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Resources  
Hub

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## Martuwarra (Fitzroy River) catchment 3-dimensional map manual

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## Acronyms and abbreviations

**3D**.....Three-dimensional

**CSIRO**.....Commonwealth Scientific and Industrial Research Organisation

**DAWE** .....Department of Agriculture, Water and the Environment

**e.g.** .....for example

**etc.** .....etcetera

**HDMI**.....High-definition multimedia interface

**NAER** .....Northern Australian Environmental Resources

**NESP**.....National Environmental Science Program

**NTD**.....Native Title determinations

**USB** .....Universal serial bus

**ute**.....Utility vehicle

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## Executive summary

This *Martuwarra (Fitzroy River) catchment 3-dimensional (3D) map manual* provides a comprehensive guide to support the ongoing use of the 3D Map at its long-term home, the Fitzroy Valley District High School. We hope the teachers, Traditional Owners and other parents and students will find all the information they need to use the 3D Map in this Manual.

This Manual starts with the background to the 3D Map and explains the aspiration for its use as a tool to support learning between Traditional Owner adults and school children, coming together around the Martuwarra. The introduction also describes how the 3D Map was built together with students of the Fitzroy Valley District High School.

The Manual aims to provide a step-by-step illustrated guide to storing, moving, setting up and using the 3D Map for educational purposes. The spatial data that are currently available to display on the 3D Map are also described. A summary of observations from previous use of the 3D Map in classes with school students is provided at the end of the Manual, together with suggestions for next steps and ongoing support.

Linkages are provided to key resources including videos, software, reports, factsheets, and other material.

# 1. Introduction to the project and the 3D Map

## 1.1 Purpose of the 3D Map Manual

This Manual aims to provide a step-by-step guide to storing, moving, setting up and using the 3 Dimensional (3D) Map of the Martuwarra (Fitzroy River) catchment for educational purposes.

The content of the Manual is therefore mainly technical. The Manual does not include any curriculum material or suggestions for lessons. The Fitzroy Valley District High School has agreed to provide a long-term home for the 3D Map and plans to develop appropriate curriculum material and lesson plans in the future.

The key purpose of Traditional Owners in presenting the map to the school is for it to be used:

*As a tool to support learning between Traditional Owner adults and school children, coming together around the Martuwarra (our emphasis).*

The Manual starts with a short overview of how and why the 3D Map was built, including the involvement of students and staff from the Fitzroy Valley District High School.

## 1.2 Showing and sharing knowledge in the Martuwarra (Fitzroy River) catchment – project summary

The 10 Traditional Owner groups in the Martuwarra catchment came together with scientists from 2015 to 2020 to find better ways to share both Indigenous and scientific knowledge about the region (Table 1). The research was supported through the National Environmental Science Program's Northern Australia Environmental Resources Hub and collaborative research agreements with each of the Traditional Owner groups. Videos, factsheets, reports and journal articles about the project are available at the [Knowledge brokering for Indigenous land management](https://www.nespnorthern.edu.au/projects/nesp/knowledge-brokering-indigenous-land-management/) web page.<sup>1</sup>

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<sup>1</sup> <https://www.nespnorthern.edu.au/projects/nesp/knowledge-brokering-indigenous-land-management/>

Table 1. Traditional Owner groups involved in the project and their relevant Native Title determinations.

<sup>a</sup> Group	<sup>b</sup> Native Title Determinations (NTD) and Registered Claims	Organisations representing the groups' interests
Bunuba	4 NTDs: Bunuba, Bunuba People #2 Part A, Bunuba Part B, Bunuba #2 Part B	Bunuba Dawangarri Aboriginal Corporation
Gooniyandi	3 NTDs: Gooniyandi Combined #2; Yarrangi Riwi Yoowarni Gooniyandi People; Giniyawarrni Yoowaniya Riwi	Gooniyandi Aboriginal Corporation; Giniyawarrni Yoowaniya Riwi Aboriginal Corporation
Jaru	1 NTD: Jaru	Jaru Claimant Group represented by the KLC
Kija	2 NTDs: Ngarrawanji; Yurriyangem Taam	Kija Claimant Groups (Ngarrawanji and Yurriyangem Taam) represented by the KLC
Kurungal	1 NTD: Kurungal	Tiya Tiya Aboriginal Corporation
Nyikina Mangala	2 NTDs: Nyikina Mangala; Nyikina Mangala #2	Walalakoo Aboriginal Corporation
Warrwa	2 Claims: Warrwa Combined; Warrwa Mawadjala Gadjidgar	Warrwa Claimant Group represented by the KLC
Wilinggin	1 NTD: Wanjina - Wunggurr Wilinggin Native Title Determination No 1	Wilinggin Aboriginal Corporation
Yi-Martuwarra Ngurrara	2 NTDs: Yi-Martuwarra Ngurrara Part A; Ngurrara Part A	Yanunijarra Aboriginal Corporation
Yungngora	1 NTD: Noonkanbah	Yungngora Aboriginal Corporation

<sup>a</sup> The group corresponds to the name of the self-determined nations or Indigenous peoples associated with the noted NTDs or registered claim(s) that overlap the boundaries of the Fitzroy basin (see Figure 1). In most cases, the name corresponds with the main language(s) spoken by the group, but not always (e.g. Wilinggin: Ungarinyin, Yi-Martuwarra Ngurrara: Walmajarri).

<sup>b</sup> Some groups include several self-identified independent sub-groups recognised by the names of the individual NTD/Claim areas, such as the three Gooniyandi and two Kija sub-groups. In other cases, the different Native Title areas correspond to sections of the lands and waters corresponding to the same group (e.g. Bunuba, Nyikina Mangala), which were claimed/determined at different points in time.

<sup>c</sup> The name of the organisation corresponds to the Registered Native Title Bodies Corporate (RNTBC), often referred to as a Prescribed Body Corporate (PBC) of the group, which are have prescribed functions under the *Native Title Act 1993* to hold, protect and manage determined Native Title areas on behalf of the Native Title holders. During the project, Jaru, Kija and Warrwa peoples were represented by their corresponding Native Title claimant groups through their representative body the Kimberley Land Council. The Wilinggin Aboriginal Corporation is the agent of the Wanjina-Wunggurr (Native Title) Aboriginal Corporation in relation to the interests of the Ngarrinyin people and activities on Wilinggin Country, which corresponds to the Native Title area overlapping the Fitzroy basin.

Traditional Owners' rights have been recognised over virtually all the catchment (Figure 1).

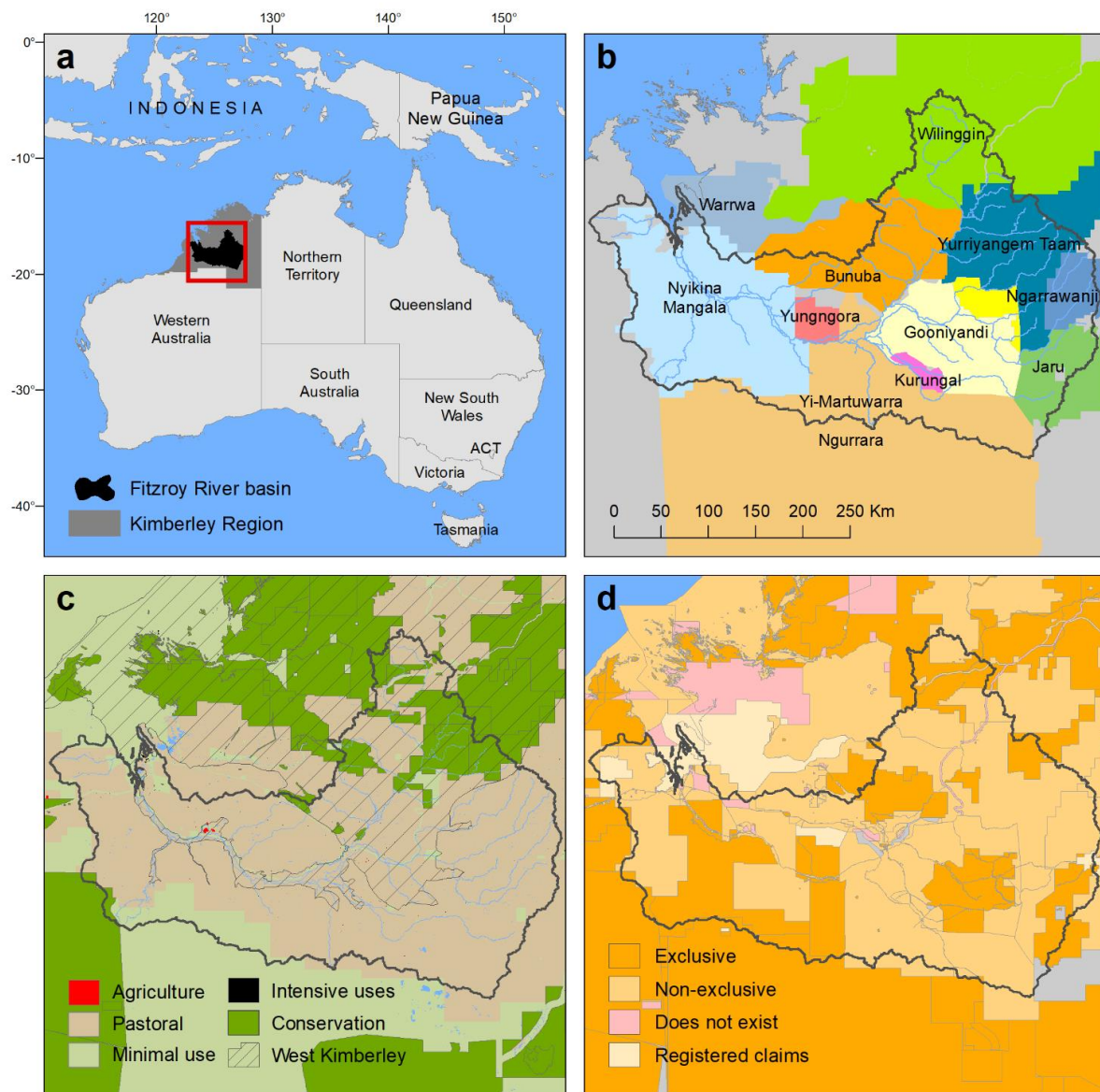


Figure 1. Martuwarra (Fitzroy River) catchment.

(a) Location of the Martuwarra (Fitzroy River) basin in the Kimberley Region of north-west Australia. According to Traditional Owners, the basin includes the Fraser River, which also drains into the King Sound. (b) Land boundaries of the 11 major Traditional Owner groups of the Martuwarra, based on 17 Native Title determinations (see Table 2). (c) Major land uses, conservation areas and boundaries of the West Kimberley Heritage Place. (d) Outcomes of the Native Title determinations, including exclusive and non-exclusive Native Title rights. Data sources: Catchment Scale Land Use Mapping for Western Australia 2008-2017, Collaborative Australian Protected Areas Database 2018, and National Native Title Tribunal Data File Geodatabase ([www.nntt.gov.au](http://www.nntt.gov.au); data extracted on 11/09/2020)

Together the members of the different Traditional Owner groups and scientists developed three different types of participatory mapping methods for sharing and showing knowledge.

First, adults and children from these groups came together to build a huge 3D model of the Martuwarra (Fitzroy River) catchment and to discuss the future of the River. Second, we used an interactive projector on a table to look at spatial data in more detail than the 3D model allowed. Finally, we worked together to make influence maps, to think about the ways

different groups of people are connected along the river. Based on those maps, we considered ways that Traditional Owners can create more power for themselves, as building blocks to a future where they have more say on what happens on their Country.

Read more about the work Traditional Owners and scientists did together in the 'Showing and Sharing Knowledge' case study on pp 87-89 of [Our Knowledge Our Way in caring for Country](#)<sup>2</sup>. Videos summarising the project are available here:

[Showing and sharing knowledge in WA's Fitzroy River catchment \(project summary\)](#)<sup>3</sup>

[Showing and sharing knowledge in WA's Fitzroy River catchment \(shorter project summary\)](#)<sup>4</sup>

### 1.3 Building the 3D Map

The Traditional Owners and scientists decided at a workshop in July 2017 to build the 3D Map together with Traditional Owner school children. The scientists worked with the Fitzroy Valley District High School to plan the workshop. In late November and early December 2017, students from the high school came together with Traditional Owner adults and the research team to build the first stage of the map over a 3-day workshop.

This map was designed to be built quickly and easily. The map was built at 1:200,000 scale because of the large area of the catchment - 93,829 km<sup>2</sup> – with a vertical exaggeration of 5. The exaggeration was used to contrast elevation over relatively flat areas and was determined by the minimum depth of the map media suitable for laser cutting (1 cm) and the contour steps (20 m) (Figure 2).

Videos about building the map at a workshop in Fitzroy Crossing in November 2017, and using it at a workshop at Birdwood Downs in July 2018, are available for download:

[Traditional Owners and researchers begin the 3D Map project](#)<sup>5</sup>

[Birdwood Downs Workshop](#)<sup>6</sup>.

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<sup>2</sup> <https://www.nespnorthern.edu.au/wp-content/uploads/2020/11/Our-Knowledge-Our-Way-Guidelines.pdf>

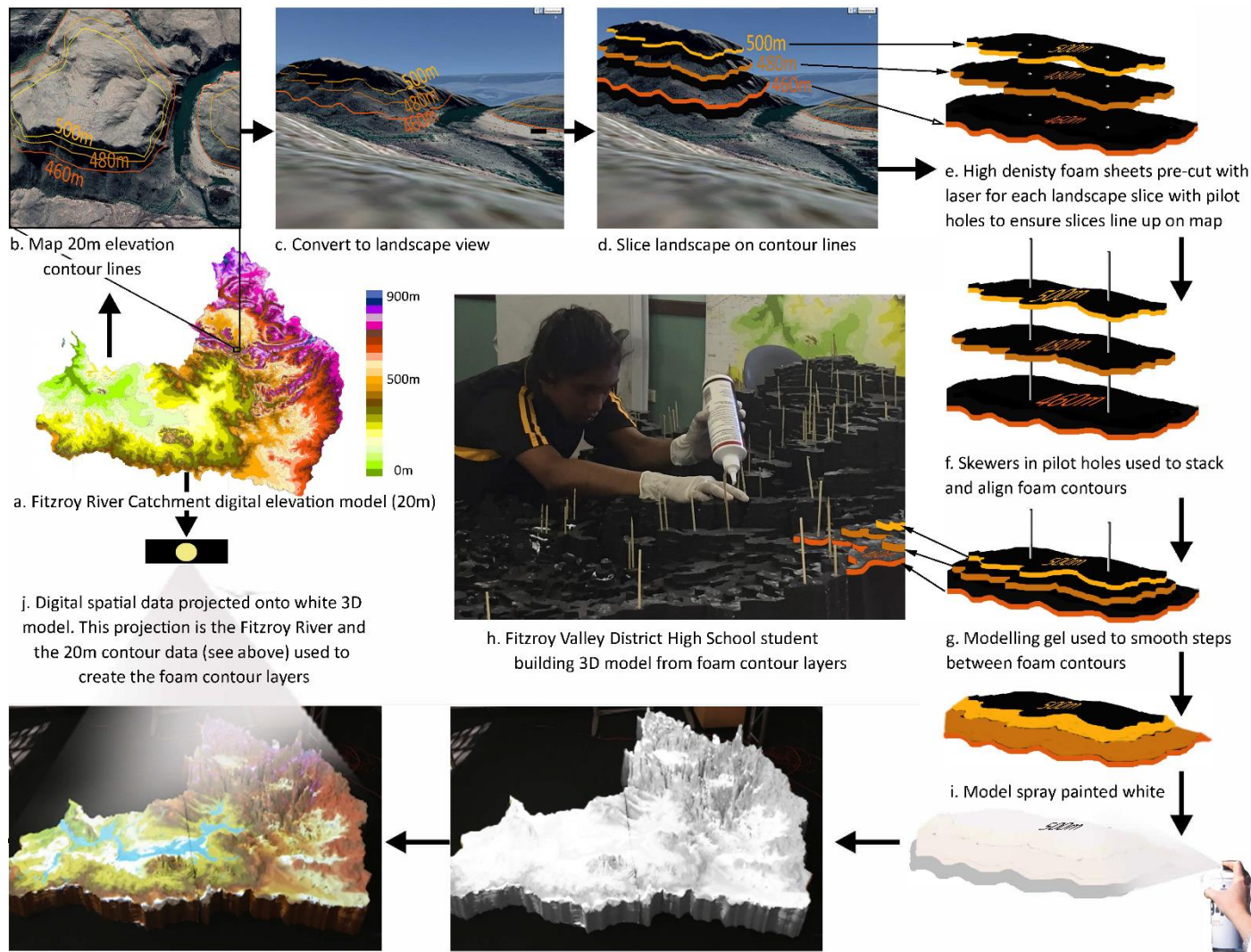
<sup>3</sup> <https://vimeo.com/530688411>

<sup>4</sup> <https://vimeo.com/531051756>

<sup>5</sup> <https://vimeo.com/278597521>

<sup>6</sup> <https://vimeo.com/288676761>





The map was made from many layers of high-density foam one for each 20-m contour, that were pre-cut with a laser in Perth prior to the workshop. The 20-m contours were derived from the shuttle radar topographic mission digital elevation model for the catchment (Figure 2 a,b). Each 20-m elevation contour was used as a template to pre-cut the foam (c,d). Each piece was etched with its elevation and contained at least 2 pilot holes (e) so, with the help of skewers (f), they could be aligned correctly when building the map. The 1-cm steps between contour layers were filled with modelling gel (g), a solid but flexible media, and the map was painted white (i) to enhance images projected onto the map to share western science knowledge (j).

Figure 2. Steps in building the 3D Map.



The workshop was a very positive experience for all involved. The students gained a lot of spatial skills and understanding about using maps. The shape of the contour lines had to be matched with the contour map to find the right place for each foam layer on the map. The students greatly appreciated working together with the adults as the guides and mentors (Figure 3, Figure 4, Figure 5).



Figure 3. Introducing the map-building tasks at the workshop in November 2017.



Figure 4. The map takes shape.





Figure 5. The 3D Map nears completion.

### 1.3.1 Displaying and sharing the 3D Map

The first stages of building the map were completed at the workshop in December 2017 (Figure 1, up to step h). Its construction was finalised by the rest of the team in Perth during 2018. The Traditional Owners decided to share the 3D Map at the National Native Title conference in Broome in 2018, in a presentation with Bunuba leader Mary Aiken, and Yi-Martuwarra leader, Marmingee Hand. A 'road show' of the 3D Map in 2018 brought together adults and children from several of the 10 Traditional Owner groups, in diverse combinations, at Fitzroy Valley and Derby State High Schools (Figure 6). The 3D Map was also shared at the Kimberley Land Council Annual General Meeting in 2018, which attracted more than 500 Traditional Owners (Figure 7).

The co-evaluation of the project in 2019 identified that the most valuable aspect of the 3D Map was Traditional Owner adults, youth and scientists learning together:

*Learning together ... different people, different Traditional Owner groups, about different things, each other and scientists, step by step, coming together around the river (group discussion notes, November 2019).*

More information about the findings from co-evaluation of the project is available in this paper [Learning together for and with the Martuwarra Fitzroy River](#).<sup>7</sup>



Figure 6. Bunuba leader Mary Aiken leading sharing of knowledge using the 3D Map at Fitzroy Valley District High School in October 2018.

<sup>7</sup> <https://link.springer.com/article/10.1007/s11625-021-00988-x>





Figure 7. Sharing the 3D Map at the KLC AGM in 2018.

## 1.4 Future use of the 3D Map at the Fitzroy Valley District High School

Towards the end of the project, the team held several discussions about the long-term future of the 3D Map. Traditional Owners involved in the project were very keen to see it stay in the Martuwarra catchment and be used to support learning together. Several options were canvassed – for example, whether a community gathering place such as an arts centre would be appropriate.

Fitzroy Valley District High School was identified as the ideal long-term home for the 3D Map, and participants were very excited and happy when the school agreed to provide a home. They also look forward to the map being available for other high schools with students who are Traditional Owners at Halls Creek and Derby.

Traditional Owners would like to see the 3D Map used as *a tool support learning between Traditional Owner adults and school children, coming together around the Martuwarra.*

The plans of the school to strengthen their two-way science curriculum, with the 3D Map as a vital part of that are strongly welcomed.

Traditional Owners aspire to be part of the learning activities that the school conducts using the 3D Map.

## 2. Hardware for the 3D Map

It could be useful to form two groups at the start – one to set up the map (this section 2) and another to set up the computer and projector (section 3 and 4).

The hardware for the 3D Map includes:

- storage and transport components
- 3D Map sections
- laminated paper maps and painter's drop sheets.

### 2.1 Storage and transport

#### 2.1.1 The boxes

The 3D Map is made in 3 sections, each of which need to travel in its own box, which is designed to house each uniquely shaped section. The sections may be stored differently – for example in two of the three boxes – but if they need to travel, they need to be packed and unpacked following the information provided here.

The boxes are designed to be clipped together for stability when moving (Figure 8). They can be placed on the back of a 2-door or 4-door ute (utility vehicle) for transportation (Figure 9).



Figure 8. Three boxes clipped together for transport.



## Box dimensions and mass

Each box requires a 2-person lift. Handles have been installed to lower risk of manual strain.

Sizes in millimetres (photo above):

- Top box = 1260 × 975 × 390 mm. 27 kg. 3D Map (NE) section 13 kg. Total 40 kg.
- Middle box = 1260 × 1075 × 505 mm. 28 kg. 3D Map (SE) section 13 kg. Total 41 kg
- Bottom box = 1260 × 1420 × 190 mm. 16 kg. 3D Map (W) section 14 kg. Total 30 kg.

### 2.1.2 Putting the boxes together for transport

The boxes are best moved individually on a trolley next to the vehicle for transportation e.g. ute. Each box can then be lifted by two people into place. When placed together correctly, the boxes will not move over one another. The boxes need to be tied down for transport.



Figure 9. (a) Moving a box with a trolley. (b) Boxes stacked on a 2-door ute.

The largest, and lightest, box is the base. The middle box should be placed on top of the base so that the points marked 'A' are lined up and the colours matching (Figure 10).

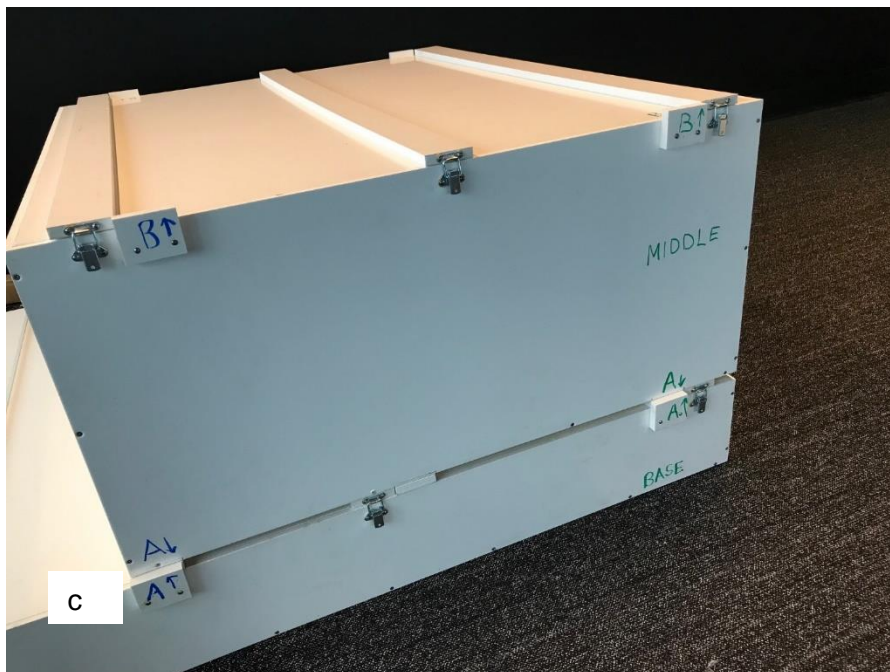
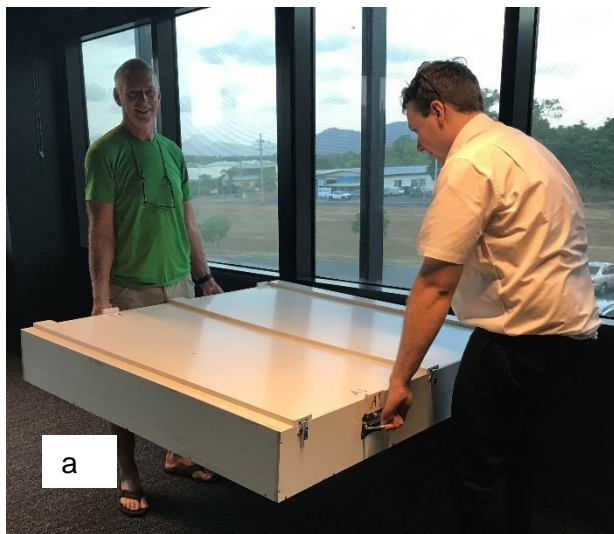


Figure 10. (a) Moving base. (b) Middle box on top. (c) Align the points marked 'A' so that colours match.

The top box should be placed on to the middle box so that the points marked 'B' are lined up and the colours matching.

When placed correctly, the boxes will not be able to slide over each other (Figure 11).



Figure 11. Boxes stacked and placed correctly with letters and colour matching.



## 2.2 The 3D Map sections

### 2.2.1 Western section

The base box holds the western section of the 3D Map. There are small wooden pins in the base to hold it in place and prevent horizontal movement. It needs to be placed in the box to align with the shape as shown, in the direction of the arrows, and should be removed in the opposite direction (Figure 12).

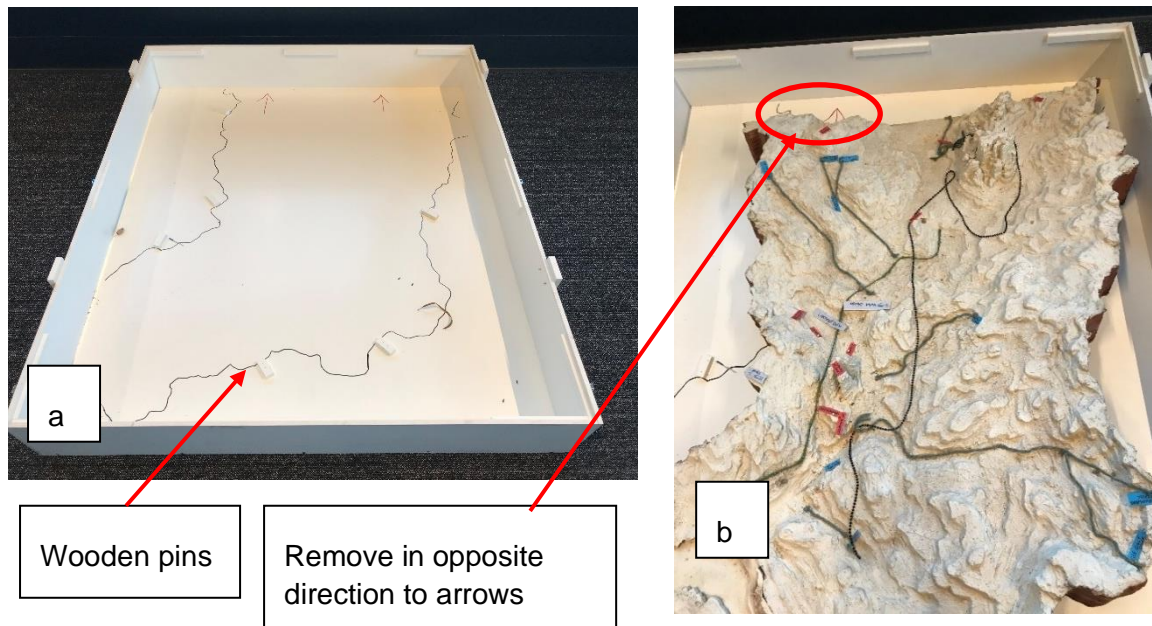


Figure 12. Moving the western section into (and out of) the base box: (a) Outline. (b) Direction of movement.

The lid is a separate piece which clips down and has small posts that hold the map in place and prevent vertical movement. The lid has the letter 'A' in different colours that show how it should be positioned (Figure 13). It should be placed down carefully and clipped into place.

