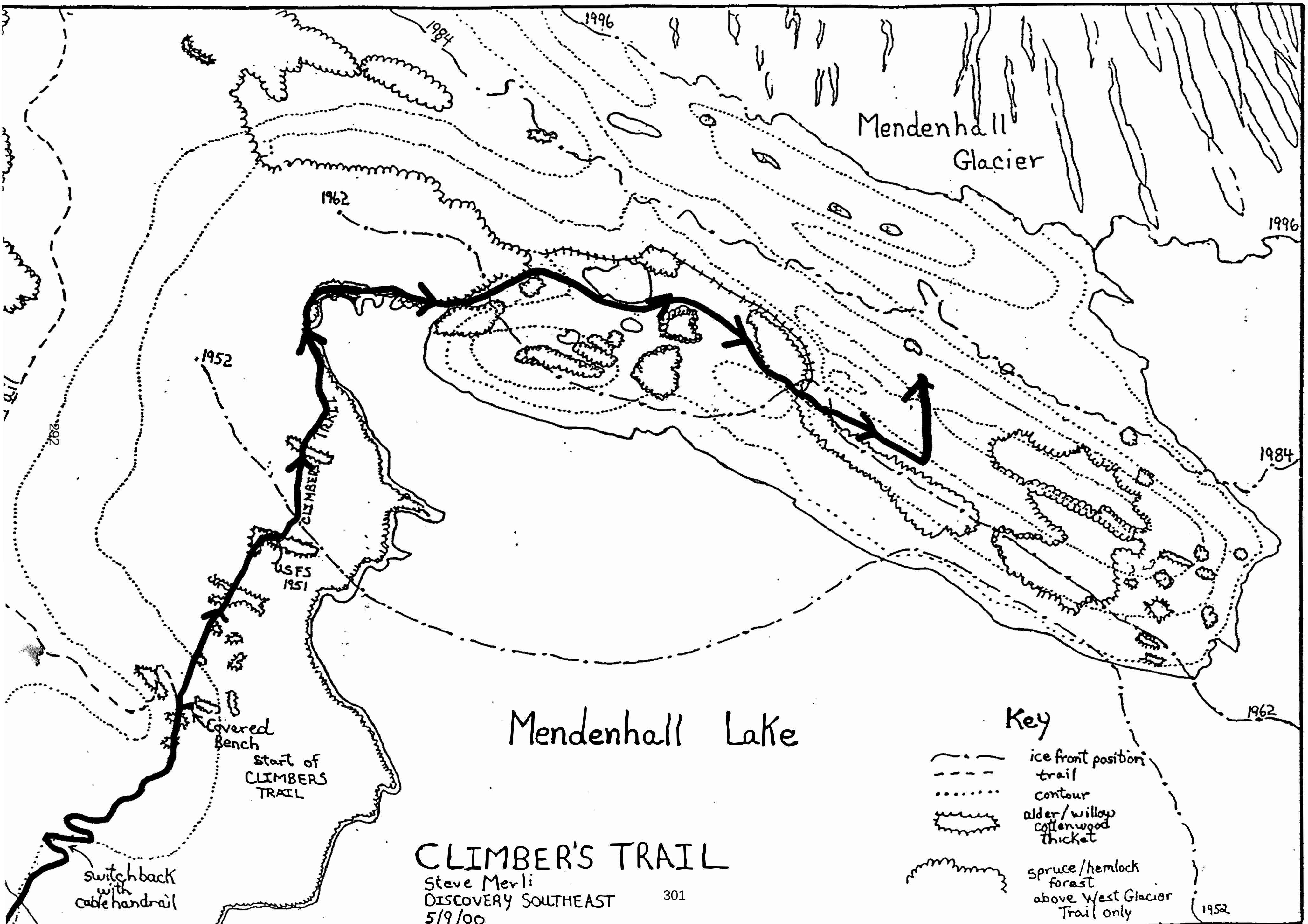
Field: This is a trip where we look for the FBI. In the fall it's not hard to find evidence of decomposition at work. Plants of all kind are dropping their leaves and getting slimey. Skunk cabbage is really good for this. Mushrooms of several kinds are abundant. Scats of animals make for interesting discussions on nutrient recycling. Of course the best thing to find is the remains of an animal. We have found dead birds, porcupines, beaver and once a small bear. Questions about how it died and what's been happening to it since are the first to come up. This always invites us to look closely. We sometimes plant a road-kill out in the field to make sure that there is an opportunity for these kinds of questions.

There is always the unspoken awareness that as we explore these questions, a realization of our own death starts to creep up to the surface. Kids will dance around this edge by talking about their dead pets. A few occassions the topic comes out straight and someone will say something about a loved one or themselves. These are special moments. I have found that kids are very fascinated by this topic. Once we get passed the drama.

Follow-up: I have just enough time to read Gary Larsen's, There is a Hair in My Dirt and answer the questions that reveal themselves. It's an oustanding finish to this lesson.

I like this class because allows us to wander into places that are really important for self-awareness. It's a topic that our culture chooses to brush off and not look at. It'd be great to have some high powered optics to look at these tiny organisms.

Map of Mendenhall (2000)



1984
1996
Mendenhall
Glacier
1962
1996
1952
CLIMBERS TRAIL
USFS
1951
1984
Covered
Bench
start of
CLIMBERS
TRAIL
Mendenhall Lake
Key
ice front position
trail
contour
alder/willow
cottonwood
thicket
spruce/hemlock
forest
above West Glacier
Trail only
1962
1952
switchback
with
cable handrail
CLIMBER'S TRAIL
Steve Merli
DISCOVERY SOUTHEAST
5/9/00

Nature studies curriculum 3-5 (2001)

How a Glacier Forms

Glaciers can begin to form when snow remains in the same area year-round, where enough snow accumulates to transform into ice. Each year, new layers of snow bury and compress the previous layers. Thus, amount of snow that falls in the winter must be greater than what melts during the following summer.

Thus, a glacier is not going to form in a typical american city, wher the summer precludes the snow from remaining year around. Thus, sorry , a glacier is unlikely to ever form in your backyard.

The compression forces the icy snow to re-crystallize, forming grains similar in size and shape to cane sugar. Gradually the grains grow larger and the air pockets between the grains get smaller, meaning that the snow is slowly becoming more packed, increasing its overall density.

After about two winters, the snow turns into a special state of water called **firn**, intermediate between snow and ice. The density of firn is roughly half of liquid water.

Over time the larger ice crystals become so compressed and even denser, so that the air pockets between them are very tiny. This is known as **glacial ice**. In very old glacier ice, crystals can reach several inches in length. For most glaciers, this growth of ice crystals can take a century or more. Glacial ice, because of its density and ice crystals, often takes a bluish or even green hue.

Type of Water	Density
Snow	0.05 g/cm^3
Firn	0.50 g/cm^3
Ice	0.80 g/cm^3
Glacial Ice	0.90 g/cm^3
Liquid Water	1.00 g/cm^3

Return to the Glacier Main Page.

Geology of the Mendenhall Valley

Composition:

Subsurface: recent outwash and alluvial sediments overlying thicker accumulation of marine sediments.
Bedrock: metasedimentary and volcanic in lower valley
quartz diorite near Stroller White
70-225 million years old
Typical rocks: slate, greywacke, sandstone, argillite, limestone, extrusive volcanics altered to greenstone, schist, and phyllite.
Rocks generally dip steeply to NE

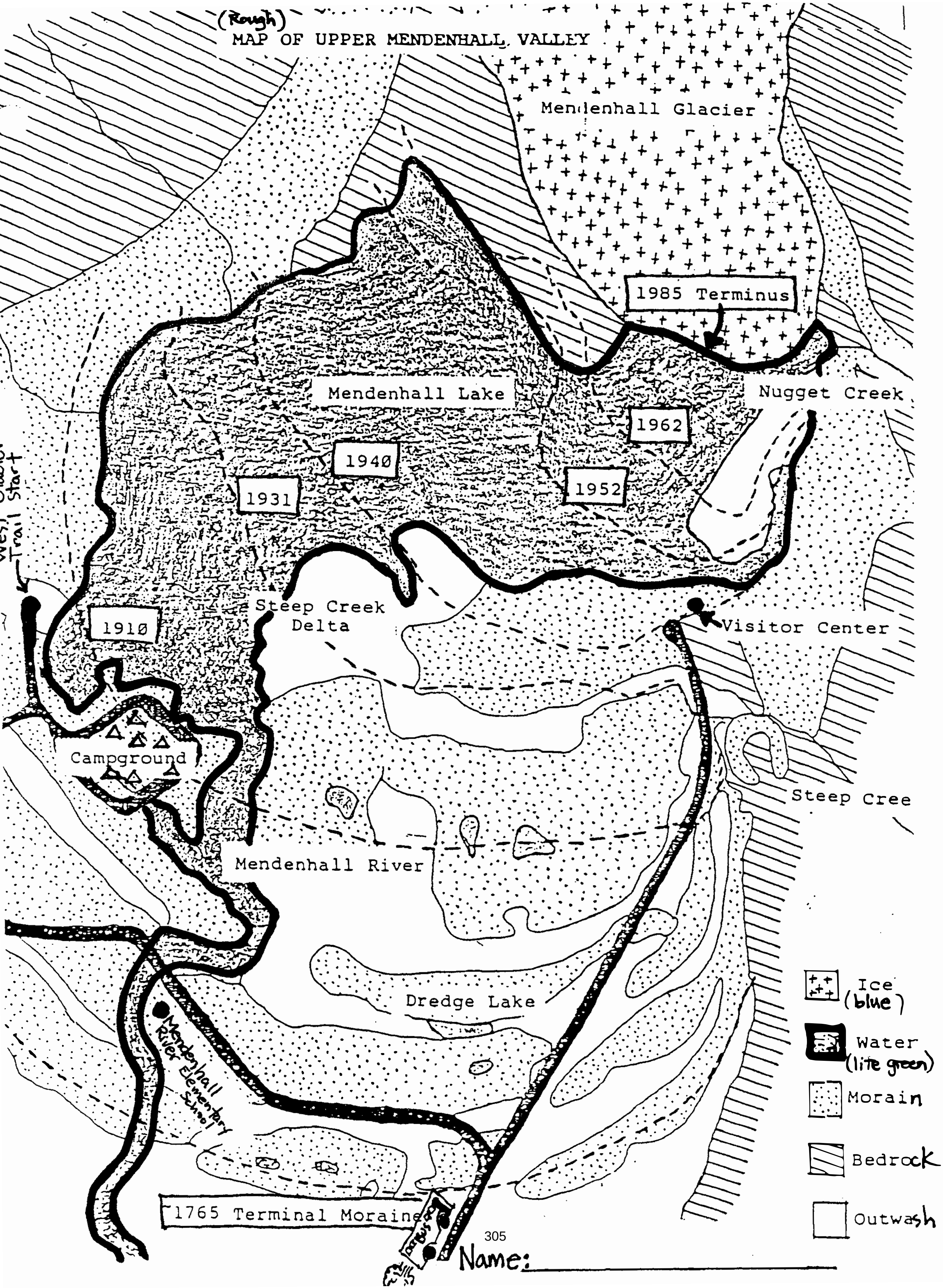
Geologic History

EARLY EPOCHS
Valley was formed by glaciation during the Pleistocene Epoch
18,000 yrs ago, ice sheet 4-5000' thick
17,000 yrs ago began to melt
During this glacial maximum, land depressed 700' in Juneau, relative to present
Worldwide ice buildup lowered sea level 360' worldwide
as ice sheet melted, both land and sea rose, but the land rose faster

MARINE PHASE: 10,000 – 4,500 BC (12,000 – 6500 b.p.)
After retreat of ice sheets, valley floor covered by seas >400' deep
11-7,500 yrs ago, the valley was free ice to the present front of the glacier
as ice receded, sediments deposited from glacier front and icebergs in the bay, also delta fans near streams
Rapid uplift of area: by 4500 BC (6500 b.p.) bedrock surface might have been within 35' of modern sea level.

NONMARINE PHASE: 4500 BC – A.D. 1750 (6500 – 250 b.p.)
glacier outwash and alluvial sediments from streams formed graded plain which advanced southward
tidal sediments deposited in front of plain
7,000 – 3,000 b.p.: no Juneau Icefield (gone completely)
3,000 b.p., climate began to cool, Icefield built back up, and glaciers advanced
Little Ice Age: began about 1,000 B.C. (3,000 b.p.): Glacier readvanced, overrode trees in lake area, excavated sediments from Mendenhall Lake, reached terminal position 1765
Increased streamflow led to flooding and burial of forest by sediments

PRESENT ERA: A.D. 1750 – present
Farthest modern advance: 1750 A.D. (250 yrs ago). Rapid retreat since 1765
glacier retreat average 40'/yr
as it retreated, temporary terminal positions recorded by morainal ridges of cobbles and boulders
Moraine material formed a dam that impounded lake
Between 1750 and 1900 the dam was overtopped, and the Mendenhall River began to flow in its present channel.
Lake became a settling pond for coarse debris.
max depth Mendenhall Lake, 200 ft
Depth to bedrock in center of valley, 180-500'
Mendenhall River carries sediment load principally derived from bank erosion, consisting of fine sand and silt.
Present: regional uplift at about 2 cm/yr, probably as a result of unloading by melting of Little Ice Age.
Sediments deposited during glacial advance are now being eroded and transported to tidewater.


(Rough)
MAP OF UPPER MENDENHALL VALLEY
Mendenhall Glacier
1985 Terminus
Mendenhall Lake
Nugget Creek
1962
1940
1952
1931
West Glacier Trail Start
1910
Steep Creek Delta
Visitor Center
Campground
Steep Cree
Mendenhall River
Dredge Lake
Mendenhall River Elementary School
1765 Terminal Moraine
Ice (blue)
Water (lite green)
Morain
Bedrock
Outwash

Name: ______________________

Discovery Southeast 1

Nature Studies: 4th grade

Naturalist: Walt Chapman **School: Gast. Elem**

Season: Fall **Unit Theme: Energy Cycle**

JSD Science Curriculum Core Content: Key Element
Over the whole earth, organisms are growing, dying, and decaying and new organisms are being produced by old ones.

Suggested Assessment Strategies
Student will list an example of a producer, herbivore, omnivore, carnivore, and detritivore.

Student will diagram an ecosystem complete with an energy cycle using examples of the above categories

Naturalist Objectives
Student will view common plants decomposing

Student will discuss the cycle of household garbage and compare to the energy cycle of the natural world.

Cross-Curricular Activities

Use the "inky mushrooms" to produce a watercolor for an art project

Create worm bins and graph number of worms over a period of time

Methods

In the first lesson students are introduced to a pyramid of Producers/Sun Munchers, Primary Consumers/Plant Munchers, Secondary Consumers/ Animal Munchers, and the F.B.I. Student contribute names of the flora and fauna that may be categorized this way. I lead a discussion of the importance of the base of the pyramid (Plants). We discuss how the energy becomes concentrated as it moves up the pyramid. The class compares this "energy cycle" to the water cycle. The importance of the FBI is stressed because it is able to complete the cycle and return nutrients back to a form that plants can use. I also challenge the students to identify a food that does not come directly or indirectly from plants.

On the field trip we play hare and lynx and look at population explosions and declines. We use muncher trays and share. We look at areas that are rich with signs of primary consumers and discuss why they are present. There is a long gone porcupine (4 yrs.) on the road above Gastineau; all that is left is some hair and quills. This site has a growth of grass and weeds that is not evident other places on the packed gravel road. This is used to illustrate the cycle in action. When time allows we finish with a game of Bear, Mosquito, Salmon.

On the follow-up we review the field trip and the energy pyramid. Students are then given the assignment to illustrate an energy cycle. They need to show all of the categories of producers and consumers as well as the FBI. They then share their working ecosystem with the class.

Evaluation

The material and activity works well with this age group. The concepts are very broad and we are able to bring into focus the natural world in the student's backyard. The games seem to especially fit the curricula and aid in the understanding if interdependence of species. Students and staff enjoy the "test" and sharing at the conclusion. At Gastineau, the 45 min. block is frequently not enough time for students to finish their illustrations and teachers have incorporated completion and sharing at later instructional sessions.

Fall/4th Grade-2001

Decomposition is the theme for this fall class. It has evolved over the years from a fairly straight forward, standard science class with life cycle diagrams and lists to a hands on discovery of common household digestive phenomena and their deeper implications for self-discovery.

The basic premise I hold to while thinking about and teaching this class is that nothing ever disappears but transforms from one way of being to another. One day early in this program I felt frustrated over the singularity of my presentation so I decided to go "off-trail" and bring into the classroom the unfinished, four day old bowl of oatmeal that was sitting on the floor of my car. I invited kids to say what it is I have in my hand. Answers like; oatmeal, rotting oatmeal, gross oatmeal, flooded the room. An air of repulsion best reflects the state of things. I found this intriqueing. The tendency was to dismiss the whole thing and get on with whatever science we were going to do.

At the same time their curiosity was aroused. I loved to use simple, everyday things to spark interest. Watching kids body language brought forward an obstacle we'd have to deal with; their perceptions.

Living in a nearly anticeptic world, children and alot of adults have this strong notion that germs are the bane of life, and if you even look at them you might die from some very strange and deadly disease.

These days, I head into fourth grade classes with a half dozen samples of rotting things. Most of them are from the kitchen, things that everyone has seen. I ask students to divide a piece of paper into six equal parts. On the board I list four questions: 1) What is it? 2) What is it doing? 3) Is it alive of dead? 4) Would you eat it? Then I give each group a specimen and ask them to answer the questions in two minutes.

It's really fun to watch the drama and the body language. Kids back away after the initial look. They begin to hold their noses. Words like YUK, GROSS, EEUUWWW begin to fill the classroom. I remind them of the two minute time frame. When it's up we rotate the specimens and answer the same questions. Each rotation the time shortens a bit.

When all the specimens have been examined, we'll look at some them more closely. But my main purpose in this class is to wrestle with the voices that initially show up when we see something rotting. This first voice is a very powerful one and has a strong tendency to shut down any further observing or learning. I call this voice, EUUWW #1. This is the instinctual voice. The one that says,"don't eat that!" A good one to have if you're really hungry and ready to eat anything. It just might kill you!

What we really want to strengthen is our EUUWW#2 voice which says,"EUUWW, thats cool!" Understanding awakens this voice and nurishes it. The best way is to remind kids that they don't have to eat this specimen for lunch; it's not going to be your next toothpaste flavor; you don't have to sleep with it, and so on. These humorous reminders invite the #1 voice to tone it down abit and just open a little space for our observer to peek through.

With the specimen of moldy beans in my hand we go through the questions. Sometimes you can't tell what it is. So I tell them. What's happening? The mold got to it before I did. That is, they're using it as food the same way we do. Is it alive or dead? That's one of those yes and no questions that start to show up when we awaken the poet mind. (see the 3rd grade, fall 2001 write-up for details on logical vs. poet mind) It depends on what your looking at. As soon as the beans were picked, they began to die, especially when they were cooked, but the mold on them is very much alive. And here's the most amazing thing, if this didn't happen, there'd be no life at all. We wouldn't be here.

This statement turns heads. What's mold got to do with me? they ask. "Everything", I answer, and we explore this by asking the third grade question, What do plants need to grow? We investigate soil and how it gets to be what it is. One of the specimens is a soil sample and we examine it. Pieces of dead leaves and stems in various states of decay are discovered. Why are they rotting and who is doing it? The Decomposers!

Usually at the beginning of the class I'll give kids a heads up on what we're going to talk about and write Decomposition on the board. Taking this word apart is a fun exercise no matter when it shows up in the lesson. (This is the key word for the standards bearers.)

Basically we categorize three types of decomposers; Fungus, Bacteria, and Invertebrates. These we simplify into the FBI. It's silly and that's why it works. Kids aren't going to forget it. Especially when I give them a homework assignment to go home and explain the FBI to their family.

Another sample is a tomato that's been worked on for many weeks by bacteria. At this stage the liquid smells very much like vinegar. This specimen offers a chance for kids to practice the #2 voice. At least one student has noticed the smell and shares this so others want to give it a try now. The look of surprise on their faces as the specimen makes its way around shows that room for understanding is taking shape. I'll throw out the reminder that of course we're not going to blend this up and pour it over icecream, but this is the same smell you get when you color Easter eggs in the spring. These bacteria are using the tomato to make their bodies and in the process their breaking apart the things that went into making the tomato as it grew on the plant.

When these kinds of explanations come up, many little side lessons arise. One is watching the spores from the molds fly off into the room and talking about how we have immune systems to deal with all kinds of foreign matter that enter our bodies. This can lead to a discussion on proper nutrition and why some foods are better than others for keeping us healthy.

Another, is asking where is this stuff going when it leaves the room? If I put it in my garden and it rots totally, then next year will my carrots use some of this stuff? Then if I eat the carrot, isn't it in my body helping to keep me alive? If I throw it in the dumpster and it goes to the landfill, will it be able to support another life very soon?

Connections is where all this heads, and lessons like these stir the pot of self-awareness because they invite kids into their bodies where a tremendous amount of information resides about who we are and where we come from. I believe that this is what this class inparts to children. Understanding the processes by which organic material gets moved around by millions of different life forms.

The field trip simply allows us to explore more fully what we have discovered in the classroom. In the woods these processes are easily recognizable, especially in the fall when the fervor of life is ebbing into the quiet of winter. Skunk cabbage leaves drop into decomposing whorls. Mushrooms push their way up into air, the fruits of much larger fungal bodies beneath the surface. Fallen trees soften as the FBI feasts on them. Dead animals we discover in various states of decay provide for some very good questions about anatomy and our own soft tissues and where they are eventually heading. On occasion we have brought roadkilled animals out with us to place upon the ground. These occassions provide the most meaningful experiences.

Snacks on this field trip can be a good topic in keeping with our investigations. Reading the ingredients one at a time and asking where in the world do they come from, continues to probe the connections.

The follow-up class I read Gary Larson's book, "There's a Hair in My Dirt", a worm's story. I have edited this book over the years because it's long and Larson has written it mostly for older audiences. It offers a good way to close this lesson, using funny pictures and story to restate what we have come to understand in our investigations.

In most classes I usually teach the kids the song, "Dirt you made my lunch." Sometimes I'll walk into the intro class singing it, or I teach it at the end. It often gets repeated, even into fifth grade. Here it is, I just sing the refrain:
Dirt you made my lunch.
Dirt you made my lunch.
Thank you Dirt, Thanks a bunch,
For my salad ,
My sandwich,
My milk,
And my munch,
Cause Dirt, you made my lunch. Thank's Dirt you made my lunch.

4th Grade Fall Program:

The FBI... Fungus, Bacteria & Invertebrates

Materials:

Refrigerator molds, fungi and compost (preferably with invertebrates visible)
Paper and pencils
Magnifying glasses
Black bear hide and skull
Gary Snyder's There's A Hair in My Dirt

Methods:

In class:

Ask students to divide paper into 6 blocks
Explain to students that they will be given 6 samples to observe and study
Ask students to answer the following questions for each sample:

What is it?
What is it doing?
Is it dead or alive?
Would you eat it?

Pass samples around
Once students have observed each sample, discuss them as a group
Introduce students to the energy cycle and to the FBI as its driving force
Invite students to consider a favorite food: pizza... and discuss FBI at work:

Plant a tomato seed in dirt
Grow a tomato plant
Pick the tomato to make sauce
Put sauce on your pizza
Sprinkle it with cheese... thanks FBI
Bake it, eat it and leave a piece on the counter
Piece starts to grow mold... the FBI goes to work
Put moldy piece in the compost pile
Composting pizza eventually makes dirt... thanks again, FBI
Put the dirt on your garden
Plant a tomato seed and the cycle starts all over again!

Sing "Dirt You Made (or Ate) My Lunch"

In field:

Look for evidence of the FBI at work... easy to find all sorts of examples
Hike to bear bones and invite students to consider why this bear died
Invite students to consider what this bear is "doing," what the bear is "becoming"
Look for blueberry sprouts growing nearby and ask what kinds of critters eat blueberries
Explain to students why they can't take bear parts home, or to the museum, etc.!

In class:

Revisit the energy cycle by looking at black bear hide and skull
Invite students to touch hide and skull and ask what this bear is "doing"
Ask students if this bear is "becoming"
Read <u>There's A Hair in My Dirt</u> as a final activity

<u>What worked?</u>

Refrigerator experiments a big hit
Finding the bear!
Comparing decomposing bear to preserved bear hide and skull emphasized the nature of a cycle:
- Decomposing bear is becoming soil, blueberry, bear, people, etc.
- Decomposing bear is part of the energy cycle
- Leaving decomposing bear in the woods means the cycle gets to continue
- Preserved bear is no longer part of the energy cycle
- The life of preserved bear can be measured by a straight line from birth to death

<u>There's A Hair in My Dirt</u> is a great wrap up

<u>What didn't work?</u>

Some kids had extreme allergies to refrigerator experiments
Keeping class as one large group (Pam Cure's class)

Discovery Southeast

Nature Studies

School:	**Auke Bay**
Season:	**4th Grade Fall**
Naturalist:	**Nonna Shtipelman**
Subject Area:	**FBI: Fungus, Bacteria & Insects... The Great Decomposers!**

Life is all about **energy**: living things need energy to move, think, sense, respond to the world, grow and reproduce. Present in the environment in many different forms, energy is light, heat, electricity, motion (kinetic energy), and the bonds between atoms and molecules (chemical energy). But what does that *really* mean? And how do living things get the energy they need to survive?

Living things depend on and contribute to the **energy cycle**, which starts 93 million miles away at the sun. The sun's energy travels to earth... and then what? All ecosystems include **producers**: living things able to convert energy from the non-living environment to a form other living things can use. Plants are the **primary producers** on land. Algae (including seaweeds) are the primary producer in the ocean.

Plants are able to do something no other living thing can do: they take the sun's energy, along with water and carbon dioxide, and transform it into oxygen and sugars, building blocks that store the energy plants need to grow and reproduce. Sugars combine with elements to make carbohydrates, fats and proteins. But what are carbohydrates, fats and proteins *really*? Energy! The same energy that moves through food webs to power all living things.

Able to make their own food, producers are the first link in the food web. **Consumers**, which can't make their own food, depend on producers for the energy they need. Consumers come in all sorts: animals that eat the plants that eat the sun are called **herbivores**, or primary consumers. Animals that eat other animals are called **carnivores**, or secondary consumers. Animals that eat both plants and animals are called **omnivores**. As plants and animals eat and are eaten, energy moves through each link of the food web, powering all living things. But, what happens when plants and animals die? Is the energy cycle broken?

Detritivores pick up where producers and consumers leave off: detritivores, or decomposers, get their energy by eating waste material and dead organisms. A critical part of the food web, decomposers return nutrients to the soil, the same nutrients plants depend on to start the energy cycle all over again. Without decomposers, nothing would ever rot, and the energy cycle would be nothing more than a straight line, measured by the life and death of each plant and animal.

Occurring at every level of the food web, some decomposers are so small we need a microscope to see them. Others are visible to the naked eye. And, others still are so big they're hard to miss. In this program, we will explore the world of the FBI: fungus, bacteria and insects.

The FBI decompose to recompose, and so it goes... the energy cycle begins anew!

Classroom Introduction: I will introduce myself and the concept of a "naturalist," inviting students to join me in using our skills and senses to explore the natural world together throughout the school year. I will introduce students to the concept of energy: its many forms, functions and pathways as it cycles through food webs. I will invite students to brainstorm ways in which living things use energy, and think about what happens when living things die. Is the energy cycle broken?

Next, we will explore the world of the FBI: fungus, bacteria and insects, by investigating a variety of refrigerator experiments. We will practice using hand lenses and our observation skills by studying and describing what we see.

Finally, I will preview our field trip: a fun, exciting and adventuresome opportunity to go out into the natural world! We will brainstorm how and where to look for the FBI, emphasize that this will not be a collecting trip, discuss what to wear and how to stay safe by paying attention to ourselves and others.

Field Trip: This is our opportunity to take what we've learned inside, out! We will go out as a group and review the skills and senses used by all naturalists. We will review important safety skills, break into at least 2 groups (depending on number of adults) and start searching for fungus, bacteria and insects. We will:

1. Explore forest and muskeg habitats while building naturalist skills.
2. Observe plant/leaf litter decomposition for evidence of the FBI.
3. Observe dead standing trees and rotting logs for evidence of energy cycling in action.
4. Make sure we are safe, warm, comfortable and learning enough to want to learn more!

Wrap Up: We will discuss our field trip, focusing on our observations, discoveries and surprises. We will read Gary Larsen's *There's A Hair in My Dirt* and discuss some common misconceptions about nature. Finally, we will emphasize our marvelous, magical and myriad connections to the natural world, and remind ourselves that in many ways, those connections are powered by the FBI.

Juneau Science Curriculum (4th Grade Life Science):

Key Elements:

1. Over the whole earth, organisms are growing, dying and decaying, and new organisms are being produced by the old ones.

2. Most microorganisms do not cause disease, and many are beneficial.

3. All organisms effect changes in the environment where they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.

Suggested Activities:

1. Identify different types of habitats or ecosystems in Alaska, the animals found there, the physical features of weather, and land cover.

2. Investigate living things for the presence of microorganisms using hand lenses and magnifying instruments.

3. Research and investigate types of microorganisms, decay processes, and the impact on other organisms.

4. Identify the role organisms play in building soils and changing the physical environment.

Hi! My name is Nonna… you can call me Nonna.

Does anyone know why I'm here today?

I work for a place called Discovery Southeast… does that give you any clues?

My job is to come to the Auke Bay school every fall, winter and spring and share with every 3rd, 4th and 5th grader (so I'll see you again this year, and probably next year too!) what I know about the natural world outside your classroom.

So, what kinds of things will we talk about?

Plants, animals….. right!

That's a lot to know!

Do you think I know it all?
No, of course not!
I can't possibly know everything.
And, I can't possibly figure it out all by myself.

So, who's going to help me?

You!
How!

Does anyone remember something called a TOOLBOX?

You probably talked about this toolbox last year.

Everyone has a toolbox and it's what we'll use to explore the world out there.

What do you think is in it?
What will we need to explore the world?

Right, eyes, ears, nose, brains, fingers… SENSES and CURIOSITY.

Good to ask questions… that's how we figure things out.

Well, we'll use our toolboxes to learn TOGETHER about the natural world.

And part of learning is SHARING.

No one knows everything but everyone definitely knows something!
How do we share ideas?
There are so many great ideas out there… and probably right in here.

But what happens if all these great ideas… all 27 of them… come flying out of our mouths all at once? Which ones will we hear?

Sensory overload!!!
Our brains get confused and just turn off… too much information.

So, what will I ask you to do when you have a great idea to share?
Right! I'll ask you to raise your hand.

I know this will take some practice… lots of practice so let's start practicing now.

Okay, let's get started… I'm going to say a word and you think about it for a minute… roll it around in your mind and tell me what it makes you think of…

DECOMPOSITION
What's that word mean to you?

Now let's think about a word that's in that word…

COMPOSITION
What does that mean?
What do we do when we compose something?
Right… put something together.

So, if to compose something means to put it together, what does decompose mean?

Right, to take it apart.

Now think about this word… RECOMPOSE.

What's that mean?
Right, to put something back together again!

Say it after me… compose, decompose, recompose, decompose, recompose, decompose, recompose… and so it goes!

Think about that as we do this next thing…

Take out a piece of paper and draw on line down the middle and 2 more across… you'll have 6 areas. Now number 1, 2, 3, 4 in each area.

Okay, I will put one of these specimens on your desks and I want you to look at it, using your toolbox… remember… your senses and your curiosity… to answer these 4 questions:

1. What is it?
2. What's it doing?
3. Is it dead or alive?
4. Would you eat it?

Don't rewrite the questions, just answer them.

Okay, ready… go through the samples…

What is it?
What's it doing?
Is it dead or alive?
Would you eat it?

Green mold on the tomato is a mold… that's part of a big family of things called FUNGUS.

The white stuff on the tomato is part of a big family called BACTERIA.

What's in the stuff that looks like dirt? INVERTABRATES.

These guys are the FBI… we'll talk about them again in a minute.

So okay, who likes pizza?

Would you put fungus on your pizza? Besides mushrooms.
How about bacteria?
How about bugs?
NO! Of course not!!!

But, when I put this tomato in my compost pile and the FBI go to work, what happens to the tomato?

The tomato rots… the FBI decompose the tomato and it rots.
The tomato becomes dirt, just like this grass.

I put the dirt in my garden and grow a tomato.
The tomato gets picked and I make sauce.
The sauce goes on your pizza.
You eat the pizza.

Oh!!! You leave a piece of pizza on the counter and it gets moldy (just like this bread…) and the CYCLE starts all over again! WOW!!!!

So, would you eat this on your pizza? NO!
So, do you eat this when you eat pizza? YES!

So, the DECOMPOSERS are really the RECOMPOSERS and so it goes… FBI, dirt, tomato, pizza, leftovers, mold… the CYCLE keeps on going…

It really just depends on how you look at things…

Okay, on Monday we're going outside to look for the FBI in action.

We're going to do 2 things…

1. Listen to the voices in our heads… the ewwwww GROSS and the ewwwwww KINDA COOL… and we're going to focus on the kinda cool voice… the FBI are really cool and without them, the forest wouldn't be here and neither would our pizzas!

2. We're going to use our toolboxes to explore the world together. What do we need to have to do that well? To be comfortable when we are outside? Right… boots, sweaters, jackets, raincoats and rainpants, hats, warm socks…

It's your responsibility to be prepared.

What happens if you're not?
If you're not prepared, you may not be able to go.

I need to know that you'll be safe and that starts with how prepared you are to be outside!

Questions?

Third Grade Class 1
Winter

Goals:
•To become familiar w/ mammals of SE Alaska
•Understand classification of mammals (Order, family, genus, sp.)
•Skull characteristics (dentition, eye position)

Intro: What is your favorite animal? (list on board, and circle only those that are mammals.) What do these animals have in common?

*4 limbs *hair *live young *warm blood *mammary glands

What mammals live here in Juneau? (list and circle carnivores, herbivores, and omnivores, use colored chalk)

Skulls: Share basic info about the differences between the three and discuss types of teeth. Figure out our own mouth and what animal is most similar to ours. Teeth are important features for these animals, just as where their eyes are located.

Demonstration: Use 3 volunteers, 2 are back to back representing a deer, and the other is a wolf. Walk around both and determine where they can or cannot see you. Predator vs. prey. Why is the position of the eyes so important? Throw ball to wolf with one eye closed and both open. Why is it more difficult to catch w/ one eye closed? (depth perception). Are predators carnivores? What about prey animals?

Family tree: Using family tree sheet, let's see what animals in SE are carnivores? Go through most common mammals. Discuss their diet and where they live. Prep. for next lesson. We'll be looking at skulls more closely next week to see if we can tell by looking at their skull, who is most closely related?

Follow-up: Leave the Understanding the family tree sheet w/ teacher to do with students.

Materials: 3 skulls (bear, wolverine, beaver), mammal tree and follow-up worksheet. overhead transparancy for mammal tree, green, red, blue chalk.

Nature studies curriculum 3-5 (2005)

Fourth Grade Fall Program- Natural Communities

CLASS #l

Objectives

•Spark interest in learning more about the plant communities they are already familiar with.
•Determine factors that influence these communities.
*Learn about primary and secondary succession, patterns in SE

Introduction

Think back to last year, Who remembers what where we went on our first field trip this time last year? What were we looking at? What do you remember learning about those plants? (names, how to recognize them). Let's refresh our memories, just like I had to do this morning to relearn your names, and then we can go from there. (Share plant samples, and brainstorm ideas.)

-Examples: Spruce, Hemlock, Elderberry, Salmonberry, Blueberry, Devil's Club, Red Alder, Willow.

*Activity- after we've talked about two examples, have partners explain to each other how they are going to recognize them.)

Plant Needs

Learning the names of the plants and animals that live here is just the beginning. Think about how fun it is to meet your classmates at the beginning of the school year, who become better friends as you get to know them better. As a naturalist, I find myself getting more excited about the natural world all of the time as I learn more and ask myself more questions about what's really going on out there. We are also going to explore the forest again this year and learn more about it. You know who's who, let's figure out why these plants live where they do. What do you think this depends on? Basically, it depends on where these plants get their needs met.

EXAMPLE: Where are your needs met when you are here at school? Hungry? You go to the lunchroom. Have to go to the bathroom? Go to the restroom. Want to get some exercise and play? Play ground etc.

Plants are so incredible when you think about it. Here we are running all over the place in order to meet our needs, but plants don't do this. They are stationary, and they get everything they need from
one place. This also makes them very fragile, because if anything changes, they may die. Can you think of examples?

What does a plant need to survive? (list on board and draw a tree using various colors of chalk, this is helpful as a visual aid.) 1. food 2. water 3. shelter/space These are factors that influence what plants grow where they do.

Let's take a look at different natural communities and decide if all of the plants are having their needs met, and if so, why are they so different?

Before we get started, what is a natural community?
Natural communities are found where plants and animals can best meed their needs. Size is not a determining factor, a commmunity can be as small as a rotting log or a puddle of water.

Slideshow

1. Desert- Is this anywhere around here? Why not? Are the plants getting what they need? Why don't more plants grow in the desert? Discuss TOLERENCE (amount of light, water-imp. factors)

2. Tropical Rainforest- What kind of community is this? Do we have rainforests like this here in SE?
Why not? (Temp., precipitation, soil chemistry)

3. Kelp Forest- What do these plants need to survivie that is different from terrestrial plants? Or
it may be that these plants are tolerent of salt water, while others are not. How do these plants get all of their needs met? What about soil? (Holdfasts & able to take up nutrients from water) Do these
plants still need sunlight to grow?

4. Glacier- Let's look at some communities closer to home, and watch how they change. When
a community changes into something else over time, this is known as succession. SE Alaska is
a great place to study succession, because after a glacier has receded, the ground is completely barren of plants and animals, and you can watch and learn about what plants grow andwhat animals arrives first. After all, most of SE has been covered by glaciers in the not too distant past. Here in Juneau, glaciers were advancing until about 250 years ago. Let's look at the sequence of how forests are formed after a glacier begins receding.

5. Glacial Rubble- It doesn't look like much, but if you look closely, you'll see small lichens and mosses growing from the rocks. These are some of the first plants to grow, as they do not need soil to grow.

6. Alder Thicket- (25 years) They are able to get started because they do not require alot of soil for their nutrients. An important nutrient to plants is nitrogen, and alders, like many early successional plants, are able to get their nitgrogen from the air, they are known as nitrogen fixers. They also have winged seeds and are able to travel with the wind far away and land on recently exposed ground.They usually only grow about 15-20 ft., and then begin to die off. What is left after they fall and begin to decompose. Soil and light. Thick alders don't let much light in for other plants to grow. Willows are also found early on. They have lighter plumed seeds and often arrive before the alder seeds and are able to get started before the alders crowd them out.

7. Spruce/Cottonwood- (100 years) Cottonwoods shade out the alders, moss able to move to ground, and this area becomes rich with plants and wildlife. lots of deciduous leaves for insects, and lots of berries.

8. Spruce (150 years)- shade out cottonwoods, mossy floor, small hemlocks begin to grow, they like shade. less deciduous, less foraging for animals.

9. Old growth- 500 years) Hemlock dominant sp. 1. uneven aged & size of trees, 2.lush understory

3. Standing and downed wood 4. Trees at least 250 years old (in this slide, this tree is feet in diameter, center rotten, outer 250 annual growth rings 5. Acidic soils

10. Succession Drawing- Here's a chart that illustrates primary succession in SE, depending on certain factors, communities may not follow this exact pattern of development. But for the most part they do. What about communities that are not starting from scratch, like they do after a glacier has receded or a volcano erupts? Do these areas undergo succession? For example, what about an area that has recently been logged? What factors have changed that could cause the community to change as well? This is known as secondary succession, and occurs in areas where there have been landslides, floods, logging etc. When we go out in the field, we are going to see areas affected by secondary succession for the most part.

Wrap up

What factors influence where plants grow?
1. Amount of Sunlight
2. Precipitation
3. Composition of soil
4. Soil Chemistry
5. Temperature of soil and air

Will these factors be different within the same community? We'll talk about this more next week.

Fourth Grade Fall- Natural Communities
Lesson Two- Phyical Factors influencing plants

*Students should have had a pre-class with their teachers about pH prior to this lesson, A pH outline and equipment for testing household items was given to each teacher.

Objectives

*learn about how plants survive
*create and/or perpetuate enthusiasm and interest in plants and their physiology
*Determine factors that influence plant growth
*Develop plan for collecting data

Introduction

What do we all need to survive?(Food, water, shelter, air) Is the same true for all animals? What about plants? If so, how do plants get the things they need?

1. Water- from the SOIL, travels through roots to the rest of plant, lose excess water through leaves.

2. Shelter- from the SOIL, which keeps the roots warm, protected, gives it support to live. Location also gives it shelter, behind a rock, below a larger tree etc.

3. Food- from the SOIL and the sun. The plant is able to make its own sugar by using sunlight energy through the process of photosynthesis. It is also able to get other important nutrients from the soil? (Notice that SOIL is involved in all three, important stuff?) Just like you and me, a plant needs other nutrients besides sugar. What can you think of that your body needs? (calcium, protein, nitrogen, iron etc.) A plant needs some of these same nutrients, but its incredible how they are able to get them. You and I simply have to eat the right foods and our body digests in uses what it needs from the food we eat. With plants it's not quite so easy. First, let's look at where they get these nutrients from, SOIL.

Soil Composition and Chemistry

What is soil? Fill empty jar with air and quickly seal the lid. What's this?
AIR, what else? Water. Organic material (Plate of organics, talk about decomposing material, scat, bones etc), inorganics (sand, minerals, rocks)

Draw a tree with extensive root system. From a birds eye view you're looking down on this tree some 300 ft. in the air, and you have special eyes so you can see below the soil and find the trees support system, how long do you think the roots would be to support a tree this high? (Nearly as long as the tree is tall, about 300 ft.) The roots also transport the water and nutrients to the rest of the plant. How? Water is easily absorbed through
Soil Cont.

pores in the roots. Food is another story. It can't get into the plant like this. (Hold up plate of organics and sand.) What form does it need to be in?
(Solution, discuss terms solubility and solution.) This is where pH comes into the picture. You have done some experiments this past week with your teacher to learn something about pH. What can you tell me about pH? Review. Draw pH scale on board, discuss acids and bases and how to recognize each.

0____________7___________14
battery acid neutral drain cleaner

*Activity- have a pair of students demonstrate mixing an acid (vinegar) and a base (baking soda). What is happening in this chemical reaction? This is a good way to refresh their memories and discuss the strength/weakness of both acids and bases. How will this affect plants?

In soil, you'll find both acids and bases, some will have more or less of one, this is one factor that affects what plants grow there. Why? Well, depending on how acidic the soil is, some nutrients become more soluble.
For example. Calcium is important to plants, and as the pH increases, the soil is more basic (alkaline), and calcium becomes more soluble. Whereas, minerals like iron become more soluble as pH decreases.

If a plant isn't getting all of its nutrients in one place, will it be able to grow? Talk about examples of hemlock and pine growing in a Muskeg.
Plants have different tolerences and are able to survive acidic conditions.

Does a plant get all of its nutrients from the soil? No, they need sunlight as well. What part of the plant takes in the light? (leaves) Make sure they are familiar with photosynthesis.

Physical Factors
So, now we're going out in the field and we want to figure out why certain plants grow where they do. Remember, it's a matter of getting their needs met, and if they don't, can they tolerate the conditions enough to survive?
What factors should we look at to determine why the plants are growing in different communities?

List on board and if there's time, demonstrate how to measure.
1. Light- demonstrate use of light meter and % Cover
2. Water- drainage, signs of moving water
3. Soil Chemistry- measuring pH
4. Soil Composition- descriptive words for soil types
5 Temperature- Air and Soil

Wrap Up Next week, we'll be going to an area up near the flume and figure out why the area has different plant communities. You'll be working in 4 teams, each team will explore and collect data from at least 2 communities, and then we will come back to class to interpret our data (What do all of these numbers mean?) Discuss ways to explore natural communities and how to collect accurate data.

Materials Needed

2 glass jars
2 paper plates w/1 organic material, 1 inorganic
vinegar
baking soda
litmus paper, pH color chart
colored chalk

Kate Savage
David Troup
Mendenhall River School

FBI/ENERGY CYCLE '05

Intro:

1. Greetings, personal introductions. Here as part of an organization called Discovery Southeast (write on board) SE part easy (SE Alaska). Discovery is the big word – think of learning about something yourself (ex.sister and garlic).
2. Naturalist (w.o.b.) – see any other word? Nature! What is nature? Trees, air we breath, mountains, water we drink, nature is just about everywhere and we're all a part of it. Naturalist is someone who pays attention and discovers things about nature.
3. Naturalists use very special tools, probably the most precious and special tools in the world. What I have here is a toolbox – not my real toolbox, just brought it so you can help me figure out what my tools are. See if you can figure out – tool box. Magnifying glass, gloves, ear muffs, apple, diaper. Senses. Where is my real toolbox? My brain, all sense connected to my brain.
4. Are you all a part of nature? Do you all have a special toolbox with very special tools? Guess what? Can all be naturalists too– that's what David and I are going to do, help you become naturalists and discover all kinds of things!
5. Tomorrow we will be going outside to look for lots of different things. Tell you in a moment. First, need to talk about being prepared for tomorrow.

As good naturalists, you pay attention to what's going on around you. For example, what season is it? Fall. What happens in the fall? Leaves, birds etc. Why do they do that? Earth's tilt away from the sun, less light and heat. What's the absence of heat? Cold! What does that mean when it comes to us going outside – out for 2 ½ hours! Don't have feathers, fur, fat, don't migrate. We have to use our toolbox to help us from getting cold.

Sending home a note to whatever adult is at home, inviting them to join us and telling them to dress warmly. You may be counting on whatever adult is at home to make sure you stay warm, but I don't want you to do that. Your homework, very important, is to go home and make sure you're ready for tomorrow. Can get help but I want you to make sure you're ready too.Hat, gloves, layers, warm socks, boots, rain pants, rain coats etc.

What's your homework?

6. Now I'm going to talk about what we'll be looking for tomorrow. Our topic is energy and the energy cycle(wob). What's a cycle? Lots of different cycles in nature – water, rocks – all end up back where they came from. Energy also cycles. Energy takes lots of different forms – light, thermal = heat, chemical etc. E gives us the ability to move, think, react, grow, stay warm. For most living things energy come in the form of food. That's how we're going to make our energy cycle.
7. Start with a squirrel. Where does does a squirrel get energy? Food/plants
8. Where do plants get energy? Light from the sun, 93 million miles away! Compose(wob) = put together. Plants are the great COMPOSERS. Use water, light, nutrients from the soil to compose leaves, stems, food/energy for animals.
9. Wolf eats the squirrel. Wolf lives a long and happy life and then dies? What happens to the wolf? Hint: NOTHING IN NATURE EVER JUST DISAPPEARS, ONLY CHANGES SHAPE/FORM (TRANSFORMS)
10. Need something to change the form of the wolf. Plant composed, now decompose – to break down(wob). Wolf decomposes, but what makes it decompose? FBI! The great DECOMPOSERS!

1. Fungi – get mushroom, fruit of fungi, actual fungus is underground.
2. Bacteria. Bacteria have a bad rap, but bacteria all around us. If it weren't for bacteria in our guts we wouldn't be able to break down food!
3. Invertebrates – what are invertebrates? Earth worms!

10. Piece of paper, pass out samples. What is it? What is it doing? Is it alive? Would you eat it?

11. Discuss samples. Start with tomato – what is it? Mold/fungus. What is it doing? Decomposing. Is it alive or dead? Both. Would you eat it? No? Would you eat it if it was on your pizza?

12. What should I do with it? Being broken down into nutrients, so throw it in my garden. Plant a tomato seed, grow a tomato plant, pick the tomato to make sauce, put sauce on your pizza, sprinkle with cheese – thanks FBI – load with mushrooms – thanks FBI – eat it, leave a piece on the counter, starts to get moldy – thanks FBI – throw in compost pile, becomes dirt.

Starts all over again!

Field trip: Look for signs of FBI/Energy Cycle – from decomposing porcupine to seedlings growing on stumps to mushrooms to fallen leaves etc., played "Hug a Tree" (re using "toolbox"), danced with the devil's club, played camouflage.

Wrap:
1. Recapped the info. from the intro.
2. Discussed field trip and the kids personal preparedness, observations of FBI/E cycle.
3. Created a food web using yarn or read "There's a Hair in My Dirt"

5Th Fall '05

Kate Savage
David Troup
Riverbend Elementary

LAND FORMS '05

Intro:

1. Greetings, personal introduction
2. Recap Disco fall sessions – TOOLBOX,trees, dich. key to id trees, FBI – stands for? The great decomposers, very active this time of year…
3. Today we're going to be covering landforms(WOB) – question: what is a land form, an example of a landform? Yes, Mountains, hills, islands, valleys – all the lumps and bumps and everything between those lumps and bumps. We drive over and around landforms every day, look out our window at landforms, in Juneau we can't see the sunset because of landforms…
4. What's in those landforms? What makes up Thunder Mountain for example? Rocks! Mountains, hills, surface of the earth made up of big beds of rock called…bedrock.
5. But what's the big deal about rocks? They just sit there right? Doing nothing? Try to show you how that's not the case at all.
6. Rocks, like everything else in nature, change all the time. Rocks change enough so they form a cycle, like E cycle. Rock cycle. Shape of a cycle? My rock cycle is going to be very simple…Rocks deep underground to rocks on the surface(WOB).
7. How do rocks get to the surface from deep underground? 1. Volcanoes(WOB)- igneous rock ("fire") and 2. Uplifting (WOB). Uplifting when huge sheets of heated rock, material floating deep within the earth come together. Volcanoes happening all the time, but uplifting takes a long, long time – geologic time, dinosaur time, so much time it's really hard to even think about…
8. Once rocks on the surface what happens? Going to use this valley as an example of changes that happen to create and change landforms once rocks on the surface. Tell a story…
9. 20,000 years ago this valley not the valley we see. In the end stages of the Ice Age and covered with huge, thick sheet of ice. 10,000 years later. The ice was melting and retreating, instead of ice water had filled in the valley created by the ice – instead of ice over our heads, maybe fish. Then two things happened to fill in the valley. Rebound –

what happens to a cushion when you get up? Still rising! Tons of material – rocks, silt – deposited by glacier and river. But not the end of the glaciers and ice! 3000 years ago, cooling period, the Little Ice Age, glacier advanced into the valley.

10. Question: What exactly are glaciers and how are they formed? Glaciers = rivers of ice. Need 2 things to happen for a glacier to form – lots of snow and cold temps so the snow sticks. More and more layers of snow – crushed, like a snowball, increase pressure compresses all the air out of the snow and forms dense ice. Eventually when enough ice, ice starts to move like a river, spreading out, spilling down, where ice meets rock layer of water so ice can slide. Speed depends on climate and slope – colder, thicker ice, steeper slope. That's what was happening in the LIA 3000 years ago – glacier moving forward down into the valley, covering the forests. Glacier is like a huge river of ice and rock that moves downhill, also like a giant bulldozer – pushing rocks, carrying rock (like tongue on ice – rocks stick, like sandpaper).
11. Then only about 40 years ago, glacier stopped. Movement still forward, but overall going back. Why? Melting…Still moving back about 30 feet a year.
12. Glacier and ice is nature happening in a big way, but the process happening in smaller ways all the time – every minute, second. Called erosion(WOB) – process where forces in nature break down rock and other surface material and material gets carried away.
13. How does rock get broken down? What are forces of nature that start erosion? Called weathering… Wind, water, gravity, even plants. Water can work in number of ways – chemical change with rain, ice – like glacier or expansion in cracks. Temp. variation within rocks too. Broken into sediment (WOB).
14. Once broken, what carries them away? Same forces -wind and water –glaciers, rain, streams, rivers, waves. Move from high to low – gravity. Same forces – in SE water is a huge force moving material! But, do all different size rocks get carried away the same? No! Sorted (WOB) – see tomorrow. Here is where size of rock very important because rocks of different sizes get carried in different ways – boulders(head), cobbles(fist), pebbles(peas), sand (see individual grains), silt (too small to see, crumble if roll), clay(too small to see, holds together). How samples, including water tight sample of clay.
15. Get carried away and end up somewhere else – called deposition. E, S and D, E, S and D – happening all around us all the time. Sediments

sorted, carried away, form layers...sedimentary rock(WOB). Where are we going in the rock cycle? Yes, back into the earth! Deeper and deeper, heat and pressure...metamorphic rock(WOB). Cycle complete...

16. Show slides of the glacier coming and going, glacial till, rock sizes etc.
17. Talk about field trip/preparedness. Handout to parents.

Field Trip: Either in classroom or in the field read "Everyone Needs a Rock" by Byrd Baylor, have kids spend time looking for their special rock, look and chat about river from bridge (lots to look at!), play with water and sediment on sand bar with buckets (alluvial/colluvial fans etc.), - why does water go where it goes? Do rivers always run in the same direction (kids love this one – yes! Down). Look for erosion and deposition which is all over the site, check out the wetlands and talk about clay holding water, play camouflage etc.

Wrap:

1. Recap what we learned in the intro. Ice on Sat.
2. Talk about the field trip. Any questions? Was anyone cold? We were really, really fortunate, but also proud of everyone for being prepared and taking out what they needed to stay warm and dry. Did everyone find their special rock? Probably all gravel – easiest to carry. My rock in my pocket have had don't remember how long. Sometimes take it out and wonder: where did my rock come from? I know where I found it but where did it really come from? Was it once deep inside the earth? Did a dinosaur ever step on it? How many droplets of rain fell on it? Was it ever bulldozed by a glacier? How long did it take to get so smooth? There's lots of things about my rock that I'll never know but I have lots of fun guessing...
3. What else did we see? Huge force of erosion in the back yard of this school! Lots of rain – water was muddy (what color is the water normally and why?) – carrying sediments down... Saw lots of sand bars – even stood on one – with sorted sediment and saw where the river was carving out the bank. So what happens with rivers? First of all, is our river straight? No! Meanders...Path of least resistance – flowing around things, moving always in the same direction (down). How a river flows and what it looks like also depends upon how much water is in it, how fast the current is flowing – how much energy is

there. Draw a river on the board – try and figure out where we'll have the most erosion and deposition.

4. Also played with water a bit. Can anyone tell me what happened when bucket after bucket was poured downhill? Where was the water fastest? Slowest? Carry the bigger or smaller rocks down? Yes, carried down and deposited them at the bottom of our stream – created a shape. Formed a fan called an alluvial fan (WOB). Vs. colluvial with gravity. Lots of alluvial fans around Juneau! When sediment carried and dumped in the ocean called a delta…
5. Slides of Mendenhall River, alluvial fans etc.
6. Concludes fall session. Disco back in winter and spring. Hope everyone has a fun and joyous holiday.

Discovery Southeast

Nature Studies: 5th grade

Naturalist: Walt Chapman **School: Gast. Elem**

Season: Fall **Unit Theme: Land forms**

JSD Science Curriculum Core Content: Key Element
Waves, wind, water, and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas.

Suggested Assessment Strategies

Student will experiment with forces of erosion and create depositions

Student will identify avalanche slopes

Naturalist Objectives
Student will view and describe the process that creates alluvial and colluvial fans.

Student will identify sediment size from boulder to clay

Student will explore muskeg and identify layers

Student will view slides with examples of erosion and deposition on Douglas

Methods

The introduction had a slide show that consisting mainly of aerial shots of Douglas Island. The school is prominent in many of the slides. The main focus is erosion and deposition and the variety of forces that shape landscapes. Sediment size is also stressed; choosing two students to represent head sized boulders and fist-sized cobble. Forces that shape landscape are listed on the board as well as sediment sizes. The avalanche chutes visible across the channel are also discussed.

The field trip begins using the hill and stream on the playground to create two alluvial fans. Students form bucket brigades and watch the erosion and deposition. The sorting of material is emphasized. Students are then gathered into one group and find and name a cobble-sized stone. The stones are collected in a five-gallon bucket and eased down the same hillside. We identify if they were sorted in a similar fashion as our alluvial fans. Students gather the stones a second time and they are released again. The group makes note of stones that travel the farthest and those that move the least. The groups then move up the trail and view the old quarry above the school. Students will have viewed the quarry at several stages during the slide show. Climbing the dirt road, students identify micro-colluvial fans and the avalanche slopes of Mt. Roberts and Sheep Mountain. Students identify bedrock as we view road cut areas. We also note the differences of the forest and muskeg.

The follow up activity is a review of the introduction and the field trip. The forces that created the landscapes that were visible are reinforced and again listed on the board as well as sediment sizes. Alluvial and colluvial fans are reviewed. The students are then given a test at the end of the class. The students have to list 4 forces that result in erosion and deposition, identify 4 sediment sizes and describe the process that creates an alluvial fan. Those students are given an extra credit question of describing the process that creates a colluvial fan. The tests are graded and given back to the teacher so that may be included in the first report card.

Evaluation

This unit does work. The teachers appreciate having something to base a science grade on; at Gastineau, science is not taught until spring. The students and staff enjoy the slide show that features many familiar landmarks through a 50-year time frame. The field trip is a fun, active, hands-on means to teach the concept of fans. Using particular students to represent sediment size is a way to empower some student who may not actively participate in academic discussions.

Fifth Grade Fall- Natural Communities
Class #1- Landforms

Objectives
*interpret concepts relating to surficial geology
*consider Juneau area landforms
*find a language to describe landscape

Introduction

When learning about a natural place, what kinds of things do we study? (plants, animals, season, climate, rocks, etc.) Now, if you wanted to piece together a story about a natural place, what would you focus on, if you wanted to learn about the events of a long time ago, hundreds or even thousands of years? (Trees, you can age the trees and find out how long the community has been there, but if you wanted to go back even further than the oldest forest, what would be your best clues in nature to observe? (Rocks, they are the greatest clues to the past) So rocks it tis, what about the shape of the land, can that help you tell its story as well?

Now that you are all in 5th grade, and this is your third year of Nature Studies, I figure you are probably ready to solve more challenging mysteries, and Geology is a great way to dig deeper into the natural world. What does it mean, Geology? The study of the earth, we could talk about all kinds of things, so in order to narrow our scope down, we are going to learn about what's going on at the surface of the earth. Surficial geology is more easily visible, but you can see signs on the surface of what's happening below. Can you think of an example (bedrock) We'll have the opportunity to explore a natural area behind school, and figure out what has happened in the past and is happening to shape the land now. Does this affect what plants and animals are living up there? How do you think?

What processes dump material on top of bedrock? Think about how rocks are carried?

-landslides	-rivers
-oceans	-glaciers
-people	-earthquakes

Let's take a look at some slides that show some of these surficial landforms.

Slide Show

1. Aerial photo- Where are we? Mt. Juneau? Gold Creek? Forests? Size of trees, types? Water? Lots of action in Juneau

2. Slope w/ sorted material- We're living on the edge...Tracing the journey of the material deposited, What carried them here and why did they stop?

3. Delta- deposited by stream, beneath lake or ocean surface.

4. Alluvial fan- formed by moving water. Why is it sorted?

5. Vegetation on fan- willow, cottonwood, sometimes spruce, usually first places to be logged.

6. Colluvial (Base of Thunder Mt.) steeper than alluvial, unsorted material, gravity moved deposits, talus and avalanche.

7. Sediment Size- Learn a lot from this, why? -boulder (head), cobbles (fist), gravel (pea size), sand (course, med.and fine), silt (too small to be seen), clay (roll in hand, sticks together.)

8. Glacial Rebound- (ask before showing slide) We've looked at landforms that are deposited from the top. How can things be deposited from below?
Here's a hint. Why is glacial rebound greater in Glacier Bay? Here the land is rebounding about 1/2" year and it is over 1"" in GB.

9. Marine Terrace- Taken from mt. Roberts looking out to Douglas. During the Great Wisconsin Ice Age 20,000 yrs. ago, the land was depressed 500 ft. below sea level.

10. Infra-red photo- Taken from planes in 1979, conifers- dark red, alpine ridge tops and alder thicket- lighter red, clear water- black. Look at the scale and point out features.

Wrap Up
Next week, you'll be working in pairs to solve puzzlers from this infra-red photo as well as use a surficial geology map. We'll also take a close look at soil, make some observations and get ready for our field trip.

Materials Needed
Slideshow

Play dough - have students create landforms

Fifth Grade Fall- Natural Communities
Class #2- Landforms

Objectives

*determine surficial factors influencing natural communities present/past.
*observe landforms and solve puzzlers using stereograms
*recognize vegetation types
*make observations of soil samples
*brainstorm methods for interpreting landscape

Introduction

Next week we'll be going up to an area behind school, and working together in teams, you will decide on a couple of mysteries that you want to solve. Then we'll take what we find and see if we can put together a story about the area from as far back in the past as we are able right up to the present. Think about what we talked about last week, and how we can go about doing this? (soil profiles, vegetation differences, contour of land, surficial landforms) Putting together the story from both the past and present can be very challenging, but making careful observations, asking ourselves lots of questions and brainstorming ideas together, we should be able to get a fairly accurate idea about what's going on up there behind the flume. Today we are going to get some practice at interpreting landscape, using aerial photos and surficial geology maps.

Activity

Stereogram puzzlers- w/ a partner, use the photos and maps to figure out the following puzzlers.
1. Locate Harborview school, its coordinates are over 5 up 2. (this is written as 5-2.)

2. How long is Harborview? You can do this by using the scale bar to measure its length. Mark the edge of the building on a piece of paper, then hold it against scale bar marked 1,000 ft. (350 ft.)

3. What is downtown Juneau built on? (look at surficial geology map.) (Delta and mine tailings)

4. Using 1984 map, find the cemetary and parking lot behind it. Is the forest surrounding this open area made up of trees of different ages and size? How do you know? (trees are spread apart, deciduous, light color)

5. Find the forest stand at 1-11. It is covered with a dense forest, it looks like a carpet. Are the trees mostly the same size or different? (same) Are they close together or far apart? (close) This is not an old-growth forest. What could have happened long ago to start all of these trees growing at once? (avalanche, logging)

6. Find 3 places where you think there is a stream? How do you know? (V-shaped contour, carved by water)

Discussion

Discuss puzzler questions, and use slide of aerial photo for students to be able to come up and point out their observations. We've taken a closer look at landscape by looking at the shape of the land and the vegetation growing on top, but what else should we consider when we are out in the field trying to piece together our story? (Surficial deposits, Soil) So let's see what we can figure out by looking at these soil samples. (Silt, clay, pebbles, gravel, unsorted and sorted material). Where is this soil from? What helped shape these rocks? How could this layer have been deposited?

Wrap Up

How many of you remember where we went last year for our field trip in the fall? Well, I've been going up there often and each time I go, another question about the place pops into my head. I have written these down and hope that together, we will be able to figure some of these things out, and more importantly, we will all come up with more question to ponder. It's fun to try to solve mysteries of the natural world, and I look forward to doing some of this with you.

Questions for the Field

1. Was this area logged? If so, how do you know? When?
2. Where is the steepest slope? What is it?
3. Where are there signs of avalanches? What is the slope?
4. What type of soil has the best drainage? What plants are growing there?
5. Where is the stream moving the fastest?
6. Were there other streams here in the past?
7. What was the average circumference of the trees before logging? After?
8. Has there been a recent avalanche here? If so, how long ago?
9. What plant community exists here today? How do you think it was different before trees were cut?

5^{th} Grade Fall Program:

Biodiversity, Biomass and Habitat Mapping in Muskeg & Forest

Materials:

Aerial photos of study areas, with proposed development marked out
Plastic bags for plant samples
Sharpies to mark bags
Plot frames (four 12-inch pieces of cord per group)
Magnifying glasses
Scissors for vegetation clipping
Foxtail throw for random plot selection
Scale to weigh plant samples

Methods:

Intro:

- Look at photos and define study areas in muskeg and forest
- Review last two years' worth of Nature Studies discoveries in study areas
- Discuss proposed development in study areas
- Discuss ecosystem/habitat productivity
    - Define and distinguish biodiversity (BD) from biomass (BM)
- Describe sampling methods
    - Random samples
    - Count number of different species in study plot (mark on bag)
    - Clip and bag every specimen on bunchberry (Sitka black tail deer winter forage)

Field Trip:

- Once in center of the habitat, throw foxtail (or pick a number/direction or throw snowballs, etc.)
- Set 1 foot square study plot around sample point
- Write habitat type on bag
- Count number of different plant species rooted in study plot and write number on bag (BD)
- Clip all bunchberry plants rooted in study plot and bag (BM)
- Play camouflage

Wrap Up:

- Separate bags by habitat type
- Dry plant species
- Weigh plants to determine biomass per square foot of habitat
- Calculate biomass per acre of habitat
- Compare biomass per habitat type
- Compare biodiversity by habitat type
- Discuss where deer would rather be in winter (where's the food, shelter, etc.)
- Discuss impacts to deer and people should development proceed as planned

What worked?

Good way to tie together 5th grader's naturalist skills by building upon 3rd/4th grades
Easy to incorporate program into 5th grade ecosystems focus
Great way to do "real science"
Easy to include math concepts (estimation, graphing, extrapolation,, etc.)
Good way to start thinking about habitat values
If deer prefer forests in winter, what value is the muskeg, etc.
Throwing snowballs to pick random study plots!

What didn't work?

Some teachers concerned with terrain covered (the knob)
Additional wrap up time would be useful to make graphs, reports, etc. for UAS

Cool Stuff in Southeast Alaska

Name:____________________Date:_____________

1. How do ice fields and glaciers form?

2. What do glaciers like to follow?

3. What is another name for a glacially carved valley?

4. What is a glacier called when the front is moving forward?

5. Backward?

6. What is the original shape of a glacially carved valley?

7. How does a V-shaped valley form?

8. How high was the ice in Southeast Alaska 20,000 years ago?

9. What do we call it when the land rises after ice leaves?

Succession of the Boreal Forest After Fire

Student Handout

Herb Stage (0-5 years)	**Shrub Stage (6-25 years)**	**Young Forest Stage (26-50 years)**	**Mature Forest Stage (51-150 years)**	**Climax Forest Stage (150-300 years)**
Fire has burned the forest, returning minerals to the soil in the form of ash. Herbs (wildflowers, grasses, sedges) may grow from seeds and sprout from roots. Mosses and lichens may revegetate as well. In addition, seeds from outside the area may be brought in by wind or animals. Shrub seedlings often sprout from unburned roots, and many trees sprout from stumps. If the fire occurred in a mature or over-mature forest, dead trees called snags may still be standing.	Shrub and tree seedlings grow larger and begin shading the grasses and other small plants. Shrubs and tree seedlings offer good cover for many animals such as birds, mice, and snowshoe hares. Foods for wildlife, including berries, seeds, buds, and leaves are plentiful. Tree snags that have fallen are decaying.	Sapling trees such as birch, aspen, and poplar (all hardwoods) have grown too tall for their leaves to be eaten by most animals. The forest canopy has become more dense, shading the forest floor. Only shrubs, herbs, and mosses that are shade-tolerant can grow under low light conditions found in this stage. Spruce begin growing among the hardwoods; however, their growth is slow. Most tree snags have fallen.	Mature hardwood trees become less abundant as some die, opening the canopy for spruce to grow taller. Hardwood saplings, tall shrubs, herbs, mosses, and lichens also grow in the canopy openings.	The canopy is more open. The forest is mostly spruce trees. Hardwoods, tall shrubs, herbs, mosses, and lichens grow in the openings. There are dying and dead trees still standing which provide food and cover for some animals. Boreal forest succession depends on soil, climate, water, and the presence or absence of permafrost. For example, in cold climates where there is permafrost and little rainfall or snow, succession may not progress beyond the shrub stage. Only dwarf trees and shrubs can grow in such environments.

WHO LIVES WHERE?

Name:

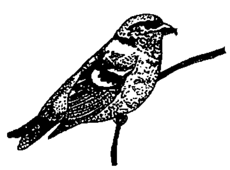
In which successional stage of boreal forest would each of these animals most likely be found? Compare the animal's needs to the information about the stages of secondary succession to figure this out. Fill in the number or numbers of the successional stage or stages in which you think each animal could survive best.

A 1 2

Flying squirrels eat fungi, berries, and seeds. They need standing live or dead trees to glide between. They escape predators by hiding amidst the branches of live trees. They need holes in snags for denning and roosting.

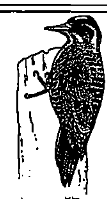
B 1 2 5

Voles eat seeds, berries, and fungi. They need many fallen logs, shrubs, and small plants to hide under.



C 4 5

Crossbills eat only the seeds of conifers and insects that live in the tops of conifers. They also nest in conifer trees.

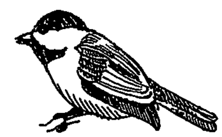


D 1 2 4 5

Three-toed woodpeckers feed on insects that bore into the bark of dead and dying spruce trees. They need large snags to dig the holes they nest and roost in.

E 3

Moose eat the branches and leaves of birch, aspen, and willow. They cannot reach the branches or leaves on young trees, so they need saplings and tall shrubs.



F 4 5

Boreal chickadees eat seeds and insects that feed on conifers. For nesting, they need holes dug by woodpeckers in large snags. They hide from predators in the branches of conifers.

G 2 3

Ruffed grouse lives in broadleaf forests. They feed mainly on the buds of birch and aspen trees. They often roost in conifer trees, but they nest on the ground under shrubs.

H 1 2 5

Red foxes eat voles and can only live in places where many voles live. Foxes dig dens under fallen logs, or into the ground under trees or shrubs.

1 Regrowth Herb Stage: Fire releases many stored nutrients. Plants and fungi begin growing soon after the fire. There are standing dead and dying spruce and broadleaf trees, called snags. Few have fallen to the ground yet.	2 Regrowth Shrub Thicket : Within 3-15 years, the site is covered by a variety of tall shrubs and saplings, such as willow, aspen, and birch. A variety of herbs grow in this stage. Dead trees lie on the ground, but many large snags remain standing.	3 Young Forest : Within 30-50 years, birch, aspen, and willows have grown into young trees. Spruce grow slowly, so they remain small. Few snags remain standing. There are fewer shrubs and ground cover plants in this stage than in other successional stages.	4 Mature Forest: After 75-100 years, the spruce have grown taller than the broadleafs. The forest is more open because many of the broadleafs have died. A few dead broadleaf trees are still standing and have holes in them. Fungi and a variety of seed and berry-producing shrubs and herbs grow here.	5 Old Forest: After 150-200 years, mainly spruce remain. The forest is fairly open and contains many large, standing dead spruce and broadleaf trees with holes. The forest floor is covered by fallen logs, and a variety of mosses and berry-producing plants.

Name:____________________

Title of Experiment: **Milkshake in a Jar**

Materials: 2 jars, various sediment sizes, water

Procedure: fill jars with sediments, add water to jar #2, shake both and observe.

JAR #1 Colluvial Sorting (gravity only, little or no water)

1. Please sketch your jar and sediments below:

Questions:

2. What sediment sizes do you observe? Boulder, cobble, gravel, sand, clay, silt? (please circle)

3. Are the sediments sorted? Or unsorted? Or both? (please circle)

JAR #2 Alluvial Sorting (water and gravity)

4. Please sketch your jar and sediments below:

Questions:

5. What sediment sizes do you observe? Boulder, cobble, gravel, sand, clay, silt? (please circle)

6. Are the sediments sorted, unsorted, or both? (please circle)

7. Which jar is more sorted?

5th grade field trip

STATION 1

What force carved out the Mendenhall Valley?
(hint: look to the north - use the compass; the needle points north)

Thunder Mountain Ridge is 3,000 feet high. The Mendenhall Towers (the peaks behind the glacier) are about 6,000 feet high. How thick was the ice covering this spot during the last ice age?
(hint: compare the shapes of Thunder Mountain and the Mendenhall Towers)

What was here 8,000 years ago, after the glacier melted back?
(hint: there's a clue in the bag)

STATION 2

Are the rocks that make up this hill sorted or unsorted? What kind of landform is this hill?

What are the two most common types of trees on this moraine?

How long ago was the glacier here?
(hint: use the chart in the bag. Find the type of forest that matches the one you see here and read how old it is on the time scale at the bottom)

STATION 3

Are the rocks in this spot sorted or unsorted? You can dig down with the trowel to check.

Was the river moving fast or slow through here? How do you know?

Why are there no trees growing here?
(hint: look at the map in the bag)

STATION 4

Are rocks in this spot sorted or unsorted? (you can dig down with the trowel to check)

Was the water moving fast or slow through here? How do you know?

What are the two most common types of trees growing here? (use the tree guide)

STATION 5

Two different kinds of mammals have had a big impact on this place. There are clues all around to which animals they are. What kind are they?

What evidence do you find that they have been here?

3 sides of a mountain, forming a dramatic **horn**. The most powerful of the glaciers that occupied this scene dug out a valley below sea level. Like most glacial valleys it has a **U-shaped** bedrock profile. When the glacier melted away the sea returned, creating a **fiord**. After thousands of years, the bottom is now covered with marine sediments.

A smaller tributary joined the main trunk glacier from the left, but it didn't gouge as deeply. The result is a **hanging valley**, also U-shaped, but perched high above the fiord bottom. A waterfall cascades from the lip. On the right, another U-shaped valley *used* to be a fiord, but was finally filled by marine deposits. A river meanders across it, capping the marine sediment with a layer of alluvium. In the 12,000 years or so since glaciers covered this landscape, streams have begun to cut shallow **V-shaped gullies**, minor compared to the spectacular erosive features of glaciers.

5) Roche moutonnées

But glacial carvings also occur on small scales. Which way did the glacier flow across this bedrock knob? *(right to left)* Such glacially smoothed topography is given another french term–**roche moutonné** ("rosh moo-toe-nay")–meaning "sheep rock," from its resemblance to lumpy sheep's wool. Roches moutonnées are smoothed and sometimes even polished on their upvalley sides, and jagged downvalley, plucking and quarrying of large boulders.

6) U-shaped valleys

Two glaciers occupied this scene in the Great Ice Age, at the height of their power even covering the ridge separating the two U-shaped valleys. The glacier coming toward us on the left cut somewhat deeper, so that when it turned to meet the smaller glacier coming from the right, a hanging valley was created. As in our diagram, a waterfall rushes down the lip.

7) High ice, moraines

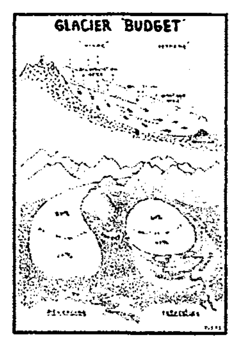
Where would you draw the Wisconsin high ice line through this scene near Haines? *(about at the top of the highest green vegetation)* What's the term for the bowl below the mountain in the center? *(cirque)* Is it still occupied by a glacier? *(Possibly. The crevasses near the top of the snowpatch indicate stress from downhill ice slippage, but this is about as small as a glacier can get. It's obviously nourished by avalanching from the cliffs above.)*

There are plain marks of erosion into the bedrock here–jagged horns and aretes, several glacial cirques, and vertical gullies caused by rockslides and snow avalanches. Do you also see surficial deposits on top of the bedrock? What's the term for the piles of loose rock and gravel at the lower right? *(colluvial fans, or rockslide, or talus)*

And what accounts for the wavy ridge of debris below the cirque glacier? Does it tell us anything about the glacier's recent history? Notice that the ridge, and all the rubble above it, are almost bare of vegetation, while the slopes on either side have brush extending hundreds of feet higher. During the Little Ice Age, which only ended about 2 centuries ago, this glacier was 3 or 4 times bigger, and bulldozed a **terminal moraine**. The glacial deposits are still unvegetated because **plant succession** takes a long time at high elevations.

To understand glacial deposits, we need to know how glacial ice moves...

8) Budget



A glacier has an "annual budget," in some ways like a human bank account. If a glacier "spends" more ice than it "earns," it may eventually go bankrupt, and melt back to an ice remnant, or a mere alpine snowfield, without enough mass to cause downhill ice flow.

Glacier ice comes not from freezing of water, but from compaction of snow, which falls year round at high elevations, and piles up year after year to a depth so great it gets squeezed into ice. All glaciers can be divided into an upper **accumulation area** and a lower wastage area (the technical term is **ablation zone**). In the accumulation area, more snow falls each year than melts. The wastage area annually loses more ice by summer melting (and ***sublimation*** *- this term optional)* than it gains by winter snowfall.

The accumulation and wastage areas are separated by the **equilibrium line**. At summer's end, the accumulation and wastage areas are easily distinguished. The accumulation area is still smooth and white, while the snow has melted away from much of the wastage area, revealing bare ice, often crevassed, sometimes blue where freshly broken, and usually "dirtier" looking from the rubble carried on the surface.

If "income" exceeds "spending," that is, if the accumulation area can deliver ice downslope faster than the wastage area can get rid of it, a glacier snout will advance. If "spending" exceeds "income," that is, more ice melts in the lowlands than the accumulation area can replace, the snout will retreat.

But it's important to realize that even in retreating glaciers, ice is *always moving forward,* always pushing down rubble, If the snout pauses in one place for awhile (that is, if the downslope ice flow and the melt rate remain equal) the constant delivery of rubble to that place will build a ridge called a **moraine.**

The farthest moraine downvalley from any particular glacial advance is a **terminal moraine.** If the glacier retreats from the terminal, then pauses again, or readvances slightly, a **recessional moraine** is formed.

The 2 glaciers at the bottom are exposed to roughly the same climate, but behave differently. The glacier on the left is knocking down trees along its snout and sides, while the glacier on the right is uncovering bare rubble. (Again, the ice in *both cases* is moving forward.)

Here's where the equilibrium line comes into play. The glacier on the left has a bigger accumulation area. Income exceeds spending, so the snout advances. Studies on the Juneau Icefield suggest that when 70% of a glacier is in the accumulation area, income and spending are roughly balanced. Most Juneau area glaciers have accumulation areas of 60% or less, and their snouts are retreating. On the coastal side of the Juneau Icefield, the equilibrium line usually lies at about 3600 feet above sea level.

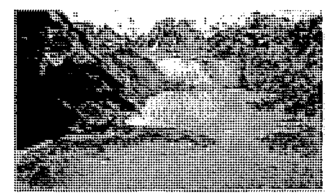
(Note to instructor: You may wish to return to slide #2 here, to retrace the 3600 foot contour on the Mendenhall, Lemon Creek and Taku Glaciers. If so, point out Grizzly Bar where the next photo was taken. You may also want to know that several "lines" occur near 3600 feet: the snow line, firn line, and equilibrium line. if you wish to pursue their relationship, explanations are found in most geology texts.

9) Taku snout

Is this glacier snout advancing or retreating? Around Juneau it's very unusual to see trees growing right next to glacial ice. The trees in the upper center should be pretty worried! This is the snout of Taku Glacier, near Grizzly Bar. The ridge of rubble spanning the center with a covering of scattered brush is a moraine. It's being shoved forward, semi-intact, as the Taku advances.

Those low alder thickets are actually surviving on this moving landform! Now what would the scene look like if the Taku snout began to retreat, leaving this moraine behind? To find out, let's fly to Glacier Bay.

10) McBride bar



The McBride is a **tidewater glacier** that extended 2 miles forward onto the **bay mouth bar** in the foreground, as recently as the 1960's. There it paused and built a moraine. The moraine temporarily insulated McBride's snout from the ocean's thawing and tidal erosion, but when the snout backed off into the deeper water of McBride Inlet, calving increased and retreat was rapid. *(To instructor: There's a good 4 part illustration of the Tidal Glacier Cycle in Roman Motyka's Taku Glacier circular.)*

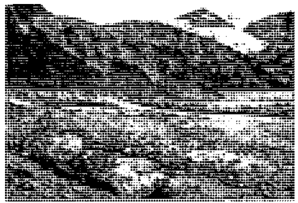
Unlike the snout and sides of the advancing Taku, there's no forest or even brush anywhere near the retreating McBride. Plant succession hasn't caught up with glacial retreat. You can view McBride Glacier in 3D on Discovery's stereogram sheets. For now though, let's zoom in on the left side of the bay mouth moraine bar...

11) McBride till

There are two kinds of surficial deposits in the foreground. At the bottom are sorted sands, which tell us water was involved. In fact, the contact between the sorted sands and the unsorted rubble is the high tide line! In upper Glacier Bay, there are few plants or invertebrates on the beach to tell us how high the water reaches.

The unsorted boulders, cobbles, gravel and sand are called **glacial till.** (Another term for till is "boulder clay," which indicates that all particle sizes from huge to tiny are involved.) Till piled into a ridge, like the one on the right, is called a **moraine.**

12) Herbert outwash

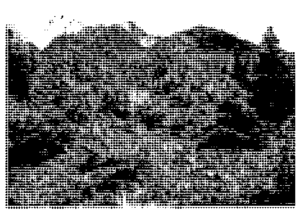


The Herbert Glacier is very similar to the Mendenhall.It also drains part of the coastal side of the Juneau Icefield, and like the Mendenhall, is presently retreating. *(Note to instructor: You may wish to return to slide 2 and have a student come up and outline the accumulation area of the Herbert, using the arrows to judge its boundary with the Taku system. The map suggests a lake at the Herbert snout. This doesn't exist, and probably never did!)*

Part of the melt waters from the left side of the Herbert snout pass behind the bedrock knob and emerge onto the large barren alluvial fan in the foreground. At its highest level, outwash covers even the bars between the braided channels. So the material of this fan is "sorted" at least in the sense that the clay, silt and fine sand is washed away.

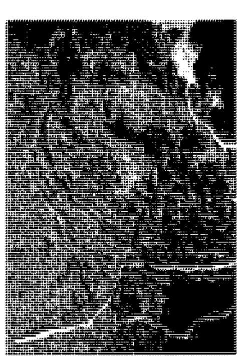
Unlike unsorted glacial till, which retains the finer particles, this outwash fan is poor at holding ground water. If the glacier recedes farther and abandons this fan, plants will grow, but much more slowly than on till. Alder may never colonize, because in dry spells its roots can't get enough moisture. In a century or so, when the surrounding glacial till supports 80 foot tall spruce and cottonwood, the outwash flat will look like....

13) Lichen turf



this! Spruces are scattered and stunted, and the ground is covered with lichens. Lets go to an air photo of the Herbert Valley, to see where this picture was taken

14) Herbert aerial, 1984



(Note to instructor: This is flat "C" on the glaciers stereogram. See puzzler ic. 3-a 1/2. Location of the flat is also indicated on the slide mount.)