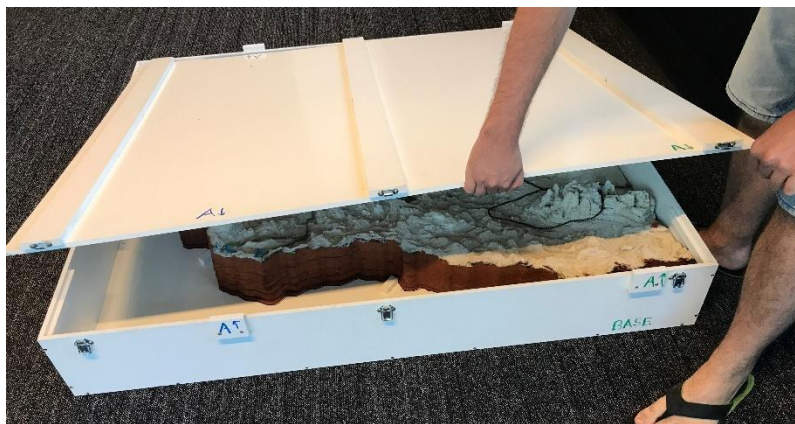


Figure 13. Placing the lid of the base into position with colour of the letter 'A' aligned.

### 2.2.2 North-eastern section

The middle box holds the north-eastern section of the 3D Map (Figure 14). There are small wooden pins in the base to hold it in place and prevent horizontal movement. It needs to be placed in the box to align with the shape as shown, in the direction of the arrows, and should be removed in the opposite direction.

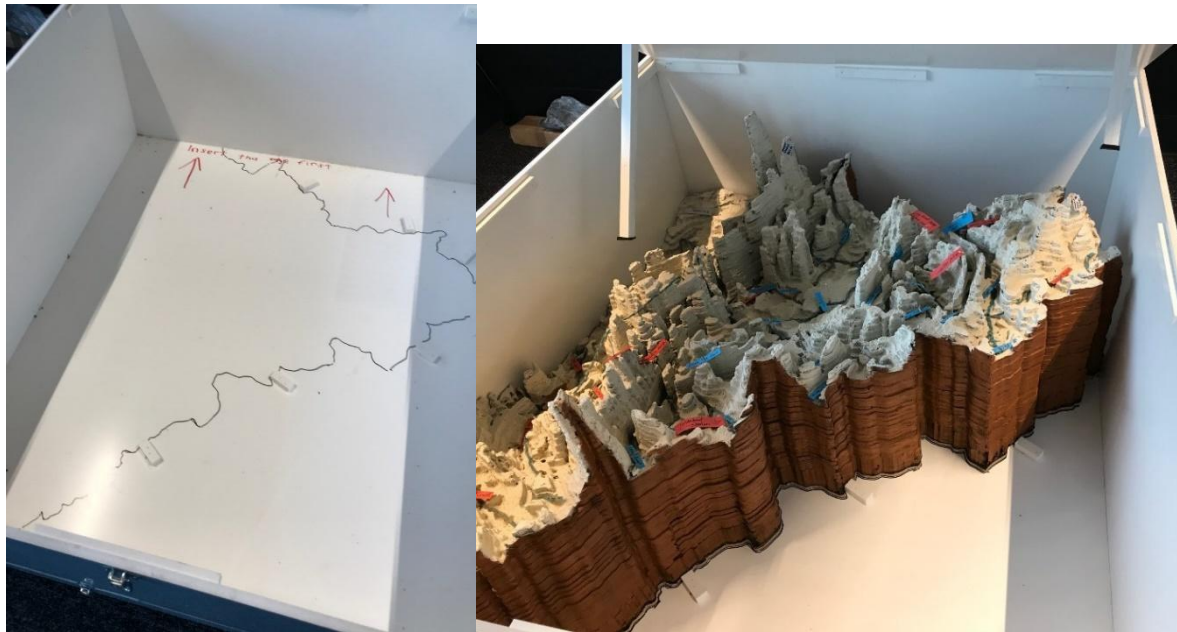


Figure 14. (a) Outline of north-east section in the bottom of the middle box. (b) North-east section in the box.

The lid is a separate piece which clips down and has small posts that hold the map in place (Figure 15). It also has marks at the top to show how it should be placed on the box. It should be placed down carefully and clipped into place.



Figure 15. Putting the lid of the middle box in place.



### 2.2.3 South-eastern section

The top box holds the south-eastern section of the map. There are small wooden pins in the base to hold it in place and prevent horizontal movement. It needs to be placed in the box to align with the shape as shown, in the direction of the arrows, and should be removed in the opposite direction (Figure 16).

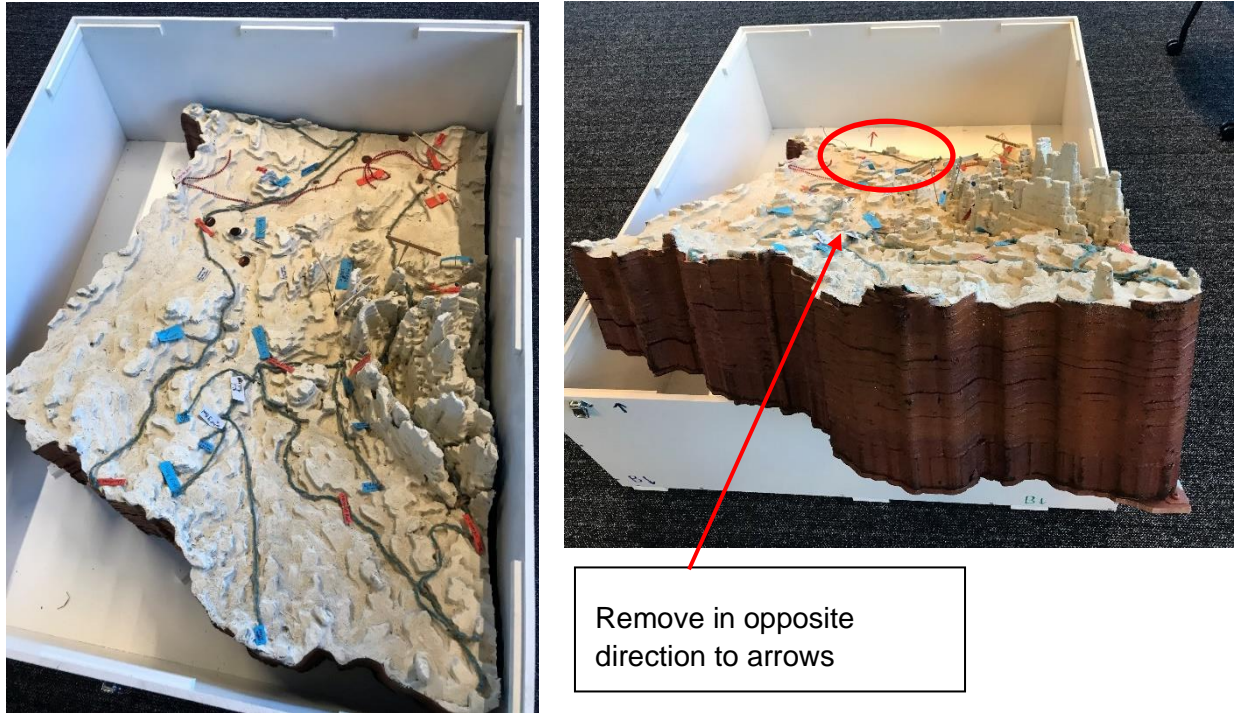


Figure 16. Removing the south-eastern section from the box.

The lid is a separate piece which clips down and has small posts that hold the map in place. It should be placed down carefully and clipped into place (Figure 17).



Figure 17. Placing the lid on the box for the south-eastern section.



## 2.3 Setting up the map

### 2.3.1 What you need

Setting up the map requires 3 things.

- 3D Map sections from the boxes – see photos above of the three different sections.
- three paper, laminated maps from the map tube – this is in the base box (Figure 18)
- painter's drop sheet – these are in the middle box (Figure 19). There are two different sheets, numbered 1 and 2. Each sheet is 3.6 m x 2.8 m.

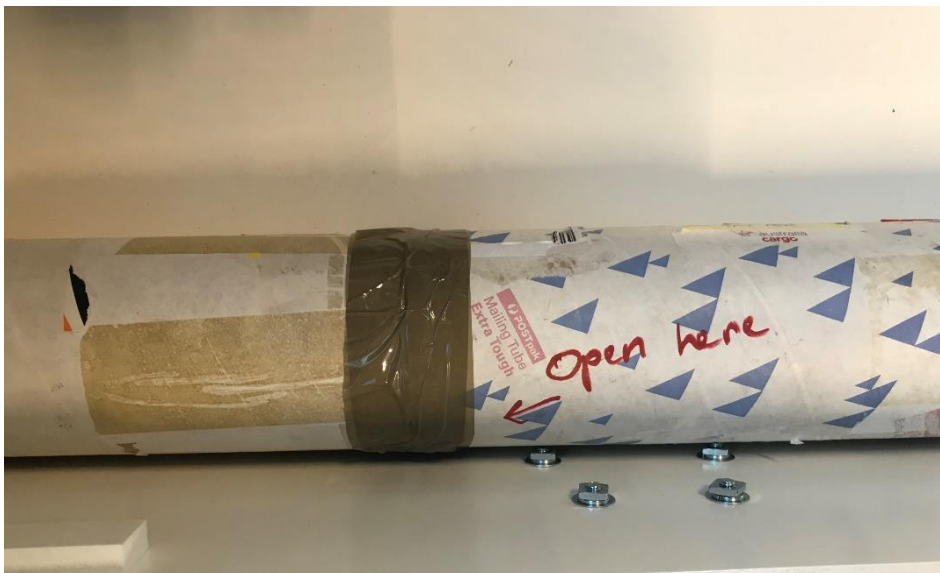


Figure 18. Map tube containing three paper, laminated, maps.



Figure 19. Two painter's drop sheets.

### 2.3.2 The steps to set up the 3D Map

#### Step 1. Make sure you have enough space

The 3D Map, together with the projector, and room for students to be around it, needs an area of 3.8 m x 3.6 m (Figure 20). The two painter's drop sheets will cover a rectangle with those dimensions. You will also need room to put the boxes to one side.

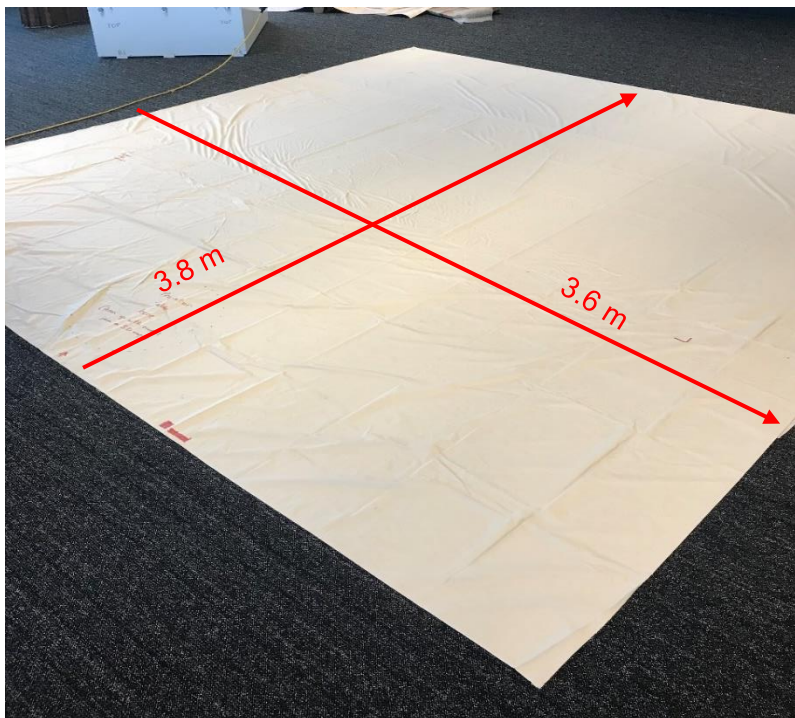


Figure 20. Painter's drop sheet showing the space needed to set it up for the 3D Map.



## Step 2. Find north

Using a compass (not supplied, but most smart phones have one), check which direction is north. If possible, you will want to orient the map in the accurate direction (north direction on the map is also actual north). To do this, you will place the painter's drop sheet so that the short sides are aligned north.

## Step 3. Lay out the painter's drop sheets

The first drop sheet should be placed with the long side to the top (north) of your available space. The second drop sheet is placed to the south of the first one and will partially cover it (Figure 21). Cover ~two-thirds of the first drop sheet with the second sheet, aligning the arrows and numbers that are marked on the second sheet with those on the first sheet (Figure 22).



Figure 21. Laying out the two painter's drop sheets.

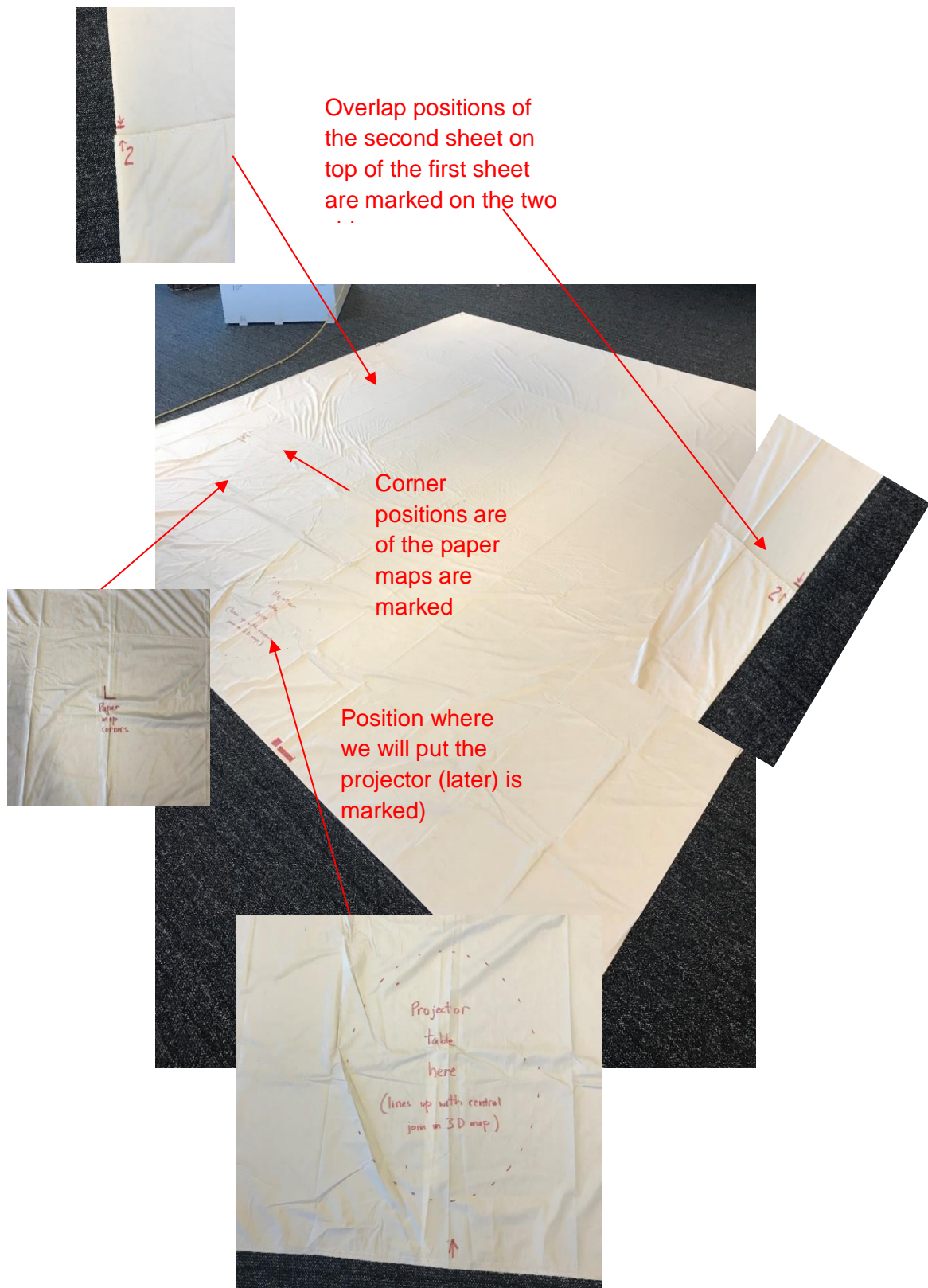


Figure 22. Marks on the second drop sheet show the correct position.



#### Step 4. Place paper maps on drop sheets

The western-most paper (laminated) map is marked with an 'A' in the top right-hand corner, the middle paper map with a 'B' and the eastern-most paper map with a 'C' (Figure 23). Maps A and C should line up with the corners marked in red on the painter's drop sheets (figure 16). The three maps butt-up with one another (Figure 24).

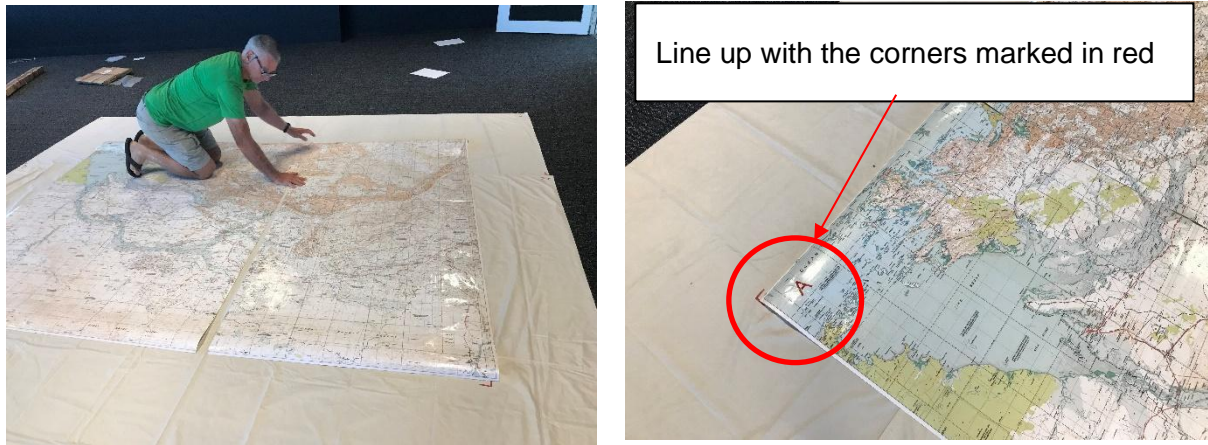


Figure 23. Aligning the paper maps on the painter's drop sheets.



Figure 24. The paper maps in position on the drop sheet.



### Step five. Place the three 3D Map sections

Place the 3D Maps onto the paper maps so that they are approximately aligned. There are some scale mismatches so the alignment will not be perfect.

The tallest section (middle box) needs to be placed in the north-east, on paper map C (Figure 25). The boundary of the Fitzroy River catchment is marked in black pen on the paper maps. The 3D Map should be placed to align with the catchment boundary.



Figure 25. Placing the north-eastern map section on paper map C.

The section in the top box needs to be placed in the south-east, so that the two surfaces with black foam face each other (Figure 26).

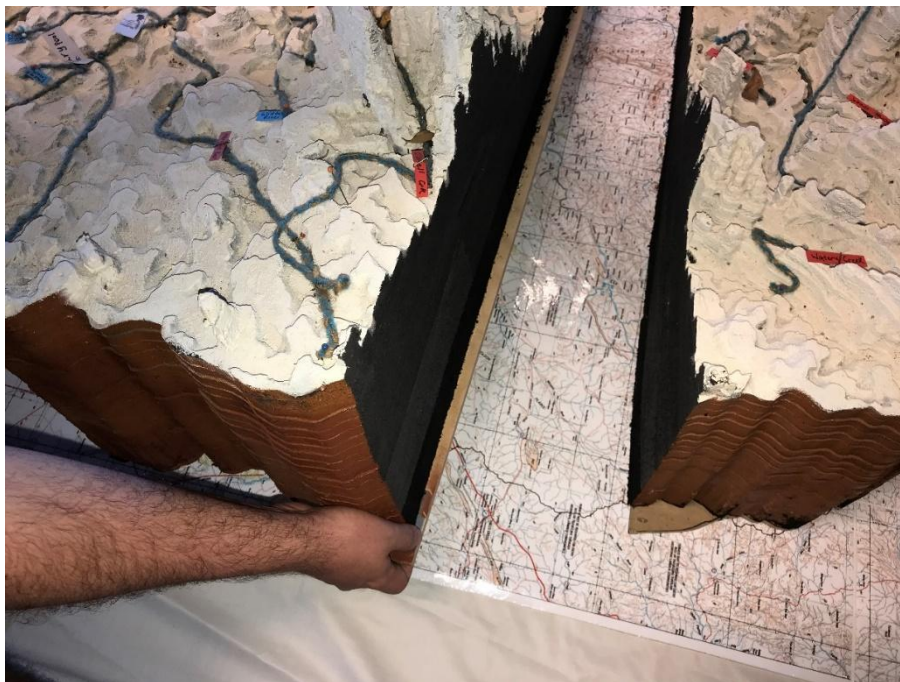


Figure 26. Placing the south-eastern section on paper map C.

When placed together, these two sections make up the eastern half of the Martuwarra (Fitzroy River) catchment (Figure 27).



*Figure 27. The eastern half of the Martuwarra (Fitzroy River) catchment.*

Finally, the western section should be placed to join the other two sections. You will find that it doesn't align properly with the catchment boundary, particularly in the west. This is because of scale mistakes with the original construction (Figure 28).





Figure 28. Western and eastern halves of the 3D map joined, showing misalignment with the underlying paper map.



## 2.4 Using the 3D Map without the projector

Now the map is in place, it can be used without the projector if desired (Figure 29). The surface of the 3D Map is soft and flexible. Pins can be placed on it to mark key features and easily removed afterwards. A range of pins and labels are available to use with the 3D Map.



Figure 29. 3D Maps sections in place and ready to be used.

Talking together around the map between senior knowledge-holders and others was found to be a good way to mark culturally important features with pins and shapes (Figure 30).

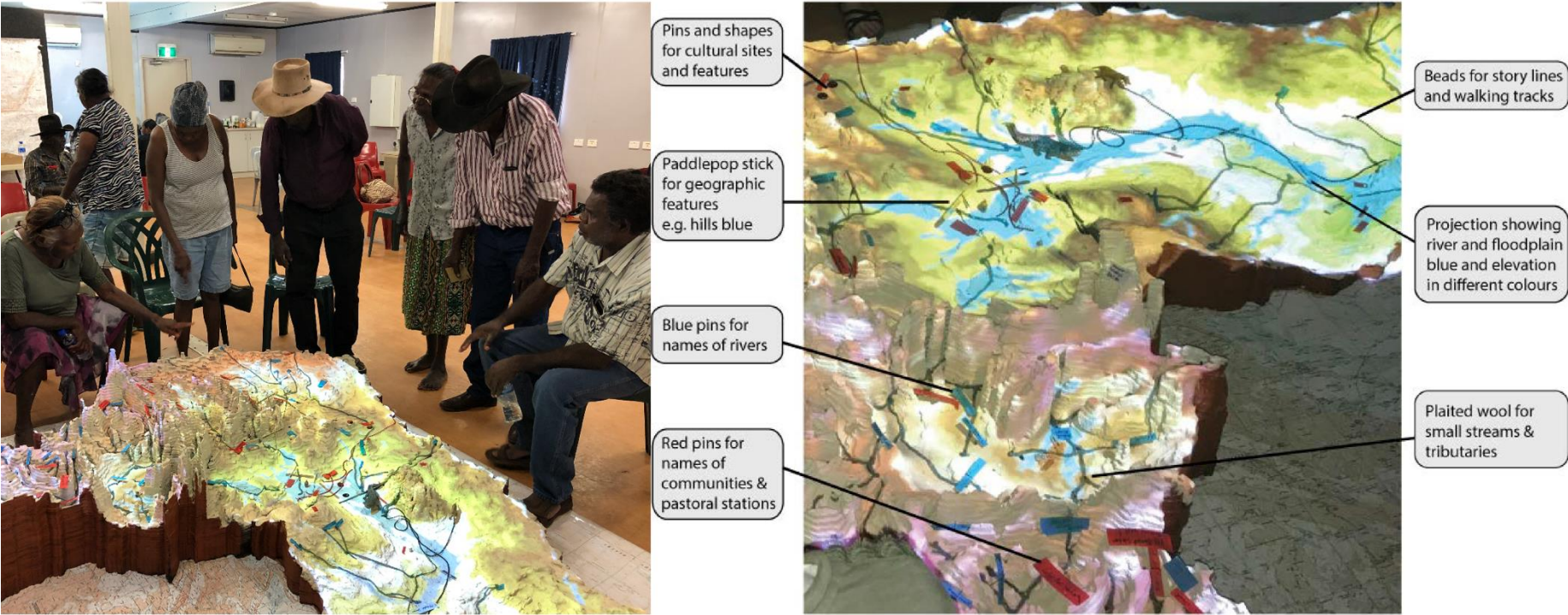


Figure 30. Using the 3D Map to mark cultural features.



### 3. Hardware for the projector display

#### 3.1 What you need to set up the projector

The 3D Map is more interesting and fun when spatial data is displayed onto it. Figure 30 demonstrates what the 3D map looks like when some simple contours (in colour) and water features are projected onto it. To set up the projector, you will need:

- flat-packed table (Figure 31)
- upright pole for the projector stand (Figure 32)
- base of the projector stand (Figure 33)
- suitcase with the projector and accessories in it (Figure 34).



Figure 31. Flat-packed table.



Figure 32. Upright pole for the projector stand.



Figure 33. Base of the projector stand.



Figure 34. Suitcase with the projector and accessories in it.



## 3.2 Assembling the flat-packed table

The table is still in the box from the factory. This box contains all the screws and the tools necessary to assemble the table, including the instructions (Figure 31). It should be straightforward. The table is not the one shown in the rest of the photos but is the same size, just a different colour (Figure 35). Once assembled, place the table onto the painter's drop sheet in the position marked in red (Figure 36).



Figure 35. Flat-packed table after assembly.



Figure 36. Place the table on the drop sheet in the position marked in red.

### 3.3 Assembling the projector stand

Remove the stand and the pole from their boxes. Screw the pole into the base (Figure 37). To raise the pole, first undo the lock (large handle, Figure 38a) Then pull the opposite handle out away from the pole, while raising the inside section of the pole (Figure 38b). Raise the inner section of the pole to its full height and lock into place with a small knob (Figure 39).



*Figure 37. Screw the projector stand pole into the base.*





Figure 38. (a) Undo the lock (large knob) and then (b) pull out the smaller knob while raising the inside section.



Figure 39. Raise the inner section to its full height and lock into place with small knob.



## 3.4 Assembling the projector and accessories

### 3.4.1 Contents of the suitcase

Open the projector suitcase (Figure 40) and remove each of the following items in readiness for setting up the projector:

- packaging and the long lead (Figure 41)
- projector in its case (Figure 42)
- clamp for holding the projector to the stand (Figure 43)
- camera (Figure 44)
- tool for setting the angles of the projector and camera (Figure 45)
- CD containing the drivers for the projector (for installation in your computer) (Figure 46)
- instructions that came with the projector (Figure 47)
- three black leads (Figure 48, Figure 49)
- plastic bag with green cardboard squares and remote control (Figure 50)
- spares and leaflets that came with the projector (Figure 51).



Figure 40. Open the suitcase.

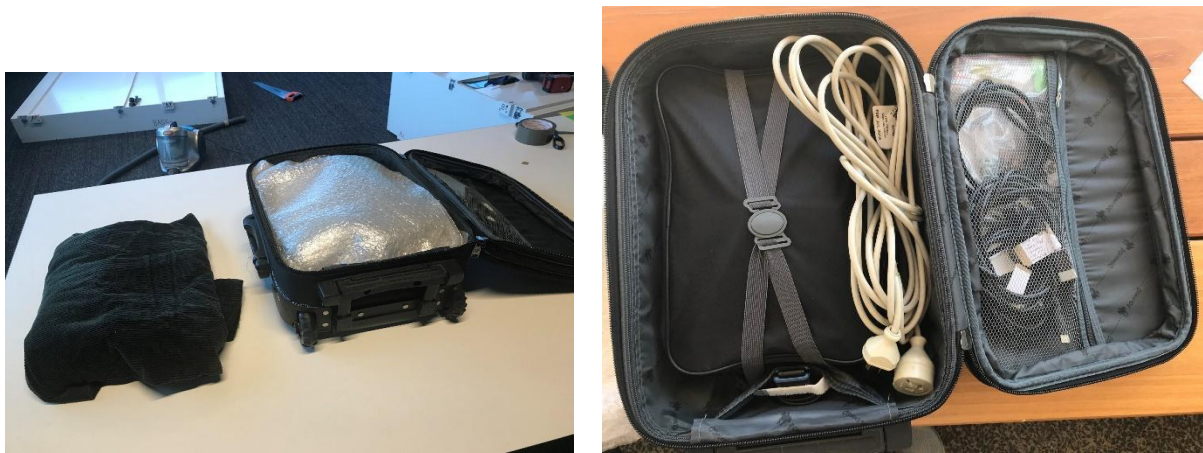


Figure 41. Remove packaging and long lead.