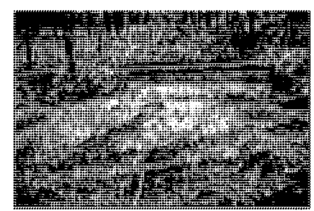
This flat was uncovered by the Herbert Glacier in the early 1900's. Can you trace the path taken by the Herbert River when it used to flow through this opening? *(Through flat C, north of the central roche, then through flat B, then down Medial Creek. All these features are identified on the stereogram sketch map.)*

Point out the following features: terminal moraine, recessional moraines. Find where the modem Herbert River is dammed temporarily behind a recessional moraine.

Now can you find an old outwash flat where an earlier version of the Herbert River was dammed behind the terminal moraine? *(The pale, lichen covered openings just inside and paralleling the terminal, north of Medial Creek.)* This earliest outwash flat is two centuries old, yet trees are still stunted on the excessively drained soils.

What about the many ponds? As the glacier retreated, large blocks of ice detached, and lay melting, sometimes for decades, in the till or outwash. Eventually pits formed, and if the bottoms were below the waterline, they resulted in kettle ponds.

15) Kettle

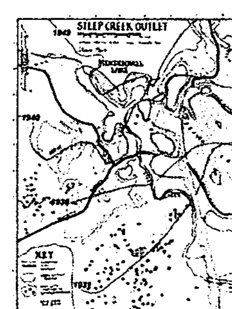


This small kettle is surrounded by 200 year old forest on the Herbert terminal moraine. Try to imagine this scene two centuries ago. Remove the down logs, moss in the water, even the soils...

16) Young kettle

Well, maybe there were no red back packs in 1793, but this is what the kettle would have looked like when it was still in sight of the glacier snout

17) Merlimap



Steep Creek comes off Thunder Mountain in Mendenhall Valley and enters Mendenhall Lake below the Visitor Center. The Mendenhall Glacier has one of the best known recessional histories of any American glacier. Beginning in 1931, the Forest Service surveyed the ice front at 3 to 5 year intervals. Their maps can be overlaid to produce a detailed picture of ice retreat, as we've done on this map of Steep Creek outlet.

Find the following features:

a) a level area *(ie. the place with the fewest contours. This is the stippled bare sand area in the center.)*

b) a kettle pond *(All of the ponds down hillfronz the Visitor Center are kettles; those above it are in bedrock depressions.)* These kettles are mostly in the brown stippled area, representing gravelly outwash terrain. The term for outwash with lots of kettle holes is pitted outwash. The moraine loop trail begins in a field of pitted outwash.

c) The year when Mendenhall Lake first emerged from the ice. Check the ice front lines. *(Sometime between 1940 and 1949. On the Visitor Center stereogram sheet, the 1948 air photos show what the glacier looked like as the lake was just opening up.)*

d) The highest point on the map. *(Hill 190+, at 8 1/2--6 1/4)* This hill is the top of a roche moutonné. Professor Donald Lawrence from Minnesota began a study of succession at Mendenhall Glacier in the late 1940's He selected the top of this roche as a photopoint, or spot from which to take repeated photographs. The next slide was taken from the top of the roche in 1952, looking northwest across the pitted outwash, when the glacier had barely uncovered the lake.

18) Lawrence 1955

In the left middle distance, scattered alders are beginning to grow on glacial till. But the pitted outwash still contains chunks of ice, and constantly shifts as they melt, killing any plant seedling that get established. The huge mound in the center is also ice-cored. Look for it in the next picture, taken from the same photopoint in 1991.

19) Retake

It's collapsed into 2 separate mounds! Look for changes as we flip back and forth between the 1991 and 1952 views. When you're done, we'll mention some things we noticed. See how many you can pick up. . .

a) the glacier is gone from view in 1991.

b) there's a new parking lot

c) the till in the left middle distance is now densely forested

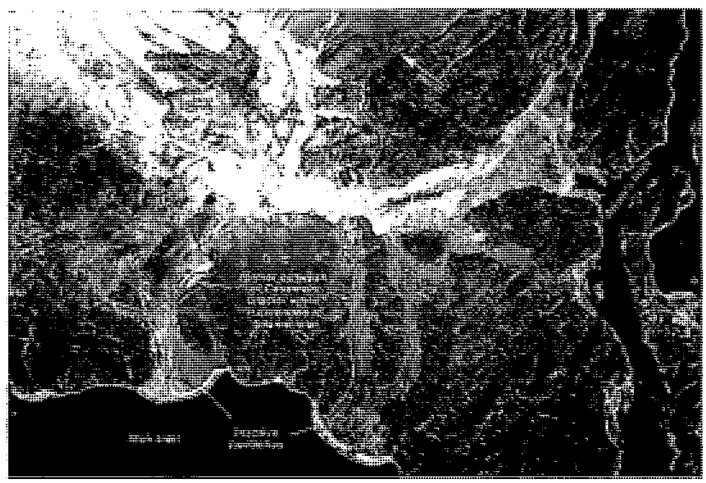
d) the bedrock in the immediate foreground has brush and small spruce

e) the pitted outwash has a few trees, but succession in much slower than on till

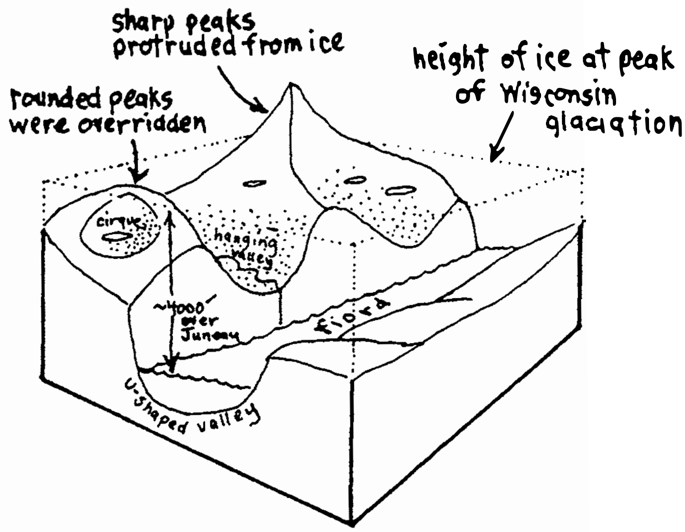
f) the bare bedrock across the lake (right side), in 1952 is brush-covered in 1991

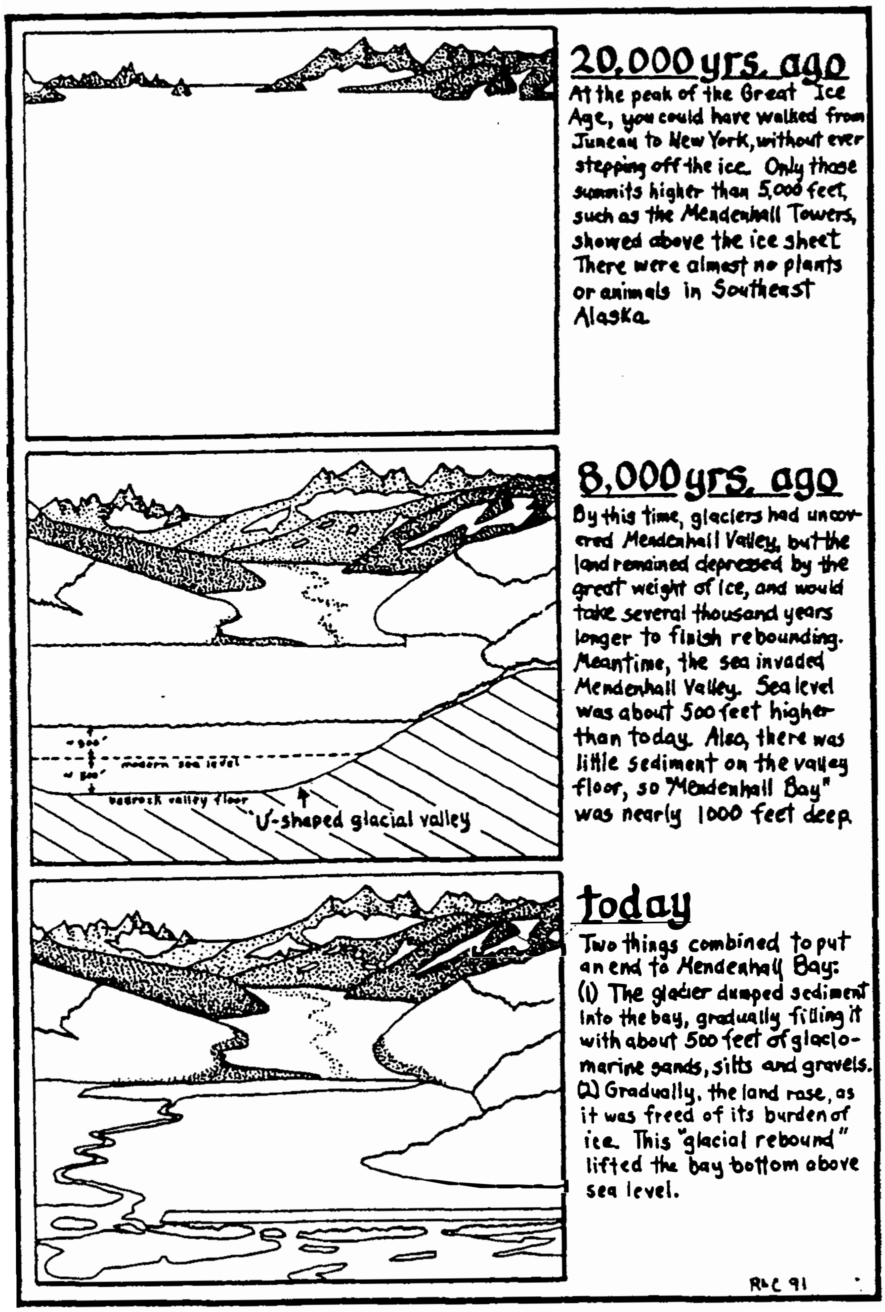
20) Casement aerial, 1979

The Casement Glacier is close to the McBride, in Glacier Bay. *(Point out the following: Casement Glacier, Muir Inlet, Adams Inlet, Seal River)* Part of this scene is included on the glaciers stereogram sheet for 3D viewing. But this slide shows a bigger area, of the whole Casement outwash system. First, see how many glacial features you can name. Then, try to piece together what happened as the glacier retreated from Adams Inlet to its present position.



GLACIAL LANDFORMS Glaciers erode the underlying bedrock, creating large scale landforms such as **U-shaped valleys** (which when flooded form **fiords**) and **cirques**. Thick ice sheets overrode summits less than about 4000 feet in the Juneau area, so these are gently rounded. Peaks which protruded from the ice, like the Mendenhall Towers, are more jagged, and were often created by several glaciers eroding back into the "headwalls" on opposing faces.



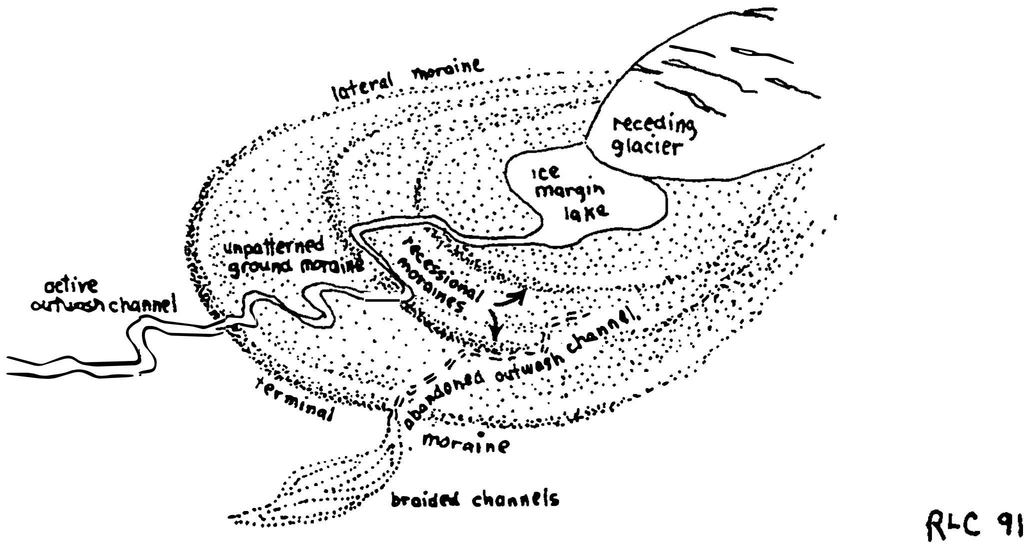


L5

In addition to landforms carved into bedrock, glaciers leave many "surficial" features. The recent Little Ice Age advance and retreat of Mendenhall Glacier resulted in landforms like those illustrated below.

Glacial deposits are **unsorted**, and consist of all particle sizes from boulders to clay. Loose glacial rubble is referred to as till. Glaciers which advance and then recede usually leave a **terminal moraine**, or ridge of till, at their farthest downvalley position. As they melt back, if they pause in their recession, or readvance slightly, they may leave **recessional moraines.**

Glacial valleys also have abundant alluvial channels and fans, often slicing through recessional moraines. This sorted outwash often occupies as much terrain as unsorted glacial till. It's easy to pick out these outwash features on air photos, even after they become vegetated.



L6

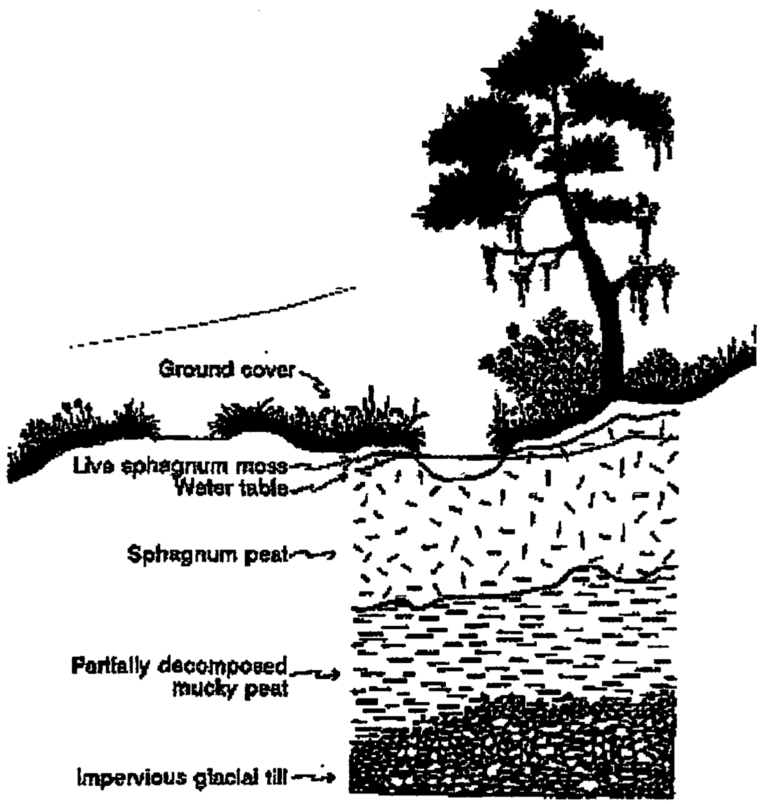
TONGASS NATIONAL FOREST

FOREST FACTS

What on Earth is Muskeg?

Like a soggy blanket draped over the landscape, muskeg, or peat bog, covers more than 10 percent of southeast Alaska. It provides a surprisingly fragile home for an abundance of plants that thrive in the wet, acid soil. During the summer, the flowers on many of them add a carpet of soft color to the muted greens and browns typical of muskeg.

Muskeg itself consists of dead plants in various stages of decomposition, ranging from fairly intact sphagnum peat moss or sedge peat to highly decomposed muck. Pieces of wood, such as buried tree branches, roots, or whole trees, can make up 5 to 15 percent of the soil.



The water level in muskeg is usually at or near the surface. Stepping on muskeg is like stepping on a sponge, and walking across it involves avoiding the multitude of open ponds that range in size from potholes to small lakes. Despite their innocuous appearance, muskeg holes can be more than just messy - they can be dangerous. Some are quite deep and offer no toeholds to help the unwary climb back out.

Sphagnum moss is the mainstay of muskeg. It soaks up and holds 15 to 30 times its own weight in water. In the process, it keeps water from draining through the soil. So muskegs can form even on relatively steep slopes, especially in Southeast Alaska's cold wet climate.

Muskeg is so wet, acid, and infertile that about the only trees that grow in it are a few stunted shore pine (*Pinus contorta*). These may grow only 5 to 15 feet high and less than 10 inches around in 300 to 400 years.

Muskegs need two conditions to develop: abundant rain and cool summers. A dead plant that falls on dry soil is attacked by bacteria and fungi and quickly rots. If that plant lands in

Unit 3
READ ME FIRST

PATTERNS OF CHANGE

Historical records indicate that when Vancouver explored Glacier Bay (now Glacier Bay National Park) in 1794, just 200 years ago, there were no forests. In fact, there was no bay, only a huge glacier. The glacier has now receded, leaving a clear record about how forests develop.

Where the ice has recently left, the land is barren and gray with rock and silt-laden runoff. A short distance outward, however, where the ice has been gone about 10 years, patches of moss, dryas, and fireweed are scattered among the gray rocks. Where the ice has been gone 30 years, the land is covered by an overstory of alder, willows, and cottonwoods with a ground cover of grasses, dryas, and other herbs. Where the ice has been gone for 50 years, the alders and cottonwoods are tall, and small spruce poke up here and there. Near Bartlett Cove, where Vancouver encountered a wall of ice 200 years ago, a dense spruce forest covers the land like a green glacier. Little light reaches the forest floor, so that there are few understory shrubs, and the ground cover is mainly moss. Scattered in the darkness, small hemlock saplings strain upward to the sunlight.

This pattern of change from bare rock to deep forest is called **succession**—*the order in which plants colonize a barren site or reestablish themselves on a disturbed site; the sequence of species that characterize how a forest grows.* Succession occurs due to competition, differences in the needs of plants, and the effects of the nonliving environment on plants and other living things.

Succession in the Pacific Coastal Forest

Land that is barren of plants (such as land uncovered after a glacier retreats) is drier and subject to more extreme temperatures than land covered by trees. Rain and wind sweep across barren areas, carrying away the minerals that plants need to survive. Few plants can survive in these harsh conditions; those that can are called **pioneer** plants. The pioneer plants in Glacier Bay are mosses, dryas, and fireweed.

As these pioneer plants grow, they send roots down into the rock crevices, sand and gravel. These roots hold the finer-grained particles and begin the formation of soil. With the aid of symbiotic nitrogen-fixing bacteria, they enrich the soil. The pioneer plant leaves, stems, and dead parts form a source of food for herbivores such as insects and birds. A few carnivores such as coyotes and ermine move in to feed on these herbivores. The spores of detritivorous fungi and microscopic organisms are blown in by the wind, and these begin the process of decay and mineral cycling. Thus an ecosystem is formed. It is not yet a forest ecosystem, and forest animals could not survive in it, but it is a step toward the establishment of a forest.

The pioneer plants trap more and more nutrients. Detritivores such as bacteria and springtails decay the plant parts, forming a shallow layer of nutrient-rich soil. Plants that need soil—alder, willow, and cottonwood—move in. The fast-growing alder, willow, and cottonwood reach skyward to shade out the sun-loving dryas and fireweed. Plants that need more soil and prefer the shade move in to cover the ground. When shrubs grow tall, large herbivores such as moose and mountain goats come to feed on these plants, and bears and wolves quickly follow. A wider variety of insects can now survive, and with them come their predators (shrews, swallows, and yellow-rumped warblers).

Alder and their symbiotic bacteria further enrich the soil with nitrogen, so that the site becomes suitable for Sitka spruce seedlings. These slow-growing trees take 75 years or more to grow above the alder and cottonwood. But eventually, they tower over all the forest plants and their canopy shades the forest floor from light. The alder, willow, cottonwood, and other plants—unable to get enough light—soon die out. So few shrubs can survive in the low-light conditions that the ground is covered by dead spruce needles, shade-loving mosses, and a few herbs. The Sitka spruce trees shade the ground so much that even their own seedlings cannot survive in the darkness. Only the seedlings of shade-tolerant hemlock are able to grow upward in the poor light.

Because few plants can survive under dense forest canopy, this succession stage provides little food for herbivores like deer, voles, and mice. When herbivores are scarce, carnivores cannot survive either. Kinglets, a few warblers, and other treetop feeding birds find habitat in the upper branches of the spruce, but ground-feeding thrushes, sparrows, and grouse move away. Overall, a young, dense Sitka spruce forest provides little habitat for wildlife.

In a true old-growth stand of coastal forest, spruce and hemlock trees may range in age from seedlings to 1000 years old.

Sitka spruce live for 500-750 years. As the spruce die, the hemlock saplings become giant trees, and the forest changes to an old-growth, climax forest. At this stage, 400 to 1000 years after the retreat of a glacier, the forest becomes self-renewing. The large, old spruce die and fall over, creating openings where young spruce seedlings can flourish. Hemlock seedlings continually grow in the shade of the larger spruce and hemlock trees. In a true old-growth stand of coastal forest, spruce and hemlock trees may range in age from seedlings to 1000 years old. Though change continues with new trees replacing the old, the subtle mosaic of old-growth forest remains fairly stable, unless it is disturbed.

Historically in the Pacific coastal forest, glaciers have been the force defining the patterns of succession, covering vegetation as they advance and leaving barren ground as they retreat. The last major retreat from most of Southeastern Alaska was 10,000 years ago. While fire is a very rare event in the wet, cool climate, winds and insect outbreaks can cause succession to start over in small patches. Natural events such as fires, floods, landslides, avalanches, and disease outbreaks set back succession in larger pockets of forest. In these, the long progression of forest development must begin anew. Most of the forest in Southeastern Alaska is a slow-changing pattern of climax —old-growth forest.

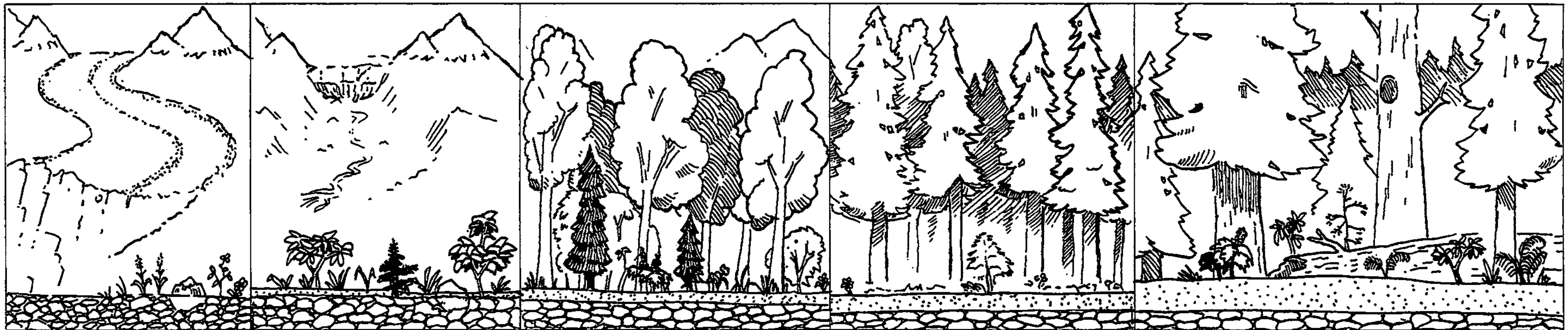
As might be expected, the wildlife that exist in Alaska's hemlock-spruce forest region are species adapted to the old-growth forest which has blanketed the area for thousands of years. Some of these species need this habitat for part of the year or for special habitat such as birthing and rearing young. In summer, Sitka black-tailed deer feed on the shrubs and herbs in the pockets of early succession forest; in winter, they retreat to areas of old-growth where they can find adequate food and shelter from heavy snows. Many birds nest and feed in the forest openings in summer. Some fly south when fall comes, but the non-migrating birds (chickadees, crossbills, siskins, nuthatches, boreal owls, and winter wrens) winter in old-growth forest. The towering trees offer shelter from cold, as well as seeds and insects for winter food. Biologists working for the Alaska Department of Fish and Game have found that brown bears, river otters, and even mountain goats, require the old-growth forest in order to survive winter and raise young. They have learned that the mice in older forests produce more young and are more apt to survive winter. The wildlife of coastal forests are species adapted to survive in this environment where extensive change is glacially slow.

Succession in the Boreal Forest

The coastal forest is subtle when contrasted with the distinctive patterns of the boreal forest of Interior Alaska. Some areas seem fairly uniform. Others are pockmarked with open patches, dotted with willow thickets, speckled with islands of aspen and birch, and edged in ragged borders of tall spruce. A portion of this mosaic is clearly the effect of variation in the nonliving environment. North-facing slopes and wet, low-lying lands underlain by ice, or permafrost, are covered by black spruce forests and

PRIMARY SUCCESSION IN THE COASTAL FOREST

Glacial advance and retreat has created much of the landscape of Southcoastal Alaska. Areas where glaciers have retreated provide an ideal living laboratory for the study of primary succession. On these sites, succession generally occurs as shown in the diagram below. Primary succession of coastal forest also occurs on new lands created by rivers, earthquakes, landslides, or volcanoes. The general patterns of succession on these sites are similar, but the species of pioneer plants would likely differ.



PIONEER STAGE: Common pioneer plants include dryas, fireweed, willow, alder, and soapberry. Alder and dryas plants have symbiotic bacteria in their roots which take nitrogen from the air, This allows these plants to grow on soil that lacks an organic nitrogen-rich layer. The leaves of these plants, once decayed, form an important part of the organic soil layer. Several feet of snow may accumulate on the ground in protected sites in winter, but strong winds will keep most areas snow-free.

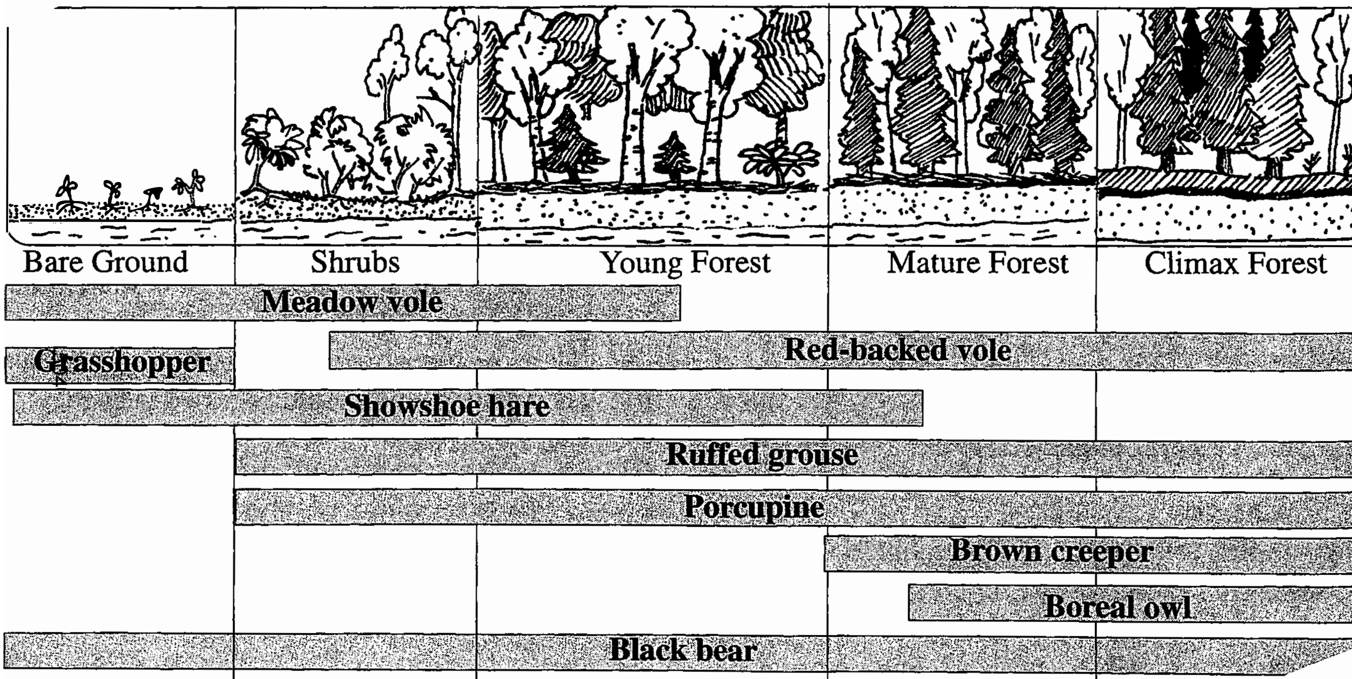
TALL SHRUB STAGE: Within 5-20 years after the retreat of a glacier, a layer of organic soil will have developed on some sites. The pioneer willow, alder, and soapberry continue to grow taller, and cotton-wood, Sitka spruce, and other plants begin to invade the site, Most of the shrubs and saplings are deciduous and do not trap very much snow in winter. The leafless shrubs slow the winds however, so several feet of snow may accumulate on the ground.

YOUNG FOREST: 70-100 years after glacial retreat, cottonwoods, red alder, and some willows have reached tree height. A few tall spruce are present and many spruce saplings grow beneath the broadleaf canopy. Strawberry, lupine, club mosses, and a variety of other ground cover plants also occur, Because many of the trees are deciduous, most of the winter snows reach the ground and accumulate.

MATURE FOREST: 150-200 years after glacial retreat, Sitka spruce trees form the forest canopy. Because cottonwood and alder trees only live 70-100 years, and their seedlings can not survive in the shade of conifers, few broadleafs remain. Hemlock seedlings are tolerant of the shade and a few grow beneath the spruce in mature forest. The needles of spruce are slow to decay, so many cover the forest floor. Relatively few ground cover plant species can grow amidst these needles and in the shade. Mosses, huckleberry, and wintergreen are often present. The dense tree canopy intercept most of the snow that falls, so that relatively little snow accumulates on the ground.

CLIMAX FOREST (or Old Growth): The length of time required for formation of old-growth coastal forest varies, but some scientists estimate 250-600 years. On well-drained sites climax coastal forest has a canopy of hemlock and Sitka spruce. Because many large old conifers have died and fallen over, the canopy is broken and allows sunlight to filter to the forest floor. The presence of trees of many different ages, including seedlings, saplings, young trees, and old giants indicates that this forest will replace itself. A wide variety of shrubs and herbs grow in the filtered sunlight of climax forest, including: alder, salmonberry, devil's club, elderberry, huckleberry, skunk cabbage, false lily of the valley, trailing bramble, ferns, and mosses. The branches of most live trees are covered with lichens and mosses. Many large dying or dead trees remain standing and many contain holes or have their heartwood rotted away so that they are hollow in the center. The large branches of the old trees hold up much of the winter snow, so that relatively little snow accumulates on the ground.

es of Plant Succession in the Boreal Forest and a Selection of Associated Wildlife Species:



Guided Imagery: The Succession Story

You are a rock that the glacier has been sitting on. Imagine yourself under the glacier. It is very cold and as the glacier has moved ever so slowly over thousands of years your edges have gotten smoother and some little crumbles from your surface have been left behind as dust when the glacier rolled you along. It is always wet. It is always cold. It is always a strange blue darkness. One day the light changes. There is a yellow glow that appears, but it flickers on and off. One thousand days later it seems as though the blue light is all gone and the yellow light that flickers on and off is always there. It's not so wet all the time, and often you are very warm. The light can be almost too bright. (Years 1—3: Pioneer)

You find yourself on the edge of a little pond, surrounded by other rocks and flat, hard scoured bedrock. There is some dust in the neighborhood, but no real soil, and no plants. Not a one. It's like that for another 994 days and then a bird flies over and drops a seed that lands right beside you on the dust. It rains a little that very day and a few days later a little sprout of green appears. Suddenly it seems as though there are green sprouts coming up wherever there is dust. Some introduce themselves as moss and others promise to be fireweed. They are called the pioneer plants because they are the first to come into the neighborhood. Their roots go down into the crevices of the barren rock base. Each year there are more of these soft and friendly plants and each year their roots go deeper into the rocks around you, making even more spaces and even more soil for the next year's crop. Insects and birds come to visit, and you see them hopping along, enjoying the seeds and flowers of the plants. The soil layer is even deeper now and doesn't blow away every year, because there are old leaves and stems and flowers all mixed in with it. Some of this soil is next to you. (Years 4—9: Pioneer)

It has been 3,655 days since the blue glacier left you behind. Not too far away, there are wavy lines on the ground when the sun shines. Skinny line patterns get longer all the time You wish you could turn and learn what they are. One day in the fall a pretty yellow leaf drifts by and you discover that alder shrubs are in the neighborhood. The lines are their branches casting shadows on the ground. Willows and other bushy plants have also moved in and sent their tangled roots ever deeper into the rocky ground. There is real soil here now. You can feel some of it piling up the side of you. Watch out! There's a moose stepping almost on top of you!. It wasn't so scary when the hares and chickadees were visiting but these giant moose are very impressive. The fireweed don't bloom here any more. When did that happen, you wonder. (Years 10—99: Shrub)

Fluffy white falling threads drift by. It must be winter again and the snow is falling. But it isn't cold. Then you realize that this must be the downy drift that comes out of the cottonwood tree. You had heard that cottonwood and a few spruce were in the neighborhood. It's 36, 552 days after the glacier slipped away. You like the way the light changes throughout the year with some cool shade in the summer and warming sun in the spring and fall. You feel the ground rumble when the neighborhood bear wakes up and goes foraging for roots. Deer like to wander by and dine on the summer bushes. You noticed that last winter the shrews were running around under the snow right beside you eating those pesky insect larvae. (Years 100—199: Young Forest)

(Years 200—250: Mature Forest) It has become shadowy and dark all the time. The light is green and hazy and filtered like squinty eyes made it. Is this some strange night? Has the glacier come back? True, the soil is almost up to your top now, but you aren't covered up by it. Leaves haven't been drifting by you every year, either. You miss their colorful show in the fall. Deer wander by less and less. The voles haven't been burrowing around. You notice that the snow doesn't pile up in the winter, either. What could have happened? It is only 73,000 days since the glacier left, but it's cold and dark and green and brown all the time now. Prickly pointed needles poke you when they come out of the sky. They don't turn into soil as fast as the colorful leaves from the fall did. It's quiet here now that the sparrows and grouse stopped chattering around. The warblers still sing in the tree tops, though. That's it! The tree tops are way up in the sky. The tree trunks are everywhere. There are 3 big, rough-barked spruce crowding around you. The spruce are crowded so thick in the forest that almost nothing else will grow. There is not enough sunshine getting through the evergreen branch umbrella to let other plants develop. The little furry plant-eaters don't come anymore because the plants are gone. The animals that need the plant-eaters to survive don't come either.... For a rock, you're a pretty good detective to have figured all that out.

You like the peace and quiet and calm of this forest, but sometimes it's really boring! For 50 years you wonder if anything exciting will ever happen again. For a rock as observant as you are, there is not much to pay attention to. You have noticed that there are hemlock trees among the spruce. But that doesn't seem like such a big deal. They are both conifers. And the hemlock grew OK because they like the shade the spruce made. New spruce didn't seem to grow, though.

KABOOM! That wasn't an earthquake. But the ground is bouncing up and down and the roaring sound is still echoing. At last there's some excitement in the old neighborhood. There is a tickling sensation all across your top. If you had a nose, you'd want to sneeze and make this stuff go away. There's dirt and a spruce branch right on top of you. That big old tree a hundred feet away must have fallen over. It popped the tops off a few other trees when it fell. There is a warm and delightful ray of sunshine just beside you. If only this big tree would get off, you could really appreciate the light and airiness.

The tree rots away eventually. Lots of little critters helped turn it into soft soil. Fungus helped, too You could feel the hairy parts of the fungus working around you and now you are being shoved gently by the fine hairs on the roots of an elderberry bush as it pushes through the new soil. Some alders are back in the area. Young spruce have begun to pop up too. There's one in the space by you that the elderberry didn't use. Its root hairs move slower than the elderberry, but squeeze you just as much. Where the broken trees stand, there are holes made by woodpeckers and the chickadees are thrilled to find such lovely high-rise apartments to live in. The deer stroll through in the winter. There is a little more winter snow now, but not so much that they can't walk through it, and they appreciate the huckleberry twigs in the neighborhood. The squirrel that just popped its head in the hole where she stores her spruce seeds for the winter told you that some of the deer would not have survived the winter without those twigs. It's a beautiful place, this old forest, full of variety and life. (Years 250—1000 Old-growth Forest)

Extensions:

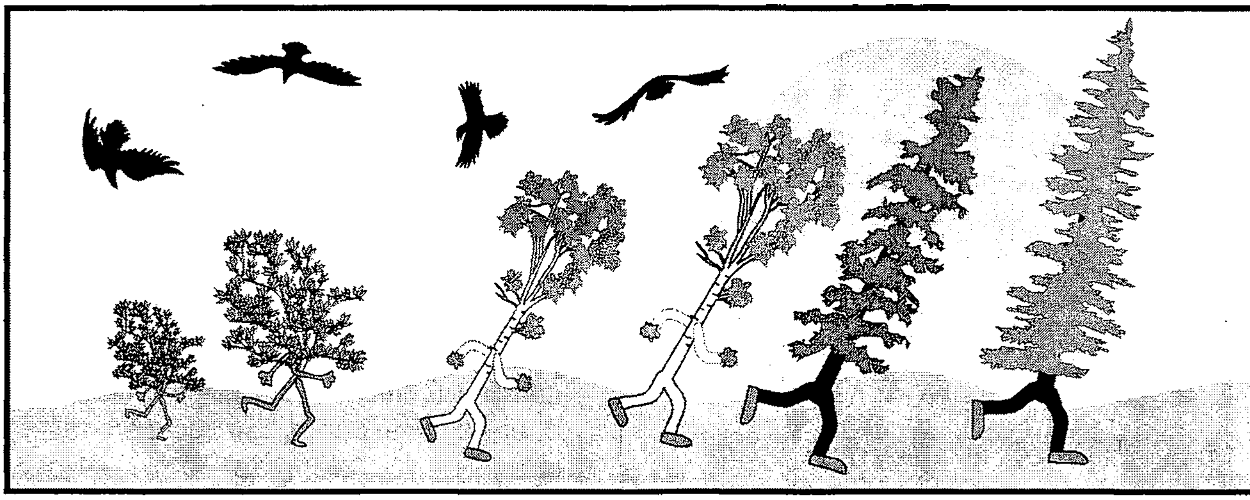
A. Use a visual aid to simulate the retreat of a glacier from the surface of the paper mural: slide-projected glacier that is dimmed or moved off the paper; a long gray cloth curtain that is pulled back; a gray paper that is rolled back.

B. Add magazine pictures or other illustrations of the animal life to the mural.

VARIATIONS

★ A. Students use the story for a book for which they develop illustrations.

THE SUCCESSION RACE



Grade Level: 5-8
Alaska State Content Standards: SA12, SA14
Subject: Science
Skills: Analysis, Description, Generalization
Duration: 1 class period
Group Size: whole group
Setting: indoors or outdoors, large playing area
Vocabulary: succession, successional stage, herb stage, shrub stage, young forest stage, mature forest stage, maturing aging forest stage, habitat, minerals, vegetation mosaic

OBJECTIVE
Students will list the factors that affect succession in a boreal forest.

TEACHING STRATEGY
Through a game, students portray plants progressing through the boreal forest succession, affected by agents of change.

MATERIALS
- Butcher paper
- Succession Cards
- Succession of the Boreal Forest After Fire

TEACHER BACKGROUND
Succession is the natural, orderly change in plant and animal communities that occurs over time. The successsional timeline has been divided into stages that portray the slow, continuous changes in an environment. When an existing environment is disturbed by fire, insects, development, resource extraction, flood, or extreme weather, it generally reverts to an earlier successional stage. Herbs and shrubs dominate the earliest stages of succession. Intermediate stages follow, dominated by tall shrubs and young trees. Finally, a mature forest stage and a climax forest stage may follow. The pace of succession may be affected by soil conditions, climate, permafrost, topography, and natural forces.

Some agents of dramatic change in the boreal forest are:

- Insect invasion
- Bark beetle attack
- Flood and/or ice jams
- Land slides
- Too many moose
- Very hot, slow fire
- A fast fire
- Person building a house
- Development or roads
- Clearcut logging

Many stages of succession may be represented in a relatively small area. For instance, you may be walking through a dark, thick forest and come upon a clearing or meadow. Some agent of change affected that particular part of the forest, perhaps insect, disease or a small fire, and killed all of the mature trees. As you continue your walk you may come upon a thicket of bushes. This part of the forest is now in the shrub stage and may have, at one time, been a meadow and before that a mature forest. This patterning of various successional stages containing different plants is called a **vegetation mosaic**. Because fire can jump from place to place within a forest or may burn at different times and different intensities in various parts of the forest, fire is often the cause of vegetative mosaics.

Each species of plant has particular **habitat** requirements. These habitat requirements include specific amounts of light, heat, soil nutrients, and water. As a particular site progresses through successional change, tall plants create shade. Layers of moss insulate the soil and cause a drop in soil temperatures. More and more **minerals** become tied up in living and dead plant material. These changes in the physical environment change the suitability of each site for different plant species. The kinds and numbers of plants present change as the physical conditions of the environment change. As each part of the forest changes, the vegetation mosaics change.

Like plants, wildlife species also have specific habitat requirements. Each species of animal needs the right kinds and amounts of food, water, cover, and space. Therefore, wildlife populations change in response to successional change.

The process of succession strongly affects wildlife use of the boreal forest. Some wildlife, such as white-crowned sparrows, fulfill their habitat needs in the shrub thickets of early forest succession stages. Others, such as white-winged crossbills, need large expanses of climax stage spruce forests to survive. Many boreal forest wildlife need a mixture of forest ages to meet their habitat needs. Snowshoe hares are a good example. Young willow and birch shrubs, which flourish in the early stages of succession, provide the food snowshoe hares need. In winter, hares need the shelter provided by spruce forests.

The variety and abundance of wildlife in the boreal forest is largely a result of the habitat diversity provided by the vegetation mosaic. The complex and constantly changing boreal forest mosaic is created and maintained by the continual pace of succession.

Succession progresses in the tundra as it does in the boreal forest, although it is not as clearly understood and is extremely slow in comparison. Early succession is visible where lake levels have lowered and plants grow on the newly drained soil. Cottongrass tussocks take a long time to establish and don't grow in recently disturbed sites; if cottongrass is evident, then the area is probably in the later successional stages. Trees or shrubs with thick, gnarled, lichen covered stems are found in the later successional stages as well. Because little research has been done regarding tundra succession, less is known about its effects on plant and animal communities.

ADVANCED PREPARATION

1. Copy and cut the Succession Cards making one set per student. Note that each stage is represented by a different color.
2. Make 5 large signs labeled "Herb Stage", "Shrub Stage", "Young Forest Sage", "Mature Forest Stage," and "Climax Forest Stage." These signs may be color-coded to match the Succession Cards.

Climax
Mature
Young
Shrub
Herb

PROCEDURE

1. Before beginning the game share the information about succession with your students as found in the Teacher Background section. Review the five succession stages with the class. Brainstorm with students some of the factors that could affect the progression of succession to the "Mature Aging Stage."
2. Set up the playing field. Mark 5 lines across a field or other large playing area, with approximately 20 feet between each line (this distance could be smaller for small groups). Place the "Herb Stage" sign at one end of the field; the other end is labeled the "Climax Forest Stage." Place the remaining signs for the "Shrub Stage," "Young Forest Stage," and "Mature Forest Stage" in the remaining sections according to the diagram above. The color-coded Succession Cards are placed (face down and scattered the width of the field) in their appropriate stage areas; no cards will be placed in the "Herb Stage." There will be more cards at the "Shrub Stage" and "Young Forest Stage" than at the "Climax Forest Stage."
3. Students line up at the "Herb Stage" to begin the game. Explain to them that they are plants in various successional stages of the boreal forest. Their goal, as a forest, is to reach the "Mature Aging Stage."
4. The teacher starts the game by calling "Start Succession!". Everybody runs from the "Herb Stage" to the "Shrub Stage" where they each pick up a card and read it. The teacher should emphasize the importance of reading the cards since information contained on them

will be discussed later. The cards at each stage will give students information about succession. They will instruct students to proceed to the next successional stage or to start over at the "Herb Stage". Students returning to the "Herb Stage" must put all their cards back (face down) in the color-coded stages before starting again.

5. As the game progresses the students should spread out over the stages of succession. The game ends when the first person reaches the "Climax Forest Stage" and calls out "Stop Succession!" Everybody must stay where they are. The first person over the line should have 4 cards. If that student does not have 4 cards, he/she puts the cards face down at the correct stages, starts over at the "Herb Stage", and the game continues. If they do have all 4 cards, it is time to have a hot crown fire burn the area and kill all the trees of the young forest and the mature aging forest. All the trees at these stages return to the herb stage.
6. At the end of the game count how many plants are in each stage of succession. Discuss the following:

a) Why don't all the plants reach the "Mature Aging Stage"? Why is this important?
b) What are some of the things (agents of change) which can cause succession?
c) How is this like and not like real succession in the boreal forest?
d) Is succession important? Why or why not?
e) Does succession happen to a plant or a forest? Explain.

7. Continue the game until all the cards have been used and no student can move. Give each student paper and pencil. Ask all to write how forests might be affected by disturbances such as insects, flood, fire, logging, etc. and the advantages or disadvantages of an area returning to an earlier stage of growth. Discuss ideas and answers.

VARIATIONS

The teacher may stop the game at regular intervals to allow students time to look around and see how the number of plants at each stage changes. A graph could be kept on the blackboard or a large pad to record the changes.

Stop the game when there are students in each of the stages. Discuss the benefits of a variety of habitat stages (vegetation mosaics). Think of ways both wildlife and humans could use each stage. How would wildlife and humans be affected if the trees were in just one stage? Could fire help maintain a wide diversity of plants and animals?

Stop the game and tell all the students to put their cards back in the stages and return to the "Herb Stage". Ask the students what might have happened to cause the entire forest to return to the "Herb Stage."

EVALUATION

Have each student list at list 10 things that could cause the progress of succession to revert to an earlier stage.

GRADE 5

Fall Lesson

Land Forms created by glaciation.

Object for Thought – Trilobite Fossil

(discussion about how fossils are formed, tie it into how petrified wood is formed.

Concepts

Ice age and glaciation

Fjords (Gastineau Channel)

Glacial Valleys (U shaped as opposed to river valleys and ravines – V shaped – use the example of "Rope Valley" from fall hike, and Mendenhall Valley. Arretes (ridges)

Cirques (basins)

Horns (nobs)

Do kinesthetic examples of each with students being the land forms and the glaciers.
Topographic maps of Douglas Island.

Learn to read the topo map.
Look at the visual shading 3D it creates from a distance.
Find locations on the map.

Find examples on the map of the different land forms.

Look at our trail and try to find examples on it of the land forms we've looked at.

What molds land here other than glaciers? (Rain, avalanches)

Post hike: Try to create a topographic map of our trail.

Winter
The last three years all the groups have done the same things during the winter.

Spring
Cinda Stanek has had a lot of input in the spring lesson, and chips in extra money so that we can do a Bird Watch at Fish Creek. She helps prepare her children in class as well to recognize bird calls and certain birds in the area.

For Classroom lessons, I build on what she is doing. We look at different kinds of bird nests, and do a nest building activity in class with sticks which has worked quite well. We learned that birds are way better at it than we are.

Fish Creek provides a great habitat which allows the class to explore in small groups, and gives opportunities for viewing songbirds as well as shore and water birds. The tide flats along the creek have yielded lots of objects, and because we are the only group using this area, it has allowed some gathering of objects to share at the end of the hike.

There is also beaver and otter activity in the Fish Creek area, allowing students to explore these areas as time allows.

SCOTT'S SOUTHEAST ALASKA SONG!
(PLEASE SING WITH ME☺)

THIS IS A SONG ABOUT SOUTHEAST ALASKA
THIS IS A SONG ABOUT HOW THE LAND WAS FORMED
GLACIERS, RIVERS, FOREST, FIORDS, AND MOUNTAINS
EROSION, DEPOSITION, AND GLACIAL REBOUND

For millions of years the plates crashed together,
as they collided mountains were made.
About 20,000 years ago the ice came in,
glaciers carved mountains and valleys were laid...

Around this time our ancestors came,
they walked ~~on~~ under the ice from a land far away.
The Tlingit, Haida, Tsimshian, Athapaskan, Aleut,
Inupiak, Eskimo, and Yupik to name a few...

After a while the ice began to melt,
trees and berries grew again, and the animals came back.
The oceans and streams filled the deep valleys with water,
salmon swam in to discover this land...

This is one story about Southeast Alaska,
it is okay to believe it or not.
But do this for me, go look at a glacier,
and watch the forest chase it back to the icefield!

THIS IS A SONG ABOUT SOUTHEAST ALASKA
THIS IS A SONG ABOUT HOW THE LAND WAS FORMED
GLACIERS, RIVERS, FOREST, FIORDS, AND MOUNTAINS
EROSION, DEPOSITION, AND GLACIAL REBOUND!

Nature Studies Seasonal Schedule Examples (2006)

Discovery Southeast
Hands-on Nature Education for Southeast Alaska
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Nature Studies

Nature Studies is the ultimate hands-on, inquiry-based, locally-focused, natural history learning adventure. The dual goals of the program are to teach children the science of nature and to engage our children with nature so they may develop a life-long, respectful relationship with their natural home here in Southeast Alaska.

At Discovery Southeast, we make possible learning about nature by learning in nature. Our natural science "classes" revolve around field trips that involve everything from bounding in the snow like a snowshoe hare to learn about mammal adaptations to winter; to visiting, and revisiting over the seasons, the carcass of a porcupine as it decomposes back into the habitat that nourished it; to listening quietly in the forest to experience the arrival of migrating songbirds returning from a winter in Mexico; to peering through a microscope at ocean's edge to see the life-source of the earth's complex marine food webs -- plankton. With Nature Studies, we make learning fun, engaging, revealing, life-changing.

Nature Studies helps build natural curiosity, interest in the study of science, personal responsibility, and self-confidence. It supports the development of connections to the natural world. The content and methods used in Nature Studies address the desired outcomes and standards for the K-12 science curriculum in participating school districts. Our naturalists work with the teachers at each elementary school to have the Nature Studies curriculum complement and enhance classroom activities.

Nature Studies in Juneau is collaboratively funded by Discovery Southeast, the Juneau-Douglas School District, and Parent-Teacher Organizations, as well as other sponsors. Discovery Southeast appreciates the support of members and contributors for Nature Studies (now in its 18th year), as it is only through your contributions that Discovery Southeast is able to sustain this important natural science education to every third through fifth grade student at participating elementary schools.

For more information, contact
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Discovery Southeast's

Nature Studies

"Stewardship starts with rewarded curiosity"
Richard Carstensen, DSE naturalist

Visit us on-line at discoverysoutheast.org!

Nature Studies in a nutshell:

- 12 hours per year of hands-on, inquiry-driven, natural science education (4 hours each fall, winter, and spring)
- Experience-based curriculum is aligned with core content of state and school district curriculum requirements for the sciences
- "Naturalist in Residence" program for all children in grades 3-5, spanning the year with seasonally appropriate lessons in forest and watershed ecology; wildlife studies (habitats, predator/prey relationships, tracking); resident and migratory birds; the intertidal zone; amphibians; fungi and bacteria; invertebrates, and other subjects
- Includes safety training and team-building exercises and role-play games
- In addition to contracts with parent-teacher organizations, depends on contributions from local residents, businesses, private foundations, and other sources of funding

What are the benefits?

- Children who are safer, more confident, and more enthusiastic outdoors
- Children who are more aware of their local environment and who appreciate the wonder of the place where they live
- Children whose natural curiosity is awakened and encouraged
- Children who become better observers and more critical thinkers
- Children who get excited about school and about *doing science*
- Children with adult mentors outside the classroom
- Teachers stimulated with new knowledge, methods, and materials

How is the Nature Studies curriculum developed?

The program is designed to compliment the school district's science curriculum for each grade level. Topics are chosen based on the natural landscape outside each school and on what is appropriate for the given season. Thanks to the proximity of natural forest to each school, students are able to walk directly from each classroom into the forest; no transportation is necessary.

How qualified are Discovery Southeast's staff?

Discovery Southeast naturalists have both academic and applied backgrounds in education and science. Equally important, Discovery Southeast naturalists are intimately connected to Southeast Alaska and have extensive knowledge of the local region's natural history. All of the naturalists are vibrant, articulate, enthusiastic and inspiring individuals, making them excellent role models for children.

Who else provides this programming?

While various aspects of natural history education may be offered by organizations such as the local Audubon Society (birds), SeaWeek (marine ecology), or the U.S. Forest Service, no other organization provides consistent, ongoing instruction on the entire spectrum of natural history topics. Using the seasons as our theme, Discovery Southeast naturalists work with the teachers to support their science curriculum.

This multi-disciplinary approach to learning permits children to strengthen skills and knowledge in a variety of topics, including science, mathematics, technology, mapping, writing and verbal presentation. Conducting our programs in the "outdoors classroom" also helps children develop social skills as they learn to act responsibly (follow safety rules), work as a team, and listen to and interact with adult mentors other than their parents or daily classroom teachers.

Why can't teachers do this program on their own?

The feedback we receive from teachers best describes why they don't want to do this program on their own. Many feel that students benefit more by having "experts in science" coming in to share their knowledge and by involving the students in hands-on learning experiences. Most teachers do not feel qualified to teach about local natural history topics that are covered in Nature Studies. They must do so much preparatory work for all subjects that most teachers cannot devote the necessary time to adequately prepare for teaching Nature Studies. Teachers also feel that there is insufficient time allotted for science in their every day lessons. Nature Studies takes children outside where they can learn science through direct experience and application.

Discovery Southeast has written a curriculum for elementary teachers that has many components of our Nature Studies program. When written, it was intended for use by the teachers so they could teach the program on their own. However, even after training sessions were conducted to share this curriculum with teachers, they still felt it was important for Discovery Southeast naturalists to do the actual teaching for the above reasons.

How has the program's effectiveness been assessed?

All Discovery Southeast naturalists are evaluated by the Program Coordinator and by the teachers. Teachers are encouraged to give verbal feedback directly to each naturalist, and are asked to complete a written evaluation at the close of each season and/or the end of the school year. The students often give verbal feedback to naturalists and they, too, are asked to complete a written evaluation at the end of the school year.

What impact does this program have on our children?

Overall, the feedback we receive from students and teachers is extremely positive. Students have a "heightened awareness and appreciation for the environment." Students express a greater interest in science, as the are "seeing things with new eyes." Most students look forward to Nature Studies and commonly exclaim, "Yea, it's science time" when a DSE naturalist appears in their classroom. Students see examples in the field that connect with what they study in the classroom. Students are inspired by the naturalists; many students say "I want to be like you when I grow up." Over 13 years, Nature Studies has been known to motivate students to pursue further study in the natural sciences and related careers.

Is there a way of doing it cheaper?

Not without compromising the integrity of the program. For example, in 1996 Discovery Southeast experimented with down-sizing Nature Studies: to accommodate the addition of programming for grades K-2, naturalists spent less time with children in grades 3-5. In the end, students, teachers, naturalists, and parents felt short-changed: children did not have enough "face time" with the naturalists to develop a strong rapport, and the naturalists did not have a chance to get to know the children or even learn their names—nor could they delve as deeply into their topics. Teachers didn't feel the naturalists were part of the school team that year, and they weren't around enough to work with the teachers. In 1997, we discontinued programming for K-2 in order to concentrate our efforts on those grades (3-5) where we have found the program to be most successful.

Some have suggested that volunteers could lead field trips. It is difficult, however, to find (and keep) volunteers with the qualifications of our staff. It is also challenging to ask volunteers to work consistently with many teachers over the course of a school year, providing preparatory and follow-up sessions for children as well as field trips for each of three seasons. Using volunteers would dramatically alter the program and diminish its effectiveness. Discovery Southeast makes every effort to hire staff who are capable of developing lasting relationships with their schools.

Where does Discovery Southeast's funding come from?

Ironically, because Nature Studies is a successful ongoing program with a long history, it does not qualify for grants from the vast majority of foundations and government sources. Discovery Southeast must therefore raise money from each community to sustain its programs. These funds typically are contributed by parent-teacher organizations, by household and business members, municipal governments, and local donors.

Does the program meet state standards for the sciences?

Yes. Discovery Southeast naturalists work directly with each teacher to prepare Nature Studies programs that—to the extent possible given natural and seasonal fluctuations—support both the teachers' individual approaches to curriculum as well as state requirements.

What do teachers say about Nature Studies?

"For me, the modeling in the classroom is invaluable. I've learned content and teaching techniques. I also appreciate the exposure to different parts of 'my backyard.' For the students, I think the greatest value is in the thinking—that is, the type of thinking that [Diane] gets them to do—the wondering, hypothesizing, problem-solving." (Harborview Elementary School, Juneau)

"[My students] are impassioned to want to go above and beyond on their science projects." (Auke Bay Elementary School, Juneau)

"Nature Studies made science come alive for the children. The Jordan Creek area became the classroom. It was the highlight of the science program for my students." (Glacier Valley Elementary School, Juneau)

"The students are given an opportunity to reach out into nature in a way they have not been able to experience before. I am pleased with the way Merli challenges the students to think... [Steve] works hard to think of effective ways to mix my content needs with his expertise." (Mendenhall River Community School, Juneau)

"The children truly understand and transfer their learning to their lives." (Juneau Community Charter School)

"For the students, [Nature Studies] gives them a different look at the natural world through friendly eyes. It seems like we're such a consumer culture that most people's view of the woods is 'What can we take out of it?' The Nature Studies program inspires kids to learn more about what's in the wilderness, and why it's important." (Gastineau Elementary School, Douglas)

"The kids have become so disconnected from the world around them, even here, so anything we can do to reestablish those connections is a vital part of education. I have learned something every time, and loved it." (Glacier Valley Elementary School, Juneau)

"Value comes from the knowledge Steve and Jane bring to the classroom before and after trips in the field. Getting kids out in the woods, observing and using their senses is valuable... the manner in which the hikes are conducted are good, getting off the trail is fun and an experience most students enjoy. For myself, I enjoy the hikes and the expertise Steve and Jane bring to the classroom. I enjoy seeing the students experience nature and seeing them get out even when the weather is not perfect... after all, we live in Southeast Alaska." (Auke Bay Elementary School, Juneau)

"For my students, [Nature Studies is especially valuable for] getting outside of the classroom, learning to appreciate the environment they live in, gaining an understanding of how this area is effected by the glacier, and learning about the creatures that inhabit this area. For me, [it's valuable for] helping me cover curriculum that I am not as well trained in as the naturalists are, so the education is enhanced." (Mendenhall River Community School, Juneau)

"Diane has a great understanding of kids! She also is excited about her work and this helps the students see the value." (Harborview Elementary School, Juneau

"Walt had the children construct survival shelters in the woods behind Gastineau. They began to look at all parts of the forest with different eyes, maybe the same kind of focus that some animals use when building their nests. Leaves and dead grass wasn't just stuff, it was insulation. Sticks and logs became structures. It was hands on and nearly every student was successful in some manner." (Gastineau Elementary School, Juneau)

Discovery Southeast Nature Studies Topics
for 3rd Grade Juneau School District Science Curriculum

Fall

Sorting/organizing/classifying local forest or muskeg plants
Preparing students for their nature studies experiences, including dressing properly, what to bring, what to expect, etc.

Science Curriculum Connections:

> Life: Energy Flow: Plants to Animals
> SC3.1 identifying and sorting examples of living and non-living things in the local environment

Winter

Mammal classification through hands on experiences with skulls, examining eye placement and tooth type and establishing organisms as predators or prey species and possibly extending to knowing mammal families.
Fieldwork will include some very basic tracking with students looking for evidence of predators and prey in the field.

Science Curriculum Connections:

> Life: Energy Flow: Plants to Animals
> SC3.2 organizing a simple food chain of familiar plants and animals
> SC3.2 identifying a simple food chin of familiar plants and animals, diagramming how energy flows through it, and describing the effects of removing one link

Spring

Aquatic insects and their role in food chains/webs

Science Curriculum Connections:

> Alaska's Seas and Rivers: Watersheds and Salmon: How are we connected to rivers? *and* Life: Energy Flow: Plants to Animals
> SC3.1 identifying and sorting examples of living and non-living things in the local environment
> SC3.2 identifying a simple food chain of familiar plants and animals, diagramming how energy flows through it, and describing the effects of removing one link

Discovery Southeast Nature Studies Topics for 4th Grade Juneau School District Science Curriculum

Fall

Energy cycling in an ecosystem; FBI

Science Curriculum Connections:

Life: Ecosystems of Alaska: Energy Cycling
The curriculum identifies energy cycling as a major study area. However, detailed points of understanding are not listed. Naturalists will convey the basics of energy cycling/transfer from solar to plants, to animals and decomposers and how that energy moves through the ecosystem back to plants

Winter

Animals and man adapting to the changing environment in which they live; winter survival strategies

Science Curriculum Connections:

Life: Ecosystems of Alaska
SC1.1 showing the relationship between physical characteristics of Alaskan organisms and the environment in which they live

Spring

Erosion and deposition

Science Curriculum Connections:

Earth: Processes that Shape the Earth: How do waves, wind, water and ice shape the earth?
Looking at the larger question of how waves, wind, water and ice shape the earth allows the naturalist the opportunity to share how to read those processes in the field; example, how do we know that ice vs water moved these sediments to this location; sorted vs unsorted materials, rounded vs jagged peaks, cutbanks and sandbars, etc

Discovery Southeast Nature Studies Topics
for 5th Grade Juneau School District Science Curriculum

Fall

Taking a closer look at plant succession in a post glaciation environment.
How plants use their unique characteristics as an advantage to survive.

Science Curriculum Connections:

Life: Structure and Function of Plants
SC2.1 identifying and sorting plants (not animals) into groups using basic external and internal features (also looking at the role they play in primary plant succession after glaciation)

Winter

How does an animal's structure result in an identifiable track and trackway, and help it survive/move in winter conditions
Tracking animals in winter

Science Curriculum Connections:

Life: Structure and Function of Animals
SC2.1 identifying and sorting animals into groups using basic external and internal features
SC2.2 explaining how internal systems (skeletal) of animals may help them survive/move

OR

Avalanche awareness and snow studies by examining the potential energy of an avalanche and the transfer of energy

Science Curriculum Connections

Energy: What is energy and what does it do?
Winter energy transfer

Spring

Nature Studies Final Experience, encompassing many elements of prior years' learning, including tracks, plant id, erosion and deposition, food chains, adaptations, energy cycling

Discovery Foundation
Nature Studies
Fall Program

THIRD GRADE

Indoor
- Introduction to plants and plant identification *
- Community characteristics defined initially by vegetation *
- How to use a plant key *

Indoor
- Introduction to field activity
- Sketch plant samples
- Practice using plant keys *

Field
- Explore natural communities *
- Key Race activity- keying out plants with a key *
- Observation and sketching natural communities

Indoor
- Summary
- Add field sketches to mural of natural communities

FOURTH GRADE

Indoor
- Introduction to natural communities
- Factors that influence plant growth *
- Review local plant species

Indoor
- Introduction to pH * (taught by classroom teacher)

Indoor
- Specific factors influencing plants: light, soil chemistry, soil and air temperature, soil composition & drainage *
- Forest Succession in Southeast Alaska *

Field
- Collect and record data
- Core trees, determine tree height, tree diameter, soil & and air temperatures, light diffusion, percent cover *
- Sketch natural communities

Indoor
- Graph field data
- Interpret results

FIFTH GRADE

Indoor
- Introduction to landforms in Juneau *
- Surficial geology *

Indoor
- Interpreting landforms *
- Using stereograms
- Preparation for field

Field
- Collect data and make observations *
- Determine surficial characteristics of communities *
- Determine plants associated w/ surficial characteristics *

Indoor
- Interpret data
- Develop story using data and present skits

* - Adheres to the Juneau School District mandated science curriculum.

Discovery Southeast Curriculum
Gastineau School

Grade 3

Concept for Mastery: Everything is always in the process of change.
Object for Wonder: petrified wood

Fall Lessons: Focus on trees, deciduous vs. conifers (easy to tell in the fall!)

What do trees need to survive? (water, nutrition, sunlight) Note: I focus on these three, though sometimes air comes up, in which case we look at the oxygen/carbon dioxide relationship between trees and the ecosystem)

How do water, nutrition, and sunlight shape the way trees grow?

What is a disturbed area? (Natural examples, as well as man-made)

How do trees cover a disturbed area? (deciduous before conifer)

How are trees seeded?

Does every tree seeded survive?

What is the role of trees that die? (this touches a bit on ecosystem)

What would the world look like if every tree survived? (this ties in with the circle of life, which goes with my overreaching concept of everything is always in the process of change)

Fall classroom activities introduce the above concepts through kinesthetic activities (become a tree), visuals, and questions to lead the students towards theories that we will examine on our fall hike.

The activities taught in the fall lessons are the ones that I want them to master to build my 4th grade activities on their already understanding these simple concepts.

Fall hike involves looking at trees as they grow, as they fall over, as they lean towards light, as they lose their leaves, as they grow close together as saplings, as they come in to disturbed areas, and where deciduous trees grow and where conifers grow.

POST HIKE for all students/all grades – 30 minutes.

Review any behavioral issues that may have come up.

Make a list:
What I saw.
What it made me wonder about?
Questions to answer? – Your theory as to your personal answer.

Winter Lesson

In terms of curriculum, I have not had a winter lesson that I want to build on, because the weather has been totally different for the two winters I have had this job. I am interested in developing some kind of a lesson about ice and snow and its effect on the land and plants (as part of my study on trees), especially by getting up to Gastineau Meadows and getting off onto the muskeg, without damaging it. This will certainly be a work in progress!

Winter 2015
Shelter building. We went off trail, and built shelters. It was a very popular lesson with the kids, and my assistant at the time developed the plan, but I have safety concerns about repeating it because of the potential for serious injury.

Looking at what it takes to survive below freezing certainly could be developed into a winter lesson.

Winter 2016
Ice.
Last winter our trail was completely impassable because of ice everywhere. Because of that, we focused on ice and what changes happen at 32 degrees. Here are some the questions the lessons were built around.

What happens at 32 degrees?

What are the differences between ice and snow and frost?

What are different ways ice form? (freezing and compression)

Does salt water freeze?

How come piled snow melts more slowly than fresh snow?

How does insulation work to keep you warm?

How does insulation work to keep things cold?

How does ice change with water and thawing? (some students learned the hard way that puddles can have ice in the bottom of them!)

Our hike was through Douglas to the boat harbor parking lot (great puddles!) and on to Sandy Beach.

Winter 2017
I integrated the concepts of survival, shelter building, with insulation and also with traditional ways in which indigenous people have lived in this area.

Classroom lessons focused on what you can do to insulate yourself and stay warm in the cold, and how that information would translate into building shelters, and how you could use this information to survive overnight if necessary.

Principle concepts and questions:

What natural products can create insulating layers from the cold? (putting some kind of layer between you and the ground)

How can you use space to build upon your natural body heat? (small spaces vs. large spaces)

How does water interfere with insulating materials, and what can you do about it? (making good choices about dress, or how you can shelter yourself from water)

I have discovered that most students think of survival in terms of food, with very little understanding of the importance of shelter and conservation of body heat.

HIKE
Building shelters for the Cotton Ball People. Students worked off trail in groups chosen by the classroom teacher integrating everything we had explored and talked about to build shelters for the Cotton Ball People, which I had made out of cotton balls, with a fabric partial wrap to make it not quite as impossible to keep them dry. Students were very engaged in the activity. I would like to keep this activity as part of my winter curriculum, but probably as a 4th grade activity. Third grade students struggled with understanding some of the concepts of insulation.

I think winter is the least predictable season here. I think any winter curriculum is always going to be subject to flexibility to make it a good hands-on learning experience, especially as my trail is uphill going and downhill returning, making it impassable if there is ice.

Spring Lesson

Birds

This lesson has been extremely popular and exciting with students and staff, alike.

Object of wonder: Story. The California Condor. (pictures to accompany story)

Measuring the wingspan: How big is your wingspan? Looking at bald eagles, wingspan vs. weight – how big is the wingspan of the California Condor? How big a wingspan would a third grader need to have to fly?

Looking at albatrosses – all the diversity in birds.

Frozen Dead Birds

Passing around in a circle for discussion: hummingbird, Harrier Hawk, red-breasted sapsucker (though last year, it had disappeared from the freezer at DSE), Steller's Jay.

Birds at tables for each student to draw and study. Handle with care!

I spent a lot of time this summer collecting gull feathers, as I would like to add to the bird lesson a kinesthetic activity using feathers to get the feel of lift like a bird does.

GRADE 4

Everything is always in a process of change

Study area: Ecosystems (this I believe is currently part of the 4th grade curriculum – I based these lessons on a request from Katy Ritter, the only one of my teachers who gave me any kind of feedback about what she would like me to cover)

Definition:
An ecosystem is the way things co-exist together.

Concepts:
Producers (sunlight to energy)

Consumers (us and most animals – what have you consumed today?)

Decomposers: The "FBI" Fungi, Bacteria, Invertebrates – the Clean up crew and recyclers

The fragile balance of an ecosystem. I touch on Climate Change and Global Warming in the 4th grade curriculum. I tie it into my overreaching concept that everything is always in the process of change.

Balance as a concept. "Winners" and "Losers" – What happens in a winter when there is no snow? Who is a winner? Who is a loser?

Related concepts – death, fire, natural disasters, all as shapers and essential parts of the ecosystem.

Food web.

Fall Lesson

Decomposers: Fungi

Concepts: parts of a mushroom

How they grow (mushroom as a verb)

Be a mushroom.

The fruiting body vs. the mycileum.

Veil/partial veil.

Gills.

Relationship between mushrooms and trees.

Spores and reproduction of mushrooms.

(review and extension: California Condors have one chick every two years, trees plant thousands of seeds, fish lay many eggs – some "parents" tend their young, and some don't – mushrooms have billions of spores)

What would the world look like if all the mushrooms spores grew into mushrooms? (this concept can be expanded with all living things – at some point I usually introduce the question "What would the world look like if no people ever died?")

I use the Forest Service booklets about mushrooms – I have a classroom set, as well as 4 waterproof field copies – I pass them out in class to look at some of the varieties of types we might encounter.

FALL HIKE – the MUSHROOM HUNT

We seek them out, photograph them, see if we can identify certain kinds.

POST HIKE – look at pictures we took.

Winter Lesson

All grades have done the same lessons for the 3 winters I have worked for DSE because of the varying winter conditions.

Spring Lesson

Change and Metamorphosis

Concept story: The life cycle of a dragonfly.

What in nature changes in the spring? Look at trees (review from 3rd grade curriculum)

How do different living things change in the spring?

What is the difference between change and metamorphosis? (think of examples of each)

Do people undergo metamorphosis? (you get some interesting answers to this – fairly philosophical)

All my spring lessons try to be a compilation of what has been learned in the course of the year, with review about the basic ideas from the fall lessons that I want to become part of everyone's body of knowledge- something they will take forward with them – something they will have mastered.

Spring HIKE – Gastineau Meadows – Goal: The Treadwell Ditch Trail

Looking at the ecosystem of the meadows – the muskeg, its fragileness, how we can respect it – look for signs where people have gone off trail and destroyed it –

Looking at the bog pools up there – aquatic insects. Looking at how the bottom of the pools are deceptive – sounding them with sticks.

Noticing the different kinds of plants growing – looking at burls on the trees and how the trees possess the ability to grow over irritants to heal.

If we can reach the Treadwell Ditch trail, it is a kind of a landmark – it connects all of Douglas Island, which is where all our students live. From it you can get past Sandy Beach, and all the way to Eaglecrest Road. It comes down into Cedar Park, and to Bonnie Brae. The kids are fascinated that they could walk home on a trail. I feel that it's a good introduction to what's out there.

Nature studies curriculum 3-5 (2008)

Lesson Title: Introduction
Grade Level: 1st

Materials: chalk and chalkboard
name tags
markers, crayons, colored pencils

Goals: This is an introductory lesson that is the stepping stone to building trust and relationships between the instructor and the students.

Objectives: This lesson will be the platform to future lessons and will help the instructor get a feel for what they already know and what the students are ~~interesting~~ interested in learning.

Lesson: Have the students come up with a list of activities they like doing in the ocean and on the beach. Have the students create a list of the things they know about the ocean.

Activity: Hand out little pieces of paper and have each student write what he/she wants to learn about the ocean. Write them on the board and decide which one they want to learn about

Hand out their name tags. Let them fill the front and back out. Have them turn them in so they can be laminated and returned next week

November 4, 2008
Lesson 1

Title of Lesson: How big is our ocean?

Grade Level: 2nd grade

Materials Needed:

Inflatable Globe

Chalkboard and chalk

Goal: Students will begin their discovery of aquatic environments and also begin to notice that water is all around them, in their neighborhoods, backyards, oceans, rivers, ponds, and creeks.

Objectives:

Lesson: Show the class the inflatable globe.

Ask students: What is this big ball?

What do you know about our big blue planet?

Discuss the different shapes and colors seen, so that students understand what land and water look like on the globe.

Activity: Have students stand in a circle.

Begin by tossing the globe to a student across the circle. The student catches the inflatable globe with two hands and looks where their hands are touching. He or she describes the location as “mostly water” or “mostly land.” Practice this a few times.

Establish a few ground rules:

Pass the globe to someone across the circle.

Call the name of the student you are passing to, before tossing the globe.

Everyone gets a turn

When each student catches the globe, he or she tells the class what they are "mostly touching": land or water. The results are tallies on a large chart with two columns marked Land and Water. When the activity is finished, count the tally marks.

Follow-up/Assessment

Ask students what they notice about the tally marks.

Which had more tallies: water or land?

Why do you think (water or land) had more tallies?

Have the students look at the inflatable globe again, and ask:

Do you notice anything you hadn't noticed before?

With a partner, encourage them to share what they notice and then share with the whole group.

Record students comments.

Elaboration:

Encourage students to notice water around them on their trips to and from school.

Where is the water they see?

In what other places have they seen water?

November 25, 2008
Lesson 3

Title of Lesson: Web of Marine Life

Grade Level: 2^{nd} grade

Materials Needed:

Where is Dinah Diatom? By Rita O'Clair and Katherine M. Hocker

Marine Animal Cards – tape them to the white board

String, Tape

Cut-outs

Butcher paper

Goal:

By the end of the lesson, the students should have a basic understanding of a marine life food chain.

Lesson:

1. Read Where is Dinah Diatom by Rita M. O'Clair and Katherine M. Hocker
2. Take 6 volunteers:

   Who ever can guess the marine animal in order gets to be it.

   Give them their marine animal card.
3. Have them stand in a circle and toss the spool of rope to each other in order of the book.
4. When they get the spool, have them read the back of the card.

4\. What happens when one mammal is missing in the food chain?

Follow-up/Assessment:

Have students work together to put the pieces of this web of life together on a poster board.

November 18, 2008
Lesson 2

Title of Lesson: Marine Debris

Grade Level: 2nd grade

Materials Needed:

Fan

Trash (plastic bottles, lighters, balloons, six pack holder, plastic bags, foam pieces, paper, glass, metal cans, straws, foam paper cups, cigarette butts, oil, etc)

Marine Debris video (www.keepoceansclean.org) or Jean-Michel Cousteau movie

Deep bin filled with water

Goal: Students will be able to:

1. Define marine debris.
2. Categorize different types of debris.
3. Determine how a material can influence what becomes marine debris.

Lesson:

Have students bring some clean and dry trash to the front of the class and show to the other students what they have.

1. Have the students separate the trash into different piles (plastic, glass, rubbers, paper, wood, cloth)
2. Have the students address the following questions:

   Will the item float or sink?

   How do you think this item ended up in the ocean?

   What plants or animals could be affected by the presence of this item?

3. Test each item for buoyancy in the bin. Record the results.

   Which items float? Which do not? (Make a list on the chalkboard)

   What will happen to the buoyant items when they get into the ocean?

What could some of the problems be with buoyant marine debris?

What will happen to items that don't float when they get into the ocean?

4. Have students address the following questions:

Which items do you think will be blown around easily?

How far do you think the item can travel?

FAN ACTIVITY

Set up the fan at one end of a table. Place each piece of trash item in front of the fan, one at a time, to see if it is blown around. Ask the students these questions:

1. Which items are easily blown around?
2. What blows trash around in the environment?
3.

Activity: Split them into groups of 4-5 and have them come up with ways to help the ocean and the animals that live there.

Come back together as a class and share findings.

Follow-up/Assessment:

Discuss the impact that humans have on their surrounding environment.

Brainstorm ideas about how people can help reduce the amount of debris in our oceans.

Extension:

If time permits, take the students out to a local water source (the beach or a stream/creek) and have them pick up trash.

Or

Encourage them to pick up trash by their local water source around their homes.

December 2, 2008
Lesson 4

Title of Lesson: Jeopardy Trivia Toss Up

Grade Level: 2nd grade

Materials Needed:

Fact sheet

Yellow card (2)

Goal:

To get as many points as possible to win the game

Lesson:

This lesson is structured so the students will recall information that has been previously taught in past lessons. Also, it will throw in new facts about the ocean.

Activity:

1. Have the students split up into groups. (Either boys vs. girls or count off to help this process depending on the class).
2. Have them elect a "team captain"

   This person will be designated the yellow sign to hold up when the team has the correct answer.
3. Now decide which team goes first. Rock, Paper, Scissors with team captains.
4. Begin the game:

   Read a trivia question and give each team 2 minutes to decide on the answer.

   (Encourage the students to whisper so the other team can't hear their answers)

   Give "team 1" captain an opportunity to answer the question correctly.

   If the answer is <u>correct:</u> give them a point on the board

   If the answer is <u>incorrect:</u> give "team 2" captain a chance to answer the question.

WHY IS THE OCEAN BLUE?

Sunlight is made up of all the colors of the rainbow: red, orange, yellow, green, blue, and violet. Some of the sunlight is reflected off the surface of the water, reflecting the color of the sky. Some of the sunlight penetrates the water and is scattered by ripples and particles in the water (this tinges the appearance of the ocean with the color of the particles). In deep water, much of the sunlight is scattered by the oxygen in the water, and this scatters more of the blue light.

Water absorbs more of the red light in sunlight; the water also enhances the scattering of blue light. Sir Chandrasekhar Venkata Raman (an Indian physicist) won the Nobel prize in 1930 for his work on light.

Some Oddly-Colored Seas:
The Red Sea often looks red because of red algae that live in this sea.
The Black Sea looks almost black because it has a high concentration of hydrogen sulfide (which appears black).

Investigation 1 - Backyard Water Discovery

Overview: In this 4-5 day investigation, students begin their discovery of aquatic environments, and start to notice that water is all around them, in their neighborhoods, backyards, oceans, rivers, ponds, and creeks. They take a first look at "Our Big Blue Planet" with a globe game, inspect jars of water and land to think about the differences, and act as outdoor "Water Detectives" to explore and map water on a walk near their school. They finish up the investigation by taking a closer look to see living things in their jars of water.

Focus Questions:

Where does our local water come from and where does it go?

What is a watershed?

Where does your drinking water come from? How do you know?

Activity 1A: Globe Toss

(one 25-minute class period)

Focus Question: Where is the water around us?

Engagement (5 minutes):
Show the class an inflatable globe. Ask students: What is this big ball? What do you know about our Big Blue Planet? Discuss the different shapes and colors seen, so that students understand what land and water look like on the globe.

Exploration (10 minutes):
Introduce the activity. Have students stand in a circle, and begin by tossing the globe to a student across the circle. The student catches the inflatable globe with two hands and looks where their hands are touching. He or she describes the location as "mostly water" or "mostly land." Practice this a few times.

Establish a few ground rules, such as:
Pass the globe to someone across the circle.
Call the name of the student you are passing to, before you toss the globe.
Everyone gets a turn.

When each student catches the globe, he or she tells the class what they are "mostly touching": land or water. The results are tallied on a large chart with two columns marked Land and Water. When the activity is finished, count the tally marks.

Explanation (10 minutes):

Class Time Required
: 1 class period
: 1-2 class periods
: 1 class period
: 1-2 class periods
: 1 class period

Inflatable globe
Chart paper and markers
2-10 glass jars with lids
Water from a local outdoor source such as a tidepool or pond.
Soil, dirt, and/or rocks
Science notebooks
Pencils
Book: *Water* by Frank Asch
Clipboard
Camera
Magnifying glasses

About 1 hour to assemble materials, determine location for walk, collect water samples, and set up science notebooks.

Prior Student Knowledge
Children will have used their senses of touch, taste, smell, sight and hearing to explore the properties of water.

It is helpful if students have had prior experiences in their science notebooks. If not, students will need an introduction to science notebooks.

Students need to be able to listen to other children as well as to speak and participate in a large group.

Vocabulary
Adult, data, detective, diatom, direction, environment, globe, larva, magnify, map, observation, ocean, phytoplankton, plankton, planet, tally, zooplankton

Words for local water, such as: creek, harbor, lagoon, pond, river, sea, slough

K-12 Standards A1, A2, B1, C3, G3

Ask students what they notice about the tally marks.
Which had more tallies: water or land? Why do you think (water or land) had more tallies?

Have the students look at the inflatable globe again, and ask:
Do you notice anything you hadn't noticed before?

Encourage them to share what they notice, first with a partner, and then with the whole group. Record students' comments.

Elaboration:
Encourage students to notice water around them on their trips to and from school. Where is the water they see? In what other places have they seen water?Evaluation: Notice students' abilities to observe, estimate, and share what they know.

Activity 1B: What's in the Jars?

(1-2 class periods)

Focus Question: How is water different from the land?

Engagement (20 minutes):
This activity requires a jar of water collected from a local outdoor source (ocean, pond, river) and a jar of land (soil and rocks), and allows children to begin the questioning process.

Put the jar of water in a paper bag. Have students ask questions to determine what might be in the bag. Guide the class with clues as needed, by telling them:

Living things grow and live in it.

It is wet.

It covers over half of our earth's surface.

Let them think and discuss their ideas, defending their thinking if there is disagreement.

Show the students the jar of water, then show them the jar of land. Begin a discussion by telling them that these are two things that are part of their everyday life and they already know a lot about them. Explain that today they are going to make a list of ways that the water (in the ocean/river/pond) is different from land." Encourage students to respond with their own ideas. Use chart paper to make a list of all differences. After the class has generated a list of how water is different from land, reread the list.

Exploration (30 minutes):
Place the jar of water and jar of land at a science center, or for a whole class activity put jars of water and land at each table. Distribute science notebooks and a pencil. Review the list of differences brainstormed by the whole class. Support students to make an observation of the water and the land. Students will draw a picture of the water and draw a picture of the land in their science notebooks. Remind them to include the date and a title on the page. Those students who can write labels and/or words can also add those to the drawing.

Explanation:
As they finish their drawings and writing they can pair-share their science notebooks. As more students complete the activity, table groups can then share together.

Elaboration (30 Minutes):
Gather the class together for a story, and read Water by Frank Asch.

The discussion afterward can include questions such as: Where do we find water? What lives in the water around us? How do we know?

Evaluation:
Use class discussion and students' science notebooks to evaluate their understanding.

A possible rubric to use for scoring follows:

Scoring Rubric:

4 Student drew a detailed picture of the jar of water and the jar of land. Title, date, and labels included.

3 Student drew a picture of the jar of water and the jar of land.

2 Student drew a picture of the jar of land but not the water.

1 Some attempts to draw were made.

0 No attempt.

Activity 1C: Water Detectives

(1 class period)

Focus Question: Where is the water in our neighborhood?

Engagement (15 minutes):
This is an awareness activity to focus on the topic of water. Reflect out loud to the class so that they can hear your reflections and wondering process; for example, "I've been thinking about our Globe Toss game. It makes me wonder about the water around us." Or "After thinking about the data from our Globe Toss game, I started asking myself: Where is the water in our neighborhood?"

Ask the students for their ideas about where water might be found. You might write the ideas on chart paper, on cards, or on a clipboard that can be used on the walk as a checklist to see how many places the students were able to predict.

Prepare students to go for a walk outside to notice water in their local environment by having them dress for the weather. Since they will all be Water Detectives they will need to bring their "scientist eyes and ears" with them. Their job is to find water or evidence of water on their field trip.

Exploration (30 Minutes):
Go on a nature walk to find evidence of water around your school area and beyond. Encourage students to look beyond the school area if mountains, hills, or other features are visible. Look for evidence of water that might not be visible at this time, such as erosion, empty streambeds, or drainage ditches. Carry a clipboard and camera to record what students say and observe, and enlist the help of any additional adults on the field trip to do the same.

Explanation (10 minutes):
Back in the classroom, debrief from the field trip, recording information on a chart with the title "Water Detective Discoveries:"

What did you notice? Where was the water you discovered? Was it close or far away? What direction was the water going? What color was the water?

Read the comments children made while being Water Detectives, and add that information to the chart.

Elaboration:
Encourage students to continue to be Water Detectives on their way home. Where do they observe water? Where is the water near their home?

As homework, students can gather data and talk over their initial ideas about water with their family.

Evaluation:
Use a checklist or anecdotal notes to gather an understanding of individual understanding.

Activity 1D: Let's Make a Map

(1-2 class periods)

Focus Question: Can we show where the water is around us?

Engagement (10 minutes):
Review with students some of the things they observed on their Water Detective walk the day before. Tell them that they will be going back to the same area to draw a "map" that will show where the water is located

Exploration (30 minutes):
Distribute science notebooks for students to put in their backpacks. Go on a walk, returning to a place where you found water during the previous lesson. Allow each child to find his or her own space for making a map as well as an observational drawing of what they see, hear, and feel around them. Distribute pencils. Remind them to start with

the date and a title. As students finish drawing and writing encourage them to share with a partner sitting next to them

Explanation (20 minutes):
Complete the maps back in the classroom.

Model a science notebook page on chart paper. Ask questions: How did we get there? What was close by? What else can you add to your map? Suggest possible additions such as buildings, bridges, trees, rocks, and docks.

Allow time for students to complete their maps, and have each child share their map with a friend as they finish.

Gather the class together, and have students sit in a circle with their science notebooks on their laps. Ask students to share ideas from their maps, while you make a chart that records common elements from all maps. This is a great opportunity for students to learn from each other. List student ideas on a chart to model writing. and elements of a map.

Elaboration (10 minutes):
Begin an with the students. Record the Observations: what students were able to see and possibly what they inferred from what they noticed (for example if they saw garbage in a creek, they might have inferred that the water was dirty or that people had been near the water)

Ask students: "Now that you've seen water in our backyard, what are some things you OBSERVED about water?" Tell them: "Later on we'll come back to: What are some things you WONDER about water? Eventually we'll document: What have we LEARNED about water?"

Evaluation:
Notice which students are able to share observations of their work. Keep notes or a checklist so that you can make more explicit instruction available for those students who do not seem to be able to work independently.

Activity 1E: Take a Close Look

(1 class period)

Focus Question: What do we see when we look closely at water?

Engagement (10 minutes):
Show students the jar of water that they looked at in Activity 1B: What's in the Jars? (The water will now be at least 5 days old, and if it has been collected from a tide pool, river, or puddle and left in the sun it will probably have a phytoplankton bloom and a green color.) Ask students what they notice about the water in the jar, and encourage them to share some observations with the whole class.

Prepare students to make an entry in their science notebooks. Tell students they will be working like scientists when they look closely and notice, and that scientists also record their observations. When scientists make observation they record the date and describe what they are looking at. Then they carefully draw what they see.

Exploration (20 minutes):
Place a jar of water at each table or work space.

Ask students to look closely at the jar of water at their table. Pose the following questions: "What do you notice about the water in jar? What colors do you see? Do you notice anything moving? Does the water look the same today as it did last week?" Provide magnifying glasses for each table. Encourage the students to use them.

Have each student draw a picture of what they observe in their science notebook.

Explanation (10 minutes)
Invite students to Pair-Share their science notebook observations.

Ask for volunteers to share with the whole class.

Elaboration (10-20 minutes):
Tell the students where the water in the jar was collected. If time allows, you may have students closely observe a jar of plain tap water that has also been sitting for 5 days, and make comparisons. Ask "Does water from the faucet have living things in it?" "What water is safe to drink?" Discuss the idea that water in our neighborhood has many living things in it that you don't always see. As homework, students may bring back some evidence (small container, sketch, or photo) of water near their home that had something living in or near it.

Evaluation:

Use class discussion and students' science notebooks to evaluate their understanding

Teacher Preparation:

Read the for more information. Prior to Activity 1B, collect water from a local outdoor water source (ocean, river, or pond). Collect enough to fill 5 jars. (If you plan to do this as a science center activity instead of as a whole class activity, you may need only one jar of water). After completing the What's in the Jars (1B) activity, place the jars of water in a sunny spot, and save them to use with the Take a Closer Look activity (1E).

For each table group, fill one jar with the water you collected and one jar with soil or rocks representing land.

Prior to Activity 1C, walk possible routes and decide where to take the students to find water in the neighborhood. Arrange for additional adult support as needed.

Science notebooks: Set up a page or two facing pages in the children's science notebooks for Land and Water comparisons (1B), with spaces for a date, a title, and a drawing of each. Set up a page for making a map and drawing of neighborhood water (1D). Set up a page for recording observations of living things in the water (1E).

Curricular Connections:

Math. The Globe Toss activity helps students practice counting skills and introduces basic concepts of probability and statistics. Allow students to revisit this activity during center or choice time, and encourage students to collect additional data: are their hands touching mostly land or water? They can compare it with the class data chart.

Language Arts. Students develop speaking and listening skills, and begin to practice writing as they use labels with drawings

Art. Students draw from their observations

Additional connections to music and poetry can be made by bringing in a picture of the planet Earth from space, and song Blue White Planet by Raffi.

Materials Needed for Investigation 1.

Student Handouts	Science notebooks
Items for Group Display	Chart paper and markers Book: *Water* by Frank Asch
Material Items	2-10 glass jars with lids Paper bag Water from a local outdoor source such as a tide pool or pond Soil and/or rocks Pencils Clipboard Camera Magnifying glasses
Facility/Equipment Requirements	Classroom space to store jars in direct sunlight. An aquatic environment (pond, puddle, stream, slough, beach, etc.) within close walking distance of school.

Investigation 1 - Habitats

Overview: In this 4-6 day investigation, students identify specific traits of a habitat. They start with a familiar local habitat and then focus on aquatic habitats. Children are guided through an initial field session, a follow-up exploration of water habitats, and discussions of aquatic habitats and the animals that live in them. They use an OWL chart to track initial thinking, useful questions, and new learning, and they use science notebooks to document thinking and discoveries as well as questions and specific comparisons and contrasts. A quick assessment check using a cut and glue animal will give teachers an idea of initial understandings of habitat.

Class Time Required	**Activity 1A** - 2 class periods **Activity 1B** - 1 class period plus 15 minutes/day for 5 days **Activity 1C** - 1 class period
Materials Needed	Science notebooks **Compare and Contrast Response Chart** Chart paper Clean jars with lids Water from local aquatic habitat Magnifying lenses Eyedroppers Small clean surfaces for observing water drops (glass slides, small plastic lids, etc.) Thermometers Rulers and/or other measuring tools **O-W-L chart** on overhead, board, or chart paper Books and posters of aquatic habitats and animals Poster board Scissors Glue Nature magazines for cutting out pictures of aquatic animals
Teacher Preparation	Determine nature walk location Prepare science notebooks for students Collect jars of water from a pond, stream, lake, river, or the ocean. Label the jars Prepare Animal Riddles Collect nature magazines with pictures of aquatic habitats that students can cut out Collect pictures, posters, and books of aquatic habitats and animals
Prior Student Knowledge	Students should know the difference between living and nonliving things, and have experience sorting plants and animals into different groups. They should also understand that animals, including humans, live in homes, and that each place has plants and animals that can survive there.

Activity 1A: Animal Habitats (1½- 2 class periods)

Focus Question:

What lives where and why?

Engagement: (10 minutes)

With the whole class, brainstorm different animal homes such as bird and squirrel nests, beehives, anthills, and barns. Chart the students' responses. Lead students in a discussion of what evidence they might find to indicate that an animal lives in a particular area. Add these to the chart. Examine the chart and discuss with students why an animal may decide to make its home in a particular place. What does the animal need to survive? Is it able to get these things where it lives? What might make a place unsuitable as a home (e.g., too wet, too dry, too cold, too hot)? Encourage students' use of the word shelter for aspects of an animal's home that protects it from other animals or factors (e.g. drying out, getting too hot or cold) that would harm it and make it difficult to live comfortably. Introduce the word **habitat**. Lead students in developing a definition for the word habitat. An example of a good definition would be: A habitat is a place where animals can live and have all of their needs met.

Exploration: (40 minutes)

Go on a nature walk to find evidence of animals in your locale. Students should bring their science notebooks and a pencil. Have students find evidence that an animal lives in a place, such as nests, anthills, spruce cone piles, droppings, tracks, or sounds. Students should record their findings by drawing a quick sketch in their science notebooks of an animal in or near its habitat.

Explanation: (10 minutes)

Students return to the classroom and complete a **Think, Pair, Share** activity with their findings. Be sure students can explain the evidence they found to show why they think a particular animal lived in a place. Students should be encouraged to label their drawings. Then, as a whole group, generate a list of animals that were found on the walk and evidence that supports each finding. You may want to compare the original chart of possible animal evidence to the chart of evidence of animals found during the walk, and have students note the differences between the two.

	A mini-lesson on the use of scientific tools would be helpful. It could include: how to use a magnifier or loupe, how to use a thermometer, using measuring tools, how to use an eyedropper, how to take care of tools, where to put them when finished.
Vocabulary	Aquatic habitat, Evidence, Habitat, Shelter, Algae, Microbe, Microscopic
Science GLEs Addressed	1st and 2nd grade standards: A1, C3, G3, G4 3rd grade GLEs: [3] SA1.1, [3] SA1.2, [3] SA3.1, [3] SC3.1, [3] SC3.2, [3] SG2.1, [3] SG4.1

Elaboration: (15 minutes)

Lead the students to an understanding that an animal's home is called its habitat. In their science notebooks, have students label their drawings of an animal's home with the word habitat. Let students know that they will find out more about why an animal would choose a particular place for its home in later investigations.

Evaluation:

Use class discussion and students' science notebooks to evaluate their understanding. A possible rubric to use for scoring follows:

Scoring Rubric: Were students able to show evidence of an animal in its home?
4 Student drew an animal in its appropriate habitat and labeled the drawing.
3 Student drew an animal in its appropriate habitat.
2 Student drew a shelter but did not match the appropriate animal to the habitat.
1 Some attempt made but animal and/or habitat were not shown.
0 No attempt.

Activity 1B: What Lives in a Jar? (1 class period plus 15 minutes/day for 4-5 days)

Focus Questions:

- What lives where and why?
- What lives in the water?
- What's in the jar besides water?

This is an ongoing investigation that will give students practice with science process skills that are important for further investigations in the unit.
Important concepts for this activity are:

- In an ordinary jar of water, there can be life.
- Living things are not always visible.

Engagement: (15 minutes)

Show the students the jar(s) of water and ask them what they can see in the jar. Students will first record a prediction in their Science notebooks. Guide them in observing and measuring the water in the jar, using thermometers and rulers. Using eyedroppers and magnifying lenses (or microscopes if available), give students the opportunity to closely examine drops of water from the jar. Be sure students date their entry.

Exploration and Explanation: (15 minutes per day for about 1 week)

Each day, provide time for students to observe and record observations of the jar(s) in their notebooks, being sure to include the date. They will record questions about what they observe. As water warms to room temperature, the jars should begin to show signs of life. Algae may begin to form. Larval stages of many insects begin in water. Provide magnifying glasses, microscopes, etc., as appropriate for further observations.

Discuss the observations briefly, allowing student questions to drive the discussion. Introduce the terms **microbe, microscopic,** and **algae,** as appropriate. If appropriate, ask students to draw and label what they can see in the jar.

Elaboration (20-50 minutes)

Ask students where they think the water came from. Brainstorm the other types of places or habitats where animals might live in the water and the types of animals (microscopic and large enough to observe directly) that live in these types of habitats. Students can design experiments to compare regular tap water with pond water or stream (lake, ocean) water. Ask students to bring in jars of water from home and describe where their water was collected, in their science notebook or on a label attached to the jar. Provide time for students to observe and compare the jars over several days.

Evaluation:

Assess student entries in science notebooks including a prediction, a question, and a draw and label page where appropriate for this activity.
For Formative Assessment: Use the **Observe-Wonder-Learn** chart.

Activity 1C: Aquatic Habitats (1 class period)

Focus Questions:

What lives in the water?

Engagement: (10 minutes)

Play the Mystery Animal Game: Give the students clues about an aquatic animal but do not tell the students that it is aquatic. Clues might include what type of shelter the animal lives in, what it eats, and some of its behaviors. Ask students to guess what animal is being described.

Who Am I?
Example 1:
Clue #1: I live in different places during different times of my life.
Clue #2: I look very different when I am born than when I am grown.
Clue #3: I like to eat bugs when I am grown.
Clue #4: I can make a loud noise.
Answer: Frog

Example 2:
Clue #1: I can make a loud noise with my tail when I am frightened.
Clue #2: I make my home of mud and sticks.
Clue #3: I can cut down a tree with my sharp teeth.
Clue #4: I have dark brown fur and large webbed feet.
Answer: Beaver

Example 3:
Clue #1: I live where it is cold most of the year.
Clue #2: I like to eat clams as well as seals.

Clue #3: I can grow to weigh more than a ton!
Clue #4: I have two tusks.
Answer: Walrus
Clues and animals can be derived from the **Alaska Wildlife Notebook Series.**

Ask students to guess what animal is being described. Write each animal on the board as it is successfully identified. Ask students to determine what all the animals have in common (they live in or near the water).

Exploration: (25 minutes)

- Display posters and books of aquatic habitats throughout the room and invite students to explore and talk among themselves for about 5 minutes, about the varied aquatic life forms.
- Clear tables and make poster boards and magazines available to small groups of students. Have students work in groups to locate, cut, and paste pictures of aquatic animals to create a poster of animals that live in the water.
- Monitor the groups and listen for questions that students ask as they work. Record these questions on chart paper.

Explanation: (10 minutes)

- Allow students to share and compare their posters with other groups. Encourage them to ask questions of the other groups to support and show evidence for their choice of animals in the poster.
- Record questions that arise from the discussion on the chart started in the exploration part of the lesson.
- Record facts that students profess to know on a separate chart.
- Ask students, in their groups, to use their science notebook entries from the nature walk, and discuss what is the same and what is different about the animals they drew in their notebooks and the animals they chose for their posters.
- One student from each group will report the similarities and differences the group noticed about the animals.

Elaboration (5-30 minutes)

- Ask students to complete the sentences on the **Compare and Contrast Response chart** in their science notebooks.
- Students can graph the variety of animals displayed on their class posters.

Evaluation

Assess small groups on their completion of a poster that displays aquatic animals.
Assess individual students on their notebook entry using the **Compare and Contrast Response chart.**
Provide pictures of aquatic animals from the Animal Mystery Game and ask students to glue a picture in their science notebooks. Tell them to draw an appropriate habitat for that animal and label the animal's food source and shelter.

Teacher Preparation

Walk possible routes for the nature walk and decide where to take the students. If necessary, arrange for permission, volunteers, and/or transportation.

Prepare science notebooks for students. If students do not have existing science notebooks, make one for each child by stapling 10-15 sheets of lined and/or unlined paper together in a construction paper folder. Students will need space to draw and write daily observations for 10-15 days. For this activity, they will need to sketch animals and label drawings in their notebook. Be sure that students' science notebooks are set up with space for daily observations, sketches, dates, and measurements.

Before completing Activity 1C, glue the **Compare and Contrast Response chart** into students' science notebooks. This should be placed in the next page after the students' drawings from the nature walk. **Compare and Contrast Explanation.**

Collect jars of water from a pond, stream, lake, river, or the ocean, trying not to capture anything other than the liquid water so that jar appears to have only water in it. Obtain samples from local water sources that are known to support a variety of life. Label the jars to show where the water was found and number the jars if more than one water source was used.

Prepare Animal Riddles.

Collect nature magazines with pictures of aquatic habitats that students can cut out. Collect pictures, posters, and books of aquatic habitats and animals.

Extension

The **Animal Riddles Extension** describes an additional activity, in which student groups write their own riddles, followed by the creation of a Riddle Book and/or a diorama.

Curricular Connections

Reading. Standards are addressed by "compare and contrast." Vocabulary. Also, connect to an additional reading: Pond (One Small Square), by Donald M. Silver or additional read-alouds.

Writing. Drawing and labeling can address writing standards. See Riddle Extension Activity for more writing activities.

Music. Learn and sing the Habitat Song (see **Teacher Background**).

Ideas for adapting to different local environment or context.
Invite local tribal council members to go on the nature walk with you.

A nature walk should be possible in all areas, even urban settings. There is probably evidence of animal life around any school building. If you can't take your students out of the building, you could make a map that shows an outdoor area familiar to them (perhaps the school grounds or a nearby park). List all the different kinds of wildlife or animal evidence that students have seen there.

Materials Needed for Investigation 1:	
Student Handouts (Included)	. Science notebooks . **Compare and Contrast Response chart**
Items for Group Display	**O-W-L chart** on overhead, board, or chart paper
Material Items	. Chart paper, markers . Clean jars with lids . Water from local aquatic habitat . Magnifying lenses . Eyedroppers . Small clean surfaces for observing water drops (glass slides, small plastic lids, etc.) . Thermometers . Rulers and/or other measuring tools

Materials Needed for Investigation 1:	
	. Books and posters of aquatic habitats and animals. . Poster board . Scissors . Glue . Nature magazines for cutting out pictures of aquatic animals
Facility/Equipment Requirements	Appropriate site for nature walk.

Alaska Science Standards and Grade Level Expectations Addressed:

1st and 2nd Grade Standards Addressed

A1 - Science as Inquiry and Process

SA Students develop an understanding of the processes and applications of scientific inquiry.

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

C1 - Concepts of Life Science

SC Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.

SC3 Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

G1 – History and Nature of Science

SG Students develop an understanding of the history and nature of science.

SG3 Students develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).

SG4 Students develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.

3rd grade Grade Level Expectations

The student develops an understanding of the processes of science by:

[3] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

[3] SA1.2 observing and describing their world to answer simple questions.

The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by:

[3] SA3.1 observing local conditions that determine which plants and/or animals survive. (L)

The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:

[3] SC3.1 identifying and sorting examples of living and non-living things in the local environment. (L)

[3] SC3.2 organizing a simple food chain of familiar plants and animals. (L)

The student demonstrates an understanding of the bases of the advancement of scientific knowledge by:

[3] SG2.1 comparing the results of multiple observations of a single local event. (L)

The student demonstrates an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base by:
[3] SG4.1 asking questions about the natural world.

Essential Question:

- Who lives where and why?

Enduring Understandings:

- Living things have certain characteristics that help them survive.
- Living things need food, water, air, and shelter to survive.
- Science is a way to help us answer questions about the world around us.

Investigation 1 Extension - Animal Riddles

Overview: This lesson builds on the prior activities designed to engage students in actively thinking about an animal's habitat. Students work together to create their own riddles about a given animal, demonstrate knowledge of that animal, its characteristics, and its habitat.

Class Time Required	1 class period
Materials Needed	Color photos of animals to accommodate the size of the students' Science Notebooks. Glue Crayons, Markers, or Colored Pencils Writing paper Pencils
Teacher Preparation	30-60 minutes to find magazine pictures.
Prior Student Knowledge	Animals have different characteristics and these characteristics can be clues to the kind of animal.
Vocabulary	
Science GLEs Addressed	1 st and 2nd grade standards: A1, C3, G3, G4 3rd grade GLEs: [3] SA1.1, [3] SA1.2, [3] SA3.1, [3] SC3.1, [3] SC3.2, [3] SG2.1, [3] SG4.1

Focus Question:

- What lives where and why?

Engagement and Exploration: (25 minutes)

Play the Mystery Animal Game again (see **Investigation 1C**), but this time give photos or pictures of selected animals to teams of students and have them make the clues for the animal. Remind students to use clues that are about the animal's habitat: what the animal eats, where it lives, what it uses for shelter, whether it is solitary or lives with others of its kind. Be sure that students record their riddles either in their science notebooks or on a separate sheet of paper, before sharing them with the class.

Explanation: (10 minutes)

Ask students to glue the picture of their animal in their science notebooks and draw an appropriate habitat for that animal. Students should label as much of the animal's habitat as they can, to demonstrate their understanding of how the animal's needs are met where it lives.

Elaboration (30-100+ minutes)

- Students can create a Riddle Book modeling the Mystery Animal Game using the riddles they worked on in their groups. Students should be encouraged to illustrate the book pages.
- Students may begin to think about whether their animal is specific to a region, a country, or possibly a continent and locate their animal's environment on a map.
- Students can design a diorama that creates a habitat for their animal.

Evaluation: (Assessment and Scoring)

Students will have written a riddle and glued it in their science notebooks. If the focus of the clues is on the animal's habitat, you should be able to discern a student's ability to consider an animal's characteristics as well its need for a specific habitat. Each student should have drawn an appropriate habitat for the animal glue-in.

Teacher Preparation:

Locate and cut out pictures from magazines or have on hand other color photos of animals that children will be familiar with. These pictures can be animals found locally, or animals that students have studied. The pictures should be small enough to fit in the student's science notebooks covering no more than 1/4 of the page. This allows the student room to elaborate on the habitat that they will draw of the animal in the photo.

Curricular Connections:

Writing. Standard L2. Writing a complete sentence with subject and predicate.

Art. Design and illustrate an animal habitat.

Geography. Locate places on a map.

Materials Needed for Investigation 1:	
Student Handouts (Included)	. Color photos of animals to accommodate the size of the students' Science notebooks
Items for Group Display	
Material Items	. Glue . Crayons, Markers, or Colored Pencils . Writing paper . Pencils
Facility/Equipment Requirements	

Alaska Science Standards and Grade Level Expectations Addressed:

1st and 2nd Grade Standards Addressed

A1 - Science as Inquiry and Process

SA Students develop an understanding of the processes and applications of scientific inquiry.

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

C1 - Concepts of Life Science

SC Students develop an understanding of the concepts, models, theories, facts, evidence, systems, and processes of life science.

SC3 Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

G1 – History and Nature of Science

SG Students develop an understanding of the history and nature of science.

SG3 Students develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).

SG4 Students develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.

3rd grade Grade Level Expectations

The student develops an understanding of the processes of science by:

[3] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

[3] SA1.2 observing and describing their world to answer simple questions.

The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by:

[3] SA3.1 observing local conditions that determine which plants and/or animals survive. (L)

The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:
[3] SC3.1 identifying and sorting examples of living and non-living things in the local environment. (L)
[3] SC3.2 organizing a simple food chain of familiar plants and animals. (L)

The student demonstrates an understanding of the bases of the advancement of scientific knowledge by:
[3] SG2.1 comparing the results of multiple observations of a single local event. (L)

The student demonstrates an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base by:
[3] SG4.1 asking questions about the natural world.

Essential Question:

- Who lives where and why?

Enduring Understandings:

- Living things have certain characteristics that help them survive.
- Living things need food, water, air, and shelter to survive.
- Science is a way to help us answer questions about the world around us.

O-W-L		
Observe	**Wonder**	**Learn**

Spring Nature Studies
Gastineau School
Plankton Studies

Outcomes/Goals:

Students will be introduced to the amazing variety of marine plankton and be inspired to learn more about them.

Students will understand that their are many different kinds of plankton living in local waters and be able to use pictorial guides to identify some of them and understand their importance to marine food chains..

Students will be able to explain the difference between zooplankton and phytoplankton and that one way that plankton are classified is according to how they live (holoplankton and meroplankton).

Students will understand that plankton go through considerable changes throughout their lives and will be introduced to some of these life cycles.

Students will understand that plankton populations undergo large fluctuations throughout the year with highest numbers in the spring, and that the life cycles of other marine species depend on these plankton cycles.

Students will be able to explain what a limiting factor is and be able to name some limiting factors for plankton populations.

Students will become more familiar with and comfortable with using dissecting scopes.

Key words/ concepts: Plankton., Zooplankton, phytoplankton, life cycle, nekton, benthos, population cycles, limiting factors, diatoms, dinoflagellates, barnacles, copepods

Introduction: "The role of the infinitely small in nature is infinitely great" Louis Pasteur

Materials: pictures of nekton, plankton and benthos, life cycle envelopes, tank and two balloons, adaptation sack.

What do you think are the most important things in the ocean?
What do you know about plankton?
One way marine organisms are classified is by how they move or are moved about.

Activity: Let's see how plankton fit in with other living things in the ocean. Each student given a color coded picture of a marine organism. Have all the plankton stand up.

Explain how plankton gets pushed around by wind and currents, can only make weak and feeble swimming movements. Demo. Have the current carry you out the door, etc. Tell all plankton they are now going to move up to the board moving like plankton with a current coming from the back of the room pushing them along. They move up to the board and place their organism in the section marked plankton. Some of them share what kind of organism they were. Tell the nekton that they are strong swimmers and have them come up to the board with strong swimming motions. Discuss who is part of the nekton. Benthic creatures crawl, wiggle, creep, move fast in short spurts. Benthos comes up to the board.

Two main kinds of plankton-plant and animal plankton. Separate the plankton on the board into the two groups. How are they different? Why is plankton so important?
-bottom of the food chain
-produces a third or more of the earth's oxygen
-most oil from millions of years of plankton deposits

Point out barnacle in the benthos and its larvae in the plankton. Some organisms spend part of their life in the plankton and part elsewhere. Find examples on board. Let's look at some life cycles. Hand out envelopes. Students work with partner to try and reconstruct life cycles. Which part in nekton, benthos, plankton? What is the advantage of having planktonic larvae? What is the advantage of being totally planktonic? Plankton is mostly in surface waters, why?

Let's look at some adaptations that plankton have that help them survive and reproduce. Demonstration: Small, clear container filled with water. One small balloon filled with fresh water, one with salt water. Why does one sink? Denser than the water. Living things denser than salt water so they tend to sink. Why do plankton need to float? If plankton keep sinking will sink out of zone where they can photosynthesize. How do they keep afloat?
Activity: Hand out bags filled with different objects, 3-4 to a bag. Students work in pairs to figure out how these objects might represent some adaptation that plankton have that help them to float. (Caution: Some students approach these objects very literally trying to fashion them all into some kind of Rube Goldberg device that will help them float. You need to give them some examples to steer them to a more abstract approach-a balloon floats in the air when the substance inside of it is less dense than the air around it-maybe plankton have sacs filled with a material less dense than salt water.) Possible objects include vials of oil (diatoms, copepods), chains, necklaces, koosh ball, frisbee (greater surface area, spines, flattened body shape),balloon, etc. Students share their ideas, give them some other examples of how these objects might represent some actual adapations to floating.

Field trip preparations.
Predict- What kinds of organisms do you think will be most abundant in our samples?

Field Trip

Review -What is plankton? Why is it important? Show a few pictures of adaptations of how it stays afloat. What other kinds of organisms might we find living in the boat harbor?

Walk to boat harbor. Split into two groups. Make observations of some benthic organisms living on dock, pilings. Demonstrate how to use the plankton nets. Have students collect organisms using the nets and from the benthic community.

Return to class. Show students how to use the dissecting scopes and have them look for plankton and other organisms in the samples they brought back. Use handouts to help identify them and observe movement and adaptations. What kinds of plankton were most abundant? How many different kinds did you see?

Wrap up

Today we will look at a huge biological phenomenon that takes place here in the spring, but goes largely unnoticed by many who live here. Without it many of the other cycles that we do notice wouldn't continue-salmon and herring spawning, healthy clam and crab populations, large numbers of eagles and bears, etc. By the end of our time together today you should be able to tell what this phenomenon is and explain some things about how it works.

Food web activity: Everyone gets 2-3 organisms and sits in a large circle the center of which is the ocean. Everyone with plant plankton places it in the ocean.(40) Why is it important? Who is eating it ? Put those out in the ocean (10). Who is eating the zooplankton? Put them out. (5) Who is eating the things eating the zooplankton?(2) Turn to the person on your right and name a food chain within this food web we created. What happens if you remove plankton from this food web?

What do the plant plankton need to grow and reproduce? Sometimes they don't get enough sun and nutrients. When might this happen?(Think of land plants.) We looked at life cycles. Plankton also go through population cycles-total numbers go up and down. Examples? Populations tend to grow until something limits them. What? Food, space, sunlight, etc. (Limiting Factors).

Activity-Plankton population simulation

color-coded cards: plant plankton- green, sunlight-yellow, nutrients-red, zooplankton-pink

Students sit in circle with an assortment of each kind of card. Start with 20 phytoplankton, 5 zooplankton, 5 light, and 45 nutrient cards in the middle. This is winter conditions in Gastineau Channel. The phyto plankton need both light and nutrients to grow and reproduce. Are they all going to be able to do it? What limits them? Spring comes, days get longer, sun is higher in sky, light intensity increases. April 7, 8, 9. Add 40 light. Now lots of light and lots of nutrients. What happens? Add 80 plant plankton, 20 zooplankton. Plankton numbers increasing late April to early May. Bloom peaks. Herring spawn, young salmon emerge from streams, benthic organisms release larvae into the plankton. What is happening to nutrients? What happens to light with all those plankton in the water? Remove 20 nutrients and 20 light. Phytoplankton biomass decreases. What is limiting the growth of the population? Remove 30 phytoplankton. Add 5 zooplankton. With fewer plankton light levels go back up. Add 20 light. Add 10 phytoplankton 5 zooplankton. Mid-may 2nd bloom (lower numbers). Why aren't numbers as high as first bloom? One possible reason-more predation-limits biomass. Does the population stay the same throughout the year? Why not? What things keep it from continually getting bigger. Look at graph of simulation. What other things happened about the same time as the peak of the plankton bloom? Herring spawn, etc. Can you think of any reasons why these might occur at the same time?

Reflections: The two fifth grade classes at Gastineau were very different. One was difficult to focus unless the lesson was very active all the time. Even then it took a lot of work to keep the activity from descending into chaos. The other class had a much easier time staying focused and our discussions and understandings reached a much higher level. The intro worked fairly well with both classes though I think they would have gotten more out of the adaptations activity if they could have started with an object a little denser than water that they added things onto to make it float. Not enough time to do that though. We had terrible weather for both field trips 39 degrees, blowing, and raining with most students not really dressed for it. Considering that I think they went well. Douglas harbor didn't seem to have either the numbers or variety of plankton as Harris Harbor. We used 10 dissecting scopes, 5 from DZ and five from Phoenix. It was very helpful to have that many, but the DZ scopes were less powerful, with poorer optics and didn't hold students attention the way the better scopes did. It was also very time consuming to track down available scopes. Generally though students found looking at the plankton very exciting and engaging. The wrap up worked ok for one class not at all for the other. Splitting the class into two groups with one working on something else during the simulation might have helped. Also turning it into an Oh Deer type of game would have worked better with the more focused class, probably would have been complete chaos with the other group.

Nature Studies Curriculum 3-5 (2009)

Title: Rabbits, Rabbits Everywhere!
Grade Level: 3-5th grade
Time needed: Approximately 15 minutes

Materials needed:
22 index cards (1/2 cards will do) with the letter "W" for white
6 index cards (again, ½ cards will do) with the letter "B" for brown
Note: If this activity is done NOT during the winter, the instructor may want to reverse the number of each card needed (see "Activity" below).
Bonus materials: Image(s) or pelts of snowshoe hares in winter coat and summer coat

Goal: This activity illustrates natural selection. At the end of the activity, students should be able to illustrate natural selection.

Objective: At the end of the activity, students should be able to talk about an advantage of adapting to one's environment. This activity is part of a lesson on animal adaptations.

Activity: As part of a lesson on animal adaptations, 4 students come to the front of the room. 2 are given "B" index cards, and 2 are given "W" cards. The students represent snowshoe hares, with different coats. The instructor can talk with the students about why the hares have different colored coats depending on the season. To represent an advantage of adapting to ones' environment, the teacher gives additional cards to the original 4 student volunteers. Both "W" students get 2 "W" cards, and each "B" student gets 1 "W" and 1 "B" card. These volunteers then hand out their new cards to other students, one card per student. The original volunteers sit down as the new group of volunteers stand at the front of the class. There should now be 2 students with "B" cards and 6 with "W" cards. The teacher again gives each volunteer 2 index cards, 2 "W" ones for each student with a "W" card, and 1 "B" and 1 "W" for each student with a "B" card. This 2nd group of volunteers hand out their cards to other students, one card per student. After this 3rd rotation, there should be 2 students with "B" cards and 14 students with "W" cards. This graphically illustrates the advantages of adapting to one's environment and natural selection.

4 Winter PRE Lesson Plan, DSE Critter Adaptations
Prepared by Scott Burton, Spring 2009

Objectives (as written in JSD/Discovery curriculum)

Animals and man adapting to the changing environment in which they live; winter survival strategies

Science Curriculum Connections:

Life: Ecosystems of Alaska

SC1.1 showing the relationship between physical characteristics of Alaskan organisms and the environment in which they live

IN CLASS:

5m Intro

Review fall briefly (Energy cycle)

Introduce subject, "What do you think we are going to study?" Use skulls, etc. to gain attention. Why do some animals have eyes on the sides of their heads, while some in front? Sharp teeth vs. flat teeth? Porcupines and quills? Define adaptation.

Outline hike and wrap-up schedule

6m Activity

Clothing
- Review clothing experiment from 3rd grade.
- How humans **adapt** to going outside
- Dress student in adult clothes

25m Activity

Slides/Pictures of critters

Deal with it, Hibernate, Migrate Riddle
- List mammals on board in respective column
  - Review briefly, tracks
    - Herb, carn, omni cards (optional, students hold up a red card for carnivore, green/herb, black omni)

10m Closing

Vole Experiment Prep
- Explanation
  - Voles "deal with it" what does that take?
  - Shelter, food, water

How to build shelter, film canisters, shelter requirements: insulation, food, water, shelter from elements and predators. Same for humans?

MATERIALS NEEDED:
Herbivore and carnivore skull, computer, projector, cords, mammals and tracking computer presentation, clothing pieces from experiment.

HIKE
FOCUS: Adaptations

Activities:

Vole experiment
Tracking
Wolf Walk
Bat and Moth game
Lynx and Hare game
Deer and Hunter/Naturalist game for snack

4 Winter WRAP LP, DSE Critter Adaptations

5m
Intro
Hike Summary

25m
Activity
Snow stories
- Review (thicket side 1)*
- Create own or fill in (with optional snow story on one side)
  - Use tracks overhead as resource*
- Focus on critter adaptations

10m
Activity
Clothing Experiment*
- Soak pieces of wool, denim, cotton t-shirt, fleece, polyester, etc in icy water, put on skin, ask which is best. Get fabric from thrift store

8m
Closing
Adaptation Song*

3rd Grade Fall Lesson Plan
Pre Hike Session 1
Discovery Southeast
Scott Burton, Tom Schwartz

15m INTRODUCTION

Self Introduction

Discovery SE and Naturalists

Discovery the nature of Southeast Alaska

Draw a map of AK, break-up the word natural-ist.

3,4,5 grade, briefly outline studies and structure of lessons hikes, etc.

Scott, Tom

Bring something interesting to pass around.

Plant Intro—Why study plants n stuff?

Share the importance of plants. Ask the food riddle. Is there any food on the planet we can live on that doesn't come from or eat a plant? Let them stew on that for a while. Eats CO2, makes 02 etc.

(Bring class to front sit on floor in half circle)

25m SORTING

A good way to learn about plants n stuff is to sort them. Let's practice. Throw some markers, or crayons on the floor. Have the kids sort. A good way to help us learn about the plants as we sort them is to make what is called a dichotomous key. Let's practice with your shoes. Have each kids take off a shoe. Shoes with laces/shoes without laces, etc. One of the naturalists draws a Dkey on the board.

(Back to desks)

Put a bunch of deciduous and evergreen samples on their desks. How would you sort these? Make a key on the board.

5m GAME

"Plant-see, can't see." Like heads up seven up, but with trees and shrubs. Have each naturalist do half the class. The kids feel the plants with their hands.

MATERIALS:
Deciduous/evergreen samples for each group in the class.

3rd Grade Fall Lesson Plan
Pre Hike Session 2
Discovery Southeast
Scott Burton, Tom Schwartz

5m REVIEW

Plants are important to study because, O2, CO2, all food begins with plants

Photosynthesis, chlorophyll, sorting, dichotomous key, evergreen, deciduous

10m GAME

"Plant-see, can't see" Like heads up seven up, but with trees and shrubs. Have each naturalist do half the class. The kids feel the plants with their hands.

15m ACTIVITY

Tree dichotomous key fill in the blanks sheet.

10m CLOTHING

Dress up a kid in adult outdoor clothes

5m SAFE CHOICES OUTSIDE

MATERIALS:
Tree and shrub samples
Blank dichotomous key
Blank dichotomous key overhead
Outdoor clothes

Salmon Eggs

A salmon's life begins as an egg. Salmon eggs are reddish orange in color. Salmon eggs are laid in gravel nests that hide and protect the eggs. The salmon eggs take at lest 50 days to hatch and can take longer depending on the temperature of the water. The colder the water the longer it takes for the fish to hatch.

Alevin

Once an egg hatches it is called an alevin. An alevin is unable to swim and is too strong to fight the current of the river. In order for an alevin to survive it must still stay hidden in the gravel of the riverbed. Alevin's have a yoke sack attached to them and that is their only source of food for weeks.

Salmon Fry

After a alevin has used up it's yoke sack it is called a fry. A fry is about an inch long and is able to finally swim and explore it's river. A fry has to find it's own food and is very vulnerable to predators.

Parr Stage

Once a fry has grown to around 2 inches it is called a parr or a fingerling. A parr has a tremendous appetite and is constantly feeding. During this time the parr begins to swim towards the ocean.

Smolt Stage

By the smolt stage a salmon has migrated itself to towards the coast and is living in estuaries. Estuaries are places where salt water and fresh water meet. This is the stage where salmon begin to undergo changes that will allow them to live in salt water instead of fresh. A salmon that has made it this far along the journey is very lucky to have survived.

Adult Stage

The salmon head straight for their hereditary feeding grounds and live in large, loose schools. They stay here for 1-5 years, depending on the species. They face many hazards from hungry predators. When the time comes they return to the streams where their life began.

Spawning Stage

When the time comes a salmon will begin to return to the stream from which it was born. During this stage the salmon will stop eating a begin to live off of it's fat reserves. They will swim all the way up stream and back to the same river they were born. After they return the female salmon dig nests in the gravel that are called redds, they then lay thousands of eggs. After the eggs are laid male salmon spread sperm or milt onto the eggs to fertilize them. Then the female salmon goes back and covers her nest. Of all the eggs laid by the female salmon only 1-10 will live to adulthood. After spawning the salmon then dies to make way for a new generation.

Is this a SALMON HEALTHY forest?

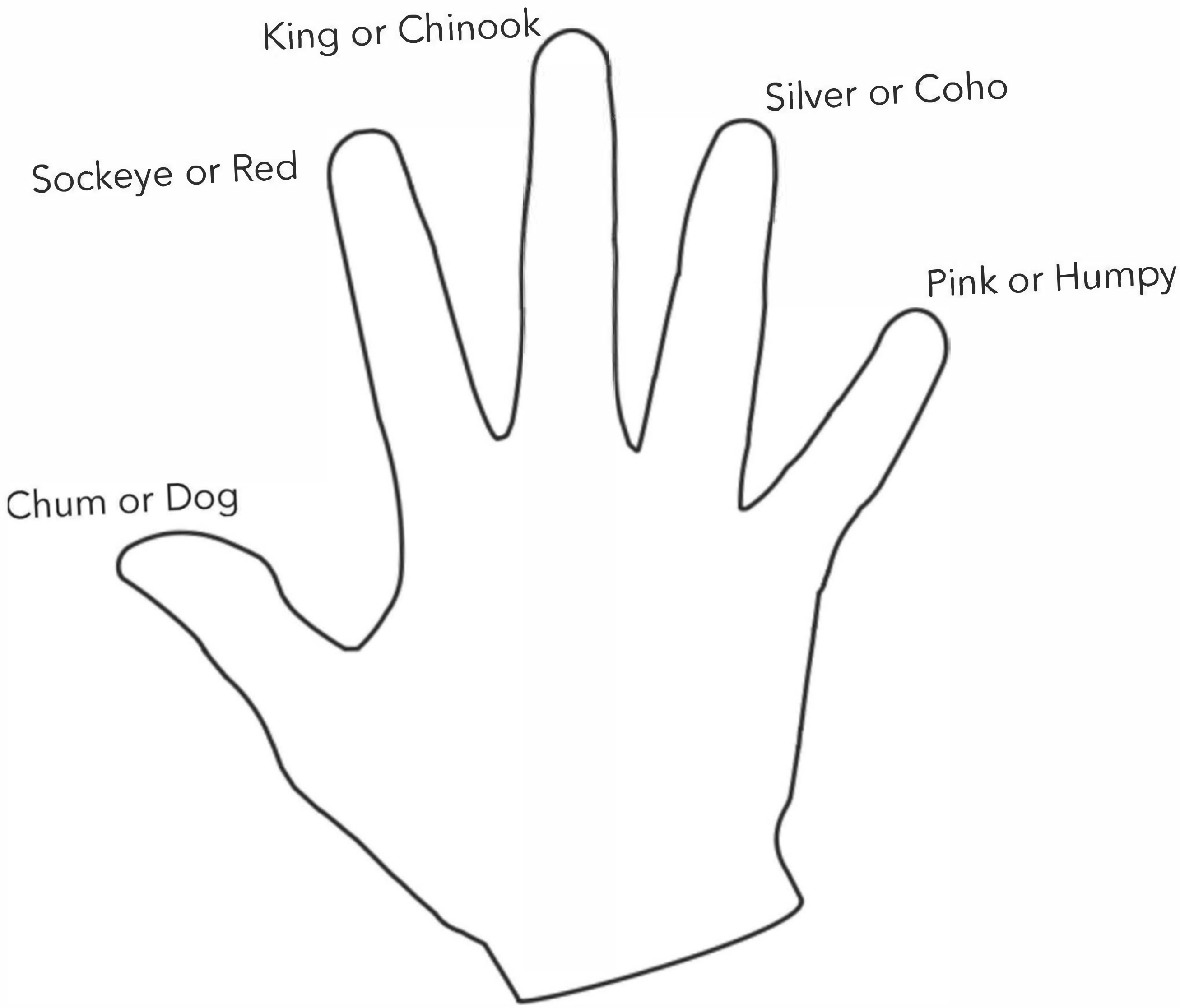
DO I HAVE?	YAY! ☺	DO I HAVE?	YAY! ☺
SITKA WILLOW		BOULDERS	
SITKA ALDER		COBBLES	
SITKA SPRUCE		PEBBLES	
WESTERN HEMLOCK		SAND	
BLUEBERRY BUSHES		SILT	
		CLAY	
NURSE LOGS			

DO I HAVE?	YAY! ☺	DO I HAVE?	YAY! ☹
MOSSES		VARIED THRUSH	
		GREAT BLUE HERON	
FOLIOSE LICHEN		BELTED KINGFISHER	
FRUTICOSE LICHEN		RAVENS	
CRUSTOSE LICHEN		EAGLES	
		GULLS	
		CROWS	
		JAYS	

DO I HAVE?	YAY! ☺	DO I HAVE?	YAY! ☺
RIFFLE		BEAR ACTIVITY: SKAT	
POOL		BEAR ACTIVITY: BEAR BEDS	
TREE COVER		BEAR ACTIVITY: BEAR TREES	
TREE ROOTS			
DECAYING LEAVES		SQUIRRELS	
AQUATIC INSECTS		DEER	
SALMON CARCASSES			

DO I HAVE?	NAY! ☹	DO I HAVE?	NAY! ☹
GARBAGE		LOW SNOW PACK	
DOGS CARS		SIGNS OF FLOODING	

Salmon High Five



Name ____________________________________ Discovery Southeast Nature Studies

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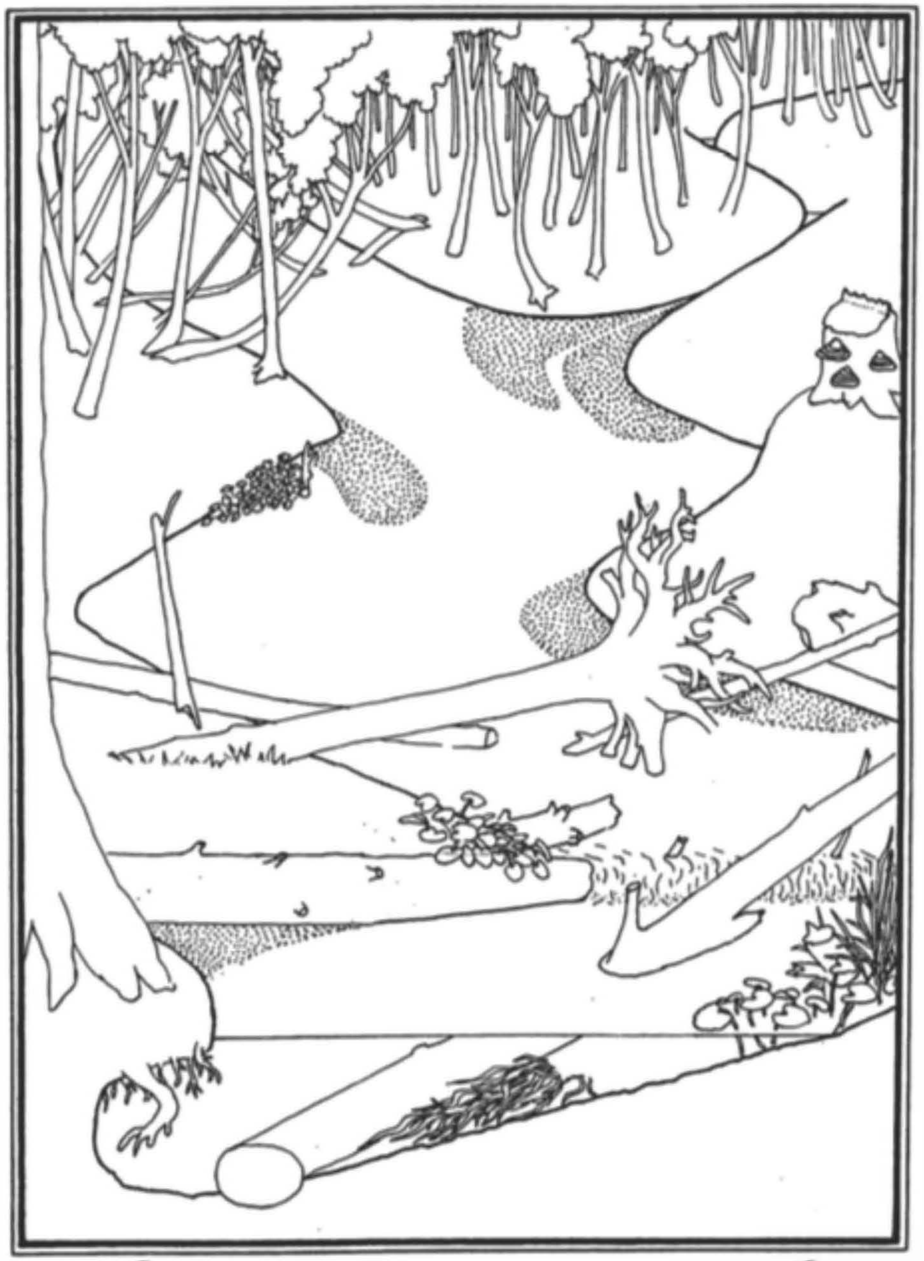


What makes a salmon healthy STREAM habitat? Find and color the stream features that create a good home for the fish. Draw tiny salmon in the parts of the stream that fish would like best.

Fish like to hide and rest under **banks** and **logs**. Plant roots keep stream banks firm. Old trees fall into the stream making safe hiding places for fish. Water flowing over logs digs nice, deep **pools**.

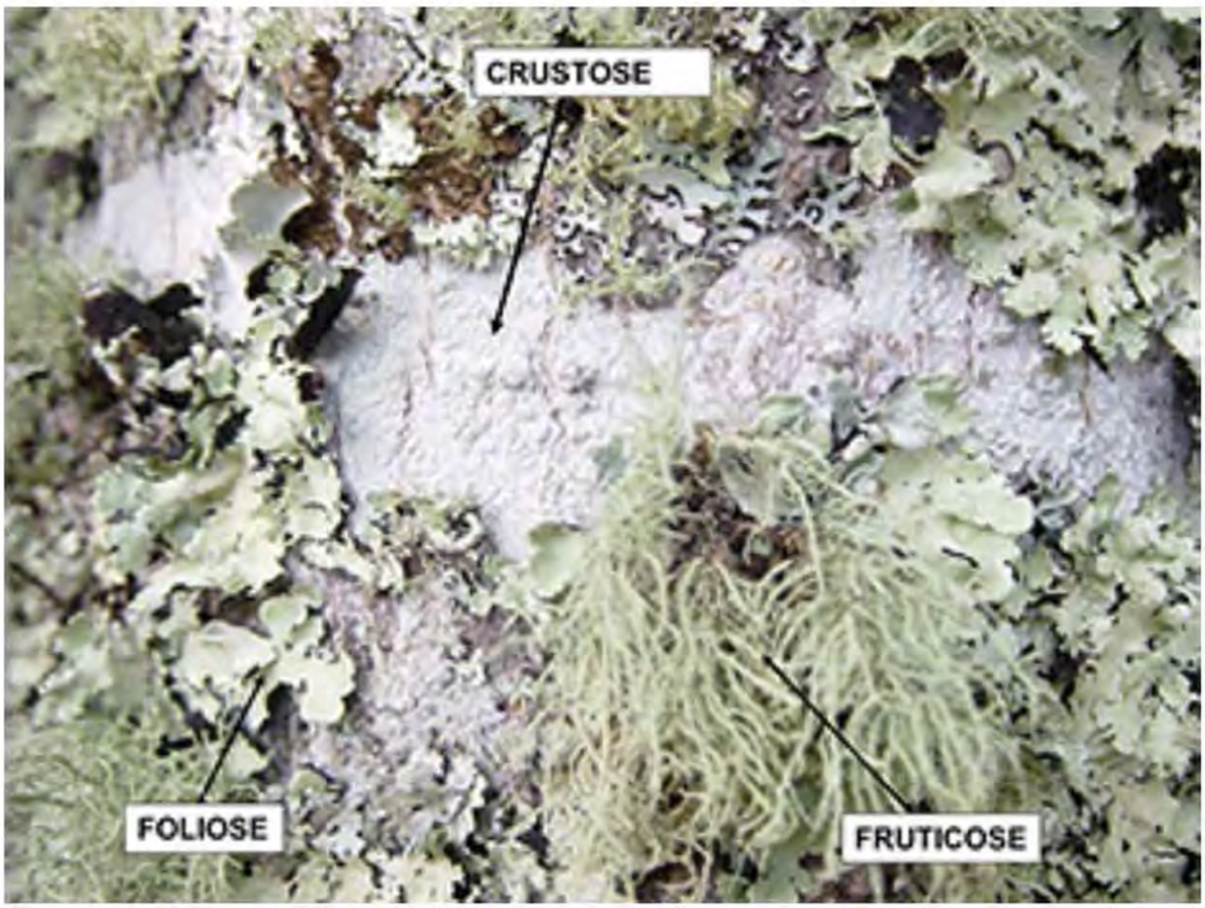
Plants that hang over or grow in the stream help small fish hide and find food. Insects live in these plants – food for fish! Emergent plants, plants that grow OUT of the water and submerged vegetation, plants that grow under water are both important habitat for **aquatic** insects.

Some small fish use tiny streams that join the main stream. They also **rest** and **feed** in slow water on the outside of curves and behind objects. Salmon depend on **gravel** to make their **redds**.

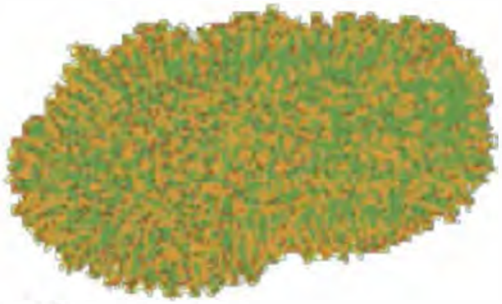
I LIKEN THE LICHENS

FRUTICOSE: WITCH'S HAIR, METHUSELAH'S BEARD, COASTAL REINDEER, FALSE PIXIE CUP
FOLIOSE: WAXPAPER, BEADED BONE, RAGBAG, FRECKLED PELT
CURSTOSE: BULL'S EYE, PENCIL SCRIPT, DUST LICHEN

The body of a lichen is composed of branching hyphae of a fungus, which harbor algal cells. The fungus gets food synthesized by the alga and the alga in return gets shelter, moisture and minerals absorbed by the fugal partner from the substrate.

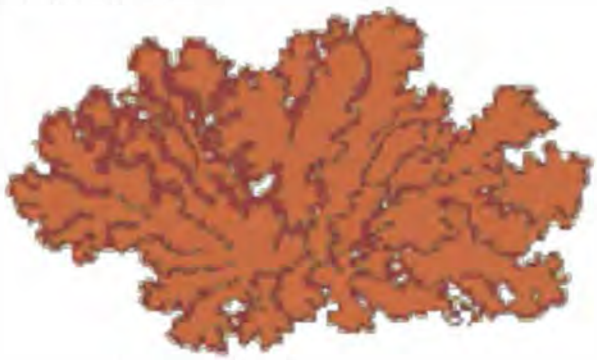


Crustose lichens : These lichens form a hard granular crust closely adhering to rocks and tree trunks.
Foliose lichens : These lichens form leaf-like thalli with lobed margins attached to tree trunks, rocks, walls, etc. They are sometimes referred to as shelf fungus.
Fruticose lichens : These lichens form much branched shrub-like habit developing fruiting bodies



A. Crustose

C. Froticose



B. Foliose

Economic importance of lichens : *Lichens are used in varieties of ways. Some lichens are valuable source of food to wild animals like reindeer. Some lichens are fried and given to cattle as food and to some extent to human beings. Some are used in medicines and other are for preparation of dyes. Litmus is prepared from certain lichens and some are also used in the preparations of cosmetics and perfumes.*

Ecological significance : *Lichens growing on rocks disintegrate them to form soil, preparing the ground for mosses and subsequently for higher plants. Thus, they help in the succession of plant communities.*

Discovery Southeast 2014 Curriculum

Discovery Southeast

Nature Studies Curriculum

Developed by Maia Wolf

With generous funding provided by

The Blackwell Fund

Juneau Community Foundation

DRAFT: September 2014

Table of Contents

Introduction

This curriculum is an overview of what Discovery Southeast teaches Juneau 3rd-5th grade classes in our Nature Studies program, as well as available resources for naturalists. It has been developed using previous Discovery Southeast curricula, input from Juneau School District teachers and staff, and the Juneau School District curricula, keeping a focus on National and Science Education Standards and Alaska GLEs (JSD learning goals indicated by italics).

The purpose of this document is twofold. The first is to provide guidance to Discovery Southeast naturalists as they embark on new Nature Studies adventures. The second is to provide teachers, parents, program participants, and community members with a comprehensive understanding of the content covered in Discovery Southeast's in-school program. This curriculum is meant to be a living document, and will evolve with Discovery Southeast, reflecting changes as we provide outstanding hands-on nature education to Southeast Alaskans.

Discovery Southeast recognizes the diversity of teaching styles within its naturalists. Since our naturalists' strengths and interests make our programs stronger, this document is intended as a foundation on which our naturalists can apply their own style. Since many teachers approach the school year differently, several sections of this curriculum include multiple paths for naturalists to take, in order to support the classroom teachers and provide the best program possible.

3rd Grade Fall: Plants, and Energy Flow

Big picture: Energy is passed from one organism to another through food webs, which can include plants, animals, dead things, and the sun.

Essential questions: How are plants, the sun, and people connected to one another by energy? What different roles do different plants play?

Learning goals:

- Students will become familiar with sorting, organizing and classifying local forest and muskeg plants
  - Students will be comfortable using descriptor words to sort plants by size, color, texture, and other distinguishing features
  - Students will be able to identify differences and distinguish between evergreen and deciduous plants
  - Students will become familiar with common traits for plants in Southeast Alaska
- Students will become familiar with a linear structure of energy flow (while energy flow is a non-linear concept, the idea of an energy cycle is not introduced until fourth grade)
  - Students will be comfortable with the idea that all organisms need energy to survive
  - Students will recognize that energy from the sun is the basis of all energy in the food chain
  - Students will be comfortable with the concept that "plants make their own food" using energy from the sun
  - Students will recognize that energy is transferred from organism to organism, not lost
- Students will be prepared for their nature studies experiences and will know how to dress, what to bring and what to expect
  - Students will be equipped with the tools to be aware and thoughtful of themselves, their classmates, and the surrounding nature on outdoor trips

Naturalist background:

Since this class is this group's first Nature Studies experience, a good way to begin a new journey is to have yourself and your assistant naturalist introduce Discovery Southeast as well as yourselves. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves.

However complex the workings of biological things, they share with all other natural systems the same physical principles of the conservation and transformation of matter and energy. Almost all life on earth is ultimately maintained by transformations of energy from the sun. Plants capture the sun's energy and use it to synthesize energy rich molecules, (primarily sugars) from molecules of carbon dioxide and water. These molecules then serve directly or indirectly as the source of energy for the plants themselves and ultimately for all animals and decomposer organisms (such as bacteria and fungi). At each stage in the food web, some energy is stored in newly made structures and some is dissipated into the environment as heat produced by the energy-releasing chemical processes in cells.

Since this is the first field trip with a new group of naturalists, it is time to set the expectations! Nature Studies students come from a variety of backgrounds and have a wide range of comfort levels outdoors. Giving tools and establishing safe practices for exploring outdoors now will help make the rest of your Nature Studies classes fun and safe. Take this first class to go over basic Leave No Trace principles, edible plant guidelines, dressing for success, bushwhacking etiquette, and anything else you need to make sure you and your students are comfortable and curious the whole time.

<u>Activities and resources:</u>

- *Keep your space, save your face:* Again, since it is the first field trip this is a great opportunity to introduce some basic tools.
    - Wide-eyed vision: The placement of an animal's eyes on its head is very important to the survival of the animal. Predators, including humans, have their eyes placed in the front, so that they can focus better on their prey during a hunt, while animals lower on the food chain have eyes on the side of their head, allowing them to keep track of their surroundings, especially any nearby predators. Have the kids think about what SE Alaska animals may need wide eye vision for various reasons, and then ask the kids to keep their wide-eye vision on for the rest of the field trip. Routinely ask to see what types of things the kids noticed, that they may not have usually seen.
    - Fox walk: have the kids walk through the playground using their wide-eyed vision and a ball-toe-heel walk (bear), as if they were sneaking up on their prey. Switch to walking on the balls of their feet (fox), and then just their toes (cougar). How do these different walking styles mimic different animals in the wild, and why do they walk differently?
    - Toll bridge walk: have one naturalist go up the trail, and the other one will make a "toll bridge," making sure that the students begin to walk up the trail in several second intervals, and that they have personal space. Ask the kids to use their wide-eyed vision and fox walk, and then discuss what they observed at the end (make sure to use all senses, not just what they saw).

- Dancing with Devil's Club: find a area dense with Devil's Club, and work as a team to find safe paths through the brush. Emphasize that speed is not important here, and that students should focus on their surroundings and selves.

- *Dichotomous shoes*: have each student take off one shoe and put the shoes in a pile. Invite one student or a small group of students to come forward to sort the shoes, and ask them what features or characteristics they used to sort the shoes. Write these words on the board, and then repeat the process with a new student or group of students. Once the shoes have been sorted several ways, discuss with the group the different methods used to sort the shoes, and segway into the importance of a standardized classification system. Classification is a valuable tool that naturalists and scientists use to help understand nature. Naturalists can use familiar classroom items to introduce the process of sorting, listing, and classification. By introducing a dichotomous key with familiar items in a familiar setting, you can help build a foundation before applying the concepts in the field.
- *What's on a pizza*? Work with the students to talk through each ingredient on a pepperoni pizza and determine where the energy comes from. The goal is to help the students trace back all of the energy to plants, which then ultimately leads back to the sun. Have the students then talk through what changes we experience and what energy we gain when we eat the pizza.
- *Six plant part scavenger hunt*: Have the kids break off into pairs or small groups and hunt through the muskeg or forest to find an example of each of the six plant parts. How does that plant part benefit the plant? How does it benefit other animals in Southeast Alaska? How does it benefit people?
- *Sticky note sorting*: Assign each child a "new identity" by giving them a nametag with a SE Alaska plant or animal on it. Have the kids use their new identities to sort themselves into groups based on the concepts of energy transfer. For the first round, allow them to sort without help, and then explain why they chose to sort the way they did. On the second round, help prompt the kids to create a group that get energy from the sun, a group that get energy from plants, and a group that get energy other animals.
- *Tree tag:* after reviewing the difference between evergreen and deciduous plants, play a group game of tag where the students are only safe from the person that is "it" if they are touching a tree that matches the classification called out by the naturalist.
- *Leaf matching activity:* All plants are the same, in that they share the six plant parts (review these), but what makes them different? Ask the kids to come up with a couple of contrasting classifying words that could be used with plants. Pass out a leaf to each kid, and in his or her science journal, have the child draw the leaf, and write five classifying words that would help us identify that particular leaf. Ask them to pay attention to details about their leaves that make them special, or unique. Have the kids compare their leaves to their neighbors' and come up with several things the leaves share, as well as several ways that they are different.

3rd Grade Winter: Introduction to Mammals and Tracks

Big picture: Mammals can be placed on a spectrum of "predator" and "prey." Mammals on either end of the spectrum share specific behavioral and structural similarities. Mammals, as well as other organisms, also leave behind markings, which can be used to tell the story of the animal's actions.

Essential questions: What specific structural differences can be used to decide if a mammal is a "predator" or a "prey?" What markings do animals leave behind that tell their story? What information can humans gain from reading animals tracks?

Learning goals:

- Students will learn to classify mammals as predator or prey species based on skull type, eye placement, and tooth type, which will additionally expose them to classification of mammal families.
- Students will hone basic tracking skills in search of evidence of predators and prey in the field
  - Students will feel comfortable identifying an animal track using details of the track and a tracking booklet
  - Students will feel comfortable telling the story of the track(s) that they find based on the track(s) surroundings

Naturalist background:

Once students become more comfortable with the idea of energy flow and a linear food chain, it is time to introduce the idea of predators and prey. While the students will likely focus on factors such as diet to distinguish between the two, introduce the idea that these animals are separated by structural features as well. Prey's eyes are positioned on the side of their heads, allowing them to maximize tier view of their surroundings, while predators are designed to focus their vision on a much smaller field. Predators have short mandibles, sharp teeth, and strong jaw muscles, designed to bring down and rip up game, while prey rely on longer jaws and wide, flat molars to grind down their fibrous diets of vegetation. Another thing that can help someone distinguish between predator and prey is the markings that the animals leaves behind.

All animals, including humans and especially mammals, leave markings behind them as they move through their lives. These markings can be used to not only identify the animal, but tell the story of its past actions. Through tracks, we can see the direction of the animal, use the gait to determine its speed, and look for other tracks to tell us whether it was alone, with another of its own species, or in close proximity to animals of a different kind. Other markings like scratch marks, chew marks, and abandoned fur and feathers can also help to establish the animal's behavior as it moved through an area, and scat can help us not only track an animal, but determine its diet and health. By looking at these stories that are left behind, students can begin to see and understand the different behaviors within the animal kingdom, as well as observe how different animals interact with each other in their natural habitats.

Activities and resources:

- *Track mats*: using mats found in the Discovery Southeast office, students can practice moving their bodies like different animals. By following visual tracks, students can see how an animal's body movements are different at different speeds, and how different animals have different bodies and body movements.
- *Crime scene*: create a series of indicators that help to tell a story of animal activity in an area. This can include tracks, scratch and bite marks, blood, fur and feathers, scat, and food sources. As a class or in small groups, have the students work together to identify what happened at the "crime scene" and establish a timeline of events. You can also have the students work together to establish a crime scene of their own for their peers to solve.
- *Camouflage:* have an "owl" chose a "perch" in a heavily vegetated area (after checking for potential hazards in the area). The owl will close their eyes and count to 15, allowing all of the other students, or "mice" to find a hiding place. The mice must be able to check in on the owl occasionally, and the owl, staying on their perch, must try to find and call out as many mice as possible. Once the owl can not find anymore mice, they can count an additional 10 seconds for the mice to find a new hiding place and repeat the process. Discuss with the class afterwards the relationship between the owl and the mice, and if the mice had to do anything special to keep from getting "eaten."

3rd Grade Spring: Freshwater Ecosystems and Aquatic Insects

Big picture: While healthy streams, lakes, and rivers provide a unique habitat for aquatic insects, they are also connected to terrestrial and marine ecosystems, and help to create larger ecosystems, which serve as habitats for many other organisms.

Essential questions: What types of aquatic animals can we find in Southeast Alaska? How do streams, rivers and lakes interact with mammals? How so they interact with the ocean? How do aquatic insects fit into an entire watershed's food chain?

Learning goals:

- Students will be able to identify the interactions between stream ecosystems, terrestrial ecosystems, and marine ecosystems
- Students will be comfortable discussing aquatic insects' place in the food chain and their importance to stream health
- Students will understand aquatic insect anatomy and lifecycles

Naturalist background:

By isolating different aspects of the environments, students can begin to identify what makes stream environments so unique. Aquatic insects provide a remarkable tool for assessing the "health" of a freshwater ecosystem. Since aquatic insects are

highly sensitive to changes in their environment, including pollution, and severe natural events, they can be used to track recent changes in the ecosystem's health. In addition to being bioindicators, aquatic insects keep streams clean by eating the vegetation that would otherwise clog the streams; some refer to aquatic insects as the custodians of the streams. They also provide a food source to many different fish, amphibians, and water birds within freshwater ecosystems.
While aquatic insects are unique to freshwater ecosystems, they are closely intertwined with other surrounding ecosystems. Using salmon as a common factor, students can also begin to explore how other organisms within the food chain from various environments rely on aquatic insects.

Activities and resources:

- *Aquatic insect collection:* best in a slow-moving or stagnant aquatic environment, supply the students with both water and air bug nets and set up a series of wide, shallow containers with several inches of water in each. Allow the students to collect insects from the water and help transfer them into the tubs for easier viewing. Have the students work together with an identification tool to identify the different aquatic insects present in the tubs.
- *Partner drawings:* after catching several aquatic insects, have the students pair up and sit back to back. One student will have an aquatic insect, and will describe it in as much detail as possible to their partner, using characteristics such as number of abdomen segments, presence of wings, number of legs, etc. The second student will draw the described insect and try to identify it based off of the description.
- *Heron, trout, mosquito:* similar to rock, paper, scissors. Heron eats trout, trout eats mosquito, and mosquito eats, or bites, heron.
- *Create an insect:* using sculpting clay, pipe cleaners, and other craft materials, have students create their very own aquatic insect and come up with a story about it. Why did they choose the pieces that they did to create their creature? Why types of structural functions do their creatures have? How does their insect fit into the food chain?

4th Grade Fall: Ecosystems of Alaska; Fungus, Bacteria, and Invertebrates

Big picture: Ecosystems are made up of interactions of organisms with their living and non-living environment. These ecosystems include food webs, which are made up of producers, consumers, and decomposers.

Essential questions: What makes up an ecosystem, and what types of interactions are represented in an ecosystem? What types of ecosystems do we have in Southeast Alaska?

Learning goals:

- Students will be able to describe energy cycling in an ecosystem
    - Students will be able to give definitions and examples of producers, consumers, and decomposers

    - Students will be able to draw connections between many different organisms on different trophic levels to create a comprehensive food web
    - Students will be able to conceptualize energy flow as a non-linear process
- Students will understand the significance of decomposers: fungus, bacteria, and invertebrates
    - Students will be able to identify and give examples of each of the "FBI" decomposers
    - Students will be able to explain how each of these decomposers fits into a food web
- Students will be able to identify and explain the significance of relationships between organic and inorganic elements in an ecosystem

Naturalist background:
Understanding and appreciating the diversity of life does not come from knowing bits of information or classification categories about many different species. It comes instead from the students' ability to see a big picture and understand how each small part (organism, interaction, or inorganic element) help make up that picture. Students' study of interactions among organisms should start with relationships they can directly observe. Questions should encourage students to consider where organic substances come from, where they go, and to be puzzled when they cannot account for the origin or fate of a particular organic matter.

An ecosystem is a biological community of interacting organisms and their physical environment. Every species is linked, directly or indirectly, with a multitude of others in an ecosystem. Plants provide food, shelter, and nesting sites for other organisms. For their part, many plants depend upon animals for help in reproduction (bees pollinate flowers, for instance) and for certain nutrients (such as minerals in animal waste products). Some species have become so adapted to each other that neither could survive without the other.

There are also other relationships between organisms. Parasites get nourishment from their host organisms, sometimes with bad consequences for the hosts. Scavengers and decomposers feed only on dead animals and plants. Some organisms have mutually beneficial relationships. The interaction of living organisms does not take place on a passive environmental stage. Ecosystems are influenced by non-living factors such as climate, water type and availability and mineral types.

The world contains a wide diversity of physical conditions that create a wide variety of environments: freshwater and oceanic, forest, tundra, mountain, and many others. In all these environments, organisms use vital earth resources, each seeking its share in specific ways that are limited by other organisms. In every part of the habitable environment, different organisms vie for food, space, light, heat, water, air, and shelter. The linked and fluctuating interactions of life forms and environment compose a total ecosystem; understanding any one part of it well requires knowledge of how that part interacts with the others.

Activities and resources :

- *Create a food web (classroom)*: Write the names or tape up photos for several Southeast Alaska organisms, representing producers, consumers, and decomposers. Ask the kids to help you draw lines and arrows to connect the organisms, and have the students explain each connection as they are made. Once all of the biotic relationships have been identified, introduce one or two non-living factors, and ask the kids how these tie into the food webs.
- *Create a food web (field trip)*: Give each student a nametag or piece of tape with a new identity as a specific consumer, producer, decomposer, or non-living element. Have the kids form a circle, and give one student a ball of twine. Ask each student to pass the twine to someone who's identity is connected with theirs within the food web, and ask them to explain the connection. Did anyone get the twine multiple times? Were there any surprising relationships? Ask the students to notice how messy the food web is, and how many relationships go into each ecosystem.
- *Science journal writing prompt*: "When you are eating a blueberry, how are you also eating a salmon?" Have the kids explore the relationship between these two things, focusing on energy transfers and how both things interact with non-living elements.
- *Producer, consumer, and decomposer scavenger hunt*: Have the kids try to find an example or evidence of, each of these major groups. How do their examples relate to each other? Can they find an example of all three decomposers (the FBI)? Do they see more of one group than the others (70% of the ecosystem is made of producers)?
- *Mushroom show*: Give the kids time to go mushroom hunting, and ask each group to bring back the three most interesting mushrooms they can find. Have each group arrange and show off their fungus, and identify characteristics that makes their fungus unique. It is important to stress the importance of not eating anything or touching their food/mouth/etc until they have washed their hands.

4th Grade Winter: Winter Mammal Adaptations

Big picture: Since animals are constantly interacting with their natural surroundings, they need to be able to change or "adapt" to changes in their surroundings. These changes can be behavioral or physical, and are very common for local animals during the winter season.

Essential questions: What are the three different ways that Southeast Alaskan animals survive the winter? What types of behavioral and physical adaptations do mammals experience during the winter?

Learning goals:

- Students will have a command of the three basic strategies for surviving winter used by Southeast Alaskan mammals (hibernating, migrating, or adapting).
  - Students will understand how adaptations help animals survive in their environments.
  - Students will be able to distinguish between behavioral and physical adaptations, and provide examples for each.
- Students will build upon critical thinking skills and creativity to understand how humans imitate mammal adaptation and survival techniques

Naturalist background:
Animals in temperate areas, like Southeast Alaska, experience four very distinct seasons, including a wide variety of living conditions. Since these four seasons offer very different living environments throughout the year, animals must have different survival tragedies for each phase of the year. Animal behaviors during the winter can be loosely classifies into three different categories: hibernating, migrating or dealing with it (adapting).
Animals that hibernate essential put their bodies on energy-saving mode for the winter. After a several seasons of heavy food consumption to increase fat (stored energy), these animals will find a sheltered area and go into a deep sleep, lowering body temperature, heart rate, and other vital functions. This initial energy boost and decrease in activity and energy consumption allows them to run off of reserved energy until their natural environment become less harsh and they have easy access to food again.
Migrating animals are driven primarily by food sources. As the change in season cuts off their preferred food sources, animals will move locations to find a new food source. Animals that migrate often do so in groups, and follow a yearly cycle, migrating to and from the same areas for their entire lives.
Animals that deal with the winter stay in the same habitats and areas year-round, and are also active in the winter. With decreased food sources and temperatures, these animals experience changes in their bodies and habits that allow them to function in the harsher environment. Many animals will develop insulating fat layers and deposits, or grow thicker coats for the winter. Since predator-prey relationships continue through the winter, these animals also experience adaptations that help to camouflage them in their new environments, such as color changes.

Activities and resources:

- *Hibernate, migrate, or deal with it*: this activity will help student get an idea for which animals are more prone to physical adaptations, which ones experience behavioral adaptations, and which ones experience few or no changes. In game show fashion, split the students into teams. Show pictures of different animals in their summer forms, and ask the students to work in their teams to identify the creature and identify whether it hibernates, migrates, or deals with it. Bonus points to the team that can tell specific adaptations for individual animals. After each animal, have the teams talk about where the animal lives, what it eats, and how that might influence its survival tactic.

- *Vole experiment*: Each student will receive a film canister filled with warm liquid gelatin to emulate a live vole, which the student will place in the nest. Adult facilitators acting as "vole" predators will attempt to locate the nests. If the "vole" survives after fifteen minutes or the gelatin remains liquid and the adults cannot locate the nests, the students have succeeded.
- *Rabbits, rabbits, everywhere:* Have four student come forward, and give them either a brown (B) or a white (W) card to illustrate what color snowshoe hare they are. After a group discussion about why snowshoe hares change color in the winter, give each student a W card (since it is winter) and have them pass both cards to new students, or the next generation. There should now be two students with B cards and six students with W cards. Repeat this last step two more times, or until the whole class are snowshoe hares, and then talk about why the W hares survived, while the B hares were outnumbered and did not do well.

4th Grade Spring: Landforms and Watersheds

Big picture: The landscape of Southeast Alaska has been shaped over many years by many processes. Many of these processes involved water in different forms, and have created different isolated water systems, or watersheds.

Essential questions: How was Southeast Alaska's landscape formed? What is a watershed?

Learning goals:

- Students will understand how many of the basic landforms in Southeast Alaska were formed
  - Students will be able to identify different natural forces that shape and influence the earth
  - Students will understand the concepts of erosion, and how organic and inorganic elements such as vegetation and water effect it
  - Students will learn about how to classify sedimentation by method, alluvial and colluvial, and size: silt, clay, sand, gravel, cobble, and boulder
- Students will be comfortable defining a watershed and providing examples
  - Students will be comfortable looking at different land formations and forces within singular watersheds

- *Students will understand that an ecosystem is a community of living things with its physical environment, functioning as a unit*

Naturalist background:

Most of our landform processes are based on a "foundation" of plate techtonics, and the collision of the Pacific plate and the North American plate that initially formed the mountians that dominate Southeast Alaska. Once the basic landforms had been created through plate techtonichs, Southeast Alaska entered many glaciation periods, ending with the most recent, the Wisconsin glaciation. Spanning from approximately 85,000 – 11,000 years ago, the glaciation covered most of Southeast in a thick layer of ice, carving deep valleys and fjords as the ice began to melt and retreat.

We can accredite not only our mountain formations to the glaciations, but our muskegs as well. Due to the incredible pressure of the ice, much of the soft, porus land was compacted, and, now that the pressure is gone, is going through a process called isostatic, or post-glacial, rebound. Areas of Southeast, in particular muskegs, are experiencing rebound up up to 1.5 inches per year.

Despite the end of the glatiation period 11,000 years ago, Southeast Alaska's landscape is continuously changing. Natural forces like rivers, glaciers, landslides, and snowfall are changing our landscape every day. Fast moving water changes glaciated "U" shaped valleys into "V" shaped valleys, and terrestrail land changes can dam or redirect flowing water.

Activities and resources:

- *Watershed table:* using a shallow plastic tub with holes drilled in one end for drainage, fill the opposite end with a bank of different types of sediment. Try to include several different sizes of material for best outcomes. Have the students come up with a hypothesis for what may happen when water is introduced to the system. Set the tub at a very mild incline with the drainage side downhill, and slowly drip water onto the sediment, simulating rain. Ask the students to observe and record the outcome, and repeat this process several more times. Talk about what has happened to the land, looking at different sediment sizes, what path the water took, and how structurally sound the material is. How does this tub relate to processes within a watershed?
- *Settlers of Southeast:* split the class into groups of four or five and give each group a basic drawing of a watershed. Tell them that as a class, they will be moving there with all of their friends and family, and will live in this new home for the next 20 years. Ask them to work together to "develop" the watershed on their paper to fit their needs for the next couple of decades. If they get stuck, lead a quick class brainstorm of things that the students need and use everyday. Once everyone has settled, pick a couple key points from their drawings and discuss how those will impact and shape the earth.
- *Glacial pressure:* using a clear container, fill the container several layers deep with marshmallows, and then place a piece of cardboard or other rigid

barrier on top. Have the students talk about how the marshmallows represent snow, and then begin to add weight on top of the barrier. Continue to do this until the marshmallows are completely flattened, and talk with the class about the process. What happened to the marshmallows? Would things have been different if they were not in a container? What would happen if you took off the weight?

5th Grade Fall: Structure and Function of Living Things; Forrest Succession

Big picture: Different organisms have different structures, which serve very different functions. These unique structures and functions affect how well an organism survives, and how it lives its life.

Essential questions: How do living things use their unique characteristics as an advantage to survive?

Learning goals:

- Students will be comfortable identifying and discussing different structural difference between similar organisms
    - Students will familiarize themselves with how plants use unique characteristics as an advantage to survive
- Students will be able to describe plant succession in a post-glacial environment
    - Students will be able to connect structural characteristics of each phase of succession

Naturalist background:

Animals and plants have a great variety of body plans, with different overall structures and arrangements of internal parts to perform the basic operations of making or finding food, deriving energy or materials from it, synthesizing new materials, and reproducing. Some of these characteristics will give individuals an advantage over others in surviving to maturity and reproducing. Populations can adapt their physical structures, physiology, and behaviors over time but individuals do not generally change during their lifetime. Many of these structural differences are easy to observe in shape, texture, and size of an organism. Structural differences of plants, especially, can be easily observed and discussed.
Building on knowledge from 3rd and 4th grade, students will study the lichen, moss, shrubs and trees that build forests and come to understand the qualities that make each species unique and important to the process. They will study how lichens and mosses begin soil building, how deciduous foliage fixes nitrogen into the soil, and how the evergreens eventually emerge upon this foundation. The naturalist will also introduce the concept of using a forest's shape and size to gauge how old it is.

Activities and resources:

- *Bird beak activity*: Assign each group of students a "beak" (chopsticks, clothespin, or spoon) that they can use to pick up "food." Give each group a bowl of "food" (marbles, paper clips, or rubber bands) and another bowl to serve as their stomach. In twenty-second intervals, have the kids try to pick up as many pieces of food as possible using their new beak. Remind the kids that they can only pick up one piece of food at a time, and they have to lift it out of the bowl (instead of pushing it along the side). Have each person record how many pieces of food they were able to retrieve, and pass the food to the next student. Rotate so that each student is able to try out each food with their beak, and then discuss how different beaks were successful or unsuccessful with different foods. What characteristics of each beak worked well? How does this experiment mimic real life bird beaks?
- *Compare and contrast:* Split students into teams or groups, and assign each team a similar item (different types of leaves, skulls of different animals, etc.). Have the students take a moment to explore their object and write down/discuss observations, focusing on the different structures and what functions they might serve. Have the students exchange objects with other groups and repeat the process. Then lead a discussion comparing and contrasting structural elements of the similar objects. What things did the items have in common? What purpose does this structural component serve?
- *Succession rock-paper-scissors:* assign a movement to each stage of forest succession and, with everyone starting as the first stage, have a giant rock-paper-scissors game. For each round that they win, they get to progress to the next stage of the forest. Rocks may challenge rocks, but not lichen, moss, deciduous, or evergreens. Once a student has won a round at every stage, they end as a proud evergreen tree.
- *Jaw movements:* distribute a small snack (carrots are a good choice) and have the class focus on the movements in their jaw and head as they are chewing. Ask them to identify each movement and sensation and talk about what structural elements might have caused it. Bring skulls from different animals to look at how different mandibles and teeth might affect a creature's diet.