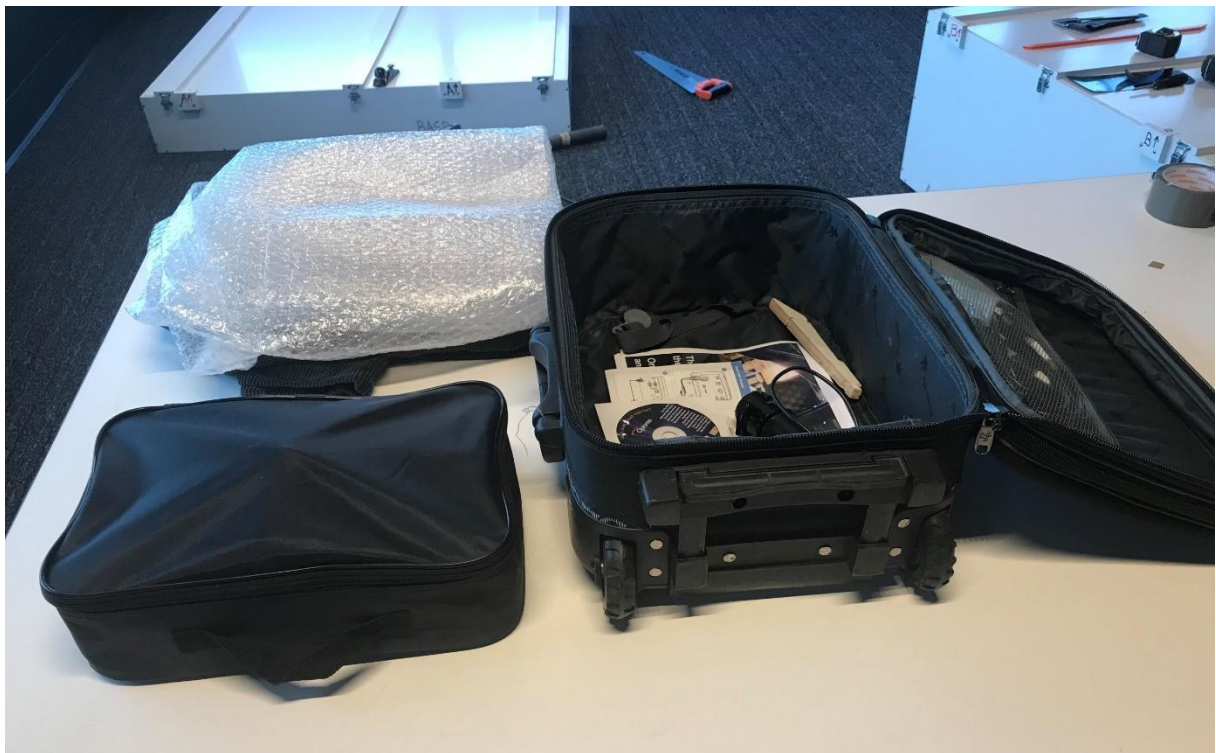


Figure 42. Undo clip holding the projector and its case in place and remove.



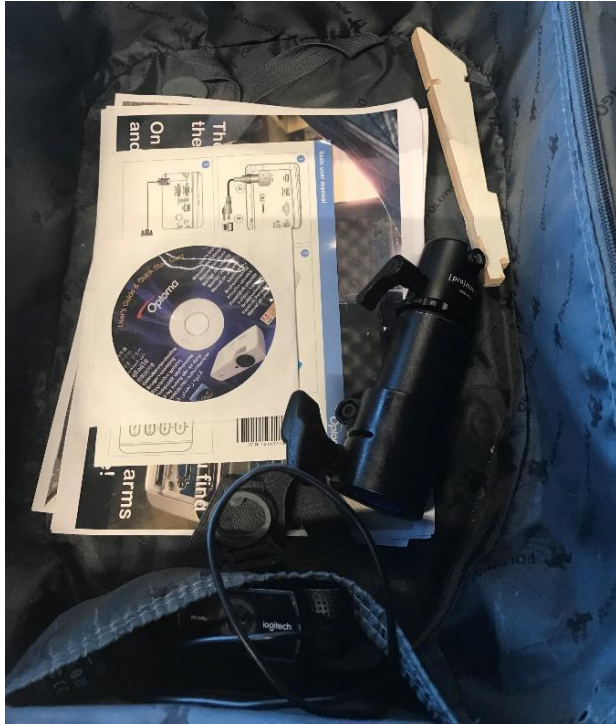


Figure 43. Remove clamp for holding projector onto the stand.



Figure 44. Remove camera.



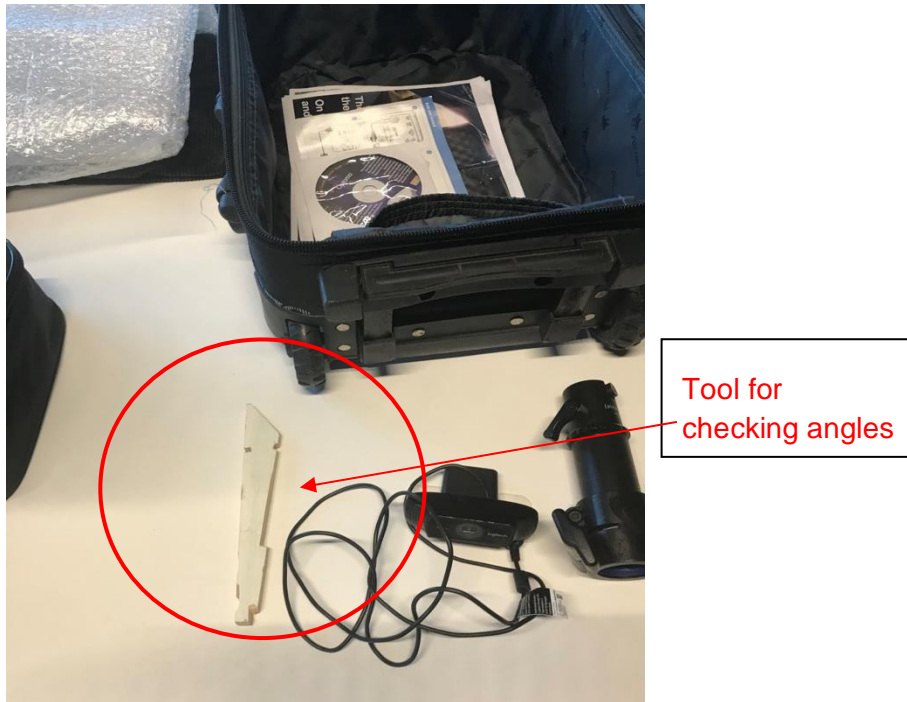


Figure 45. Remove tool for checking angles of projector and camera.

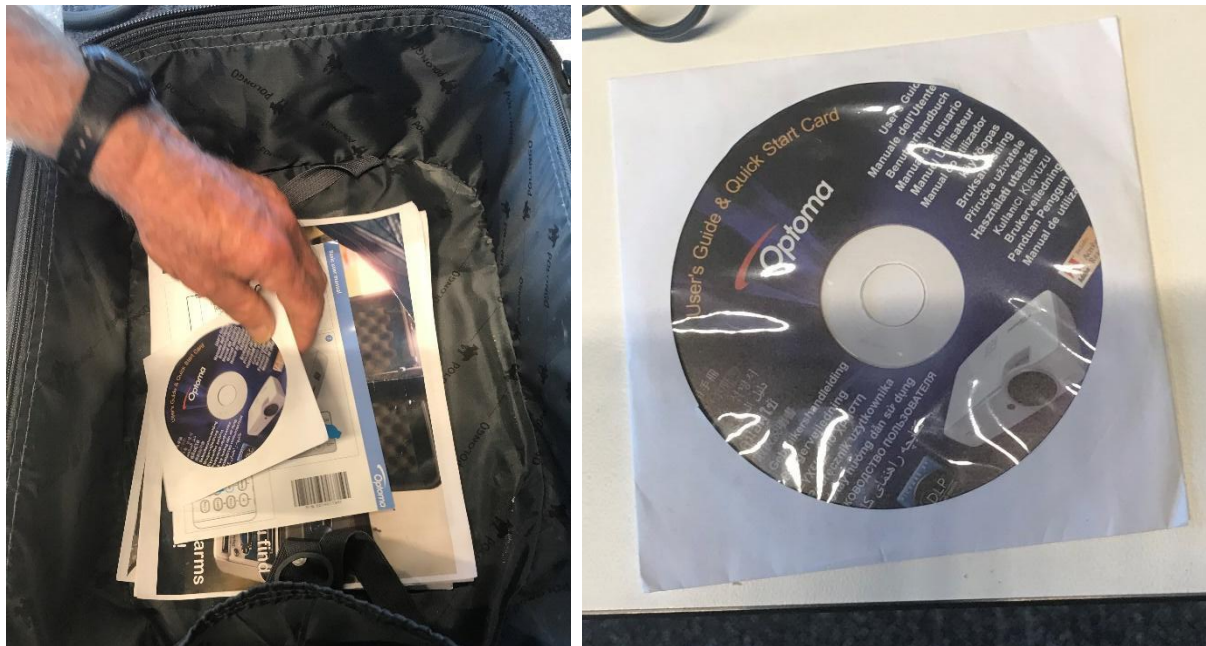


Figure 46. Remove CD with projector drivers (for installation in your computer).

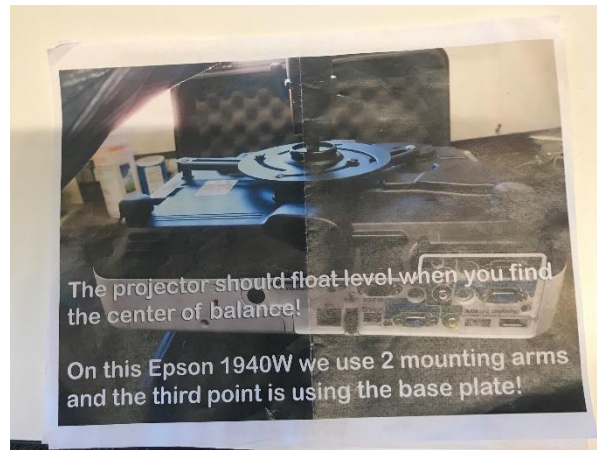
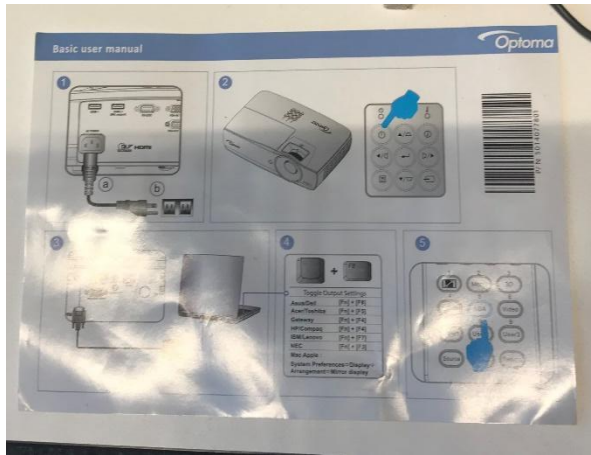


Figure 47. Instructions that came with the projector.



Figure 48. Remove 3 leads – showing here the extension lead for the camera.





Figure 49. HDMI lead (for connecting the projector to your computer) and power lead for the projector.

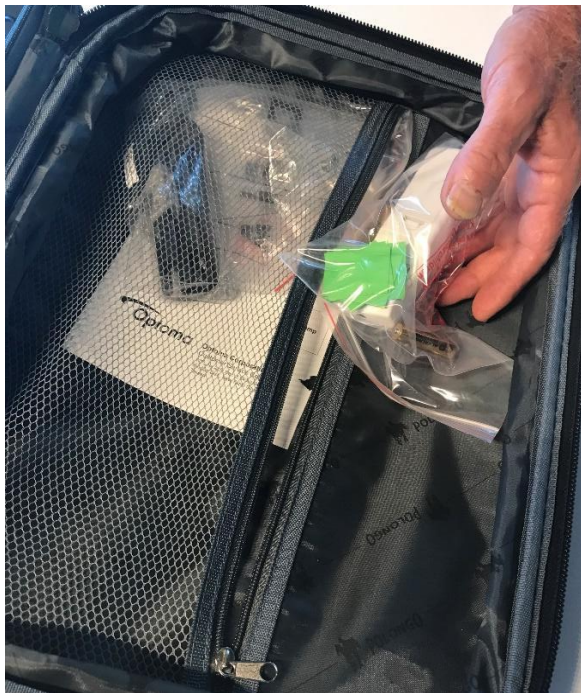


Figure 50. Plastic bag with green cardboard squares and remote control for projector.



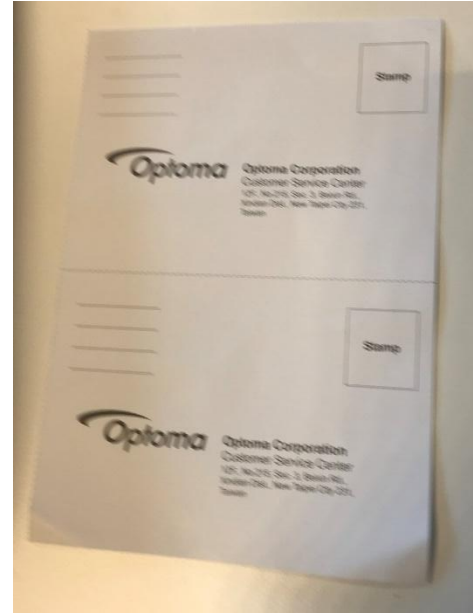


Figure 51. Spares and leaflets that came with the projector.

### 1.1.1 Steps to attach the accessories to the projector

The camera, the clamp and the leads need to be attached to the projector before it is mounted on to the projector stand.

#### Step 1. Remove projector from its case

Undo the velcro fastener and remove the projector (Figure 52).



Figure 52. Remove projector from its case.

## Step 2. Attach the clamp to the projector

The clamp screws on to the mounting at the top of the projector. Tighten it firmly (but do not over-tighten) to a position at 90° to the projector (Figure 53).



Figure 53. Attach clamp to mount on the top of the projector.

## Step 3. Adjust clamp to the correct angle

The position of the clamp on the projector stand determines whether the 3D Map will be covered by the light from the projector. A tool has been provided that will help you to set the clamp at the right angle.

Slightly loosen the handle close to the base of the clamp – this will allow you to move the angle of the clamp away from, or closer to, the top of the projector. Use one end of the wooden tool to make sure the clamp is at the correct angle. Tighten the handle so that the clamp stays in position (Figure 54).



Figure 54. Adjust clamp to correct angle using the wooden tool.

#### Step 4. Attach cords to projector

Turn the projector on its side and plug in the power cord (Figure 55). Plug the HDMI lead into the socket on the far left, marked with a red arrow (Figure 56). The other end of the HDMI lead will go into the computer.



Figure 55. Plug power cord into projector socket.



Figure 56. Plug HDMI lead into socket on far left at back, marked with a red arrow.



### Step 5. Attach camera to projector

Turn the projector upside-down so that it is now resting on the clamp. The camera attaches with special velcro tape. Press the velcro down firmly on both sides and the middle to make sure it is properly attached (Figure 57).



Figure 57. Attach camera by the special velcro tape and press down firmly on both sides and middle.

### Step 6. Adjust camera to the correct angle

The position of the camera on the projector stand determines whether the camera can see all of the 3D Map. Provided the camera can see all of the map, the computer program automatically adjusts the projection so that the catchment shape aligns with the edges and peaks of the 3D Map. Use the other end of wooden tool provided to set the camera at the correct angle (Figure 58). You may find it helpful to leave the wooden wedge in place to prevent movement.

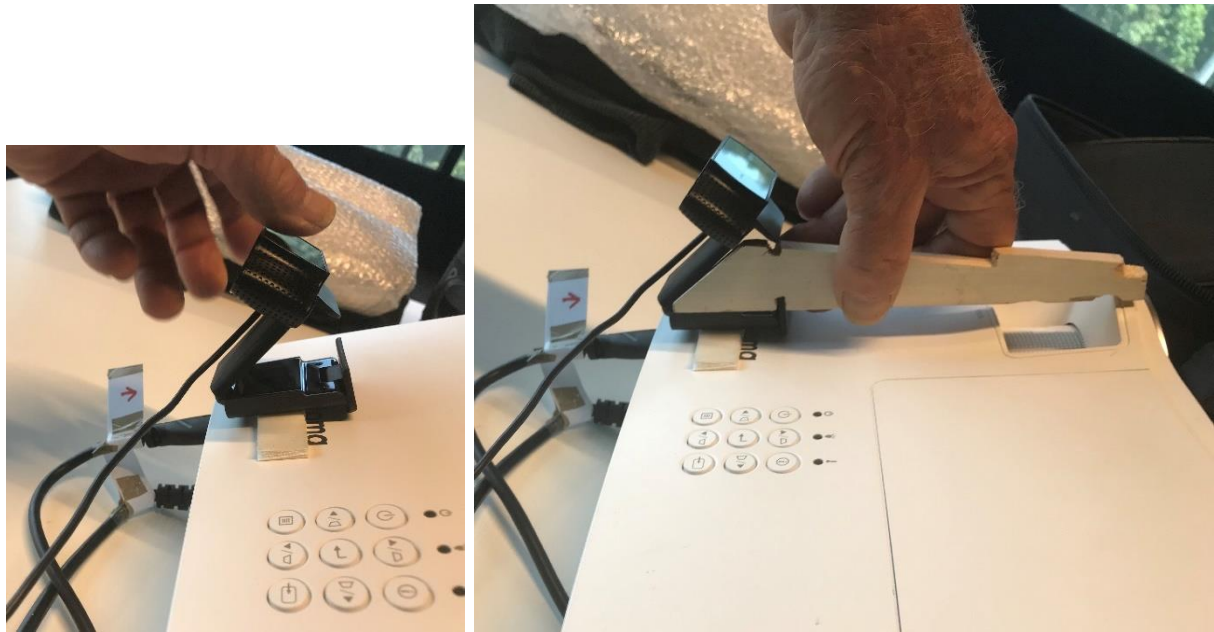


Figure 58. Adjust camera to the correct angle using the wooden tool.

### Step 7. Place projector on stand and stand on table or vice versa

In these photos, we show the projector stand being placed on the table first (Figure 59), and then the projector placed on the pole (Figure 60). Depending on your height, it may be easier to place the projector on the stand first, and then the stand on the table. The projector faces down and is on the same side as the 3D Map.



Figure 59. Place the projector on the table.





Figure 60. Place projector on stand.

### **Step 8. Place table nearby stand and computer on table**

The computer (not supplied) needs to be close to the projector stand, on a small table (not supplied) (Figure 61).



Figure 61. Place small table and computer next to projector stand.



### Step 9. Plug cords from projector to computer

The cord from the camera is not long enough to reach the computer in the position shown, so an extension has been provided (Universal Serial Bus, USB female-to-male). Plug the USB from the camera into the female end of the extension lead, and then plug the male USB into the computer (Figure 62).

The long lead will be needed to reach the power cord from the projector. The high-definition multimedia interface (HDMI) lead will be long enough to reach the computer in the position shown. Plug in the power cord and plug the HDMI lead into the computer (Figure 63).



Figure 62. Plug camera lead into the USB extension, and the USB extension into the computer.



Figure 63. Plug in the power cord to the long lead and the HDMI lead to the computer.

### Step 10. Put batteries in the projector remote control

The batteries are in the plastic bag, and once placed in the remote control, the projector is ready to use and can be turned on with the remote control by pressing the red button (Figure 57). The batteries should be removed from the remote control whenever it is not in use.

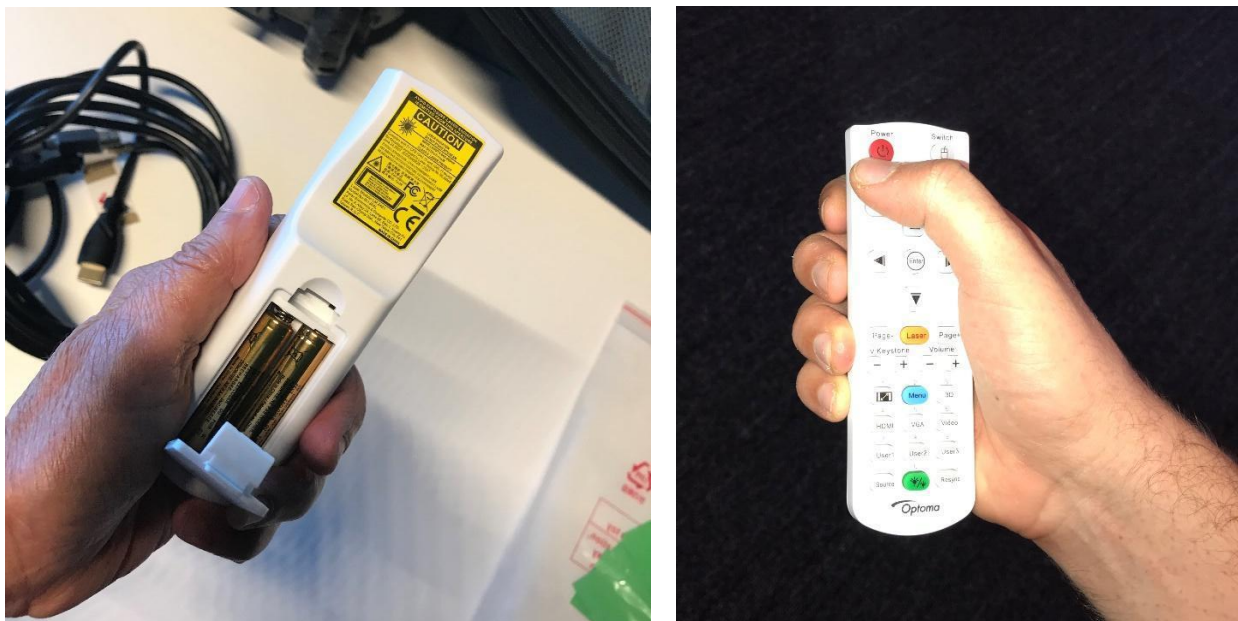


Figure 64. Put batteries in the remote control.

## 4. Installing the projector drivers and computer software

### 4.1 Install the projector drivers

If your computer has a CD drive, you can use the disk provided to install the drivers for the projector (Figure 39). However, as many computers do not have CD drives these days, you may need to download it from the web. Optoma drivers can be downloaded here:

<https://www.optoma.com/support/download/world-wide/>

Once the file is downloaded, open it and follow the instructions for installation. Your computer may automatically install these drivers if it is connected to the internet when the projector is plugged into it.

### 1.2 Install the computer software

To download the computer software, you will need to use a Google Drive link and download the zip file. To use a Google Drive link, you need to have a Google email (Gmail) account. Many people already have a free Gmail account. If not, you can easily create one. Just put 'Create Google account' into your internet browser, click on the link, and follow the instructions (Figure 65).

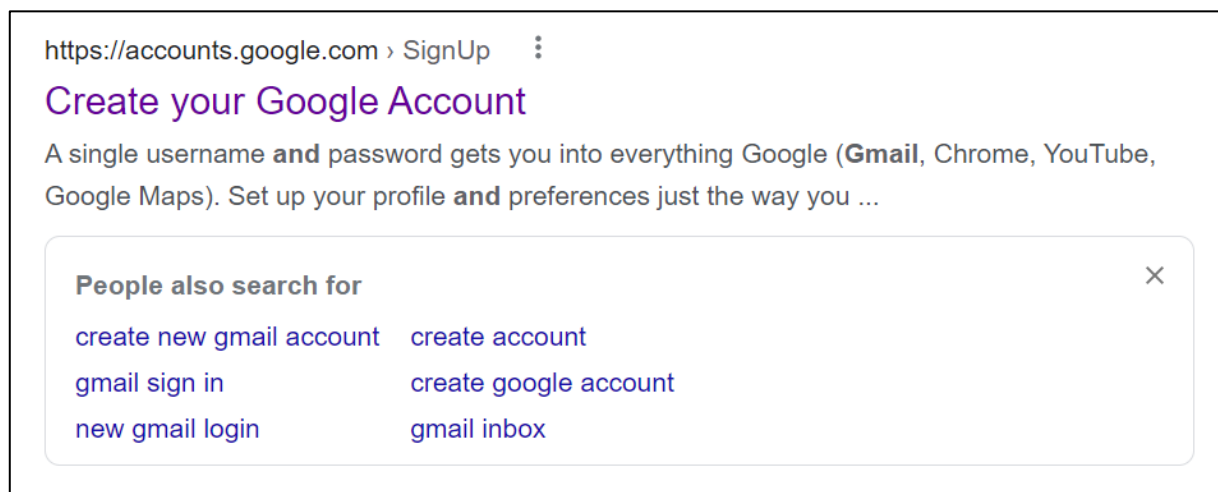


Figure 65. Create a Google account if you don't already have one.



Once you have a Google account, search for 'Google Drive' using any internet browser (Figure 66), click on the link and log into it using your Gmail account (Figure 67).

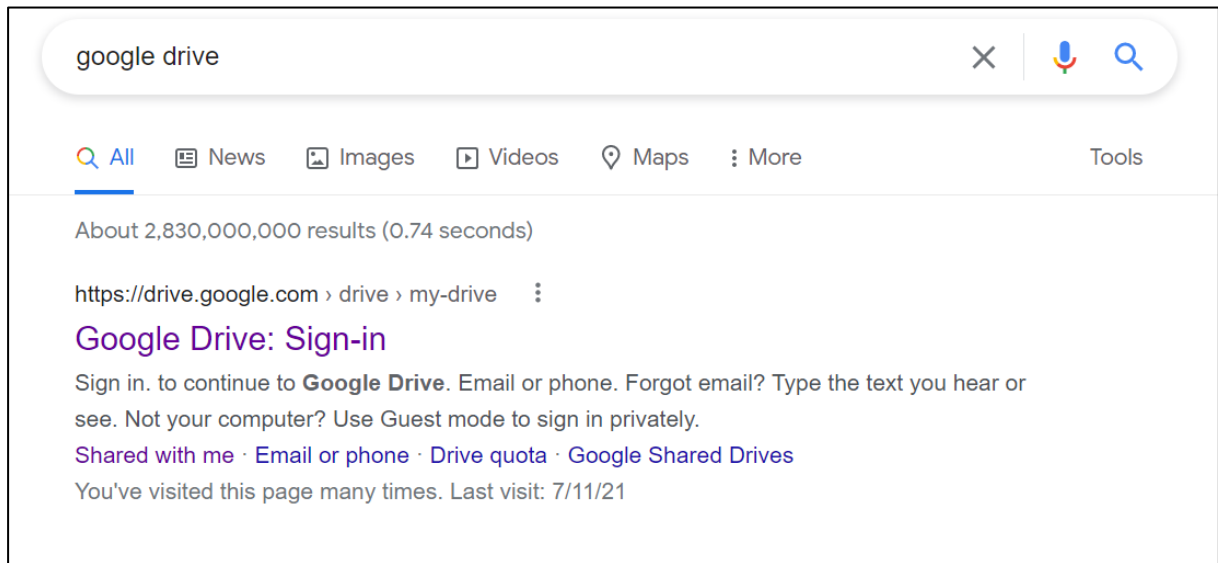


Figure 66. Find Google Drive using your browser and click to sign in.