5th Grade Winter: Heat and Energy Transfers

Big picture: Heat is a result of energy that is produced by all living things, transfers from one place to another, and causes changes in things.

Essential questions: How is heat produced? How is heat transferred? What examples of these transfers can be found in nature? How can heat from the sun be used to do useful work?

Learning goals:

- Students will be able to distinguish between heat sources and types of heat transfer, and provide natural examples for each

- Students will be able to describe the three types of heat transfer and give examples of each
    - Students will feel comfortable with the mechanics of convection
        - Students will understand why warm air rises and cool air sinks
- Students will be able to relate the ideas of heat production and transfer to global climate systems

Naturalist background:
Energy is a major exception to the principle that students should understand ideas before being given labels for them. Children benefit from talking about energy before they are able to define it. Ideas about energy that students encounter outside of school—for example, getting "quick energy" from a candy bar or turning off a light so as not to "waste energy"—may be imprecise but are reasonably consistent with ideas about energy that we want students to learn. The one aspect of the energy story in which students of this age can make some headway is heat, which is produced almost everywhere. Students need not come out of this grade span understanding heat or its difference from temperature. In this spirit, there is little to be gained by having youngsters refer to heat as heat energy. For the more easily observed sources of energy, students can start to consider inputs and outputs; what it takes for something to work and what all the effects are.

When two objects come into contact with each other, heat energy moves between them because the particles in one object collide with, or 'bing,' the particles in the other object. Transferred heat resulting from the collision of particles is called *conduction*. Conduction works best through solids, especially through materials such as metals. An example includes observing a raw egg fry as it hits a heated frying pan.

Heat energy transferred by the movement of a liquid or gas is called *convection*. When particles are heated, they move faster, expand, become less dense, and 'bang,' the particles rise. As the liquid or gas cools, the particles move slower, contract, become more dense, and 'bang,' the particles sink. This movement of heating, expanding, rising, cooling, contracting, and sinking is a continuous one. An example is to observe the amount of wind in the early morning compared to the afternoon. Wind is an example of a convection process in motion.

Conduction and convection need a medium to transfer heat energy; however, radiation does not. *Radiation* uses electromagnetic waves such as ultraviolet, visible, infrared, and microwaves, 'boom.' These invisible waves carry energy through empty space, as well as through solids, liquids, and gases. All objects give off electromagnetic radiation, which means warm objects emit more radiation than cool objects. An example is the radiation from a campfire making you feel warm as you roast marshmallows.

Activities and resources:

- *Phase change game*: Have the kids huddle in a group, representing a solid. Prompt them to notice that while they are stationary, they are most likely quite cold. Show them also that there are boundaries to the group, and they are creating a solid shape. Ask the kids to begin walking around, representing liquid, and have them notice their own change in temperature as they increase the amount of energy they are using. Finally, have the kids run around the space, trying to stay as far from each other as possible, representing gas molecules. Talk about the change in temperate that they experienced when they switched from walking to running, and talk about how once the molecules began to move more, there was no shape to the group, and the students moved to fill the available space. Finish by having several minutes where you call out different phases, and the students act out the molecules for each phase.
- *Pony bead experiment*: Using tiny bits of cold butter, secure the three beads to the spoon handle. Have the kids come up with a hypothesis as to which bead will fall off the spoon first, and why they think so. Place the spoon in a glass jar, and fill the jar with enough hot water so that just the bowl of the spoon is submerged. Watch the spoon and time how long it takes for each bead to melt off the spoon. Have the kids compare their hypothesis to the results.
- *Seal gloves*: put a thick but even coating of Crisco or lard between two rubber gloves, allowing you to put your hand inside the inner one without touching the insulation. Allow students to put on a regular rubber glove and submerge their hand in a bucket of ice water, and then do the same with your modified glove. Ask them to talk about their different experiences, and discuss why they experiences different sensations for each glove. How does this experiment relate to the animal kingdom?
- *Sleeping bag experiment*: reminding the students that heat comes from energy, ask them to explain how a sleeping bag works. Weather permitting, take the class outside, and ask for a couple of volunteers. Have one hop right into a sleeping bag with a thermometer. After a minute, check and record the temperature. Have a kid do a mild amount of exercise (jumping jacks work well) and then get in the bag. After a minute, take and record the temperate inside the bag. Repeat this process with a kid who has just run a couple laps around the playground. Compare and discuss the different temperatures, and how they reflect different sources and transfers of heat.

5th Grade Spring: Humans and the Ocean

Big picture: Humans rely on oceans for necessary resources and recreational opportunities. Because of this, human actions often impact the ocean.

Essential questions: How do people interact with the ocean? What can we do to take care of the ocean?

Learning goals:

- *Students will be comfortable with the idea that all oceans on earth are connected to each other and to humans*
- *Students will be able to explain human interactions with the ocean*
  - Students will be able to identify multiple resources that humans extract from the ocean
  - *Students will be able to identify multiple direct impacts that humans have on the ocean*
  - Students will understand that humans can indirectly impact oceans
  - *Students will gain an understanding on how to become a "steward of the ocean" or a "friend of the sea"*

Naturalist background:

The ocean is a very important resource, both economically and culturally, for Southeast Alaska. The plentiful and easily accessible marine resources helped the subsistence based Alaska Native Peoples of Southeast develop in a way that other Native Peoples could not. Since less energy was spent gathering, preparing, and preserving food, more time and energy cold be devoted towards the creation of the unique art forms that are now recognized world-wide. Southeast's culture is still tightly intertwined with the ocean, but in addition to subsistence living, the ocean now fuels one of the major industries, commercial fishing.

Human interaction with the ocean is not limited to harvesting marine life. It has become the site of many recreational activities, a path on which to transport both goods and people, and an everyday part of our lives.

Since humans constantly interact with the ocean, there are direct impacts (bycatch, pollution from cruise ships, oil spills, fish farming, and overharvesting), but there can also be indirect impacts that stem from non-marine activities (pollution further up watershed, waste management, and erosion from terrestrial recreational activates and development projects). These impacts tend to be harmful, but are often overlooked when discussing human interactions with the ocean.

Activities and resources:

- *Salmon web:* lead a discussion about the role that salmon plays within Southeast Alaskan communities, addressing both commercial fishing and subsistence living. Think about all the ways that humans capture salmon and all the ways that humans impact salmon, creating a visual web of interactions as you go. Encourage them to be as creative as possible, for instance, humans like to build on riverbanks, and the sediment from development projects can affect salmon spawning grounds.
- *Fishing for the future:* Have students form groups of four or five, and give each group a bowl of 20 kidney beans and 10 lima beans, a straw (to represent line fishing), a spoon (dip net) and a tea strainer or similar (trawl nets). Each student will be a "fisher" whose livelihood depends on catching fish - lima beans represent halibut, and kidney beans represent salmon. Each fisher will have 20 seconds to catch fish (transfer beans out of the bowl), and

they must catch at least two fish in each round to survive. The fish remaining in the ocean after each fishing season represent the breeding population, and thus one new fish will be added for every fish left in the ocean. After each student has tried out each "fishing technique," lead a discussion about the role that technology has played in fishing in the past several years. What happens to the populations as technology increases? What impacts could this have?

- *Marine debris timeline:* draw a timeline on the board ranging from several days to 100 plus years. Give each student a flashcard with a piece of marine debris and ask them to place it on the time showing how long they think it will take to decompose. Have the students explain their choices, and have group discussions for any major discrepancies. If you have time, ask students to identify how their piece of debris may impact the ocean's wildlife.

Group Management Suggestions

Classroom:

- For classes that have worked with DSE before, it is nice to a quick review of previous lessons. This is especially helpful for a new naturalist, as it allows you to figure out what the kids learned with a previous naturalist.
- Classroom management can be more difficult than content
    - Ask the teacher for the class-specific attention signal, whether it is a verbal call and response, and visual sign, or a clap
    - Make sure that all of the attention is on you and your assistant naturalist. If you rely on the teacher to manage classroom behavior, the students' attention will be spread across the room, instead of just on you
    - Plan a lesson with several smaller portions. The transitions will keep attention on you as you move through the content

Fieldtrip:

- Know the area, and have a plan. If you can, walk through the fieldtrip beforehand with your assistant so that you are comfortable in your surroundings and there are no surprises.
    - Identify any distractions (bodies of water, dead animals, etc), and either find alternate routes to avoid these, or incorporate them into your lesson.
- State your expectations before you leave the classroom, and again once you are outside. It may be difficult for the students to fully pay attention during transition times, and it is important that they know what is expected of them.
- Bring a watch or some other easy timepiece with you. Teachers are on a very tight schedule, and it is important to get the students back to the classrooms on time.

Additional resources

Written resources:

- The Nature of Southeast Alaska by Richard Carstensen
- A History of Juneau Trails: A Watershed Approach by Richard Carstensen
- JSD Art Kits - http://www.juneauschools.org/district/instructional-services/elementary-art/art-kits

DSE resources:

- Discovery Southeast Staff
- JuneauNature.org
- Jordan Creek Curriculum

Other JSD science providers:

Many classes take field trips to or are visited by representatives from the U.S. Forest Service, DIPAC, and Alaska Department of Fish and Game during the year. The following people are great resources for coordinating programming, building knowledge, and bouncing around new ideas.

- US Forest Service (Karen Maher)
- DIPAC (Rich Mattson)
- Alaska Department of Fish and Game (Kristen Romanoff)
- NOAA (Bonita Nelson)
- SAGA (Nate Heck)
- Audubon
- Territorial Sportsmen
- US Fish and Wildlife

Mendenhall Glacier

Lesson Plan for grades 1-3, Natural Science

Prepared by Sam Walker, Discovery Southeast

OVERVIEW & PURPOSE

This lesson will introduce students to mapping techniques, and will encourage them to see the interactions between rock, ice, and water at the Mendenhall Glacier. Students should develop a better understanding of how different elements interact in a given space.

OBJECTIVES

1. Differentiate between rock, ice, plants, and water.
2. Notice how those four elements interact at the Mendenhall Glacier,
3. Obtain an understanding of how to map a familiar area using basic tools.

MATERIALS NEEDED

1. Clipboard
2. Colored pencils (4 separate shades)
3. Field access to Mendenhall Glacier
4. Topographic Map of Mendenhall Glacier

VERIFICATION

Steps to check for student understanding

1. Review student maps of schoolyard
2. Review student maps of Mendenhall Glacier
3. Discuss location of landmarks on student maps

ACTIVITY

Classroom introduction activity (1 hour)

Take students out into the schoolyard with colored pencils, paper, and clipboards. Ask them to "map" the schoolyard. They should include major landmarks such as: the school building, fences, grassy areas, play equipment, game courts, trails/sidewalks, etc. Distances between objects don't have to be measured to a key, but should be roughly correct. Ask them to color in the objects based on the material they think they correspond to. You could use four distinct materials as a guide: green for plants/grass, grey for cement/gravel/stone, purple for plastic, and black for metal. For example, the school building and paths should be grey, the play equipment black or purple, and the woods/fields green. Once they have finished their map, take them back into the classroom and ask them to share their maps with the class. You can ask them about choices concerning distance (ie, is the basketball court really that close to the school?) and materials. After they have discussed their schoolyard maps, hand out a topographic map of the Mendenhall Glacier and tell them they are going to create maps of the glacier themselves. Point out key features on the map and ask them to help you identify them (visitor's center, Mendenhall Lake, Mendenhall River, Mendenhall Glacier, etc.).

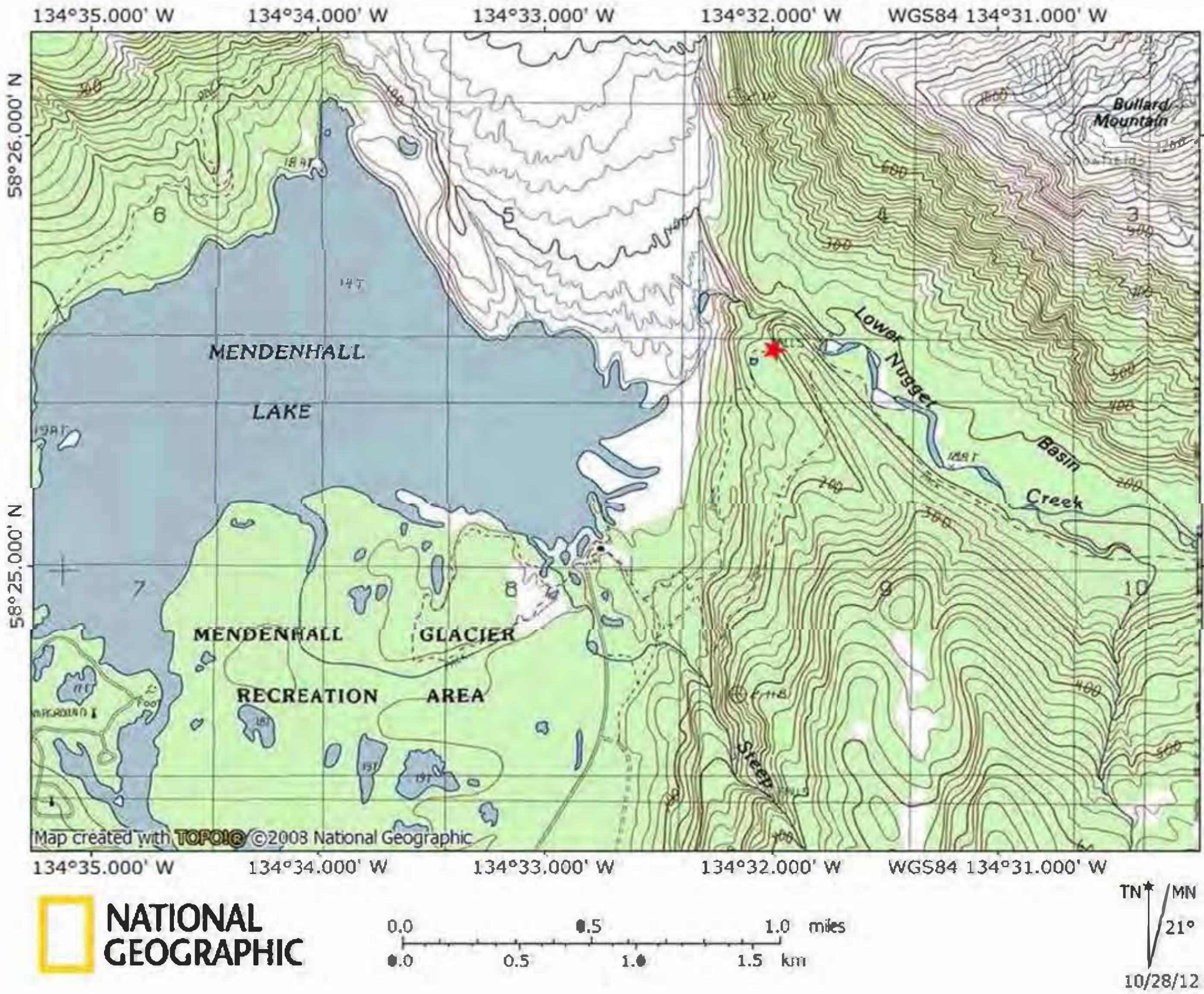
Field trip (1.5-2 hours)

After arriving at the Visitor's Center, hike to Nugget Falls (about 20 mins walk). From Nugget Falls peninsula, point out the key features you identified in class. Pass out mapping materials, with colored pencils this time representing rock, ice, plants, and water (grey for rock, green for plants, blue for water, and purple for ice). Ask them to create a map of the area using the same methods employed during the schoolyard mapping project. Their maps should include the Mendenhall Glacier, Mendenhall Lake, the bare rock surrounding the glacier, and the wooded areas around Mendenhall Lake. Make sure they identify where they are (Nugget Falls) on the map.

Classroom follow-up activity (30-45 mins)

Review students' Mendenhall Glacier Maps as an entire class. Have them explain to you where they found water, ice, rocks, and plants. Ask them why certain areas exist where they do on the map. Encourage them to understand the processes underlying the formation of the area. Help them to understand that the bare rock shows where the glacier retreated, that the lake is formed from glacial run-off and was exposed as the glacier retreated, and that after many years plants start to grow in the wake of where the glacier had been.

Supplementary Material (Mendenhall Topo):



Mendenhall Glacier

Lesson Plan for grades 4-6, Natural Science
Prepared by Maia Wolf, Discovery Southeast

OVERVIEW & PURPOSE

This lesson will help students begin to understand long-term glacial processes, and to be able to identify and explain different glacial elements. Students can then begin to understand how these processes and features work together overtime to make glaciers a unique geographic feature.

OBJECTIVES

1. Obtain a basic understanding of long-term glacial processes, including creation, advancing, and recession.
2. Define key glacial terms.
3. Identify key glacial terms on both a drawing of a glacier, as well as on the Mendenhall Glacier.

MATERIALS NEEDED

1. Mendenhall Time Lapse Photos (photos 1 and 2a, 2b, & 2c)
2. Glacial Landscape worksheet (worksheets 1a and 1b)
3. Glacier Field Sketching worksheet (worksheet 2)
4. Clipboards
5. Pencils
6. Online Glacier Jeopardy Game (jeopardy.rocks/juneauglaciers)
7. Field access to Mendenhall Glacier

VERIFICATION

Steps to check for student understanding

1. Review their Glacier Field Sketching worksheet (2)
2. Evaluate their performance during Online Glacier Jeopardy
3. Evaluate participation in group discussions

ACTIVITY

Classroom introduction activity (1 hour)

(Optional: compile a list of what students already know about glaciers as a jumping-off point.) Project Time Lapse photo 1, and ask the students to tell you how a glacier is created and how it moves, based off the image. Help guide the discussion to address three key points: 1) the glacier is created in the icefield, which is located at a high elevation where snow falls more frequently. Since snow is heavy, the weight of the different layers of snow causes it to compress and turn into ice. This ice is what creates the glacier. 2) since snow is constantly falling, and ice is constantly being created, glaciers are always growing and moving. Just like a river that follows the land, glaciers are always flowing downhill, following the path of least resistance. As long as we get enough snow, the glacier continues to advance. 3) if there is not enough snow falling at the source, and if the face of the glacier is too warm, the glacier will calve, or fall apart faster than it can grow, and it will appear to be shrinking up the valley, or receding.

Project the Glacial Landscape worksheet (1a) on the whiteboard/smartboard, and ask students to work in pairs to find 3-5 features that they are curious about on the image (you can also give print-outs to each student pair). Ask student pairs to come up one by one and circle the features that they are curious about. As a group make observations and try to come up with a definition of the feature, as well as why it might exist. *(Example: I am curious about the lines in the rock near the face of the glacier. I notice they they don't exist above the glacier, and that they are the same direction as the glacier. Maybe they were made by the glacier moving past the rock. With help from my teacher, I know these are called "striations.")* Have the students put these key terms in their science notebooks.

Once all of the identified features have been explained, project the Mendenhall Time Lapse photos, starting with 1. Have the students work together to find the features on the images. Use both 1 and 2a, 2b, & 2c photos to show how the glacier has changed with time.

Field trip (1.5-2 hours)

After arriving at the Visitor's Center, hike to Nugget Falls (about 20 mins walk). From Nugget Falls peninsula, quickly review long-term glacial processes, help students find the Juneau Icefield, and then give students 20 minutes to find and sketch different glacial key terms using Glacier Field Sketching worksheet (2). Encourage students to move around the peninsula in order to see different features up close, and establish yourself and other adults as resources if they students have questions. At the end of 20 minutes, ask students to circle up, and see which features were popular, and which features were not identified (some features are hard to see from this location, and will be easier to see from the second stop). Answer any questions with a group discussion, and then prepare to walk back towards the visitor center. During the walk, ask the students to search for signs that the glacier once covered that area. If a student finds a sign, ask them to shout out or raise their hand, so that the class can all take a look. Some of these signs are be lack of vegetation, granite, large boulders far distances away from the valley walls, kettle ponds, and striations on the rocks. Stopping to talk about these signs as they are identified, hike to Photo Point, and take 5-10 minutes to finish field sketching. Review the key terms once more as a group before heading back to the bus.

Classroom follow-up activity (30-45 mins)

Project the Glacial Landscape worksheet (1b) for a quick review of the field trip. Break the class into four teams, and have them sit with their team. Review long-term glacial processes and key glacial terms using the Online Glacier Jeopardy Game.

Mendenhall Glacier

Lesson Plan for Grades 7-9, Natural Science

Prepared by Sam Walker, Discovery Southeast

OVERVIEW & PURPOSE

This lesson will introduce glacial terms and help students identify long-term glacial processes. It will focus on the history of glaciation in Southeast, and on the history of the Mendenhall Glacier in particular. It will emphasize nature journalling as as a tool with which we can better understand the Mendenhall Glacier.

OBJECTIVES

1. Students will be able to define key glacial terms.
2. Students will become familiar with the journals of John Muir, and will produce short journal entries of their own.
3. Students will learn how to identify glacial features in the field.

MATERIALS NEEDED

1. Glacier Vocab Sheet (worksheet 1)
2. Image of the Mendenhall Glacier
3. Excerpt from John Muir's *Travels in Alaska* (handout 1)
4. Clipboards
5. Pencils
6. Paper
7. Field access to the Mendenhall Glacier

VERIFICATION

Steps to check for student understanding

1. Evaluate Glacial Landscape Worksheet and Vocabulary
2. Discuss John Muir handout and evaluate participation
3. Evaluate students' journal entries.

ACTIVITY

Classroom introduction activity (1 hour)

Begin by projecting the numbered photograph of the Mendenhall Glacier directly on the whiteboard. Begin reading out key glacial terms and their definitions. After reading a term and its definition, ask the students to think about and mark where that glacial feature might appear on the image. For instance, after telling them the definition of a glacial horn, guide them to look for an isolated peak in the picture and have them write the term next to the peak. Certain terms, like Kettle Ponds, might not be visible on the image, but students can describe where those features might be present in relation to the picture. Students should record key glacial terms and definitions in their science journals. After the students have identified the ten key glacial terms, ask them to think about the glacier in broader terms. How is the glacier formed? (It is created in the icefield where, at a high elevation, snow collects, compresses, and turns into ice). How does it move? (With ice constantly being created, the glaciers move and grow like rivers, running downhill). How and why does it recede? (if there is not enough snow falling at the source, and if the face of the glacier is too warm, the glacier will calve, or fall apart faster than it can grow, and it will appear to be shrinking up the valley, or receding).

After discussing glaciers in general terms, hand out copies of the passage from John Muir's *Travels in Alaska*. Introduce Muir as a 19th century naturalist who, dedicated to the preservation of natural ecosystems, made two scientific trips to Southeast Alaska in 1879 and 1880. In the selected excerpt, Muir explains the nature of glaciers to a group aboard the ship Cassiar as they sail through the Wrangell narrows. Discuss with students how Muir describes the glaciers: what language does he choose to use? Can they identify any of the glacial terms in the descriptive passage? After, explain to the students that they will write a descriptive journal entry of their own after a field trip to the Mendenhall Glacier.

Field Trip (1.5-2 hours)

After arriving at the Visitor's Center, hike to Nugget Falls (about 20 mins walk). From Nugget Falls peninsula, quickly review long-term glacial processes and have the students point out the 10 key features they learned in class. Then, on a piece of paper, have them begin to compile field-notes on what they see in order to compose a descriptive journal entry. Which features are present in front of them, which are obscured or absent, and what do they see that confuses or surprises them? Draw their attention to the recession area they hiked through to arrive at Nugget Falls. What kind of trees and plants do they notice (largely alder)? How long do they think it took the glacier to recede from the Visitor's Center to its current location (roughly 60 years)? If it helps students to sketch the area, have them create visuals of the glacial features they studied in class.

Classroom follow up (45 minutes)

Have the students create journal entries detailing their experiences at the glacier. Make sure that they include at least 5 of the glacial terms introduced earlier. After they have written their entries (roughly one page), have them share their writing and discuss.

Supplementary Materials:

Glacier Vocab:

1. Ablation area:

The area of the glacier that is wasting away.

2. Accumulation area:

The area of the glacier that is accumulating snow.

3. Arete Ridge:

A sharp, steep, jagged, and narrow ridge of rock separating two glacier valleys or cirques

4. Bedrock:

The solid rock underneath the glacier

5. Crevasses:

Cracks that develop in the glacier's surface in the zone of brittle flow.

6. Horn:

A steep, isolated peak formed from glaciers wearing away a mountain summit from three or more sides

7. Kettle Ponds:

A small pond or lake formed by the melting of a mass of buried ice.

8. Lateral Moraine:

Moraine of rock debris formed at the side of a glacier

9. Terminus:

The lower end of the glacier.

10. U-Shaped Valley:

A valley with a U shape cross section, steep walls, and a broad flat floor.

Image of Mendenhall Glacier:

John Muir, excerpt from *Travels in Alaska* (1879)

John Muir, excerpt from *Travels in Alaska* (1879)

"Is that a glacier," they asked, "down in that cañon? And is it all solid ice?"

"Yes."

"How deep is it?"

"Perhaps five hundred or a thousand feet."

"You say it flows. How can hard ice flow?"

"It flows like water, though invisibly slow."

"And where does it come from?"

"From snow that is heaped up every winter on the mountains."

"And how, then, is the snow changed into ice?"

"It is welded by the pressure of its own weight."

"Are these white masses we see in the hollows glaciers also?"

"Yes."

"Are those bluish draggled masses hanging down from beneath the snow-fields what you call the snouts of the glaciers?"

"Yes."

"What made the hollows they are in?"

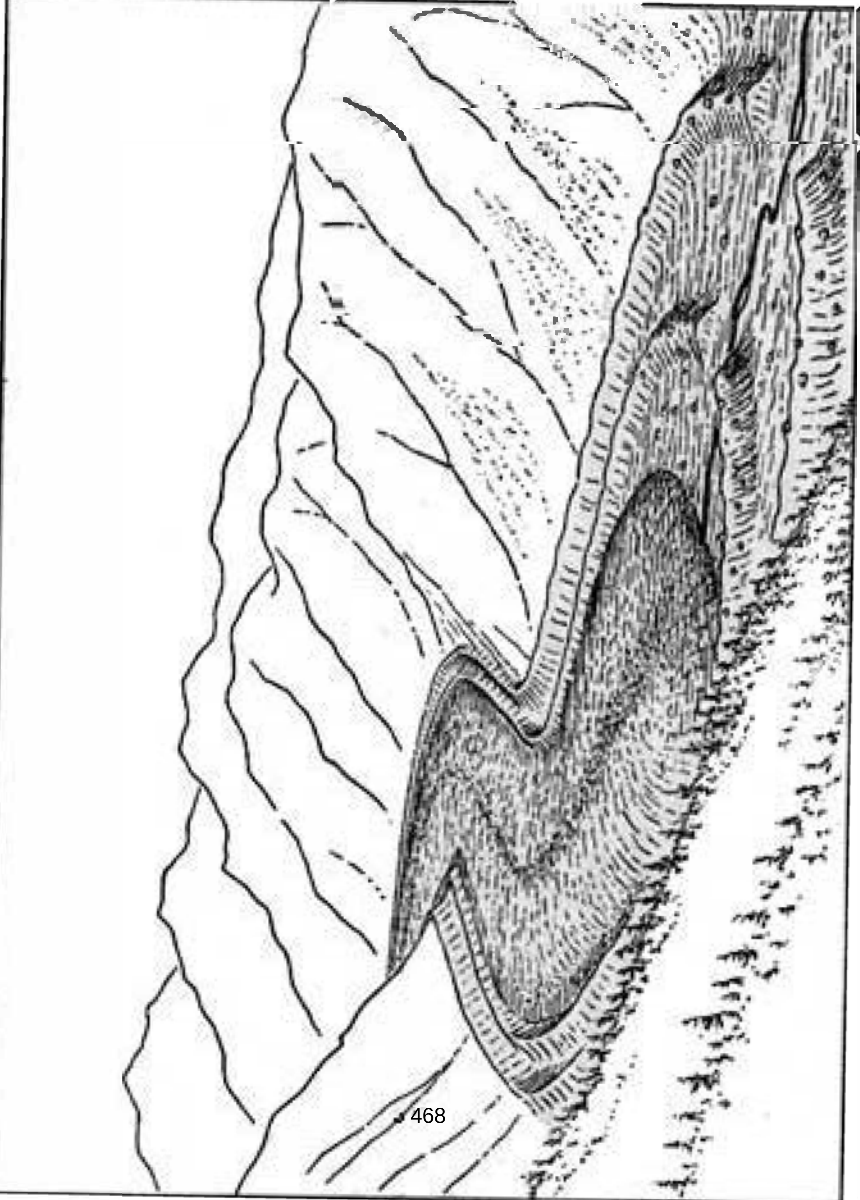
"The glaciers themselves, just as traveling animals make their own tracks."

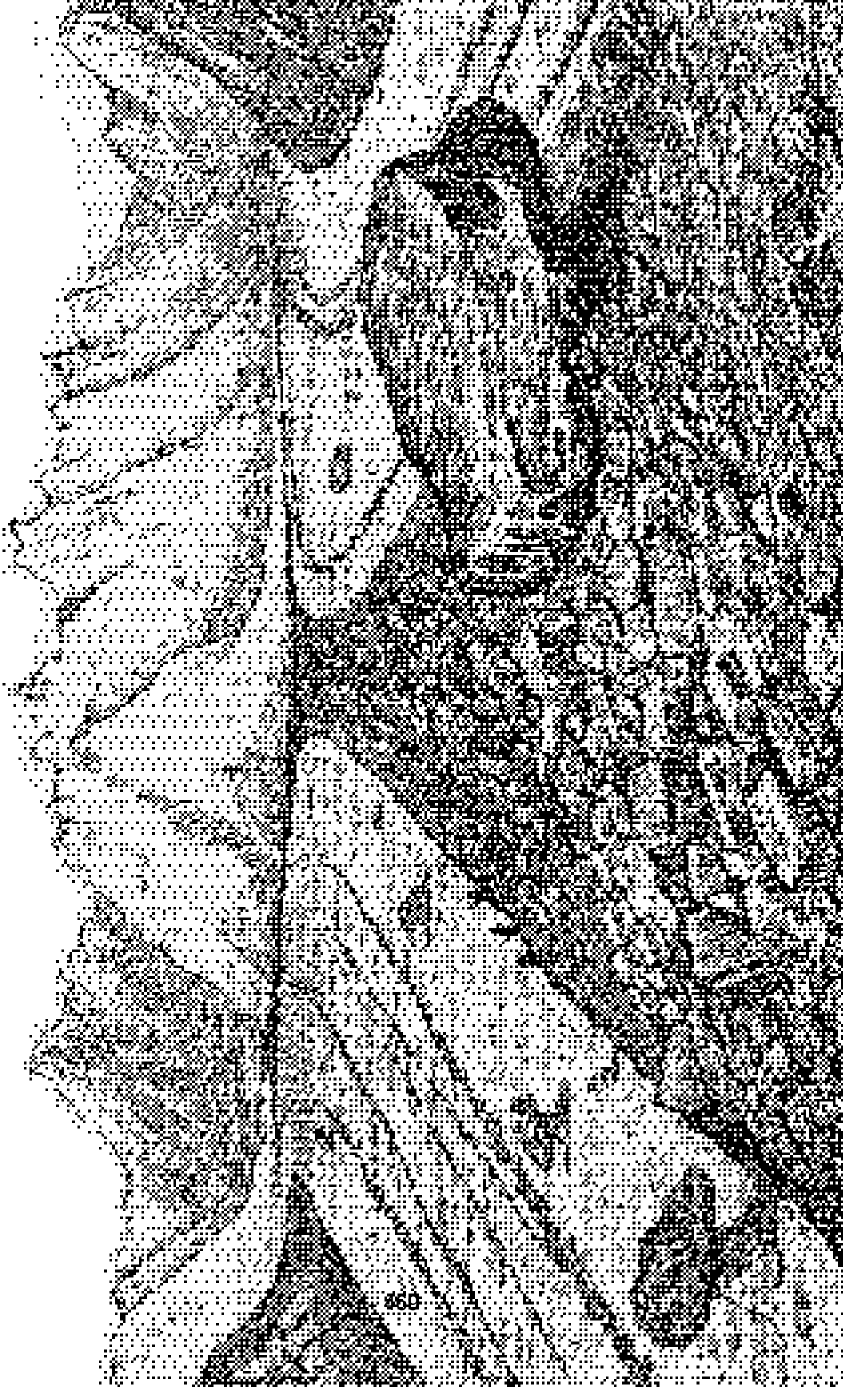
"How long have they been there?"

"Numberless centuries," etc. I answered as best I could, keeping up a running commentary on the subject in general, while busily engaged in sketching and noting my own observations, preaching glacial gospel in a rambling way, while the Cassiar, slowly wheezing and creeping along the shore, shifted our position so that the icy cañons were opened to view and closed again in regular succession, like the leaves of a book.

About the middle of the afternoon we were directly opposite a noble group of glaciers some ten in number, flowing from a chain of crater-like snow fountains, guarded around their summits and well down their sides by jagged peaks and cols and curving mural ridges. From each of the larger clusters of fountains, a wide, sheer-walled cañon opens down to the sea. Three of the trunk glaciers descend to within a few feet of the sea-level. The largest of the three, probably about fifteen miles long, terminates in a magnificent valley like Yosemite, in an imposing wall of ice about two miles long, and from three to five hundred feet high, forming a barrier across the valley from wall to wall. It was to this glacier that the ships of the Alaska Ice Company resorted for the ice they carried to San Francisco and the Sandwich Islands, and, I believe, also to China and Japan. To load, they had only to sail up the fiord within a short distance of the front and drop anchor in the terminal moraine.

Another glacier, a few miles to the south of this one, receives two large tributaries about equal in size, and then flows down a forested valley to within a hundred feet or so of sea-level. The third of this low-descending group is four or five miles farther south, and, though less imposing than either of the two sketched above, is still a truly noble object, even as imperfectly seen from the channel, and would of itself be well worth a visit to Alaska to any lowlander so unfortunate as never to have seen a glacier.






1993 Photo: J. D. Beedle
2010 Photo: J. D. Beedle

Field Sketching at the Mendenhall

Directions: During the course of the hike you'll see a variety of glacial features. You will also see the effects of glacial succession. Below you'll find a few key terms that you learned in class. Next to those terms you'll find a box. When you spot a particular feature in the field, please sketch that feature in the box. Be as detailed as possible. Try to include notes about where you found the feature, and note any peculiarities or questions you might have.

1. Striations

2. Bedrock

3. Crevasses

4. Arete Ridge

5. Medial Moraine

6. Kettle Ponds

7. Lateral Moraine

8. Face

9. Ice field

Nature studies curriculum K-5 (2016)

Introduction to Nature Studies/Food Chain

Lesson Plan for 3rd grade fall

OVERVIEW & PURPOSE

The first session of nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea of a food chain and the terms producer, consumer, and decomposer.

EDUCATION STANDARDS/OBJECTIVES

1. Students will become familiar with a linear structure of energy flow (while energy flow is a non-linear concept, the idea of an energy cycle is not introduced until fourth grade)
    - Students will be comfortable with the idea that all organisms need energy to survive
    - Students will recognize that energy from the sun is the basis of all energy in the food chain
    - Students will be comfortable with the concept that "plants make their own food" using energy from the sun
    - Students will recognize that energy is transferred from organism to organism, not lost

2. Students will be prepared for their nature studies experiences and will know how to dress, what to bring and what to expect.

    - Students will be equipped with the tools to be aware and thoughtful of themselves, their classmates, and the surrounding nature on outdoor trips

MATERIALS

1. Photo food chain sets of 4-5 different species. Food Chain Photos
2. Predator Prey Game: energy tokens, 2 or 3 headbands.
3. Wrap activity- s

ACTIVITY

Introduction Session

PART 1: Observations and questions

1. Introduction: Since this class is this group's first Nature Studies experience, a good way to begin a new journey is to have yourself and your assistant naturalist introduce Discovery Southeast as well as yourselves. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves.

2. Observations: As a class discuss how we make observations using our senses. Explain, "when I say go, get up and explore the room with 'scientist senses'. Find something you may not have noticed before and make a specific observation." Model getting up silently and exploring the room touching, smelling, listening, and looking closely. "For example I noticed this book case looks like it is made from one sheet of wood, but if I look closely I can see that it is actually particle board with a kind of wood printed sticker on the outside." You have 2 minutes, GO!

3. Asking Questions: "The way scientists learn about things is by asking questions. Curiosity about the world is what fuels learning. When I say go head back to the same thing you found and made an observation about. This time think of an I wonder... question about what you found. After you have done that find a partner and share your observation and question." Model what you expect them to do and 'think aloud' your thoughts and question that you come up with.

PART 2: Food Chain

1. Everything on my pizza came from the sun. Have students draw a pizza in their science notebook and add toppings.

"I am going to make a claim that everything on a pizza comes from the sun. Do you agree with my claim? If you disagree, share which topping you believe does not come from the sun."

As they provide ideas prove them wrong by tracing it back to the sun. For example, "the sauce comes from tomato, and a tomato can only grow with energy from the sun". Draw a food chain as you are describing it.

Pizza sauce
↑
Tomato
↑
SUN

Introduce the idea of decomposers. Watch this video about the FBI (decomposers) https://www.youtube.com/watch?v=cBzXhOO-MEc

2. Introduce vocabulary: producer, consumer, decomposer.
3. Hold up photos from the Food Chain Photos set. Have students determine which is which. Hold up each photo of one set, "Raise your hand if you think this is a decomposer..."
4. Invite 4 volunteers to help you model the next activity. The 4 students line up side by side at the front of the room and have to get in order of who eats who. Ask the class if they agree, if they would or could change the order in any way.
5. Hand out photos to each table group and tell them to get into order. When they are finished they should sit down so that you know when they are done.
6. Have each group present to the class, "I am an eagle and I eat salmon, I am a salmon and I eat..."

PART 3: How to Prepare for the Trip

1. Ask for a volunteer to help you with modeling.
2. Ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"
3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

*students may ask about bringing water, snacks, journals, camera, backpacks etc. I encourage students to travel with as little as possible, a science journal and pencil only if there is an activity in the field which requires it.

Field Trip Session

1. **Wide-eyed vision:** The placement of an animal's eyes on its head is very important to the survival of the animal. Predators, including humans, have their eyes placed in the front, so that they can focus better on their prey during a hunt, while animals lower on the food chain have eyes on the side of their head, allowing them to keep track of their surroundings, especially any nearby predators. Have the kids think about what SE Alaska animals may need wide eye vision for various reasons, and then ask the kids to keep their wide-eye vision on for the rest of the field trip. Routinely ask to see what types of things the kids noticed, that they may not have usually seen.

What did you see that you may not have noticed before?

2. **Fox walk:** have the kids walk through the playground using their wide-eyed vision and a ball-toe-heel walk (bear), as if they were sneaking up on their prey. Switch to walking on the balls of their feet (fox), and then just their toes (cougar). How do these different walking styles mimic different animals in the wild, and why do they walk differently?

** Along the way point out decomposers and producers. "How does this organism interact with other members of the ecosystem?"

3. Become a scientist/naturalist. What senses can we use today?

- SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.
- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

**1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the groups' attention to hear from individuals with hands raised.*

4. **Toll bridge walk:** have one naturalist go up the trail, and the other one will make a "toll bridge," making sure that the students begin to walk up the trail in several second intervals, and that they have personal space. Ask the kids to use their wide-eyed vision and fox walk. At the end of the bridge they need to 'pay the toll' by telling you what they observed (make sure to use all senses, not just what they saw).

   Do a second toll bridge walk. This time the toll is an I wonder question. Help them think about how they can discover their own answers to their questions.

5. **Decomposer hunt.**

a. I point out a mushroom explain how they decompose.
b. Act it out.
- Extend your hyphae (arms) through the leaf litter.
- Thread them together to create mycellium. As you are doing this you are breaking down leaves and sticks, crushing them with you hyphae and turning them into small particles.
- Pop your head up, this is the fruit body of the fungus. Your job is to drop spores so that new fungus can grow
- Drop your spores

c. Find one! Mushroom hunt. Set boundaries and assign adults to monitor certain areas.

6. ***Game:* Predator prey**

**Materials for this game are in the Discovery Southeast office*

Whoever is giving out the tokens is the 'sun'.

Plants/Producers

- Should be about ⅔ of the class.
- They are given 10 energy tokens (can be poker chips, foam squares, rubber bands) and need to hide with their tokens, in the arena.
- They get their energy from the sun and grow with water, air, and nutrients from the soil.
- Producers must have at least 3 energy tokens at the end of the game in order to survive.
- If a plant runs out of energy it dies. If that happens, plants come to a central location and wait for a decomposer to bring them back to life. When they get new energy tokens from the decomposer they find a new hiding spot.

Animals/Consumers

- Should be the remaining students minus 2 who will be decomposers.
- They get their energy by eating plants. When they find a producer they will be given an energy token from the producer.
- If they are tagged by a decomposer they die and have to give all of their energy tokens to the decomposer. They start collecting energy tokens again by finding the producers.
- Consumers must have at least 5 energy tokens at the end of the game in order to survive.

<u>Decomposers</u>

- Should be 2 or 3 decomposers, it helps if you have a headband or something to distinguish them.
- They get their energy from dead and decaying animal and plant material. They turn it back into nutrient rich soil to allow for new growth.
- When they tag an animal it is dead, and they are given that animals energy tokens.
- After they have collected energy tokens from a dead animal they immediately find a plant in the central area to bring them back to life. Give all collected energy tokens to the producer.
- Decomposers need to help at least 4 plants by the end of the game in order to survive.

*this game can be complicated for 3rd graders. It may help to start with just producers and consumers and then add in the decomposers in a second round.

DEBRIEF: It is very important to include this piece. This helps the students create meaning from their experience.

Split the group in 2 and have one group work with the assitant naturalist to debrief the game. Sit in a circle and take thoughts from volunteers.
Questions to elicit discussion:

- What do you think was the most important role in the game? Why?
- Are there any other parts of the environment that helped you survive in the game (rocks to hide behind, sound of the river to hide your sound)?
- What would happen if we took away all of the producers? Consumers? Decomposers? How would that effect the ecosystem?

Wrap

1. Read the book Dory Story by Jerry Pallotta.

There is a copy at the Douglas Public Library. Before reading explain that the book is about a food chain in the ocean. The students will help you build the food chain by making a signal with their fingers (hooking pointer fingers together) when they think they have heard of another link in the food chain. For example, if they heard that a salmon was eating herring, they make the link signal with their fingers. This will prompt you to add salmon and herring to the food chain that you are illustrating on the board.

Dory story

by Jerry Pallotta ; illustrated by David Biedrzycki.

Personal Author:
Pallotta, Jerry.

Publication Information:
Watertown, Mass. : Talewinds, c2000.

Physical Description:
1 v. (unpaged) : col. ill. ; 24 x 29 cm.

ISBN:
9780881060751

Abstract:
While taking a bath with his new red toy dory, a boy imagines himself alone on the ocean getting a first-hand look at the ocean's food chain.

2. Create a food chain.

- Have students fold a piece of paper in fourths, or draw lines to divide it into 4 equal parts.
- Label the bottom section the sun, they can draw if they choose.
- Label the second section Producer. Select one producer that we saw on the field trip that you believe is food for an animal. Draw it and name it in the producer section.
- Label the third section Consumer. Select one consumer that you think eats the producer that you chose.
- Label the third section Decomposer. Select a decomposer that we saw on the trip and draw and name it in the last section.
- If there is time, have the students share their food chains with each other.

Tracking with Measurement

Lesson Plan for 3rd Grade Winter

OVERVIEW & PURPOSE

The winter session of nature studies has students finding evidence of animals. Using non-conventional forms of measurement they identify who the tracks belong to.

EDUCATION STANDARDS/OBJECTIVES

1. Students will hone basic tracking skills in search of evidence of predators and prey in the field.
    - Students will feel comfortable identifying an animal track using details of the track and a tracking booklet
    - Students will feel comfortable telling the story of the track(s) that they find based on the track(s) surroundings

3.MD.3. Select an appropriate unit of English, metric, or non-standard measurement to estimate the length, time, weight, or temperature (L)

3.MD.5. Measure and record lengths using rulers marked with halves and fourths of an inch. Make a line plot with the data, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.

Introduction Session

MATERIALS

Science Notebooks
Cut out animal tracks (supplies in Crime Scene set in the DSE office)

ACTIVITY

Before class starts, arrange four sets of animal tracks around the room.

PART 1: Things Animals Leave Behind

Show the Things Animals Leave Behind slideshow which explains what kind of animal evidence we may find when we are out exploring.

"Do you think we will see any animals out there? If we don't see any animals what may we find?"

Write a list on the board of their ideas

- tracks
- scat
- what they have been eating
- where they may live

PART 2: About an Inch

1. Introduce the ruler- explore the differences between inches and cm's. Explain that because the measurements in our tracking book are in inches, we will be using inches.
2. Have the students practice measuring a few things at their desk (name tag, notebook, etc). As they are measuring go around the room and make sure they are using inches and are measuring from the 0.

"*We are going out in the field to collect measurements of animal tracks. It will be better if we don't have to bring any additional tools beside our body and brain. Can anyone think of what we can use to measure in the field?"*

3. When the students have arrived at the idea of using a part of their body as a measurement tool, explain that all of the measurements in the tracking book that we are going to use are in inches.

4. *"What part of your body is about an inch?"* Give the students a few minutes to use the ruler and find 1 or 2 body parts that are about an inch. *"Notice that I am saying* about *an inch. What does that word* about *mean?"* *"When we estimate it gives us a close enough measurement"*.

5. Collect ideas on the board of inch long body parts. Cross out those that will be difficult to use in the field (eye, nose, ear).

6. Give them another couple of minutes to determine a part of their hand that they are going to use for their inch measurement.

*I have found the most successful is the width of two kid fingers.

7. Measure one thing on your desk using your new measurement tool. Check to see if you are correct with your ruler. Make any changes necessary.

PART 3: Measurement without a ruler

1. *"Now it's time to practice and measure the things we will be looking for out in the field! There are four sets of animal tracks in this room somewhere. I would like you to find them and measure the width of the track and record it on the board."*

Go over width vs length, and point out that the marker line is the beginning of the track, not the edge of the felt. Also note that each track has a front and a hind track which may have different widths, and they should measure them both.

2. Give the students about 10 minutes. Draw the tracks on the board with a space below each where they students can record the measurements.

3. When they are finished give the accurate measurements and what animal they belong to.

PART 4: Preparing for the trip

1. Ask for a volunteer to help you with modeling.
2. Tell the students what the weather report is calling for and then ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"
3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

Field Trip Session

MATERIALS

Tracking books

ACTIVITY

PART 1: Warm up the senses

Become a scientist/naturalist. What senses can we use today?

- SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.
- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

PART 2: Exploration- Looking for Tracks

1. Travel to an area where you know there may be tracks. Explain where to look for tracks. *"If you were a deer/snowshoe hare/wolf where would you travel? Why?"*
2. Find a track, draw a circle around it. Measure it with your 'hand inch ruler' and ask a few students to look in the back of the tracking book for a track that is ____ inches. While they are looking it up talk about the shape, how it may have changed since the animal was there. Where it was coming from and where it may be going, how heavy the animal was determined by how deep the track is.
3. Have the students partner up and looking for evidence. *"Remember that we are looking for tracks today but there are other forms of evidence we can find. What else may we find?"*
4. Set boundaries, give a time limit and remind the students not to step on any tracks they find.
5. Meet back and have partner teams share what they found.

PART 3: Create your own tracks

*This and the next activity work better with smaller groups. If possible split the group in 2 and have them complete one activity and then switch to complete the other.

1. Each student will create a set of tracks in the mud. Do an example. Start by drawing a line *"this will be the start"* measure the correct number of inches with your hand measurement, and draw a second line *"and this will be the end."* Look closely at the shape of the track, practice drawing the shape in another spot. When you are ready draw the track using the start and end lines to determine the width of the track.
2. Assign each person a spot in the mud, sand, or snow.
3. Give them about 10 minutes to complete their track. Keep them on task by saying "*you should be finished with your start and end lines by now! You should be working on your final print now."*
4. Partner them up. One student leads their partner to their track, then they switch. They will use the tracking books to figure out which track their partner has created.

PART 4: Animal Homes

1. *"Imagine that you are an animal that lives in this area. Where would you decide to build your home? Which animal are you going to be? How will you determine what will make the best home? When you have found it, hide [insert item here…a rock?] in the home."*
2. Partner students up before you ask them to hide their 'animal'. Have one partner look for a home in one area and the other partner to look in the opposite direction.
3. After 5 minutes have the students return to the central area and have each partner search for the home. Students may use hot and cold to help their partner find the home.

Wrap

MATERIALS

Crime Scene materials
Crime Scene Handout
Tracking books

ACTIVITY: Crime Scene

1. Hand out the Crime Scene sheet and have students determine which tracks belong to whom. They may use the tracking books to help.
2. While they are working set up the crime scene.
3. When the first student is finished explain the crime scene, *"A crime(s) has been committed. We need your help to work as detectives and figure out what happened. Your job is to determine what the crime was, who was the victim, the accused, and any bystanders. When you are finished with your handout, come up to the scene and see if you can figure it out."*
4. Have the class sit in a circle. *"Who thinks they can explain a crime that happened here?"* Have one student make a claim and back it up with evidence.
5. *"If you agree with [insert name here] raise your hand. If you disagree with [insert name here] raise your hand. Someone who disagrees or has something to add, please tell us your idea. Please start with 'I respectfully disagree with ... because...'"*
6. Continue the debate until you have reached consensus or stand off. You can tell them what happened or leave it open for future discussion.
7. Discuss the remaining crimes in the same manner.

Aquatic Insects

Lesson Plan for 3rd grade fall

OVERVIEW & PURPOSE

The final nature studies session of the year is a really fun one where students investigate the life cycle, structure and adaptations of aquatic insects.

EDUCATION STANDARDS/OBJECTIVES

Next Generation Science Standards

1. **3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

2. **3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change.

MATERIALS

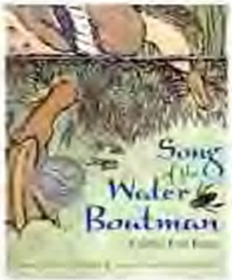
Aquatic Insects Slideshow
Mayfly, Stonefly, Caddisfly handouts (below)

Material for teachers to show the class before our session

1. Introduction video about aquatic insects: https://www.youtube.com/watch?v=-qSNXRxJWTc
2. Digital copy of John Hudson's book on Aquatic Insects of Alaska:

http://www.naturebob.com/sites/default/files/AquaticInsects.pdf

3. Song of the Water Boatman and Other Poems



Song of the water boatman : & other pond poems

written by Joyce Sidman ; illustrated by Beckie Prange.

Personal Author:
Sidman, Joyce.

Publication Information:
Boston : Houghton Mifflin, 2005.

Physical Description:
1 v. (unpaged) : col. ill. ; 30 cm.

ISBN:
9780618135479

Abstract:
A collection of poems that provide a look at some of the animals, insects, and plants that are found in ponds, with accompanying information about each.

Reading Level:
NP Lexile

Program Information:
Accelerated Reader Grades K-4 5 0.5 Quiz 84962 English fiction, vocabulary quiz available.
Accelerated Reader AR LG 5.0 0.5 84962.

ACTIVITY

Introduction Session

Essential Question: How do aquatic insects interact with their environment in order to survive?

PART 1: What is an aquatic insect

1. Write aquatic insect on the board and help the students come up with a definition. Start with insect. Next name some things that are aquatic, ask students to give you a thumbs up when they think they know what the word means. When most students have thumbs up have one student share their idea.
2. Share this powerpoint that outlines the various features of an aquatic insect and how it survives, including
   - Habitat
   - Breathing

- Moving
- Feeding
- Defense
- Life Cycle

Aquatic Insects Slideshow

As you introduce each feature (breathing, moving, feeding, defense) have the students replicate an action that you demonstrate. For example, for insects that breathe using a snorkel have the students place their imaginary snorkel from their mouth to the surface of the water and breathe in and out a few times. For the life cycle, have the students act out the complete and incomplete life cycle.

PART 2: Game: Act Like Your Insect

1. Explain that each table group is going to become an expert in one type of aquatic insect and will have to act like that insect and answer questions about it. The rest of the class will guess what they are.
2. Hand out copies of the aquatic insect profiles (below) to each table group. Give them 5 minutes to learn and prepare.
3. One group starts by acting out the way that their insect moves. If needed, students may ask questions to gather more clues about which insect they are.

Caddisflies

Habitat
Still water and fast moving streams

Breathing
Gills

Movement
Wriggler

Feeding
microorganisms- build nets and capture small bits of organic material that floats by

Defense
They build a case around their body

Life cycle
Complete metamorphosis

Mayflies

Habitat
All stream habitats

Breathing
Gills

Movement
Swimmer- they move their abdomen up and down like a dolphin

Feeding
Green stuff- algae

Defense
Camouflage and behavior- they move at night

Life cycle
Incomplete metamorphosis

Stoneflies

Habitat
All stream habitats

Breathing
Gills

Movement
Scuttler- side to side motion

Feeding
Other bugs and plants

Defense
Camouflage and behavior- they move at night

Life cycle
Incomplete metamorphosis

Field Study Session

Materials:

Nets

Buckets

Icecube trays

Data sheets and clipboards

Hand lenses

Small buckets- yogurt containers

Plastic spoons

Solo walk cards

Solo walk to field study destination

Have students participate in an adaptation and macroinvertebrate themed solo walk to the field study destination. This will allow students to 'center' into being scientists for the day. Have your assistant stay back with the kids as you go forward on the trail and set out one solo walk card per 20-30 feet. Have your assistant send a kid every 1-2 minutes. At the end of the solo walk gather the students. Have an activity at the end to occupy students while they wait on others to complete the solo walk.

Collection

1. Ask the students if they notice different parts (or habitats) in the river or creek where you are investigating. Where do you think we will see the most insects? Why? Will there be different species in different location?
2. Split into 2 or 3 groups, depending on how many adults and appropriate locations you have. One should be in faster moving water and another in a slower part of the stream.
3. Show the students how to find and collect the insects.
    a. Turning over large rocks
    b. Using the net

4. Set expectations: have students think about what it would be like to be an insect and how to respectfully handle and investigate the creature without harming it. Explain how to use the tools appropriately.

Observation

5. After about 15 minutes have students stop collecting and start observing. Each student will have a small container and a plastic spoon with at least one critter to look at. Take 5 minutes and have students look closely with hand lenses to make some observations and formulate some questions.
6. Have the students partner up to share observations, questions, and fill out their data sheet.
7. Switch habitat groups and repeat the process.

*This is a good time to take photos of the insects that the students collected, have other adults help you with this. The photos will be used in the wrap.

Wrap

Materials:

Printed photos of aquatic insects (at least 20-40)

Mayfly, Stonefly, Caddisfly handouts (above)

Stickies

Plain white paper

Healthy Stream

Tell the students that one tool that stream scientists use in determining whether a stream is healthy or not is if it has mayflies, stoneflies, and caddisflies. Those species can only survive if there is enough dissolved oxygen in the water. If the stream is too polluted it does not have very much dissolved oxygen and the insects cannot survive.

Look over your evidence in each of the locations where you did your sampling. Engage in a discussion with the students exploring these questions:

- Did we find all three species?
- Why do you think these areas are clean or polluted?
- What would happen if they started up the Silverbow mine again?

Captions

Ask the students what they know about captions. Explain the purpose and show examples. Captions give readers information about what they are seeing in a photo or diagram. Write a few example captions. Remind the students to use what they know and the handouts on each species to give more detail to their captions.

Have students select one photo and a sticky. The student writes the caption on the sticky and puts it back in the pile of photos and grabs a new one. Once all of the photos have at least one caption, have the students grab a photo with a caption and challenge them to write a more detailed caption. Both stay on the photo.

Create Your Own

1. Give each student a plain white piece of paper and explain that now they are going to create their own aquatic insect.

2. Walk them through the process. First, ask them what type of habitat does their insect live in? Have them draw or write it down.
3. Start with the outside body shape, "if your insect lives in swift water, what kind of body shape do you think it should have?"

4. Add a head, "think about how your insect eats, what does its mouth and head look like to help it find food?".

5. Add legs and tails, "how does your insect move around? Think about what kind of legs or other structures help it to get around or stay put?".

6. "How does your insect breathe? Add any necessary features that help your insect breathe.

7. Next think about defense, if a fish or bird or larger insect tries to eat your insect, what kind of defenses does it have to protect itself?"

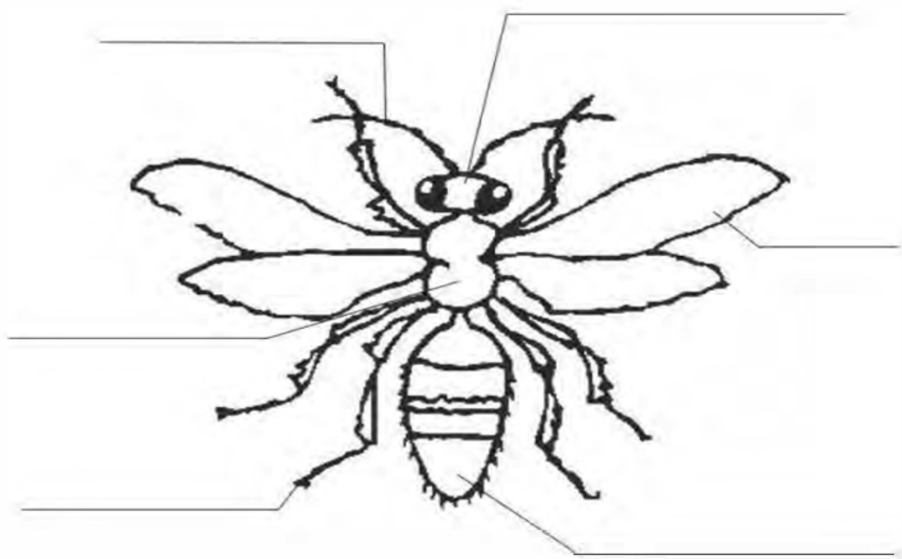
8. Remind students to add labels to explain their drawing.

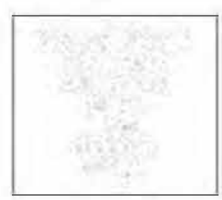
If you can, collect the drawings and create a class book. Have students add nonfiction writing about aquatic insects.

Aquatic Macroinvertebrates

Aquatic Macroinvertebrate- Animals **that live in the water** without a backbone that **we can see with our naked eye**.

Insect Anatomy





Things I want to remember:

Aquatic Macroinvertebrate Investigation

What is the relationship between________________________________ and
(measured variable)

__________________________.
(changed variable)

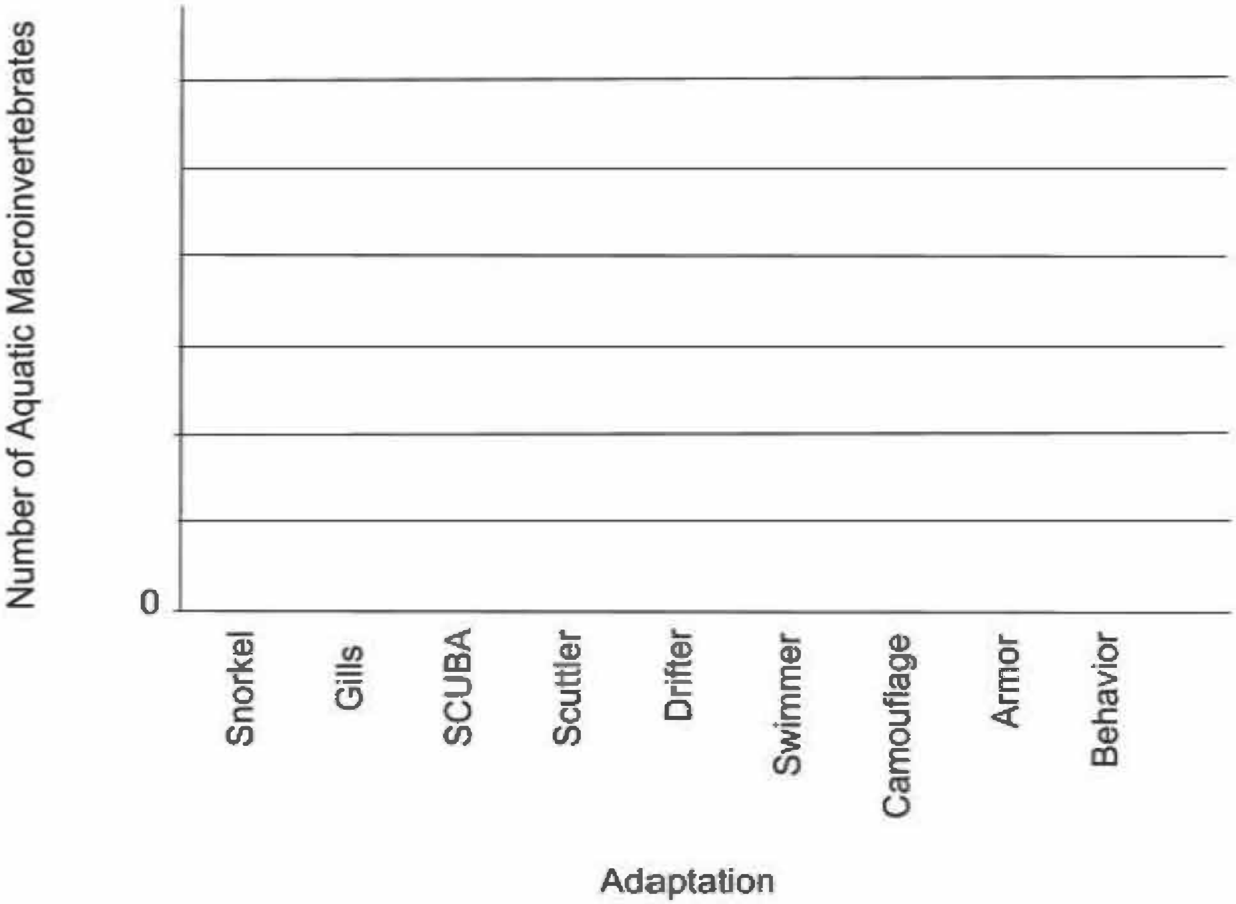
(measured variable)		(changed variable)		
		pool	**riffle**	**run**
breathing	snorkel			
	gills			
	SCUBA			
movement	scuttler			
	drifters			
	swimmers			
defense	camouflage			
	armor			
	behavior			

I notice...

I wonder...

Graph your results in the bar graph below:

Aquatic Macroinvertebrate Adaptations in ________ habitat



I notice...

I wonder...

I think____

because____.

Ecosystems of Alaska/Food Webs

Lesson Plan for 4th grade fall

OVERVIEW & PURPOSE

The first session of nature studies in their second year is focused upon the interaction between living and nonliving things in the ecosystem.

EDUCATION STANDARDS/OBJECTIVES

1. Students will be able to describe energy cycling in an ecosystem.
   - Students will be able to give definitions and examples of producers, consumers, and decomposers
   - Students will be able to draw connections between many different organisms on different trophic levels to create a comprehensive food web
   - Students will be able to conceptualize energy flow as a nonlinear process
2. Students will understand the significance of decomposers: fungi, bacteria, and invertebrates.
   - Students will be able to identify and give examples of each of the "FBI" decomposers
   - Students will be able to explain how each of these decomposers fits into a food web
3. Students will be able to identify and explain the significance of relationships between organic and inorganic elements in an ecosystem.

MATERIALS

1. Videos to send teachers prior to the NS class:

   FBI song
   https://www.youtube.com/watch?v=cBzXhOO-MEc

   Decomposers
   https://www.youtube.com/watch?v=uB61rfeeAsM

   Food chain

https://www.youtube.com/watch?v=MuKs9o1s8h8

2. Recommendation to teachers to complete the Scientific Drawing art kit: http://www.edlinesites.net/files/_4WEho_/ea56dea8de0a2e113745a49013852ec4/Scientificdrawinglesplan.pdf

2

Introduction Session

MATERIALS

Various types of moss, mushrooms, and animal bones and feathers.
3 garbage bags with labels: producer, consumer, decomposer

ACTIVITY

PART 1: Vocabulary

1. Ecosystem: Write the word on the board and have the students think about what it means, have them share with someone at their table group about what they believe an ecosystem is. Take a couple of ideas until you have a working definition. Take apart the word by defining the root word and the prefix- eco means earth and system is when things are working together.

2. Producers: Have the students follow your direction as you narrate, "start as a seed crunching your bodies into a ball, then emerge from the seed and start to stand, stretch your arms out to gather the sunlight. Now grow tall and sink your roots down into the ground to collect water. What are you?"

   "When I say producer, make your best plant pose"

3. Consumer: Sniff the air, point your ears in the direction of a sound. Silently stalk up to a kid and give her a sniff and then get scared away.

   "What am I?"

   "When I say 'consumer' act like an animal."

4. Decomposer: This one is difficult to act out, you will need to narrate. "I think I smell something tasty. Let's just scuttle over here and have a taste. Mmmmm….dead porcupine, my favorite!"

   "Does anyone think they know what I am?"

   Guide them toward the idea that you are an insect. Explain that insects are a part of the FBI- decomposers that are either Fungus, Bacteria, or Invertebrates. Explain what a fungus is and that invertebrate is a fancy word for insect.

   "When I say decomposer act like a member of the FBI."

Call out each vocabulary word and have them act like each member of the ecosystem.

PART 2: Ecosystem Sort

1. Place a bag filled with plants, mushrooms, and animal bones, fur, and feathers with each group of 4-6 students.
2. Lay down three garbage bags with a label of Producer, Consumer, and Decomposer around the room.
3. Have the students take the things out of the bag one at a time, each student having a chance to use their senses to investigate it. The group must agree which category the item fits into and then they place the item on the appropriate garbage bag.

When the activity is complete, talk about some of the misconceptions- lichens, moss, etc.

Discuss non-living aspects of the environment, "Are there any other things in an ecosystem that don't belong to any of these categories?" Look around the room and point out some alive, dead, and non-living items. If you have time ask what the world would be like without non-living things.

"Each component of an ecosystem gives something and gets something from the other members of the ecosystem- that's what makes it a *system.* Everyone select one item from the three garbage bags and think about what it gives to the ecosystem and what it gets from the ecosystem. When the time is up you will share your idea with a partner."

PART 3: How to Prepare for the Trip

1. Ask for a volunteer to help you with modeling.
2. Ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"
3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

*students may ask about bringing water, snacks, journals, camera, backpacks etc. I encourage students to travel with as little as possible, a science journal and pencil only if there is an activity in the field which requires it.

Field Trip Session

MATERIALS

String for micro hike
Materials for the predator prey game

ACTIVITY

1. **Expectations:**
- Sticks and rocks stay on the ground
- Be respectful to the environment
- Stay with the group
- Don't touch or taste mushrooms

**Management tips:*
- *Gather the students in a toe to toe circle for discussions and instructions. Count out loud to encourage them to circle up quickly.*
- *To get attention, "if you can hear me clap once, if you can hear me clap twice..." "if you can hear me touch your nose, moose antlers, etc." "point at a person who is talking right now- that person should be me!" "I would like your attention in 3, 2, 1 eyes and ears on me."*
- *1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the group's' attention to hear from individuals with hands raised.*

2. Become a scientist/naturalist. What senses can we use today?
- SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.
- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

Along the way point out decomposers and producers. "How does this organism interact with other members of the ecosystem?"

3. **Decomposer hunt.**

a. I point out a mushroom explain how they decompose.
b. Act it out.
- Extend your hyphae (arms) through the leaf litter.
- Thread them together to create mycelium. As you are doing this you are breaking down leaves and sticks, crushing them with you hyphae and turning them into small particles.
- Pop your head up, this is the fruit body of the fungus. Your job is to drop spores so that new fungus can grow
- Drop your spores

c. Find one! Mushroom hunt. Set boundaries and assign adults to monitor certain areas.

4. ***Game:* Predator prey**
**Materials for this game are in the Discovery Southeast office*

Whoever is giving out the tokens is the 'sun'.
Explain where the 'arena' boundaries are.

In a class of 24: 13 producers, 6 herbivores, 3 carnivores, 2 decomposers

Plants/Producers

- They get their energy from the sun and grow with water, air, and nutrients from the soil.
- They are given 10 energy tokens (can be poker chips, foam squares, rubber bands) and need to hide with their tokens, in the arena.
- Producers must have at least 3 energy tokens at the end of the game in order to survive.
- If a plant runs out of energy it dies. If that happens, plants come to a central location and wait for a decomposer to bring them back to life. When they get new energy tokens from the decomposer they find a new hiding spot.

Animals/Consumers: Herbivores

- They get their energy from eating plants. When they find a producer they will be given an energy token from the producer.
- If they are tagged by a decomposer they die and have to give all of their energy tokens to the decomposer. They start collecting energy tokens again by finding the producers.
- Consumers must have at least 5 energy tokens at the end of the game in order to survive.

Animals/Consumers: Carnivores

- Select two or 3 students to be carnivores. Ask the teacher to volunteer students who could use some recognition.
- They get their energy by eating herbivores. When they see an herbivore and successfully tag them the herbivore gives them one energy token.
- If they are tagged by a decomposer they die and have to give all of their energy tokens to the decomposer.
- Carnivores must have at least 7 energy tokens at the end of the game in order to survive.

Decomposers

- They get their energy from dead and decaying animal and plant material. They turn it back into nutrient rich soil to allow for new growth.
- When they tag an animal it dies, and they are given that animals' energy tokens.
- After they have collected energy tokens from a dead animal they immediately find a plant in the central area to bring them back to life. Give all collected energy tokens to the producer.
- Decomposers need to help at least 4 plants by the end of the game in order to survive.

*this game can be complicated for 4th graders. It may help to start with just producers and herbivores and then add in the carnivores and decomposers in a second and third round.

DEBRIEF: It is very important to include this piece. This helps the students create meaning from their experience.

Split the group in 2 and have one group work with the assistant naturalist to debrief the game. Sit in a circle and take thoughts from volunteers.
Questions to elicit discussion:

- What do you think was the most important role in the game? Why?
- What happened to the energy [tokens]? Did any of the energy disappear?
- What strategies did you use? Do you think animals in the wild use the same strategy?
- Are there any other parts of the environment that helped you survive in the game (rocks to hide behind, sound of the river to hide your sound)?
- What would happen if we took away all of the producers? Consumers? Decomposers? How would that affect the ecosystem?

5. **Micro hike**

"Imagine that I have a shrink ray and I use it to shrink you down so that you are a half an inch tall. Show me on your fingers about how big you think a half an inch is. Imagine this is a new national park and you are in charge of creating a natural history trail for others who are your size."

- Your hike must have at least 3 stops where you explain something interesting. Mark the stops so you know where they are.
- Include 1 producer and 1 decomposer.

Hand out pieces of string approx 1.5 meters long.

When they have completed their hike have them partner up and take their partner on a guided hike on the trail.

6. Give out plastic baggies and have the students collect a sample from the ecosystem that they find interesting. They will use it to create a scientific sketch when we do the wrap.

Wrap

MATERIALS

Each student should have one specimen in a resealable bag that they collected on the trip
Science notebooks
Hand lenses

ACTIVITY

Scientific Drawing

1. Look at your object! Spend at least five minutes, pencils down, just looking at the object you wish to draw. Look at it close up, at arm's length, and from all possible angles. Look for patterns and overall shapes as well as details.

2. Sketch the outside shape first. Next include details. Last include areas of light and dark and patterns.

3. Add at least three labels that tell the observer more about the specimen. It could be pointing out the 'stem' or 'vein' of a leaf, or describing elements that you can't see in the drawing like 'curls up when layed flat'.

4. Make one observation and write one question that you have about the specimen.

5. Look at the field guides that I brought to determine what the scientific and common name is for your species.

6. Write the name of your species as the title of your science notebook entry.

Topographic Landscapes and Natural Resources

Lesson Plan for 4th Grade Winter

OVERVIEW & PURPOSE

This session of nature studies teaches the students how to read topographic maps. They will imagine they have travelled back in time and are tasked to find a location for a winter Tlingit camp. They will need to find appropriate locations and natural resources that will help their clan survive.

EDUCATION STANDARDS/OBJECTIVES

Science

Next Generation Science Standards: 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features. [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

JSD: Ecosystems of Alaska: Ecosystems are made up of interactions of organisms with their living and non-living environment.

Social Studies

CULTURAL CONNECTIONS Cultural Anthropology & Global Connections
Categorize the different Alaska cultural groups according to region and elements.

- Recognize relationships between Native Alaska groups and the land and climate

GLOBAL ECONOMICS Production, Distribution, Consumption

- Identify the natural resources of Alaska and how they are used in commerce (mining, fisheries, timber, tourism, etc)
- Describe ways that individuals use natural resources to meet their subsistence needs.

CONNECTIONS

1. Sitka Spruce and Hemlock art kit
2. Alaska Postcards art kit
3. Zoom In on Alaska art kit

Introduction Session

MATERIALS

Science Notebooks
Topo mountain model
Topographic maps of the area (enough for 1 map for 4-6 students)

ACTIVITY

PART 1: 3D to 2D

1. Vocabulary: write the words elevation and topographic on the board. Have the students help you define each term.
2. Show the students the completed topo mountain model. Explain that they will be drawing the model on a sheet of paper.
3. Take the model apart and hold up the largest piece. Ask the students to draw the shape in their science notebooks. Encourage them to fill the page. Draw your version on the board.

4. Measure the height of the mountain and label it along the first topo line on the board. It makes a good math activity if each layer of the model is a fraction of an inch.
5. Repeat until you have put the mountain model back together.
6. Ask:
    - *Looking at your map, which side of the mountain is the steepest? How do you know?*
    - *Which side is the least steep? How do you know?*
    - *Make up a rule (lines close together= steep, lines far from each other = flat)*
    - *Where is the highest point? Mark it with a star*
    - *Where is the lowest point? Mark it with a fish*
    - *If you were going to hike this mountain which route would you take? Draw that on your map.*

PART 2: Topographic Maps

1. Write the following questions on the board and have students work in groups to answer. They should write the answers in their science notebook.
    - Where is the highest point?
    - The lowest point?
    - Find a mountain
    - Find a river or creek. Where do they usually start and end?
    - Find your house

2. If some groups finish early challenge them to draw a topo map of the classroom.

3. Have each group share their answer to each question as a class.

3. When they are finished give the accurate measurements and what animal they belong to.

PART 3: Preparing for the trip

1. Ask for a volunteer to help you with modeling.
2. Tell the students what the weather report is calling for and then ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"
3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

Field Trip Session

MATERIALS

Printed topo maps of the area

Pen or pencil

Clipboards
Instruction Sheet

ACTIVITY

PART 1: Before you leave the classroom

Goal: to investigate various topographical features and see how it effects the landscape.

> *"Each partner team gets a topo map of the area and will need to bring a pencil.*
>
> *Start by adding the school to your map. Put a dot where you think it is. I will help you find it and show you how big to make it.*
>
> *Imagine you are a small Tlingit clan looking for new a new winter camp. You will need to find what you need to survive the winter and provide for the clan. What will you need to establish your new village? Use what you know about this indigenous group to think about what you may want to find.*
>
> *As you are walking think about 4 more natural resources that you can find in the forest that will help you and your community."*

Have the students partner up or assign partners. Each parter group carries a map and the Instruction Sheet.

Ideas:

1) Shelter. where is a good spot that has dry ground, open enough to build a shelter?
2) Timber- where are there tall trees that you can cut down to build the shelter?
3) Hunting- find somewhere with animal tracks
4) Gathering- find somewhere with wild edibles like berries, fiddleheads, mushrooms, etc.
5) Baskets- find a place with spruce trees to harvest roots to weave spruce root baskets.
6) Fishing- find a creek where there may be fish
7) Fire- where are there shorter trees (10-20 feet) that will be good for burning.
8) Water- to drink and bathe and cook with. Remeber that water that is not moving will make you sick.
9) Safety- can you find an area that is difficult to get to, with natural boundaries where you could hide in case another tribe attacked or you were trying to get away from a predator.
10) A trail that leads to the ocean

PART 2: Warm up the senses

Become a scientist/naturalist. What senses can we use today?

- SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

PART 3: Natural Resources and Landforms

1. When you arrive at your first location, have students fill out the Instruction Sheet.
2. This activity works best in two groups. The first half of the class to finish is the first group.
3. Discuss as a group what each partner team has come up with regarding what type of land and natural resources you will be looking for. Look at the topo map to determine where you think you want to travel.
4. Decide on where you are going first. As you travel have the students track the route on the map.
5. When they find an item on their list they create a symbol on their map. There should also be somekind of key that explains what the symbol represents.
6. Trade map carrying and recording duties with partners about half way through the trip.

PART 4: Models

Find an area where partner teams can work together to build a model of their village. Ask them to represent each of the items that they listed on their instruction sheet, in their model.

Wrap

MATERIALS

Clay- enough for 1 cup per partner team
Toothpics
Aluminum foil or baking trays

ACTIVITY: 3D Models

1. Ask students what natural resources or landforms they listed on their instruction sheet.
2. As they tell you something, ask what the land was like where they found that thing. For example, if they listed 'shelter' ask them what did the land look like where you decided a good spot for shelter was. Was it steep? Flat? Soggy? Rocky? Trees?

3. Continue to list items on the board and what the land was like.
4. Sit in a circle so that all students can see what you are doing. Take a chunk of clay and a piece of aluminum foil and explain,

   "I am going to create an ecosystem out of clay that will represent the area where the new winter camp will be located. First I am going to determine where the ocean will be. Next I am going to build mountains. If I look out the window I see that a lot of the mountains around here are in ranges, so I will build that in my model.

   Next add rivers. If water falls on this part of the mountain, where do you think it will go? You can look at the topo maps that I brought in to see where creeks usually are on mountains, or you can look out of the window.

   Now look at your list of spots and think about what the land looked like when you found that spot yesterday. For example, River and Liam decided they needed hunting grounds and they found a good spot for this in a meadow that was open with very few trees which had soggy ground and was surrounded by blueberries. If I were to add that spot to my ecosystem I would put it here beneath this mountain, I'll add a little clay and make a flat meadow and then grab a toothpick to mark that as an important location."

5. Give out clay and foil and have the students get to work!
6. If you have time have the students share their models.

Processes that Shape the Earth

Lesson Plan for 4th Grade Spring

OVERVIEW & PURPOSE

This session of nature studies teaches the students how to look at the landscape and recognize changes that have occured because of the movement of water and air. They will also learn about different types of landforms such as mountains, rivers, alluvial fans, and how they are created and changed.

*this lesson is designed for the Mendenhall River near the Brotherhood Bridge trail. Modifications will need to be made if the lesson is going to be completed in another area.

EDUCATION STANDARDS/OBJECTIVES

Science

JSD: Earth Science- Processes that Shape the Earth

Next Generation Science Standards:

- 4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- 4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

CONNECTIONS

1. Alaska Postcards art kit
2. Alaska Landscapes with Georgia O'Keeffe art kit
3. Landscapes of the Iditarod art kit
4. Water Dance art kit

Introduction Session

MATERIALS

Science Notebooks
Tray (cookie sheet)
Sand
Ice cube
Spray bottle

ACTIVITY

PART 1: Introduction to weathering, erosion, and deposition.

1. Vocabulary: write the words weathering, erosion, and deposition on the board. Briefly explain what the word means and then show the students the motion that goes with the word.

'When I say weathering I would like you to say 'break it up! Break it down!'. Make up a dance move to go with it. When I say erosion, you say 'I like to move it move it, I like to move it move it!' and move around the room. When I say deposition, you say 'aaaaaaand, STOP'. And sit down wherever you are in the room.'

Feel free to call out one of those three words at any point during the lesson to keep the students on their toes.

PART 2: Icecube Glacier

Question: How do glaciers change the surface of the land?

1. Show the students the glacier model and ask *'do glaciers move? What do you think happens to the land around it when the glacier moves?'*
2. Move the ice cube around on the sand. Have students notice how the sand surface has changed.
3. Flip the ice cube upside down and see what the bottom of the glacier ice cube looks like.
4. Melt the ice cube either by leaving it in a warm place, spraying water on it, or by blowing a hair dryer on it.
5. Help the students notice how the water has changed the sand landscape (created a river) and where the bits that were one the bottom of the glacier end up along wtih other sediment that the stream picked up along the way (deposition).
6. Encourage the students to identify one place where they see erosion, and deposition.

PART 4: Mapping

1. Look on Google Earth where we are going to go on the trip.
2. Have students draw the major landforms that they see. Start with the river and add mountains, hills, cliffs or any other major landform.
3. Watch this video on why rivers curve.
4. Have students label on their maps at least 4 places where they think they are going to see erosion and deposition.

PART 3: Preparing for the trip

1. Ask for a volunteer to help you with modeling.
2. Tell the students what the weather report is calling for and then ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"

3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

Field Trip Session

MATERIALS

Maps of the area (1 per groups of 4 or 5)
Clipboards with paper and pencils
Two large flat rocks
Large piece of cardboard
5 gallon buckets

ACTIVITY

PART 1: Identifying Erosion and Deposition

As you walk encourage the students to stop and identify areas where they see erosion and deposition. Ask the students to mark the places on the map. Take a photo of each spot (the photos will be used for the video project to be completed during the wrap up).

Be sure to point out a spot where: two currents converge, and undercut bank, a place where you can see plant or tree roots holding the soil in place.

PART 2: Warm up the senses

Become a scientist/naturalist. What senses can we use today?

- SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.
- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

PART 3: Mountains

1. With two large flat rocks, demonstrate convergent and divergent plate boundaries. Show how mountains are formed and why earthquakes occur. Have students look toward the towers to see if they can identify rock layers and how the plate has been forced up.
2. Ask the students to find two large rocks and create either a convergent or divergent mountain. Have them add layers of sand, smaller rock, and dirt. Have them 'plant' trees and bushes on the slopes.
3. Come around with a water sprayer and investigate what happens. How does water change the mountain?
4. Make wind with a large piece of cardboard and epeat the same process to see how wind erosion affects their mountain.

PART 4: Geology

1. Split the class into three groups.
2. Ask each student to collect 4 interesting rocks and place them in a pile with the group.
3. Ask students to put the rocks in groups, they can make as many groups as they want and can organize them as they wish.
4. Move from group to group to debrief. If they have organized them by size, talk about deposition and how the river has dumped a bunch of similarly sized rocks in one place. If they have organized by shape talk about weathering and how the rocks have been shaped by the tumbling of the river. If they organize by pattern adn or/color, talk about rock types and how granite is not a naturally occuring rock in this area, also the effect of chemical weathering and how it can cause oxidation and rust.