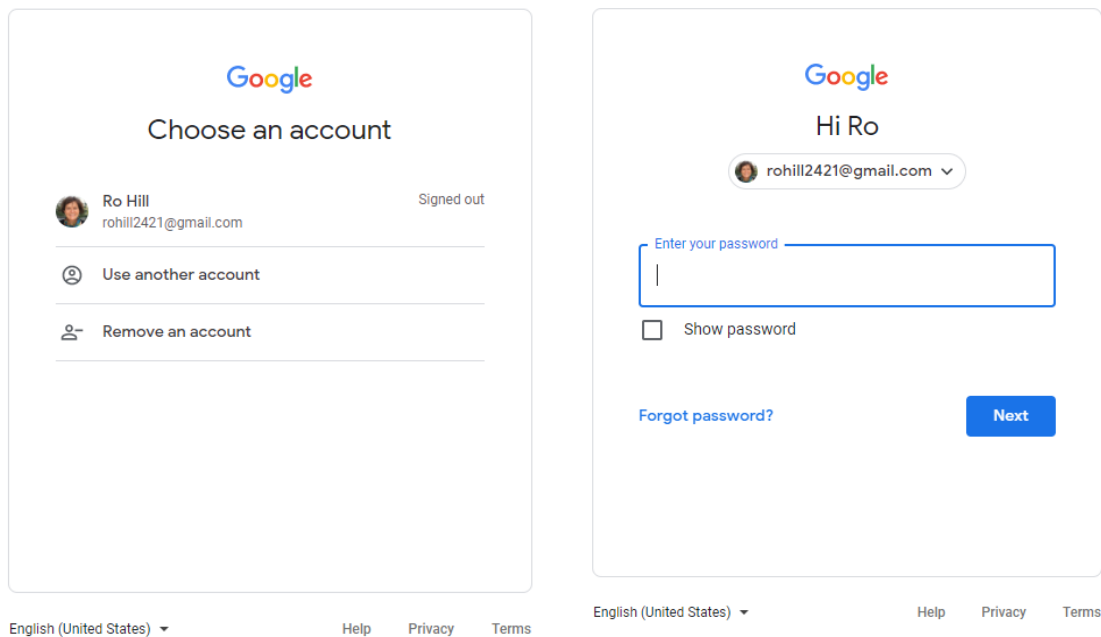


Figure 67. Sign into Google Drive using your Gmail address and password.

Once you are logged into Google Drive, you will be able to download a zip file with the software in it using this link:

<https://drive.google.com/drive/folders/18dtjK6eT6nE1c2DcoccNSGMz8hkMOUHK?usp=sharing>

You may receive a message 'unable to scan the file for viruses'. Click 'Download Anyway' (Figure 68).

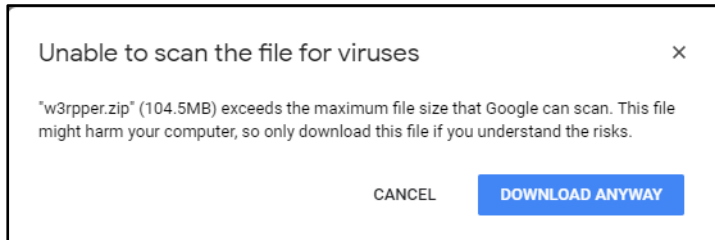


Figure 68. Message that 'unable to scan the file for viruses' may be received. Click 'Download Anyway'.

Find the zip folder in your downloads folder – it is called 'w3rpper'. Unzip the file. To do this, you can right-click on the zip file and choose 'Extract all' from the drop-down list. You will be asked to save the file somewhere on your computer (Figure 69).

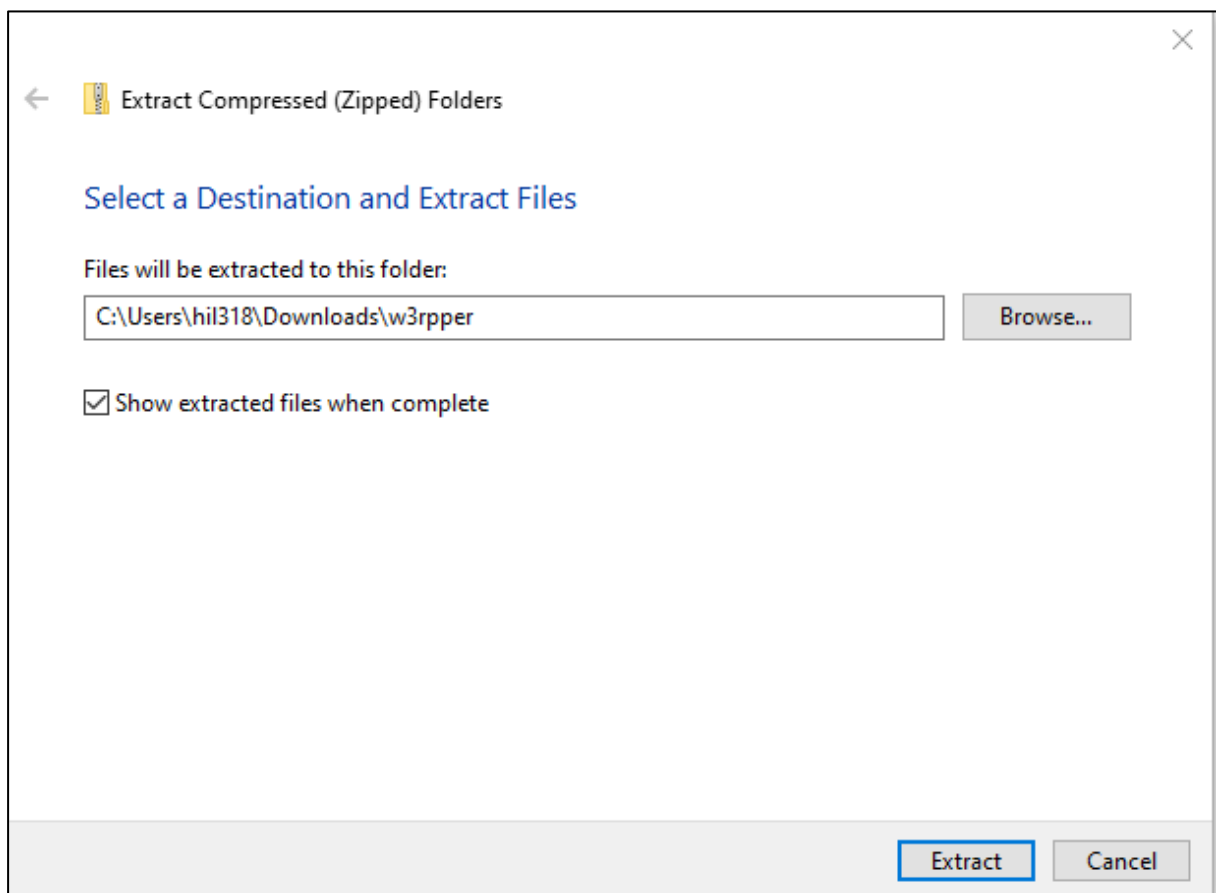
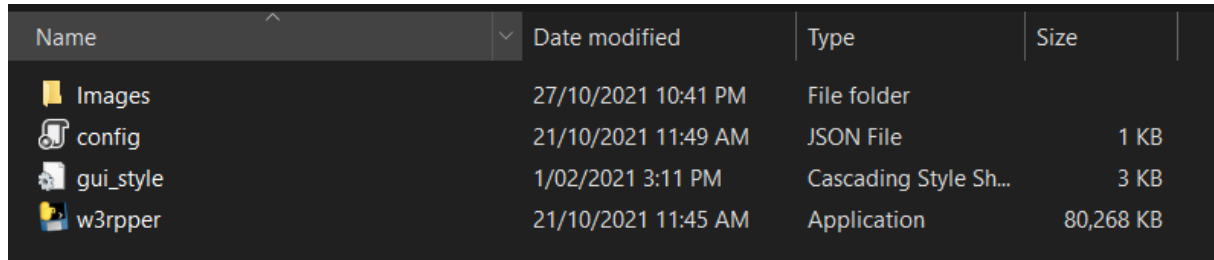


Figure 69. Extract the files from the zip file and save them into a convenient place on your computer.

Open the folder. It should contain the following:

1. Folder called 'Images'. This file contains the images that can be selected to be projected on the model. Extra images can be placed in the folder to be projected.
2. Application called w3rpper is the executable to run the software.
3. Gui\_style.css file used to colour the GUI and configuration file (do not modify these) (Figure 70).



Name	Date modified	Type	Size
Images	27/10/2021 10:41 PM	File folder	
config	21/10/2021 11:49 AM	JSON File	1 KB
gui_style	1/02/2021 3:11 PM	Cascading Style Sh...	3 KB
w3rpper	21/10/2021 11:45 AM	Application	80,268 KB

Figure 70. Files to run the program.

Once unzipped, you will have a full copy of the software and don't need to download again. You can use a USB stick to move it to another computer as long as you keep the required files.



## 5. Projecting onto the 3D Map

### 5.1 Start the software and projector

Open the software by double-clicking the 'w3rpper.exe' file.

You may receive a message that 'Windows protected your PC'.

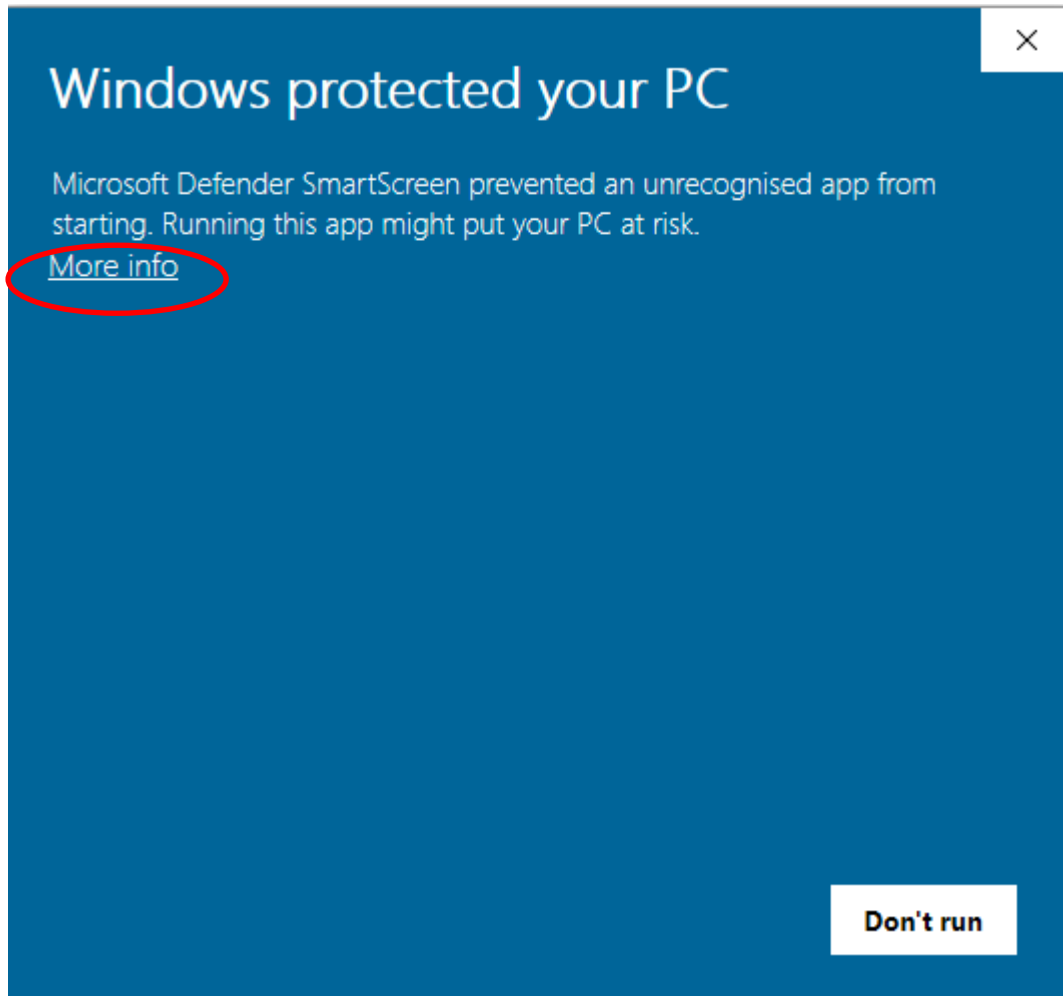


Figure 71. Message 'Windows protected your PC' may be received. Click '[More info](#)'.

A new screen will appear after you click 'More info' (Figure 72). Click the 'Run anyway' button.

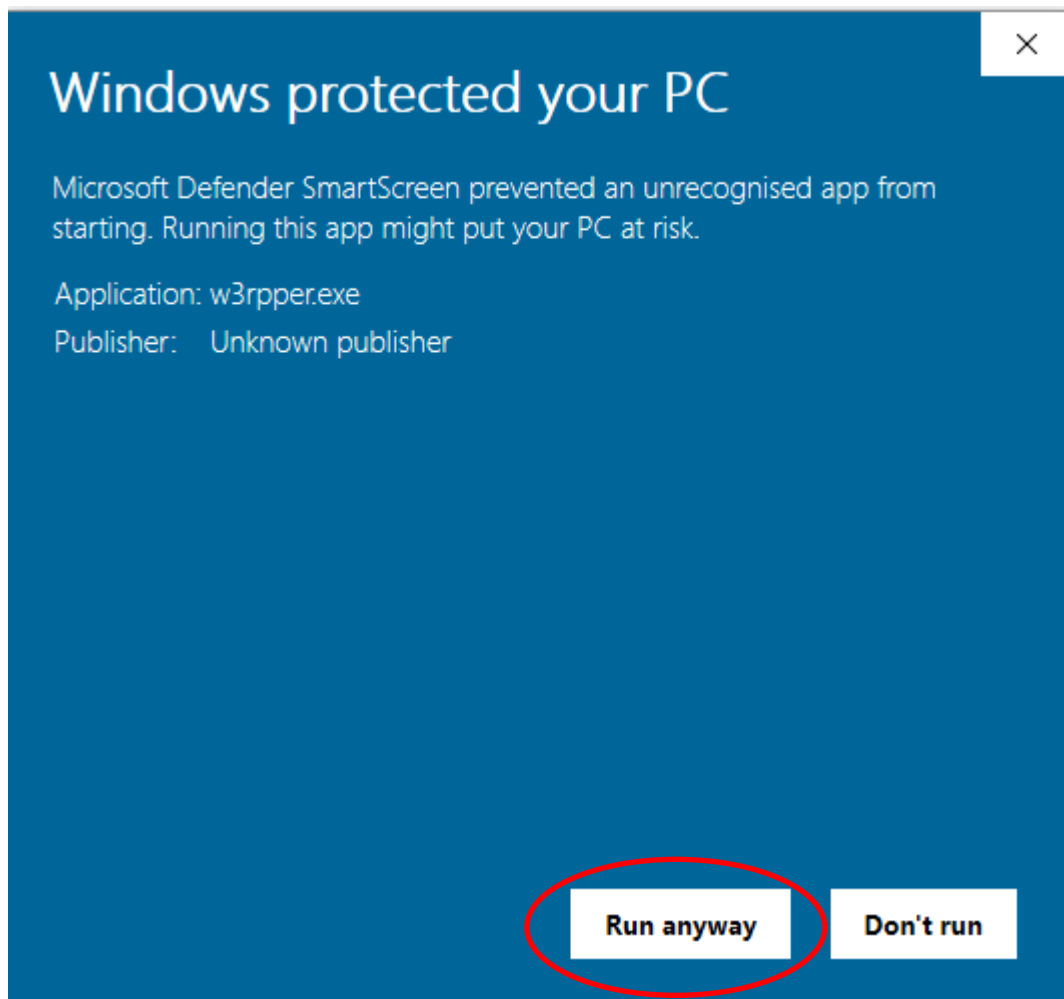


Figure 72. New screen appears after clicking 'More info' on the screen in Figure 71. Click 'Run anyway'.

It may take a while to load and a command prompt may appear (Figure 73). This is launching the application. You need to wait until the start-up home screen appears (Figure 74).

Next check the camera settings, which should show:

Resolution: 1920 x 1080

Camera: Default (Figure 75).

If the wrong camera and resolution are being displayed, you can change these using the drop-down menus. If there is no camera, make sure the USB connection has been made and restart the program. Start the projector using the remote control (Figure 76).

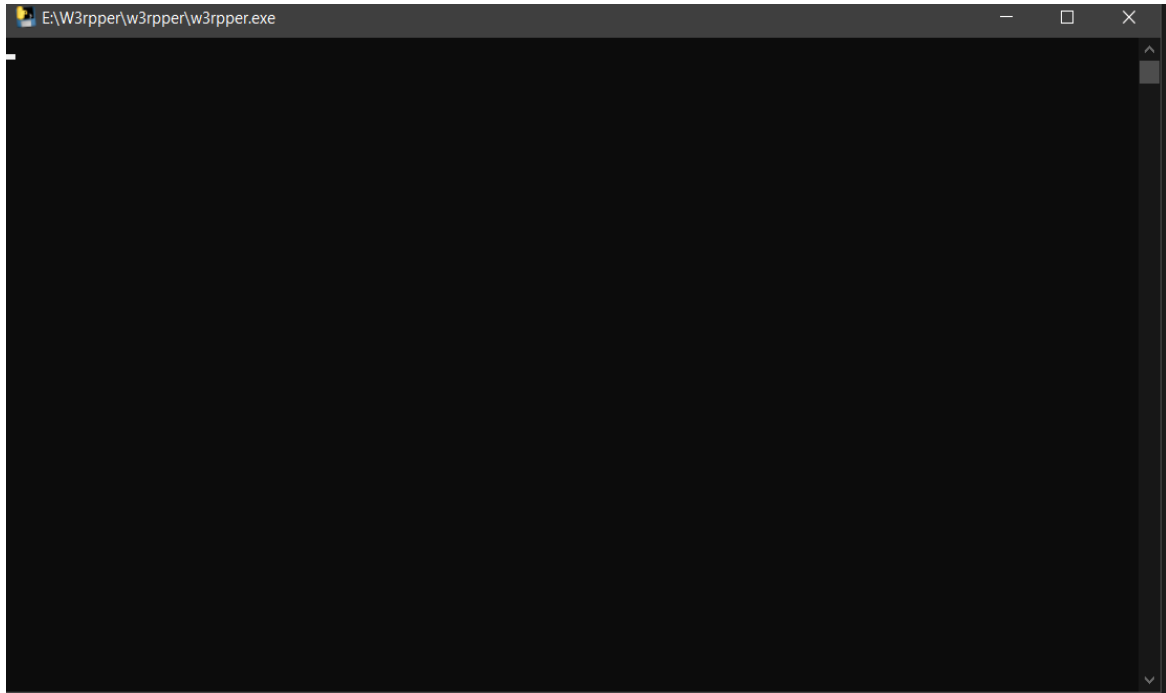


Figure 73. Example of a screen when the command prompt is loading – wait for this to finish.

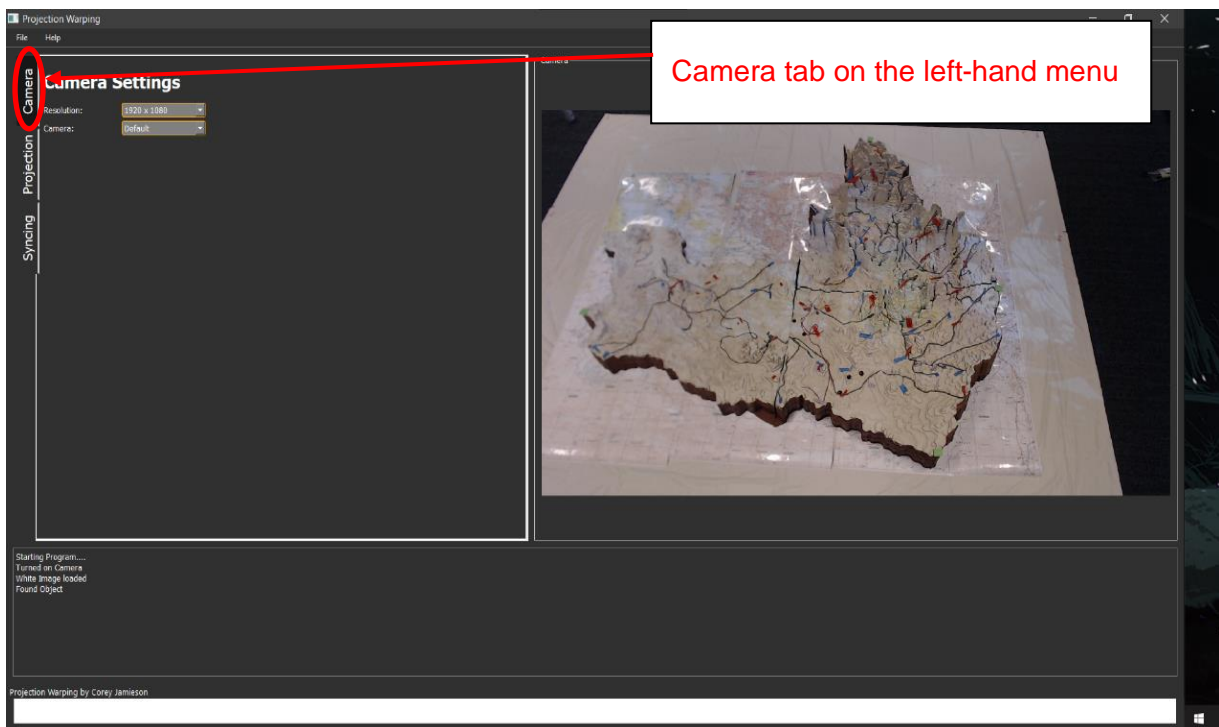


Figure 74. Home screen and location of the camera tab to change settings.



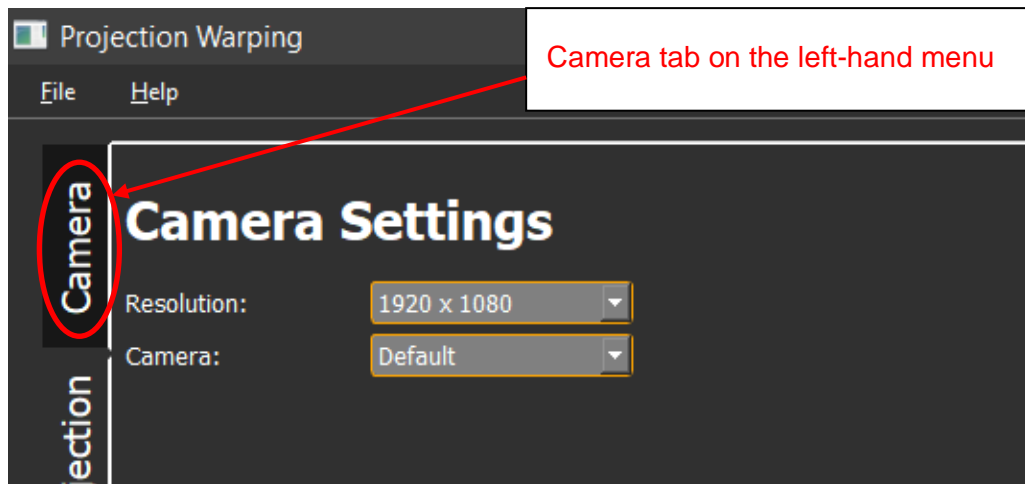


Figure 75. Correct camera settings.

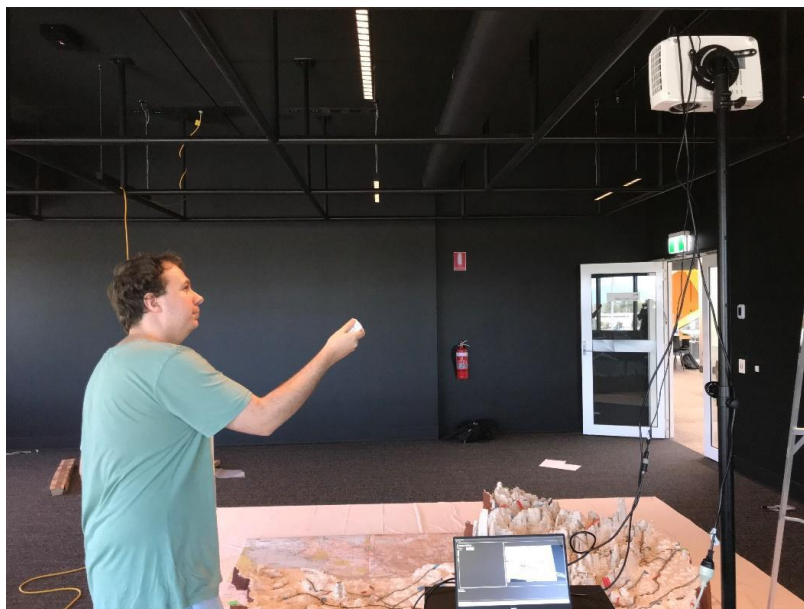


Figure 76. Start projector using the remote control.

## 5.2 Align the projector image footprint and camera with the 3D Map

It is necessary to make sure the footprint (rectangle of light) from the projector screen covers the 3D Map and that the camera can see all the 3D Map before calibrating the image.

The program provides a window with a blank white screen to help with that. You can find the window with the blank white screen clicking on the 'Task view' button on your task bar at the bottom of your screen (Figure 77) and displaying all your open windows. One of the windows will be the blank white screen (Figure 78).

**Tip:** If you can't find the "Task View" button on your taskbar, right-click the taskbar and enable "Show Task View Button" in the context menu.

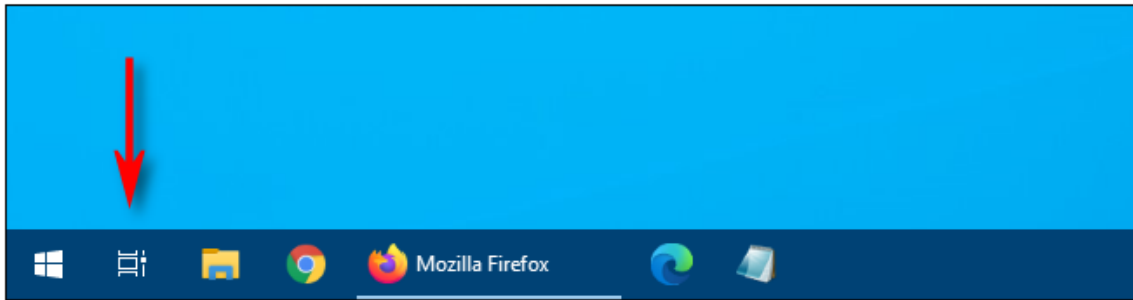


Figure 77. Click on the 'Task view' button to display all your open windows and find the window with the blank white screen.

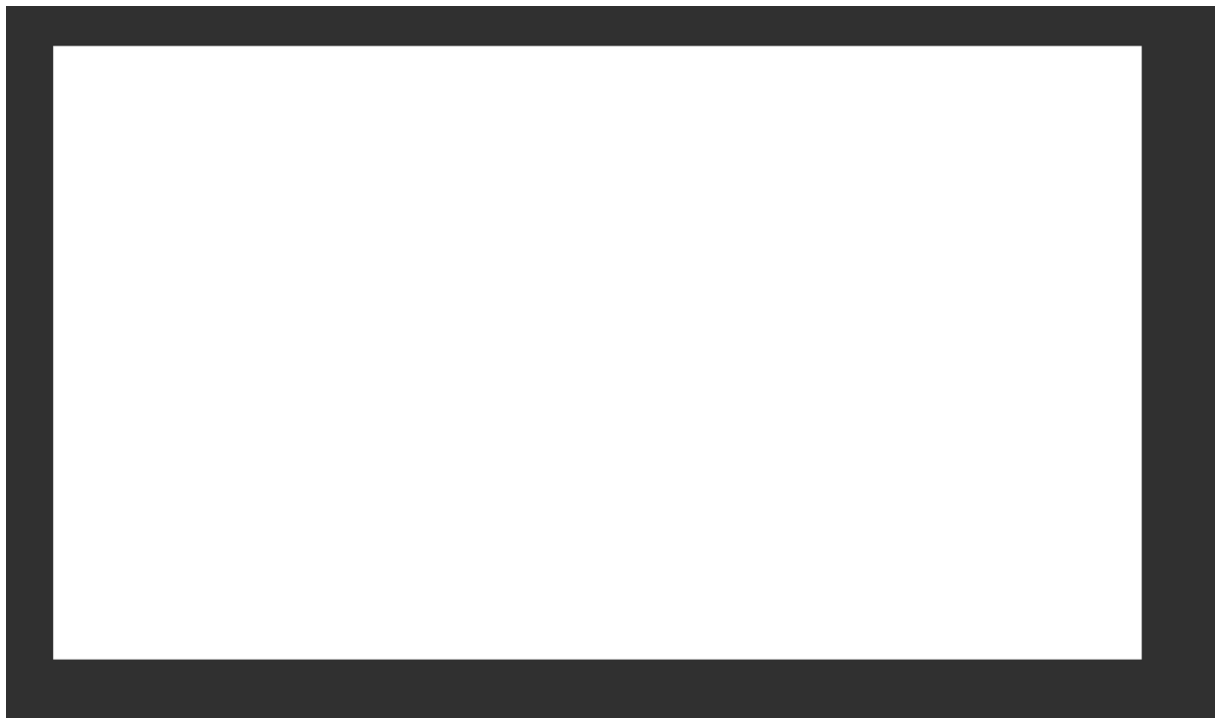


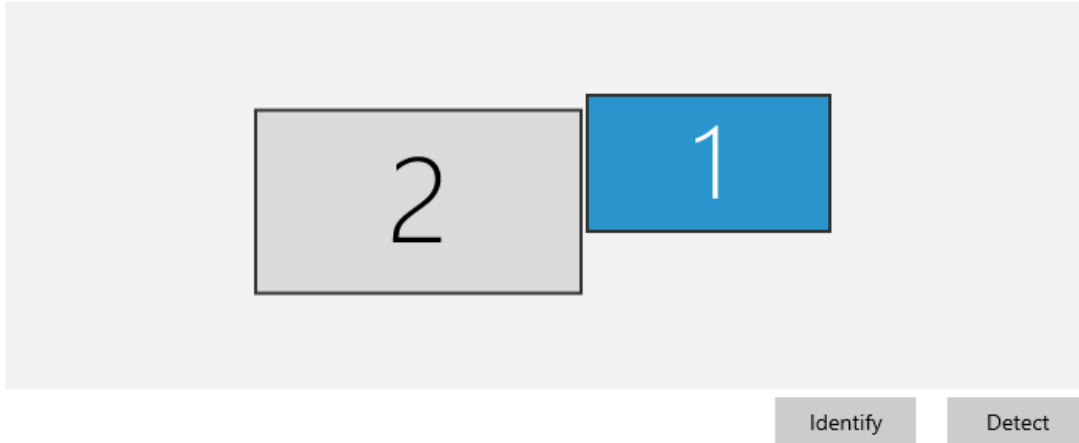
Figure 78. Blank white screen window.

For the program to run, the home screen needs to be on the computer display, and the blank white screen on the projector. Make sure that your computer is in two-screen mode (Figure 79), with the display extended (Figure 80).

# Display

## Rearrange your displays

Select a display below to change the settings for it. Press and hold (or select) a display, then drag to rearrange it.



## Brightness and colour

Change brightness for the built-in display



Night light



[Night light settings](#)

## Windows HD Colour

Get a brighter and more vibrant picture for videos, games and apps that support HDR.

[Windows HD Colour settings](#)

Figure 79. Computer in two-screen mode.



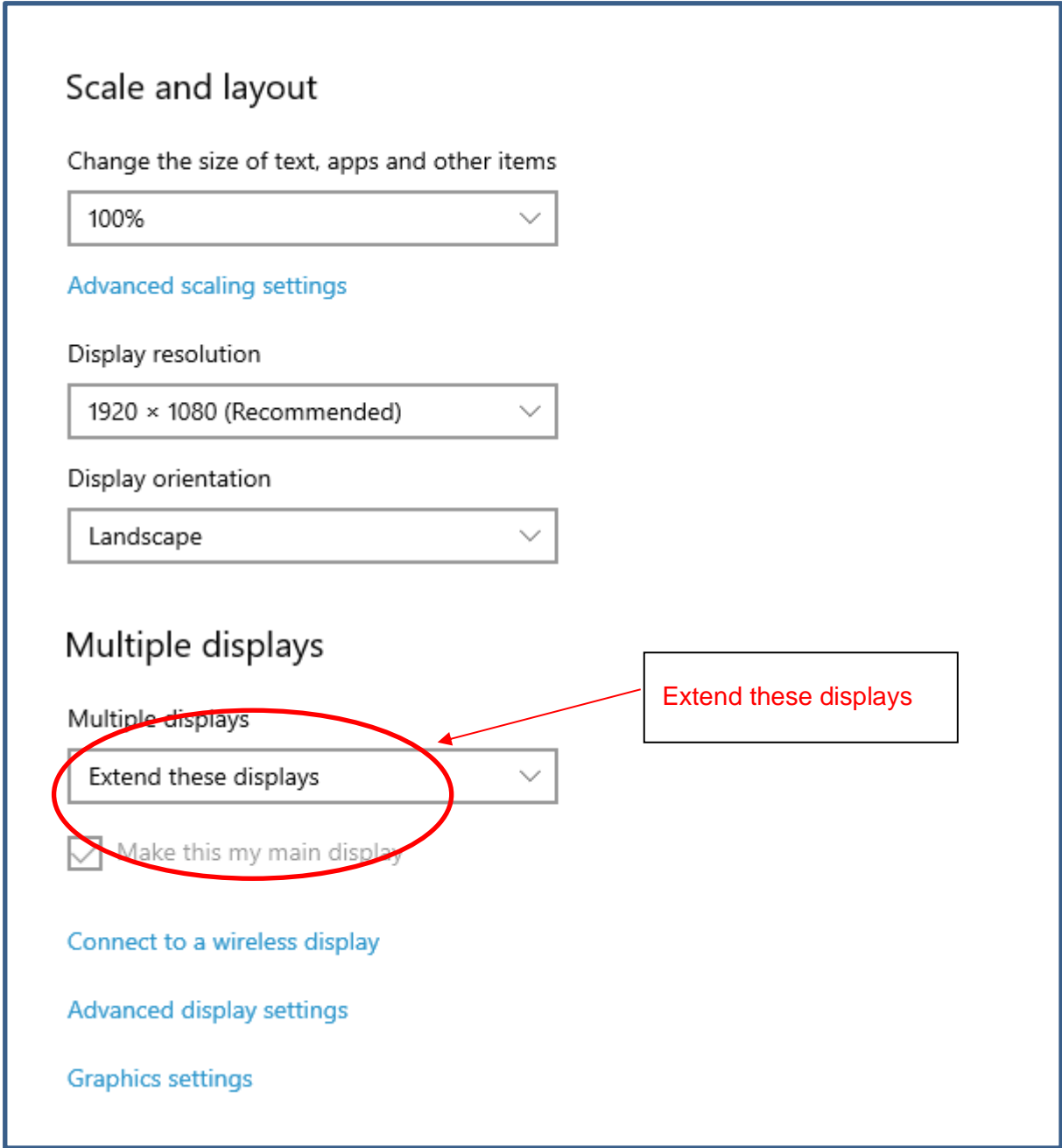


Figure 80. Extend the displays.

On your computer, move the projector's blank image onto the second display of the computer. There are many ways to do this, and most people have their preferred method – please use that. We recommend using the shortcut Window-Key + Shift + Right Arrow to quickly move a window to the projector screen. Make sure the white window is selected!

You will now see a bright rectangle of light shining onto the 3D Map. If the light does not cover all the 3D Map you will need to adjust the position of the projector or the position of the 3D Map (probably easier to move the map) (Figure 81 and 82). Darkening the room will make it easier to see the alignment of the rectangle of light with the 3D Map.



*Figure 81. Blank white image from projector shining on and covering the 3D Map – photo taken from the south side.*

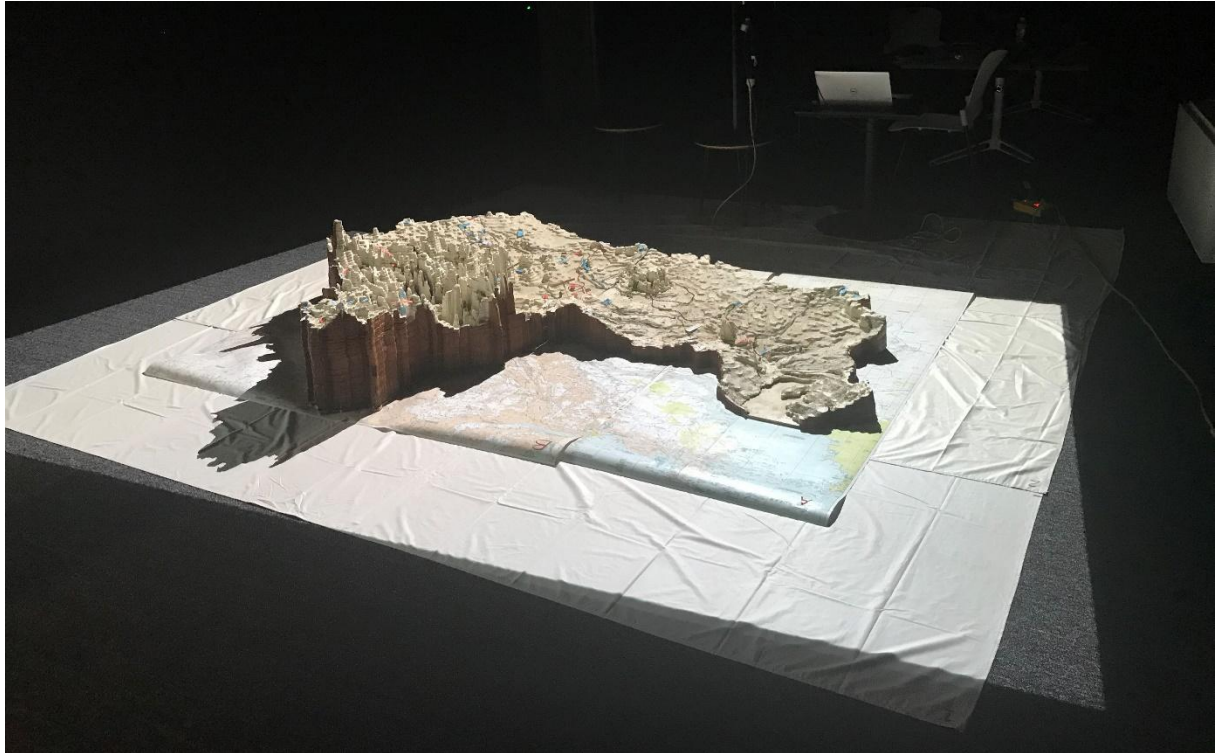


Figure 82. Blank image from projector shining on and covering the 3D Map – photo taken from north side.

Return to your computer and check if the image on the right of the home screen is displaying all the 3D Map (Figure 83). If part of the map cannot be seen, you will need to adjust the angle of the camera.



Figure 83. Camera image on the home screen is displaying all the 3D Map.



### 5.3 Syncing the projector image and the 3D Map

Now that the projector image is covering the 3D Map and the camera can see the 3D Map, the automatic syncing can be performed. There are several steps to sync the image.

#### **Step 1. Place 4 green cardboard squares on the 3D Map**

Place 4 of the green cardboard squares (from plastic bag in projector case, see Figure 50) at the extreme edges of each side. The position does not have to be exact (Figure 84, Figure 85).



*Figure 84. Place green cardboard squares on the extreme edges of each side of the 3D Map.*

Four green cardboard squares on the extreme edge of each side of the 3D Map

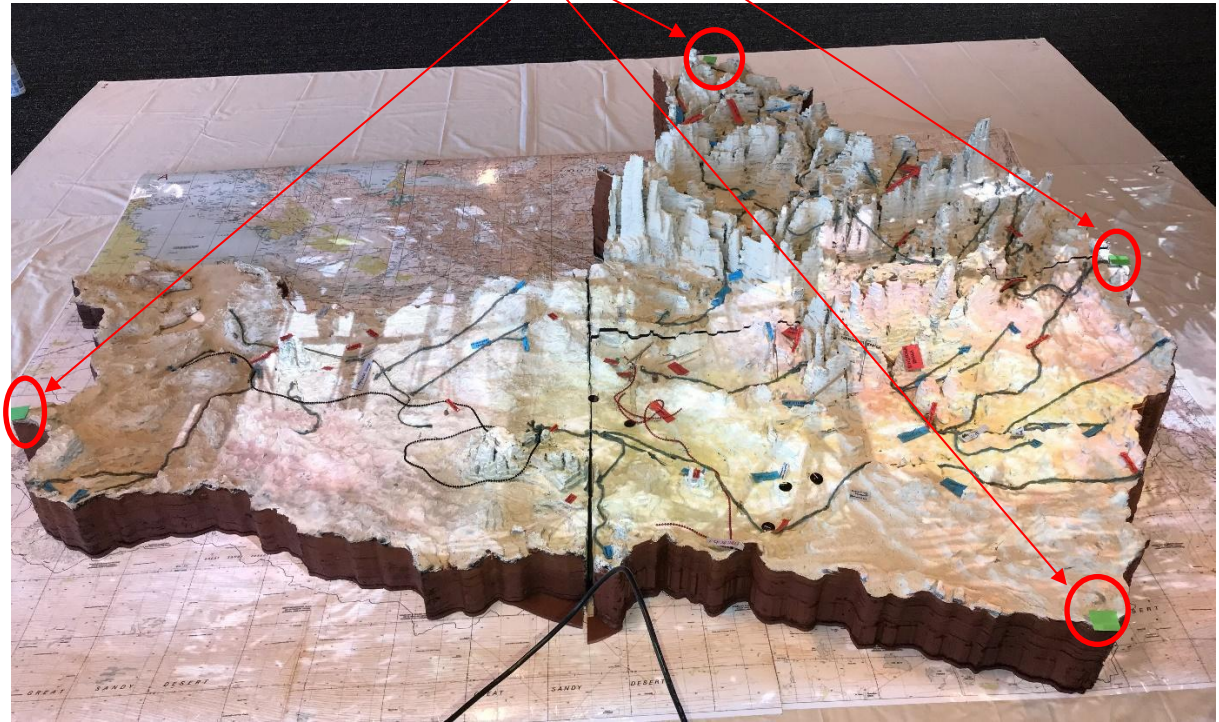


Figure 85. Place green cardboard squares on the extreme edges of each side of the 3D Map.

## Step 2. Change home screen to 'Syncing'

Next, change the home screen from 'Projection' to 'Syncing' on the left-hand menu (Figure 86). With the 'Auto Mode' button highlighted, press the 'Start syncing' button (Figure 86).

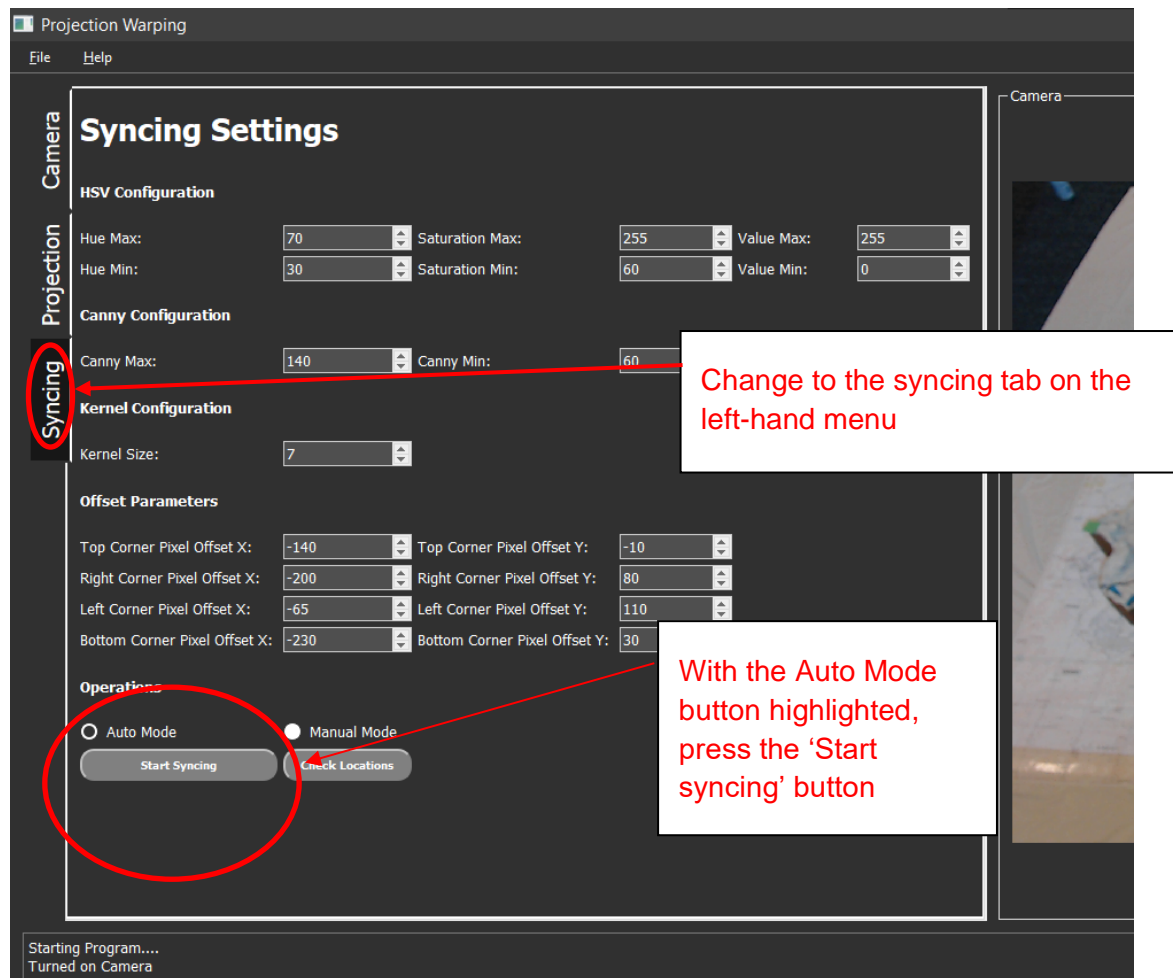


Figure 86. Change home screen to 'Syncing' and press the 'Start syncing' button.

The automatic syncing program works by linking up the green cardboard squares on the 3D Map with purple dots generated by the software (Figure 87). Once the syncing program has finished its work, there will be a good – but not perfect – fit between the image from the projector and the 3D Map (Figure 88).



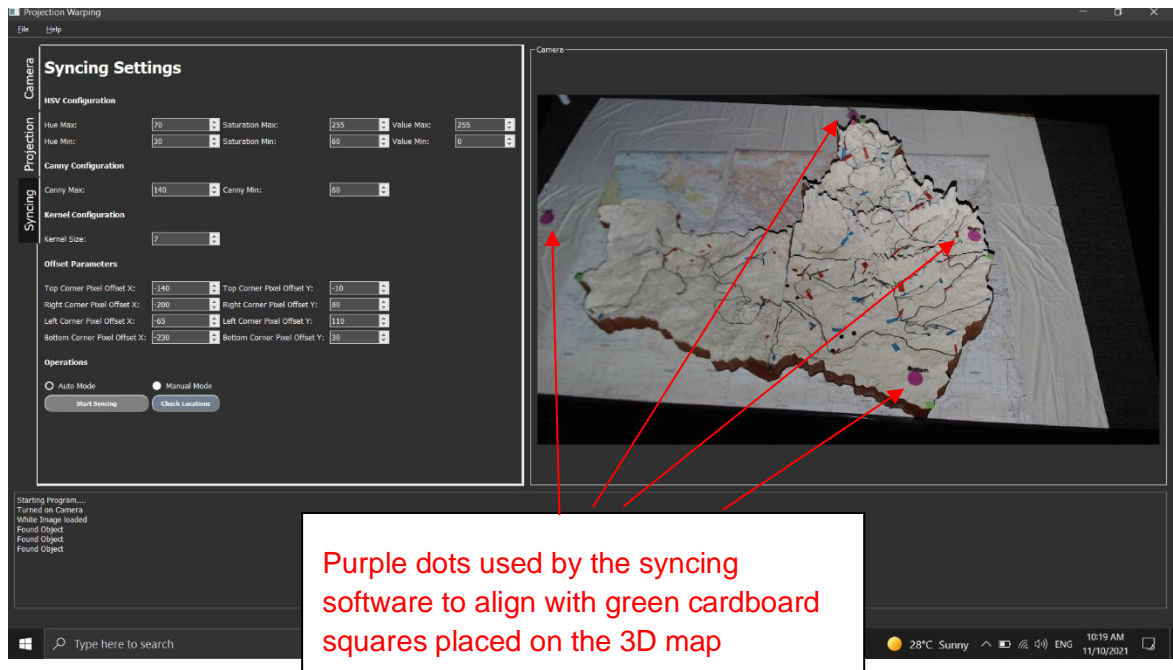


Figure 87. Purple dots used by the syncing software to align the projection to fit onto the 3D Map.

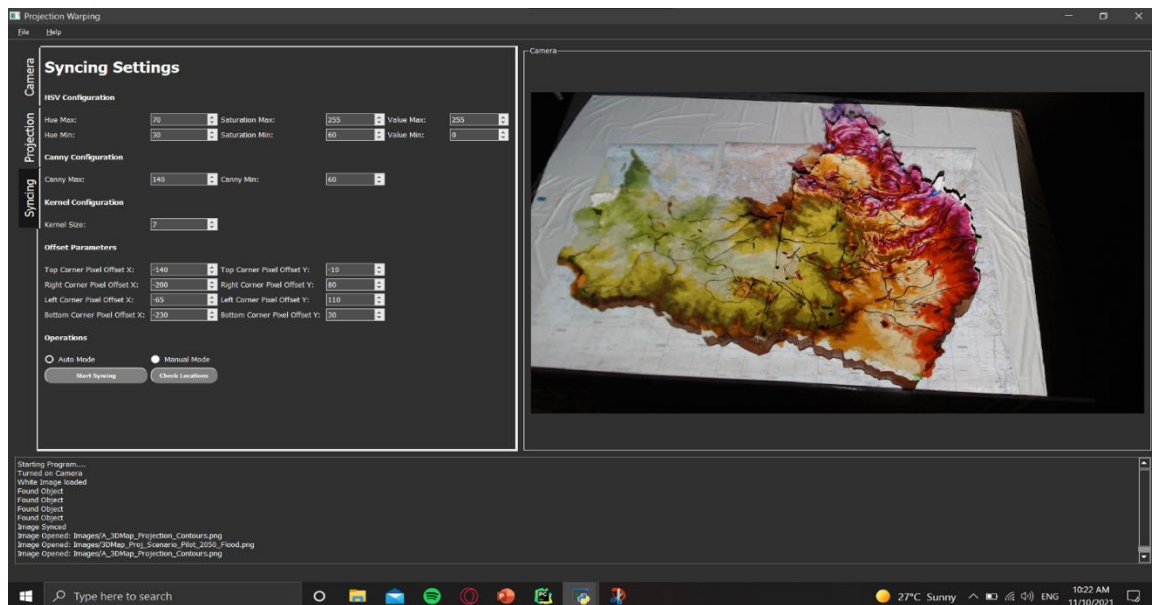


Figure 88. Image synced to fit the 3D Map.

## 5.4 Troubleshooting

If the image appears distorted after pressing the 'Start syncing' button, it may be because the camera cannot see all the green cardboard markers and so can't line these up with the purple dots.

Try the following steps to fix this problem. First, select the 'file' dropdown and select 'Display Blank Image' to reset the projection screen image to a blank image. Then in the Syncing menu click on the 'check locations' button (Figure 89).

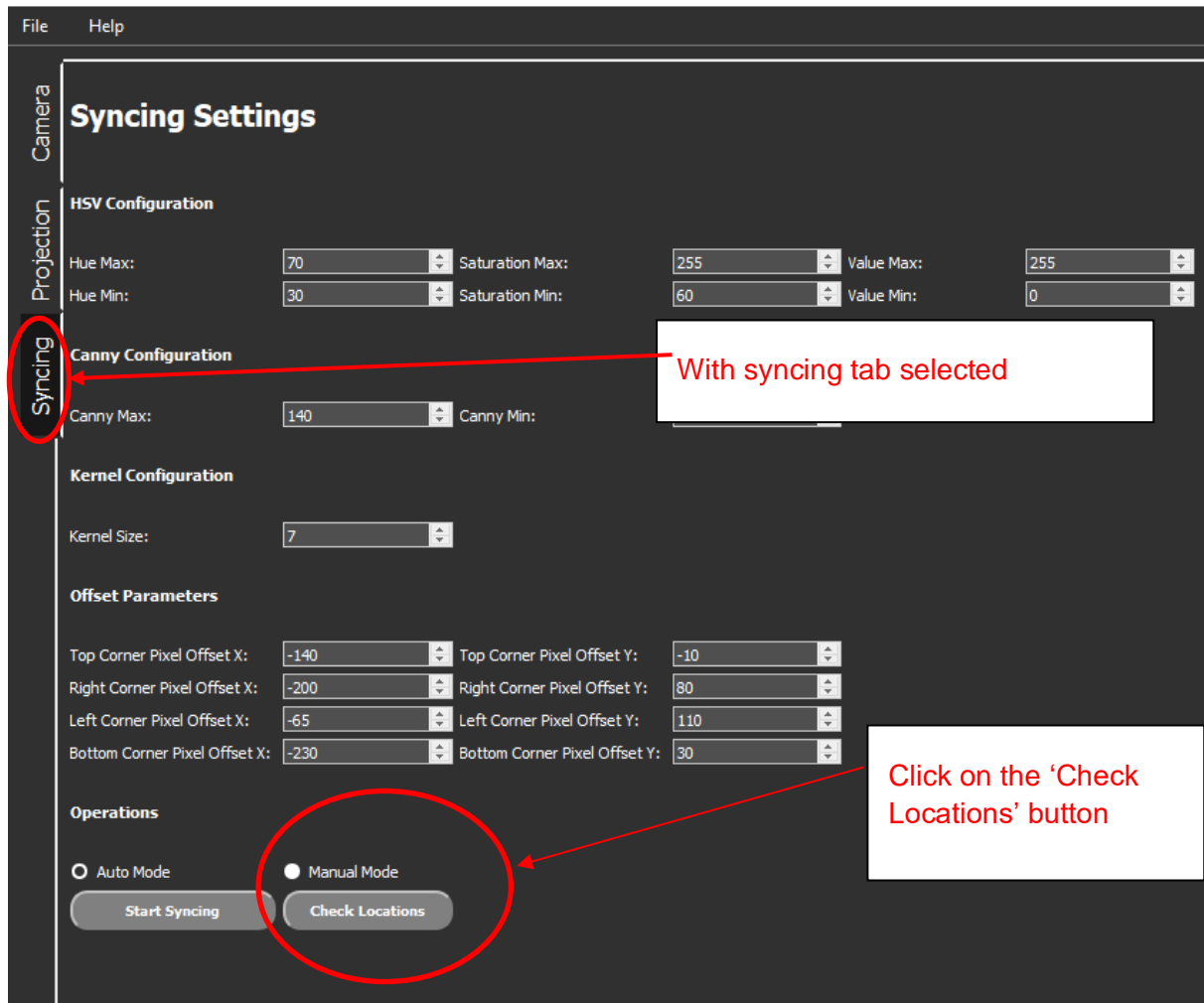


Figure 89. With syncing tab selected, click the 'Check Locations' button.

This should make the projector display the 4 purple circles (Figure 87). If there are fewer than 4, it means that the camera cannot see one of the markers. You will need to adjust the camera's position or the 3D Map position.

When 4 purple circles are in the camera's view, press the 'Start syncing' button as it should work. If not, try again until it does work!

## 5.5 Adding images

The software allows for more images to be added. To do this, open up the folder called 'Images' located in the same directory as the 'w3rpper' application (Figure 70). Once open, you can paste the new images into this file. In the w3rpper application, under the 'Projection' tab, there is a 'Re-detect' button (Figure 90). This will find any new images without closing the program. You can also select this option from the 'File' taskbar dropdown. Closing and re-opening the program will also detect new images in the image folder.