PART 5: Almost an Oxbow

1. Remind students of the video you watched explaining why rivers curve. Ask if they can see a spot on their map where there is almost an oxbow.
2. Hike in to the spot where the trail narrows. Have the students identify the spot that is the thinnest. Ask why this is happening.
3. Have them estimate how wide the strip of land is, and how many years it will take for the river to work its way completely through the land.
4. Have students lay on the ground and calculate an apporoximate width based on their height.

PART 6: Engineering

Hike further down the trail where you can see one side of the almost oxbow and looking the other way you can see the bridge that cars drive over.

Explain the challenge: you have been hired by the City of Juneau to make a recommendation on how to deal with the erosion in this area. You need to decide if you are going to try to stop the erosion, or move the trail. Based on your choice, what will need to happen in order to make this a safe place to have a trail?

If you are going to try to fight the erosion, what are you going to build/plant/place to stop the erosion? Where will you put it? How will you do it?

If you are going to move the trail, where will it go? Why? Do you think that it will be affected by erosion in the future?

Draw and write your ideas.

When everyone is finished have groups present their ideas to another group.

Bring students to the riverbank and point out what CBJ did to deal with erosion under the bridge. Do you agree? Would you have done it differently?

PART 7: Bucket Brigade

1. Split the class into two groups
2. Have one student stand at the top of the embankment, one student beside the water.
3. All other students fill in the gaps.
4. Explain that you are going to work together to get the water from the river to the person standing at the top of the bank by passing the bucket from person to person.
5. The person at the top of the bank will dump the water. Repeat until each student has had a chance to dump.
6. Next try two buckets at a time, three buckets at a time.
7. Each group will debrief with an adult: what did you notice? How is this similar to what we see around us (encourage students to look at Thunder Mountain). If the bank was steeper or flatter would the results be different? If we had more or less water what would change? What did you notice about where the material was deposited? What size and type of material travelled the farthest?

Wrap

MATERIALS

Video camera
Paper
Markers or colored pencils

ACTIVITY: Erosion, Deposition, Weathering

1. Split the class into groups of three.
2. Each group will create a poster that details one place on our trip where they saw erosion,

deposition, or weathering.

3. The poster should have an illustration, a definition or their topic, and a written explanation of what process is being shown.
4. Videotape each group present their poster to the class.
5. Put the videos together to make a class movie like this one.

Adaptation

Lesson Plan for 5th grade fall

OVERVIEW & PURPOSE

The first session of nature studies in their third year is focused on structural and behavioral adaptation.

EDUCATION STANDARDS/OBJECTIVES

1. The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:

[5] SC2.1 identifying and sorting animals into groups using basic external and internal features

[5] SC2.2 explaining how external features and internal systems (i.e., respiratory, excretory, skeletal, circulatory, and digestive) of plants and animals may help them grow, survive, and reproduce

MATERIALS

1. Videos to send teachers prior to the NS class:

Plant Structure and Adaptations
Plant Adaptations

2. JSD art kit on scientific drawing: Draw Aquatic Insects

Introduction Session

MATERIALS

Science Notebooks
Examples of plants and animals with interesting adaptations (devil's club, spruce bough, marten pelt and skull, black bear pelt, moss) with a pile of stickies beside each one.

ACTIVITY

PART 1: Behavioral Adaptations

1. Introduce the idea of structural and behavioral adaptations
2. Have the students open their science notebooks and respond in writing (with pictures if they would like) to the following prompt.

"You are out on a field trip with your class to Admiralty Island. The boat drops anchor and everyone gets ferried to the shore to explore. You mess around on the beach for a while and then you see an interesting bird fly into the woods. Against your better judgement you decide to follow it into the forest. Is it a peregrine falcon? You check your guide book to see if you can determine the species. The bird keeps flying deeper into the forest and you follow it in. Lost in thought and determined to learn more about the bird you realize you have been gone a long time. As you look up from your guide book you hear a boat engine- uh oh. As fast as you can you run to the shore just in time to catch a glimpse of the boat with your class on it motoring out of the bay, leaving you behind. You realize that you are now alone and will have to spend the night here in the forest. What do you do?"

3. Give the students about 5 minutes to record their thoughts in their notebooks.
4. Have them turn to a partner to share their ideas.
5. Take a few examples who want to share with the whole class. Write the ideas on the board.
6. Define **behavioral adaptation-** the things organisms do to survive. For example, bird calls and migration are behavioral adaptations.

PART 2: Physical Adaptations

1. *"Same scenario as above. However, this time a forest spirit speaks to you from the trees. She tells you that she will help you survive the night. She will give you one animal adaptation to help you. That means that you will still be human, however, you will have the eyes of an eagle, or the claws of a bear, or the wings of a heron."*

"Think about what you need to survive:

- *defense against predators*
- *offense against prey*

- *how to moderate temperature*
- *how do their senses work? Where are their eyes located, big ears, etc.*
- *how do they get around? Long legs, fly, swim*
- *what do they look like? camouflage"*

2. *"What will you choose?"* Give the students 5 minutes to sketch their new human form that will help them adapt to the environment on Admiralty. You may want to discuss what season it is, what the weather is like, temperature of the water, and other animals that live on the island.

3. Have the students share at their table groups and then show a couple of examples on the document camera.

PART 3: Investigation

Set up several stations with different species: *(these are examples, feel free to use others)*

1) Sea lion skull
2) Marten (if we have a skull and a pelt)
3) Bear
4) Mallard
5) Worms
6) Moss

1. Have students travel to each station and determine at least one adaptation. Write the adaptation on a sticky note.
2. If you have time, share the stickies with the class. To get the students more involved ask if they agree or disagree by raising their hand after you read the adaptation idea.

PART 4: Preparing for the trip

1. Ask for a volunteer to help you with modeling.
2. Ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"
3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

*students may ask about bringing water, snacks, journals, camera, backpacks etc. I encourage students to travel with as little as possible, a science journal and pencil only if there is an activity in the field which requires it.

Field Trip Session

MATERIALS

Blindfolds (enough for half of the class)

ACTIVITY

PART 1: Each one Teach one

Split the group in two. It is helpful to have 2 adults with each group. The second adult stays at the start to monitor students and release the next one.

1. Take Student 1 to the first stop which is a plant with a specific adaptation. Teach them the adaptation. Student 2 travels to the first station (plant with an adaptation) and learns from Student 1. Next, walk Student 2 to the next station (plant) and teach them the adaptation, etc. Teacher lets another student go and then other adults spread themselves along the trail.

POSSIBLE ADAPTATIONS:
Waxy surface: keeps too much water out.
Leaf shape: how do they shed water?
Bark: thick bark helps protect the inner core from cold and protecting the tree from parasitic fungi.
Roots: thin soil, the roots spread wide.
Old man's beard: epiphytes which get all water and nutrients from the air. The algae part makes the food, the fungi part stores the water.
Soil: poor nutrients, so new trees grow on stumps (nurse logs) to take advantage of the nutrients from the decomposing logs.
Height: trees can grow very tall due to the amount of precipitation.
Smell: skunk cabbage draws in pollinators.
Mosses: need very little soil and light to grow.
Lichen: can grow on rocks and creates the starting soil by secreting acids that breaks down the rock. That with the addition of the dead lichen creates enough soil for the next successional plant- usually moss.
Needles: can heave off a snow load. Not much surface area so it protects the photosynthetic cells. Waxy surface draws moisture away.

PART 2: Meet a plant

1. Pair up
2. One student is blindfolded and the other is the guide.
3. Guides lead their blindfolded partner to a plant. They will point out notable parts of the plant that will distinguish it from other plants.
4. After sufficient exploration of the plant, the guide leads their partner back to the gathering place.
5. Next the blindfolded person needs to find the plant.
6. When everyone who was blindfolded has found their plant, meet back at the gathering area for a discussion.

Discuss:

"What do plants need to survive?" (water, light, nutrients, space)
"What are some characteristics of this particular environment?"
- lots of water
- lots of light in summer, little light in winter
- cold
- small amount of nutrients

Give an example of how skunk cabbage adapts to survive:
- waxy coating to drip off excess water (physical adaptation)
- roots that regulate water consumption and can live in a bog (behavioral adaptation)
- large leaves to capture sunlight in the low canopy (physical adaptation)
- regulates its own temperature by creating its own heat (behavioral adaptation)
- puts off a smell to lure in pollinators (behavioral adaptation)

7. Those who guided will now be blindfolded.
8. Guides lead their blind person to a plant. Point out notable parts of the plant.
9. Guides tell their partner about the plants' adapation.
10. Blindfolded person needs to find the plant.

PART 3: Game- Animal Adaptation

Focus on Behavioral adaptations for round 1 and 2:
1. Play tag (you can call it predator/prey). When students are tagged that means they have be killed by a predator and must come to the boneyard (central meeting place).
2. Have each students choose what animal they are.
3. Explain the boundaries.
4. If an adult notes any unsportsmanlike behavior, the student will sit out for the following rounds. We will be giving out adaptation cards to anyone who shows sportsmanlike behavior.

Rules for round 1: you have to **walk**, you have to **stay out in the open**, you **can't make any noise**.

Rules for round 2: none. Stay alive.

Debrief: what behavioral adaptations did you employ as the predator or as the prey?

Rules for round 3:
Same as round 2 however, this time several students are given Physical Attribute Cards.
Students must follow the instructions on the cards.

Debrief:
*Likely you will get a lot of "That's not fair!!" after playing this round. Before addressing anything else, talk about the natural word- is it fair?

- What were some examples of physical adaptations that helped the prey?
- Do predators have physical adaptations that help them?
- If you designed this game what physical adaptation cards would you create?

PART 3: Game- Scavenger hunt

- Find each of the numbers listed. Species will be given a number.
- When you find it list at least one adaptation.

1) Devil's club
2) Spruce tree
3) Skunk cabbage
4) Moss
5) Fungus
6) Crab shell
7) Insect
8) Weasel pelt
9) Deer skull
10) Bear skull
11) Sea lion
12) Great blue heron skull
13) Raptor skull
14) Wing
15) Bear print

PART 5: Species Sample

Find an area that is diverse in plant life. Have each student select one sample to put in a resealable bag to bring back to the classroom with them.

Wrap

MATERIALS

Each student should have one specimen in a resealable bag that they collected on the trip
Science notebooks
Hand lenses

ACTIVITY

PART 1: Scientific Drawing

1. Look at your object! Spend at least five minutes, pencils down, just looking at the object you wish to draw. Look at it close up, at arm's length, and from all possible angles. Look for patterns and overall shapes as well as details.

2. Sketch the outside shape first. Next include details. Last include areas of light and dark and patterns.

3. Add at least three labels that tell the observer more about the specimen. It could be pointing out the 'stem' or 'vein' of a leaf, or describing elements that you can't see in the drawing like 'curls up when laid flat'.

4. Write at least 2 adaptations that the plant uses to help it to survive.

5. Look at the field guides that I brought to determine what the scientific and common name is for your species.

6. Write the name of your species as the title of your science notebook entry.

PART 2: Super Squirrel

"You are going to design a new animal- super squirrel who is uniquely adapted to live in the forest we visited yesterday. Think about what physical and behavioral adaptations could add to their chances of survival.

First draw the head, what do the eyes look like? Are they big or little? On the front, back or side of the head? Now draw the ears, what is the shape? How big are they? Do they behave in a certain way?"

Continue walking the students through the physical attributes of a squirrel. Next move on to behavioral adaptations.

"Now think about how they live. Do they live alone or in a group? Do they migrate or hibernate? How do they store food? How do they care for their young?"

Heat

Lesson Plan for 5th Grade Winter

OVERVIEW & PURPOSE

This session of nature studies is focused on how heat is created and transferred. Students complete experiments to determine how to best insulate and conduct heat in the natural environment and then adapt their strategy using household materials.

EDUCATION STANDARDS/OBJECTIVES

Science

The student demonstrates an understanding of how energy can be transformed, transferred, and conserved by
[5] SB2.1 classifying the changes (i.e., heat, light, sound, and motion) that electrical energy undergoes in common household appliances (i.e., toaster, blender, radio, light bulb, heater) The student demonstrates an understanding of the interactions between matter and energy and the effects of theses interactions on systems by
[5] SB3.1 identifying physical and chemical changes based on observable characteristics (e.g., tearing paper vs. burning paper)

The student demonstrates an understanding of the processes of science by:
[5] SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating. *
[5] SA1.2 using quantitative and qualitative observations to create their own inferences and predictions

Introduction Session

MATERIALS

Science Notebooks
Scraps of material (wool, cotton, denim) **available at the DSE office*

ACTIVITY

PART 1: Introduction Discussion

Ask the question, *"Where does heat come from?"* and give the students a few minutes to write down ideas in their science notebooks.

List ideas on the board and clarify and misconceptions.

Group discussion. *"Does it stay in one place or does it move?"*

Vocabulary
CONDUCTION- the transmission of heat through matter.
INSULATION- a material or substance that is used to stop heat, electricity, or sound from going into or out of something

PART 2: Conduction

1. Define conduction and insulation
2. Write the following on the board:

Good conductors transfer heat well, they do not keep you warm.
Good insulators do not transfer heat well, they keep you warm.

3. Have the students make a prediction.

Hold up the three pieces of fabric. *"Which do you think will be the best conductor?"*
Raise your hand if you think it is the cotton? Record the number of votes on the board.
Wool? Denim? Fleece?

4. Conduct the experiment:

   a) Start with no material- have the students place two fingers to their cheek and hold them there for 30 seconds. Ask them to pay attention to the heat travelling from cheek to fingers.

      "In order to quantify our data, this test establishes how good conductor would transfer heat. I would give this test a 10 on a scale from 0 to 10."

b) Make sure each person has one piece of fabric. Have them write which fabric in their science notebooks. After 30 seconds have them record a number from 0-10. 0 being that no heat transferred from cheek to fingers, 10 being just as much heat transferred as when we did it without any material.

c) Repeat until each student has completed the experiment with all of the fabrics.

PART 3: Preparing for the trip

1. Ask for a volunteer to help you with modeling.
2. Tell the students what the weather report is calling for and then ask the students to imagine it is the day of the field trip and they are going to get dressed so that they are prepared to be outside. "What do you put on first?"
3. As the students talk about appropriate clothing, pull the item out of your backpack and have the model put it on.

Field Trip Session

MATERIALS

Film canisters
Jello or gelatin mixed and still hot in a thermos
Laser thermometers **available at the DSE office*

ACTIVITY

PART 1: Before you leave the classroom

Give each partner team a film canister. Fill it with hot gelatin or jello mixture. Explain that these are vole babies, and we are going to find a place out in the environment where we are going to try to keep them warm enough to survive.

PART 2: Finding Homes for Voles

Take the vole babies out into the environment and find somewhere to build them a home. Each partner team thinks about how to best insulate the film canisters so that the gelatin stays as a liquid. If it turns solid that means that the heat has escaped and the vole babies are not warm enough to survive.

PART 3: Warm up the senses

Become a scientist/naturalist. What senses can we use today?

- SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

PART 4: Natural Insulation

Groups find a rock about the same size as a fist.

Challenge: Warm up the rock and keep it warm.

1) Heat up the rock for 2 minutes. *How will your group heat the rock up? How are you going to conduct heat into the rock?*
2) Keep it insulated for 2 minutes. *What materials will you use to keep it warm?*
3) Record the temperature and calculate the heat loss.

Make a plan, collect your natural insulation and when you are ready line up at the conduction station.

Groups travel through three stations. Two groups can go at the same time.

1) Conduction station- groups heat up the rock. At the end of the 2 minutes they take the temperature of the rock using a laser thermometer.
2) Insulation station- groups use whatever natural materials they have collected and place the rock inside for 2 minutes. They may not use conduction at this station and so no one can touch the rock or the insulation.
3) Final temperature station- measure the final temperature and calculate total heat loss.

What worked best as insulation? Share strategy and results as a group.

PART 4: Voles

Return to where the vole babies were placed and see if any survived. Discuss strategy and effective insulation.

Wrap

MATERIALS

Rocks
Random materials- clothes, blankets, paper, foil

ACTIVITY: Insulation

Design something that will keep your rock as warm as possible.

Repeat the heat a rock activity that we did in the field, but this time you can think about different ways to conduct heat to warm up the rock, and also what materials will you use to design an insulated home for the rock to keep it warm?

Stations:

1) Plan
2) Heat it up/conduction station- 2 minutes to heat and then take the temperature
3) Insulation station- quickly tranfer your rock to the insulation home you designed and built. Keep it there for 2 mintues.
4) Take the final temperature and calculate the total heat loss. Write it on the board.
5) When you are finished- in your science notebook design a home for yourself made of all natural materials. Imagine you are stranded on Admiralty Island for the winter. In order to survive you have to build a home that will keep you warm. You do not have any modern tools, including an ax.

Celebrating our Alaskan Landscape

Lesson Plan for 5th Grade Spring

OVERVIEW & PURPOSE

This session of nature studies is a celebration of three years of nature studies. This is the last trip that the students will have with Discovery and a chance to practice some of the essential elements of outdoor exploration and learning. Typically the intro and wrap sessions are combined into the hike time to make a full day trip outside.

EDUCATION STANDARDS/OBJECTIVES

Science

JSD: Structure and Function of Living Things

Next Generation Science Standards:

- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

CONNECTIONS

1. Andy Goldsworthy; Art from the Earth art kit

Field Trip Session

MATERIALS

Science notebooks or paper and pencil

ACTIVITY

The Hike:

For this final session of Nature Studies it is nice to have some kind of goal to hike toward like a cabin or a peak. Some good ones are: the Glacier, Dan Moller, Mount Roberts.

On the hike remember to take photos, talk about prior trips, what they love about the environment here in Southeast and how they plan to get outside and enjoy during summer break.

PART 1: Finding Connections

Pick an area with a lot of ecological variation. Have the students explore the area and find one plant, rock, or other element of the landscape that they identify with.

Have them think about what they have in common with it, what they appreciate about it and/or how it symbolizes something in their life.

Split into two or three groups and have each person present their item and explain why they picked it.

PART 2: Looking Closely

1. In partners, each team needs to look for something in nature that has a pattern.
2. Identify the pattern (example- spruce trees have a row of branches all at the same level about every foot if you look at the tree vertically).
3. Predict how the pattern will continue, if it has an 'end', if there are any other species that share the same pattern.
4. Draw it.

PART 3: Doing Work

1. Students choose between: music, art, obstacle course, building.

Music: using rocks, water, or whatever you can find- create a piece of music with a beginning, middle and end.

Art: create a piece of earth art- a simple design around a pattern. Use only natual items. It can be a sculpture, a flat piece built on the ground, or you can use a tree or another living thing and transform it to make something beautiful.

Obstacle course: create a challenging and safe obstacle course using natural elements. Think about jumping over, climbing under, climbing up, going around, carrying things, scooping things, breaking sticks, throwing stones. It should be simple, safe, and fun.
Building: Build a boat, or some sort of mini building using only natural elements.

2. They should work in teams and each have a chance to share their creations with others.

PART 4: Fun Factor

1. Play a game: predator prey, camoflauge, forest ninja, sardines, capture the flag. Remind the students that they can always visit nature and play one of their favorite games.

PART 5: Time Alone

1. Have the students find a spot where they will be alone. You may have to place them.
2. For 10-15 mintues they are expected to be alone- that means no talking, making gestures, eye contact, etc. with others.
3. You can ask them to just simply sit and observe, or give them a task.
4. Sound/smell/touch mapping- each student gets a piece of paper and they draw 4 or5 concentric circles. They place themselves in the center. Identify sounds, smells, textures in the environment around them and geo-locate them on the map, add a symbol and/or label each.

PART 6: Reflection

1. In a circle have students take a minute to think about their time and the things they have done during nature studies. You may need to remind them.
2. Take turns sharing favorite moments. One way to structure this is 'rose, thorn, bud'. The rose is a favorite moment, a thorn is something that didn't go well, and a bud is something they are looking forward to.

Nature studies curriculum K-5 (2017)

Where do Animals Live?

Lesson Plan for Kindergarteners Winter

OVERVIEW & PURPOSE

The first session of nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea that animals have homes called habitats, and will practice using weather words stormy, windy, sunny, cloudy, or snowy.

EDUCATION STANDARDS

1. K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.
2. K-ESS2-2: Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
3. ESS3.A: Natural Resources (DCI): Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

OBJECTIVES

1. Students will make observations about the weather to make decisions about how to prepare for our time outside.
2. Students will observe animal habitats, questioning why an animal chose that location for it's home.
3. Students will recognize that animals choose where to live based on what they need (water, air, food, shelter material)
4. Students will gain an appreciation for the "outdoor classroom" and will understand what their behavior should be like while outside.
5. Students will understand that they are naturalists.

MATERIALS NEEDED

1. Science Journals, pencils

ACTIVITY

Introduction Session

<u>Part 1: Introduction/Warming up our senses (30-40 minutes)</u>

1. <u>Introduction:</u> Since this class is this group's first Nature Studies experience, a good way to begin a new journey is to have yourself and your assistant naturalist introduce Discovery Southeast as well as yourselves. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves. Tomorrow we'll be going to our "outdoor classroom" to practice being naturalists.
2. <u>Classroom activity:</u> Making Observations- Ask for a few volunteers to demonstrate the activity. Have one student stand in front of the room and have the class "observe" them. Take the student into the hallway and change 5 things about the student's appearance. Bring the student back in front of the class, class can give one change at a time. Now break the kids into groups, have them carry out this activity again. At the end, ask what SENSE did they use for this activity?
3. Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel?*
4. <u>Warming up our Senses:</u> Ask students if they know that they have *more* senses to help them make observations. See how many senses they can come up with on their own, write them up on the board with a picture of the body part. Now ask if they think animals have the same senses we do. See if they can help you come up with wild animals that have extra strong sight, hearing, smelling, touch, taste. We are now going to be a super wild animal and have the best of all their senses and go for a nature walk to our tree. Are you ready to smell like a polar bears, listen

like a caribou, see like a snowy owl, feel like an arctic fox. We're not going to taste anything except rain, or snow falling from the sky (do not pick up snow to eat).

5. <u>Attention Getter:</u> If it hasn't already been introduced, introduce attention getter and practice a few times.
6. <u>Dress for the weather:</u> Have students dress for a walk, reminding them to dress warmly. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at all times.
7. <u>Practice Walk:</u> Lead class out the door to the "class tree", everyone should be quiet with all their senses turned on full volume. Once at the tree, go through each sense: Become a scientist/naturalist. What senses can we use today?

   SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

   - TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
   - HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
   - VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

   * 1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the groups' attention to hear from individuals with hands raised.
8. <u>Observe the Tree:</u> Make observations about the tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder…" question about the tree. Make a prediction about what it might look like next time you see it.
9. <u>Walk back to classroom:</u> Let them know that tomorrow we're going to go for a longer walk, review what they need to wear.

Field Trip Session

1. Review: What did we do yesterday? How is today's weather different from yesterday? How is it the same? Today's trip will be slightly longer outside: did anyone feel cold? If you felt cold, what can you change about how you prepare to make yourself warmer?
2. Overview of today: Today we'll be thinking about where animals live, their "habitat". Have discussion about what their own homes are like?
3. Dress for the weather: Have students dress to go outside, double checking to make sure they will all be warm/dry enough to be outside for about an hour.
4. Warm up senses: Before leaving, remind students that when we go outside into nature, we want to warm up our senses. Who remembers what animals we're going to think of for each sense? *GO over each sense*.
5. Look for Animal Food: Ask students to look around for food for an animal, maybe a squirrel? Collect samples at a few different locations and put them in a big pile at each location. Which area has the most? Why?
6. Look for Animal Homes: Ask students to explore in an area where you've stopped as a group. Do you see any animal homes/habitats? Where would a bird live? Where would a squirrel live? Porcupine? Bear? Who might we find in these woods? If they haven't found a squirrel midden yet, guide them to one. Make observations as a group about the midden, where it's located, how big it is, etc. Prompt kids to think of "i wonder" questions. " I wonder why the squirrel chose this tree…" etc.
7. Naturalist Reminder: Remind students that by observing nature and creating I wonder statements, they are being naturalists!
8. Continue Walking: Walk for a bit, stopping at an obstacle where they have to share an observation before they can cross it if there is time.
9. Build a habitat (10-15 minutes): Stop at a location with lots of open space. Have students work in groups of 4 or 5 to create their own habitat for a miniature: *insert arctic animal here.* The animal should feel safe inside this habitat, and protected from the cold, is there water nearby? What will it eat? Have students share their habitats and thoughts with you, the assistant and the teacher, so that all groups are heard by at least one adult. OR Have students present to ½ the group, so that simultaneously the whole class is engaged in sharing, but they don't have to see EVERYONE's habitat.
10. Return to classroom: Use Journal to debrief field trip. Review what the weather was, what habitat they found, and what kind of habitat they created. Make an

entry in their science Journal. First, making observations about the weather. Then, draw an animal habitat, with labels indicating that they have the essential components of an animal habitat (water, food, shelter, air). Maybe an arctic animal or maybe an animal we saw on our trip?

Wrap-Up in Classroom -30 minutes

1. Bring in a bird's nest to show the kids. Who's is this? What's it made of? Is this a home? A Habitat?
2. Read a story- Not sure which one yet, some options are: Animals building homes- wendy perkins. welcome home, Bear by Il Sung Na
3. Connect the story to their experience, and let them know we'll see each other in the spring. Have kids make some predictions about what will be different about our next meeting. What will our tree look like? What will the ground look like? What will we be wearing to go outside?

What needs to eat?

Lesson Plan for Kindergartners Spring

OVERVIEW & PURPOSE

In the second session, students are introduced to the idea that things are living and non-living. Some things that are living need to eat, and some do not and make their own food.

EDUCATION STANDARDS

1. K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.
2. K-Ess2-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.
3. LS1.C: Organization for Matter and Energy Flow in Organisms: All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

OBJECTIVES

1. Students will make observations about the weather to make decisions about how to prepare for our time outside.
2. Students will look for signs of animal/plant interactions.
3. Students will recognize and understand that animals need to eat in order to be alive and that plants make their own food with water and sunlight.
4. Students will practice being naturalists in their outdoor classroom by being attentive and following behavioral guidelines set by the Lead Naturalist.

MATERIALS NEEDED

1. Science Journals, pencils

ACTIVITY

Introduction Session

Part 1: Introduction/Warming up our senses/visit our tree (30-40 minutes)

1. Introduction: This will be the students' second experience with Discovery southeast, so this should be review. Ask the students if they remember what a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves.
2. Classroom activity: Observations warm up: show two images side by side, and have them find differences. This is a review of our first observation game where we changed things about our own appearances. Quick matching activity: have photos of some animals that live here, and have some plants brought in from outside, have students match the food to the animal, this can be done in small groups of 3-4 students.
3. Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel?* This is repeat from Winter trip, so propose all these as review questions
4. Warming up our Senses: Ask students if they remember that they have *more* senses to help them make observations. See how many senses they can come up with on their own, write them up on the board with a picture of the body part. Now ask if they think animals have the same senses we do. See if they can help you come up with wild "arctic" animals that have extra strong sight, hearing, smelling, touch, taste. We are now going to be a super arctic animal and have the best of all their senses and go for a nature walk to our tree. Are you ready to smell like a polar bear, listen like a caribou, see like a snowy owl, feel like a arctic fox. We're not going to taste anything except rain, or snow falling from the sky.
5. Dress for the weather: Have students dress for a walk, reminding them to dress warmly. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at

all times.

6. Review our attention getter and practice.
7. Practice Walk: Lead class out the door to "class tree", everyone should be quiet with all their senses turned on full volume. Once at the tree, go through each sense: Become a scientist/naturalist. What senses can we use today?

   SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

   - TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
   - HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
   - VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

   * 1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the groups' attention to hear from individuals with hands raised.
8. Observe the Tree: Make observations about the tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder…" question about the tree. Make a prediction about what it might look like next time you see it. How is it different from last time we saw it?
9. Walk back to classroom: Let them know that tomorrow we're going to go for a longer walk, review what they need to wear.

Field Trip Session

1. Review: What did we do yesterday? How is today's weather different from yesterday? How is it the same? Today's trip will be slightly longer outside: did anyone feel cold? If you felt cold, what can you change about how you prepare to make yourself warmer/drier?
2. Overview of today: Today we'll be thinking about what needs to eat food. What do you all eat?

3. Dress for the weather: Have students dress to go outside, double checking to make sure they will all be warm enough to be outside for about an hour.
4. Warm up senses: Before leaving, remind students that when we go outside into nature, we want to warm up our senses. Who remembers what animals we're going to think of for each sense? *GO over each sense.*
5. Look for things that are alive: Ask students to look around for things that are living. Everyone touch something that is alive. How do you know it's alive? Does it need to eat? Does it have a mouth? Might something else eat IT?
6. Look for something that is not living: everyone now touch something that is not alive. How do you know it's not alive?
7. Naturalist Reminder: Remind students that by observing nature and creating I wonder statements, they are being naturalists!
8. Pretend you are a...: Announce different animals/plants. After animal is announced, have kids pretend to be that animal and find something to eat. Bring the food back to the middle and make a pile. Prompt kids to think of "i wonder" questions. "" etc. When a plant is said, students should stay in one place with their hands flat toward the sky to grow from the sun.
9. Continue Walking: Walk for a bit, stopping at an obstacle where they have to share an observation before they can cross it if there is time.
10. Game: Split into two groups for Plant/animal tag: Have 5 kids be deer, 3 be the sun. Everyone else is grass. Set boundaries. Deer tag grass, grass crouches down when tagged, sun tags crouched down grass to help it grow again. When explaining, have them make predictions about who tags what. How can the sun make the grass come back?
11. Return to classroom: Use Journal to debrief field trip. Review what the weather was, what food they found, what makes something alive etc.. First, making observations about the weather. Then, draw something alive, and draw what it needs to be alive (either food, or sun).

Wrap-Up in Classroom

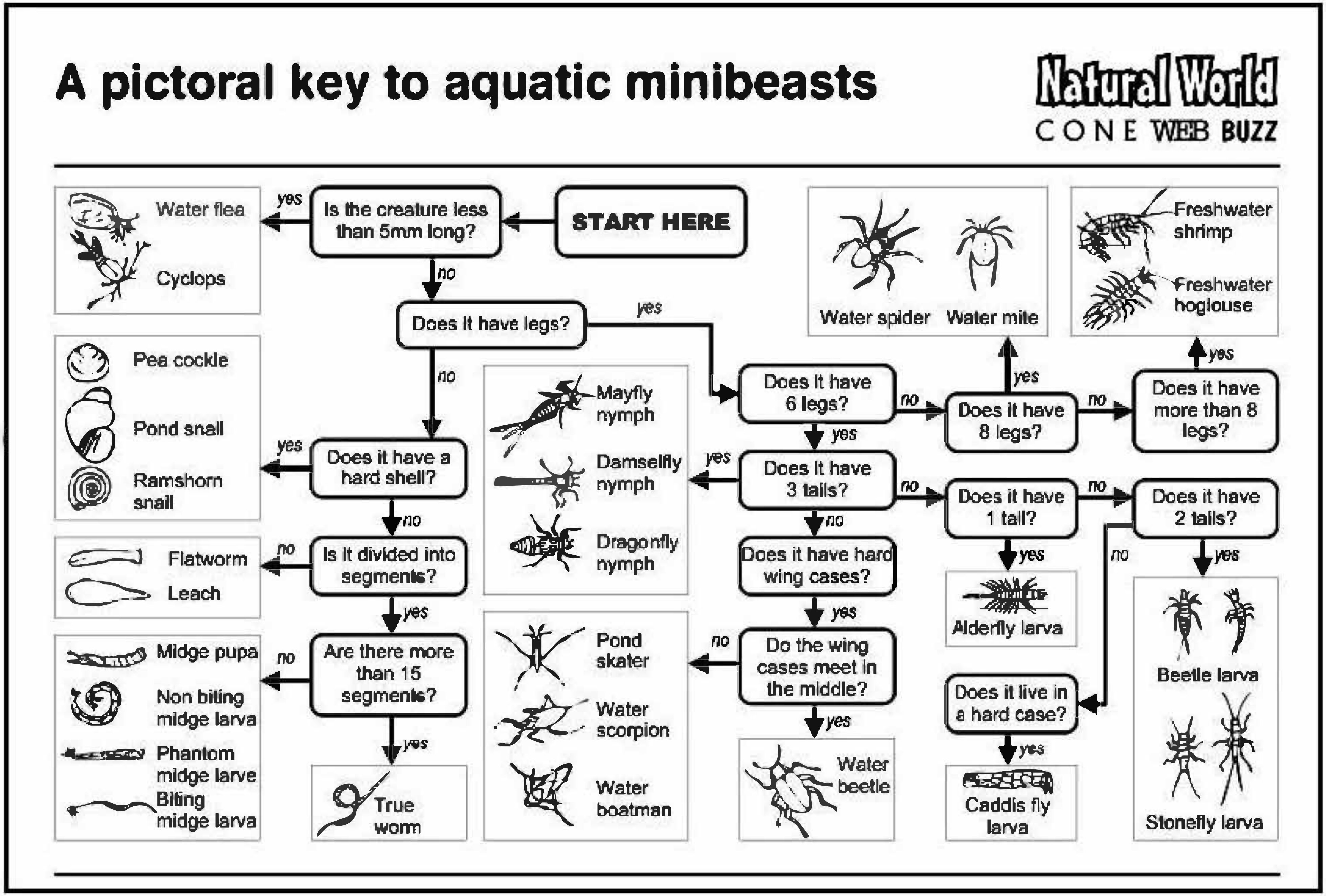
1. Read a story- Blueberry Shoe
2. Connect the story to their experience outside, maybe reviewing some of our local animals and what they eat.
3. Thank you and I look forward to being naturalists with you all next year in 1st grade!

Design a Bug

Name:______________________

Please use your imagination and create a new aquatic insect below.

Your aquatic insect should include: 1. six legs, 2. an exoskeleton, 3. three body sections 3. a way to breathe, 4. a way to stay on the bottom in fast moving water, 5. protection from predators, 6. a way to catch food 7. any extras! Please label your drawing with all of these things.


A pictoral key to aquatic minibeasts
Natural World
CONE WEB BUZZ
START HERE
Is the creature less than 5mm long?
yes
Water flea
Cyclops
no
Does it have legs?
yes
no
Does it have a hard shell?
yes
Pea cockle
Pond snail
Ramshorn snail
no
Is it divided into segments?
no
Flatworm
Leach
yes
Are there more than 15 segments?
no
Midge pupa
Non biting midge larva
Phantom midge larve
Biting midge larva
yes
True worm
Does it have 6 legs?
no
Does it have 8 legs?
yes
Water spider
Water mite
no
Does it have more than 8 legs?
yes
Freshwater shrimp
Freshwater hoglouse
yes
Does it have 3 tails?
yes
Mayfly nymph
Damselfly nymph
Dragonfly nymph
no
Does it have 1 tail?
yes
Alderfly larva
no
Does it have 2 tails?
yes
Beetle larva
Stonefly larva
no
Does it live in a hard case?
yes
Caddis fly larva
no
Does it have hard wing cases?
yes
Do the wing cases meet in the middle?
no
Pond skater
Water scorpion
Water boatman
yes
Water beetle

JOYFUL NOISE

Poems for Two Voices

NOTE

The following poems were written to be read aloud by two readers at once, one taking the left-hand part, the other taking the right-hand part. The poems should be read from top to bottom, the two parts meshing as in a musical duet. When both readers have lines at the same horizontal level, those lines are to be spoken simultaneously.

Grasshoppers	Grasshoppers
hopping	hopping
high	
Grassjumpers	Grassjumpers
jumping	jumping
	far
Vaulting from	
leaf to leaf	
stem to stem	leaf to leaf
plant to plant	stem to stem
	Grass-
leapers	leapers
Grass-	
bounders	bounders
	Grass-
springers	springers
Grass-	
soarers	soarers
Leapfrogging	Leapfrogging
longjumping	longjumping
grasshoppers.	grasshoppers.

Water Striders

Whenever we're asked	Whenever we're asked
if we walk upon water	if we walk upon water
we answer	we answer
	Of course.
To be sure.	
	It's quite true.

Whenever we're asked
if we walk on it often
we answer
Quite often.

All day through.
Should we be questioned
on whether it's easy
we answer

A snap.

Should we be told
that it's surely a miracle
we reply
Balderdash!

Nonsense!
Whenever we're asked
for instructions
we always say

and do as we do.

Whenever we're asked
if we walk on it often
we answer

Each day.

Should we be questioned
on whether it's easy
we answer
Quite easy.

It's a cinch.
Should we be told
that it's surely a miracle
we reply

Rubbish!

Whenever we're asked
for instructions
we always say
Come to the pond's edge

and then put down another,

Believe me, there's no call
at all to be nervous

But by that time our student
no matter how prudent
has usually

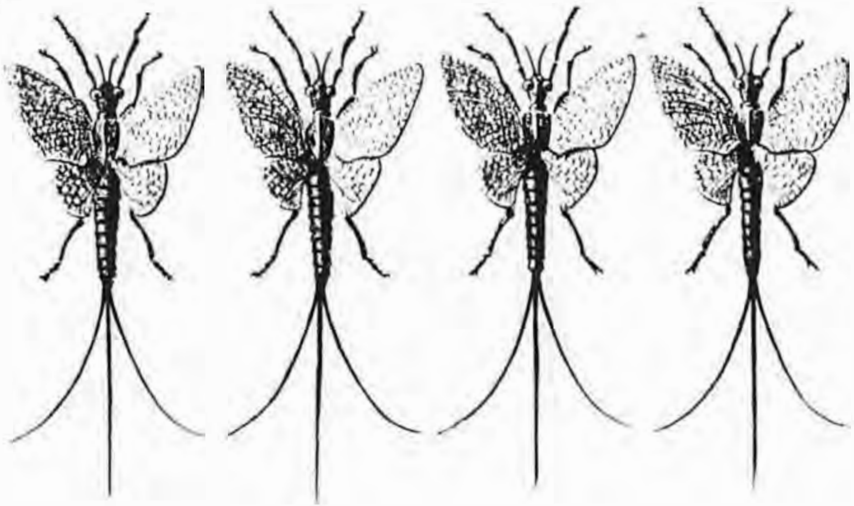
sunk from view.

Put down one foot

resting upon the thin film
on the surface.

as long as you're reasonably
mindful that you—
But by that time our student

has usually
don't ask me why
sunk from view.

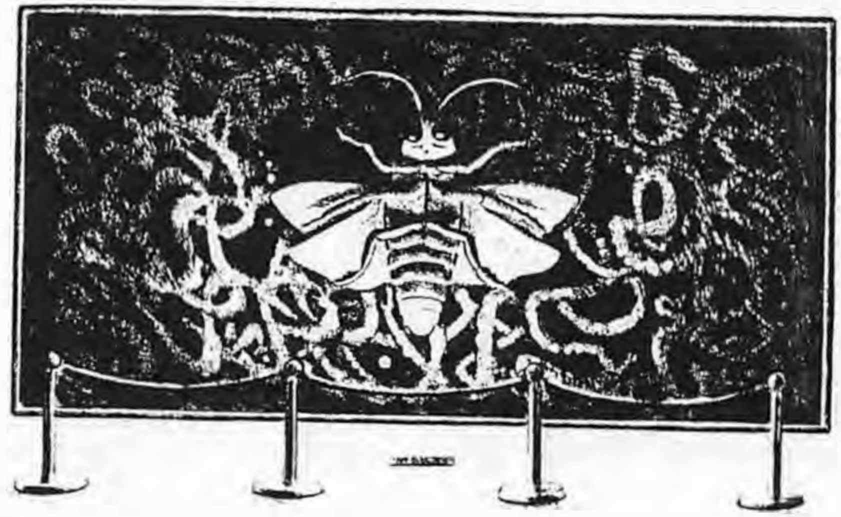


Mayflies

Your moment	
	Mayfly month
Your hour	
	Mayfly year
Your trifling day	
	Our life
We're mayflies	We're mayflies
just emerging	just emerging

rising from the river,	
born this day in May	
	birthday
and dying day,	
	this particle of time
this single sip of living	
	all that we're allowed.
We're mayflies	We're mayflies
by the millions	by the millions
fevered	
	frenzied
rushed	
	no redwood's centuries
	to squander as we please.
We're mayflies	We're mayflies
swarming, swerving,	swarming, swerving,
rising high	
	then falling,
courting on the wing,	
	then mating in midair.
We're mayflies	We're mayflies
laying eggs	laying eggs
our final, frantic act.	

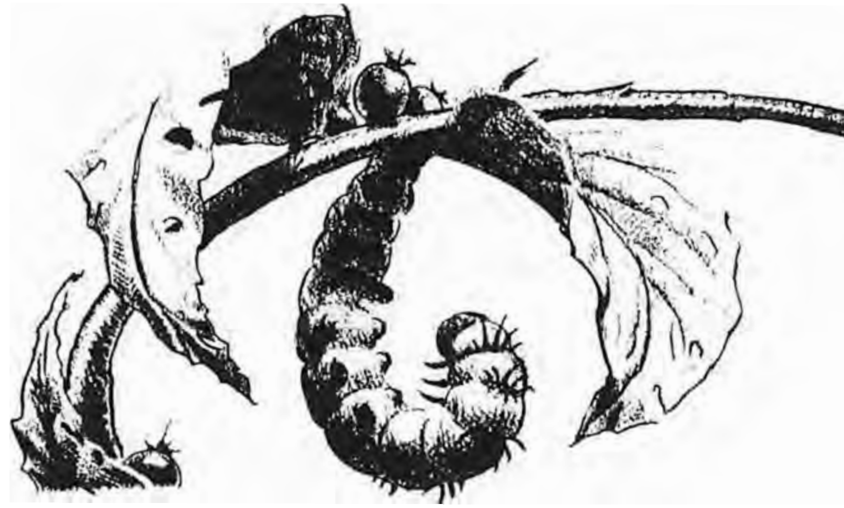
	Sun's low
light's weak	
	in haste we launch them
	down the stream.
We're mayflies	We're mayflies
lying dying	lying dying
floating by the millions	
	on the very stream
from which we sprung	
so very long ago	
	this morning
back when we were	back when we were
young.	young.



Fireflies

Light	Light
	is the ink we use
Night	Night
is our parchment	
	We're
	fireflies

No matter the month	No matter the month
we stay well fed and warm,	
	unconcerned about cold fronts
	and wind chill and storms.
For while others are ruled	For while others are ruled
by the sun in the heavens,	
	whose varying height brings
	the seasons' procession,
we live in a world	we live in a world
of fixed Fahrenheit	
crick-et	crick-et
	thanks to ***our*** sun:
our unchanging	
	reliable
steadfast and stable	
bright blue	bright blue
pilot light.	pilot light.



Chrysalis Diary

	November 13:
Cold told me	
to fasten my feet	
to this branch,	
	to dangle upside down
	from my perch,
to shed my skin,	
	to cease being a caterpillar
and I have obeyed.	and I have obeyed.

December 6:

Green,

the color of leaves and life,

has vanished!

has vanished!

The empire of leaves

lies in ruins!

lies in ruins!

I study the
brown new world around me.

I fear the future.

I hear few sounds.

Have any others of my kind
survived this cataclysm?

Swinging back and forth
in the wind,
I feel immeasurably alone.

January 4:

I can make out snow falling.

For five days and nights
it's been drifting down.

I find I never tire of
watching the flakes
in their multitudes
passing my window.

Astounding.
I enter these
wondrous events
in my chronicle

February 12:

Unable to see out
at all this morning.

and branches falling.

ponder their import,

and wait for more.

The world is now white.
Astounding.

knowing no reader
would believe me.

An ice storm last night.

Yet I hear boughs cracking

Hungry for sounds
in this silent world,
I cherish these,

miser them away
in my memory,
and wait for more.

I wonder whether
I am the same being
who started this diary.

like the weather without.

my legs are dissolving,

my body's not mine.
This morning,
a breeze from the south,
strangely fragrant,

a faint glimpse of green
in the branches.

March 28:

I've felt stormy inside

My mouth is reshaping,

wings are growing
my body's not mine.

a red-winged blackbird's
call in the distance,

And now I recall
that last night
I dreamt of flying.

Nature studies curriculum K-5 (2018)

What can we learn from the trees in the Tongass?

Lesson Plan for 1st Grade Autumn

OVERVIEW & PURPOSE

The first session of nature studies is focused on getting the students confident when exploring outside, understanding how to be prepared and safe, and practicing making observations and asking questions. They are also introduced to some of the different trees found in our rainforest. After getting to know the trees a bit, students will be asked to take notice of some adaptations that the trees here have, and consider how an understanding of those adaptations can help people.

EDUCATION STANDARDS

1. 1-LS1-1: Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
2. LS1.A: Structure and Function: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

OBJECTIVES

1. Students will practice learning in the outdoor classroom by following behavioral guidelines and uses their senses.
2. Students will practice the basics of the scientific process using observations to ask questions and then make predictions.
3. Students will learn about some of the trees that grow in the temperate rainforest

and a few of the adaptations that help them survive and thrive.

4. Students will gain experience creating a scientific drawing based on what they observe including labels.
5. Students will design a paper structure that can remain standing in simulated wind based on what they have learned about the parts and adaptations of trees.

MATERIALS NEEDED

1. "Salmon in the Trees"
2. "Tongass; the Last American Rainforest"
3. DK Eyewitness Books: Tree
4. Prepped sheets of paper for the "trees"
5. Books or desks to hold "tree roots"
6. An outdoor long measuring tape to quickly mark out the height of a tree
7. Write in the Rain Paper
8. Paper/Science Journals and pencils

ACTIVITY

Introduction Part 1: 30-40 minutes

1. Introduction: Since this class is this group's first Nature Studies experience, a good way to begin a new journey is to have yourself and your assistant naturalist introduce Discovery Southeast as well as yourselves. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves. Tomorrow we'll be going to our "outdoor classroom" to practice being naturalists.
2. Write up on the board the sentence, "There are salmon in the trees." Let them know that we are talking about salmon being inside, or a part of trees, not hanging in them. Ask kids what they think about when they read that. What does it make them wonder? Encourage them to keep asking questions and let them know that we are going to "leave the question "raw" for now, but we will get back to it. For this first session of nature studies, we are going to be thinking about trees -

specifically some of the amazing trees that make up our temperate rainforest, called the Tongass, here in Juneau. - 5 minutes

3. Classroom Activity: A Daa Yaneisa Look closely at tree ring discs. Spread out tree ring samples on tables and have kids get out their science/sketch notebooks and a pencil. Choose a tree ring sample to look closely at and draw what you see. Now look even closer, find new details to add (possibly show examples of naturalist sketches of tree rings). Practice using "I notice" and "I wonder" sentence stems. This would also be a good time to show an example or two of art/drawings by adult naturalists of other tree ring samples for inspiration. - 15 minutes
4. Read a book or a selection from a book. Talk about how salmon get in the trees. First find out if they have any ideas. Then talk about how bears and other animals carry salmon far from the streams where they spawn, and often only eat part of them, or eat them and then digest them and turn them into scat. In either case, the salmon bring with them a special type of an element called Nitrogen 15 from the ocean. The soil here is actually really poor in nitrogen, but with the help of all those decomposing salmon, our forest can get the nitrogen it needs to grow our enormous trees. Since scientists can take samples of tree rings and look REALLY closely at them and find this Nitrogen-15 (that comes from the ocean), we can truly say that here in Juneau there are salmon in the trees. - 10 minutes
5. Preview Tomorrow: Let kids know what that tomorrow we'll be going for a longer walk.   Was anyone cold on our short walk yesterday? Wet? Everyone should have boots, rain gear, and warm layers for tomorrow. - 5minutes

Field Trip Session (approximately 1.5 hours)

1. Dress for outside: Have students get ready to go outside. - 10 minutes
2. Warming up senses: Have them turn on their senses before you leave the classroom so that they are walking very quietly in the hall.
3. Walk to the trailhead and "knock on the door." Since this is the first session of Nature Studies for this grade, you will need to fill them in about what it means to knock on the door, why we do it, and how it can help us. - 20 minutes
4. Begin the Hike: Head deeper into the woods. Divide kids into groups of two or three. Can they find a tree that is too large to wrap their arms around when they are holding hands? What about one that is just right? Can they find a tree that fits their own arms just right? What about a teeny tiny one? While they are looking at a teeny tree, it is a great time to draw their attention to the similarities between this tiny tree, and a larger "parent" tree nearby. "How can you tell, even though this tree is much smaller, that it is a "baby" of one of these big ones?" - 10 minutes

5. Meet a Tree: In small groups with one adult (ideally less than 4 kids per adult) have kids close their eyes, safely lead them to a tree and have them explore it with their hands. ANy sort of exploration without their eyes is okay. This should be a quiet activity, no more than whispers. The adult will safely lead them (holding hands will probably be best) to and from the tree. When the group has returned to the starting point, the students can try to find their tree.
6. Find a tree to love: Now have students spread out in the area and find a tree to love. Spend some time looking at it. What makes it special? How would you describe it to someone else? What animals/creatures might make this tree a home? Now hand out write in the rain paper to students and have them do a sketch of their special tree, or just a part of their tree (if they like). Be sure to have them take their time. -15-20 mintes
7. Walk a tree height: To give kids a better idea of just how tall the trees really are in the Tongass, ask one child to stay in one spot and be the base of the tree. Pace out a distance that is roughly equivalent to the height of a tree that they might see walking through the forest (approximate average heights for our area: hemlock-right around 100 feet, spruce- about 120 feet) and have kids spread themselves out along the "trunk." Take marvels, noticings, and wonders. Remind kids that trees are like people, every single one is different, and so this just gives us a general idea of how huge these trees really are! - 10-15 minutes
8. Build a Tree: *** Extra activity could be done in classroom: Act out the different parts of a tree. Heart wood, bark, roots, leaves, branches (maybe phloem and xylem?)
9. Walk back to classroom, paying careful attention to all these lovely trees! Take time along the way to help students learn to identify hemlock, spruce, and yellow cedar. - 15 minutes

Wrap-up (40 minutes):

1) Review/Remember: Review what we did on our field trip. We probably saw hundreds of trees yesterday. What keeps them standing in a strong wind? If I leave a lawn chair out in the driveway on a windy day, it will blow over. You guys have all heard the wind howl here, especially in the winter. Some trees come down, but most stay. How do they do that? Discuss. Now let's go see if we can test some of our ideas. - 5-10 minutes
2) Activity: Have students work together in groups to try and figure out how to keep a paper tree from falling over in a wind. Quickly demonstrate how to construct a "tree" out of paper and have kids use a flapping hardcover book as the "wind" to

see if their tree will remain standing. For our purposes, a “tree” can be constructed using a sheet of notebook (or similar) paper torn in half, widthwise, Each sheet should be aproximately 8.5”X5.5”. Twist up the paper tightly, similar to a fire starter, flattening and squooshing the bottom enough to make the “tree” stand. Now have students use their book to GENTLY create some wind to see if their tree will remain standing (the creation of wind can also be done by an adult if it looks to cause a management issue with a particular group). When it doesn’t, see if children can think about what else trees have that enable them to stay standing in the wind. Head towards the understanding that trees are capable of withstanding wind for two reasons:they bend so they don’t break, and their roots ground them deeply into the earth, holding them fast. Have students now attempt to fashion another “tree,” but instead of squooshing the bottom, have them leave the paper flat and whole or in wide strips and place that part between two big books or desks as “roots” to demonstrate how a tree can then hold fast. The trees can also now be tried side-by-side with the same amount of wind. After the experiment, make sure to mention that trees have one other awesome adaptation they use. They have learned to flex and bend with the wind. Because they do not stay rigid, they are less likely to break in a strong wind. - 20-30 minutes

3) Review our original statement of “There are salmon in the trees.” Who remembers what this means? What do kids think about this now?
4) Goodbye: Here, a parallel can be drawn, if you like, between trees and also our need as people to be grounded/rooted, and flexible as well. :) Let them know we’ll be back together in the winter for another Nature Studies field trip. Thanks, and we’ll see you soon! - 5-10 minutes

How does daylength change the way things live?

Lesson Plan for 1st Grade Winter Nature Studies

OVERVIEW & PURPOSE

The first session of nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea that the patterns in the sky change how plants and animals live.

EDUCATION STANDARDS

1. 1-ESS1-2: Make observations at different times of year to relate the amount of daylight to the time of year.
2. 1-ESS1-1: Use observations of the sun, moon, and stars to describe patterns that can be predicted.
3. LS1.D: Information Processing: Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to external inputs.

OBJECTIVES

1. Students will be comfortable following behavior guidelines for the outdoor classroom.
2. Students will be comfortable with the process of making observations and asking questions in the outdoors and understand that they are all naturalists.
3. Students will recognize that patterns in the sky like daylength/nightlength affects how animals and plants behave/grow.
4. Students will try to predict what sky patterns we can expect to see in spring.

MATERIALS NEEDED

1. Science Journals, Pencil

ACTIVITY

Introduction Session

PART 1: Classroom visit 1: 30-40 Minutes

1. Introduction: Since this class is this group's first Nature Studies experience, a good way to begin a new journey is to have yourself and your assistant naturalist introduce Discovery Southeast as well as yourselves. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves. Tomorrow we'll be going to our "outdoor classroom" to find out what animals and plants do in the winter time.
2. Classroom Activity: Let kids know that naturalists pay attention to all kinds of things in nature, from flowers, to weather, even to daylight. Ask students to close their eyes if they like and imagine summer, not in a book or movie, but in Juneau. After they have had a bit of thinking time, ask them to share some of their images, and record them on the board under the heading "Summer in Juneau". After they have shared, do the same for "Winter in Juneau". Have them each illustrate their favorite two ideas of summer/winter differences on a large piece of paper folded into quarters, folding the bottom under so that it remains blank. Collect the drawings and gather students together to read a book that demonstrates the change in light during a year in Alaska "Welcome to the Icehouse" is a good one, although it should be mentioned that Juneau has big changes in light, but not quite this dramatic. Another story to consider is "dear rebecca, winter is here". When the book is finished, ask students if they noticed anything different about the illustrations. If they don't notice the change in daylight, this should be hinted at until noticed. Tell kids that tomorrow we will talk about why this change happens, and how plants and animals are affected by it.

Part 2: Classroom Visit 2: 40 minutes Practice field trip to class tree

1. Classroom activity: Making Observations- Ask for a few volunteers to demonstrate the activity. Have one student stand in front of the room and have the class "observe" them. Take the student into the hallway and change 5 things about the student's appearance. Bring the student back in front of the class, class can give one change at a time. Now break the kids into groups, have them carry out this activity again. At the end, ask what SENSE did they use for this activity?
3. Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel?*
4. Warming up our Senses: Ask students if they know that they have *more* senses to help them make observations. See how many senses they can come up with on their own, write them up on the board with a picture of the body part. Now ask if they think animals have the same senses we do. See if they can help you come up with wild "arctic" animals that have extra strong sight, hearing, smelling, touch, taste. We are now going to be a super arctic animal and have the best of all their senses and go for a nature walk to our tree. Are you ready to smell like a wolf, listen like a _____, see like a _____, feel like a ____. We're not going to taste anything except rain, or snow…
5. Attention getter: If it hasn't already come up, introduce attention getter and practice a few times.
6. Dress for the weather: Have students dress for a walk, reminding them to dress warmly and to stay dry. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at all times.
7. Practice Walk: Lead class out the door to the "class tree", everyone should be quiet with all their senses turned on full volume. Once at the tree, go through each sense: Become a scientist/naturalist. What senses can we use today?

SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to

where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

* 1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the groups' attention to hear from individuals with hands raised.

8. Observe the Tree: Make observations about the class tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder…" question about the tree. Make a prediction about what it might look like next time you see it. Why aren't there any leaves? Link to daylight.
9. Walk back to classroom: Remind kids about tomorrow, dress warmly, wear boots, gloves, hats, etc.

Field Trip Session

1. Review: What did we do yesterday? How is today's weather different from yesterday? How is it the same? Today's trip will be slightly longer outside: did anyone feel cold? If you felt cold, what can you change about how you prepare to make yourself warmer?
2. Overview of today: We will be going for a walk to the woods, looking for animals and plants
3. Dress for the weather: Have students dress to go outside, double checking to make sure they will all be warm enough to be outside for about an hour.
4. Warm up senses: Before leaving, remind students that when we go outside into nature, we want to warm up our senses. Who remembers what animals we're going to think of for each sense? *GO over each sense.*
5. Exploration Time: Say to students, "Let's go see if we can get a peek at what a squirrel's life might look like this time of year." This could be substituted for another animal at the field trip location, and then should be followed up by several others animals. Make sure to be following up students' observations by asking them why they think that is true right now.
6. Game: Play camouflage. This game has a child acting as the predator in the middle of a wooded area. Explain to students that colder temperatures in the

winter means that animals have to conserve as much energy as possible. In the case of a predator, like a great-horned owl, that means that they spend lots of time watching. In this game the "prey" scatter among the area surrounding the owl, while the owl counts to 25 slowly with eyes closed. The thing that is challenging is that they need to hide in plain sight - they have to be able to see the owl from their hiding spot. The owl then calls in anyone they can spot without leaving their designated landing spot. When they have carefully looked and can't spot anyone else, call the rest of the students in. It is surprising how close some will be without being detected. Have a quick conversation with the class- what made some people harder to spot? Cover, camouflage and stillness can be introduced and discussed before the game is played again with a new owl.

7. Continue Walking: Walk for a bit, stopping at an obstacle where they have to share an observation before they can cross it
8. Activity: Changing daylength. Have students get into character as little squirrels in summer time. Have them imagine it's a warm summer day and the day is SOO long. Give them 4 minutes to collect as many spruce cones as they can for their cache. Once time is up, regroup and describe the changing season to fall (have them help describe the changes) have a minute of "rest", then give them 2 minutes to collect spruce cones then 2 minutes "rest" (darkness). Transition into winter, less daylight, 1 minute with "3 minutes rest" . Spring back to 2 minutes.
9. Return to classroom: Use Journal to debrief field trip. Review what the weather was, and what observations we made. Make an entry in their science Journal. First, making observations about the weather, then about what animal signs they found.

Wrap-Up in Classroom

1. Activity: Have students finish the bottom 2 quadrants of their paper they started at the first class session. They should choose one of the animals that was observed on the field trip. First complete the winter quadrant, and then have them make a hypothesis about what that animal's life would be like in the summer and illustrate it, adding labels or writing if they wish.
2. Demonstration: Use kids and a flashlight to demonstrate how the light changes during the seasons in the center of a circle so everyone can see. Give them time to come up with their own way of modeling this with objects in the classroom.
3. Make predictions: What will we see on our next trip? What will our class tree look

like? What clothes do you think we'll be wearing? Reference the story book.

4. Thank you: We will see you in spring!

What sounds does nature make?

Lesson Plan for 1st grade Spring Sound Studies

OVERVIEW & PURPOSE

The second session for 1st graders, they are introduced to the sounds found in nature and how animals have different shaped ears to help their hearing.

EDUCATION STANDARDS

1. 1-PS4-1: Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
2. 1-PS4-4: Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
3. LS1.A: Structure and Function: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects etc.

OBJECTIVES

1. Students will use their sense of hearing to focus on sounds found in nature.
2. Students will discover ways they can improve their own hearing by changing the shape of their ears to be more like animals with good hearing.

MATERIALS NEEDED

1. Science Journal and Pencil
2. Paper to make cones out of
3. Photos of animals with big ears/good hearing
4. Bird songs on cd/computer

ACTIVITY

Introduction in Classroom: (30-40 minutes)

1) Introduction/Recap: This will be the students' second experience with Discovery southeast, so this should be review. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided to find their own answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves.
2) Lesson Subject Intro: Try to get the students to practice being quiet in the classroom: "hunt the silence" Is there anything that makes noise all the time? Have kids close their eyes, while lead, assist, and teacher make sounds using different things around the room. Students are instructed to only point to the object not share what they hear. Play some bird songs that we will likely hear on our trip. Have kids draw the song, then have them act it out. Practice a few times, and maybe see if they can guess which bird is singing.

3) Classroom activity on sounds: Teach them what a sound map is. Demonstrate on the white board (projector would be best, so naturalist could stand in middle of the room to demonstrate). We'll be making one of these tomorrow on our field trip. Just like you drew those bird songs, you can draw what you hear, or you can try to write the word.
4) Testing Ear Shapes: Show photos of animals that have a good sense of hearing. What do their ears look like compared to our own. Is there anyway we can *improve* our hearing? Invite them to try some different techniques. Have them make a prediction about a technique and then test it. When making the prediction, take a vote by show of hands and write it on the board, then test it. For example: If I were to make a dome with my hands over my ears, who thinks I could hear something better? (count hands) worse? (count hands). Then test: Making a dome over ears with hands say a silly phrase at a normal volume while they have their hands over their eyes (control) then with domes over their ears. Do a recount of results. This is science! Test some other options:, using hands for "deer ears" facing forward and facing backward. Could we make something with this piece of paper that would improve our hearing? Try to get them to come up

with some ideas to test. If they haven't already, show a cone shape.

5) Wrap up/Preview of tomorrow: When we go outside tomorrow, we're going to be focusing on sounds that we hear and ways we can hear more sounds. We'll be making a sound map, and practicing our naturalist skills that we used last field trip. Review what they need to bring tomorrow: warm clothes, boots, rain gear etc.

Field Trip: 1.5-2 hours (longer hike)

1) Review what we'll be doing today as Naturalists: Get ready to go outside, walk to a good spot in the woods, make a sound map on our own, try different ways to hear better, play a game, and hike back. Any Questions?
2) Rules when walking: when walking on sidewalk, you should be paying attention and stay with the group… Rules for being in the woods: no rocks, no sticks, review attention getter. This is our "outdoor classroom", listening/paying attention is still important.
3) Dress for the weather: Discuss weather, what do we need to wear today? Make sure students are properly dressed before leaving classroom.
4) Stop by Class tree?: If time, make a quick stop at the class tree: Become a scientist/naturalist. What senses can we use today?

SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

* 1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the groups' attention to hear from individuals with hands raised.

5) Observe the Tree: Make observations about the tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder..." question about the tree. How does it look different from last time we visited it? Make a prediction about what it might look like next time you see it.
6) Get going on sidewalk/Group Scavenger hunt (harborview esp): Have smaller groups assigned to adults with a list of things we're looking for on our way to "our spot" Kids report to the adult once they've found various things: a flower, a tree taller than a building etc.
7) Sound Map: Once in the woods at our spot, place kids individually on a square mat around and have them begin their sound map once everyone is placed. ~5minutes.
8) Activity: Split into two groups, assistant and lead each taking a group. First, lead deer ears: Have kids take a minute or two to decide what style ear adaptation they want to test, they can use natural materials or their hands. Have them sit in a line, walking backwards from them while reading a story, have them raise their hand when they can't hear you anymore. Mark your spot. Have them use their test ear, and repeat walking backwards. Have them write down what they made and if it helped their hearing or not. Second, do "nature band". What sounds can we make with the materials found in nature? Let kids explore for a few minutes finding different ways to make sounds. Then try to get students to play together to sing a song?
9) Game: Bat moth. Has anyone seen a bat before? They have really good hearing, and can find moths with just their ears, since they are generally flying when it's dark out. Echolocation. We're going to pretend to be a bat and a moth to test our hearing. Select a bat, blindfold them. Have the rest of the kids form a circle holding hands to keep the bat and moth inside. The bat claps, and the moth claps back. Taking turns to get everyone a chance to be bat or moth in two or three groups (if teacher can lead one group) should take 15-20 minutes.
10) Get back into our senses for Hike Back to classroom.

Wrap Up

1) Recap what we did on our field trip by making a science journal entry. Have them write about what the weather was, and what ear shape worked the best to improve their hearing.
2) Read a story about nature sounds or bats?
3) Thank students for participating in Nature studies, and we'll see you next year when you're in 2nd grade!

How can plants tell us about animals?

Lesson Plan for 2nd Grade Spring

OVERVIEW & PURPOSE

The second session of nature studies in 2nd grade is focused on plant/animal interactions, specifically looking for signs of those interactions in the form of pollinators/seed dispersers.

EDUCATION STANDARDS

1. 2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.
2. LS4.D: Biodiversity and Humans: There are many different kinds of living things in any area, and they exist in different places on land and in water.

OBJECTIVES

1. Students will understand that plants and animals interact.
2. Students will gain experience collecting data as part of the scientific process.
3. Students will understand that animals rely on plants for food.

MATERIALS NEEDED

1. Science Notebooks, pencil
2. Tubs, filled with spruce cones to bring into classroom

ACTIVITY

Introduction in Classroom: (30-40 minutes)

Part 1:

1) **Introduction/Recap: This will be the students' second experience with Discovery southeast, so this should be review. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves. Recap our last trip together. What did we see? Where did we go? What did we learn about our world? Introduce our topic by asking the essential question.**

2) **Classroom activity: Bringing in tubs of spruce cones in varying levels of having been eaten. Discuss spruce cones and where they come from. Who's eating these cones? Talk about red squirrels, what are they eating? Have students in table groups count how many total spruce cones there are, how many have been eaten completely, how many have been eaten a little bit, and how many haven't been eaten at all. Then graph their findings. What does this mean?**

3) **Read a story: Flowers are calling- rita gray**

4) **Preview of tomorrow: Tomorrow we will be doing a very similar thing out in the woods. We will be looking for signs of animals by looking at plants, especially looking for pollinators. What do you need to wear to go out on a field trip? Coat, boots, etc…**

Field Trip

1) **Review what we did yesterday. Yesterday we practiced taking information from what we see and writing it down. Today, we're going to do a similar thing, but outside.**
2) **Dress for the weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather?** *Touch*. **When you came to school today, how did the weather** *feel?* **How should we dress for this?**
3) **Warm up senses: Ask students to name our other senses that we'll be using outside.**
4) **Become a scientist/naturalist. What senses can we use today?**

SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
- VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

* 1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the groups' attention to hear from individuals with hands raised.

5) Head out on trail
6) Arrive at our "outdoor classroom" and begin looking for signs of animal/plant interactions. Allow a few minutes for free exploration, find a sign of an animal and show it to a friend or an adult, but let's leave things where we find them for the next class.
7) Data: Find an area with some skunk cabbage. As a group, formulate some questions about what you see. Why are there skunk cabbage here? What animals like skunk cabbage? Can we see any signs of those animals?If skunk cabbage is accessible: find some skunk cabbage, look for signs of grazing. Use a rope to create "plots for three groups of students to do some counting. Splitting group into at least three groups, assistant, lead, and teacher each being responsible for one group. Count skunk cabbage in the area and count how many have been nibbled on and how many have flies on the flowers. Write it down for later. This could also be counting flies on the flower stalks... it depends on what's there.Or look for other budding plants, most likely new leaves. Any munched on leaves?
8) Game: Walk to a clear place: Deer, grass, sun tag. Split into two groups, set boundaries. In instructing the game of deer, skunk cabbage, sun tag have them figure out what tags what. Deer tags skunk cabbage, they crouch down until a sun tags it and it regrows. Deer can't tag sun. WIth about 12 kids, having three deer

and two sun works pretty well. After game: why did we play that game? OR: Pollinator Tag: Most kids will be flowers, with a paper with their name on it as their "pollen" when they get tagged by a pollinator, they have to give their pollen to the pollinator. If the pollinator already has a pollen, they give it to the flower, and the flower can then make a fruit and stop running, and crouch down. 3 pollinators will probably be enough. At the end, we can look at where names ended up, everybody is mixed up, right?

9) Quiet Walk: End our time in the outdoor classroom with some quiet walking, spread out, no one should be near another person, make one observation, and when you make it to the end of the quiet stretch, share it with me, or the assistant naturalist.
10) Hike back: Continuing with a quiet tone: have students tune into their senses for the walk back, how does the trail look different on the way back to school. Can you find anything new?
11) Science Journal: write down something about our trip in your science journal?

Wrap Up

1) Data processing:Looking at numbers that we collected, what can we learn about skunk cabbage? Make a graph or some sort of visual representation of what we found and counted.
2) Discussion: Why are flies attracted to Skunk cabbage? A look at other pollinators to keep an eye out for, birds, bees, moths, etc. As more flowers bloom in spring,
3) Naturalist Challenge: I challenge you all to observe a pollinator this spring and summer and to teach someone else about why pollinators are important.
4) Thank you all for being part of nature studies this year, I hope you all get the chance to use your senses in the outdoor classroom before your 3rd grade nature studies.

Navigating Our Forest

Lesson Plan for Grade 3, Discovery Southeast

Prepared by Kate Cruz

OVERVIEW & PURPOSE

Students will gain an appreciation for the characteristics of forest life and develop a relationship with a local ecosystem and basic skills to orientate themselves to place.

NGSS STANDARDS

1. 3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
2. 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.
3. 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

OBJECTIVES

From this lesson, students will be able to:

1. Define habitat, adaptations, understory, ground cover, midstory, and canopy.
2. Explain how animals adapt to their environment.
3. Demonstrate an understanding of how animals change their environment.
4. Create a model using magnetism to meet human needs.

Intro	Field	Wrap-Up

• Woodland charades
• Forest profile
• Mystery Animal
• Gallery Walk
• Navigating like a porcupine
• Forest agreements
• Navigating like a human (compasses)
	• Capture the flag: s'eek vs xalak'ách'
	• Mystery object: touch
	• Camera
	• Stations
	  ○ Observations as a porcupine
	  ○ Compasses
		• Video/recap
		• Think-Pair-Share
		• Interpreting Graphs
		• Aas Kwaanee

MATERIALS NEEDED

Classroom

- Tlingit Animal Cards HERE
- Mystery animal clue description
- Compass materials (enough for each pair...1 cup, 1 magnet, 1 needle, 1 piece of wax paper)
- Class set of directional compasses
- Accompanying slides HERE

Who Am I? (10 mins)

Students are randomly handed one of the animal cards each and told to keep their card a secret. Ask for volunteers to come "strike a pose" of their animal, and allow 7-8 seconds to guess. If needed, encourage the student to add a motion to help their class guess. Finish by allowing entire group to strike their pose.

Forest Profile

If we were to look at the forest like a slice of cake, where would your mystery animal fit into the different layers? (slide 2)

Mystery Animal (10 mins) X̲alak'ách'

Sometimes naturalists need to use clues from the forest to figure out the whole story. We can use tracks, scat, dens, and other evidence to find out more about animals, even the ones we can't always see.

It's time for you to use your imagination to draw the mystery animal based on just 5 clues. You can draw a real or fake animal, but it needs to have the following parts.

- Body armor
- Long, continuous growing teeth
- Night vision
- 8 fingers and 10 toes with claws
- Magical skin

If you get done early, you can add in elements of a habitat, where this animal would live or labels for the different body parts.

Art Gallery Walk (5 mins)

- Take a walking tour of everyone's mystery animal drawings.

Knowing Your Way Around the Forest

- (slide 3) Porcupines can navigate their surroundings, day or night. The trails they make are a consequence of visiting the trees they choose to use in a winter dening site, but they do not need the trails to find home. Although they no doubt use a combination of smell, touch, and sight, porcupines have been found to have an incredible memory. In experiments, mazes could be rotated and tilted to confuse the porcupine, and even after 100 days passed, they could still find their way with great accuracy.

- Porcupines are prevalent in Tlingit stories and artwork, helping Raven to shape the seasons and creating grooves in tree bark.

Forest Agreements (5 mins)

Since we'll be visiting the home of the porcupine and other animals, let's agree on the way we will act.

- Humor
- Respect for self, elders and others

Compasses (15 mins)

- Porcupines may be using an internal sense of direction to navigate their habitat, what do we use?
- Make class set of model compasses
- What are some of the problems with our model?

Field Study

Reminder of Field Agreements (10 mins)

- Humor
- Respect for self, elders and others
- Taking care of basic needs (snack, water, bathroom break before leaving)

Hike to Behrend's Slide (15 mins)

S'eek & Xalak'ách' (20 mins)

- Capture the Flag at bottom of hill
- Set up a xalak'ách' den (tarp) that the s'eek (black bears) are standing guard in front of, assign about 5 s'eek to protect the den, the rest are xalak'ách' trying to get their "food" (bandanas) to the tarp without getting tagged. If they do get tagged, they have to freeze. Another color bandana can be used as an unfreezing bandana by a teammate, if that person is tagged, they should drop the bandana so someone else can pick it up.

Cueing into Our Senses (5-10 mins)

- To settle back down after capture the flag, pick a natural object to be passed around the circle with eyes closed. Students will use sense of touch to guess the mystery object. **Note: Alder catkins work well for this game

Camera (10 mins)

- Pair up, help your partner find beauty in quick snapshots as you go up the hill
- Be sure to take one picture of the ground cover, one of the understory, one of the mid-canopy, and one of the canopy.

- Can anyone find the eagle's nest?

Station Rotation (20-30 mins each) x2

- Spruce Tree Group: Find their special spot, read Roald Dahl poem about a porcupine, create a sound map, and 7 observations from the perspective of a porcupine. Walk back up to switch groups.
- Top Group: Compass skills (intro, reminder of how xalak'ách' orientates to forest, bezel ring, direction of travel arrow, other parts, practice finding 4 cardinal directions as a group)
- Hand out direction cards (all the same for the class) and let them know they need to freeze wherever they end up so we can see who gets "closest to the right spot" **note: the end is exactly where they started.
    - Walk 15 paces North.
    - Walk 30 paces West.
    - Walk 60 paces South.
    - Walk 45 paces East.
    - Walk 45 paces North.
    - Walk 15 paces West.

Conclude together about what to do if they get lost in the woods.

Hike Back to School (10 mins)

Debrief

Field Re-cap (5 mins)

Show highlight video.

Think-Pair-Share:

- What surprised you on the trip?
- What do you want to learn more about?

Have a student summarize what they noticed about the forest when viewing it from the perspective of a porcupine? IE: The thickness of the trees, the sounds during the sound map, and looking up and down the layers of the forest.

Remembering the Four Cardinal Directions

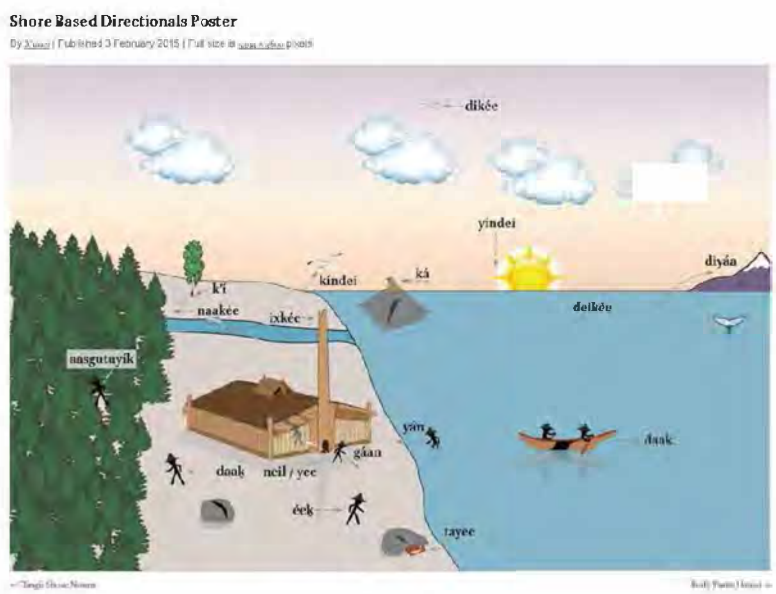
Remember how we learned about the different parts of the compass? We're going to think about the four directions, N, S, E, and W again.

Play quick round of cardinal direction/four corner game identifying each corner as it's relative direction. Like musical chairs, students pick a corner to go stand in, pick someone to be your compass needle, spin them around and where they end up pointing is the direction/group that has to come back to sit down. Play until there is a winner.

Intro to Tlingit Navigation

Magnetic compasses and the four cardinal directions are the only way people have learned to know their away around the land. In fact, compasses are uni-directional, meaning they mostly give us information about where we want to go, but not always where we have been.

Tlingit navigation oriented to place by using language regarding to and from the sea. Naakée, traditionally meaning upstream (like a salmon would swim) has now become a reference to North as well. Ixkée, downstream or South.



Students can draw a map to remember their hike that includes important or memorable landscape features, activities we did, and use of the four cardinal directions and/or Tlingit directions.

Beaver and Porcupine Story

Finish with the Tsimshian beaver and porcupine story.

We will be learning about beavers next, and how their unique adaptations help them to shape their environment more than any other animal in the world.

Hibernate, migrate or deal with it

Lesson Plan for Grade 3, Nature Studies WINTER

Prepared by Abby Hines

OVERVIEW & PURPOSE

This lesson focuses on the variety of adaptations the flora and fauna of Southeast Alaska have to survive and thrive during the cold winter months. Adaptations (physical and behavioral) covered include: cryptic coloration/camouflage, hibernation and torpor, and migration.

BACKGROUND

Find background information under each activity in this lesson plan.

EDUCATION STANDARDS

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

LS4.C: Adaptation

3-LS3-2: Use evidence to support the explanation that traits can be influenced by the environment.

OBJECTIVES

Students will be able to:

1. Define adaptation using examples of both behavioral and physical adaptations.
2. Construct an evidence-based argument to explain why certain animals live in Southeast Alaska

and others do not using concepts such an adaptation, and habitat requirements.

MATERIALS NEEDED

Intro

1. Pelts, skulls, feathers, bones
2. Lots of winter clothes

Field study

1. Jello
2. Thermos of hot water
3. Containers (small, medium and large)
4. Hibernation story
5. Stuffed animals
6. Poker chips
7. Sit spot pads

VERIFICATION

Steps to check for student understanding

1. Student prior knowledge is shared during intro discussion and brainstorm.
2. Adaptation charades provides a summative assessment for student understanding of the adaptations we have learned about.

INTRO

Discuss and brainstorm *(15 min)*

Walk into the classroom with loads of winter clothing on. Explain to students that you are just mammal trying to adapt to the cold.

Discussion: What does it mean for an animal to *adapt*?

Adaptation- a change or the process of change by which an organism or species becomes better suited to its environment.

Explain that there are two types of adaptation: 1) behavioral and 2) physical. Using the whiteboard brainstorm examples of winter adaptations with students. Categorize each example as either behavioral or physical.

Adaptation exploration *(30 min)*

Turn your focus onto specific adaptations organisms must have to live in southeast alaska during the winter. What sorts of challenges do organisms face during the winter here?

Set out a variety of pelts, skulls, bones, and feathers with pictures of the animal at each table group of students. Provide magnifying glasses for students to investigate the specimens with. Have students work in teams to figure out what adaptation(s) are present in each specimen. Students may use science journals to record their observations.

FIELD STUDY

Hike to field study destination *(15 min)*

Use this time to explore and search for animal sign. Talking about animal adaptations along the way.

Sit spot *(20 min)*

Distribute sit spot cushions and encourage students to find a place away from friends where they can be silent successfully. Invite students to take 15 silent moments to listen and observe the natural world around them. After the sit spot encourage students to share what they observed with their five senses.

Warming up *(20 min)*

After the sit spot students will be cold. Explain that there are two main ways in which animals can warm up: exercise and eating.

Play park ranger to get students warmed up. Instead of calling out types of animals, call out various different adaptations during the game.

Call together group and discuss winter physiology.

The most important adaptation in how animals regulate their body temperature is whether they are cold or warm blooded. A cold blooded animals get their heat from the outside environment, because of this their body temperature fluctuates. Except for birds and mammals, most of the animal kingdom is cold blooded. Unlike cold blooded animals, warm blooded animals have to regulate their own temperature either through movement or eating. If they cannot 'deal with it' animals will migrate, hibernate or fail to survive.

Winter adaptations outdoor laboratory (1.5 hours)

Students will conduct a variety of investigations to develop an understanding of winter physiology and animal adaptations. This may either be done as stations or as a whole class.

Size and surface area (20 min)

Students will investigate the relationship between heat loss and size/surface area. Students will pour liquid jello mix in one small container, one medium size container and one large container. After 20 minutes students check on the containers to see if they survived (are still liquid). Note that students can put their animal models (jello containers) out for the experiment, move on to the next activity, and return to it.

> Background: In many instances the size and shape of an animal will determine whether it is warm or cold blooded. Generally large animals are warm blooded. Smaller warm blooded animals tend to have round shapes that ensures heat stays close to important internal organs. If warm blooded animals are too small they will lose more heat than they can generate.Whereas, cold blooded animals tend to have elongated shapes to increase surface area and thus heat absorption from the environment. For warm blooded animals heat loss is proportional to surface area.

How much do I have to eat? (20 min)

Play predator-prey survival game:

Draw out boundaries to show where food tokens are and predator-free zones. Food tokens are placed behind a boundary. Hula hoops can be placed in the middle of the area to denote camouflaged places were prey can hide from predators. Divide the class into two groups- predators (about ¼ of the class) and prey (about ¾ of the class).

Goals: Prey must cache 5 tokens to survive and move to the next generation (next round). Prey can only get one token at a time. Predators need to get 3 tokens in order to survive and reproduce. Predators get tokens by 'eating' prey (tagging).

All prey starts behind the safe line. Predators start on the boundaries. Predators give prey a 10 sec head start to get food until they come into the area. Prey that are eaten/tagged stay on the sidelines until the round is over, then they switch to being a predator. Predators that do not have 5 tokens at the end of the round switch to prey.

Discuss how much energy is needed just to get food and how this is impacted by predator-prey population numbers and winter climates.

> Background: The energy warm blooded animals use to keep warm comes mostly from the food they consume. Food is stored chemical energy that the body converts through exothermic internal combustion reactions. Because warm blooded animals have to maintain their own body temperature they require more food than cold blooded animals. This is not only a physical adaptation but also can be seen in various behavioral adaptations such as caching.

revisit size and surface area and talk about insulation as an adaptation

Wolf walk (20 min)

Pick a short bit of trail and set up brown, white, and black stuffed animals along the trail. Students then walk solo down the trail as 'wolves' trying to spot their prey (the stuffed animals). Emphasize that animals are not to be moved but that they should keep track of how many they saw in their mind. Follow up this activity with a small discussion on camouflage and how some animals change coat colors for the winter (ermine).

Hibernation (and torpor) station (20 min)

Set up a 'cozy' spot with sit pads. Read a storybook that highlights hibernation or have students write a perspective story of how they think it would feel to hibernate.

> Background: If an animal cannot migrate, one way they my cope with cold temperatures is by hibernating. During hibernation breathing, heart rate and metabolism slows while the animal lives off of its' fat reserves. Both warm and cold blooded animals hibernate. Note that many animals we think are 'hibernating' are actually in a torpor. There are three forms of dormancy: hibernation, torpor, and evistation. Hibernation is an prolonged period of reduced metabolism, heart rate and body temperature, whereas torpor is not prolonged. During torpor an animal will wake up periodically. Evistation is a form of dormancy that occurs during hot and dry climates typically during the summer months.

DEBRIEF

Adaptation skits *(45 min)*

Have students work in groups of 5 to 6. Students will act out one adaptation we either learned about or saw during our field study (hibernation, torpor, insulation, body shape and size, camouflage, caching) while the rest of the class guesses.

The physics of heat

How do animals stay warm?

Lesson Plan for Grade 4, Nature Studies WINTER

Prepared by Abby Harding

OVERVIEW & PURPOSE

This lesson focuses on thermodynamics, specifically how energy in the form of heat is transferred and transformed. Students will conduct an experiment in our 'outdoor laboratory' to observe how heat is lost without proper insulation. This experiment will be extended into a discussion on how animals retain heat during the cold months.

BACKGROUND

Physics

Heat transfer is the process by which internal energy from one substance transfers to another substance. Heat transfer occurs by three mechanisms:

1) *Conduction*- transfer of energy (heat) from one substance to another by direct contact.

2) *Convection*- the transfer of energy (heat) through a fluid caused by molecular motion.

3) *Radiation*- energy that is radiated or transmitted in the form of rays, waves, or particles.

Thermal engineers often try to mitigate heat transfer and loss of energy by creating insulative barriers. Insulation is defined as material that is used to stop the passage of electricity, heat or sound from one conductor to another. A good insulator is a poor conductor. Insulation works by reducing the conduction, convection and/or radiation of heat from one substance to another. Poor conductors of electricity are also poor conductors of heat. The insulative value of a substance is measured by its R-value. A higher R-value indicates higher insulative value. R-value = (square meters of material x °C)/watts.

Animal adaptations and voles

Animals that live in colder environments have adapted to have natural insulative properties, and/or modified metabolic rates in order to survive. Whales have blubber that serves as excellent insulation, while other animals have thick fur or hibernate to survive freezing temperatures.

Voles are a great example of a terrestrial animal that has adapted to survive freezing temperatures through behavioral and physical adaptations. Voles are one of the smallest mammals. They play an important role as a food source for wolves, birds of prey, coyotes, foxes, martens, and black bears. Alaska is full of voles that are rarely seen. Voles are active during the winter months in their tunnels under the snow (the subnivean zone) to keep warm. We have two types of voles in Alaska: the meadow vole and the red backed vole. Typically, voles live in groups (mostly females), this helps them conserve body heat in the winter. Often younger males are rejected and freeze to death in the winter. Voles don't live much longer than a year. Voles eat grasses and sprouts in the spring and summer and in the fall and winter they will eat roots, seeds and other dead voles.

EDUCATION STANDARDS

4-PS3-1: Make observations to provide evidence that energy can be transferred from place to place by sound, light, *heat* and electric currents.

PS3.D: Energy in chemical processes and everyday life

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

OBJECTIVES

Students will be able to:

1. Define convection, conduction, and radiation using examples.
2. Demonstrate using evidence-based reasoning how heat is transferred and transformed.
3. Understand what adaptations animals have to live in cold climates.

MATERIALS NEEDED

Intro

1. Electric kettle
2. Cocoa mix

3. Cups
4. Spoon
5. Poster of definitions
6. Adaptations book

Field Study

1. Vocabulary cards
2. Jello mix
3. Hot water (in thermos)
4. Film canisters
5. Picture of a vole
6. Clip boards, data sheets and pencils

Debrief

1. Recycled materials for insulation
2. Tape or glue gun
3. Vole models

VERIFICATION

Steps to check for student understanding

1. Assess prior knowledge is initial intro debate and discussion
2. Review using thermodynamics charades activity
3. Assess student understanding by completion of vole survival experiment and data collection.
4. Review and assess student understanding using debrief journal questions and insulation designs.

INTRO

Debate and discuss

Write on board: What is heat and where does it come from?

Background information:

Heat is defined as a type of energy that can be transferred from one object to another or even created at the expense of the loss of other forms of energy.

Temperature on the other hand is a measurable physical property; the average kinetic energy of the atoms in the system. When a substance has a high temperature the atoms in that substance move very rapidly, whereas when a substance has a low temperature the atoms in that substance move slowly.

Heat transfer

During the debate your assistant should be prepping the cocoa for students. Pass out cocoa and explain the heat transfer using the cocoa as an example. Pin up the poster prepared with the 3 heat transfer definitions on it.

There are 3 forms of heat transfer:

Conduction- transfer of energy (heat) from one substance to another by direct contact. This is happening right now in your hand! The heat from the cup of cocoa is transferring to your hand!

Convection- the transfer of energy (heat) through a fluid or gas caused by molecular motion. Heating water in electric kettles like we did to make the cocoa is an example of convection. The heating coil placed at the bottom of the kettle heats the water and cause a convective current to form, heating the water. Think of what water looks like when it boils, this is convection at work!

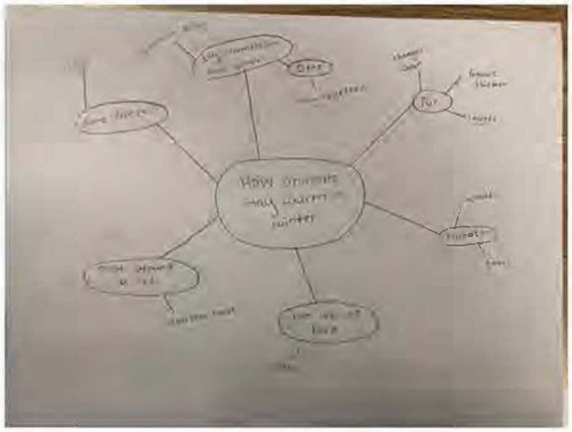
Radiation- energy that is radiated or transmitted in the form of rays, waves, or particles. Now let's pretend that we all left our cocoa out while we went for a hike. We came back and it was cold. To heat up our cocoa we could use a microwave. A microwave uses electromagnetic waves that travel through the air into the water of our cocoa to heat it up!

Short story- Animal adaptations

Now that we have learned about heat and how it transfers and transforms let's bring our attention to how these concepts interact with living things. While students enjoy their cocoa read a short story on animal winter adaptations.

-OR-

Have students work independently in their science journals to make a mind map of depicting how animals stay warm in the winter. Example below:



Remind students to dress appropriately for field study

FIELD STUDY

Optional indoor activity- *thermodynamics charades (20-30 min)*

Revisit the concepts and vocabulary learned in the intro by having students act out vocabulary words: cold, hot, heat, temperature, conduction, convection, and radiation while audience guesses.

Hike to field study destination *(10-20 min)*

During the hike encourage students to look for animal tracks and signs in snow.

After the hike encourage students to observe how their body temperature changes or their body's response to physical activity. Are they sweating? Why do we sweat?

As you come to the subnivean zone study area discuss how animals keep warm- The most important adaptation in how animals regulate their body temperature is whether they are cold or warm blooded. A cold blooded animals get their heat from the outside environment, because of this their body temperature fluctuates. Except for birds and mammals, most of the animal kingdom is cold blooded. Unlike cold blooded animals, warm blooded animals have to regulate their own temperature either through *movement* or *eating* enough food (stored chemical energy that our bodies transform into heat).

Exploring the subnivean zone *(30 min)*

Another way animals stay warm in the winter is by controlling or engineering the microclimate they live in by building dens, tunnels or other insulated areas. The subnivean ("sub" meaning under, "nives" meaning snow in latin) zone is the area under the snow. Many rodents use this area to create snow tunnels and burrows to navigate and stay warm in the winter. Sometimes you can see these tunnels if you dig down in the snow. More intricate tunnels will include separate sleeping areas, runways, multiple entrances and even bathrooms! While the subnivean zone can be beneficial to small rodents, it can also be a hazard. Owls, and foxes can hear voles and mice under the snow, and other predators such as ermine can slip into the tunnels and catch the small rodents that live there. Snow tunnels can also collapse on top of its occupants.

Working in their research teams students will use shovels to dig into the subnivean zone of an open area (meadow or field ideally) and investigate. It is best to find a hole or entrance and dig straight down with a flat snow shovel.

Vole Survival *(1 hour)*

Experiment in our outdoor laboratory : Students will use three film canisters filled with liquid jello to simulate a live, warm animal (vole) that must be insulated in order to survive (remain liquid). One film canister will serve as a control with no intervention. The other two film canisters students will engineer natural insulation or choose a manmade fabric (cotton, wool, fleece, denim) to insulate them. Students will record data on their experimental results using the provided data sheet.

Divide students into research teams of 4 or 5.

1. Have students free explore and find suitable habitats where they think voles would live. Encourage students to imagine that they are a vole searching for a suitable winter home.
2. Call students back in and explain the experiment methods/procedure. Allow students to search for insulation materials and develop a plan for insulating their jello voles. **NOTE: while students plan mix jello in thermos and pour jello into canisters.**
3. After each group has had a chance to plan, pass out the materials. Each research group will have a vole model (film canister with liquid jello), and a clipboard, pencil and data sheet to record their findings.

4. Allow students 2 minutes to insulate and place their jello voles. Once all jello voles have been placed start a timer for 15 to 30 minutes (during which you can play a game). Jello voles should be left alone for the duration of the timer.
5. Have students revisit their jello voles and record data.
6. Debrief the experiment with students. Make sure to tie in heat transfer/transformation and animal adaptations.

Tips and tricks for a successful vole experiment:

- Have a large thermos of hot water and mix the jello in the thermos right before the experiment. EMPTY THE THERMOS RIGHT AFTER TO AVOID A SOLID JELLO DISASTER.
- One large thermos full of hot water calls for 2 normal size jello packets.

- It is better to have the students engineer the insulation for all the voles at once. If you only conduct the experiment with one vole at a time be prepared with small activities to do between experiments. This method creates a TON of transitions.
- Be aware that jello does leak out of containers if they are laid on their side. Urge students to stand their jello voles upright.
- If it is warmer out you will need more time for the jello to get cold.

How do humans adapt? *(30 min)*

Have students partner up and have one partner sit on the bare ground and one partner sit on a sit-pad for 10 minutes. Invite students to switch seating positions and discuss what they noticed. Discuss the role of insulation in keeping us warm and reference winter clothes.

DEBRIEF

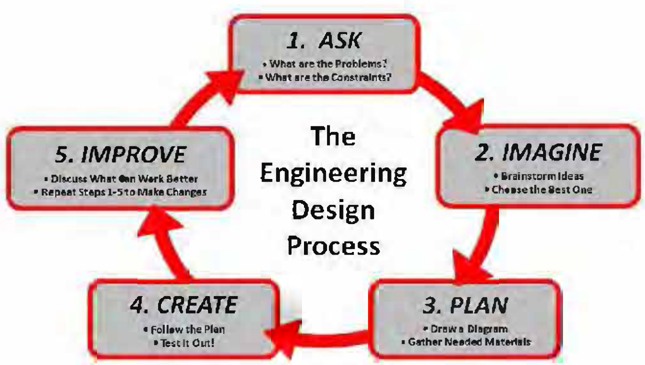
Knowledge sharing *(10-20 min)*

Allow time for students to share data from the vole survival experiment. Have students write and respond to the following questions in their science journals:

1. What insulation worked the best in our vole experiment?
2. How did the heat leave the vole model? (conduction, convection or radiation)
3. Is there a material that would have worked even better?

Biomimicry- engineering insulation *(20 min)*

Explain the basics of the engineering process using the below diagram. Students will use graphing paper to create a blueprint of an insulation design (to scale). Explain why engineers and scientists use graphing paper and what it means to be 'to scale'.



Scale: with uniform reduction or enlargement. For example, if a map is to scale this means that each feature is presented in an accurate size relative to each other. A scale displays the relationship between how things are displayed on a map, drawing or model and how they are in real life.

Have students work in their same research teams to design insulation for another (hypothetical) vole experiment. The design should be realistic and reflect materials that are available.

Nature Studies- The physics of heat

Research team____

Today's weather:

Temperature ____________

Circle what applies:

Clouds Rain Snow Sun Other:________________

Vole Survival Data		
Insulation	Location	Vole condition (circle one)
		liquid semi-liquid solid
		liquid semi-liquid solid
		liquid semi-liquid solid

What insulation method and location worked the best? Why do you think it worked?

A Snowslide Ecosystem:

Living with Dleit Kaadi

Lesson Plan for Grade 5, Ecosystems & Energy

Prepared by Kate Cruz

OVERVIEW & PURPOSE

This lesson will cover the movement of matter and energy among plants, animals, decomposers and their environment. Interdependent relationships and flow of energy within our forest ecosystems will be taught in the context of the Behrend's slide area.

ESSENTIAL QUESTION

What effects to living and non-living factors have on populations?

EDUCATION STANDARDS

1. **5-PS2-1** Support an argument that the gravitational force exerted by Earth on objects is directed down.
2. **5-LS2-1** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
3. **5-ESS3-1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

OBJECTIVES

Students will be able to:

1. Friction between snow or rocks and the underlying ground holds the snow or rocks in place on a slope, preventing avalanches and landslides. In order for an avalanche or landslide to occur,

friction must be overcome.

2. Identify ways in which energy flows within a temperate forest ecosystem.
3. Recognize that all energy originates from the sun.
4. Understand the interdependent relationships within an ecosystem including decomposers, producers, and consumers.

Intro	Field	Wrap-Up
• Drone Footage • Bear energy • How many Bears live here? • Data analysis and limiting factors • Forest agreements	• Oh! Deer • Graphing population dynamics • Close observations on hike up • Stations (Bioengineering plants and Interview té)	• Video/recap • Trophic Level R-P-S Tournament • Interpreting Graphs • Aas Kwaanee

RESOURCES

- Accompanying slideshow
- Project Wild: How Many Bears in the Forest?

*This lesson was inspired by the NGSS approved Disruptions in Ecosystems unit found here:https://www.teachingchannel.org/blog/2018/06/15/ecosystems-an-ngss-designed-unit

INTRODUCTION (45 minutes)

(Class Activity 1.1) Engage: ***How do living things interact with living and non-living parts of the environment.***

Drone Footage

Ecosystems are the community in which animals and plants interact with their environment. Watch the drone footage to view a unique ecosystem right outside our door. Prompt students to keep an eye out for living and non-living components of the ecosystem as they watch.

Abiotic/Biotic

Think Pair Share about living/non-living elements. Write a list on the board under biotic and abiotic columns. Explain that this is a western science dichotomy, but that in Tlingit and other Indigneous worldviews, there was not the same classification as everything is viewed as having a spirit.

Let's focus on one animal that can be found within this ecosystem, the s'eek or black bear.

Class discussion or journal activity: Where does the s'eek's ENERGY come from?

- Where does it get its matter to grow, maintain body mass, and heal?
- What happens to mass that is not needed?

(Class Activity 1.2) Explore: ***What are limiting factors for population growth?***

Project Wild: How many bears live here?

- Spread pre-made cards around floor
- Explain rules: desks are their dens, acting as bears harvesting food, can only grab one card at a time then bring it back to their desk
- Assign one blind bear, one hopping/injured bear, and one sow responsible for two cubs (needs to collect twice as much food)
- After harvesting is over, students draw table on slide 4 and add up all of their poundages (each color represents different food source, cards labeled by first letter and 5 or 10 representing 5 or 10 pounds)
- Do class inventory of how many bears gathered more than 80 pounds, and how did the blind bear, injured bear, and sow do?

Conclude back on carpet with group discussion on limiting factors (slide 5) and agree on respectable behaviors for the upcoming fieldtrip (slide 6). Identify the abiotic and biotic factors that s'eeks need to thrive, and quickly identify the producers, consumers, and decomposers in the s'eek's food story.

Possible Lesson Extensions for Teachers:

1. Convert student s'eek food into ratios or percentages
2. Research local s'eek requirements for food annually.
3. Students can discuss what they think the differences would be for black s'eek and brown xóots diets and habitat needs.

(Field Activity 1.3) Explore: ***How do organisms interact with each other?***

Class Transition (10 mins)

Hike to Behrend's Slide (15 mins)

Oh! Deer Activity at the bottom of the hill (when possible, if not up top on gravel) (20 mins)

Oh Deer! (20 mins) *adapted from Project Wild activity

1. Review the four main components of a habitat and assign a body motion for each (food, water, shelter) and indicate that for the sake of our model, space will be represented around us.
2. Students will be black s'eeks and Sitka blacktail deer, animals that display a classic predator prey relationship in Southeast Alaska. Remind students that although sometimes black s'eek do capture young fawns, they mostly feed off of winter kill carcasses.
3. Ask one student to record data, or if everyone wants to play, have another adult keep track.
4. All students should form one straight line facing you. Pick someone to be the first s'eek and have them face directly across the deer line, about 20 feet away.
5. On your data sheet, list 1-7 to represent the number of "years" you'll be simulating, a column for deer, and a column for s'eeks.
6. Have students spin around (so they can't see each other), pick one of the three symbols (they cannot change what they pick until the next year), and on the count of three they will turn back towards each other. Habitat doesn't move, they are rooted into the ground, only the s'eek (who ambles-walks slowly) can move through the habitat. The s'eek will need to look for someone who matches their symbol, walk to them, grab their hand and walk them back to the s'eek line.
7. If the s'eeks cannot find a matching symbol, they die, recycling their energy back into the habitat, and rejoin the habitat line.
8. Repeat the game for 6-7 years.
9. Debrief what happened to the population dynamics as a whole group, mention that you will be graphing this data back in their classrooms for the wrap-up day.

Camera (take at least 2 pictures of biotic and 2 pictures of abiotic factors) on the way up the hill. (10 mins) Students in pairs, one student acts as the "photographer" to guide the "camera" to something picteresque. Can be high or low, far or close, arrange camera to take picture, tap on shoulder to open "shutter/eyes" and tap again to close. Should be a 3-5 second still shot capture. Then partners switch. Stop 3 times on hike up to include the eagle's nest and the bear claw marks along trail.

(Field Activity 1.4) Explain: ***What effects do biotic and abiotic factors have on populations?***

Stations: (25-30mins each)

- Biotic with Claire (hike to big spruce tree, sound map, and plant engineering)
    - Sound map: Students ground themselves to surroundings by simple sound map exercise (x in center of paper)
    - Presentation on the ballistic seed dispersal capabilities of the invasive dwarf mistletoe

parasitic plant (not all relationships are predator/prey) on hemlock trees. Students need to design a plant that disperses seeds through wind, vector, gravity, or ballistics)

- Abiotic with Kate (pick a té, rock ID game, interview a rock)
  - Students go find a rock in the slide area that calls to them
  - Play quick round of rock ID game where each student writes a 1-2 sentence description of their rock, detailed enough to be able to identify their rock from a pile
  - Go to quiet sit spots to interview their rock

Hike Out (10 mins)

(Class Activity 1.5) Elaborate: ***How do biotic and abiotic factors affect patterns of interaction among organisms?***

Video/recap

Watch picture reel, think-pair-share about what surprised you on the trip and what are you still curious about?

Introduce concept of trophic levels and the five levels needed for the rock-paper-scissors tournament. Symbols include grass (fingers waving), deer (antlers), bear (claws), eagle (wings), mushroom (triangle above head).

Slide 9 recaps the movement of energy through the trophic levels and why there are more primary producers than apex predators.

Review graph of the Oh! Deer game, contrasting color representation, and trends as seen in slide 10. Finger trace their predictions for other predator/prey trends (slide 11).

Taking those same intrepretive skills, students can work in pairs to read the story shown on slide 12 from Isle Royal moose and wolf populations. Make sure to point out that there is more than just predator/prey relationships here as seen in the late 1990's.

Remind students that just like the terms abiotic and biotic are constructs of western science, so are graphs. Other worldviews have different ways of communicating out science. Locally, at.oow', oral narratives, totem poles, Chilkat blankets, songs, dances, and house panels were used to share knowldge. Ask students to find a comfortable place within the classroom and read Aas Kwaani as guided imagery.

Finish with journal prompts on last slide.

Snow Studies

Lesson Plan for Grade 5, WINTER Nature Studies

Prepared by Abby Hines

OVERVIEW & PURPOSE

This lesson will cover the physical properties of snow through the lens of phase changes and snow crystal formation.

BACKGROUND

Snowflakes or snow crystals form as water vapor freezes around particles found in the air. Water vapor must directly convert into ice to become a snowflake. Snowflakes are NOT frozen raindrops. Two factors control how snowflakes are formed: 1) temperature and 2) moisture. With millions of combinations of temperature and moisture in the air there are millions of of possible snowflake designs. As a general rule of thumb warmer temperatures and high atmospheric moisture result in more intricate snowflakes, whereas, cold temperatures and low atmospheric moisture result in simple, less intricate snowflakes. Snowflakes all have six-fold symmetry because of the physical properties of water and the structure of water molecules in an ice crystal lattice. The simplest snowflake form is a plate hexagon. In some cases of rapid crystal formation, asymmetry of individual branches can occur.

From the instant snow hits the ground it begins to metamorphize, experiencing all three phases (solid, liquid and gases). These phase changes are critical in understanding the physical properties of snow layers and avalanches. As snow falls it creates layers. These layers can differ in composition, hardness, and temperature depending on weather. For example: if the are experiences a wet and heavy snowfall followed by a clear cold snap, the wet heavy snow will form a layer of fragile snow crystals on top. If it snow again, these two layers will be buried creating an unstable layer where the snow crystals formed. These unstable layers are what avalanche scientists look and monitor for. Snow hardness profiles can be taken using your own hand, a pencil and a knife. Below is a standard depiction of a snow hardness profile that avalanche scientists use.

Slight variations in hand hardness can be recorded using + and - qualifiers (i.e. P+, P, P-). A value of 4F+ is less hard than 1F-. Individual layers may contain a gradual change in hand hardness value. These variations can be recorded in a graphical format (Figures 2.8 and 2.9), or by using an arrow to point from the upper value to the lower value (i.e. a layer that is soft on top and gets harder as you move down would read 4F+ → 1F).

Table 2.1 Hand Hardness Index

Symbol	Hand Test	Term	Graphic Symbol
F	Fist in glove	Very low	
4F	Four fingers in glove	Low	/
1F	One finger in glove	Medium	✕
P	Sharp end of pencil	High	✎
K	Knife blade	Very high	✖
I	Too hard to insert knife	Ice	▬

Hardness is not the only attribute avalanche scientists test. Other attributes include temperature measured every layer, grain size and shape of snow crystals, liquid water content, and layer age. In this lesson students will measure temperature, grain size and shape, and hardness. Grain size is measured by taking a couple representation crystals from each layer and measuring them using a ruler. Grain shape is measured and recorded using the following table.

2.5.4 Grain Form (F)

The International Classification for Seasonal Snow on the Ground (Fierz and others, 2009) presents a classification scheme composed of major and minor classes based on grain morphology and formation process. This scheme is used throughout this document. Primary classes are listed in the table below. Subclasses are listed in Appendix F.

Table 2.2 Basic Classification of Snow on the Ground

Symbol	Basic Classification	Data Code
+	Precipitation Particles (New Snow)	PP
◉	Machine Made snow	MM
/	Decomposing and Fragmented Particles	DF
●	Rounded Grains	RG
□	Faceted Crystals	FC
∧	Depth Hoar	DH
∨	Surface Hoar	SH
○	Melt Forms	MF
▬	Ice Formations	IF

EDUCATION STANDARDS

1. N-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
2. ESS2.A: Earth materials and systems (hydrosphere)
3. 5-PS1-2: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved (phase changes).
4. PS1.A: Structure and properties of matter
5. ESS3.C: Human impacts on earth systems

OBJECTIVES

Students will be able to:

1. Demonstrate knowledge of phase changes through experimentation and modeling.
2. Identify types of snow crystals and the relation to avalanche risk
3. Understand the role that snowpack, and ice play in the earth's hydrosphere.
4. Develop a model or mode of communication to display a snowpack profile, its' characteristics, and risk of avalanche.

MATERIALS NEEDED

Intro

1. *The Story of Snow* by Mark Cassion and Jon Nelson, Ph. D.
2. Beakers (6)
3. Snow

Field Study

1. Cloud type identification sheets
2. Hand lenses (2 per group)
3. Black paper (1 per student)
4. Thermometers (1 per group)
5. Iphone magnifying lens
6. Snowflake classification cards
7. Shovels (1 per group)
8. Pencils
9. Butter knives (1 per group)
10. Measuring tapes (1 per group)

Debrief

1. PB&J materials
2. Slide show

VERIFICATION

Steps to check for student understanding

1. Journal responses to initial snow observation
2. Weathering forecasting
3. Snowflake sorting
4. Data collections sheet
5. Snow pit delineation
6. Methods writing

INTRO

Take a moment to remind students what was studied in fall nature studies (the *biosphere* through the lens of energy flow through ecosystems). Emphasize that this winter we will be focusing our attention on the *hydrosphere* and *atmosphere* through the lens of snow studies.

- All together there are 4 puzzle pieces that make up the earth's systems. Scientists refer to these as 'spheres'. The bio(*life*)sphere which consists of all biotic factors on earth, the geo(*ground*)sphere which consists of all the rocks, minerals and landforms on earth, the atmos(*air*)phere which contains all of the earth's gases, and lastly, the hydro(*water*)sphere which consists of all of earth's water sources.

***Observing snow structure and quality** (10 min)* Set out a 500 or 1000 mL beaker filled with snow at each table. Allow students to make observations about the quality and characteristics of the snow using hand lenses and their science journals. This will be revisited at the end of the intro.

***Snow as science** (20 min)*

Read *The Story of Snow* by Mark Cassion and Jon Nelson, Ph. D. Explain and discuss how and why scientists study snow.

and/or show the following video: https://www.youtube.com/watch?v=-M48RfaWcWA

***Revisit beaker of snow** (10 min)* Allow students to revisit the beakers of snow on their tables and make observations regarding the changes they noticed in their science journals.

FIELD STUDY

Students will work in research teams of 4-5 for this field study.

What's the weather today? *(15 minutes)*

Start by inviting students to make simple sensory observations, tuning into their our sensory systems. Students will practice being meteorologists by working in groups to determine what weather patterns are present. Working in groups of 4-5 students will take the ambient air temperature using a thermometer, make visual observations about cloud type using provided guide sheets and record this data on their data collection sheets. Discuss how weather may influence the types of snowflakes formed. Have groups hypothesize what types of snowflakes they will find based on their weather observations.

Snowflakes and crystals *(45 minutes)*

Working in groups have students sort snowflake pictures into classifications as they see fit as scientists. Explain that they will have to justify their classification system to other groups using evidence based statements. Discuss that just as they have sorted the different snowflakes, scientists have come up with classifications for snowflakes based on shape.

Investigation: Have students catch or find snowflakes using a piece of cold (not brought out from the classroom) black cardstock. Students will investigate the different crystal shapes and forms using the snow crystal identification sheet and a hand lens. Allow students to work in their research teams to fill out the data collection sheet. As students are observing their snowflakes come around and take pictures of snowflakes using a magnifying camera lens. These photos will be shared during the debrief class.

NOTE: If it is not snowing you can have students observe previously fallen snow or frost crystals (using the frost ID sheet instead).

Digging and mapping *(45 min)*

Now that we have learned about the intricacies of individual snow crystals, let's take a look at how snow crystals interact to form snowpack. Have students work in their research groups to *dig* and *map* a snow pit for analysis.

1. Choose a place to dig your snow pits. An ideal location has little vegetation and is not in direct sunlight. Direct sunlight will provide false temperature readings.
2. As a large group determine the aspect (using a compass), slope (using a clinometer), and predominant vegetation cover (may use UNESCO classification system for extra challenge) of your location. Have students record this using the snowpit data collection sheet.
3. Have students dig one snowpit per group. This snowpit should reach all the way down to the ground and should be big enough for standing in.
4. Once students have dug their snowpits have encourage them to draw a map of the location of

their snowpit. Challenge them to try and draw such an outstanding map that they could come back to the same location in the spring.

***Snow profiles** (45 min)*

At this point students should have dug their snow pits already and be ready to collect data on the layers of snow they observe using the snowpit data collection sheet.

1. Students will start by delineating each layer using the measuring tape and recording their findings on the snowpit diagram (snowpit data collection sheet).

2. After delineating snowlayers, students will measure and record snow hardness of each layer using the technique described above.

3. Students will then measure and record snow crystal size (in mm), and shape in each layer using the provided diagram on the snowpit data collection sheet.

4. Students will record temperature for every layer using provided thermometers.

5. Lastly, students will determine if there are any unstable or interesting layers present in their snowpit.

DEBRIEF

***Revisit our investigation** (15 minutes)*

Prepare the photos taken of student snowflake discoveries and snow pits in a slide show shared with a class. After the slideshow have students turn and talk to a partner, reviewing what methods we used in the field to investigate snow.

***Writing our methods** (30 minutes)*

Have students practice writing like scientists. Explain that a critical part of science is explaining *how* an investigation or experiment is performed so that others can replicate it. Start with the example of a peanut butter and jelly sandwich: 1) have students come up with a list of the steps necessary to build a PB&J 2) then make a sandwich in front of the class following these directions EXACTLY 3) discuss what worked and what did not. Allow students to write their own methods or instructions of the steps of our snow studies investigation in their science journals.

RESOURCES

UNESCO Classification: https://www.nasa.gov/pdf/187510main_MUC_Codes.pdf

Snowpit protocol (where tables are from):
https://culter.colorado.edu/~kittel/WEcol_Handouts/SnowPit_Protocol&Guide.pdf

Group members: ______________________________________
Date:_____________

Snow Studies Investigation

Weather Observations

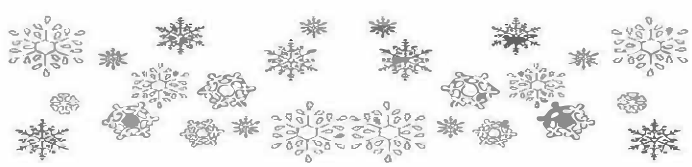
Temperature:__________

Cloud type:______________________________

Describe the weather today:_________________

____

____



Snow crystal classification

1. Did you find any snow crystals that looked the same? Circle: Yes or No
2. Describe and categorize four snow crystals you found using the snowflake classification sheet.

   Snow crystal #1_______________________________________

   Snow crystal #2_______________________________________

   Snow crystal #3_______________________________________

   Snow crystal #4_______________________________________

3. What snow crystal type was most common?______________________

4. What snow crystal type didn't you find at all?______________________

5. Are the types of snow crystals you found the kind you would expect for the weather you observed? Circle: Yes or No Why or why not? ___________

____

____

Snow Pit Study

Using the space below draw a map of the area in which you are digging your snowpit. Make sure to include plants, and significant landscape features.

Legend

Scale

____

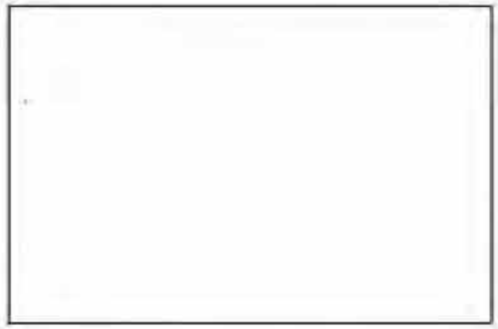
Snow pit profile

___m

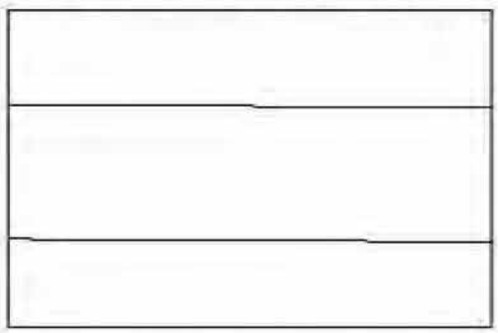
0 m

Snow pit directions

1. *Measure* the depth of your snow pit from the ground to the top of the snow using the measuring tape. Record your measurements in meters (m) on your snow pit profile drawing like the example below.



2. *Identify* each of the layers in the snow pit. Record each layers measurement using the tape measure and draw a line where it starts and ends like the example below.

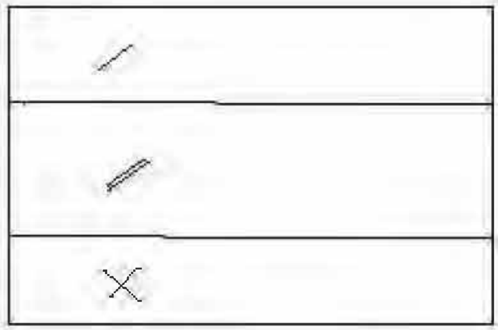


3. First, *measure hardness* of each layer using the hand hardness index.

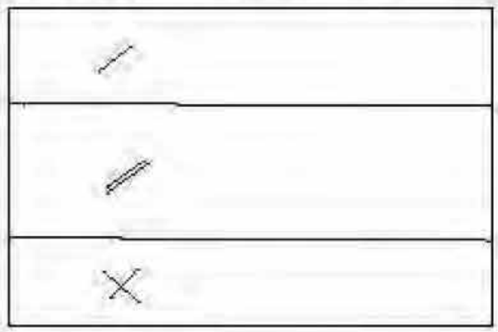
Table 2.1 Hand Hardness Index

Symbol	Hand Test	Term	Graphic Symbol
F	Fist in glove	Very low	
4F	Four fingers in glove	Low	✓
1F	One finger in glove	Medium	✕
P	Sharp end of pencil	High	/
K	Knife blade	Very high	⋇
I	Too hard to insert knife	Ice	■

Record your results using the graphic symbol in each layer on the snow pit profile like the example below.



4. Next, *measure the temperature of* each layer using a thermometer and record the temperature of each layer on the snow pit profile like the example below.

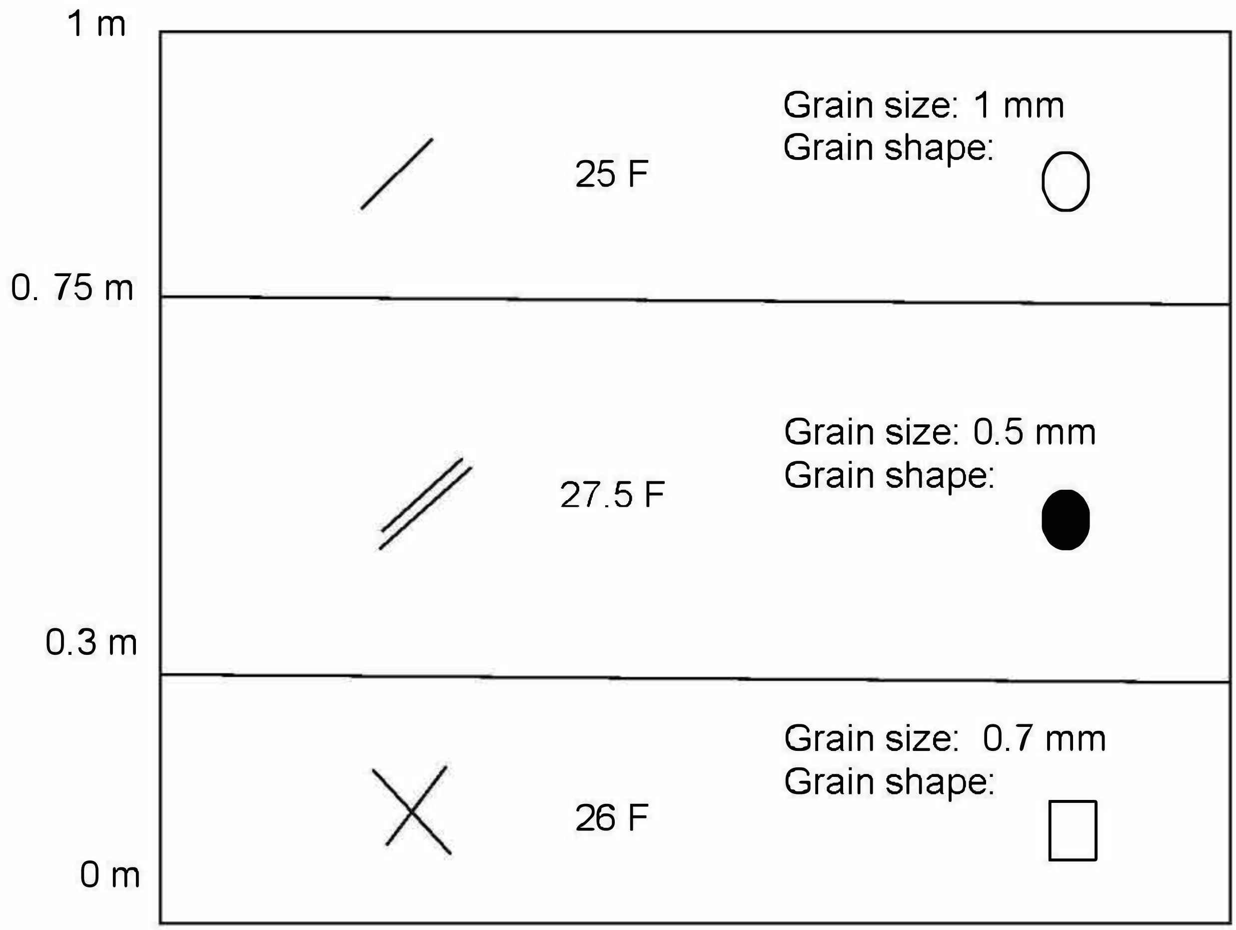


5. Next, *measure the grain size and observe shape of the ice crystals* present in each layer using the chart below. Grain size is measured by taking a couple representation crystals from each layer and measuring them using a ruler. Grain shape is measured and recorded using the following table. Do your best trying to identify the shape of ice crystals.

Table 2.2 Basic Classification of Snow on the Ground

Symbol	Basic Classification	Data Code
+	Precipitation Particles (New Snow)	PP
▦	Machine Made snow	MM
⁄	Decomposing and Fragmented Particles	DF
●	Rounded Grains	RG
□	Faceted Crystals	FC
∧	Depth Hoar	DH
∨	Surface Hoar	SH
○	Melt Forms	MF
▬	Ice Formations	IF

Record your observations using the symbol and your measurements on the snow pit profile like the example below.



6. Lastly, look at all of the data you just recorded. What does it tell you about the stability or condition of each layer? Is there a weak layer that avalanche scientists would flag as a danger? Discuss this with your research team.

Hydrosphere

Lesson Plan for Grade 5, WINTER Nature Studies

Prepared by Abby Hines

OVERVIEW & PURPOSE

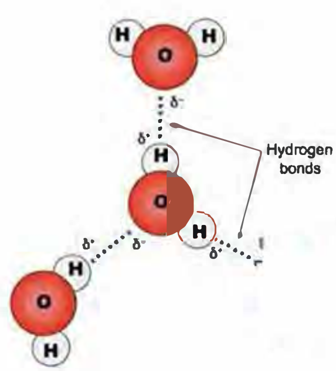
This lesson will cover the physical properties of water, the distribution of water sources on earth, water quality and the ways in which the hydrosphere interacts with the biosphere, atmosphere and geosphere.

BACKGROUND

Water chemistry

"Water is called the "universal solvent" because it is capable of dissolving more substances than any other liquid. This is important to every living thing on earth. It means that wherever water goes, either through the air, the ground, or through our bodies, it takes along valuable chemicals, minerals, and nutrients (USGS)."

Water has a few special properties that allow it to be the universal solvent. Water is a polar molecule, meaning that is has a positive and negative charge like a magnet. This comes from its chemical structure. Positive and negative charges are attracted to one another. When the positive side on one water molecule comes near the negative side on another water molecule they stick together and form a bond giving water its cohesive nature. See diagram below.

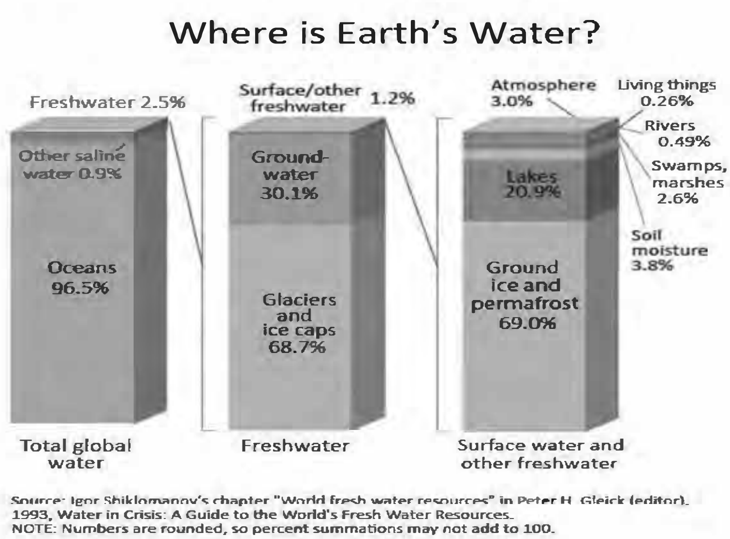


Other properties that make water special are the properties of adhesion and cohesion. Adhesion occurs when water is attracted to other substances like when a drop of water adheres to a leaf. Cohesion occurs when water molecules are attracted to other water molecules as seen in a drop of water.

Water as a resource

"Alaska's abundance of rivers, lakes, wetlands, snowfields, and glaciers comprise an estimated 40 percent of the Nation's surface water. There are more than 12,000 rivers in Alaska, and three of those rivers, the Yukon, the Kuskokwim, and the Copper, are among the ten largest rivers in the United States. Alaska has more than 3 million lakes ranging from pond size to 1,000 square miles (US Fish and Wildlife Service)."

About 72% of the earth's surface is comprised of water. Of that 96.5% is stored in our oceans. See the diagram below for an explanation of earth's water reservoirs.



Water quality testing

For the scope of this lesson water quality testing will cover pH, turbidity, temperature and dissolved oxygen.

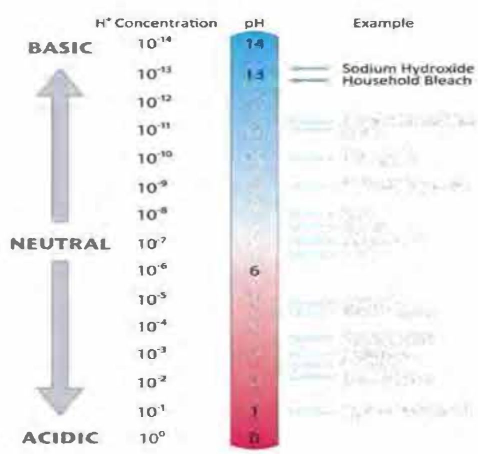
Turbidity

Turbidity is the measure of the relative clarity of a liquid or measure of the degree to which water loses its transparency due to the presence of suspended particles. It is generally thought of as a good measurement in testing water quality and habitability. Turbidity can be measured in a variety of ways but is typically measured using a secchi disk. This tool was invented by

Angelo Secchi in 1865. A standard freshwater secchi disk is 20 cm in diameter with alternating black and white quadrants. Marine secchi disks are plain white with a 30 cm diameter. Typically the secchi disk will be mounted on a line and lowered into body of water until it is no longer visible. The length (in meters) of the line at which the secchi disk becomes no longer visible is recorded and used to calculate turbidity. Generally, low turbidity is associated with healthy bodies of water.

pH

pH is a logarithmic scale from 0 to 14 used to measure the acidity or alkalinity of a solution. See scale below for reference. Simply put pH is the measurement of the molar concentration of free hydrogen ions in a solution. It is debated what pH really stands for but many believe it stands for "the power of hydrogen", tracing it back to the Danish chemist Søren Peder Lauritz Sørensen at the Carlsberg Laboratory in 1909. There are a number of ways pH can be measured either by probe or by indicator reagents. Indicator reagents turn color to indicate pH and are commonly used because of their convenient nature. A common pH indicator used is litmus paper. pH probes work by converting pH readings into electrical potential. This method is rarely used outside of laboratories as the equipment in specialized, fragile and sensitive to minute environmental changes. pH is a vital and common measurement of water quality. Photosynthesis and resperation can impact pH measurements. Carbon dioxide is the most common cause of acidity in aquatic ecosystems. Minerals near bodies of water rich in calcium carbonate or bicarbonates can neutralize pH. Factors such as coal mining, wildfire ash runoff, acid rain, and the mineral composition of an area can all affect the pH of a body of water. Generally, a pH between 6.5 and 8.5 is considered healthy for freshwater ecosystems.

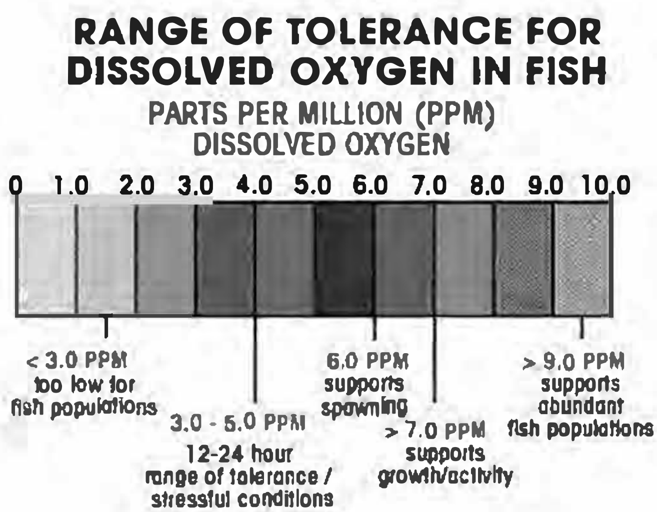


Temperature

Temperature is one of the most basic water attributes measured during water quality testing. Water temperature impacts the chemical and physical attributes of a body of water. One particularly significant impact is temperatures influence on dissolved oxygen. The solubility of oxygen decreases as temperature increases, making survival of aquatic organisms difficult. Water temperature affects metabolic rates of aquatic organisms as well. Some bodies of water such as lakes experience seasonal changes in temperature profiles referred to as turn over. These seasonal changes are natural and healthy. Many factors can influence water temperatures such as weather and climate patterns, turbidity, and thermal pollution. Generally, a cooler stream is considered healthier than a warm stream but this is dependent on many factors. For spawning salmon water temperatures must remain between 13°C and 17°C depending on species.

Dissolved oxygen

Dissolved oxygen (ppm) in aquatic ecosystems is critical to the survival of organisms. There are two main sources of oxygen in a body of water: 1) the atmosphere 2) aquatic plants. Oxygen from the air mixes with water and plants produce oxygen as a byproduct of photosynthesis. As mentioned above temperature plays a major role in the dissolved oxygen content of a given body of water. Other factors such a chemical pollutants and agricultural runoff may also impact dissolved oxygen levels by producing oxidation-reduction reactions or massive algal blooms. See chart below for reference.



EDUCATION STANDARDS

1. ESS2.A: Earth materials and systems (hydrosphere)
2. PS1.A: Structure and properties of matter
3. 5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on earth.
4. ESS3.C: Human impacts on earth systems

OBJECTIVES

Students will be able to:

1. Understand the distribution of water on our planet and within their local watershed.
2. Develop a model watershed and define the characteristics of a watershed.
3. Develop connections and understanding of how the hydrosphere, atmosphere, biosphere and geosphere all interact in weather events, and water quality.
4. Investigate and describe the process of testing water quality of a given body of water including: pH, turbidity, temperature, and dissolved oxygen.

MATERIALS NEEDED

Introduction

1. Blow up earth ball
2. Spray bottles (10)
3. Dark markers
4. White printer paper

Field study

1. Water quality testing kits

Debrief

1. Science journals
2. Slide show

VERIFICATION

Steps to check for student understanding

1. Watershed models and exploration
2. Class discussions
3. Water quality data recording
4. Writing our methods

INTRODUCTION

Take a moment to remind students what was studied in fall nature studies (the *biosphere* through the lens of energy flow through ecosystems). Emphasize that this winter we will be focusing our attention on the *hydrosphere* and *atmosphere*.

- All together there are 4 puzzle pieces that make up the earth's systems. Scientists refer to these as 'spheres'. The bio(*life*)sphere which consists of all biotic factors on earth, the geo(*ground*)sphere which consists of all the rocks, minerals and landforms on earth, the atmos(*air*)phere which contains all of the earth's gases, and lastly, the hydro(*water*)sphere which consists of all of earth's water sources.

***Earth toss** (10 minutes)*

Ask students what the blue on the globe represents (A: water). Invite students to make "I notice..." and "I wonder..." statements regarding the globe.

Explain that we are going to conduct an experiment to see just how much water is on earth. Make a circle with students and toss the earth ball around the circle, making sure each student has a turn. Have students keep track of whether they touched water or land. Once everyone has caught the ball ask students who touched water to raise their hand. Discuss the fact that 72% of earth's surface is water and of that water 96.5% of it comprises the oceans.

***Our watershed** (25 minutes)*

We have discussed water as it relates to the entire earth, now let's zoom in to our community. Ask the class: "How does our community (human and natural) use and rely on water?"

One way water boundaries are set is by watershed. Write this on the board: A watershed is an area or ridge of land that separates waters flowing to different rivers, basins, or seas. In order to understand what a watershed is we are going to build a model.

Building a model watershed:

Demonstrate this process beforehand

1. Students crumple up a sheet of paper and then partially uncrumple it. The paper should represent mountain peaks and valleys.
2. Students draw along the ridge lines with black or blue markers.
3. All the adults in the room will come around with spray bottles as the rainstorm and spray a landscapes
4. Students record what happens in their science journals
5. Conduct a gallery walk for students to explore and see the differences between the landscapes

Visit Juneau Nature

http://juneaunature.discoverysoutheast.org/content_item/clickable-map-of-aakw-taaku-aani/

Use this interactive map with the class to explore the different watersheds of our area.

FIELD STUDY

Students will work in research teams of 4-5

What's the weather today? *(15 minutes)*

Start by inviting students to make simple sensory observations, tuning into their our sensory systems. Students will practice being meteorologists by working in groups to determine what weather patterns are present. Working in groups of 4-5 students will take the ambient air temperature using a thermometer, make visual observations about cloud type using provided guide sheets and record this data on their data collection sheets. Discuss how atmosphere and the hydrosphere interact to create weather. For an additional challenge ask students how the geosphere influences weather.

Hike to field study destination *(15-20 minutes)*

Encourage students to look for components of the biosphere, geosphere, hydrosphere and atmosphere or properties of water along the way. How many can they spot?

> Trail Game: As students are hiking play biosphere tag. Every once in awhile turn around and yell out something the students must touch before an adult tags them. Examples: something from the biosphere.

Water cycle exploration *(20-30 minutes)*

Find a space near an aquatic habitat to investigate and explore. Encourage students to free explore their outdoor laboratory through the lens of a hydrologist. When students come back discuss: 1) What impact does water have on this space? 2) How would this ecosystem change if it experienced a 25% decrease in precipitation? 3) How would you go about measuring or assessing the quality or health of the water in this ecosystem?

Water quality testing *(1 hour)*

Working in their research groups students will test the water quality (using the water quality testing kits) of several different water bodies or sections of a larger body of water. Data will be recorded using the attached worksheet.

DEBRIEF

Revisit our investigation *(15 minutes)*

Prepare the photos taken of student discoveries and water sampling procedures in a slide show shared with a class. After the slideshow have students turn and talk to a partner, reviewing what methods we used in the field to investigate water quality.

Writing our methods *(30 minutes)*

Have students practice writing like scientists. Explain that a critical part of science is explaining *how* an investigation or experiment is performed so that others can replicate it. Start with the example of a peanut butter and jelly sandwich: 1) have students come up with a list of the steps necessary to build a PB&J 2) then make a sandwich in front of the class following these directions EXACTLY 3) discuss what worked and what did not. Allow students to write their own methods or instructions of our water quality investigation in their science journals.

EXTENSIONS

Why water? *(25 minutes)*

Open up this activity with a simple question: Why water? Why do all living things need water and not another liquid like vinegar or orange juice?

Explain that water has a few properties that make it

Set up two stations (one monitored by you and one by your assistant):

1) Adhesion and cohesion (10 minutes)

- Explain adhesion and cohesion
- Pair students into groups of two or three and give each: 1 cup water, 1 pipette, and one square of wax paper.
- Have students pipette a few drops of water onto the wax paper. How small a droplet can you make? How close can you get two droplets together without touching? Allow time for experimentation and play.
- Pass out one penny per group. Ask: "How many water droplets can fit on a penny?" Allow students to experiment and record data and observations in science journals.

2) Polar water (10 minutes)
    - Explain polar vs nonpolar
    - Pair students into groups of two or three and give each: 1 bottle of water, and 1 pipette.
    - Ask: "What happens when you put oil in water?" record hypotheses in science journals.
    - Have students pipette a few drops of oil into the water. Allow time for experimentation, recording observations and play.
    - Have students hypothesize as to why oil and water don't mix. Use molecular diagrams of each to aid in the discussion.
    - Encourage students to experiment further at home: You can mix nonpolar and polar substances together if you add a special protein to break down the molecular barriers. This protein is found in egg yolks.

RESOURCES

https://water.usgs.gov/edu/solvent.html

Name(s):_____________________________ Date:____________

Water Quality Testing Data Sheet

Time of day:_______________________________

Location:__________________________________

Weather:__________________________________

Observations of water body (color, movement, smell etc.)________________________________

____

Test	Test 1	Test 2	Test 3	Average
Water temperature (℃)				
Turbidity (m)				
pH				
Dissolved Oxygen (ppm)				

Notes:

Nature Studies from the Perspective of Past DSE Naturalists (2019)

Steve Merli

Before I knew anything about Discovery Southeast, I was learning from and being inspired by Steve Merli when I was still a classroom teacher. I was watching him simultaneously connect deeply with nature and kids. I also would see him reach out to kids where they were at and validate them over and over - giving them choice when possible, and always leading them back to checking in with their own body, brain, and heart. I watched him and wanted what he had. I wanted to be able to slow myself down in such a way that I could connect to kids like that. To breathe in the day and be present with them exactly where they were. So really, Steve brought me here, just 16 years later.

When I was hired as a lead naturalist, I asked Merli if I could come observe a lesson with my "naturalist hat" on instead of my "classroom teacher hat". He graciously accepted and I watched him call on kids who I was sure would choose to not participate for one reason or another. But over and over, they would - with a combination of gentle encouragement and open choice, kids chose to buy in to the wonder he was spinning. He points out that by giving them that choice and by promising them that they are safe, but that they don't have to participate if they don't want to, we give them back control over their own lives.

Watching him work with kids always lights my own fire. After the lesson I asked him, if he was going to give a piece of advice to himself as a beginning naturalist almost 30 years ago, what would it be? He answered almost immediately, KEEP IT SIMPLE. I teased him a bit, and said, "That's it? Of all the advice you could give me, that's it?" "That's it," he affirmed with a smile.

So I started there and I continue to come back to this. Getting kids outside does not need to be complicated. If we get them "out there" with the right lens on, amazing things will happen all on their own.

When I talked to him more about digging back into what he thinks are really the most important pieces of the work that we do as naturalists, he also highlighted CONNECTION. He feels that connection is what it is all about. This need for connection cuts across everything - it is in our need for connection with each other, with nature, but most especially with ourselves.

He feels that the science standard is secondary to getting kids out there. The standards will be met naturally as their curiosity rises. He focuses on not giving them a lot of information to start with; by just taking them out to discover things, he prefers their knowledge build organically.He encouraged me to not to be afraid to push boundaries a bit, the land of safety holds no curiosity We are allowing them to dance with their own boundaries. When they are having to struggle just a bit, empathy begins to rise for each other and the natural world, and then can be turned inward.

“Everything has a track, and every track has a story.” Something for us to be mindful of as a life truth, not just an animal tracking lesson.

Megan Gahl

Megan was a naturalist at Harborview. She described some common threads in her field trips. She often took classes up the stairs above the cemetery (they would count the stairs), and then utilized the lower trail that runs roughly parallel to, and just above the flume boardwalk. She said that they also would go up to “the big rock,” a well-known landmark just a bit higher up the hill. With lots of adults and very firm boundaries, classes also spent time in Gold Creek looking for macroinvertebrates. She made sure to mention that the use of common language between naturalists really helps in the field.

She noted that they saw lots of porcupine sign and that it was important to watch out for “widowmakers” in the flume area. She admitted that, because of its location, Harborview can be a more challenging school to teach from, and thought that it was extremely important to go out with a clear goal in mind of what you want kids to get out of the time spent in the field.

Megan mentioned that Tom McKenna is a huge advocate for Discovery Southeast. She also felt that just getting kids out there was a big deal - and the goal was hopefully they would “grab on” to at least one thing as a takeaway.

Clay Good

Clay Good has spent lots of time helping out with science resources/ planning, and as an assistant in the field. He heartily encourages naturalists to use the new science standards! He was interested less in WHAT naturalists taught, and more about HOW they were teaching - including the questioning techniques used, student engagement, and the safety protocols that are used. He recommended that a set of standardized values across all naturalists be communicated with students before going out in the field. A further personal analysis of possible organization-wide areas of improvement is on file along with a sample lesson plan template.

John Hudson

John did his work with the 3-5 graders at Auke Bay. He loved getting to explore his area of expertise with students, aquatic insects. He started with macroinvertebrates in 3rd grade and then allowed this to lead into food chains in 5th.

He used macroinvertebrates to contrast structure. Questions were asked to entice kids to look closer. What do they need to obtain food? How do they move? Students used this knowledge to then compare the aquatic insects in streams vs. standing water. When not focusing on these tiny critters, he also had kids think about squirrels and spruce trees.

John's enthusiasm and passion is infectious. Kids pick up on topics quickly because he is so incredibly interested in them himself.

*A copy of his power point presentation on aquatic insects is on file.

Scott Burton

When you meet Scott, it is easy to tell he is passionate about the outdoors and getting kids as deeply into it as possible. When he was a naturalist at Gastineau, the area looked a little different. There was not a cleared area behind the school, and the big trail above Orca Point Apartments wound through a gravel pit, not an alder grove.

He first took us back behind the school and showed us the ditch in which he would have classes look for aquatic insects in the springtime. He had a great suggestion of using the plastic containers that spinach comes in from Costco to allow students to see the little critters more clearly.

Another area just behind the school received high levels of use with one age-level in particular, when he went out - and would still be very useful for the same purpose. When studying erosion, at the very start of a lesson he would have the students work as a team to make a mountain. Then he would demonstrate alluvial/colluvial sorting with a bucket brigade. One part of the activity that he remembered being particularly effective was to have kids connect with a coble. They were to choose a cobble that they liked, study it closely enough that the could describe it in great detail to a friend, and name it. Scott would then gather them all up in a bucket and send them down the mountain. Telling students to go find their cobble and stand by it. This was a great conversation starter for why exactly some cobble were so far away from the mountain, and some stayed close. He found that this activity was a good "energy dump" at the beginning of a field trip - allowing students to get rid of some of their wiggles early on, and thereafter be more receptive to activities that required more focus.

When continuing on up the hill, he liked to play tree tag to get everyone (including adults) loosened up and laughing. Kids would be challenged to race to touch a deciduous or coniferous tree, and as time allowed, be taught the difference between "handy hemlock" and "spiky" spruce, then asked to find one of these, etc. The adults in the group would also play, unfreezing those students who got tagged.

The major trail above Gastineau is a perfect place to talk about succession, as several decades ago it was a gravel pit, and now the gravel pit is not even visible through the alder. Conifers are starting to move into the area as well.

Scott mentioned that he would keep his eyes open for roadkill to scoop up and go place in a secluded, yet still accessible spot to allow students to watch the FBI in action. As they headed up through the area that was close to where the gravel pit used to be, he also mentioned how much he liked to do sound mapping and the quiet game with classes. However, his quiet game had a twist. He would challenge students to yell as loudly as possible for one minute - to get it all out (he mentioned how kids are never allowed to yell and scream and whoop) and then would ask them to do some observational writing in the silence that remained afterwards for a bit.

As we continued uphill and entered the beginning of the meadow area, he mentioned that thrift stores were a great resource to find random materials you might like to use in lessons. I thought this was a super tip.

While we were in the meadows he talked a lot about what a great place this was to explore, particularly in the winter. It is the ideal location for snow science lessons, and to see if kids can wolf walk (step only in the footsteps in front of them) while talking about animal tracking. Scott fondly remembered the snow science activity using film canisters and jello to represent voles and their winter adaptations. He also loved taking kids across the muskeg and into the woods, well away from the main trail.

It seemed to me that Scott believed deeply that kids need time just to be kids - and that the Discovery Southeast field trips provide a perfect place for them to run, jump, play, yell, and learn through the process. A lot of his teaching happened through the use of games focusing on connecting students deeply to the land. He felt that the science would happen naturally, and that, while the lesson goal was important, the more imperative need was for kids to get going - outside.

Tom Schwartz

Tom started working for Discovery as a naturalist 10-11 years ago. He began by working as an assistant naturalist with Scott Burton and then was a Lead at Auke Bay the next year. He continued in this work for 5 years.

When Tom was assisting Scott at Gastineau, he remembers getting "lost" in the muskeg, time in the woods, and all of the fun that went with lots of tracking opportunities. Playing in the snow and focusing on snow stories and the tales tracks tell, also was a big part of the winter work they did there. He also talked about studying animal adaptations through the "vole experiment." They would spend time just exploring, to see what they could discover together as a group.

He talked about some of the amazing things groups got to witness behind Auke Bay such as: deer, snowshoe hare, coyote tracks, and even a wolf kill. They also were able to talk quite a bit about the energy cycle and FBI. He spent a lot of time asking kids, "What do you think about that?" encouraging them to ask questions and think for themselves.

When he was teaching about animal adaptations and behaviors, he enjoyed featuring local birds: the red-breasted sapsucker, great blue heron, eagle, loon, hummingbird, American dipper, and dark-eyed junco were among his favorites. He got a kick out of kids' amazement when he would play "Bird Songs of Alaska" on his phone when they were out in the field, and birds would come to them and answer back.

Tom utilized lots of different activities when working with third, fourth, and fifth graders. When working with a group of new 3rd graders, some of the first work he did was defining some terms, and what it is that naturalists and Discovery Southeast do. They also would work together to make a dichotomous key for plants - laying the groundwork for just what it is that naturalists do. Once they ventured out into the field he focused less on "stop and listen to the naturalist time," and more on keeping them moving. He would allow them time to explore and games to play, guided by questions that he would pose to the group. As the landscape allowed, he would teach about succession - alders and conifers, talk about the canopy, and tie it all together with a game of tree tag. Later on, landforms and fjords and glaciers also were something that he introduced - talking about the little ice age. Since 5th graders got ski passes for the winter, in 5th grade he would also teach about avalanches and dig snow pits. Tom also enjoyed teaching about animal adaptations specifically about the bats of Southeast Alaska. He has bats that live at his house during the warmer months. One day a researcher came into his yard with a tracking receiver, as one of the bats that lived at Tom's house had been tagged. He let Tom know that researchers had dispelled the myth of bats migrating south to survive the winter, and had found a sheltered, slightly warmer cave on Admiralty where all of the bats from Southeast would congregate to wait out the winter.

Rick Bellagh

Rick worked for Discovery Southeast from 2007-2014 at Harborview. He found that one of the best ways to open kids' eyes to the natural world around them was to sing with them. He highly recommends the work of the "Banana Slug String Band." They wrote songs such as "Dirt, You Made My Lunch," "FBI," and other great tunes. The String Band came out of San Mateo Outdoor Education.

When studying animal signs and tracking, he enjoyed bringing in food that looked similar to the animal scat they would see in the field. So once kids knew what they were looking for, they had more success finding it in the field. And it was fun! For scat representation, he used: Raisinettes for deer, Gobstoppers for snowshoe hare, Mike and Ike's for porcupine, and Whoppers for moose.

With 3rd graders, he talked about FBI, scat and tracks, and then aquatic insects in the spring. 4th graders discussed compost (FBI), scat and tracks, and shelter building. He taught fire building with 5th graders (making up his own song to the Pointer Sisters' "Fire"). This included teaching them about tinder and kindling.

He loved using the space off of Behrends Avenue for his outings. Care was to be taken while crossing the avalanche chute, but once across this, the area is basically a wildland park and is a gold-mine for wildlife studies.

On the way back from a trip, he would always do a toe-to-toe circle with the group to solidify what they learned together.

Rick is a guy who is passionate about the work of Discovery Southeast, and is eager to share his knowledge with new naturalists. Being a lead Naturalist was his favorite job ever, and he has much wisdom to share.

Walt Chapman

Walt took us for a hike in the woods above Harborview and shared some of his favorite things he did during his time as a Naturalist with Discovery Southeast.

He would walk kids past the condos and up the trail there - and then head higher. The first section below the flume trail was really just a warm-up for his sessions. Once the group got to the intersection of the smaller uphill trail and the flume path, he would continue up the mountain, taking even smaller game trails. He let us know that how high he went was dependent upon how confident and capable at hiking each particular class was.

One of the places he showed us after we had been hiking up for a while was “the big rock”. This was a landmark that had been mentioned by other naturalists as well. It is a stone that feels very old and has trees wrapped around it, despite its size. This was a spot where he would stop and get kids asking questions. He worked hard to not answer all their questions, but to leave them curious - giving them just enough info to leave them wanting a bit more. Walt said this was a great jumping-off point for research done together when they returned to the classroom. It is his feeling that if you hand kids all of the answers, it shuts down their natural curiosity. After reaching the “big rock” we headed uphill for just a bit more, but then our course changed and we set off in a direction taking us mostly directly across the mountain.

He pointed out a really interesting nursery log that had been down for many years and at this point had been fairly overtaken by decomposers. Walt remembered the fun that he had with classes as they would be able to crawl through this log after it had been hollowed out but was still open and stable.

As we started to head downhill a bit, he brought us to an area that had trees growing in a very surprising way. These were the “spider trees”. They were trees that had roots exposed and above ground for 2-3 feet before they entered the soil, leading to the comparison of spider legs. This was another spot where Walt would ask kids to pause and ponder what had happened. Do trees normally grow like this? Do they like having their roots above the earth? No? Then what happened here? He pointed out a few spots where he would work with classes lower on the mountain, but felt that the close proximity to the flume trail made it hard. He much preferred being higher up on the hill.

Walt’s passion for working with kids and his enthusiasm for getting them outside shines through in the work he does. He is a great source of wisdom for new naturalists - especially those working in the Harborview area.

Kelly Sorensen

To briefly answer your questions- the lessons that I wrote formal lesson plans for in 2016 were the ones that I used regularly and I tried to make them accessible to anyone (including new naturalists) though I definitely have some favorites. Fall is a great time to talk about decomposition so any kind of FBI lesson usually goes over well, I have also done plant and animal adaptations with more limited success.

Winter can be tricky because of the inconsistent weather, I have tried tracking several times and if the snow is good it is awesome, if not it is not awesome. My advice to a more seasoned naturalist is to try an inquiry based lesson during winter so you can really get into an interesting more involved version in the spring (5th grade works best). This is essentially framing a concept with some background knowledge- for example adaptation. During the pre-lesson, bring in some plants that they will likely see in the field, teach them about some common adaptations and ask them what they are wondering about. Try to narrow down all of the questions to a few that will be possible to experiment with like 'which plants can tolerate colder weather and why? Why does Devils club grow really tall in some places and not others?'. During the field session have students do some hands on research and try to answer the questions. End it off with a debate. I have done a survival lesson based on the idea of establishing a new fish or hunting camp and tie it to landforms and topography that the students really like. It needs some dialling in but the concept is pretty cool.

Erosion and aquatic insects are two spring lessons that always go well and are fairly easy for newbies. In general my advice is always to talk less, kids learn best by doing and not by going on a guided walking tour of the forest. Any activity that has them literally connecting with nature is the best, even if it doesn't seem as academic as it could be. For the littles that is usually sensory based activities and games with very few rules, and for the intermediates they like any kind of a challenge (scavenger hunt, natural insulation competition).

Nature studies curriculum K-5 (2019)

What do Squirrels Need?

Lesson Plan for Kindergarteners Fall

OVERVIEW & PURPOSE

The first session of nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea that animals need air, water, and a home to survive, we'll specifically talk about the red squirrel. We will practice using weather words stormy, windy, sunny, cloudy, or snowy.

EDUCATION STANDARDS

1. K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.
2. K-ESS2-2: Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
3. ESS3.A: Natural Resources (DCI): Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

OBJECTIVES

1. Students will make observations about the weather to make decisions about how to prepare for our time outside.
2. Students will observe animal habitats, questioning why an animal chose that location for it's home.
3. Students will recognize that animals choose where to live based on what they need (water, air, food, shelter material)
4. Students will gain an appreciation for the "outdoor classroom" and will understand what their behavior should be like while outside.
5. Students will understand that they are naturalists.

MATERIALS NEEDED

1. Mystery Scene: at least 30 whole spruce cones, 20 partially eaten cones, 20 fully eaten, bag full of midden scraps, some branches with spruce needles, pieces of bark, maybe a log. A cloth to set it up on. A speaker and squirrel sounds ready.
2. Scavenger Hunt- at least 6 copies
3. Photos of Squirrels
4. Science Journals, paper plates, hand lenses, and pencils for wrap up

ACTIVITY

Introduction Session

Part 1: Introduction/Warming up our senses (40 minutes)

1. Introduction: Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves. Tomorrow we'll be going to our "outdoor classroom" to practice being naturalists.
2. Animals and Us: We will be learning about how animals stay safe and grow. Ask the students: How do *you* stay safe, grow and be healthy? This will prompt a discussion on what we need to be alive and what we have in common with animals.
3. Solve a Mystery: Using our imagination, we'll go for a walk around the classroom, pretending to be in the woods. Splitting the class in two during this process, each half will circle up around the "mystery". On a piece of cloth, there will be various parts of a spruce tree, and specifically spruce cones: enough whole and "eaten" for each student to have one in front of them to investigate. There will also be piles of bracts. Using their senses, the naturalist will guide them through the process of noticing, What happened here? Eventually they may or may not come to the conclusion that this is evidence of a squirrel.
4. Wrap up the mystery: Let them know the answer to the mystery if they didn't already figure it out. Get them thinking about what is the same about what Squirrels need and what's different compared to us. I.e. we both need food, but squirrels eat spruce cones, and we don't!

Introduction Part 2: Practice Walk 30 minutes

1. Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel*?
2. Attention Getter: If it hasn't already been introduced, introduce attention getter and practice a few times having kids plant their feet like roots of a tree and facing their toes towards me to listen for next instructions.
3. Expectations outside: The same as in the classroom: We're going to our "outdoor Classroom", not recess. Rocks and sticks stay on the ground, we stay together as a group, and when I use attention getter, we are quiet and listening. When we are walking to and from school, it's usually okay to talk to a neighbor, but we should be using level 1 voices so we don't disturb any animals.
4. Dress for the weather: Have students dress for a walk, reminding them to dress warmly and dry. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at all times.
5. Practice Walk: Lead class out the door to the "class tree", everyone should be quiet with all their senses turned on full volume. Once at the tree, go through each sense: Become a scientist/naturalist. What senses can we use today?

   SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

   - TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
   - HEARING: Class challenge: 30-60 seconds of quiet, point to any nature sounds you hear.
   - VISION: What does the tree look like?
6. Observe the Tree: Make observations about the tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder..." question about the tree. Make a prediction about what it might look like next time you see it.
7. What is our body telling us?: By show of hands, cue kids to tune into their body while outside. Are you cold? Wet? How are your hands? Feet? Legs? Head? Would you want to stay out for longer or go inside? What Can we bring/wear tomorrow to make our bodies feel better?
8. Walk back to classroom: Let them know that tomorrow we're going to go for a longer walk, review what they need to wear.

Field Trip Session

1. Review: What did we do yesterday? How is today's weather different from yesterday? How is it the same? Today's trip will be longer outside: did anyone feel cold? If you felt cold, what can you change about how you prepare to make yourself warmer?
2. Overview of today: Today we'll be thinking about where squirrels live, their "habitat" and what they need to be safe and grow .
3. Pretend to be a squirrel: show a photos of a squirrel with a spruce cone in it's mouth. Have them pretend to be squirrels with you. Remember together what a squirrel needs to live: water, food, a home, air. (sometimes this doesn't happen until we're outside if they're getting too warm in gear) Could show video clips of what squirrels act and sound like:
   https://www.youtube.com/watch?v=RtqcDfg0QLg
   https://www.youtube.com/watch?v=HleGtR7SLgo
   https://www.youtube.com/watch?v=0o5N1hIY0Dk
   https://www.youtube.com/watch?v=U0L95f-L1gs
4. Dress for the weather: Have students dress to go outside, double checking to make sure they will all be warm/dry enough to be outside for about an hour to an hour and a half.
5. Bathroom?
6. Warm up senses: Before leaving, remind students that when we go outside into nature, we want to use our senses (and our brains!) like naturalists. *GO over each sense*.
7. Walking Scavenger Hunt: Some schools have a long walk to the woods, this can be a nice activity to engage their senses and keep them on the move. Break up into smaller teams to complete a scavenger hunt. As many teams as there are adults works best. The goal is to find everything before we get to our destination.
8. Is this a good place for a squirrel to live?: Thinking about the things a squirrel might need to live, have we seen any so far? Water! Have them take a deep breath (air)
9. Look for Animal Food: Ask students to look around for food for a squirrel. If you were a squirrel, would you want to live here? What would you eat? Break up into as many teams as you have adults and have them collect as many spruce cones as they can in 2-5 minutes (depends on engagement, time, and weather). After time is up, group back up together, and let them know that they have to have x amount of cones to survive, have groups return to their piles and count (maybe by 10s if they've learned that). Group up again, did everyone survive? I always set the number so that everyone does survive.
10. Build a nest (10-15 minutes): Now in their groups they have to build a home for their squirrels. Before breaking off, lead a discussion about where a squirrel might like to build a home, and what is important to have nearby: food, water, shelter from wind/cold. *Remind them not to run with sticks and that the sticks they use to build should not be bigger than their own two hands across (imagine if a squirrel could pick it up). If there is time, a brief museum walk around to the different homes to share with each other what they made.

11. Look for Animal Homes/evidence of a squirrel: Ask students to explore in an area where you've stopped as a group. Show them spruce cones that have been munched on by a squirrel and show them a squirrel midden.
12. Return to classroom: If weather was bad and we came back early, Journaling about the weather and a drawing of their squirrel home. Otherwise, a quick recap, wrap up and see you tomorrow.

Wrap-Up in Classroom -30 minutes

1. Review our Field trip. What did we see? What did we do? Bring in three cones: one full, one ½ eaten, one completely eaten. Why would a squirrel not eat the whole thing?
2. Show Video from Nature Bob: either "The Red Squirrel of Alaska". This video can be fast forwarded some, but shows eating, a home, and has a short audio clip of their sound and is 6 minutes total. It's a good time to have some discussions while watching.
3. Act like a squirrel break: If you're class is still feeling squirrely: have students stand up and follow you around the room pretending to be a squirrel: what would they do if a predator is near by? How do they eat? How do they sleep?
4. Observational Drawing: Using the Observe, plan, practice draw cycle, show students how to do an observational drawing of a spruce cone. Write the words Spruce cone, and possibly Squirrel Food on the board for them to add a label.
5. Optional Seed Extraction: If time, give students a paper plate and a few hand lenses per table. Show them how to find the seeds inside and see how many they can get. They'll soon learn it's hard work! This activity is messy, but really engaging.
6. Let them know we'll see each other in the winter. Have kids make some predictions about what will be different about our next meeting. What will our tree look like? What will the ground look like? What will we be wearing to go outside?

How can we prepare for all of the different types of weather in Juneau?

Lesson Plan for Kindergarten Winter

OVERVIEW & PURPOSE

The second session of nature studies continues to focus on getting the students confident when exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also asked to think about how weather affects us (and other critters) and what they can do to prepare for different types of weather. They will practice using weather words such as; stormy, windy, sunny, cloudy, or snowy.

EDUCATION STANDARDS

1. K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.
2. K-ESS3-2: Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to severe weather.
3. PS2.A: Force and Motion: Pushes and pulls can have different strengths and directions.
4. PS2.B: Types of Interactions: When objects touch or collide, they push on one another and can change motion.

OBJECTIVES

1. Students will make observations about the weather to make decisions about how to prepare for our time outside.

can you change about how you are dressed to help yourself be warmer? - 5 minutes

2. Overview of today: Today we'll be thinking about weather and where we can find pushes and pulls in nature.
3. Dress for the weather: Have students dress to go outside, double checking to make sure they will all be warm/dry enough to be outside for more than an hour. - 5-10 minutes
4. Weather Scavenger Hunt: Weather themed scavenger hunt or Reporter for the walk.
5. Document the weather: Find a good spot to be for a while, set kids up with sit spots, clipboards, rite in the rain paper, and pencils and have them draw what they see labeling the weather. Clouds, rain, fog, wind, sun etc.
6. Measuring the weather: Depending on the days weather- bring a tool that can be used to measure the weather: thermometer, wind sock, rain gauge, ruler for snow depth.
7. Moment to wonder: What do you think the squirrels are doing today? Birds? Bears?
8. Return to Classroom

Wrap-Up in Classroom -30-40 minutes minutes

1. What was your favorite part of our field trip? What was something that surprised you? - 5-10 minutes
2. What do animals do in different weather? Share photos from nature Bob of different animals in different weather.
3. Next time it will be spring, what will the weather be like then? What will we wear for our nature studies?

- Wind Maze Activity - While most of the class is working on their no such thing as bad weather activity, have the assistant naturalist circulate to offer guidance, while you lead the wind maze activity set up on the floor out of the way or at a table. Have your first group help you set up the unifix sticks into a maze shape (see attached photo for a general idea). Then show them the small sphere and ask one child to roll it through the maze. After that is accomplished, tell them "Great! Now do it without touching it.:)" Hmm... allow some brainstorming of possible ideas, and then, when appropriate. After kids in the group have all had a chance to try this new technique, ask them what they think is happening. Guide them toward understanding our breath can provide a push even when not touching something. What in nature acts this way? (the wind). Continue with other groups in the same fashion until all students have tried the maze. - 20-30 minutes

3. Let students know that we are going to continue thinking about weather the next time we meet, and challenge them to see how many different types of weather they can notice between now and then. - 5 minutes

<u>Part 2: Warming up our senses and practice walk to our tree (35-45 minutes)</u>

1. <u>Introduction:</u> Tomorrow we'll be going out into the field to continue our work as naturalists. Today we will be reminding ourselves how to turn on all of our senses so that we can make the most of our time outside. We will also take a practice walk to our tree. - 2 minutes
2. <u>Classroom activity:</u> Making Observations- Ask for a few volunteers to demonstrate the activity. Have one student stand in front of the room and have the class "observe" them. Take the student into the hallway and change 5 things about the student's appearance. Bring the student back in front of the class, the class can give one change at a time. Now break the kids into groups, have them carry out this activity again. At the end, ask what SENSE did they use for this activity? - 10 minutes
3. <u>Weather:</u> From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch.* When you came to school today, how did the weather *feel*? - 5 minutes
4. <u>Warming up our Senses:</u> Ask students if they know that they have *more* senses to help them make observations. See how many senses they can come up with on their own, write them up on the board with a picture of the body part. Now ask if they think animals have the same senses we do. See if they can help you come up with wild animals that have extra strong sight, hearing, smelling, touch, taste. We are now going to be a super wild animal and have the best of all their senses and go for a nature walk to our tree. Are you ready to smell like a polar bears, listen like a caribou, see like a snowy owl, feel like an arctic fox. We're not going to taste anything except rain, or snow falling from the sky (do not pick up snow to eat). - 5 minutes

5. Attention Getter: If it hasn't already been introduced, introduce attention getter and practice a few times.
6. Dress for the weather: Have students dress for a walk, reminding them to dress warmly. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at all times. - 5 minutes
7. Practice Walk: Lead class out the door to the "class tree", everyone should be quiet with all their senses turned on full volume. Once at the tree, go through each sense: Become a scientist/naturalist. What senses can we use today?

   SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

   - TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
   - HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.
   - VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length? Last 1, 2, 3 share.

   * 1, 2, 3 share: count to 3 and then make a gesture with your hands that invites the group to speak all at once. Students should only say one or two words to describe their thoughts and say it only once. Use a normal tone of voice, no need to yell. This allows the entire group to participate, including quiet students, without having to hold the group's attention to hear from individuals with hands raised. - 10 minutes
8. Observe the Tree: Make observations about the tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder..." question about the tree. Make a prediction about what it might look like next time you see it. - 5 minutes
9. Walk back to classroom: Let them know that tomorrow we're going to go for a longer walk, review what they need to wear.

Field Trip Session (approximately 1.5 hours)

1. Review: What did we do yesterday? How is today's weather different from yesterday? How is it the same? Today's trip will be slightly longer outside: did anyone feel cold? If you felt cold, what

can you change about how you are dressed to help yourself be warmer? - 5 minutes

2. Overview of today: Today we'll be thinking about weather and where we can find pushes and pulls in nature.
3. Dress for the weather: Have students dress to go outside, double checking to make sure they will all be warm/dry enough to be outside for more than an hour. - 5-10 minutes
4. Weather Scavenger Hunt: Weather themed scavenger hunt or Reporter for the walk.
5. Document the weather: Find a good spot to be for a while, set kids up with sit spots, clipboards, rite in the rain paper, and pencils and have them draw what they see labeling the weather. Clouds, rain, fog, wind, sun etc.
6. Measuring the weather: Depending on the days weather- bring a tool that can be used to measure the weather: thermometer, wind sock, rain gauge, ruler for snow depth.
7. Moment to wonder: What do you think the squirrels are doing today? Birds? Bears?
8. Return to Classroom

Wrap-Up in Classroom -30-40 minutes minutes

1. What was your favorite part of our field trip? What was something that surprised you? - 5-10 minutes
2. What do animals do in different weather? Share photos from nature Bob of different animals in different weather.
3. Next time it will be spring, what will the weather be like then? What will we wear for our nature studies?

What are the parts of a tree?

Lesson Plan for 1st Grade Autumn

OVERVIEW & PURPOSE

The first session of nature studies is focused on getting the students confident when exploring outside, understanding how to be prepared and safe, and practicing making observations and asking questions. They are also introduced to trees in the Tongass, specifically paying attention to the basic parts of trees and their functions.

EDUCATION STANDARDS

1. 1-LS1-1: Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
2. LS1.A: Structure and Function: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

OBJECTIVES

1. Students will practice learning in the outdoor classroom by following behavioral guidelines and uses their senses.
2. Students will practice the basics of the scientific process using observations to ask questions and then make predictions.
3. Students will learn about some of the trees that grow in the temperate rainforest and a few of the adaptations that help them survive and thrive.
4. Students will gain experience creating a scientific drawing based on what they observe including labels.
5. Students will design a paper structure that can remain standing in simulated wind based on what they have learned about the parts and adaptations of trees.