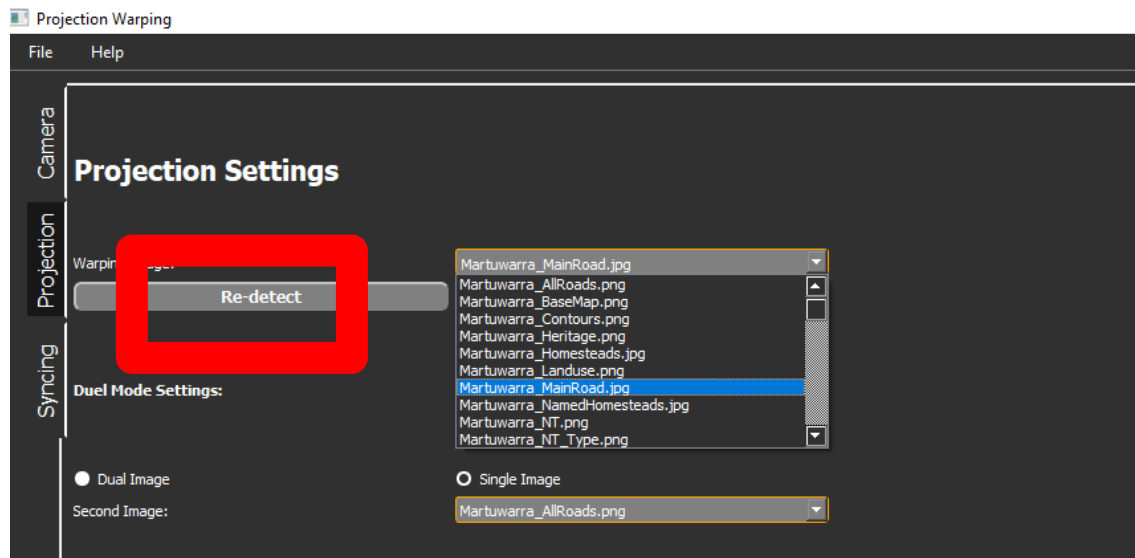


Figure 90. Location of the 'Re-detect' button.

## 5.6 Closing the program

When finished with the program, there are a few ways to close it. In the 'File' taskbar dropdown, there is an exit button which will close all windows. If you close the program from the 'X' it will only close the current window and not the projection window or command-prompt launcher. You will need to close all these windows as well. The keyboard shortcut Alt + F4 will also close all the windows.

## 5.7 Known bugs

- Pushing the 'Start syncing' button with no markers detected will crash the program.
- Changing the camera to a non-existent camera may cause the camera to stop working. Restart the program if this is the case.
- Pushing the 'Start syncing' button while an image is already on the model will cause the warping to go crazy/crash.
- Manual mode may crash if the configuration settings have changed to values it cannot deal with.

Please avoid these actions and restart the program if it crashes.



## 6. Displaying spatial data on the 3D Map

### 6.1 Choosing images

On your computer, change the left-hand menu from camera to projection tab (Figure 91).

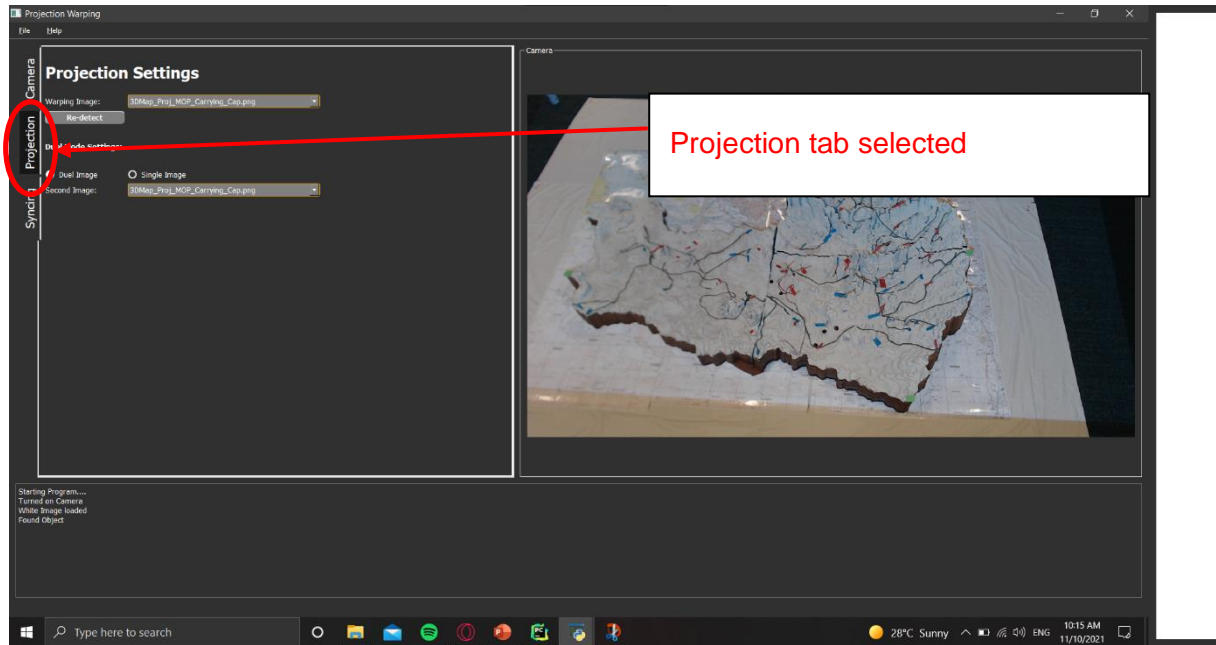


Figure 91. Change home screen from camera to projection on the left-hand menu.

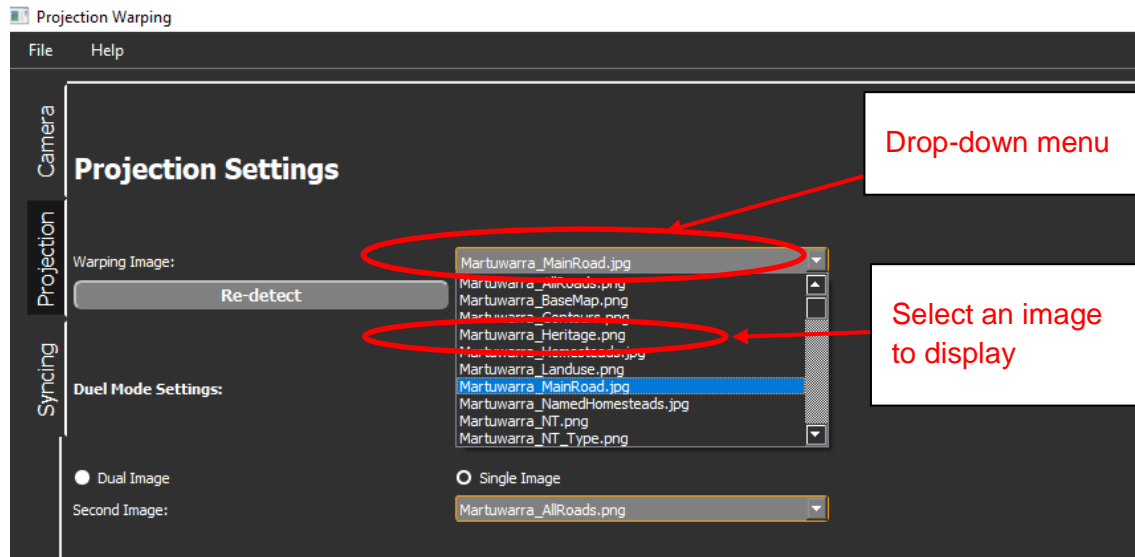


Figure 92. Select the image that you want to display.

Now you can use the drop-down menu to select which map you would like to display over the map (Figure 92). By selecting the dual image button, you can display 2 images overlapping each other (Figure 93).

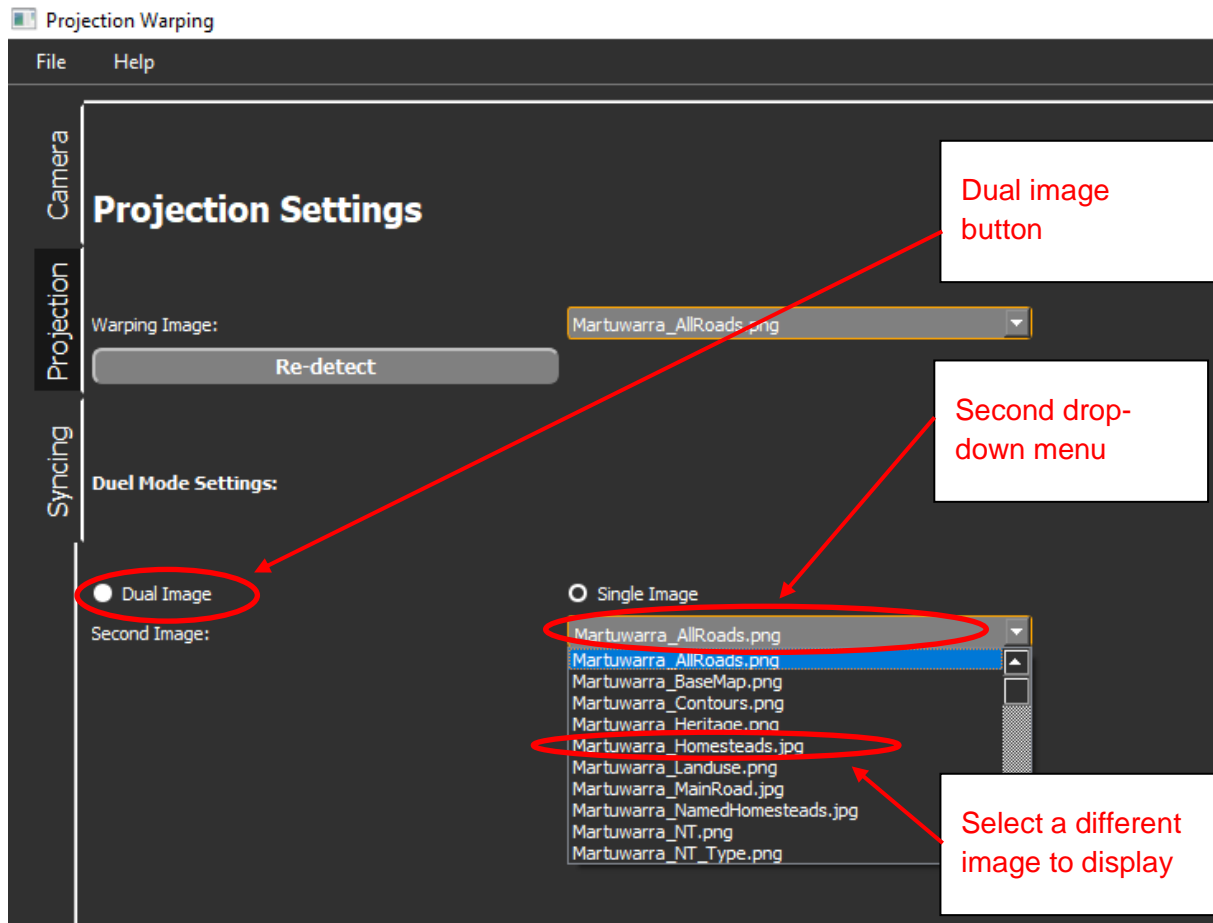


Figure 93. Dual image display.

## 6.2 Available spatial data

The available images for display include: images with single data types (e.g. contours), images with multiple data types, combined and modelled (e.g. land systems, grazing potential), and fire and flood (natural hazard) images. These images were primarily developed through the [Multi-objective planning in northern Australia](#) project.<sup>8</sup>

The images do not include data for the Fraser River catchment. This catchment was added to the 3D Map later and reflects the Traditional Owners' views that the mouth of the Martuwarra is to the west of the mouth of Fraser River. Unfortunately, this information came forward too late for us to add the Fraser catchment to the spatial data, but it has been added to the 3D Map.

The images are not maps, and do not include a scale bar, a north arrow or a legend. Including these causes difficulties with displaying the image on the 3D Map surface. Information relevant to the legends appears on the next pages. We have added a north arrow and scale bar to the first image – it is the same for all other images.

<sup>8</sup> <https://www.nespnorthern.edu.au/projects/nesp/multi-objective-planning-northern-australia/>

## 6.3 Single data type images

### 6.3.1 Contour map

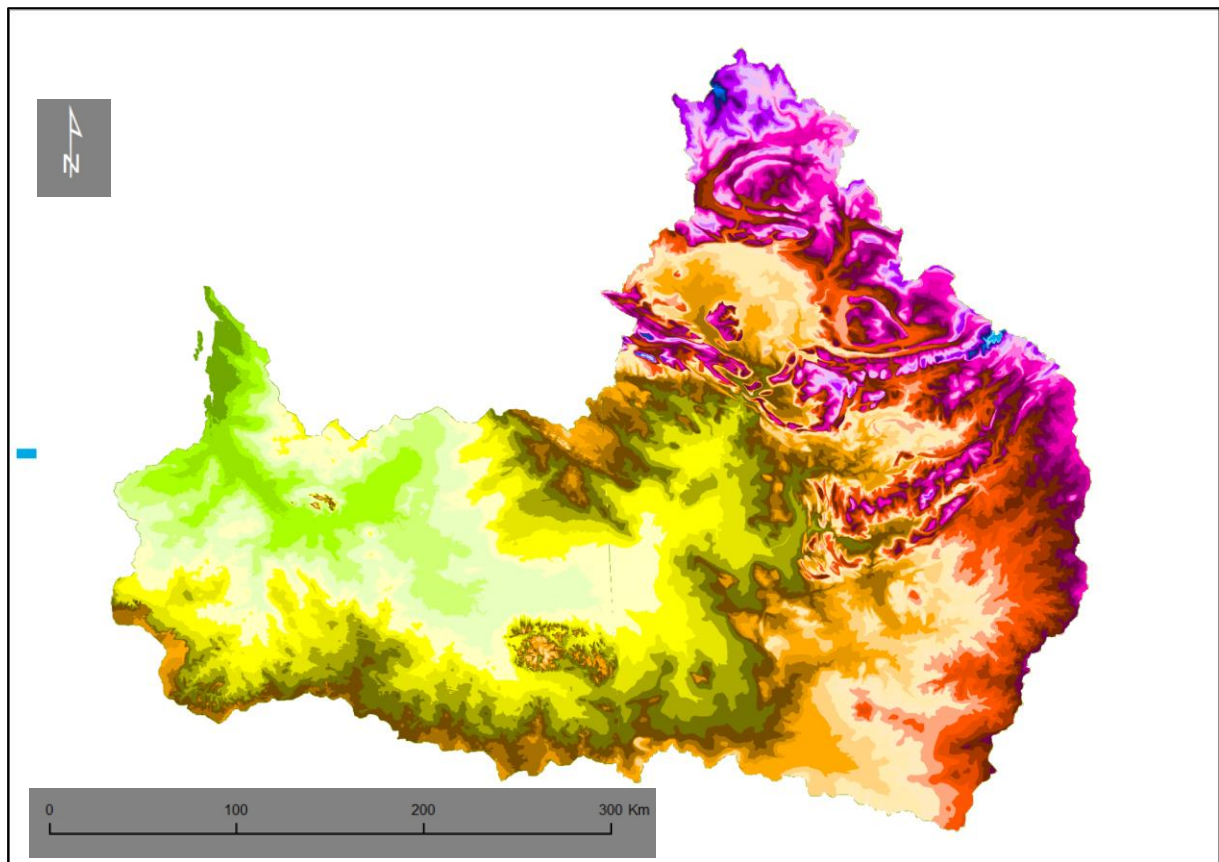


Figure 94. Contour map.

A basic contour map of the region (Figure 94) is the default projection image.

In the drop-down menu, this image is named 'Martuwarra\_Contours.png'.

This shows elevation above sea level. Lowest areas are green, then moving through to cream and yellow, olive, and brown, orange to red to burgundy and finally magenta to pink and finally the highest peaks are blue. (Legend to be supplied).



### 6.3.2 Google Earth image



Figure 95. Google Earth image.

Figure 95 is a true colour satellite image, from Google Earth (2017), clipped to the edges of the Fitzroy River catchment.

In the drop-down menu, this image is named 'Martuwarra\_BaseMap.png'.

### 6.3.3 Main roads

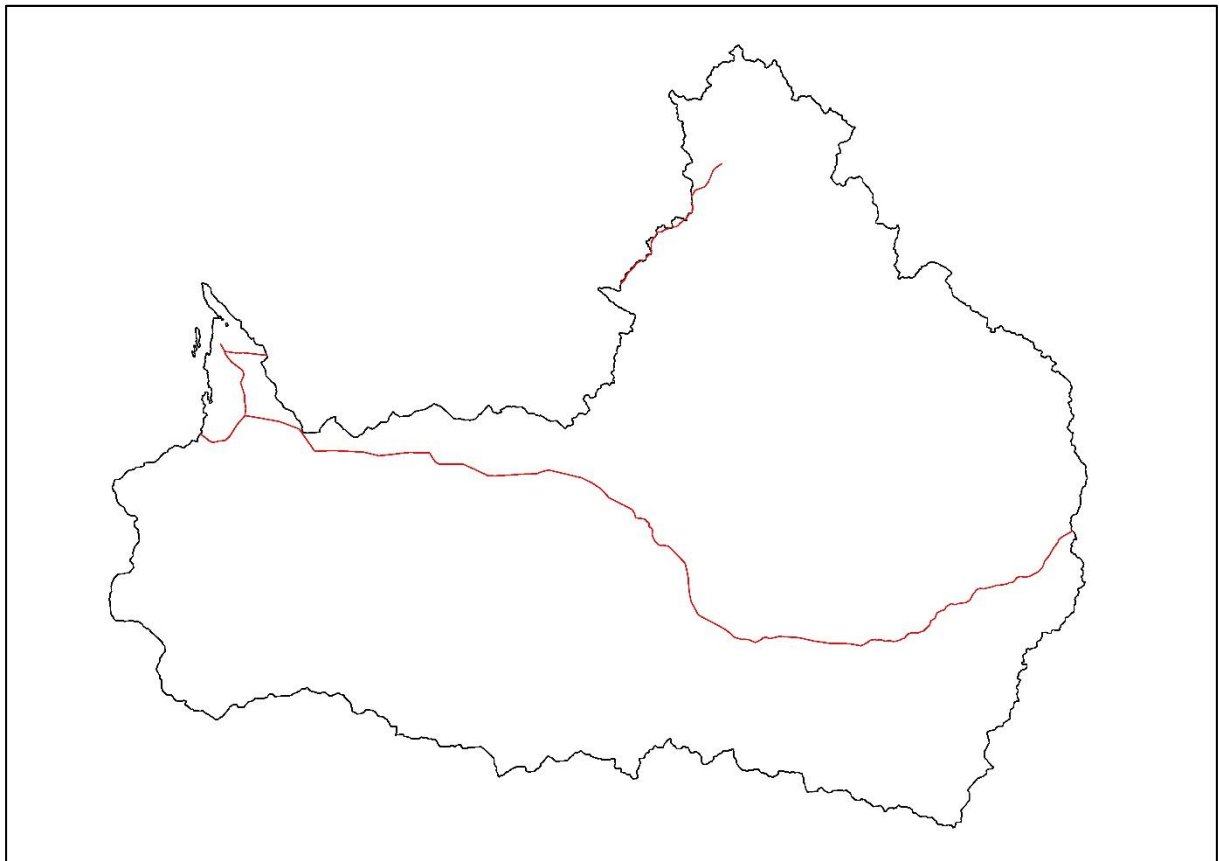


Figure 96. Main roads.

— Major Road

Figure 95 shows the main roads in the Martuwarra catchment.

The road to Halls Creek and the sections of the Gibb River Road in the catchment are included. This map will make it easier for people to locate themselves.

In the drop-down menu, this image is named 'Martuwarra\_MainRoad.jpg'.

### 6.3.4 All roads

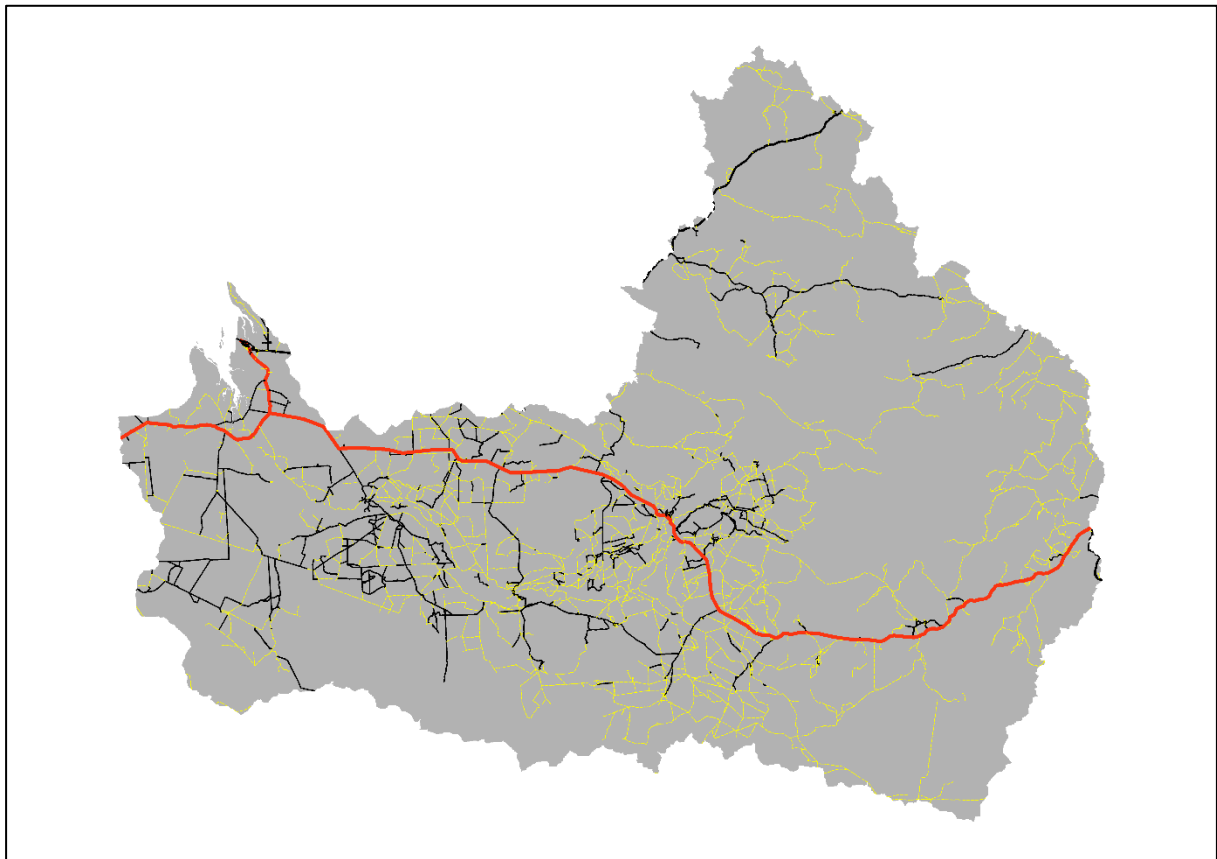


Figure 97. Broad classification of mapped roads of the Martuwarra catchment.

#### Road types






-  Highways
-  Main roads
-  Minor roads
-  Laneways
-  Tracks

Figure 97 shows the mapped roads in the catchment according to a broad classification.

In the drop-down menu, this image is named 'Martuwarra\_AllRoads.jpg'.



### 6.3.5 Native Title

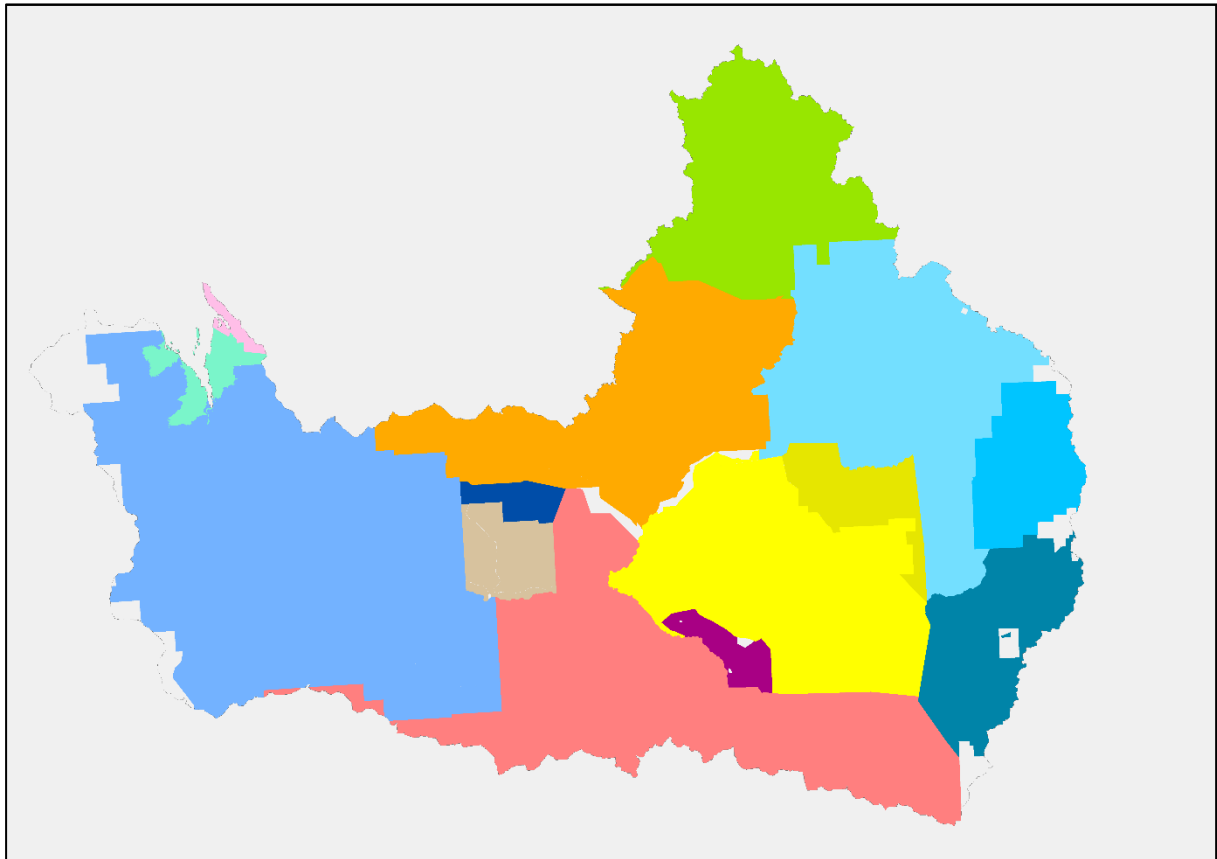


Figure 98. Native Title areas.

#### Native Title group

Bunuba	Kija	Wanjina-Wunggurr
Ginyjawarni Yoowaniya Riwi	Ngarrawanji	Yi-Martuwarra Ngurrara
Gooniyandi	Nyikina Mangala	Yungngora
Jaru	Tiyatiya	Other

This image (Figure 98) shows the Native Title boundaries for all the Traditional Owner groups in the catchment, both exclusive and non-exclusive, determined and pending. This image was prepared in October 2021 and is not automatically updated.

In the drop-down menu, this image is named 'Martuwarra\_NT.png'.

### 6.3.6 Native Title exclusive and non-exclusive

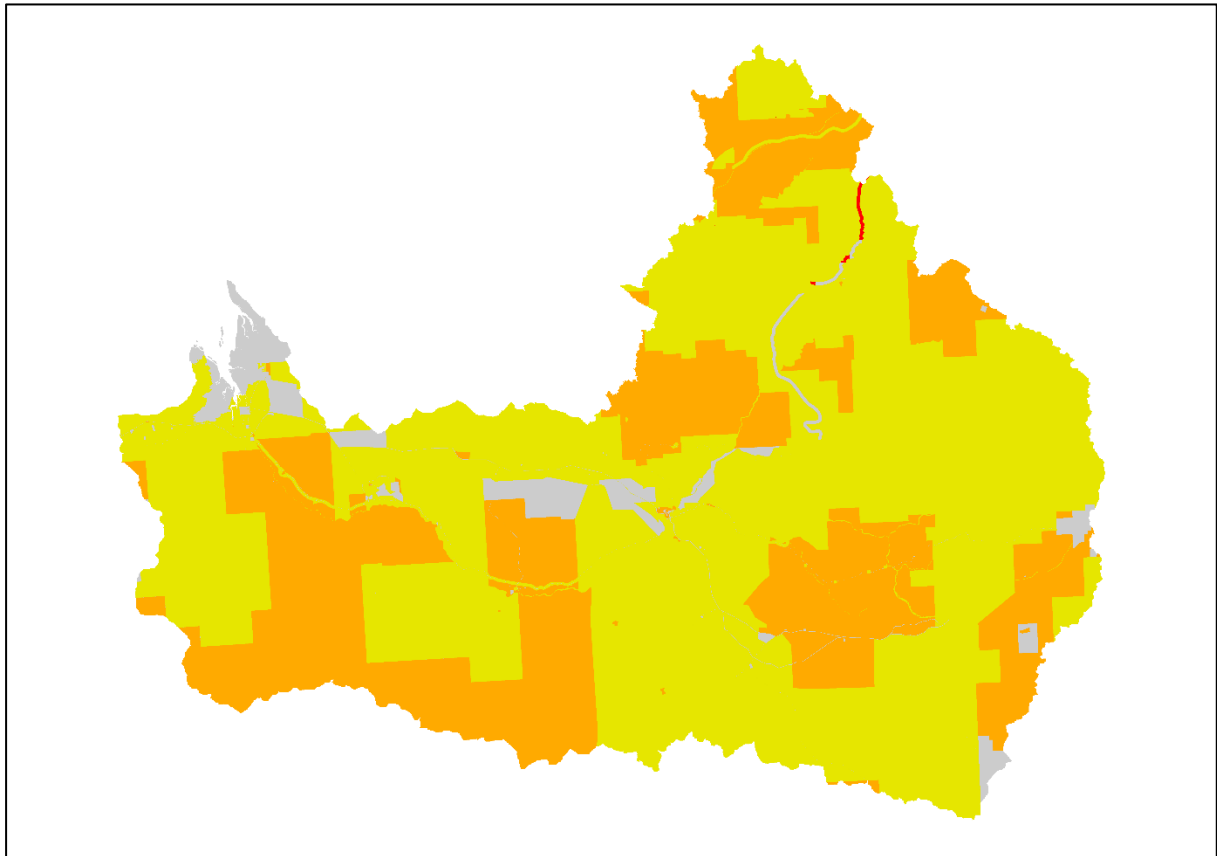


Figure 99. Types of Native Title.

#### Native Title determination (outcomes)

- Native title exists (exclusive)
- Native title exists (non-exclusive)
- Native title extinguished
- Native title does not exist

This image (Figure 99) shows the Native Title types in the catchment as of October 2021.

Non-exclusive areas are where the Native Title rights co-exist with the rights of others, such as pastoralists.

In the drop-down menu, this image is named 'Martuwarra\_NT\_Type.png'.

### 6.3.7 Pastoral station boundaries

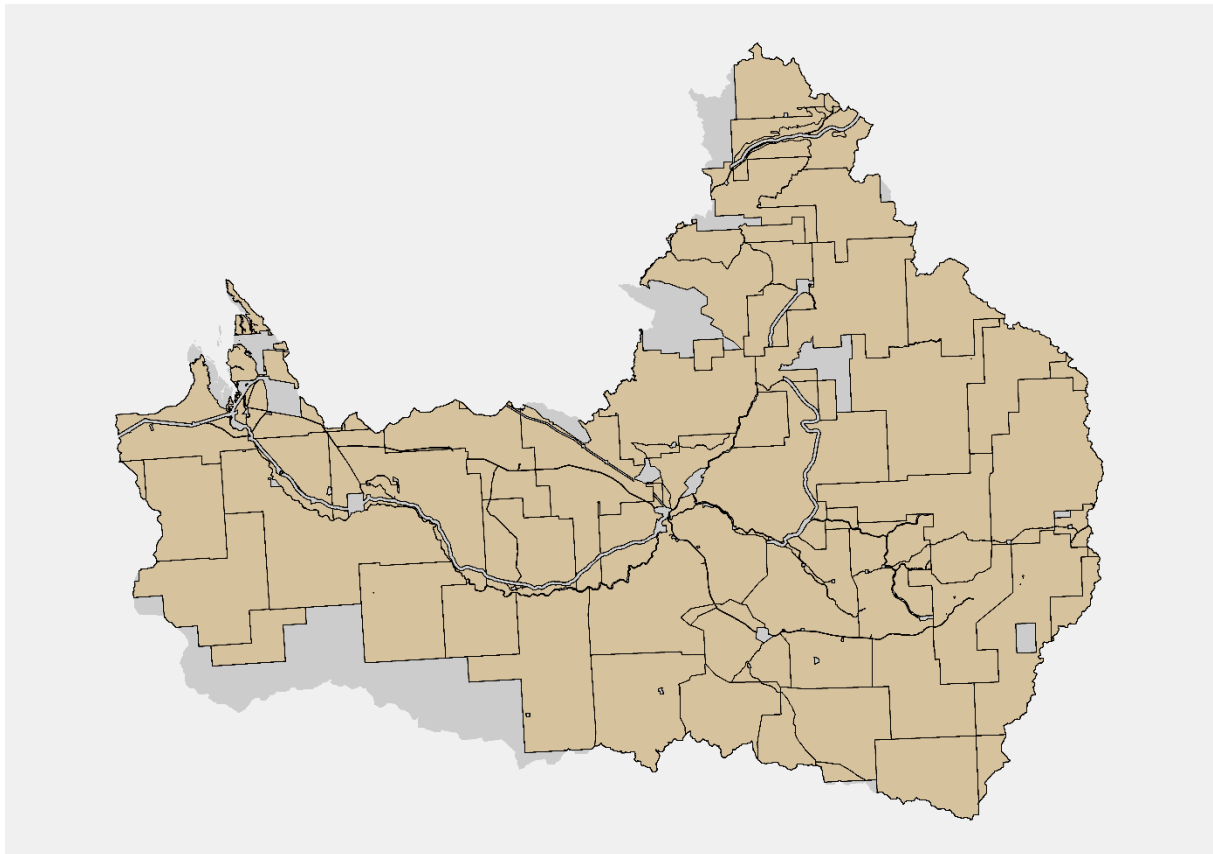


Figure 100. Boundaries of pastoral stations of the Martuwarra catchment.


 Station boundaries

Figure 100 shows the station boundaries in the catchment.

In the drop-down menu, this image is named 'Martuwarra\_Stations.png'.



6.3.8 Pastoral stations with names

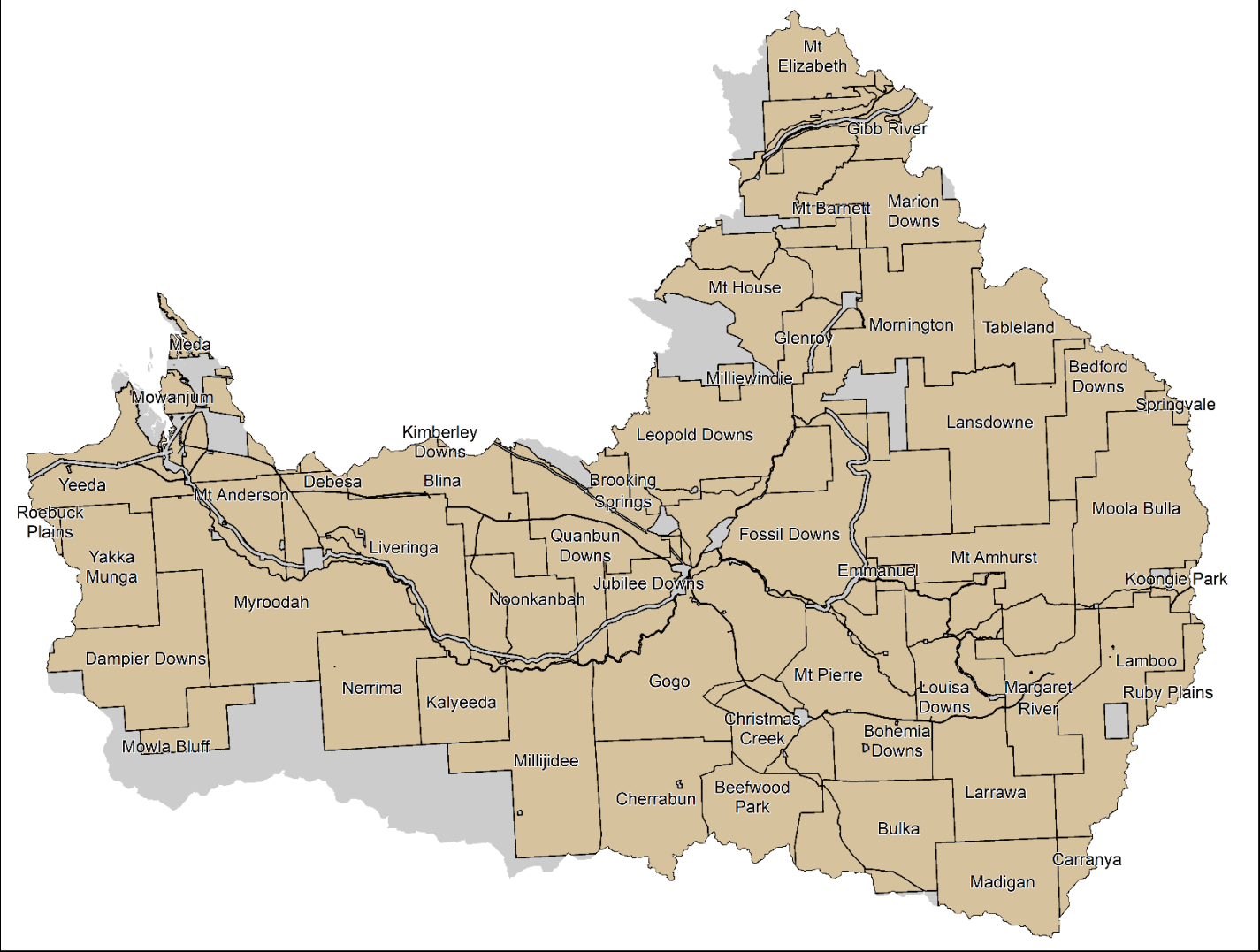


Figure 101. Pastoral stations with their names. Image called 'Martuwarra\_NamedStations.png'

### 6.3.9 Homesteads

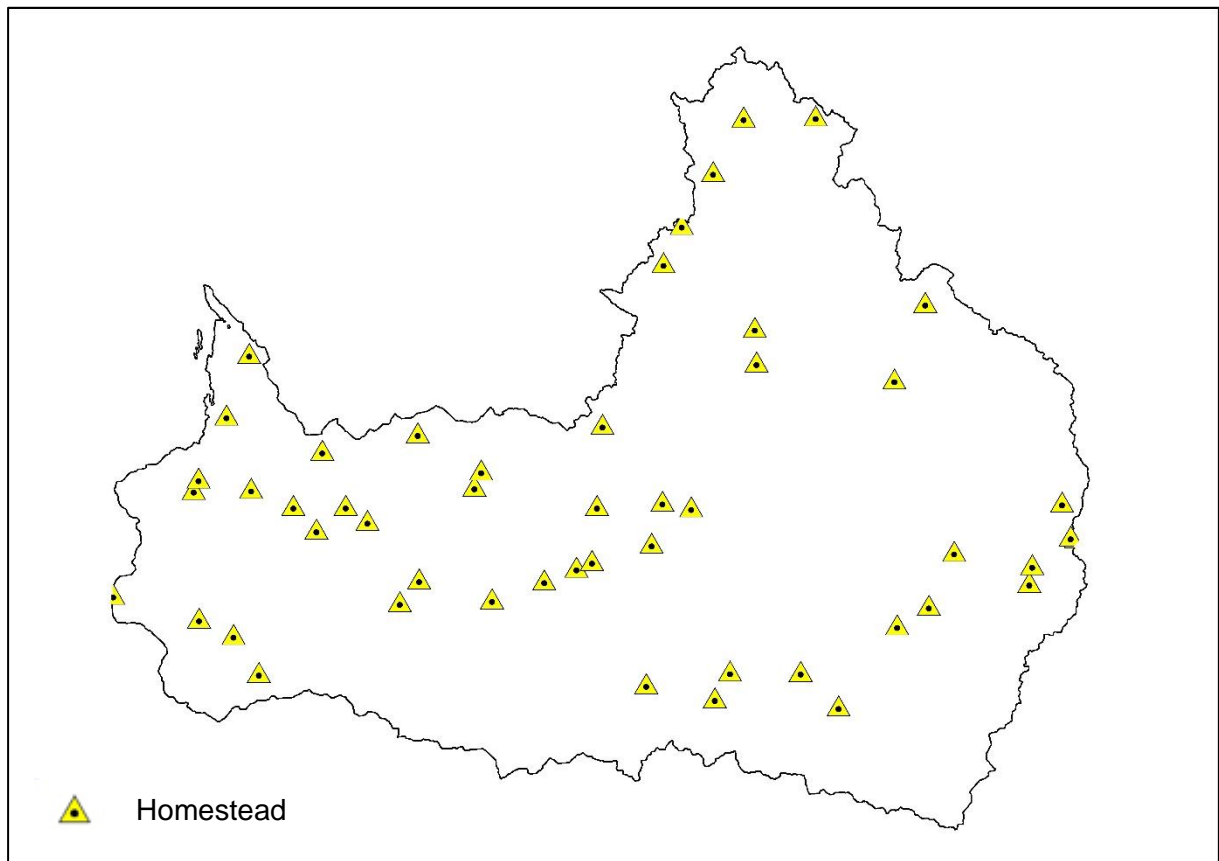


Figure 102. Location of station homesteads.

Figure 102 shows the location of the station homesteads.

In the drop-down menu, this image is named 'Martuwarra\_Homesteads.jpg'.

### 6.3.10 Homesteads with names

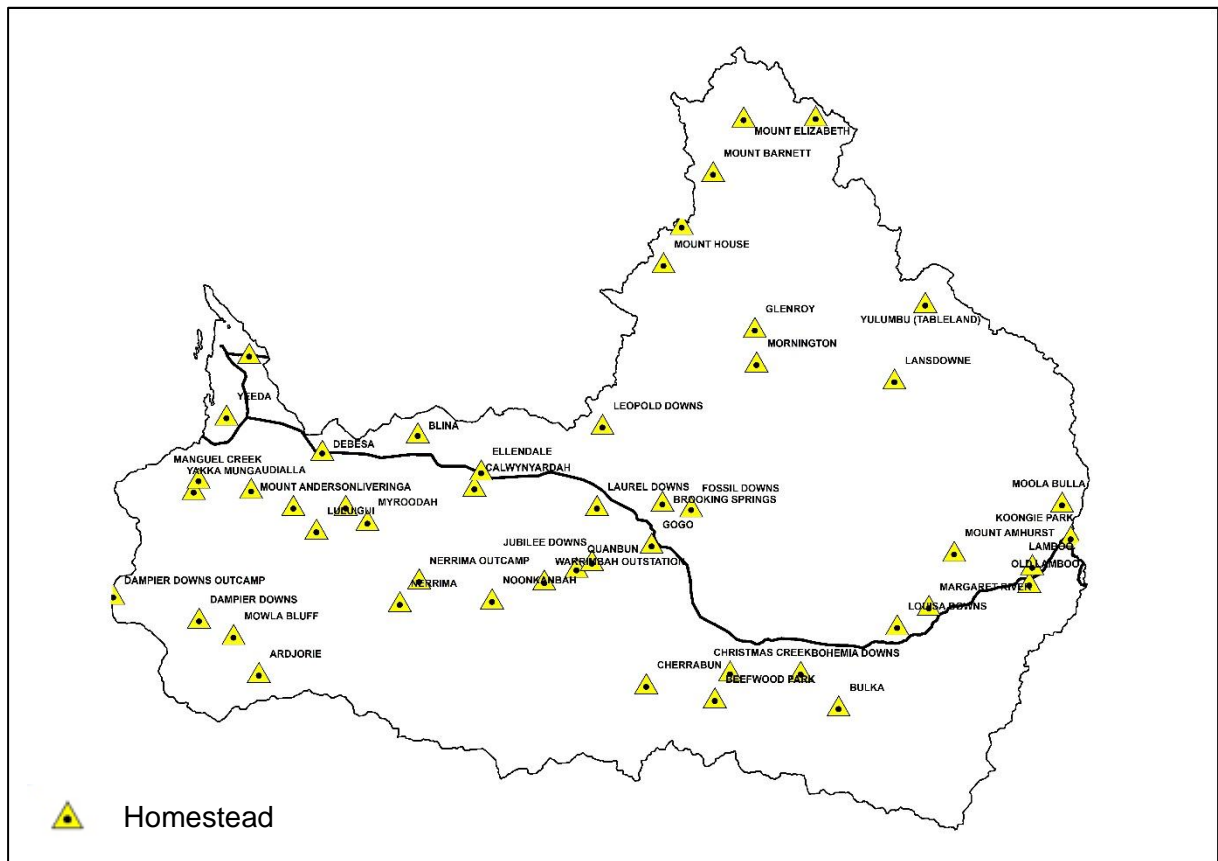


Figure 103. Location of homesteads with their names.

Figure 103 shows the location of the station homesteads.

In the drop-down menu, this image is named 'Martuwarra\_NamedHomesteads.jpg'.



### 6.3.11 Land use

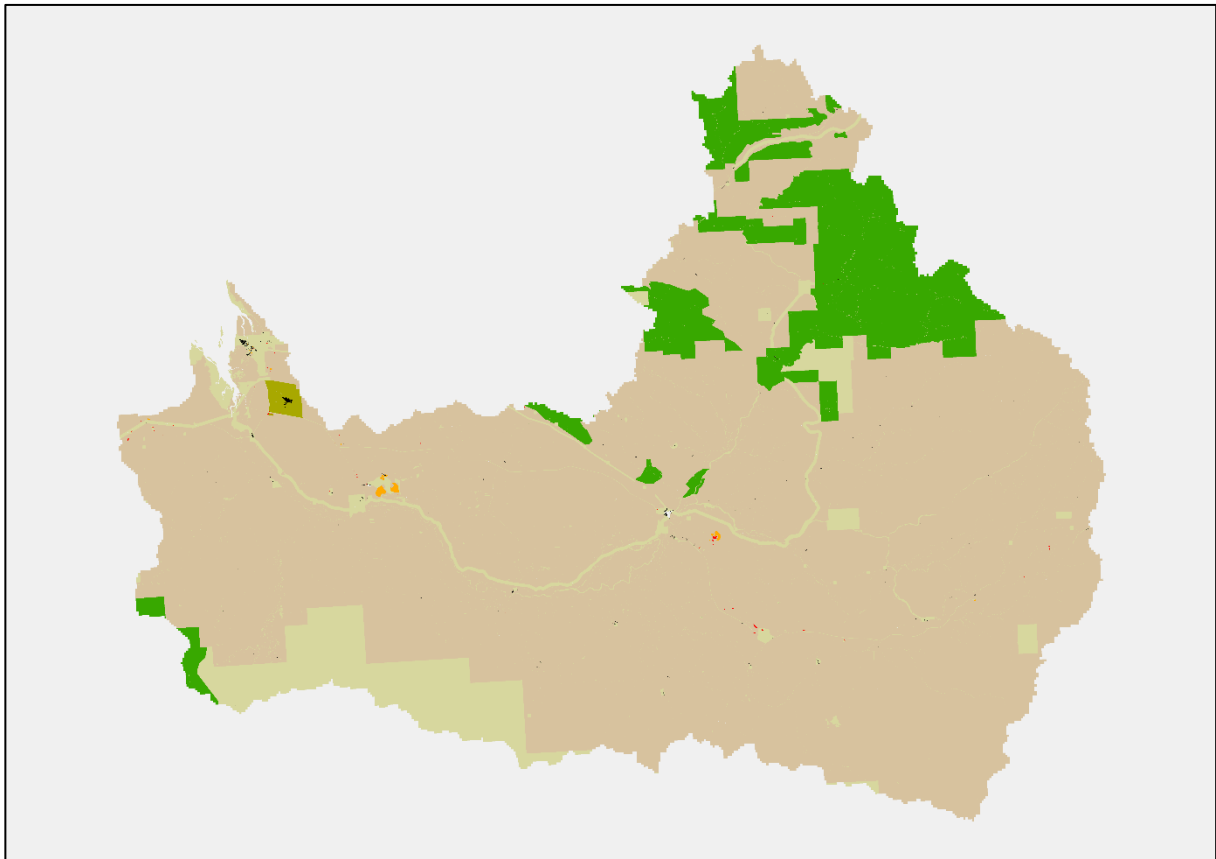


Figure 104. Current broad land uses in the Fitzroy catchment.

#### Broad land uses

	Pastoral		Intensive agriculture
	Minimal use		Mining
	Protected area		Other intensive uses
	Military Area		

This land-use image (Figure 104) is based on latest land-use map (around 2018) and updated with major changes, mainly related to intensive uses. Other intensive uses include infrastructure, industrial, commercial, residential, and services.

In the drop-down menu, this image is named 'Martuwarra\_LandUse.png'.

### 6.3.12 National Heritage listing area

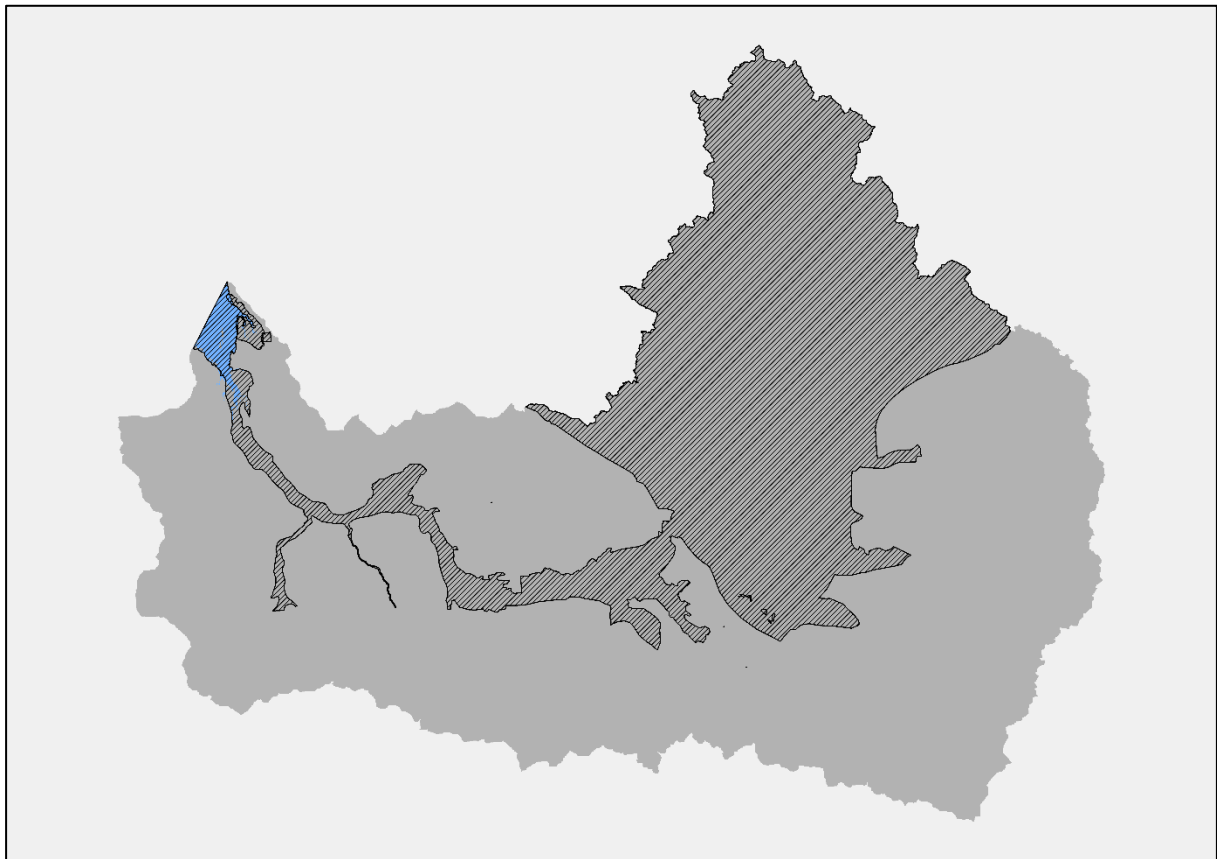
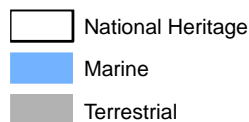


Figure 105. National Heritage listing area.



A large part of the Martuwarra catchment (Figure 105) is listed as National Heritage under the Environment Protection and Biodiversity Conservation Act 1999.

Most of it is listed under the West Kimberley National Heritage Listing, which includes terrestrial and marine areas. More information about what this means for the protection and management can be found at [National Heritage Places – West Kimberley](https://www.awe.gov.au/parks-heritage/heritage/places/national/west-kimberley)<sup>9</sup>.

In the drop-down menu, this image is named 'Martuwarra\_Heritage.png'.

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<sup>9</sup> <https://www.awe.gov.au/parks-heritage/heritage/places/national/west-kimberley>

## 6.4 Multiple data type images

### 6.4.1 Land systems

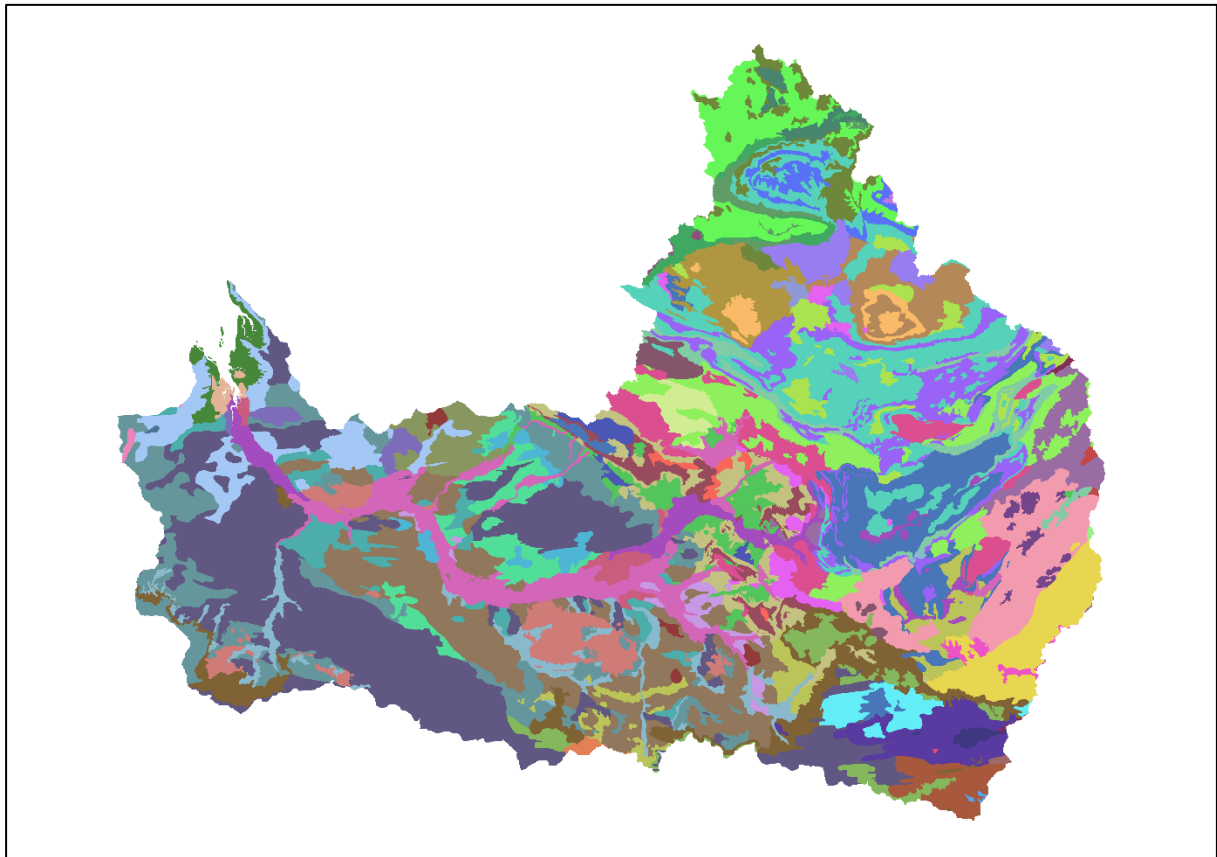


Figure 106. Land systems of the catchment.