MATERIALS NEEDED

1. Intro: Tree Cookies: 1 per kid is ideal of relatively equal sizes
2. Science Journals and pencils
3. Photos of trees and other tree cookies
4. Field: Buckets with list of items to collect taped on outside
5. An outdoor long measuring tape to quickly mark out the height of a tree
6. Paper, cardboard clipboards and pencils if time to do drawing outside
7. Wrap: Book: Are Trees Alive?
8. Prepped sheets of recycled paper for the "trees" and Books or desks to hold "tree roots" for Wrap

ACTIVITY

Introduction Part 1: 30-40 minutes

1. Introduction: Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves. Tomorrow we'll be going to our "outdoor classroom" to practice being naturalists.
2. Review Parts of a Tree: Introduce this falls nature studies topic of Trees. What are the parts of a tree- can be helpful to draw a tree as they name the parts.
3. Classroom Activity: A Daa Yaneisa Look closely at tree cookies. After explaining what a tree cookie is (the inside/cross section of a tree trunk). Review observational drawing cycle: observe, plan, practice, draw. Students will each have a tree cookie to study and draw. Encourage them to find new details and add them (with labels!) to their drawings. Practice using "I notice" and "I wonder" sentence stems.
4. Wrap Up Drawing: Have students share their drawings with a partner (or in a circle), then meet back at the center to talk about what tree rings can show us. Show examples of other tree cookies or stumps that look very different. Explain why we can count the rings: in winter trees slow down their growth because there isn't as much sunlight and it's cold (dark lines), in summer when there is lots of sun and warmth they grow a lot (light colored thick lines). So when we count the years, we just count one, not both.

Introduction Part 2: Practice Walk 30 minutes

1. Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel*?
2. Attention Getter: If it hasn't already been introduced, introduce attention getter and practice a few times having kids plant their feet like roots of a tree and facing their toes towards me to listen for next instructions.
3. Expectations outside: The same as in the classroom: We're going to our "outdoor Classroom", not recess. Rocks and sticks stay on the ground, we stay together as a group, and when I use attention getter, we are quiet and listening. When we are walking to and from school, it's usually okay to talk to a neighbor, but we should be using level 1 voices so we don't disturb any animals.
4. Dress for the weather: Have students dress for a walk, reminding them to dress warmly. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at all times.
5. Practice Walk: Lead class out the door to the "class tree", everyone should be quiet with all their senses turned on full volume. Once at the tree, go through each sense: Become a scientist/naturalist. What senses can we use today?
6. Observe the Tree: Make observations about the tree. What does it look like, what does it feel like, what does it smell like, can you hear it? Ask an "I wonder..." question about the tree. Make a prediction about what it might look like next time you see it.
7. What is our body telling us?: By show of hands, cue kids to tune into their body while outside. Are you cold? Wet? How are your hands? Feet? Legs? Head? Would you want to stay out for longer or go inside? What Can we bring/wear tomorrow to make our bodies feel better?
8. Walk back to classroom: Let them know that tomorrow we're going to go for a longer walk, review what they need to wear.

Field Trip Session (approximately 1.5-2 hours)

1. Dress for outside: Have students get ready to go outside. - 10 minutes
2. Warming up senses: Have them turn on their senses before you leave the classroom so that they are walking very quietly in the hall.
3. Sesnses and arrival to woods: Once you've arrived to the woods, gather kids in a circle to get them tuned into their senses. Going through each sense.
4. Reporter: While walking in a single file line, play "reporter". The first child in line pulls off to the side and repeats a word or phrase about something on the trail as the rest of the line walks by. Best done if whispered so that people have to pay attention. This is a good time to use "handshake Hemlock" and "spiky spruce" to start thinking about different types of trees we have here, their differences, and their names.

5. Tree Scavenger Hunt: Hand out buckets with scavenger hunt lists to groups of 4-5 kids with one adult. Give boundaries or continue walking during the hunt, collecting various parts of trees that are already on the ground. Ending at a place where we can see roots. Instruct the groups to 1) sort what they collected into like piles (leaves, bark, twigs, needles, cones, fruit etc) 2) investigate one pile at a time to come up with it's purpose- what does this do for the tree? 3) create tree art-allow kids to either work together, in pairs or individually within their group to build a tree with what they collected or anything else on the ground around them. If time, a museum walk.
6. Meet a Tree: This activity requires an appropriate space, a little extra time, and a safe group dynamic, so may not always be right for each class. In small groups with one adult (ideally less than 4 kids per adult) have kids close their eyes, safely lead them to a tree and have them explore it with their hands. Any sort of exploration without their eyes is okay. This should be a quiet activity, no more than whispers. The adult will safely lead them (holding hands will probably be best) to and from the tree. When the group has returned to the starting point, the students can try to find their tree.
7. Find a tree to observe and draw: Now have students spread out in the area and find a tree to observe and draw. Spend some time looking at it. What makes it special? How would you describe it to someone else? What animals/creatures might make this tree a home? Now hand out write in the rain paper to students and have them do a sketch of their special tree, or just a part of their tree (if they like). Be sure to have them take their time, and give them the opportunity to introduce their tree to a partner. -15-20 mintes
8. Walk a tree height: To give kids a better idea of just how tall the trees really are in the Tongass, ask one child to stay in one spot and be the base of the tree. Pace out a distance that is roughly equivalent to the height of a tree that they might see walking through the forest (approximate average heights for our area: hemlock-right around 100 feet, spruce- about 120 feet. Tallest spruce 200ft!, tallest tree in the world Coastal Redwood 379 ft! Largest tree Sequoia 102 Ft circumference!) and have kids spread themselves out along the "trunk." Remind kids that trees are like people, every single one is different, and so this just gives us a general idea of how huge these trees really are! - 10-15 minutes
9. Walk back to classroom - 15 minutes

Wrap-up (40 minutes):

1) Review/Remember: Review what we did on our field trip. We probably saw hundreds of trees yesterday. Bring in the largest tree cookie- I wanted to share this with you all. If there wasn't time for winter/summer growth ring, this is a good time for that. Have students count back the rings to see how much this tree grew since they were born. Then count your own age!
2) Story: Are Trees Alive?: This book explores parts of trees and compares them to the human body. A great book to make connections to the actual field trip. Also, a great lead in to the next

activity. What keeps them standing in a strong wind? What parts of the tree help them stand up strong? Roots, and trunk is usually what they say. - 5-10 minutes

3) Activity: First step: a challenge to use paper to design a tree that stands up. Using only paper, demonstrate rolling it up, asking for ideas and advice on how to get it to stand up on it's own on a desk. This is a good way to show that it's okay to share ideas, it's okay to have an idea fail, and you may have to try a few things. Thinking about how a real tree stands up, they may end up giving you the idea to rip the paper to make roots at the bottom, this will help them too! After a very thorough demonstration, have them each make their own tree that stands up on its own. Once most have done that, introduce some "wind" flapping a book next to their tree. Second step: can you think of a way to keep your tree from falling down in the wind? They may need some prompting and ideas. Third step: introduce using a book or block as a tool, many tree models will have roots at this point, but they won't be weighed down by anything, Have them think about how roots stay in one place. After the experiment, make sure to mention that trees have one other awesome adaptation they use. They have learned to flex and bend with the wind. Because they do not stay rigid, they are less likely to break in a strong wind. - 20-30 minutes
4) Goodbye: Let them know we'll be back together in the winter for another Nature Studies field trip. Thanks, and we'll see you soon!

Pre-lessons and Extensions:

Tree Art Lesson from Kris Dorsey: Draw a spruce tree from memory. Have students using pencils and colored pencils draw a spruce tree from memory. Then take your class outside to a spruce tree on or near your campus and have them draw a spruce tree from observation. Take some time to compare their drawings having kids "notice" different things. Then, using the JSD art kit "Draw a Tree Seedling" have them do an observational drawing of a tree seedling. Take some time to compare the adult tree drawing to the seedling tree drawing.

<u>Tree Cookie Studies:</u> Get your own class tree cookie to study and learn about. (will develop this more after jim gilbert tries it out

<u>Post Field Trip Drawing of collected parts:</u> If the teacher would like to bring back the collected parts in the buckets to give the kids an option at centers or choice to do some more observational drawings, or to investigate the parts with a magnifying glass

What lives in the Tides?

Lesson Plan for Grade 1 Harborview Winter

OVERVIEW & PURPOSE

Nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to Tidal areas and the many different living things that you can find there. They will learn how to collect data and will see how data can be turned into something visual (a graph). Students will also think about how animals have certain parts to help them survive in the intertidal environment.

EDUCATION STANDARDS

1. LS1.A: Structure and Function: All organisms have external parts. Different animals use their body parts in different ways.
2. 1-ESS1-2: Make observations at different times of year to relate the amount of daylight to the time of year.

OBJECTIVES

1. Students will practice learning in the outdoor classroom by following behavioral guidelines and uses their senses.
2. Students will practice the basics of the scientific process using observations to ask questions and then make predictions.
3. Students will learn about some of the animals that live in the tidal zone.
4. Students will gain experience creating a scientific drawing based on what they observe including labels.

MATERIALS NEEDED

1. Binoculars (enough for each adult to be in charge of a pair)

2. Embroidery Circles?- borrow from Seaweek buckets that JSD has at school
3. Paper/Science Journals and pencils (classroom)
4. Book of Intertidal Organisms (Field guides are good for field trip)
5. Flat trays for each table
6. Intertidal organisms from beach near whale statue

ACTIVITY

Introduction Part 1: 30-40 minutes

1. Introduction: This can be a good time to recap what happened last time we visited. Introduce the Assistant (if they are different) and give a brief overview of what we will be studying in Nature this session.
2. Show intertidal creatures: Bring in some mussels, barnacles, maybe some seaweed. Give kids a chance to touch everything, as they'll probably have gloves on for most of the field trip. Practice using "I notice..." and "I wonder..."
3. Sorting: Sort them if possible or at least identify how many different things there are. If they know the names, write them down in a list in their notebooks. They can use the field guides to identify them, adults can help.
4. Practice Counting: In bins at table groups, have differing amounts of shells, barnacles, rocks to practice taking data. Have students count how many of each they find.
5. Observational Drawing: Have them choose one thing to draw in their journal from observation. A Daa Yaneisa. Examine it, look closely. Label their drawing, add details!
6. Preview Tomorrow: Let kids know what that tomorrow we'll be going for a practice walk. What will the weather be tomorrow? Everyone should have boots, snowsuit/raingear, warm hat, gloves/mittens, warm layers underneath. -Have a student demonstrate- 5 minutes

Introduction Part 2: (40 minutes)

1. Classroom activity: Similarities between the living things we explored. Barnacles, mussels, snails, clams, seaweed. What's similar? What's different? Create lists for each item. This is a chance to go into depth about structure and function of tidal animals. Why do some they have shells? Etc. This could be a good place for a book:

2. Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel*?

3. Attention getter: If it hasn't already come up, introduce attention getter and practice a few times. -3 minutes

4. Dress for the weather: Have students dress for a walk, reminding them to dress warmly and to stay dry. Let students know that when we walk outside with Nature studies, we are focused on our senses. Students should not pick up/throw rocks or sticks. It's important to pay attention to the group as well as nature, stay with the group at all times. -5 minute

5. Practice Walk: Lead class out the door: Warm up senses:

   -SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

   -TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?

   - HEARING: Class challenge: 30-60 seconds of quiet, point to any nature sounds you hear?

   -VISION: Focus on a nearby tree. What does the tree look like? Can you describe it to your neighbor?

6. What is our body telling us?: By show of hands, cue kids to tune into their body while outside. Are you cold? Wet? How are your hands? Feet? Legs? Head? Would you want to stay at for longer or go inside? What Can we bring/wear tomorrow to make our bodies feel better?

7. Walk back to classroom: Let them know that tomorrow we're going to go for a longer walk, review what they need to wear.

Field Trip Session (1.5 hours) *** Plan to go at a low tide!

1. Introduction: Go over the plan for the field trip
2. Dress for outside: Have students get ready to go outside- bathroom!
3. Warming up senses: Remind them to turn on their senses and brains before you leave the classroom so that they are walking very quietly in the hall.
4. Begin hike: Walk across bridge and down to harbor/across to the whale statue, have a few binoculars along and embroidery hoops.
5. Warming up Senses: Lead students in the Warming up Senses activity: Become a scientist/naturalist. What senses can we use today?

   SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
- HEARING: Class challenge: 30-60 seconds of quiet, point to any nature sounds you hear.
- VISION: What can we see?

6. Exploration: Allow 5 minutes of initial exploration. Set some boundaries, remind them that we are entering a living things home and we should be gentle. What can we find here? After a few minutes, call the group back together near a spot close to the water. Have you found things that are interesting? Quick share of what's been discovered.
7. Finding the tidelines: Does anyone know where the tide will come up to? How do you know? Is the water coming in or going out right now? How could we find out? Invite them to think of ways to observe which way the tide is going, reminding them that it takes 6 hours for the tide to switch. Could we make a mark somehow and see if the water gets closer or further away while we're here? Have students pair up to make their own mark to monitor while we're there, if they'd like. (can be helpful to have a survey flag to mark this)
8. Observations: Have students pair up and find one living thing to focus on, could be something small or large, what do you notice about where it is living? What does it feel like? Etc. Does it stay in the water when the tide comes up? Have them come up with an "I wonder..." statement. Video record them?
9. Game: Seagull Simon Says: Seagull (fly around), anemone (stand still with arms waving up), Seastar (make a star with body), Mussel (stay in one place opening bent arms and closing them), barnacle (put hands on floor and kick one foot to get your food, be careful not to kick anyone), 1st grader (the cue to get them to regroup in a circle in case the seagull fly too far away). This is a chance for kids to warm up a bit, and move around play it for 5 minutes or so. Could be used multiple times to help warm up and get attention.
10. Animal Counts: Give pairs or trios embroidery hoops to set out in different spots of the tide zone. Have them count different creatures that they find. How many types, how many of each? Report to an adult to write down their numbers. If it's low tide, you can set up "plots" throughout the tidal zone. Collect the numbers from the adults so you can graph them for wrap up. This can be done more than once if time allows.
11. Return to classroom: Walk back to classroom.

Wrap UP:

1) Review/Remember: Review what we did on our field trip: maybe show photos/videos taken. Review numbers that we collected. What do they mean?
2) Matching Data to Graphs: Using their data from the day before, match the bar graph that represents the numbers. First show a simple example of data and a graph to match on the

board. Activity: Each table will have a complete set of data and it's graph, they will have to look for matching numbers. Regroup, what did we find out? Why are graphs useful? Demonstrate how if we look at them side by side, we can quickly see which has more or less of one thing.

3) Tidal Photos: Show photos of the whale statue stairs at low tide and high tide. Then talk about what we found in the different areas.
4) Goodbye: Let them know we'll be back together in spring for another Nature Studies field trip. Thanks, and we'll see you soon!

What sounds are found in the forest?

Lesson Plan for 1st grade Spring Sound Studies

OVERVIEW & PURPOSE

The second session for 1st graders, they are introduced to the sounds found in nature and how animals have different shaped ears to help their hearing.

EDUCATION STANDARDS

1. 1-PS4-1: Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
2. 1-PS4-4: Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
3. LS1.A: Structure and Function: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects etc.

OBJECTIVES

1. Students will use their sense of hearing to focus on sounds found in nature.
2. Students will discover ways they can improve their own hearing by changing the shape of their ears to be more like animals with good hearing.

MATERIALS NEEDED

1. Science Journal and Pencil
2. Sample objects to test, cone, ball with holes, cup, cup with a hole etc
3. Photos of animals with big ears/good hearing

4. Bird songs on cd/computer

ACTIVITY

Introduction 1 in Classroom: (30-40 minutes)

1) Introduction/Recap: Remind the student that during Nature Studies, we are all practicing being "naturalists".
2) Lesson Subject Intro: Read "Have you Heard the Nesting Bird?" By Rita Gray. Have students try the sounds out loud with you.
3) Activity: Have students sit at their desks with their science journals. Play some bird songs that we will likely hear on our trip. Demonstrate one first- using your finger in the air to mimic what the sound does. Does it go up and down? Have them practice with you a few times with their own finger. Then show them how to draw what their finger is doing. Play bird songs multiple times:
4) Bald Eagle Call
5) Varied Thrush
6) American Robin
7) American Dipper
8) Golden Crowned Sparrow
9) Steller's Jay
10) Have kids practice in the air then draw the song. Show them the photo of the bird they heard and have them label their drawing. Practice a few times, and maybe see if they can guess which bird is singing after drawing 3-5.

11) Classroom activity on sounds: Teach them what a sound map is. Demonstrate on the white board (projector or lapboard would be best, so naturalist could stand in middle of the room to demonstrate). Have the assistant point to students to make different sounds. The naturalist in the middle will draw it. Explain that if a sound is close by, you draw it closer to you, maybe bigger, than a far away sound. We'll be making one of these on our field trip. Just like you drew those bird songs, you can draw what you hear, or you can try to write the word.

Introduction 2 in Classroom: (30-40 minutes)

1) Animal Ears Pass the Photo: This is borrowed from Artful Teaching Protocol: What do you **think** you know about this topic? What questions or **puzzles** do you have? What does the photo or topic make you want to **explore?** Using print outs of different photos of animals with different shapes and sizes of ears "pass the photo". The class will sit around the perimeter of the rug,

pair up and then pass the photo on "1,2,3...pass the photo". This should lead into a discussion of why animals need to hear. What are they listening for? The differences between a predator's ears and a prey's ears can be written on the board. Is there anything ELSE you notice about a predator vs. prey face? (eyes, teeth?)

2) When we go into nature, is it important for us to listen? Are there ways we can be better listeners? What more could we discover by listening? Brainstorm ways we could hear more on our walk... being quiet, being still, spreading out, going to a place with less noise from other people, closing our eyes? Cupping our ears?
3) Wrap up/Preview of tomorrow: When we go outside tomorrow, we're going to be focusing on sounds that we hear and ways we can hear more sounds. We'll be making a sound map, and practicing our naturalist skills that we used last field trip. Review what they need to bring tomorrow: warm clothes, boots, rain gear etc.

Field Trip: 1.5-2 hours (longer hike)

1) Review what we'll be doing today as Naturalists: Get ready to go outside, walk to a good spot in the woods, make a sound map on our own, try different ways to hear better, play a game, and hike back. Any Questions?
2) Rules when walking: when walking on sidewalk, you should be paying attention and stay with the group... Rules for being in the woods: rocks and sticks stay on the ground, we stay together as a group, review attention getter. This is our "outdoor classroom", listening/paying attention is still important.
3) Dress for the weather: Discuss weather, what do we need to wear today? Make sure students are properly dressed before leaving classroom.
4) Stop by Class tree?: If time, make a quick stop at the class tree (if there is one): Become a scientist/naturalist. What senses can we use today?

   -SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

   - TOUCH: Keep your eyes closed and turn toward the wind. Wind usually travels from an area of warmth to an area of cold or the other way around, I wonder why the wind is coming from that direction?
   - HEARING: Keep your eyes closed and listen for a sound that I will make. Point to where you think I am. Open your eyes to see if you were correct.

   - VISION: Look straight up. Do a 1, 2, 3 share to hear what everyone saw. Now look over the heads of the students opposite and do another 1, 2, 3 share. Now really zoom in and look right in front of your feet.

5) Get going on sidewalk/Group Scavenger hunt (harborview esp): Have smaller groups assigned to adults with a list of things we're looking for on our way to "our spot" Kids report to the adult once they've found various things: a flower, a tree taller than a building etc.
6) Sound Map: Once in the woods at our spot, place kids individually on a square mat around and have them begin their sound map once everyone is placed. ~5-10 minutes. If they don't have notebooks, cardboard clipboards and write in the rain paper works great. Come back together as a group, did anyone hear a bird they recognized from our classroom listening? What else did you hear? Share your sound map with a neighbor.
7) Activity: Deer Ears: Talk about how it's a "fair test". I will read the same passage, walk the same area, you will be in the same place. Is there anything that's not fair? (maybe my voice?). Have students sit in a line, walking backwards from them while reading a story, have them raise their hand when they can't hear you anymore. Mark your spot (flag is good and obvious). Have them cup their hands behind their ears, and repeat walking backwards.
8) Nature Band: What sounds can we make with the materials found in nature? Let kids explore for a few minutes finding different ways to make sounds. Then try to get students to play together to sing a song?
9) Game: Bat moth. Has anyone seen a bat before? They have really good hearing, and can find moths with just their ears, since they are generally flying when it's dark out. Echolocation. We're going to pretend to be a bat and a moth to test our hearing. Split class into two groups to actually play the game. Select a bat, blindfold them. Have the rest of the kids form a circle holding hands to keep the bat and moth inside. They are "trees". The bat claps, and the moth claps back. Taking turns to get everyone a chance to be bat or moth in two or three groups (if teacher can lead one group) should take 15-20 minutes.
10) Get back into our senses for Hike Back to classroom.

Wrap Up

1) Review: What did we do on our field trip? See? Hear? Do you remember when we tried cupping our hands behind our ears. How did that change the way we could hear? We have a scientific experiment for you today.
2) Scientific Experiment: Find a good tool to improve our ability to hear something quiet from far away. Have some objects on the tables for them first to test- a cone, a cup, a solid ball, a ball with holes in it etc. Have students partner up and test each one. Making a "fair test". Do you all remember how we tested our ears outside? What can we do to make today a fair test? Don't forget a "control" test with no tool. Maybe have the partners start by standing across a table from each other (same distance) and have a way to measure differences. Choose the same word to say? Whisper only?

3) Recap what we did on our field trip by making a science journal entry. Have them write about what the weather was, and what ear shape worked the best to improve their hearing.
4) Thank students for participating in Nature studies, and we'll see you next year when you're in 2nd grade!

Follow Up Lesson for Teachers: Providing some basic materials (paper, scissors, string, tape, paper clips etc.)- "engineering Challenge". From what you learned in our Fair test, and from what we observed in the photos of different animal ears: try to design your own tool that would help you hear something quiet from far away. Design, make, test, adjust, test again. Basic concepts that they should have noticed: cone shapes with more surface area work well to funnel in sounds. Consider how their own ear is already shaped. 30-40 minutes.

How does water change the shape of the earth?

Lesson Plan for 2nd Grade Fall

OVERVIEW & PURPOSE

The first session of nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea that water, in its various forms, changes the shape of the earth by erosion and glaciation.

EDUCATION STANDARDS

1. 2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid
2. 2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area
3. ESS2.C: The Roles of Water in Earth's Surface Processes: water is found in the ocean, rivers, lakes, ponds and glaciers. Water exists as solid ice and in liquid form.
4. ESS2.A: Earth Materials and Systems: Wind and water can change the shape of the land.

OBJECTIVES

1. Students will understand that water exists in different forms-solid or liquid.
2. Students will understand that water when there is a lot, or if it is moving fast, or if both are true, can cause erosion and change the shape of the earth.
3. Students will understand how to identify land that has been shaped by water.
4. Students will learn how to act in our outdoor classroom and will understand that we are all naturalists.

MATERIALS NEEDED

1. Science Journals, pencils
2. Ice block in sand, soil box with water,

Pre-Lesson information for Teachers:

To get students thinking about erosion, you can show some of these videos:

https://www.youtube.com/watch?v=Kdx2kjvi51A This is Bill Nye on Erosion. It may be more in depth than you'd get in 2nd grade. 6:54 is sand experiment much like we will do on our field trip. The first 10 minutes (while there are some weird bill nye moments) have the most relevant info. Differentiates between weathering and erosion, and uses water as the example (later it discusses wind erosion, chemical weathering etc)

https://www.youtube.com/watch?v=8a3r-cG8Wic (Why Rivers Curve?)

https://www.youtube.com/watch?v=TDw3o75dQSU (Mendenhall River Oxbow erosion in 2014

https://www.youtube.com/watch?v=F09ejxk9WdU Mendenhall flooding event of this summer including breaking through

https://www.youtube.com/watch?v=_ng7lKDnZns

ACTIVITY

Intro 1: Naturalist Introduction: Erosion Model Part 1

1) Introduction: Since this class is this group's first Nature Studies experience of the year, a good way to begin is to have yourself and your assistant naturalist introduce Discovery Southeast as well as yourselves. Ask the students what they think a naturalist is, and encourage them to develop a definition that allows them to be "budding" or "aspiring" naturalists. Discovery Southeast naturalists practice hands-on education and inquiry learning, encouraging students to think out loud and give their own observations as they are guided along to the right answer. Once students realize a naturalist is simply a person who studies nature, they are invited to become naturalists themselves.
2) Classroom activity: Erosion Modeling and observational drawing. What is a model? Why are they a useful tool?

3) Split classroom into two groups. One group will be with one naturalist studying erosion by liquid water model. The other Group will be with other naturalist studying erosion by solid water (glacier) model.
    a) First I notice and I wonder statements and questions
    b) Demonstrate before- have students draw a before (bird's eye view)
    c) Demonstrate the erosion- I notice
    d) Have students draw results
    e) In partners have them try to explain what happened and why
4) Clean up, tomorrow we will switch groups

Introduction 2: Erosion Model part 2

1. Quick Review: We are naturalists, and we are studying water and how it changes the shape of the earth.
2. Classroom Activity part 2: Erosion Modeling and observational drawing. Split classroom into two groups. One group will be with one naturalist studying erosion by liquid water model. The other Group will be with other naturalist studying erosion by solid water (glacier) model.
    a. First I notice and I wonder statements and questions
    b. Demonstrate before- have students draw a before
    c. Demonstrate the erosion- I notice
    d. Have students draw results
    e. In partners have them try to explain what happened and why

3. Compare: How are the two models the same? How are they different? What are they modeling in real life?
4. Tomorrow we'll be looking for EVIDENCE of erosion. What might this evidence look like where we are going? (can we see a glacier? Or where a glacier used to be?) Where would we be likely to find it? (near water…)
5. What to wear: Look outside today,

Field Trip

1) Review what we did yesterday and preview what the field trip will be like.
2) Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel?*
3) Dress for weather: Encourage
4) Warming up our Senses: or "Knock on the Door" Become a scientist/naturalist. What senses can we use today?

SMELL: Close your eyes and take a deep breath through your nose. What do you smell? Turn and tell a person next to you what it smells like.

- TOUCH: Keep your eyes closed and turn toward the wind.
- HEARING: Keep your eyes closed and listen for a sound that I will make. Point to any sound you hear.

- VISION: Look straight up. Now look over the heads of the students opposite. Now really zoom in and look right in front of your feet. Can you find something that is less than an inch in length?

5) Hike: Scavenger Hunt: To get them thinking and using their naturalist skills, break up into groups (as many as you have adults) to complete a scavenger hunt as we walk.

6) Make our own Model: Finding an area with sand/dirt/silt (depends on where you are) have groups of students build a mountain. Then come by and pour water on it. Can you do something differently to prevent this? Opportunity for engineering- try a different design?

7) Evidence of Erosion: Once groups have identified areas with evidence of erosion, stop and observe. What is the evidence? Where is the sediment going?
8) Return to classroom: On hike back, lead them in a quiet walk. Spread them out, having them start one at a time, have them focus on their senses and share at the end of a short stretch of quiet walking with you something new they noticed.
9) Journal: Get out science journals and make a journal entry. Have the date, weather, and location written down. Then have them make a drawing of what we found.

Wrap Up

1) Review: What did we do yesterday? What evidence did we find of erosion? Was it what you expected? What did you discover in our experiment with the sand? Was anyone able to come up with an idea to stop the erosion from happening?
2) Engineering: Can erosion cause problems for humans?
3) Leave with a Question: Where does it go? Erosion is the movement of rock away from an area, where does that rock end up? Erosion----deposition: Using magnetic letters formed in the word of Erosion, draw a river on the board. Use your “weathering hammer” to break up the letters in erosion. Then erode away each letter showing it float down the river and land in a new location… completing the word deposition.
4) Thank you: Thank you and we’ll be back in winter to study the properties of water.

What are the different states of water and where can they be found in nature?

Lesson Plan for 2nd Grade Winter

OVERVIEW & PURPOSE

As this is the second session of nature studies, students should only need a short review about exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea that water, in its various forms, changes the shape of the earth by erosion and glaciation.

EDUCATION STANDARDS

1. 2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid.
2. ESS2.C: The Roles of Water in Earth's Surface Processes: water is found in the ocean, rivers, lakes, ponds and glaciers. Water exists as solid ice and in liquid form.
3. PS1.A: Structure and Properties of Matter: Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
4. PS1.B: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

OBJECTIVES

1. Students will understand that water exists in different forms-solid, liquid, and gas.

2. Students will identify water in its differents states while outside in nature.
3. Students will predict when and how water might change from one state to another.
4. Students will learn how to act in our outdoor classroom and will understand that we are all naturalists.

MATERIALS NEEDED

1. Science Journals
2. Photos in plastic sheets
3. Graduated cylinder
4. Large bowl or tupperware container of fresh snow
5. A balance- 2 identical containers that fit on the balance (empty hummus containers work well) Fresh snow!
6. Field: rite in rain paper on clipboards with pencils, scavenger hunt
7. Wrap: "The Snowflake: A Water Cycle Story", access to computer/screen to show photos

ACTIVITY

Intro 1: Naturalist warm up/Practice walk: first visit 45 minutes

1) Classroom Activity: Pass the Photo (pass the object Artful teaching protocol) Bring about 15 photos of water, ice, snow, mist, rain that are from Juneau. In pairs, students look at the photo, notice and wonder, then pass the photo. After everyone has seen the photos, what do they all have in common? Water! Talk about the different phases of water and what they can look like.
2) Make prediction: Show the class a clear cylinder container of water with an obvious line marking where the water is. Have them make a prediction to their neighbor if the water will shrink, stay the same or expand after it's been frozen.

Introduction 2 (40 minutes)

1. Quick Review: We are naturalists, and we are studying water and how it changes.
2. Classroom activity: Use journals: what did you predict about the cylinder of water? Take a poll, and reveal that the water expanded when it froze into ice.
3. Second Prediction: Observe a container of snow. What do you notice about it? Show them a container of snow and a container of water (predetermined to weigh the SAME). Have students predict which will weigh more. Then put on the balance. Reiterate that when water freezes it expands and takes up more space! It may look like more when it's snow, but it weighs the same as just a little water.

4. Tomorrow we'll be looking for signs of water in its different states out in nature. Remind how to dress, and that it's the students' job to be prepared.

Field Trip 1.5-2 hours

1) Review what we did yesterday and preview what the field trip will be like.
2) Weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel*? - 5 minutes total introduction time
3) Dress for weather - 10 minutes
4) Hike: scavenger hunt and/or reporter: making stops along the way to make observations about water/ice, and signs of winter. What exactly we do is highly dependent on conditions. - 10 minutes
5) Observational drawing: If weather is appropriate, have them draw an area that shows all three phases of water with labels.
6) Act out the Phases of water: A good warm up activity to get them moving. When liquid- they touch and walk around each other. Solid, they freeze while touching each others shoulders. Gas they run away from each other. Could introduce: evaporation, condensation etc....
7) Activity: In groups of twos or threes give them the challenge of creating a sculpture out of snow that shows all 3 states of water (solid, liquid, and gas). Ideally, this should be a collaborative piece. Spread groups out and circulate between them offering assistance, advice, asking questions. However, this activity is pretty self-sustaining. Have students finish and share with the group what they chose to make. - 15 minutes
8) Return to classroom: On hike back, lead them in a quiet walk. Spread them out, having them start one at a time, have them focus on their senses and share at the end of a short stretch of quiet walking with you something new they noticed.

Wrap Up 45 minutes:

1) Review what we saw and did on our field trip sharing highlights, and passing out drawings.
2) Book: "The Snowflake: A Water Cycle Story" Before reading, review important phase change words: evaporation, freeze, melt, etc. Have them pay attention to the story, anytime the water droplet changes a phase, have them put their finger on their nose. 15 minutes
3) Connect: Connect to our fall lesson on erosion. Show photos of frost heaves and frost cleaves. What did we learn about what water does when it freezes? Expands! What happens if that water is in a crack? It makes the crack bigger and causes *weathering*.. - 5 minutes
4) Thank you: Thank you and we'll be back in Spring for another trip to our "outdoor classroom"

How does the Glacier Shape the Earth?

Lesson Plan for 2nd grade Gastineau trip to Mendenhall Glacier

OVERVIEW & PURPOSE

The first session of nature studies is focused upon getting the students confident exploring outside, understanding how to be prepared and safe, and to practice making observations and asking questions. They are also introduced to the idea that glaciers carve out valleys, cause erosion, and transport sediment.

EDUCATION STANDARDS

1. 2-ESS1-1: Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
2. 2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area.

OBJECTIVES

1. Students will understand that glaciation is a slow process
2. Students will understand the concept that glaciers carry materials on and within them, leaving them behind as glacial erratics.
3. Students will understand that the rocks embedded in them is what causes the weathering and produces silt.
4. Students will learn how to act in the outdoor classroom and know that they are all naturalists.

MATERIALS NEEDED

1. Intro 1: two stream tables from JSD 4th grade erosion kit.
2. Intro 2: 2 Ice blocks with sand in long container
3. Rocks for grinding
4. Science Journals
5. Field: 2 Buckets, 15 cups, clipboards, paper (rite in the rain?), pencils, scavenger hunt sheets, clear cup
6. Wrap: Flubber Model: Jounrals http://www.geology.um.maine.edu/user/Leigh_Stearns/teaching/flubber.html

ACTIVITY

Introductions: 2 40-45 minutes is ideal

Part 1: first visit 30-40 minutes

1) Introduction: Remind students that to be a naturalist we use tools that are part of our bodies: our 5 senses and our brains especially. This will be their 3rd year in nature studies, so they should know what to expect.
2) Topic Intro: Can Rocks Move water? -turn and talk, take a few answers. Can Water move rocks? Turn and talk- take a few answers. What do you think is stronger, rock or water? We're going to find out
3) Classroom activity: Ice block glacier models: Split class into two groups, having assistant and lead in charge of a glacier station. Remind students of behavior expectations for the two stations (unfortunately no touching for this one). Using Ice block and sand, we will show how glaciers cause erosion and how they carve out valleys. First I notice and I wonder statements and questions
    a) Demonstrate the erosion
    b) Have students make observations noticing changes
    c) In partners have them try to explain what happened and why- key vocabulary: morraine, U-shaped valley, PUSH, glacial erratic, silt, striations?
    d) Ask students to predict what the bottom of the glacier will look like: Demonstrate the weathering that occurs beneath glacier with rocks and black paper
4)

5) 

6) Rock Grinding: Rock grinding station to make silt- have kids take turns grinding the rocks onto a tray to see how much silt we can make. The breaking up of rocks into smaller pieces is Weathering! Predict: if we pour this into a cup of water, predict if it will float or sink. What happened?
7) Act it out: To emphasize vocab words- act out weathering (break it down break it down), erosion (I like to move it move it) and deposition (aaaannnnnd stop).

Part 2: Stream Model: 40 minutes

1) Recap/Transition: Yesterday we wondered about which was stronger rock or water. What did we discover? The model we used during our last visit showed us how solid water can move rocks by pushing or carrying them. Today we're going to talk about how water can move rocks even when it's liquid- streams!
2) Stream Table Model: 20-30 minutes: Borrowing 2 stream tables from the 4th grade JSD science kit, split the class in two and explore what happens to the sand/silt when water is introduced into the system. This is a time for predictions and conversations about what they notice. Ask students to make predictions before trying new things. Were they right? What could we change about the model to make MORE sand move? First I notice and I wonder statements and questions
   a) Demonstrate a river forming and flowing
   b) Have students make observations noticing changes
   c) In partners have them try to explain what happened and why- key vocabulary: meander,

braiding, erosion, cliff, oxbow, canyon, valley (v-shaped)

3) Draw results: If you have time, students can draw the results of the investigation in their journals, starting with the shape of the stream table can help. This can be a good time to write the vocab words down on the board. Have them label their drawings.
4) Regroup: If time, discuss some differences/ similarities between the two types of erosion (ice moves slow, water moves fast, ice can carry bigger rocks? etc...)
5) Preview of tomorrow: Tomorrow we are going on a field trip to the glacier. Has anyone been there before? We will be there for about 2 hours, what kinds of clothes do you think we need to bring? Who's job is it to be prepared?

Field Trip: 2 hours

1) Preview of the day: Today we are going to get on a bus, drive out to the glacier, we are going to walk along the lake making observations, we will do an activity, and walk back. We will be outside for almost 2 hours, so dress for the weather.
2) Dress for the weather: From inside, what sense can we use to observe the weather? Let's look outside to see what the weather is. What other sense is important for knowing the weather? *Touch*. When you came to school today, how did the weather *feel*? How should we dress for this?
3) Warm up senses: Ask students to name our other senses that we'll be using outside.
4) Arrive at glacier: Get on trail and Become a scientist/naturalist. What senses can we use today?
5) Erosion Scavenger Hunt: In teams (one per adult) the kids will walk along the nugget falls trail in search of different signs of erosion from liquid water and from ice. 10 minutes
6) Adult Tag: Once we get to the open beach area introduce adult tag. When Any DSE person calls out an object, the kids have to tag it before an adult tags them. Change up what your calling out to reflect what you want them to notice. 10 minutes
7) Describe the land: After walking a distance, stop and circle up on sit spots. Have students describe the landform we walked over: sandy etc... Why is it the way it is? Has it always been this way?
8) Draw the Glacier: Before you get too close to nugget falls, stop at a good viewing place of the glacier. Have students do their best to draw what they see, the mountains, the ice, the lake, adding details like cracks in the ice and rocks on the ice. 20 minutes
9) Build a Mountain: Once at Nugget Falls beach or closest beach: Break kids up into teams, have half the teams build mountains out of sand, and the other half build mountains out of rocks. Then fill a bucket with water and hand out cups to the sand team kids. Partner a sand mountain team with a rock mountain team. Have students who built the sand mountain pour water on their mountains noticing what happens. Repeat with the rocky mountain. What did they notice?

Finally. Have a glacier (ideally an ice berg, but more realistically a large rock) plow through the mountains. 20 minutes (5 to build, 5 for instruction, 10 for water pouring)

10) Cloudy water: Why does the water in the lake look like this? (hold up one of the samples). Remind them about grinding the rocks together in the classroom. Then ask students to think back about our classroom activities. Is this glacier moving? Can you see it moving? How do you *know* it's moving? Is it carving out a valley? Has it carved out a valley? (look back) Does it carry things? Glacial erratics;
11) Hike back to bus: On hike back, read the group. An active group might do well with some more adult tag. Reporter: arrange kids in a single file line, like each one teach one have one student step to the side, and give them a "message", as each student walks by the first student, they receive that message and continue on. If you can bring them down you can try a quiet reflective walk: Spread them out, having them start one at a time, have them focus on their senses and share at the end of a short stretch of quiet walking with you something new they noticed.
12) Bus back to school

Wrap UP

1) Review: review with students what we saw on our field trip
2) Video: Show video clips of a river and of a timelapse of the glacier. What's different about it? Glaciers are slower, and tend to be much bigger, and so they can carry bigger things.
3) Flubber Model: Using white and blue striped flubber and a tarp, create a flubber glacier model. Have students draw in their journals the model labeling it's parts. Have the students think about what about this model (and the other glacier model) is realistic, and what's not quite right?
4) Alternative to Model: journal or paper write up: On a piece of paper divide into 4 equal parts: I noticed, I wished, I wonder, I learned.
5) Thanks: Thank you all for being part of nature studies, I will be back here in the winter and we'll go into the outdoor classroom that is in our backyard!

Ecosystem Exploration

Lesson Plan for Grade 3, FALL Discovery Southeast

Prepared by Abby Hines

OVERVIEW & PURPOSE

This lesson provides a sensory investigation of three ecosystems found in SE Alaska. Students compare and contrast ecosystems to develop an understanding of organismal adaptation and survival. Students explore interdependent relationships within ecosystems through observation and play-based learning.

BACKGROUND

An ecosystem is defined as a biological community of interacting organisms and their physical environment. Another way to define an ecosystem is all the living and nonliving things that interact in a given area. Southeast Alaska lays in the temperate coastal ecoregion of Alaska. Within this ecoregion lays multiple ecosystems and habitats including: muskeg bogs, temperate rainforests, rivers, lakes, coastal marine areas, salt marshes etc. Between each ecosystem lays an ecotone or convergence of two ecosystems. These zones are often rich in biodiversity and home to unique species. Comparing ecosystems and studying ecotones provides ecologists with information regarding ecosystem health, function and organismal adaptation. A common model used to depict ecosystems is a food web or web of life. These models showcase specific interdependencies within an ecosystem. See below.

EDUCATION STANDARDS

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

LS4. C: Adaptation

LS4. D: Biodiversity and Humans

OBJECTIVES

Students will be able to:

1. Define ecosystem, and give examples of ecosystems seen around Juneau.
2. Demonstrate knowledge of the different biotic and abiotic components of an ecosystem.
3. Develop arguments to support why certain organisms live in certain ecosystems and not others.

MATERIALS NEEDED

1. Ecosystem Observation worksheet- found on drive (1 per student)
2. Pencils (1 per student)
3. Salmon box 'clipboards' (1 per student)
4. Scientific drawing example
5. Paint swatches (1 per student)
6. Blindfolds (15)
7. Web of life puzzle
8. Find my home activity materials

VERIFICATION

Steps to check for student understanding

1. Ecosystem observation sheet completion
2. Demonstration of understanding- scientific drawing
3. Final knowledge sharing group mind maps

INTRO

What is an ecosystem? (20 min)

Hook: Lay out a sheet or piece of cloth. Under this cloth hide 3-6 items from the local ecosystem (branches, spruce cones, antler etc.). Have students surround this cloth in a circle. Discuss that everything under this cloth is from the *ecosystem* behind their school and are in some way connected to one another. Together you will investigate one object at a time, identify it, decide whether it is abiotic or biotic and how it is connected to its' ecosystem.

After this initial investigation, write the definition of ecosystem on the white board. An ecosystem is defined as a biological community of interacting organisms and their physical environment. Another way to define an ecosystem is all the living and nonliving things that interact in a given area.

Food web brainstorm *(15 min)*

Using the ecosystem that was demonstrated in the first activity, brainstorm components of that ecosystem and write them down. Once these ecosystem components are listed, a food web can be made to emphasize interconnectedness. Write this on butcher paper or a poster so that it can be referred to later.

Coloring ecosystems *(20 min)*

Using coloring sheets of various ecosystems (coral reef, arctic, forest) instruct students to make their own food webs by drawing arrows between the different components illustrated. After they have completed their food web they may finish coloring their ecosystem. Encourage students to share where and why they drew arrows between certain components.

FIELD STUDY

Exploring Ecosystems with our Senses *(15 min)*

Encourage students to free-explore this ecosystem as ecologists. Instruct students to find one piece of this ecosystem that can fit in the palm of their hand to bring back to the group. Gather as a group and have students share what they found and how they think it functions in the present ecosystem.

Ecosystem Observations (*2 hours*)

Pick three ecosystems or habitats before the trip for students to study. At each ecosystem have students conduct a short sit spot and fill out one of the columns on the ecosystem observation sheet. It is ideal to have a decent amount of hiking between ecosystem observations where students can be physically active between times of heavy concentration. Emphasize using our senses to explore the world around us. Each ecosystem observation can be different to engage students.

For example, you may choose to approach each observation from a different sense:

1) **Surrounded by *sound***- After students finish their ecosystem sit-spot, have students focus their attention to the sounds around them. Silently sitting in a group, encourage students to point to the sounds they hear. This is great practice in identifying sounds and their origin point.

2) **Focus on *feeling*-** After students finish their ecosystem sit-spot, have them work in pairs to explore the ecosystem using their sense of touch. With one student blind folded, the other student will guide the blindfolded student through the ecosystem. The guide should point out important components of this ecosystem to their partner, encouraging their partner to touch and feel SAFE things.

3) **Emphasizing *eyesight***- After students finish their ecosystem sit-spot, handout paint strips to each student. Challenge students to find all the colors on their paint strips in the ecosystem- emphasizing using our sense of sight to accomplish this task.

Scientific Drawing *(30 min)- note this activity may be skipped due to time restraints*
Take time for students to pick a plant or animal to draw from the last ecosystem you visited or in reference to the web of life game just played. Use the back of the handout for students to draw and record observations. Emphasize that they are picking a plant or animal to study as a practicing ecologist. *Encourage students to revisit this area to study their plant or animal each season using the skills we learned today.*

DEBRIEF

Considerations for Instructor: I recommend using the Web of Life game for Auke Bay and the rotating stations for Mendenhall River Community School. Web of Life works really well for classes that are accustomed to circle time or using long periods of concentration while sitting on the rug/floor. The stations may work better for students who experience difficulty sitting for a long period of time.

Ultimately, it is up to the instructor so feel free to choose your own adventure!

Web of life *(45 min)*
Find a spot where students can comfortably be in a big circle. This activity allows students to tangibly interact with interdependent relationships within the ecosystems that surround them. Web of life is played as a large group activity. Each student is given a “name tag” depicting an aspect of the ecosystem, a ball of yarn is then tossed from person to person while the thrower says out loud what their connection with the receiver is. Talk about what connections are made, emphasizing that everything is connected. You can expand on this topic by breaking connections or eliminating parts of the ecosystem. What happens?

Pro tip: Have students pass the yarn ball UNDER the web. That way it is easier to untangle at the end.

-or-
Ecosystem Exploration Stations *(45 min)*

Station 1. Scientific Drawing

Scientific Drawing . Have an assortment of natural items found in the forest ecosystem you explored earlier with students. Examples include, Cottonwood Leaf, rock, stick, or spruce cone. Have Scientific Drawing sheets on the table or you could use their science journals if available. Have them write a few simple observations at the bottom of the scientific observation sheet.

Station 2. Web of Life Puzzle

Have an assortment of laminated forest abiotic and biotic factors sitting on the table. You will also need the laminated arrows as well. Have students create their own web of life using the pictures and arrows. Have an example of a complete web of life on the table for them to view.

Station 3. Find my home

Students match the organism to their ecosystem. Using laminated pictures of different ecosystems (forest, ocean, river, bog) and laminated pictures or specimens of biotic and abiotic things students will match the ecosystem components with the correct ecosystem. Provide a secret key for students to check after they have completed it.

RESOURCES

https://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.list

With my eyes I see…			
With my nose I smell…			
With my hands I feel…			
With my ears I hear…			

With my eyes I see…			
With my nose I smell…			
With my hands I feel…			
With my ears I hear…			

Choose a plant or animal that you observed today. **Draw** this plant and **label** the important parts. **Explain** using words how you plan to study this plant or animal.

SCIENTIFIC DRAWING
______________________________ ______________________________ ______________________________.

Choose a plant or animal that you observed today. **Draw** this plant and **label** the important parts. **Explain** using words how you plan to study this plant or animal.

SCIENTIFIC DRAWING
____________________ ____________________ ____________________.

You are a Naturalist

Lesson plan for 3rd grade fall

OBJECTIVES

1. We are all naturalists: we can use our 5 senses to navigate and experience what is around us.
2. We can intentionally position ourselves in space in relationship to what we see around us, even in challenging times (dancing with Devil's Club, keep your space save your face).
3. We are becoming aware of how noise grabs our focus. We notice this and so we raise our hands. We each take care of the group's focus in this way.

MATERIALS NEEDED

1. Wrap:
    a. Sense games:
        i. A stick of beaver chew or sapsucker holes (sight)
        ii. Essential oil on a piece of paper (smell)
        iii. Blindfold, 3 yellow beanbags, 3 green beanbags (hearing)
        iv. Dark bag w/ 3 natural science items inside (touch)
        v. Blue apples in a jar (taste)
2. Field: Usual hiking gear

INTRO

An introduction to Discovery Southeast (45 min)

Activity: Class Discussion

1. Who are we? We introduce ourselves. We will be in here often. We are *naturalists*. What is a naturalist?
    a. We decode the word (look for the word hidden inside this word).
    b. We de-mystify the word (we are all naturalists).

2. We are all naturalists because we can all use our 5 senses
    a. List them! (Taste, touch, hearing, vision, smell)
    b. We use these senses to encounter our world. Practice this with them. Without moving or speaking ("no need to report back"), let's find something in the room in the room of a given color, focus on it, and then find something else in the room that is a different version of that color.

FIELD

Finding the self, finding the relation (1.5-2 hours)

Before we go out the door, we have our layers on. We establish that Steve will lead and the teacher will bring up the rear. We know that we will be in a line in school, but when we leave school, we do not need to be in line. We not that most of the time when you leave school you are going home or going to recess, but what we are about to do is neither go home nor go to recess. We leave sticks and stones and snow on the ground.

When we go out the door (RB) we open the gate. We will go on-trail for a bit, opening the gate before crossing the bridge (GV), and then we will go off-trail shortly after. We will pause from time to time to let a lesson land. The first lesson is: **Keep your space, save your face** (10 min)

When we go out we look around us. We become aware of being cold, hot, tired, thirsty. We become aware of who is close to us and who is far away. We cross through denser and less dense underbrush, and sometimes streams. We find lessons in natural history and science along the way, and stop to discuss these as they arise.

Eventually, Steve leads us to a Devil's Club patch. Slow down, look around you. You can move, the Devil's Club cannot. This is an exercise of Keep your space, save your face. We will call this **Dancing with Devil's Club** (5 min intro, then as long as it takes to navigate the patch as a group). It is the second major lesson to land with this group while we are out.

WRAP

Coming to our senses (45 min)

Activity: 5 senses games

Before the kids arrive (if possible) Steve dabs essential oil on paper and lets it sit in the room. Once circled up, come back to the field trip. He invites students to report back what they remember. Inevitably, one will mention a sensation.

Senses. Do you remember those 5 senses we listed last time we were in class together? (We list them)

Well, we're going to get our senses warmed up.

1. *Smell (2-5 min).* Some of you may have already noticed something a little different about the classroom when you came in. Using your nose, can you tell me what has changed? Do you notice the new smell? (Sometimes this will land, sometimes less so. Not a problem either way)
2. *Sight (2-5 min).* We get the beaver chew/ sapsucker stick out. We will look at it for a bit, and with our eyes, recreate the tree based on the stick. Where was this? Who cut this? Use our eyes to tell the story. Your eyes are good at this (underlying neural lesson: vision interior/ vision exterior come into union → creativity is a version of vision)
3. *Sound (8-10 min).* Steve gets a volunteer. Blindfold the volunteer. Work sound control on this one -- the group must be silent for the game to work. Show the volunteer what will happen first: you will throw a beanbag on the ground, and she will try to match it. You will in fact throw three. Blindfold her, give her three beanbags, and you hold the other three. When it is all quiet, throw the first. Now it is her turn. She will match your throw as best she can with her own beanie bag. Repeat twice, in different directions. We humans are VERY good at this game although we don't know it. When you are done have her open her eyes. If time, ask for a second volunteer and repeat.
4. *Touch (8-10 min).* Ask for a volunteer to sit in the center of the circle with you. He will also be blindfolded. When he is ready, his task will be: reach into the dark bag, and choose an item (1 of 3). He will describe what he feels to us as he feels it. No guessing what it is. This is not about telling the story of what you have found or figuring out what it is. This is just about feeling the item. Have him pull it out, unblindfold him, and discuss the object with the class. You can do this for as many objects as you wish, depending on time.
5. *Taste (8-10 min).* Ask for another volunteer to come up. Present her with the jar of blue. The crowd will react, but what matters is just you and her. Offer that she can eat this, but she doesn't have to. It might be scary or weird, because that is what your eyes are telling you. ("It's true," Steve will often say, "you and I just met. You may not trust me yet. That's okay.") Often, the first few volunteers will come up to it, consider, and decide not to eat it. "NO" IS A VERY GOOD THING. This is essential for them to understand. They are under no pressure to eat this. Eventually a volunteer will decide to eat it, and pause with them to consider what it is that they are eating . Have them use words to describe what they are eating. Help them to discover what they already know: they have just eaten an apple.
    a. The lesson here is how powerful our eyes are. Our eyes say this is not normal. Our eyes

keep us safe. Sometimes, our eyes also trick us, as with the blue apples.

We bring it in for a short discussion if we have time.

Everything is a track; every track tells a story

Lesson plan for 3rd grade winter

OBJECTIVES

1. We can interpret the patterns we see around us and within us. We can understand the importance of the context in which these patterns play out. We can begin to tell the story of how this track ("pattern" or "evidence") came to be.
2. We can use our imagination to tell the story of how a track appeared, and why it appeared. We learn to do this with tracks outside of us and inside of us.

MATERIALS NEEDED

1. Steve's powerpoint on tracks
2. Track mats (snowshoe hare, squirrel)
3. Usual hiking gear

INTRO 1

We use a tracking powerpoint to learn how to let tracks tell us a story (45 min).

Activity: Powerpoint

During this powerpoint, the central themes communicated are:

1. TYPES OF FEET: Flat-footed walkers, toe walker, toenail walkers. Demonstrate the differences and similarities. Look at some pictures of each. (Bone structure comparison)
2. BEING A TOE-COUNTER: 1, 2, 4 and 5 toed walkers (horse, deer, dog, bear) -- look at these

photos of different tracks. Notice which way the toes are pointing. Where is this animal going? Put the animal back in its steps and watch it walk across the picture.

3. FEET AREN'T THE ONLY TRACK-MAKERS: Other kinds of tracks: scratching, scat, bones, feeding signs, deer beds, river beds, glacial valleys, etc.
4. SCALE AND CONTEXT: Steve helps students to notice not just the track but what material the track was left in -- mud, silt, sand, etc. He shows them a picture of beach versus river mud and sees if they can tell us which one is which. They will know, but it may take some time for them to realize how it is that they know which one is the beach (ie shells). Using dinosaur tracks pics, Steve discusses scale.
5. *Everything is a track. Every track tells a story.*

INTRO 2

We understand tracks by making them ourselves (45 min)

There is time to finish the powerpoint if we didn't have time at first.

Activity: Track Mats

- Steve splits the group into two seated lines, assistant unrolls the track mat down the middle between the two seated lines. Steves walks them through how we will move on it in the same way that animal moves. Is it a hopper or a runner?
- One line goes, then the other line goes.
- This is a somatic exercise, and most of the lesson is learned in the body. Consequently, we must take care of the emotional and physical safety of students. A lesson Steve likes to land is that *every body* (he splits that word for them) will do this differently, and that's ok. This is not easy. Quiet can be an important aspect of safety. We do this quietly, and we do not need to react when someone goes across the mat. No one is forced to participate, all are supported. Some need support the whole way. All of that is ok.

FIELD

We go out tracking (1.5-2 hours)

Before we go out the door, we have our layers on. We establish that Steve will lead and the teacher will bring up the rear. We know that we will be in a line in school, but when we leave school, we do not need to be in line. We note that most of the time when you leave school you are going home or going to recess, but what we are about to do is neither go home nor go to recess. We leave sticks and stones and snow on the ground.

When we go out the door (RB) we open the gate. We will go on-trail for a bit, opening the gate before crossing the bridge (GV), and then we will go off-trail shortly after.

When we open the gate, we track within our bodies. Track the tensing and relaxing of the muscles, track the sound of wind, track the feel of wind with our faces, track the stillness in us. We will pause from time to time to let this same lesson land. We return to the gate a number of times while we are out in the woods to practice this tracking.

When we go out we look around us. We become aware of being cold, hot, tired, thirsty. We become aware of who is close to us and who is far away. We cross through denser and less dense underbrush, and sometimes streams. We find lessons in natural history and science along the way, and stop to discuss these as they arise.

Eventually, Mr. Merli leads us to a place he knows that we will find some sort of sign. Slow down, look around you. What do you see? Who made this? How did it get here? Find tracks of the river (RB) and the creek (GV). Find tracks of snow falling from trees. Let them work towards discovering what made these. The answer is less important than the wondering. Sometimes we find the animals themselves. Other times, we find lots of sign. Other times, the lesson is simply how to keep warm in Juneau in the winter.

WRAP

We come home (0-15 min)

There is no official wrap in Steve's 3rd grade winter. Sometimes we build an extra ten or fifteen minutes into a field trip in order to sit quietly together and ask the kids what they saw. Even the rosiness in their cheeks is a track, Mr. Merli sometimes reminds them. We look around, and in one another's faces we can see that we have been outside and it was cold.

S'igeidí

Lesson Plan for Grade 3, Nature Studies WINTER

Prepared by Kate Cruz

OVERVIEW & PURPOSE

This lesson focuses on the variety of adaptations the flora and fauna of Southeast Alaska have to survive and thrive during the cold winter months. Adaptations (physical and behavioral) are explained with an emphasis on beavers and porcupines as a continuation of the interior Tlingit oral narrative from the fall lesson.

EDUCATION STANDARDS

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

LS4.C: Adaptation

3-LS3-2: Use evidence to support the explanation that traits can be influenced by the environment.

OBJECTIVES

Students will be able to:

1. Define adaptation using examples of both behavioral and physical adaptations.
2. Construct an evidence-based argument to explain why certain animals live in Southeast Alaska and others do not using concepts such an adaptation, and habitat requirements.

ESSENTIAL QUESTIONS

- How do animals thrive in their habitat?
- How do changes in a habitat affect how organisms live there?

- Why and how do beavers change their environment?
- Why and how do humans change their environment?

MATERIALS NEEDED

Intro

1. Pelts, skulls, tracks/casts, wood chews of porcupines and beavers
2. Beaver costume: flippers, goggles, headphones, tail, teeth

Field study

1. Bandanas, skittles, touch box with natural objects (two is preferred), small jars with fresh scents (coffee bean, shampoo, cedar shavings, cinnamon sticks)

Resources

1. X'unei, Lance Twitchell's Porcupine and s'igeidí PPT (interior Tlingit narrative)
2. Porcupine/s'igeidí Tsimshian translation
3. Habitat observation worksheet
4. Yellowstone - https://www.youtube.com/watch?v=ZfSzArgX9mA

Intro	Field	Wrap-Up
• Habitats/adaptations • Build a s'igeidí • s'igeidí/Porcupine oral narrative • Forest Agreements	• 5 Senses • Tracking	• Migrate, hibernate, or deal with it? • Beaver drone footage • Journaling

INTRO (45 mins)

***Discuss and brainstorm** (10 min)*

This fall, we explored the forest from the perspective of a _______________? A Xalakách! A porcupine. We were surrounded by signs of a porcupine living by, does anyone remember some of the clues left behind? We call the space an animal is able to live a habitat. Let's think of some habitats here in Alaska. Students think-pair-share and generate a list on the board. What are some adaptations, or things you would need to live in each of these environments?

Build a Beaver *(10 min)*

Explain that we are going to "build" an animal that has adaptations, both behavioral and structural that allow for that animal to live both on land and in water here in Alaska. Even though you may guess the animal early on, we're not going to call out the answer until the end as a whole class.

Have a student volunteer and ask students to start to name certain features the animal would need, for each correct one identified, add to the costume. Adaptations include:

- Flippers: large, webbed feet to move easily through an aquatic environment
- Goggles: Eyelids are transparent to be able to see through them as they swim
- Headphones: Ear and nostril openings can be closed to keep out water
- Tail: Help regulate heat and body temperature, as well as a communication method.
- Teeth: As a rodent, their teeth grow their whole lives, ideally suited for cutting down trees. They cannot digest the cellulose in the cottonwoods and willows, but bacteria in their guts can, and then beavers digest the bacteria. They store extra branches in their dams so they can easily reach these when their ponds are frozen over. They do eat fresh buds, greens, grass, and aquatic plants in the spring. They also can store oxygen and swim underwater for half a mile.
- Fur: Beavers groom castoreum, a waterproofing oil, into their fur with their feet.

Allow students to look at skulls, pelts, quills, and tracks.

This winter, we'll be exploring similar forests from the perspective of a s'igeidí. How are we going to adapt to the cool, wet weather we will experience tomorrow?

Forest Agreements

- Patience
- Be Strong in Mind, Body, and Spirit

FIELD STUDY (2 hours)

Reminder of Field Agreements (10 mins)

- Patience
- Be Strong in Mind, Body, and Spirit
- Taking care of basic needs (snack, water, bathroom break before leaving)
- Making sure students know what group they are a part of so can easily be separated into 2 groups

Hike to field study destination *(15-20 min)*

Use this time to explore and search for animal sign. Talking about animal adaptations along the way.

Sense Stations *(20 min)*

As we are exploring the winter environment from the perspective of a s'igeidí, we're going to get a little more in touch with our own senses.

To tune in to our bodies, do brain gym for a few minutes (figure 8's, cross over, toe touches, owl stretch). We're going to start out all together, then break into two stations.

Hearing (15-20 mins)

- s'igeidís use sound as a defense mechanism. When faced with predators, s'igeidís will slap their tail on the surface of the water to release a loud boom, scaring the threat away and warning other s'igeidís at the same time.
- We can modify Sharing with Nature's Bat/Moth game to fit the s'igeidí's story. Choose one student to be a s'igeidí. Have all other students form a circle joining hands. These students will be the s'igeidí's habitat. Blindfold the s'igeidí then choose another student to be a s'eek. The s'igeidí will call out "slap" to imitate a tail slap and the s'eek will then answer "s'eek." The s'igeidí will try to zero in on the s'eek by repeating "s'igeidí." The s'eek has to answer in turn. If the s'igeidí runs into someone in the circle, the habitat will gently redirect them back into the center. Once the s'igeidí tags the s'eek, the game is over and can start again with new sigedis and s'eek.

Bring energy back down with a sound map activity by the river.

Station #1 (25-30 mins):

- *Sight:* First, let's check our eyesight. s'igeidí actually are nocturnal and can't see great distances, we'll test how good your eyesight is. Split into 2 groups. Group s'igeidí will face Group Xalakách and separate by about 20 feet. Hand out food picture cards to just Group Xalakách and have them look at it but keep it to themselves. When s'igeidí are ready, Xalakách will turn the card towards them and s'igeidí will try to see the image. If they guess wrong, they take a step closer to the other line, and continues on until they can correctly identify the image. Repeat the activity for the other line.

- *Touch:* Sit or stand in circle, reach inside touch box to feel natural objects. Don't try to guess what they are right away, just think about what they feel like and try to describe those sensations.

Station #2 (25-30 mins):

- *Smell:* In small tubs, have shavings of cottonwood, alder, and cedar. Students have to find their matching smell from across the line and can check to see how they did under the bottom of each container at the end.
- *Taste:* In two lines facing one another, line A closes their eyes. Place a skittle into their open hand and have them chew without looking. Line A then tries to guess the flavor of the skittle and line B can confirm if they were correct or not based on the color.

Tracking

Now that students are cued into using their senses to explore the forest, what are the animals that live here trying to tell us? Use the sense sheet to work with a partner to explore the natural area, paying close attention to any tracks that you might come across.

DEBRIEF

So, do beavers hibernate or migrate south? *(10 min)*

Beavers spend their winters inside of their lodge (min 7:00 til end), a barrier they build to stop the flow of water. Their lodges are built in the fall to protect them from predators and have underwater entrances. Full of fresh branches, beavers body heat and breath will change the snow layer on top of the lodges making them visible. The ponds and lodges they create offer habitat and resources to other animals year-round.

Drone footage *(10 mins)*

How do beavers change Alaska and their habitats?

Let students brainstorm and discuss.

Here is one way beavers have changed landscapes dramatically:

1. Yellowstone - https://www.youtube.com/watch?v=ZfSzArgX9mA

S'igeidí/Xalakách Narrative *(10 min)*

In journals, create a T chart for physical and structural adaptations. Show X'unei's PPT as you read the translation. Allow students a few minutes to think about what adaptations (either porcupine or beaver) are featured in the story.

Journaling *(20 mins)*

Imagine a day in the life of a s'igeidí. It can be winter, spring, summer, or fall. What would your habitat look like, and what would you be up to for the day? Would you be by yourself or with others, would it be daytime or nightime, and how would you be using your senses and adaptations?

Aquatic Insects

Lesson Plan for Grade 3, SPRING Nature Studies

Prepared by Abby Hines

OVERVIEW & PURPOSE

The final nature studies session of the year is a really fun one where students investigate the life cycle, structure and adaptations of aquatic insects.

BACKGROUND

Aquatic insects by definition spend most of their lives in water. Insects are arthropods, meaning that they are invertebrates that have jointed legs. Other arthropods include lobsters, centipedes, and crabs. In order to be classified as an insect the organism must have three main body parts: a head, thorax and abdomen, 6 legs, two compound eyes, antenna, and a hard exoskeleton. The abdomen houses most of the important internal structures of the insect, whereas the thorax contains many external structures the insect uses for movement such as legs.

Aquatic insects are a vital component of healthy aquatic ecosystems serving as a food source for waterfowl and fish. In North America there are more than 8,600 species of freshwater aquatic insects. The biological diversity seen in aquatic insects is nothing short of amazing! Aquatic insects are very sensitive to environmental changes and pollution, for this reason they are often used as bioindicators for ecosystem health.

There are many different kinds of aquatic insects. Listed below are a few of the major groups of aquatic insects you are likely to encounter:

- Mayflies (*Ephemeroptera*)
- Dragonflies and Damselflies (*Odonata*)
- Stoneflies (*Plecoptera*)
- Caddisflies (*Trichoptera*)
- True flies (*Diptera*)
- True bugs (*Hemiptera*)
- Dobsonflies and alderflies (*Megaloptera*)
- Water beetles (*Coleoptera*)

Breathing
How do aquatic insects breathe? Just like terrestrial insects some aquatic insects breathe through holes in their exoskeleton called spiracles. However, they have some very specialized adaptations that allow them to be underwater. They may close their spiracles when they submerge and open them when they resurface or carry bubbles on top of their spiracles in order to breathe like a SCUBA diver. Others have snorkel attachments to their spiracles or gills for breathing dissolved oxygen underwater.

Eating
Aquatic insects eat a variety of things. Some have specialized mouth pieces that scrape algae off rocks or shred vegetation, others engineer intricate silk nets or hang their mouth open to catch detritus. Some of the larger species are predators that stalk, kill and eat other aquatic insects or small fish.

Movement
For the purposes of this lesson there are 3 categories in which aquatic insect may be divided into based on their locomotion: 1) scuttlers- move side to side using legs 2) Swimmers- move forward and backward in a swimming motion 3) drifters- float along with the current.
Defense
Like any other organisms, aquatic insects must adapt either physically or behaviorally to survive. Aquatic insects can have a variety of adaptations such as: camouflage or cryptic coloration to hide from predators, armour or hardened exoskeletons, and behavioral strategies such as mimicry to avoid hazards.

Growth
Like other arthropods, as aquatic insects grow they must shed their exoskeleton and grow a new one periodically. As an insect grows it goes through developmental changes, this is called metamorphosis. There are two types of metamorphosis: complete (distinct changes: egg→ larvae→ pupa→ adult) and incomplete (grows into a larger version: egg→ nymph→ adult).

EDUCATION STANDARDS/OBJECTIVES

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Material for teachers to show the class before our session

1. Introduction video about aquatic insects: https://www.youtube.com/watch?v=-qSNXRxJWTc
2. Digital copy of John Hudson's book on Aquatic Insects of Alaska: http://www.naturebob.com/sites/default/files/AquaticInsects.pdf
3. *Song of the Water Boatman and Other Pond Poems* by Joyce Sidman

INTRO

Essential Question: *How do aquatic insects interact with their environment to survive?*

PART 1: What is an aquatic insect (you can use the first sheet of the handout for this portion)

1. Write aquatic insect on the board and help the students come up with a definition. Start with insect. Next name some things that are aquatic, ask students to give you a thumbs up when they think they know what the word means. When most students have thumbs up have one student share their idea.

2. Share the aquatic insects powerpoint found on the google drive that outlines the various features of an aquatic insect and how it survives, including:
   - Habitat
   - Breathing
   - Moving
   - Feeding
   - Defense
   - Life Cycle

As you introduce each feature (breathing, moving, feeding, defense) have students replicate an action that you demonstrate. For example, for insects that breathe using a snorkel have the students place their imaginary snorkel from their mouth to the surface of the water and breathe in and out a few times. For the life cycle, have the students act out the complete and incomplete life cycle.

PART 2: Game: Act Like Your Insect

1. Explain that each table group is going to become an expert in one type of aquatic insect and will have to act like that insect and answer questions about it. The rest of the class will guess what they are.
2. Hand out copies of the aquatic insect profiles (attached) to each table group. Give them 5 minutes to learn and prepare.
3. One group starts by acting out the way that their insect moves. If needed, students may ask questions to gather more clues about which insect they are.

FIELD STUDY

Solo walk to field study destination (20 min) Have students participate in an adaptation and macroinvertebrate themed solo walk to the field study destination. This will allow students to 'center' into being scientists for the day. Have your assistant stay back with the kids as you go forward on the trail and set out one solo walk card per 20-30 feet. Have your assistant send a kid every 1-2 minutes. At the end of the solo walk gather the students. Have an activity at the end to occupy students while they wait on others to complete the solo walk.

Aquatic insect collection (40 min)

1. Ask the students if they notice different parts (or habitats) in the river or creek where you are investigating. Where do you think we will see the most insects? Why? Will there be different species in different locations? Help students identify the different microhabitats (riffle, run, pool).
2. Split students into 6 groups, depending on how many adults and appropriate locations you have. Each group will be assigned a location either pool, riffle or run. Note these locations may change if sampling from a body of water other than a stream.
3. Show the students how to find and collect the insects.
    a. Turning over large rocks
    b. Using the net
    c. Emphasize NOT dumping their specimens out because they are needed for collecting data and observation.
4. Set expectations: have students think about what it would be like to be an insect and how to respectfully handle and investigate the creature without harming it. Explain how to use the tools appropriately.

Aquatic insect observation (40 min)

1. After students have collected aquatic insects for about 30 minutes have students carefully separate each insect into the separate compartments of the ice cube tray. Take 10 minutes and have students look closely with hand lenses to make some observations, formulate questions, and identify what insect they are observing.
2. Students can sort insects how they see fit i.e. by species, or other characteristics.
3. Have the students work as a team to fill out their data sheet using careful observation and hand lens.
4. Have students hold on to their specimens for the next activity.

*This is a good time to take photos of the insects that the students collected, have other adults help you with this. The photos will be used in the wrap.

Stream health assessment (20 min)

Tell the students that one tool that stream scientists use in determining whether a stream is healthy or not is if it has mayflies, stoneflies, and caddisflies. Those species can only survive if there is enough dissolved oxygen in the water. If the stream is too polluted it does not have very much dissolved oxygen and the insects cannot survive.

Look over each of the sampling location- Engage in a discussion with the students exploring these questions:

- Did we find all three species?
- Why do you think these areas are clean or polluted?

DEBRIEF

Knowledge sharing (20 min)

Compile student data in one master sheet beforehand. Project this sheet and allow students to fill out their own data tables (found in handout). Have students construct 'I notice' and 'I wonder' statements from the data.

Graphing our results (25 min)

Using the worksheet at the end of this lesson plan, have students create a bar graph to represent their data. Demonstrate created the first couple bars on the graph as a class.
This activity aligns with the 3rd grade JSD math standard for measurement and data.

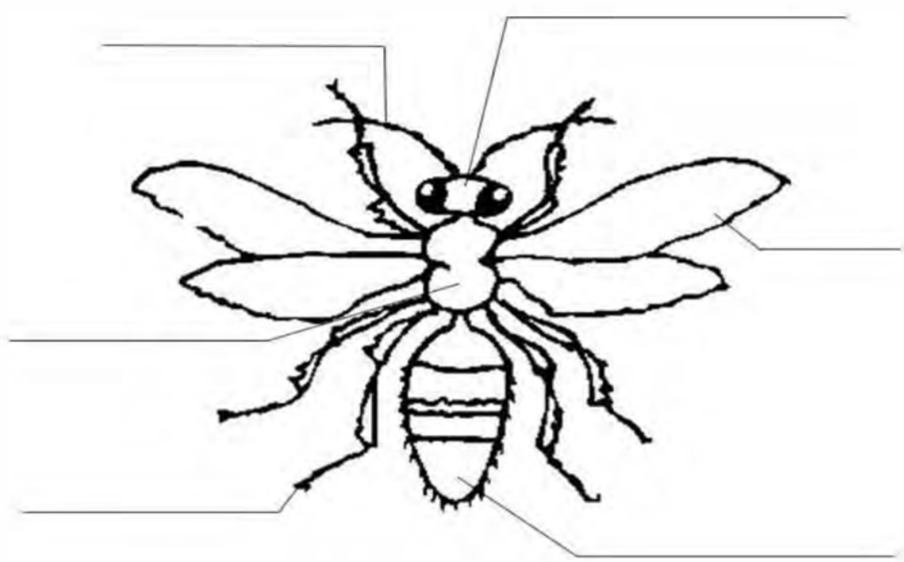
RESOURCES

https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/420/420-531/420-531_pdf.pdf

Aquatic Macroinvertebrates

Aquatic Macroinvertebrate- Animals **that live in the water** without a backbone that **we can see with our naked eye.**

Insect Anatomy



Word Bank
abdomen
antennae
head
legs
thorax
wings

Things I want to remember:

Aquatic Macroinvertebrate Investigation

What is the relationship between________________________________ and
(measured variable)

______________________________.
(changed variable)

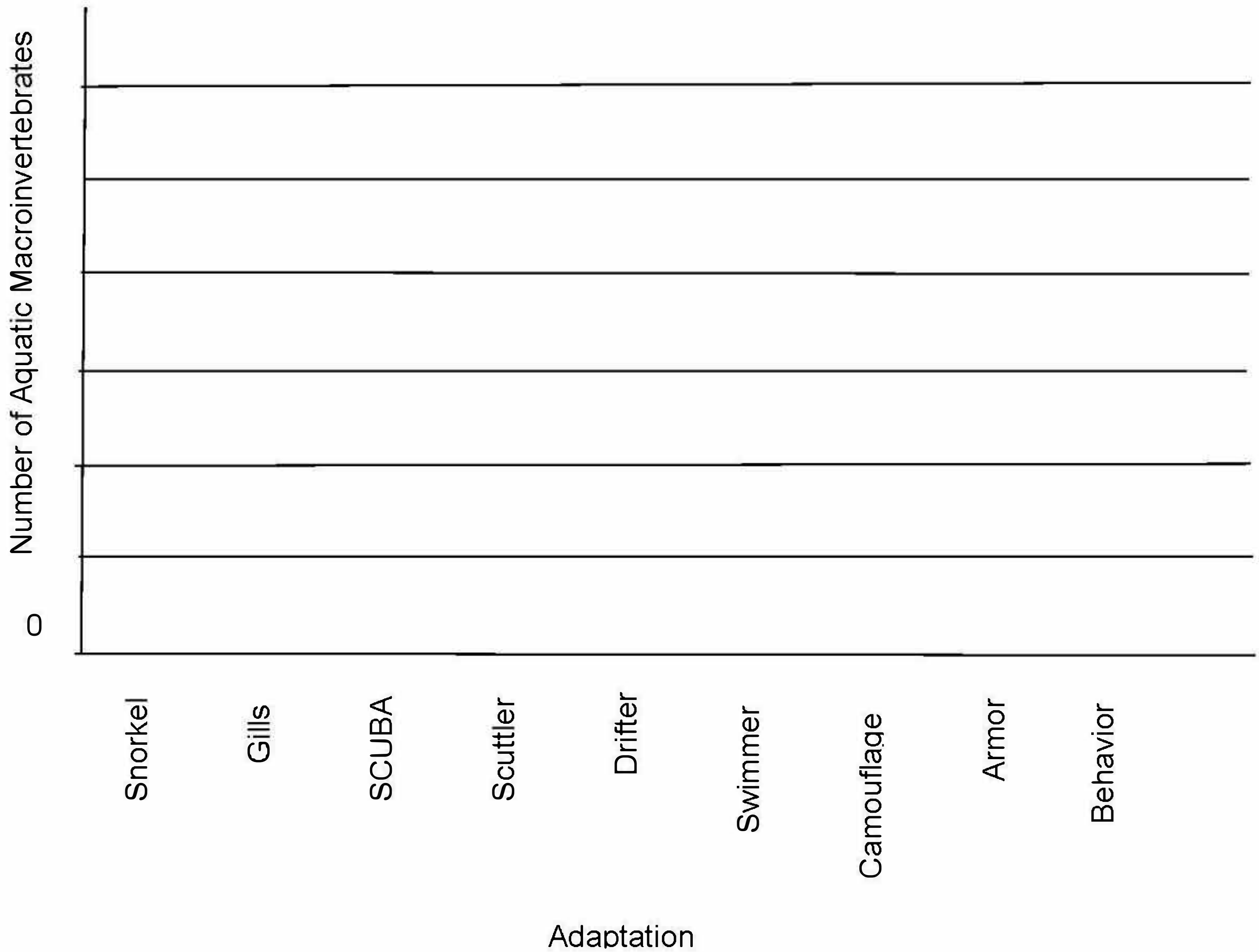
(measured variable)		(changed variable)		
		pool	**riffle**	**run**
breathing	snorkel			
	gills			
	SCUBA			
movement	scuttler			
	drifters			
	swimmers			
defense	camouflage			
	armor			
	behavior			

I notice...

I wonder...

Graph your results in the bar graph below:

Aquatic Macroinvertebrate Adaptations in __________ habitat



I notice____.

I wonder____.

I think____

because____.

S'igeidí & Xalak'ách' Finale: Ecosystem Exploration

Lesson Plan for Grade 3, Nature Studies SPRING

Prepared by Kate Cruz (modified from Abby Harding's and Steve Merli's spring lessons)

OVERVIEW & PURPOSE

This lesson provides a sensory investigation of three ecosystems found in SE Alaska. Students compare and contrast ecosystems to develop an understanding of organismal adaptation and survival. Students explore interdependent relationships within ecosystems through observation and play-based learning.

EDUCATION STANDARDS

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

LS4. C: Adaptation

LS4. D: Biodiversity and Humans

OBJECTIVES

Students will be able to:

1. Define ecosystem, and give examples of ecosystems seen around Juneau.
2. Demonstrate knowledge of the different biotic and abiotic components of an ecosystem.
3. Develop arguments to support why certain organisms live in certain ecosystems and not others.

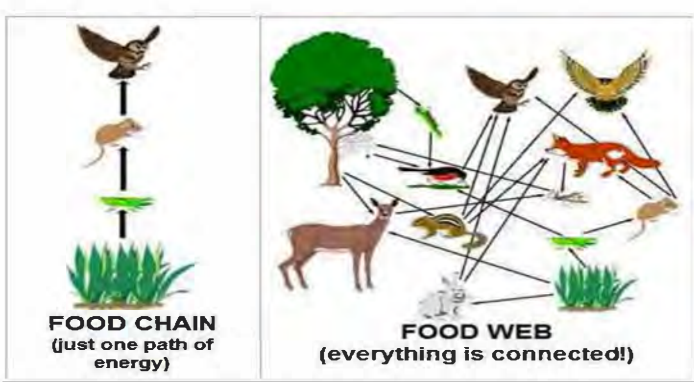
MATERIALS NEEDED

1. X'unei, Lance Twitchell's Porcupine and s'igeidí PPT (interior Tlingit narrative)
2. Porcupine/s'igeidí Tsimshian translation
3. Habitat observation worksheet

Intro	Field	Wrap-Up
• Review fall and winter field trips and learnings • Food Chains • Trophic Level R - P - S tournament • Prep for field observations • Forest Agreements	• Hike to Gold Basin Rd • Color Palette of SE Alaska • Share Out • Macroinvert Station • MicroHike Station	• Foodchain collage

BACKGROUND

An ecosystem is defined as a biological community of interacting organisms and their physical environment. Another way to define an ecosystem is all the living and nonliving things that interact in a given area. Southeast Alaska lays in the temperate coastal ecoregion of Alaska. Within this ecoregion lays multiple ecosystems and habitats including: muskeg bogs, temperate rainforests, rivers, lakes, coastal marine areas, salt marshes etc. Between each ecosystem lays an ecotone or convergence of two ecosystems. These zones are often rich in biodiversity and home to unique species. Comparing ecosystems and studying ecotones provides ecologists with information regarding ecosystem health, function and organismal adaptation. A common model used to depict ecosystems is a food web or web of life. These models showcase specific interdependencies within an ecosystem. See below.



INTRO (45 mins)

Discuss and brainstorm *(10 min)*

This fall, we explored the forest from the perspective of Xalak'ách' and made compasses, we even learned to navigate with Tlingit terms. This winter, we used all 5 senses to explore the forest from the perspective of s'igeidi and how adaptations allow animals to live in their habitats. Today we're going to learn about how all of these things come together to form an ecosystem, does anyone know what that word means?

Xalak'ách' Food Chain *(10 min)*

North American Porcupines are like koala bears, the food they eat has such little nutritional value they have to eat all of the time! They eat the inner bark of spruce and hemlock year-round, and in the spring they eat the green buds of cottonwood and willow. They also really need salt, so they chew on animal bones and are often found on the side of the road to try to fill that need.

Brainstorm the food chain of a porcupine on the whiteboard. Porcupines are generalist herbivores, predators include lynx, great horned owls, bears, wolves and wolverines.

Sun - Vegetation - Porcupines - Bears

What are the adaptations that help them protect themselves?

Rock - Paper - Scissors Tournament *(10 min)*

Food chains help us to show who eats what within an ecosystem, or the community of living and non-living things in an area.

Introduce concept of trophic levels and the five levels needed for the rock-paper-scissors tournament. Symbols include grass (fingers waving), porcupine (spikes), bear (claws), eagle (wings), mushroom (triangle above head).

S'igeidí Food Chain *(10 min)*

How does this food chain compare to the food chain of a s'igeidí? If we were to play again, what would be the same and what would be different?

Beavers eat not only bark, but also aquatic plants of all kinds, roots, and grasses. As they exhaust the food supply in the area, the beavers must forage farther from their homes. This increases the danger from predators.

When an area is cleared of food, the family migrates to a new home. In Alaska wolves, lynx, bears, and humans are important predators of beavers.

Sun - Vegetation - Beavers - Humans

Field Prep

Study a mini-ecosystem at a neighborhood tree to observe interaction between living and non-living things. We will also be exploring at least 2 different ecosystems from various perspectives, using all of our senses.

Forest Agreements

- Live in Peace and Harmony

FIELD (2 hours)

Forest Agreements

- Live in Peace and Harmony

Hike *(30-45 mins)*

Gold Basin Rd via Cope Park stairs

Nature's paint palette *(20 mins)*

Handout paint strips to each student. Challenge students to find all the colors on their paint strips in the forest as you hike. Share out favorite color and where they found it.

Stations *(20 mins each)*:

- *Station 1 - Macroinvertebrates:* We take a minute to talk about being **Gentle Giants.** Steve tells the kids a story: "Imagine you are having a sleepover with all your best friends. It's winter, and there's snow on the ground and it's still snowing. You're all cozy and about to listen to a great story when -- BAM! A giant comes in and rips the roof right of your house, grabs you, and throws you out into the snow! What would that be like? You're out there in shock watching the snow land on your face, unable to move. We're about to be the giant in that story. Those invertebrates out there are in their homes, and we're going to have to be as gentle as possible."

  Explain how to gently flip a rock, scan for movement, and pour water over the rock and into a cup below to catch invertebrates. In this way, we never touch them.

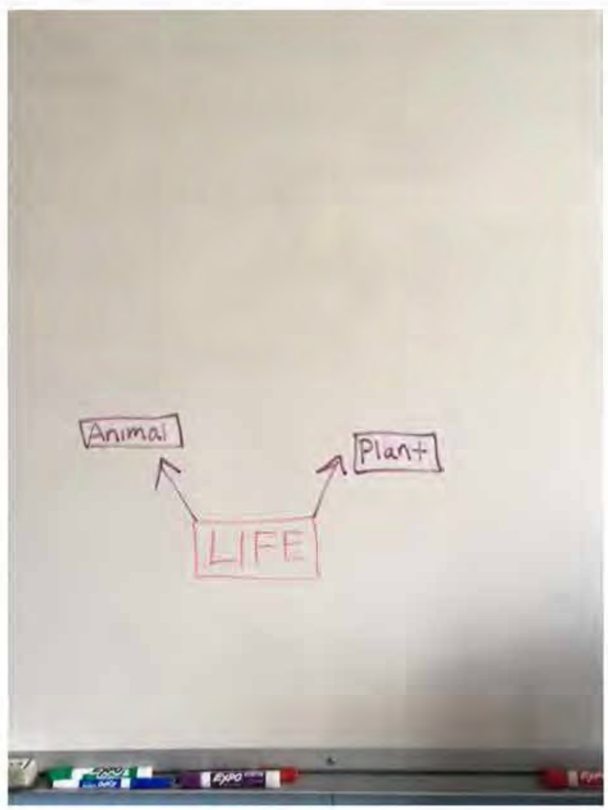
  How do macroinvertebrates connect to healthy beaver and porcupine populations and habitats?

- *Station 2 - Ecosystem Exploration:* Hand out ecosystem worksheet, challenge students to find a sit spot, free explore, do a micro-hike, and then try to find a different ecosystem to explore using their senses.
- Rotate stations

***Hike Back** (20-30 mins)*

Harborview via Cope Park stairs

DEBRIEF (45 mins)

What is this box? Sit down on the ground with the students in a circle and produces a large salmon box. "This is the Box of Life," he says, "Using our imaginations, we're just going to put every living thing on earth in there. So that means we're in there, too."	
How should we split the box? "Within this box, there are two boxes," and we draw that on the board (see attached picture). "If you had to split this box in two, so that all of life fit either in one box or the other box, how would you label the two boxes?" There will be many answers that are not what we are looking for. Navigate through these as inspired. **Actual answer**: plant and animal. Label the boxes on the board.	

Now we'll look at animals. If all animals were split into one of two categories, what might those two categories be? What would you call the box?

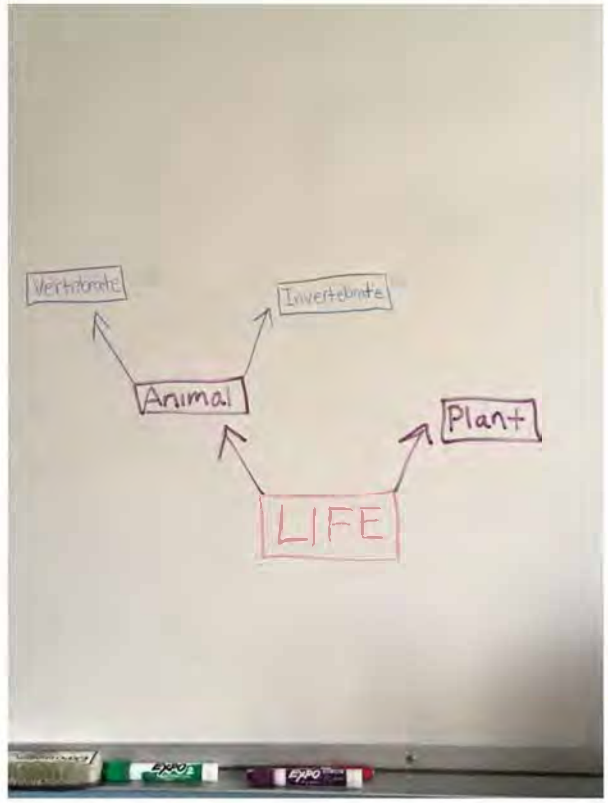
The nearly inevitable answers: hot/ cold blooded, human/ animal, land/ water -- this is not what we are looking for.

Let the students really puzzle this one out. When they need help, Steve pulls out a vertebrae, and directs the kids to each take one hand and place it on the bump at the base of their neck. "This is a bone," he says. "In fact, it's one of many bones called vertebrae, that make up your spine."

Usual the word vertebrae will prompt the answer from the class:

The actual answer: Vertebrate/ Invertebrate

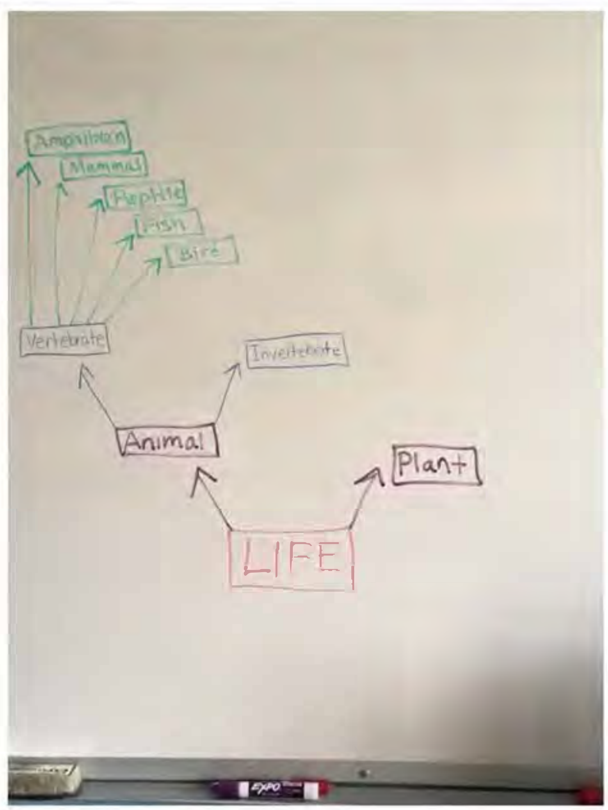
He takes a lot of time with the vertebrae bones, locking them together "like lego," and discussing the spinal cord. It is important to know your spine.



So, who else has a spine? Inside the vertebrate box there are actually 5 boxes! We bet you've heard of them before. Let's name them.

Answer: amphibian, bird, fish, mammal, reptile

Each box has a representative animal inside. Take time with the kids to name these animals. *Short-tailed weasel, puffer fish, frog, tortoise, willow ptarmigan*

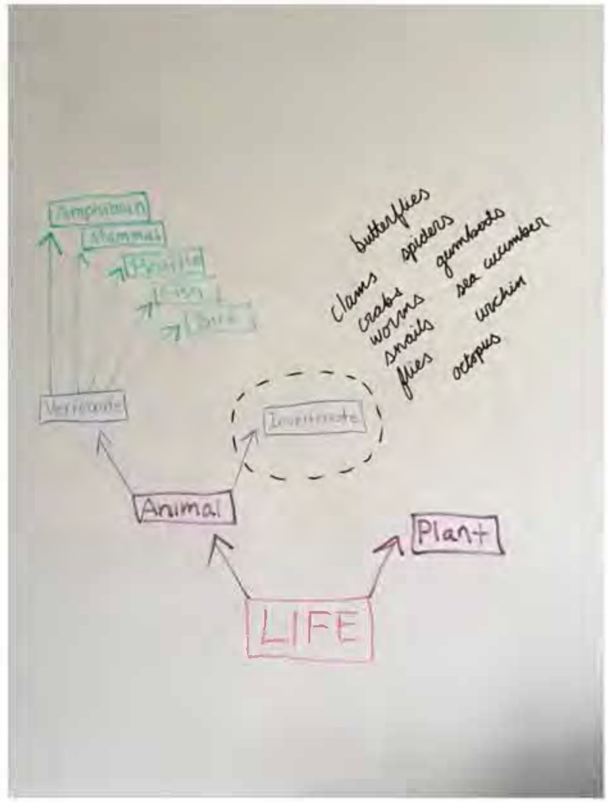


But let's get back to that other box that we haven't opened yet: invertebrates! Things that go in this box have no inner skeleton. Either they are all soft (jellyfish) or they have hard skeletons or shells on the outside (clams). Who might we find in here?

Kids will have about a million answers. Sometimes a reptile or two ends up in here by accident and we sort that out as it comes up. Snakes and frogs are favorite false invertebrates.

Just list them, don't worry about boxes here. Steve usually mentions that if we had a real invertebrate box, there would be "like 50,000 boxes inside of it!"

Steve then lets the kids know that this is the box we'll be focusing on together.



The Box of Life (Aquatic Macroinvertebrates)

Lesson plan for 3rd grade spring

OBJECTIVES

1. We can separate living organisms into vertebrate and invertebrate subcategories. We can see the similarities and differences in each of these groups.
2. We can tell the story of an insect's life from egg to adult, and begin to recognize what makes an insect an insect.

MATERIALS NEEDED

1. Intro 1: Steve's Box of Life (and subsequent smaller boxes within)
2. Intro 2: Steve's images of invertebrate larvae and adults, sketching materials for students
3. RB Field: Dip net, 4 white plastic trays, and 1-2 tarps, usual hiking gear
4. GV field: 30 white plastic cups in a 5 gallon bucket (GV), usual hiking gear

INTRO 1

Box of Life (45 min)

Activity: Opening the Box of Life/ Class Discussion

The description below is split in two. The written part describes the discussion that Steve facilitates, and the images are what he or the assistant draws on the board as the class progresses through the discussion.

What is this box? Steve sits down on the ground with the students in a circle and produces a large salmon box. "This is the Box of Life," he says, "Using our imaginations, we're just going to put every living thing on earth in there. So that means we're in there, too."

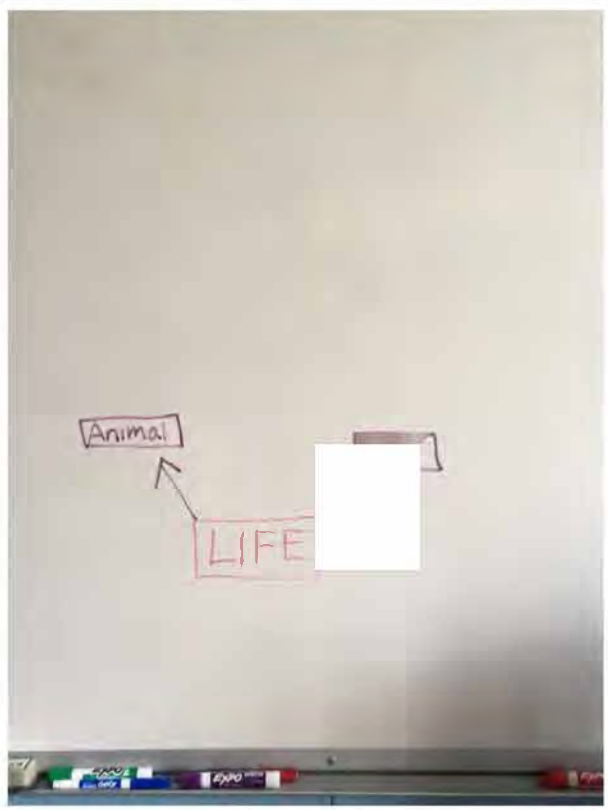
2-5 min

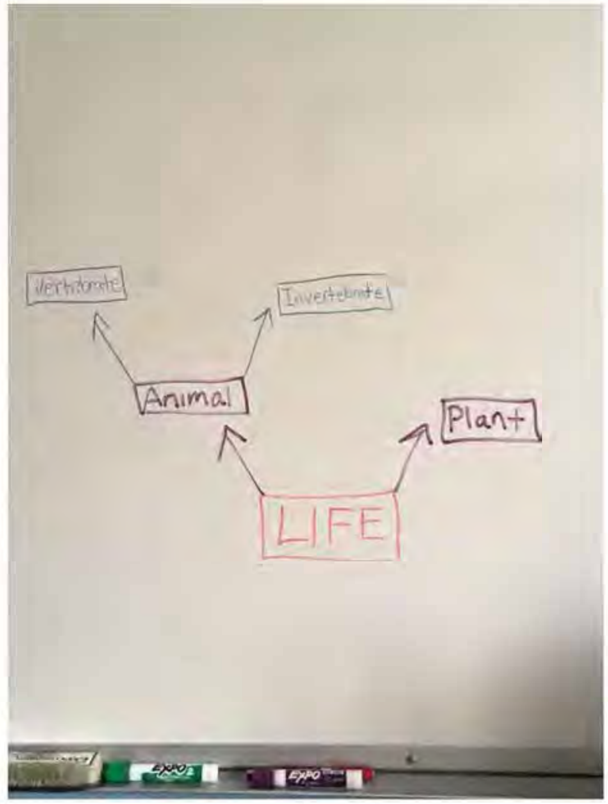
How should we split the box? "Within this box, there are two boxes," Steve says, and we draw that on the board (see attached picture). "If you had to split this box in two, so that all of life fit either in one box or the other box, how would you label the two boxes?"

There will be many answers that are not what we are looking for. Steve navigates through these as inspired.

Actual answer: plant and animal. Label the boxes on the board.

2-5 min



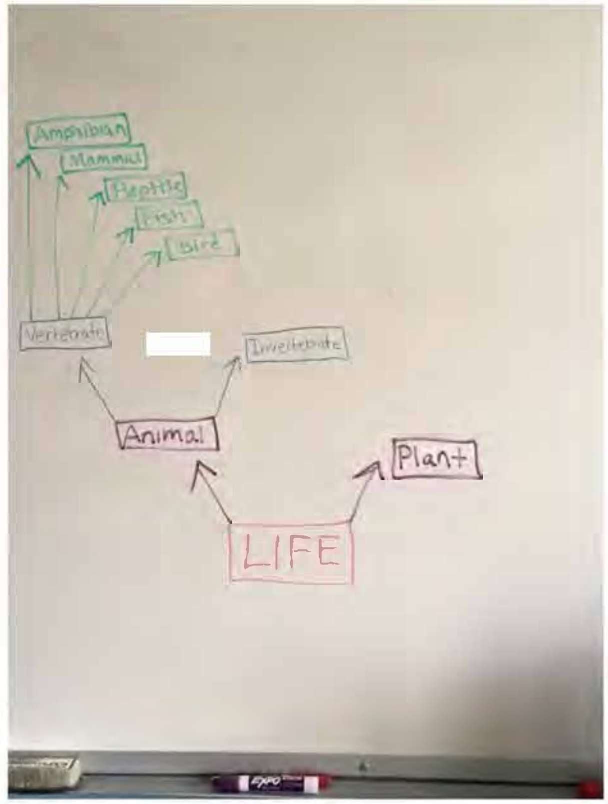

Invertebrate
Animal
Plant
LIFE

So, who else has a spine? Inside the vertebrate box there are actually 5 boxes! We bet you've heard of them before. Let's name them.

Answer: amphibian, bird, fish, mammal, reptile

Each box has a representative animal inside. Take time with the kids to name these animals. *Short-tailed weasel, puffer fish, frog, tortoise, willow ptarmigan*

7-10 min



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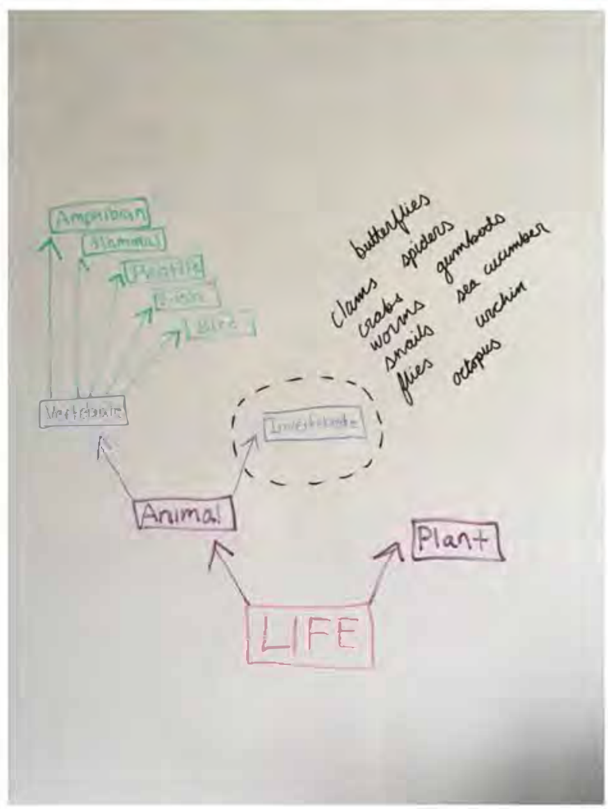
Just list them, don't worry about boxes here. Steve usually mentions that if we had a real invertebrate box, there would be "like 50,000 boxes inside of it!"

Steve then lets the kids know that this is the box we'll be focusing on together.

7-10 min



INTRO 2

We draw insects (45 min)

Activity: Nature Drawing

- Students get out their science/ nature journals and a pencil, turn to a blank page, and look toward the front of the room.
- Steve uses the screen projector to project an image of a dragonfly larva (RB) or a stonefly larva (GV). We discuss how we will look at this animal to sketch it. We will go slow. You do not need to be right. We will break it into parts.
- Steve narrates the drawing process and the assistant draws on the board beside the projection, so students can see what it means to break it down into shapes: First just draw that top shape (the head), then the next shape down (the thorax), and then lastly that big shape at the bottom (the abdomen). Take lots of time here. Add the six legs.
- Steve does not name the parts until after the kids have drawn them (head, thorax, abdomen). Then we discuss with them what makes an insect: 6 legs, 3 body parts. Spiders, for example, are not an insect, although we do call them bugs.
- If at RB, Steve lets the kids know that this kind of drawing is something they will be doing on their field trip later.

FIELD

We go out in search of macroinvertebrates. (1.5-2 hours)

We take a few minutes to talk about being **Gentle Giants.** Steve tells the kids a story:

"Imagine you are having a sleepover with all your best friends. It's winter, and there's snow on the ground. You're all cozy and about to listen to a great story when -- BAM! A giant comes in and rips the roof right of your house, grabs you, and throws you out into the snow! What would that be like? You're out there in shock watching the snow land on your face, unable to move. [pause] We're about to be the giant in that story. Those invertebrates out there are in their homes, and we're going to have to be as gentle as possible."

If we're at GV, he also explains how to gently flip a rock, scan for movement, and pour water over the rock and into a cup below to catch invertebrates. In this way, we never touch them.

Before we go out the door, we have our layers/ boots on. We establish that Steve will lead and the teacher will bring up the rear. We leave sticks and stones on the ground.

At GV, we head towards the water tower up the hill from the school. We follow the Jordan Creek feeder stream uphill to a place where it is calm enough to get the whole class to climb into the water, with white plastic cups, to search for invertebrates. Adults are stationed along the stream at any places of concern.

At RB, we walk to Rotary Park with a dip net and white plastic trays. Steve fills the trays with water, dipnets along the banks of the pond, and brings each net-full to each of the four trays. Students look for invertebrates in the trays, and sketch what they see.

Time is generally split 60/40 between invertebrate activity and hike.

Power (the story of water and soil)

Lesson plan for 4th grade fall

OBJECTIVES

1. We understand where we are in space and can take this experiential knowledge (I am at my desk) and translate it into abstract representation (this dot is at its box on my map).
2. We can use our experience rolling down hills, riding bikes, and watching water to tell us about the relationship between incline, velocity, and inertia (although none of those words are necessary to use yet).
3. We can feel the power of that downward pull. We can understand that the same power that moves us faster and faster when we go downhill on bikes also moves water and boulders, carves riverbanks, causes landslides, and forms the way we live our lives.

MATERIALS NEEDED

1. Mr. Merli's powerpoint on the history of the Mendenhall River
2. Paper maps of RB (RB specific)
3. Pencils, blank paper (or opposite side of RB paper maps)
4. 5-6 buckets
5. Usual hiking gear

INTRO

Coming back together, we re-introduce ourselves. We take time to remember the adventures from last year. We think a little about the field trip ahead of us this fall.

1. Activity: Mapping
    a. Pass out blank papers (if at RB, pass out maps and have students flip map to blank back side) and pencils to all students. Ask students to imagine themselves looking down on the classroom from above. Draw your desk in the room, exactly where it is (help them

by noting where they are in relation to the doors, corners, and other landmarks in the room). Fill in the room. Where are the other desks? What else is here? Let them take their time, and check in with them as they go. (10 min)

2. Powerpoint
    a. Using Mr. Merli's powerpoint on the history of the Mendenhall River, the lesson we land is that the river changes over time (everything is a track, every track tells a story).
    b. We take a moment to pause and consider how water moves, not just in the Mendenhall River, but down Thunder Mountain. It creates a shape called an *alluvial fan* (keyword for this lesson). Let's look at some pictures of that.
    c. How rocks move/ how water moves to form an alluvial fan: draw the incline of Thunder Mountain up on the board, then the flattening out of the valley. Imagine riding your bike down this. Where will you move fastest? Where will you move slowest?
3. Coloring map (optional/ RB)
    a. After learning about the way the Mendenhall has changed over time, let's take a moment to flip your pages over and color in what we see. Put the colored in picture up on the projector. You'll need some colored pencils. Take a moment to talk about the recent breakthrough. This is a quiet activity. Check in with the kids as they go. (10 min)

FIELD

Before we go out the door, we have our layers on. We establish that Steve will lead and the teacher will bring up the rear. We know that we will be in a line in school, but when we leave school, we do not need to be in line. We note that most of the time when you leave school you are going home or going to recess, but what we are about to do is neither go home nor go to recess. We leave sticks and stones and snow on the ground.

When we go out the door we open the gate. At RB this is usually behind the school, in the playground, or on the field. At GV this in the parking lot of the Thunder Mountain trailhead. We stay on-trail for a bit and then we will go off-trail shortly after. Each bucket is carried by a volunteer.

Activity: Bucket Brigade

- RB: At the breakthrough beach downriver from the RB bridge, we take a moment to remember the alluvial fan. Have the kids line up on the hillside, one end close to the water and the other end at the top of a small sandy hill. Explain that those at the bottom of the line will fill the buckets and send them up, one by one, full of water. The person at the top end of the line will pour their bucket down the hill, then take their bucket and walk to the lower end of the line. The line shifts up. Each subsequent person pours their bucket in the same place, takes their empty bucket down to the water, and shifts the line up the hill. Stop every few buckets to see how the rocks and sand move. Where are the big rocks? Where will it go next? How does it change if we pour two buckets at once? Three? Four? Five? All six?

- GV: All the same, except you go up the hill towards the water tower, and do your bucket brigade there. Pause on your way up to notice that you are currently standing on a very old alluvial fan. Have students notice the slow incline of the landscape.

When you run out of time, go home.

WRAP

We come home

Sometimes the wrap for this class is leftover activities from the intro. Sometimes we finish the powerpoint, draw maps that we didn't have time for, or go back to the image of a bike going down Thunder Mountain. Other times, there is no wrap at all, and Steve splits the intro in two, so we do Intro, Intro, Field with a few minutes at the end for reflections and questions in the classroom.

Weathering, Erosion, Deposition Oh My!

Lesson Plan for Grade 4, FALL Nature Studies

Prepared by Abby Hines

OVERVIEW & PURPOSE

This lesson will provide a meaningful exploration of geological processes that shape our world. Students will explore mechanical, chemical, biological weathering, stream characteristics, deposition, and ice, wind, and water erosion.

BACKGROUND

Weathering, erosion and deposition shape the landscape around us. Weathering or the break down of rocks and minerals into smaller pieces comes in three forms: mechanical, chemical and biological. Once a rock face has experienced weathering these weathered pieces may be eroded or transported elsewhere by wind, ice, water or gravity. From a plant growing through a sidewalk to the glaciers that carve out Southeast Alaska, weathering and erosion can be seen anywhere. When eroded material stops or deposits beautiful geologic and hydrologic features such as alluvial and colluvial fans form.

EDUCATION STANDARDS

1. NGSS 4-ESS1-1 (changes in landscape over time)
2. 4-ESS2-1 (weathering and erosion)

OBJECTIVES

From this lesson, students will be able to:

1. Define geology, weathering, erosion, sediment, and deposition.

2. Explain different forms of weathering and erosion from ice, water, wind, gravity, vegetation, and chemical processes.
3. Demonstrate an understanding of geological time scale

MATERIALS NEEDED

Introduction

1. Chalk
2. Vinegar
3. Granite
4. Lichen rock (left as pet rock)

Field Study

1. Geosphere solo walk cards
2. Scavenger hunt sheet (1 per 2 students)
3. Access to rocks at end of solo walk
4. Outdoor laboratory
    a. Tubs of sand and ice blocks (2-3 sets)
    b. Regular sized ice cubes made with sand on the bottom
    c. Chunks of slate
    d. Buckets (3)
    e. Vocab flags
    f. Laminated pictures of wind erosion

Debrief

1. Laptop with story of the life of a rock video

https://www.youtube.com/watch?v=fbDD0FkH2lk&pbjreload=10

2. Drawing and writing utensils and journals

VERIFICATION

Steps to check for student understanding

1. Demonstration of knowledge in building landforms.
2. Demonstration of knowledge in labeling stream
3. Summative assessment- perspective stories

INTRODUCTION

Experimenting with weathering (30 minutes)

In this experiment we are going to watch weathering happen before our eyes. Your responsibility is to observe and take notes about the processes you see taking place. There are 3 investigation stations set up. You will be rotating around the classroom to complete each one, using the attached worksheet to take observational notes. Note that students can paste sheet into science journals if desired. Stations will take 5-7 minutes each.

Station #1: Chemical weathering- Students use pipettes to apply water to limestone and watch it erode.

Station #2: Mechanical- Students will knock pieces of granite together and watch dust form as a result of mechanical weathering.

Station #3: Biological- Students will observe a rock covered in lichen or moss with a hand lens and guess what is happening. NOTE: This rock can be left with the classroom as a 'pet rock' for them to observe change over time.

Have students return to seats or gather in a circle to share and discuss their findings with the group. Reveal that they have observed the 3 types of weathering today and that we will be investigating this concept further during our hike.

1. Biological (an animal or plant breaks apart the rock)
2. Mechanical (physically breaks up rock)
3. Chemical (dissolves or decays rocks by changing its chemical composition).

Expansion or journal question to leave students with: Where does weathered rock go? How is it transported?

Field Study

Hike to field study destination- ideally with obvious erosion*

***Intro** (20 min)*

Last class we learned about weathering: the fundamental process by which rocks are broken down into smaller pieces. Who can remember the three types of weathering we investigated? (A: mechanical, biological, chemical). Today we are going to learn about what happens to those little rock pieces...the next step in this geological process is called erosion.

Vocabulary: write the words **weathering**, **erosion**, and **deposition** on small handheld whiteboard. Briefly explain what the word means and then show the students the motion that goes with the word.

'When I say weathering I would like you to say 'break it up! Break it down!'. Make up a dance move to go with it. When I say erosion, you say 'I like to move it move it, I like to move it move it!' and move around the room. When I say deposition, you say 'aaaaaaand, STOP'. And sit down wherever you are in the room.'

Erosion brainstorm

Brainstorm: What are some ways weathered pieces of rock could be transported?

We can see examples of erosion all around Juneau! From the glaciers transporting weathered rock to the flooding of the Mendenhall River, erosion happens all around us (show pictures). Today we will focus on wind, ice and water erosion. Let's go on an adventure to see what evidence of erosion we can find!

This lesson changes with each school drastically. This is a strength in that you as the instructor have the ability to make this lesson extremely place-based. Below is a list of possible activities you can choose from to create this lesson in a way that fits your class's needs and resources.

Weathering/erosion scavenger hunt *(15-20 min)*

After defining erosion as a class encourage students to work in groups of 4-5 to complete the scavenger hunt together in an area where there are ideally multiple sources of erosion. This can morph into a structured free-exploration as well.

Solo walk through the geosphere *(40 min)*

Students participate in a geosphere themed solo walk. Solo walk cards are placed 15-30 feet apart on the trail leading students through a natural area in which there is evidence of erosion. Debrief questions: "What is one thing you learned on your solo walk?" "What was one thing that surprised you?"

Interview a rock *(15 min)*

Find a rocky spot and encourage students to free-explore with the goal of finding a rock that fits in their palm. After students find their rocks come together in a circle and explain that we will be interviewing a rock, similar to how people interview people. Emphasize that as practicing geologists their job is to figure out their rock's history using clues they see in the landscape around them. After interviewing, come together and share.

Ice erosion glacier investigation *(30 min)*
Set up long shallow tubs filled with sand and supply a glacier (a large ice block). Students will investigate what happens as the ice is pushed through the sand. Additionally, students will investigate glacial scarring by rubbing ice cubes with sand in them against slate. This is a great indoor alternative for foul weather.

Ice Erosion guided imagery *(20 min)*
Go for a glacier hunt- look for evidence of glaciers during a hike through the woods (moraines, glacial erratics, glacial silt etc.). Encourage students to find a rock that fits in their palm. End your hike with the guided imagery "The Succession Story" (found in the curriculum catalog) while students hold their rocks. This activity is best done as a whole class.

Water erosion bucket brigade *(30 min)*
Set up a bucket brigade area (gravel slope close to water source). Have students create a bucket brigade from the water source to the gravel slope (a line of students that pass a bucket from one person to the next until it is spilled over the eroded 'landscape'). Students take turns being the bucket spiller or 'headwaters'. Students observe what happens as more and more water is added to the slope, and place vocabulary flags into the eroded slope where these phenomena are seen. Ensure that after each group the flags are taken out and the slope returns to its original state (no canyons or rivers).

Water erosion scavenger hunt *(30 min)*
Have students free explore the stream or a recently eroded area looking for evidence of erosion, deposition, and weathering. For groups that need a little more guidance vocabulary flags could be used to indicate where certain phenomena are taking place.

Water erosion water sampling *(15 min)*

If your school is by a river or water source with high turbidity it can be fun to collect a sample of the turbid water. The water sample can be given to the class to be observed over time. Over time suspended sediments will settle into layers based on weight. This is a great extension activity to leave with classes.

Wind erosion dancing *(30 min)*
Students are provided with pictures of wind eroded landscapes. Students develop "I notice…", "I wonder…", and "I think _________ because ________." statements in response to the pictures. They then create an interpretive dance or tablou to explain what is happening in their picture to the class. This is a great indoor alternative for foul weather.

DEBRIEF

Perspective stories (45 minutes)

Review what we did and learned during field study. Play video: https://www.youtube.com/watch?v=fbDD0FkH2Ik&pbjreload=10

Write on the board key vocabulary terms:

- Erosion (wind, water, ice)
- Deposition
- Weathering (mechanical, biological, chemical)
- Geologist
- Have students write stories from the perspective of one of the following: a rock in a glacier, a stream bank, a tiny particle of clay in a stream, a river. Students share.

Name________________________

Weathering Investigation Stations

Station 1	Station 2	Station 3

Name________________________

Weathering Investigation Stations

Station 1	Station 2	Station 3

Winter Adaptation in Southeast AK

Lesson plan for 4th grade winter

OBJECTIVES

1. We can notice how different bodies do different things in order to deal with the conditions they live in.
2. We can understand the difference between hibernation, migration, and staying awake and eating. We can see how each one of these actions is a way that the living deal with winter.

MATERIALS NEEDED

1. Usual hiking gear
2. Furs of weasel family, bear

INTRO

Let's take a moment to think about what is going on outside right now. It's winter, so it's probably pretty cold outside. There might even be snow, or ice. Different animals deal with this in different ways (so do plants, but we'll mostly be focused on animals today). You may already know this, but when you think of what animals do to deal with weather like this, what do you think of?

Elicit the answers to this question. The students will usually know *hibernation* and will use a bear as an example. Press for other examples. Many will guess, few will know for sure. Other good examples **in the southeast** are marmots, frogs and bats. It may take a bit of time to think of these as a group. In the meantime, many other animals will be suggested as hibernators, which gives us time to discuss those animals which are not hibernators: porcupine, beaver, songbird, etc. Steve will often say, "No, that one is doing something else right now," and not yet move to *migrators,* or *stayers and eaters.* Bat is always the last to be guessed, and often needs some hints to the class. "This is a small mammal that flies and eats insects," Steve often says. Students will need to be reminded of all three parts of this hint: 1. Mammal, 2. Insect eater, 3. Flyer. Some classes don't guess it until he tells them it is awake and flies at night. Then the information comes right to the forefront of their minds. “Isn’t it interesting how when I said it flies at night, all of a sudden that word was available to you, when it wasn’t before?” Steve will usually say. “That’s pretty cool how our minds do that.”

Then we move on to other ways animals deal with winter. *Migrators:* songbirds, whales, some owls and ducks. And then there is this group that Steve renames every time we do this lesson: the *stayers.* (the stay-awakers, the stick-arounders, the eaters, etc.) This is the group that is out there right now, living constantly in the winter, largely above ground. Squirrel, porcupine, deer mouse, mallard, chickadee, beaver, deer, wolf, etc. These are the ones we are going to look for when we go out for our field trip.

FIELD

Before we go out the door, we have our layers on. We establish that Steve will lead and the teacher will bring up the rear. We know that we will be in a line in school, but when we leave school, we do not need to be in line. We note that most of the time when you leave school you are going home or going to recess, but what we are about to do is neither go home nor go to recess. We leave sticks and stones and snow on the ground.

When we go out the door we open the gate. At RB this is usually behind the school, in the playground, or on the field. At GV this in the parking lot of the Thunder Mountain trailhead. We stay on-trail for a bit and then we will go off-trail shortly after.

While we are out, we remember the lessons we’ve learned in the past, and keep an eye out for those animals awake and eating right now. We use our skills to track and notice. We stop to consider the cold and the wet, and how it might feel to be an animal in this weather, knowing that a porcupine -- for example -- never goes into its house. It never sits by a fire. It is out here all the time

WRAP

This lesson changes a lot depending on the needs of the class that day. Mr. Merli has the class circle up and sit together, and puts the furs of an otter, a bear, a martin and a mink out on the ground. Students will want to touch them. As long as they are being respectful, that is ok.

While we touch the furs we talk about what we just did (Steve tries to schedule the wrap to be immediately after the field lesson), and how these animals live and move in this landscape. We talk about the difference between the bear and those in the weasel family. We take out the frozen short-tailed weasel and pass it around, inviting the curiosity and sadness that comes with holding a dead animal in our hands. No one has to hold the weasel if they don’t want to. A key aspect of this lesson is that those that hibernate don’t do so because it is cold, but because there is no food for them. Otter, beavers, mink etc. all still experience the cold, but their food sources remain.

Rooted to Our Land

Lesson Plan for Grade 4, SPRING Nature Studies

Prepared by Abby Hines

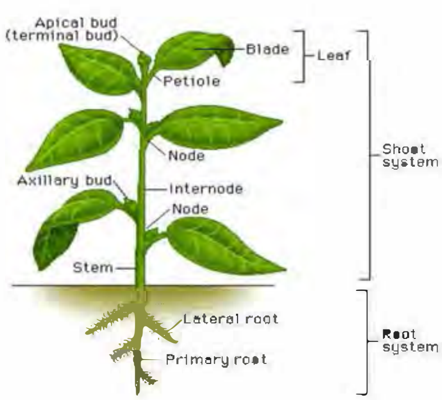
OVERVIEW & PURPOSE

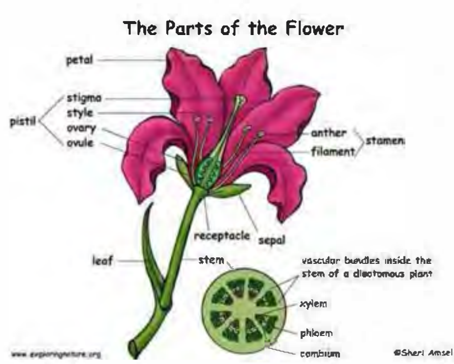
This lesson explores the fascinating world of plant identification, structure and function. Students will become familiar with local flora and plant adaptations through investigation and hands-on inquiry.

BACKGROUND

Plant structure and function basics

Most plants possess three main structures: leaves, stems, and roots. The leaves of the plant provide a relatively large surface area for light absorption and gas exchange. Leaves can be thought of as the plant's food factory as they are the main site in which photosynthesis occurs. Stems are typically long and cylindrical woody tissues containing xylem (vascular tissue that conducts water and nutrients upward), phloem (vascular tissue that conducts sugars and metabolic products down from leaves) and sclerenchyma (fibers). Roots provide anchorage in the soil, surface area for nutrient and water uptake and absorption. Other structures may include defensive armament such as thorns, seeds, and flowers. See diagrams below for reference.





Common plants in SE Alaska

Southeast Alaska's temperate rainforests have a diversity of plant life. From towering Sitka spruce to the blanket of moss that covers the forest floor there is no shortage to explore. There are many resources you can use to identify the common plants found in Southeast Alaska. Below are some helpful resources.

Common plants of Alaska's Muskeg
https://www.fs.fed.us/pnw/pubs/journals/pnw_1985_robuck001.pdf

Wildflowers of Alaska https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd529923.pdf

Common trees of Alaska https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5320147.pdf

EDUCATION STANDARDS

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.

LS1.A: Structure and function

OBJECTIVES

Students will be able to...

1. Identify the macroscopic structures of plants and their respective functions.
2. Recognize why certain plants have adapted to have certain structures and function based on the environment around them.

MATERIALS NEEDED

Intro

1. Bin of plant parts (30)
2. Hand lenses (15)
3. Butcher paper

VERIFICATION

Steps to check for student understanding

1. Brainstorming, and intro scientific drawing assess for prior student knowledge
2. Scientific diagrams

INTRO

Brainstorming *(10 min)*

What is a plant? What characteristics make a plant a plant?- Brainstorm and write students responses on a piece of butcher paper (it will be revisited during the debrief).

Scientific drawing *(15 min)*

Have students in their science journals draw the 'essential' parts of a plant and label them. Encourage students to think about what each of these structures do. Have students share their scientific diagrams and emphasize that this is practice for our field study.

What's your function? *(20 min)*

Tell students to pick one plant part from the bin and be seated. Their job is to observe this plant part carefully using a hand lens and determine what it's function is using evidence. Students should write this in their journals.

FIELD STUDY

Hike to field study destination *(15 min)*

Encourage students to notice the variety of plant life around them. Asking what they noticed when you arrive.

Connecting with place *(30 min)*

Read Tlingit story: "Let's go! A harvest story" By Hannah Lindoff

Lead a conversation with students about how they connect with the land around them.

Explain that we will be harvesting a wild edible or useful plant. It is up to you as the naturalist to determine what wild edibles are in season and safe to eat. Spruce tips and blueberry flowers are abundant in late April and throughout May.

Plant quest *(20 min)*

In a botanically diverse area allow students to complete the plant quest scavenger hunt attached to this lesson plan. Students have to read the clue, find the plant, and report back to you for the next clue. The next clue will only be given if the first clue is answered correctly. Students get a nature badge (fragrant bedstraw or some other sticky leaf) for completion.

Each two teach two *(40 min)*

Pick a trail that is botanically diverse. Students teach one another using pre-made E1T1 cards along the trail. Have the group of students stay back with you assistant. Take two students to the first plant (ex: western hemlock), describe a couple facts about this plant to the students, and give them the card. It is now their responsibility to educate all the students that come down the trail next about their plant. When the next pair of students comes down the trail they will stop and learn about the first plant then come to you to learn about their plant and receive the E1T1 card. This process repeats itself until all students have had a chance to learn from each pair. Your assistant should be the last to go down the line and will 'collect' students along the way until the end up to you!

Species accounts *(30 min)*

Go over the ABCD's (Accurate, Big, Colorful, and Detailed) of scientific drawing. Allow students to choose which ecosystem from the previous exercise they would like to work in. Students choose a plant and draw it. Focus student's attention on the different structures they are observing and their function. Encourage students to label their drawings.

DEBRIEF

Art gallery *(10 min)*

Invite students to display their scientific diagrams from field study and conduct a gallery walk.

Inside plants (35 min)

Investigate the internal structures of plants by using tree cookies, and other dissected plant structures. Microscopes can be used for this investigation. Encourage students to investigate plant structures on their own.

PLANT QUEST CLUES

1. My evergreen needles are spiky and unforgiving. I am Alaska's state tree.

2. I have cones but am not an evergreen. I have specialized bacterium in my roots that allow me to fix nitrogen from the atmosphere into a form other organisms can use.

3. I am one of the tallest trees around, yet my top bends down. My needles are soft to touch, and my small cones abound.

4. Many mistake my pink-orange aggregate fruit for berries. They are delicious none the less. Growing near streams and in the forest you'll find me.

5. The only pine tree in this area, I try to stand tall and proud but as I start growing my trunk twists, turns, and contorts me.

6. Some judge me by my name and smell before they get to know me. Upon a closer look you'll see my beautiful yellow flowers and large sprawling leaves.

7. I grow in groups where my bright pink flowers compliment fiery sunsets and my seeds are carried by the wind.

8. I am pollinated exclusively by bees, with the end result you will be pleased- Plentiful berries for jams, jellies, pancakes, and pies!

9. I stretch from two to seven feet tall to reach the sunlight of the forest understory. My acidic red berries grow in clusters and my leaves resemble hands.

10. I grow among the moss on the forest floor or near bogs where the soil is acidic. I have four to six

small leaves and small white flowers that bloom in the summer.

11. I lack stems and roots, instead I use rhizoids as my anchor to grow on the ground, logs, or rocks.

12. I am an evergreen but not a tree. I am a small plant with sori under my leaves. To reproduce I release spores instead of seeds.

Key:

1. Sitka spruce (*Picea sitchensis*)
2. Red alder (*Alnus rubra*)
3. Western hemlock (*Tsuga heterophylla*)
4. Salmonberry (*Rubus spectabilis*)
5. Shore pine (*Pinus contorta* var. *contorta*)
6. Skunk cabbage (*Lysichiton americanus*)
7. Fireweed (*Chamaenerion angustifolium*)
8. Blueberry (*Vaccinium* spp.)
9. Highbush cranberry (*Viburnum edule*)
10. Bunchberry (*Cornus canadensis*)
11. Moss spp.
12. Deer fern (*Blechnum spicant*)

EXTENSION ACTIVITIES

Fluorescent flowers

Put white carnations in a vase with water and highlighter fluid (break a highlighter and dump the fluid in). 12-24 hours later shine a UV or purple light on the flower. The plants vascular system will be highlighted to show where water transported through the plant.

https://www.youtube.com/watch?time_continue=21&v=c3VVUsuowNM

Birds

Lesson plan for 4th grade spring

OBJECTIVES

1. We can identify common birds in our neighborhood by sight and sound.
2. As a group, we can come to stillness and silence quickly, in order to observe birds.

MATERIALS NEEDED

1. Bob Armstrong bird videos: https://www.naturebob.com/videos (Intro 1)
2. 30 frozen dead birds, nature journals/ sketchbooks and pencils (Intro 2)
3. Spotting scopes (2) and usual hiking gear (field)

INTRO 1

An introduction to bird calls and behavior (45 min)

Students sit in a way that they can see the screen. Steve talks to them about crossbills, water dippers, wrens, and red-breasted sapsuckers (sometimes other birds if we have time). While he talks, we watch NatureBob videos, cued up by the assistant. We make sure to notice the ways that birds' bodies are adapted to their habits, food sources, and environments. We listen for their calls, and try to remember some of them for later.

INTRO 2

Sketching, a closer inspection of birds (45 min)

Steve either gives each table group of students one frozen bird, or each student comes up and chooses their own frozen bird to study. This activity is done in silence, as much as possible. When birds have been given out, students use their sketchbooks/ science notebooks to draw what they see. Steve always makes sure to note:

- Look before you draw, so that you can draw what you *see*, not what you imagine.
- Take your time.
- It takes a little bravery to make the first mark.
- It does not have to be perfect.
- If the whole bird feels overwhelming, try focusing on one detail of the bird. Just its feet, or its eyes, or one feather, for instance.
- If you have a question or need help, raise a hand.

FIELD

Finding birds, finding stillness (1.5-2 hours)

When we go out the door (RB) we open the gate. We will go on-trail for a bit, (opening the gate before crossing the bridge at GV), and then we will go off-trail shortly after. We pause from time to time to let a lesson land. The first lesson is how we practice getting still. Steve spots or hears a bird, get the kids to get still, and listen/ watch to see if the bird comes closer the stiller and quieter we are.

Once we have practiced getting still and observing a few times, Steve sets up one spotting scope and the assistant sets up a second. Both are placed in an open area, while Steve explains how a scope works, and how we should not touch it when we look through it. RB hikes usually take place at the breakthrough beach, the field behind the covered playground area, and across the bridge. GV hikes usually start at the pond on Trinity Drive, and then heads back towards the trailhead of the Under Thunder Trail.

Pass the Energy

Lesson Plan for Grade 5, FALL Nature Studies

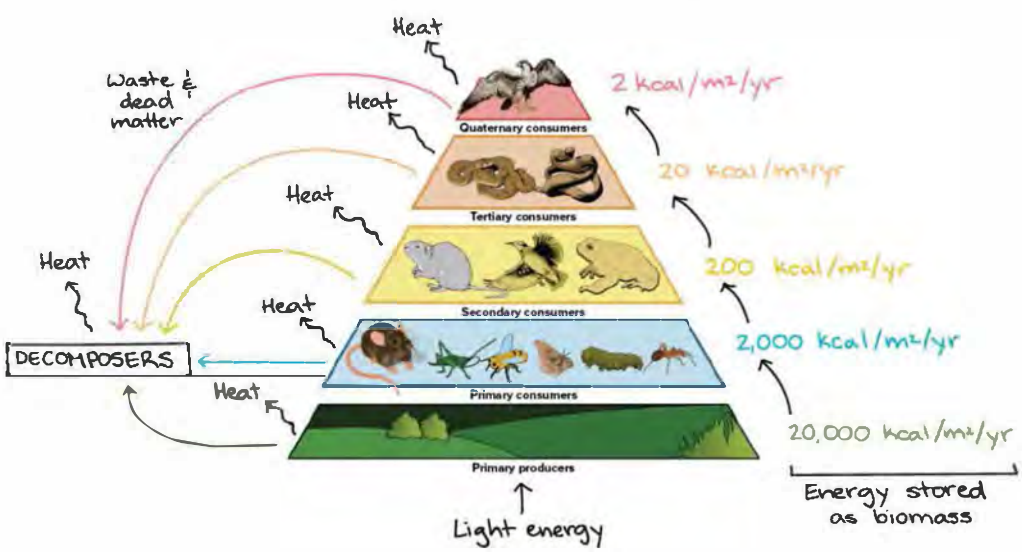
Prepared by Abby Hines

OVERVIEW & PURPOSE

This lesson will cover the movement of energy among plants, animals, decomposers, and their environment. Interdependent relationships and flow of energy within our forest ecosystems will be taught in the context of "Salmon in the Trees".

BACKGROUND

Ecology is defined as the study of organisms, the environment and their interactions. Ecosystems maintain homeostasis by cycling energy and nutrients in and out of the system. This is done through a number of different processes such as photosynthesis, respiration, predation, and decomposition. Trophic pyramid models depict the energy flow through ecosystems from each trophic level to the next. Generally, only 10% of the energy available at each trophic level is transferred to the next level as depicted below. This transfer of energy and biomass is especially important in understanding the bioaccumulation of toxic substances such as mercury in ecosystems.



Decomposers draw energy from all trophic levels and release energy as heat. Decomposers play a critical role in nutrient cycling and fixation as well. Examples include phosphorus, and nitrogen cycling. For this reason, decomposers and detritivores are focused on in this lesson. Decomposers absorb nutrients at a molecular level (think of fungi and bacteria), whereas detritivores consume and internally digest dead and decaying materials (most invertebrates). There is an astonishing amount of biological diversity in most forest soils, making these microhabitats ideal study areas.

EDUCATION STANDARDS

1. **5-LS1-1** Support an argument that plants get the materials they need for growth chiefly from air and water.
2. **5-LS2-1** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
3. **5-PS3-1** Use models to describe that that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

OBJECTIVES

Students will be able to:

1. Identify ways in which energy flows within a temperate forest ecosystem.
2. Recognize that all energy originates from the sun.
3. Understand the interdependent relationships within an ecosystem including decomposers, producers, and consumers.

MATERIALS NEEDED

1. Salmon in the trees book
2. Data recording sheet (5)
3. Hand lenses (10)
4. White board + markers
5. Soil invertebrate ID sheets (5)
6. Quadrats (5)
7. Clipboards (5)
8. Timers (5)
9. Ball of yarn

10. Ecosystem component “name tags”
11. Rope Trophic pyramid & labels

VERIFICATION

Steps to check for student understanding

1. Assessment of student skits
2. Check for understanding throughout investigation

INTRODUCTION (45 minutes)

Start with opening up a debate in the classroom: Where does most of the energy on earth come from? A: The sun (except for some thermal energy coming from the earth’s core).

Read excerpt from Salmon in the Trees (129-140) or show video: https://www.youtube.com/watch?v=8K87F2IABbE

Have students develop a model of how energy flows in the system described in the book:

1) Have students act out salmon in the trees (basic energy cycling) with costumes

2) Draw an ecosystem energy flow model based on salmon in the trees.

Alternatively, you can use a variety of ecosystem models for students to act out (i.e. wolves in yellowstone, salmon in the trees, snowshoe hare and lynx, mountain pine beetle, algae blooms)

FIELD STUDY (2.5 hours)

Hike to field study destination (15-20 minutes)

Encourage students to look for producers, consumers, and decomposers along the way. How many can they spot?

Trail Game: As students are hiking play ecosystem tag. Every once in awhile turn around and yell out something the students must touch before an adult tags them. Examples: producer, decomposer, abiotic factor, biotic factor.

Free explore the forest ecosystem as ecologists (20 minutes)

Define boundaries and invite students to explore the forest through the lens of an ecologist. Identify producers, consumers, and decomposers in this ecosystem.

Decomposing in the forest (15-20 minutes)

Have students 'center in' to the day through a guided visualization. Invite students to lay, sit or stand in a place in the forest. Reference salmon in the trees- have students imagine themselves as a chum salmon decomposing in the forest. Fungus, bacteria, and invertebrates are all working to decompose them. Slowly they add 180 grams of nitrogen to the surrounding forest (important component in DNA, chlorophyll, and proteins), then 20 grams of phosphorus (important in cell division and new tissue growth). Scientists from the University of Washington estimate that streamside vegetation gets about 25% of its nitrogen from salmon. Explain that plants get most of the materials they need for growth from the air and water ($6CO_2 + 6H_2O$ + light energy = $C_6H_{12}O_6 + 6O_2$) but the nutrients such as nitrogen and phosphorus found in the soil are essential for plant life.

Soil macroinvertebrate investigation (1 hour)

Decomposition is an important energy and nutrient cycling process in nature. Decomposers (bacteria and fungi) and detritivores (invertebrates) release, and make available nitrogen, phosphorus and other nutrients important to forest life. We are going to investigate the I in F.B.I.

> Procedure: Question- "What is the relationship between number of types of macroinvertebrates and location?" Students will work in teams of 5 to investigate macroinvertebrates found in their quadrat (sampled 3 times for 10 minutes each using the provided data sheet). Each group will sample a different location (on the trail, in the forest, next to the stream etc.), record their data, and calculate the average for their location. Student groups will then share data with other groups so that their data table is complete. Work as a group to write a conclusion based on maximum and minimums found, and determine potential confounding variables. Discuss what the results indicate about the rate or process of decomposition in this ecosystem if anything.

Trophic pyramid puzzle (20 minutes)

Set up the rope model of a trophic pyramid on the ground. Have students label the levels using the provided labels and sort themselves (wearing name tags of different organisms) into each level. Talk about how energy flows through an ecosystem.

WRAP-UP (45 minutes)

Use the first 20 minutes of class to wrap up the investigation. Allow students to share data, and come up with a conclusion as a scientific community.

Web of life- interdependent relationships (25 minutes)

This activity allows students to tangibly interact with interdependent relationships within the ecosystems that surround them. Web of life is played as a large group activity or a small group activity. Each student is given a "name tag" depicting an aspect of the ecosystem, a ball of yarn is then tossed from person to person while the thrower says out loud what their connection with the receiver is. Talk about what connections are made, emphasizing that everything is connected. You can expand on this topic by breaking connections or eliminating parts of the ecosystem. What happens? How does energy flow through this system?

RESOURCES

http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=407

https://www.learner.org/courses/envsci/unit/text.php?unit=4&secNum=3

What is the relationship between ____
(Measured variable)
and_________________________________.
(Changed variable)

	(Measured variable)			
(Changed variable)	Sample 1	Sample 2	Sample 3	Average

Conclusion:

What impacted your study? What would you change to improve your study?

What questions do you still have that you would be able to investigate further? How would you investigate this? Why would you investigate this?

Field Notes:

Use this space to draw or take notes on anything related to your investigation. This could include sketches of specimens, math, or other important notes.

Dirt, you made my lunch

Lesson plan for 5th grade fall

OBJECTIVES

1. We can name the process of decomposition, and explain how it is a necessary part of the cycle of living and dying.
2. We can name and identify decomposers (ie members of the FBI): fungus, bacteria and invertebrates.
3. We use our 5th grade minds to come to a better understanding of our own interdependent relationship with the FBI, balancing the "Eew! That's gross!" with the "Eew! That's cool!"

MATERIALS NEEDED

1. Usual hiking gear
2. *There's a Hair in my Dirt*, by Gary Larson
3. Mold Studies (4-6 items)

INTRO

We take a moment to re introduce ourselves, and remember what we've done before. We remember, as a group, the lessons from the past two years together.

We're going to be working with a word today. It's called *Decomposition.* Write it on the board. Take it apart (find the word "compose" inside the word, talk about the way we build, and then un-build.)

Activity: Mold and Bacteria studies

- We get into 4-6 desk groupings of 2-5 kids per desk grouping, get out a pencil and paper, and write a chart on it that sort of looks like this:

1.	2.
3.	4.
5.	6.

- There will be an item placed on your table. You should feel free to investigate it.
- In each box, you will answer these questions about the item: What is it? What is it doing? Is it alive or dead? Would you eat it?
- When you and your group are done, we rotate items. Answers for item no. 1 go into box no.1. Answers for item no.2 go into box no.2, etc.
- Place molding items on desk groups. Support the dueling feelings of “Eew that’s gross!” and “Eew that’s cool!” This means you are constantly circling, attending to the kids’ immediate repulsion and curiosity, supporting both as needed.
- When all molds have arrived with all kids, have them put the lids back on the items, and discuss.

Discussion: Was it alive or dead? Which parts are living, which parts are dead? Take a moment as it lands with kids that the mold is a different living organism that lands on the item and begins to decompose it. Mold is one of our decomposers. There are three really important decomposers out there:

Fungus

Bacteria

Invertebrates

All of these are what keep up alive. Without the FBI, we have nothing to turn dead plants and animals back into dirt. Without dirt, no plants and animals. Without plants and animals, no us. The FBI is why you are alive right now. And they are what we are going to look for when we go out on our field trip.

FIELD

Before we go out the door, we have our layers on. We establish that Steve will lead and the teacher will bring up the rear. We know that we will be in a line in school, but when we leave school, we do not need to be in line. We note that most of the time when you leave school you are going home or going to recess, but what we are about to do is neither go home nor go to recess. We leave sticks and stones and snow on the ground.

When we go out the door, we open the gate. At RB this is usually behind the school, in the playground, or on the field. At GV this in the parking lot of the Thunder Mountain trailhead. We stay on-trail for a bit and then we will go off-trail shortly after.

We go out looking for the FBI, and usually find lots. We try to take a moment with each (fungus, bacteria, and invertebrates). Fungus and invertebrates are usually the easiest to spot. Decomposing stumps make a great lesson. A dead porcupine, taken to the top of the hill at RB, recently made a great lesson in what decomposition really means. A porcupine dissection can take nearly an hour when the kids are really invested. Finding traces of last year's dead porcupine also tells us a lot about how the porcupine was turned into the bodies of ravens, trees, and insects.

WRAP

Settle into a comfortable place, seated on the ground. Talk a bit about what happened out in the field.

Activity: Read *There's a Hair in my Dirt*, by Gary Larson, explaining that you're skipping a few pages in order to make sure we get through the whole book, but the story still makes sense.

When you get to the end, it often takes a moment for the kids to realize what the message of the book is. That not only does our lunch depend on the FBI, lunch also depends on us, eventually. We eat the plants that come from the soil from the FBI, and the FBI eats us and makes us soil for the plants. This happens to all living bodies everywhere all the time, no exceptions.

Sometimes this brings up a lot of feelings (awe, disgust, horror, sadness, laughter, etc). Hold space for the feelings that arise. Feeling this lesson is how we learn this lesson. Steve often finishes by singing them the song *Dirt you made my lunch*.

Snow Studies: Does Snow Listen?

Lesson Plan for Grade 5, WINTER Nature Studies

Prepared by Kate Cruz

Inspired by Julie Cruikshank

OVERVIEW & PURPOSE

This lesson will cover the physical properties of snow through the lens of phase changes and snow crystal formation.

BACKGROUND

Snowflakes or snow crystals form as water vapor freezes around particles found in the air. Water vapor must directly convert into ice to become a snowflake. Snowflakes are NOT frozen raindrops. Two factors control how snowflakes are formed: 1) temperature and 2) moisture. With millions of combinations of temperature and moisture in the air there are millions of of possible snowflake designs. As a general rule of thumb warmer temperatures and high atmospheric moisture result in more intricate snowflakes, whereas, cold temperatures and low atmospheric moisture result in simple, less intricate snowflakes. Snowflakes all have six-fold symmetry because of the physical properties of water and the structure of water molecules in an ice crystal lattice. The simplest snowflake form is a plate hexagon. In some cases of rapid crystal formation, asymmetry of individual branches can occur.

From the instant snow hits the ground it begins to metamorphize, experiencing all three phases (solid, liquid and gases). These phase changes are critical in understanding the physical properties of snow layers and avalanches. As snow falls it creates layers. These layers can differ in composition, hardness, and temperature depending on weather. For example: if the are experiences a wet and heavy snowfall followed by a clear cold snap, the wet heavy snow will form a layer of fragile snow crystals on top. If it snow again, these two layers will be buried creating an unstable layer where the snow crystals formed. These unstable layers are what avalanche scientists look and monitor for. Snow hardness profiles can be taken using your own hand, a pencil and a knife. Below is a standard depiction of a snow hardness profile that avalanche scientists use.

Slight variations in hand hardness can be recorded using + and - qualifiers (i.e. P+, P, P-). A value of 4F+ is less hard than 1F-. Individual layers may contain a gradual change in hand hardness value. These variations can be recorded in a graphical format (Figures 2.8 and 2.9), or by using an arrow to point from the upper value to the lower value (i.e. a layer that is soft on top and gets harder as you move down would read 4F+ → 1F).

Table 2.1 Hand Hardness Index

Symbol	Hand Test	Term	Graphic Symbol
F	Fist in glove	Very low	
4F	Four fingers in glove	Low	/
1F	One finger in glove	Medium	X
P	Sharp end of pencil	High	✎
K	Knife blade	Very high	⌘
I	Too hard to insert knife	Ice	▬

Hardness is not the only attribute avalanche scientists test. Other attributes include temperature measured every layer, grain size and shape of snow crystals, liquid water content, and layer age. In this lesson students will measure temperature, grain size and shape, and hardness. Grain size is measured by taking a couple representation crystals from each layer and measuring them using a ruler. Grain shape is measured and recorded using the following table.

2.5.4 Grain Form (F)

The International Classification for Seasonal Snow on the Ground (Fierz and others, 2009) presents a classification scheme composed of major and minor classes based on grain morphology and formation process. This scheme is used throughout this document. Primary classes are listed in the table below. Subclasses are listed in Appendix F.

Table 2.2 Basic Classification of Snow on the Ground

Symbol	Basic Classification	Data Code
+	Precipitation Particles (New Snow)	PP
⊛	Machine Made snow	MM
/	Decomposing and Fragmented Particles	DF
●	Rounded Grains	RG
□	Faceted Crystals	FC
∧	Depth Hoar	DH
∨	Surface Hoar	SH
○	Melt Forms	MF
▬	Ice Formations	IF

EDUCATION STANDARDS

1. N-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
2. ESS2.A: Earth materials and systems (hydrosphere)
3. 5-PS1-2: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved (phase changes).
4. PS1.A: Structure and properties of matter
5. ESS3.C: Human impacts on earth systems

OBJECTIVES

Students will be able to:

1. Demonstrate knowledge of phase changes through experimentation and modeling.
2. Identify types of snow crystals and the relation to avalanche risk
3. Understand the role that snowpack, and ice play in the earth's hydrosphere.
4. Develop a model or mode of communication to display a snowpack profile, its' characteristics, and risk of avalanche.

Intro	Field	Wrap-Up
• Review from fall (abiotic/biotic) • Examination of 4 spheres (s'eek) • Elder co-presentation	• Snow experiment • Field study values • Stations	• Migrate, hibernate, or deal with it? • Beaver drone footage • Journaling

INTRO

Take a moment to remind students what was studied in fall nature studies (the *biosphere* through the lens of energy flow through ecosystems, with an emphasis on abiotic and biotic factors). Emphasize that this winter we will be focusing our attention on the *hydrosphere*, *geosphere, and atmosphere* through the lens of studying and showing respect for snow.

This fall, we studied what animal? S'eek, or black bear, whose habitat consists of areas such as Behrend's Slide, an active avalanche zone. We hiked up the path, and saw evidence of where the snow slides repeatedly happen. S'eek is part of the biosphere, that contains all living things including humans. But why bring up s'eek today, when we are studying snow? What is the interconnectedness between bears, snow, our mountains, and our oceans? Think-Pair-Share about this example.

We're going to set up a quick experiment to study snow, and we'll be seeking an answer to the question does snow listen?

I packed this jar with snow [insert how many inches] and a rubber band marks the original amount of snow. We need to make predictions as a class as to how much water is in the snow? How can we measure this? Let students come up with some methods, and then records their predictions on the board in inches.

Mr. Katzeek (Tlingit elder) is going to help us to understand more about the relationship between living beings and the world around us. We're going to be studying more about snow, from the perspective of meteorologists and avalanche forecasters, people who study the interaction between land and sky both today and in the past to understand how to act in the right ways around snow.

This is especially important to understand in Alaska, where the ocean meets the land, because our climate and our snow is unique along the coast and creates everything we know and love.

[David's stories of a young Yanyeidi man and Katseen in reference to having respect]

Allow students to journal following the prompts in the PPT.

Here in Juneau, avalanches are a big concern for safety and infrastructure, so just like in David's story, there is a need for respect and people are using sound waves like mentioned in the two oral narratives. Finish with introducing the idea that you will be working in groups of 3-4 students when we are out in the field that all study snow from different perspectives and for different reasons.

Revisit beaker of snow *(10 min)* Allow students to revisit the jar of snow and make observations regarding the changes, especially in phases, that they notice in their science journals.

FIELD STUDY

Students will work in research teams of 3-4 for this field study.

Wild Animal Scramble *(15-20 minutes)*

Pin cards on to the backs of students coats and allow them time to walk around, asking questions about their animal and winter behaviors in order to try to guess who they are.

What's the weather today? *(15 minutes)*

Start by inviting students to make simple sensory observations, tuning into their our sensory systems. Students will practice being meteorologists by working in groups to determine what weather patterns are present. Working in groups of 4-5 students will take the ambient air temperature using a thermometer, make visual observations about cloud type using provided guide sheets and record this data on their data collection sheets. Discuss how weather may influence the types of snowflakes formed. Have groups hypothesize what types of snowflakes they will find based on their weather observations.

Snowflakes and crystals *(35 minutes)*

Working in groups have students sort snowflake pictures into classifications as they see fit as scientists. Explain that they will have to justify their classification system to other groups using evidence based statements. Discuss that just as they have sorted the different snowflakes, scientists have come up with classifications for snowflakes based on shape.

Investigation: Have students catch or find snowflakes using a piece of cold (not brought out from the classroom) black cardstock. Students will investigate the different crystal shapes and forms using the snow crystal identification sheet and a hand lens. Allow students to work in their research teams to fill out the data collection sheet. As students are observing their snowflakes come around and take pictures of snowflakes using a magnifying camera lens. These photos will be shared during the debrief class.

NOTE: If it is not snowing you can have students observe previously fallen snow or frost crystals (using the frost ID sheet instead).

Digging and mapping *(30 min)*

Now that we have learned about the intricacies of individual snow crystals, let's take a look at how snow crystals interact to form snowpack. Have students work in their research groups to *dig* and *map* a snow pit for analysis.

1. Choose a place to dig your snow pits. An ideal location has little vegetation and is not in direct sunlight. Direct sunlight will provide false temperature readings.
2. As a large group determine the aspect (using a compass), slope (using a clinometer), and predominant vegetation cover (may use UNESCO classification system for extra challenge) of your location. Have students record this using the snowpit data collection sheet.
3. Have students dig one snowpit per group. This snowpit should reach all the way down to the ground and should be big enough for standing in.
4. Once students have dug their snowpits have encourage them to draw a map of the location of their snowpit. Challenge them to try and draw such an outstanding map that they could come back to the same location in the spring.

Snow profiles *(30 min)*

At this point students should have dug their snow pits already and be ready to collect data on the layers of snow they observe using the snowpit data collection sheet.

1. Students will start by delineating each layer using the measuring tape and recording their findings on the snowpit diagram (snowpit data collection sheet).

2. After delineating snowlayers, students will measure and record snow hardness of each layer using the technique described above.

3. Students will then measure and record snow crystal size (in mm), and shape in each layer using the provided diagram on the snowpit data collection sheet.

4. Students will record temperature for every layer using provided thermometers.

5. Lastly, students will determine if there are any unstable or interesting layers present in their snowpit.

Sound Map *(5 min)*

Finish with an opportunity to sound map.

DEBRIEF

Revisit our investigation *(15 minutes)*

Journal about how much water was in the snow? Is there anything we're not thinking about that might have impacted the total volume of snow? How close were your guesses?

RESOURCES

UNESCO Classification: https://www.nasa.gov/pdf/187510main_MUC_Codes.pdf

Snowpit protocol (where tables are from):
https://culter.colorado.edu/~kittel/WEcol_Handouts/SnowPit_Protocol&Guide.pdf

Group members: ______________________________________

Date:____________

Snow Studies Investigation

Weather Observations

Temperature:_________

Cloud type:____________________________

Describe the weather today:________________

____

____

Snow crystal classification

1. Did you find any snow crystals that looked the same? Circle: Yes or No
2. Describe and categorize four snow crystals you found using the snowflake classification sheet.

   Snow crystal #1____________________________________

   Snow crystal #2____________________________________

   Snow crystal #3____________________________________

   Snow crystal #4____________________________________

3. What snow crystal type was most common?______________________

4. What snow crystal type didn't you find at all?______________________

5. Are the types of snow crystals you found the kind you would expect for the weather you observed? Circle: Yes or No Why or why not? ____________

____

____

Snow Pit Study

Using the space below draw a map of the area in which you are digging your snowpit. Make sure to include plants, and significant landscape features.

Legen

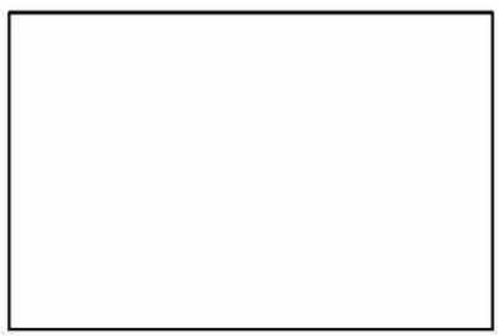
Scale

____

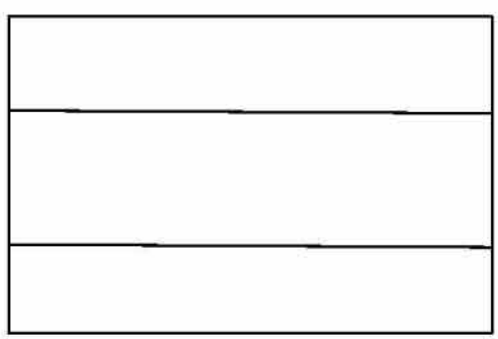
Snow pit profile

Snow pit directions

1. *Measure* the depth of your snow pit from the ground to the top of the snow using the measuring tape. Record your measurements in meters (m) on your snow pit profile drawing like the example below.



2. *Identify* each of the layers in the snow pit. Record each layers measurement using the tape measure and draw a line where it starts and ends like the example below.

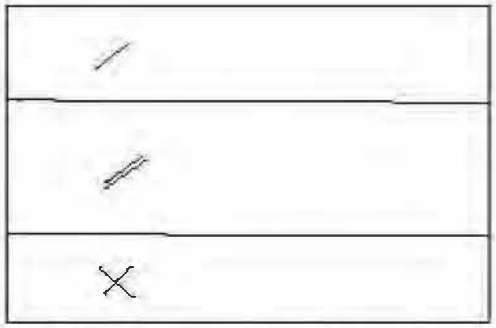


3. First, *measure hardness* of each layer using the hand hardness index.

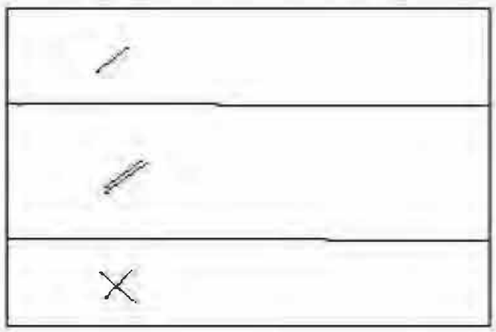
Table 2.1 Hand Hardness Index

Symbol	Hand Test	Term	Graphic Symbol
F	Fist in glove	Very low	[illegible]
4F	Four fingers in glove	Low	/
1F	One finger in glove	Medium	X
P	Sharp end of pencil	High	//
K	Knife blade	Very high	X
I	Too hard to insert knife	Ice	■

Record your results using the graphic symbol in each layer on the snow pit profile like the example below.



4. Next, *measure the temperature* of each layer using a thermometer and record the temperature of each layer on the snow pit profile like the example below.



5. Next, *measure the grain size and observe shape of the ice crystals* present in each layer using the chart below. Grain size is measured by taking a couple representation crystals from each layer and measuring them using a ruler. Grain shape is measured and recorded using the following table. Do your best trying to identify the shape of ice crystals.

Table 2.2 Basic Classification of Snow on the Ground

Symbol	Basic Classification	Data Code
+	Precipitation Particles (New Snow)	PP
[illegible]	Machine Made snow	MM
/	Decomposing and Fragmented Particles	DF
●	Rounded Grains	RG
□	Faceted Crystals	FC
∧	Depth Hoar	DH
∨	Surface Hoar	SH
○	Melt Forms	MF
■	Ice Formations	IF

Record your observations using the symbol and your measurements on the snow pit profile like the example below.

/	Grain ○
⫽	●
×	□

6. Lastly, look at all of the data you just recorded. What does it tell you about the stability or condition of each layer? Is there a weak layer that avalanche scientists would flag as a danger? Discuss this with your research team.

Spheres of Life

Lesson plan for 5th grade winter

OBJECTIVES

1. Students understand the interdependence of the 4 spheres discussed. None stands apart from the others, and we are related to all 4.
2. Students can highlight an individual aspect of any of the spheres and name which category it falls into, and in what way it is related to the others (ie moss, biosphere, needs atmosphere to breathe, hydrosphere to grow, and geosphere for nutrients).

MATERIALS NEEDED

1. Bones and skulls
2. Something spherical (a globe will do, or sometimes a borrowed clementine)
3. Usual hiking stuff
4. Sometimes pencil and paper/ nature journal

INTRO

We take a moment to remember, as a group, the lessons from the past two years together, especially the most recent lesson in the FBI. Now we're going to apply that sort of thinking to some new words, which we'll get to in just a minute.

We start our lesson with what we know: a bear. Imagine a bear. What are bears doing right now? A kid will usually raise a hand and tell you bears are asleep. True. While a bear sleeps and sleeps -- if it is a female -- it will usually give birth to a cub.

Mr. Merli asks the group to hold out a hand in front of them, gently cupped, offering his own as a guide. "Like this," he says. "A baby bear, when it is born, is this big." He lets the lesson land, and then continues: "Its eyes are closed, and it is hairless. It has a lot of growing to do. So how does it grow? What does it eat?" Sometimes a kid will raise a hand and tell us that cubs nurse from their mom. Sometimes

Mr. Merli just tells the class. "Everything that cub needs in order to get from this size," he says, looking at his cupped hand, "to this size," indicating the size of a bear cub in spring, his hands approximately a foot apart, "is in mom. But come springtime, when mom wakes up and they both head outside, what's the first thing she wants to find?" Food, a kid will usually suggest. "Food indeed! Lots and lots of it!" Mr. Merli says. "And what does a bear eat?"

Inevitable answers from kids	Mr. Merli's most common responses
SALMON! They eat so much salmon!	Actually, in any given year, *you* eat more meat than a bear does. A bear eats a lot of salmon, and a deer here and there, but not as much as you do. So yes, salmon, but what else?
Trash!	That's true, there are some bears that eat trash, and that's on us, right? That's a human thing, and it's usually no good for the bear.
Some sort of plant	That's also true. Bears eat all sorts of different plants. They eat spruce tips in springtime, and sometimes they eat grasses and even the inner bark of trees in the fall, but there's one kind of plant they love most of all...
Berries!	Yes, a bear eats tons and tons of berries. Berries are what pack on the weight for any bear, and bears need weight to hibernate. They come through a berry patch and just eat the whole branch, leaves and all. Bears love berries.

Using the berry and the bear, we introduce the *biosphere.* "Who knows another word for life?" Mr. Merli often asks. "Who knows what the scientific study of life is called?" Eventually, the prefix *bio* comes up. Bio, which is latin for life. We're going to add this word *sphere* to the end of that. You all know what a sphere is.

Steve runs across the room to lift a globe off the shelf. "Here is a sphere! We're living on it. Check that out. If you were to draw that on your paper, as a 2 dimensional object, that's a circle, right? But here, you can see it has a third dimension."

We explain that all living things, in this case, the bear and its food, make up the *biosphere.* We write the word up on the board, with the word "life" underneath it.

The bear eats the salmonberry to grow, but what does the salmonberry eat? What does a plant need to live?

The students, by raising their hands, will eventually tell you: sun, soil, water, and air.

Take these on one at a time, asking the question, who knows another word for water? To get to the prefix *hydro*. Add -sphere to the end, and you've got *hydrosphere* up on the board. Who knows what the study of rocks and earth is called? Work towards the prefix *geo,* and then add sphere to the end to get *geosphere* up on the board. Soil is made up of decomposed stuff (remember the FBI?) and minerals, or tiny rocks from the geosphere. Lasty, does anyone know a word for air that ends in -sphere? Does anyone recognize the word *atmosphere?* "Atmos" means steam or gas. So now we have our 4 spheres up on the board:

Biosphere -- life Hydrosphere -- water Geosphere -- earth Atmosphere -- steam/ gas	Bear ↓ Salmonberry ↓ Sun + soil, water, air

And we can see the interconnectedness of all 4. (Assistant will color code/ use arrows as available to mark the connecting words)

FIELD

Before we go out the door, we have our layers on. We establish that Steve will lead and the teacher will bring up the rear. We know that we will be in a line in school, but when we leave school, we do not need to be in line. We note that most of the time when you leave school you are going home or going to recess, but what we are about to do is neither go home nor go to recess. We leave sticks and stones and snow on the ground.

When we go out the door, we open the gate. At RB this is usually behind the school, in the playground, or on the field. At GV this in the parking lot of the Thunder Mountain trailhead. We stay on-trail for a bit and then we will go off-trail shortly after.

We make sure to pause regularly to notice how those 4 spheres appear in our life. They appear around us and they appear within us.

WRAP

Settle into a comfortable place, seated on the ground or at desks. Talk a bit about what happened out in the field. Remember our 4 words.

We lay out several skulls (usually moose, wolf, otter) and the hind legs of a snowshoe hare. We take a moment to attach the spheres to this animal -- What did it eat? Where did it live? What made its bones? And then we take a moment to really appreciate and understand what is in front of us. We may draw the skulls, or write about them. This part of the lesson changes every time. Sometimes we just talk about them, and all of a sudden 45 minutes is gone.

Phenology

Lesson Plan for Grade 5, SPRING Nature Studies

Prepared by Abby Harding

OVERVIEW & PURPOSE

This serves as a culminating lesson in which students explore interactions between the biosphere, geosphere, hydrosphere, and atmosphere through the lens of phenology. Students will explore all facets of their local ecosystem through phenological observations recorded in their very own nature journals.

EDUCATION STANDARDS

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

ESS2.A: Earth materials and systems

ESS3.C: Human impacts on earth systems

OBJECTIVES

Students will be able to....

1. Identify characteristics of and define biosphere, geosphere, hydrosphere and atmosphere.
2. Demonstrate using examples how the four spheres interact and influence one another.
3. Construct evidence-based arguments demonstrating how humans impact earth systems through the lens of climate change.

MATERIALS NEEDED

Intro

1. Binding sticks (1 per student)
2. Long sheets (6in x 36in) of cardstock or watercolor paper (1 per student)
3. Binding string or twine
4. Markers and pencils
5. Interacting spheres puzzle pieces

Field study

1. Sit pads (1 per student)
2. Clip boards (1 per student)
3. Hand lenses (1 per student)
4. Watercolor pencils (group share) and brushes (1 per student)
5. Spring phenology journals (1 per student)
    a. Have extra completed ones for students that were absent during the intro
    b. If it is raining it's a great idea to supply a gallon ziploc "journal jacket" to each student.

VERIFICATION

Steps to check for student understanding

1. Literary discussion of naturalist excerpt reading
2. Brainstorming phenological events
3. Journal entries and knowledge sharing in debrief
4. Climate change graphing art

INTRO

Nature storytime (10 minutes)

Read an excerpt from your favorite naturalist's writing i.e. Sigurd F Olson's *Wilderness Days* or *Braiding Sweetgrass* by Robin Wall Kimmerer.

Discuss- What the story was about? How the author described the world around them? What seasonal changes or observations did they point out?

What is phenology? (10 minutes)

Phenology is the study of the timing of plant and animal lifecycle events, such as studying humpback whale migration or the time of brown bears awakening from torpor. Call on students to brainstorm a list of different phenological events that occur in Southeast Alaska.

Phenology journals- Why write about nature's patterns? (10 minutes)

Humans have been noticing and recording natural phenomena since time immemorial. Today naturalists, scientists, and farmers journal and record phenological observations to better understand when to plant certain crops, when to hunt or fish, and to identify patterns or changes in those patterns.

Building our journals (20 minutes)

Demonstrate how to build phenology journals to students (see directions). Students will then build simple 10 page journals using cardstock or watercolor paper and sticks and string for binding. Once the journals have been made, students will design the cover of their spring phenology journal, number the pages and label each section.

FIELD STUDY

Looking for signs of spring

Sit spots (20 minutes)

Provide students with sit pads and invite them to find their own space where they can participate in a silent activity. Once students have settled explain that we will be tuning into the world around us using our senses for 15 minutes. At the end of these 15 minutes come together as a group to discuss your findings.

*A Naturalist's Journey (*2 hours*)*

Students will explore 4 different ways of communication through nature journaling:

1) *Naturalist writing-* students will write short descriptions of the season and the world around them using the writing style exemplified in the text read in the introduction class.
2) *Phenology observation-* students will record phenological data such as: date, time, temperature, observations of flora and fauna etc.
3) *Scientific drawing-* students will create species accounts for an organism found in the ecosystem they are studying. A species account includes an observational drawing, labels, and facts about the organism.

4) *Sample collection*- students will collect a small sample of nature to tape into their journals and describe.

Each journal activity will occur in a different area, preferably a different habitat or ecosystem. The hikes between provide a good break for students to be physically active, and explore multiple habitats.

Conclude your field study with a time for students to share their findings and journals with one another. Encourage students to think about how various phenological events have changed or are changing in response to climate change.

DEBRIEF

Climate change is changing the seasons? *(10 min)*

Lead a class discussion on what climate and climate change is. What implications does it have for SE Alaska? What changes to the seasons have you or your family/friends noticed?

Climate change in graphs *(35 min)*

Two local graphical representations of climate change will be presented and discussed with the class:

1) Yellow cedar distribution and population data
2) Glacier recession data

* Reference graphical art curriculum for data and resources *

Taking the trend line from the data, students will create artwork, making the trendline the focus. A gallery walk or talk about art and science coming together to convey climate change will follow.

The Big One

Lesson plan for 5th grade spring

OBJECTIVES

1. We have the self-confidence, tenacity, and diligence to be in the woods for many hours without losing interest, energy, or the ability to be present. We have a personal relationship with these woods.
2. We understand how glacial and marine history has shaped the land we walk on.

NOTE:

For Steve's 5th grade spring hike, we have no wrap. Steve has a larger seasonal time allotment of 7 hours, in order to take one long hike with each 5th grade class. Hikes usually run 8:30-2:30. Lunch, snacks and water come with us into the field.

MATERIALS NEEDED

1. Intro: Steve's hike powerpoints (GV, RB)
2. Usual hiking gear
3. Lunch, snacks, water, and any medical necessities for kids.

INRO

Where you live, from above.

Activity: Powerpoint, discussion (45 minutes)

Steve and his assistant guide the class through a discussion of where we live, starting with an aerial photograph of the Mendenhall Valley. Using a photoshop recreation image from Richard Carstensen of how the glacier may have looked in 1865, students can understand how this area has been shaped over time. (30 minutes)

We talk about readiness. Topics discussed often include: LNT, going to the bathroom in the woods, what to bring, cell phone usage and blister care.

FIELD

Where you live, on foot.

We hike from the basketball court at the end of Fritz Cove Road to the end of Industrial Boulevard with RB students. Safety concerns: steep trailsides, topping boots in deep wetland streams, sloughs. Of special interest: birds, navigation, what happens socially and emotionally after about 5 hours of being outside.

We hike from the school to the glacier with GV students. Safety concerns: steep trailsides, steep mountain streams. Of special interest: forest life, being offtrail for a long time, what happens socially and emotionally after about 5 hours of being outside.

The goal is to connect the kid with the world. Here is your school, here is you, and here is how far you can go on your own two feet. The world is your oyster. Your backyard is a mountain, a wetland, an enormous glacier. You can explore all of it, whenever you want. You are ready to graduate to middle school.