Alexander	Camelgooda	Duffer	Glenroy	Luluigui	Pigeon	Tableland
Amy	Carpentaria high	Egan	Gogo	Mamilu	Pinkerton	Wanganut
Bannerman	Carpentaria low	Fork	Isdell	Margaret	Precipice	Wave Hill
Barry	Chestnut	Forrest	Karunje	Mulan	Reeves	Wickham
Barton	Clifton	Fossil	Kennedy	Myroodah	Richenda	Windjana
Bohemia	Coonangoody	Fraser	Koongie	Napier	Rose	Winnecke
Buldiva	Cornish	Geebee	Landrigan	Neillabublica	Ruby	Yeeda
Bulka	Cowendyne	Gidgia	Leopold	O'Donnell	Sisters	
Burrmundi	Djada	Gilgie	Looingnin	Oscar	Spincrete	
Calwynyardah	Dockrell	Gladstone	Lubbock	Pago	St George	

Land systems (Figure 106) are identified through combining data about landscape, soils and vegetation types to classify areas into land classes that describe the areas based on its. The land systems of the catchment were derived by the Western Australian Department of Agriculture. Each colour represents one of the 67 land systems found in the Fitzroy catchment.

In the drop-down menu, this image is named 'Mult\_Martuwarra\_LandSystems.png'.



## 6.4.2 State land types

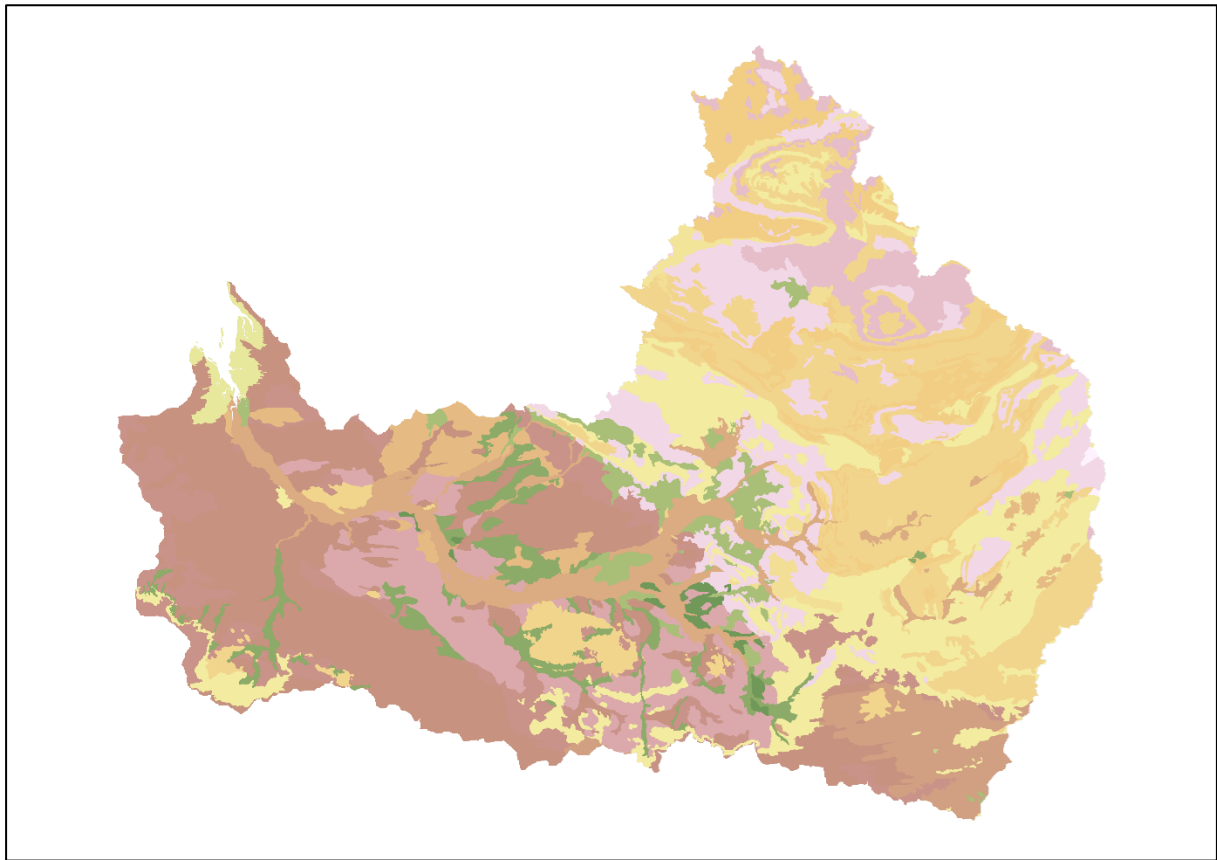


Figure 107. Land types recognised by the WA State government.

<span style="display: inline-block; width: 15px; height: 10px; background-color: #4F81BD; border: 1px solid black; margin-right: 5px;"></span> Alluvial and sandy plains with soft spinifex grasslands	<span style="display: inline-block; width: 15px; height: 10px; background-color: #D9A78F; border: 1px solid black; margin-right: 5px;"></span> Plains with low woodlands and spinifex/tussock grasslands
<span style="display: inline-block; width: 15px; height: 10px; background-color: #709248; border: 1px solid black; margin-right: 5px;"></span> Alluvial plains with mixed woodlands/shrublands and mixed grasses	<span style="display: inline-block; width: 15px; height: 10px; background-color: #C48E7A; border: 1px solid black; margin-right: 5px;"></span> River plains with grassy woodlands and tussock grasslands
<span style="display: inline-block; width: 15px; height: 10px; background-color: #80A080; border: 1px solid black; margin-right: 5px;"></span> Alluvial plains with tussock grasslands	<span style="display: inline-block; width: 15px; height: 10px; background-color: #A07060; border: 1px solid black; margin-right: 5px;"></span> Sandplains and dunes with acacia shrublands and spinifex
<span style="display: inline-block; width: 15px; height: 10px; background-color: #A0C080; border: 1px solid black; margin-right: 5px;"></span> Calcrete plains with spinifex grasslands	<span style="display: inline-block; width: 15px; height: 10px; background-color: #805050; border: 1px solid black; margin-right: 5px;"></span> Sandplains and dunes with pindan woodlands and spinifex/tussock grasslands
<span style="display: inline-block; width: 15px; height: 10px; background-color: #D0E080; border: 1px solid black; margin-right: 5px;"></span> Coastal plains, cliffs, dunes, mudflats and beaches; various vegetation types	<span style="display: inline-block; width: 15px; height: 10px; background-color: #804040; border: 1px solid black; margin-right: 5px;"></span> Sandplains and occasional dunes with shrubby spinifex grasslands or pindan woodlands
<span style="display: inline-block; width: 15px; height: 10px; background-color: #E0E080; border: 1px solid black; margin-right: 5px;"></span> Hills and lowlands with eucalypt woodlands and spinifex	<span style="display: inline-block; width: 15px; height: 10px; background-color: #C06060; border: 1px solid black; margin-right: 5px;"></span> Stony plains with spinifex grasslands
<span style="display: inline-block; width: 15px; height: 10px; background-color: #E0D080; border: 1px solid black; margin-right: 5px;"></span> Hills and lowlands with eucalypt woodlands and tussock grasses	<span style="display: inline-block; width: 15px; height: 10px; background-color: #E08080; border: 1px solid black; margin-right: 5px;"></span> Undulating plains and uplands with eucalypt woodlands and spinifex
<span style="display: inline-block; width: 15px; height: 10px; background-color: #D0C080; border: 1px solid black; margin-right: 5px;"></span> Hills and ranges with spinifex grasslands	<span style="display: inline-block; width: 15px; height: 10px; background-color: #E0A0C0; border: 1px solid black; margin-right: 5px;"></span> Undulating plains with eucalypt woodlands and mixed grasses
<span style="display: inline-block; width: 15px; height: 10px; background-color: #C0A080; border: 1px solid black; margin-right: 5px;"></span> Hills, ranges and plateaux with eucalypt woodlands and spinifex	<span style="display: inline-block; width: 15px; height: 10px; background-color: #F0E0F0; border: 1px solid black; margin-right: 5px;"></span> Undulating stony plains with cracking clay soils and tussock grasslands
<span style="display: inline-block; width: 15px; height: 10px; background-color: #A08080; border: 1px solid black; margin-right: 5px;"></span> Hills, ranges and plateaux with eucalypt woodlands and tall grasses	

The land types (Figure 107) recognised by the WA State government aggregate the 67 systems show in Figure 106 and include other information, especially in the legend.

In the drop-down menu, this image is named 'Mult\_Martuwarra\_LandTypes.png'.

### 6.4.3 Species richness

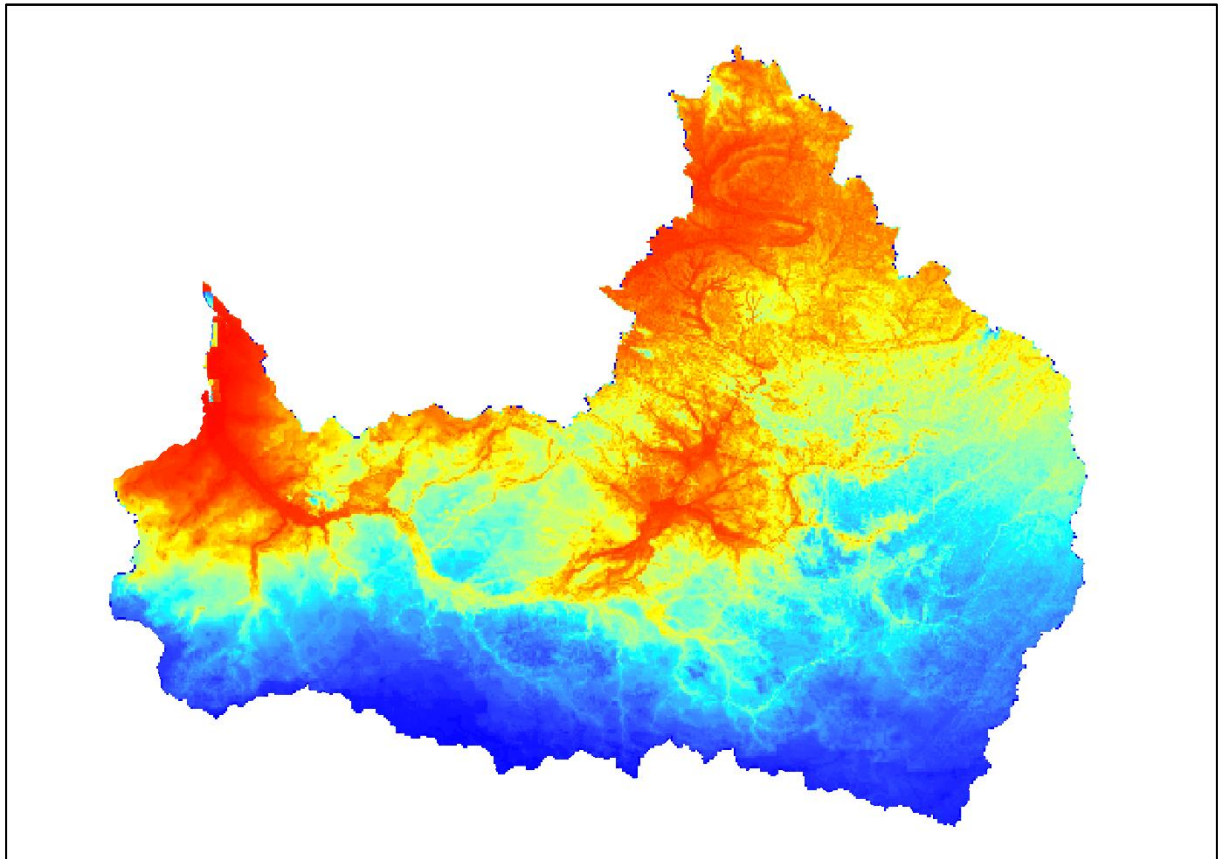
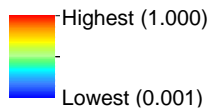


Figure 108. Conservation value based on species richness and their conservation status.

#### Weighted species richness



This image (Figure 108) shows areas of high and low value for conservation of species, based on species richness where blue is low, and red is high. Value was standardised from 0.001 (lowest value) to 1 (highest value) to simplify interpretation and allow combining or comparing with others maps. Species richness indicates the number of distinct species in an area - the higher the number of species the greater the species richness value. In this map, species with conservation status (endangered, threatened, vulnerable etc) have been given greater weight. Details of how these were calculated are available [here](#)<sup>10</sup>

In the drop-down menu, this image is named 'Mult\_Martuwarra\_ConsValAll.png'.

<sup>10</sup><https://doi.org/10.25903/p324-m141>

#### 6.4.4 Added value for biodiversity conservation

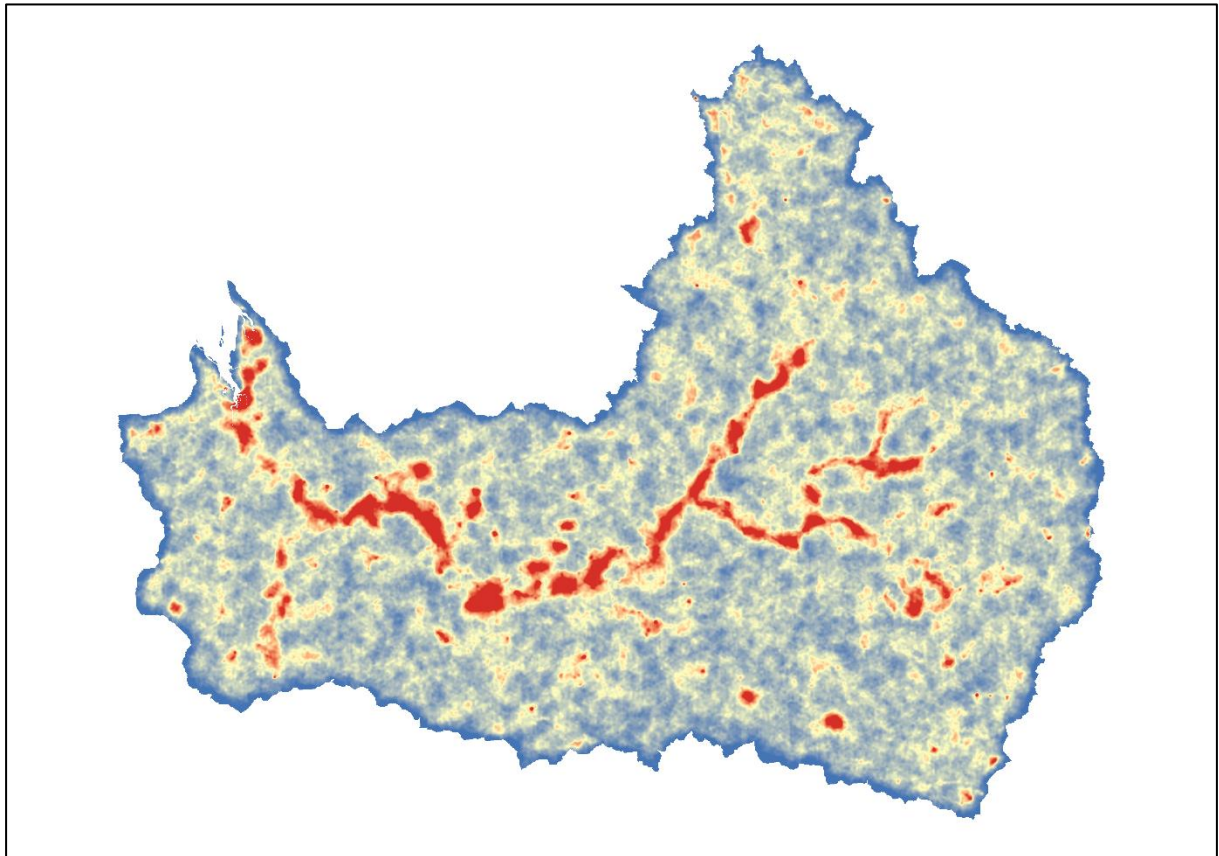
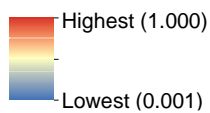


Figure 109. Value for biodiversity conservation of increasing the protection of different parts of the catchment.

##### Conservation value



This image (Figure 109) shows the relative value of parts of the catchment for biodiversity conservation, which includes terrestrial and aquatic ecosystems. Conservation of the areas in dark red would add most to biodiversity conservation and those in blue would add least. Details of how these were calculated are available [here](#).<sup>11</sup>

In the drop-down menu, this image is named 'Mult\_Martuwarra\_Add\_Cons.png'.

<sup>11</sup><https://doi.org/10.25903/p324-m141>



### 6.4.5 Potential for mining

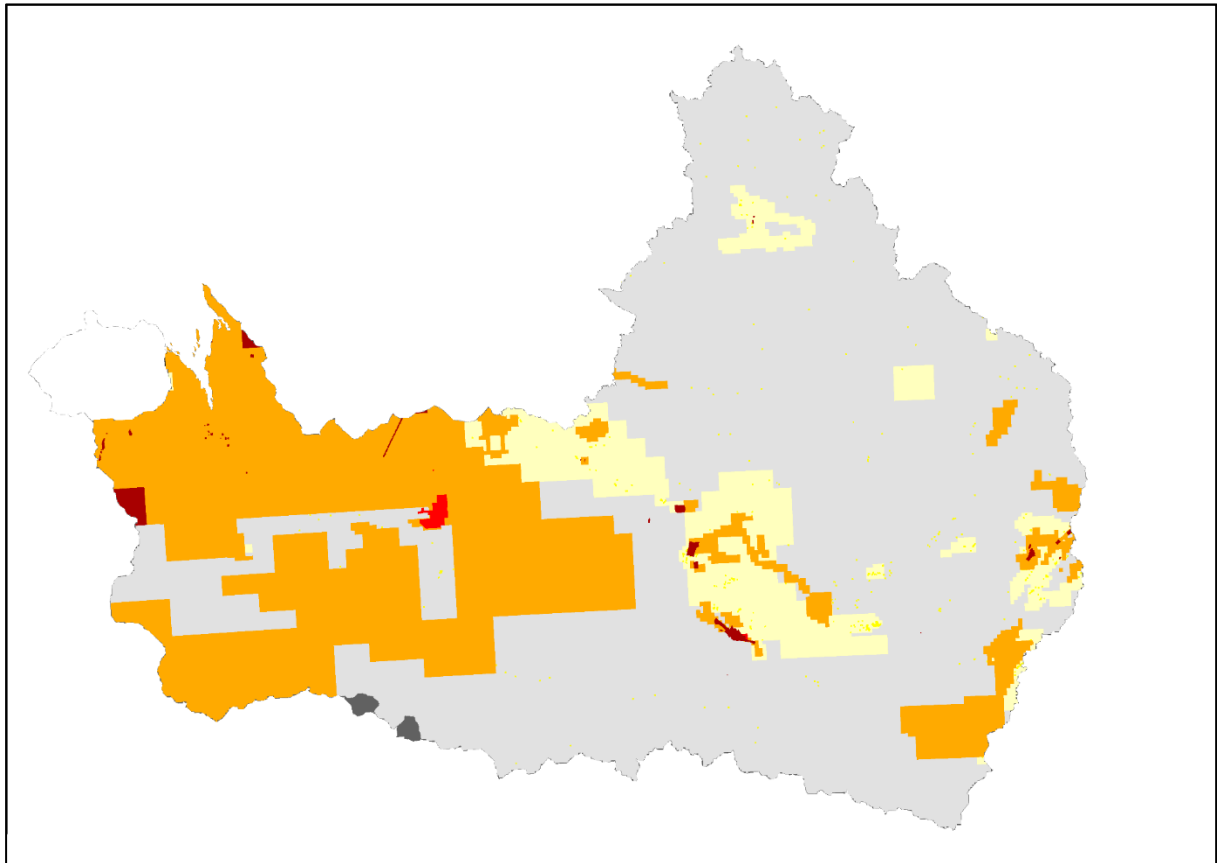


Figure 110. Potential for mining activity in the catchment.

#### Mining potential

- Active mine sites
- Proposed mines and applications for mining leases
- Current exploration permits
- Known resource presences
- Applications for exploration permits and areas advertised for exploration
- None reported

Figure 110 shows the potential for mining activity in the catchment. It represents potential based on available data on current and proposed mining leases and exploration permits (petroleum, minerals, coal, infrastructure and known mineral occurrences) from Western Australia's and Geoscience Australia's spatial databases (updated to 2019). The map depicts potential likelihood or uncertainty, from very likely/most certain (proposed mines and applications for mining leases) to less likely/most uncertain (applications for exploration permits and areas advertised for exploration).

In the drop-down menu, this image is named 'Mult\_Martuwarra\_PotMining.png'.

### 6.4.6 Grazing potential

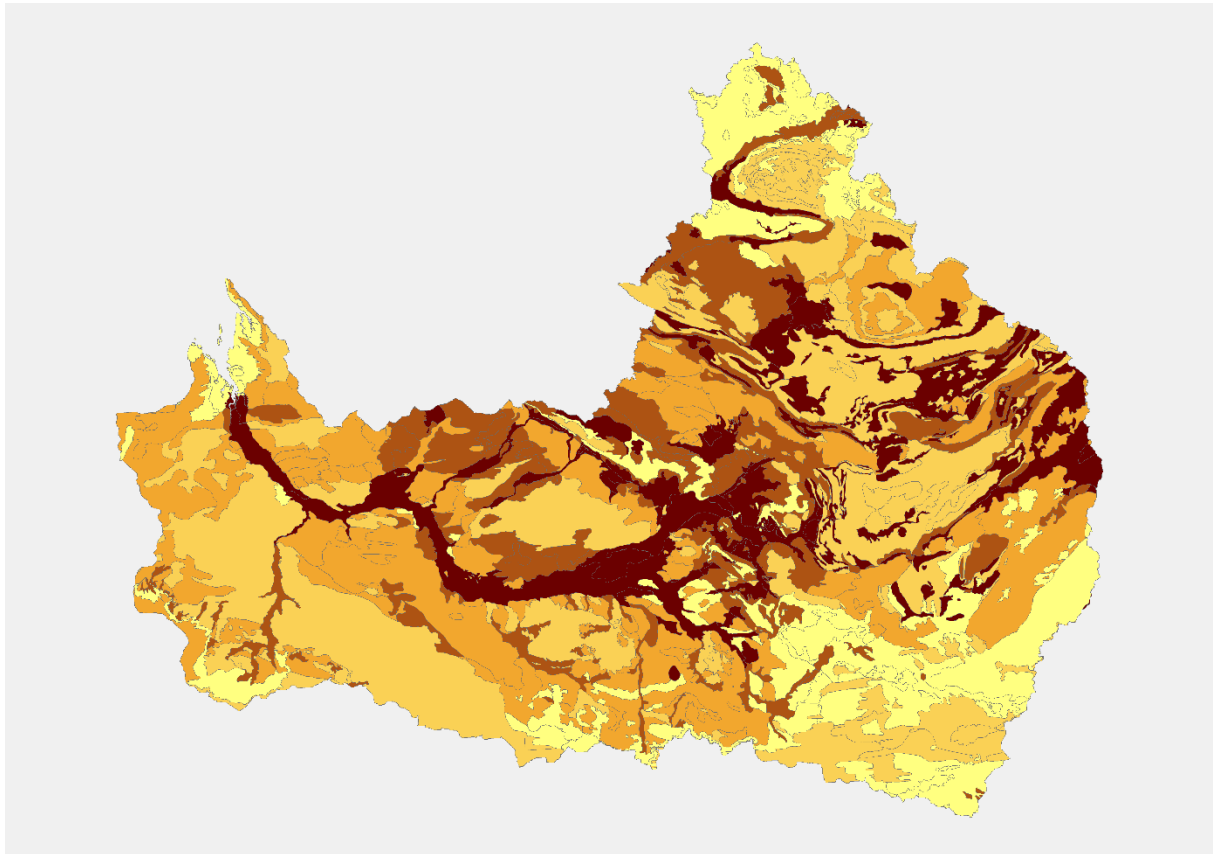
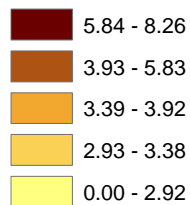


Figure 111. Grazing potential.

#### Carrying capacity



This image (Figure 111) show the value of grazing in different parts of the catchment based on the long-term average carrying capacity (CC) of land systems.

In the drop-down menu, this image is named 'Mult\_Martuwarra\_PotGrazing.png'.

### 6.4.7 Carbon farming potential

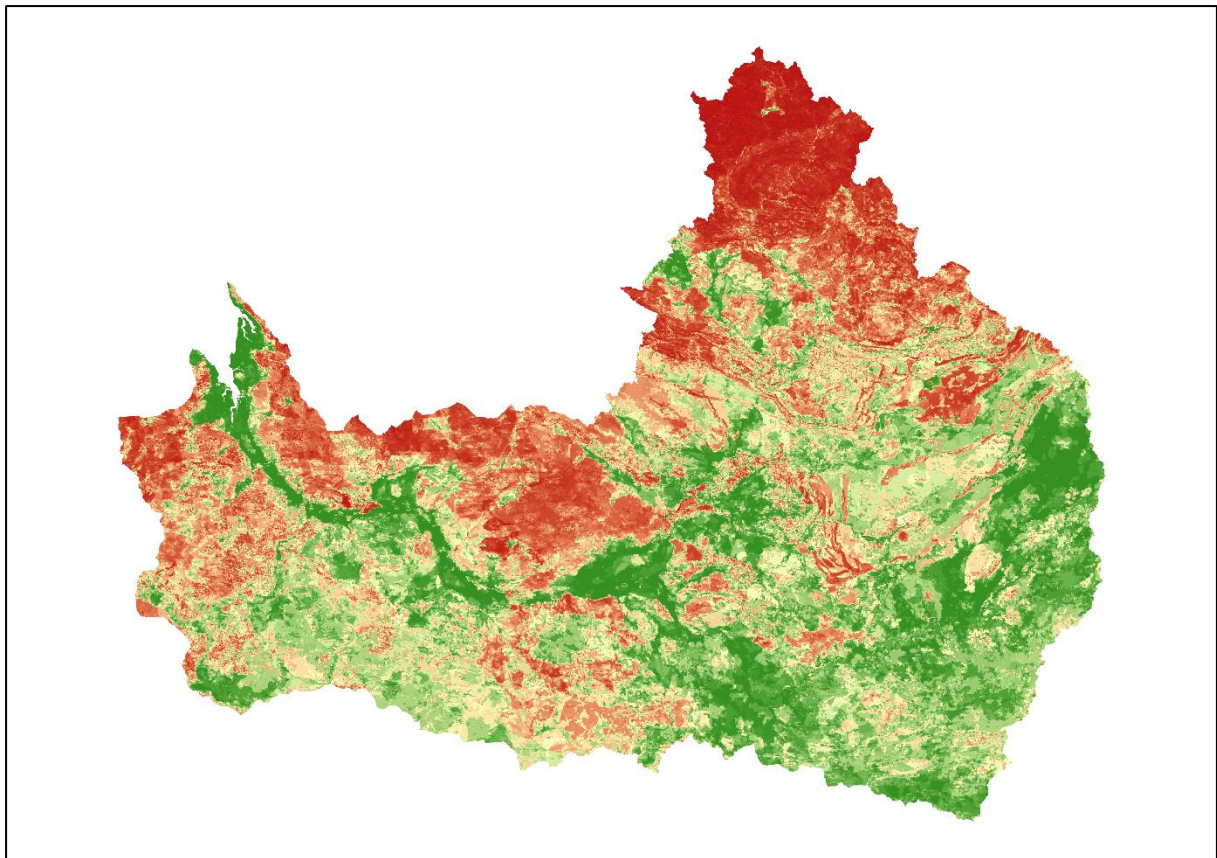
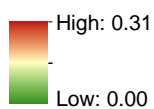


Figure 112. Carbon farming potential based on average carbon dioxide (CO<sub>2</sub>) emissions from fires.

#### Annual CO<sub>2</sub>e emissions



This image (Figure 112) shows one estimate of the potential for carbon farming based on managed savanna burning to abate carbon emissions. The map shows the average potential annual emissions of CO<sub>2</sub>e (Carbon dioxide equivalents) estimated based on 19 years of fire scars maps and potential emissions from fires varying according to vegetation type. For more details see [final report from NESP project 1.6](#)<sup>12</sup>.

In the drop-down menu for images, this image is named 'Mult\_Martuwarra\_PotCarbon'.

<sup>12</sup> <https://doi.org/10.25903/p324-m141>

## 6.5 Natural hazards – fire and flood images

### 6.5.1 Fire frequency

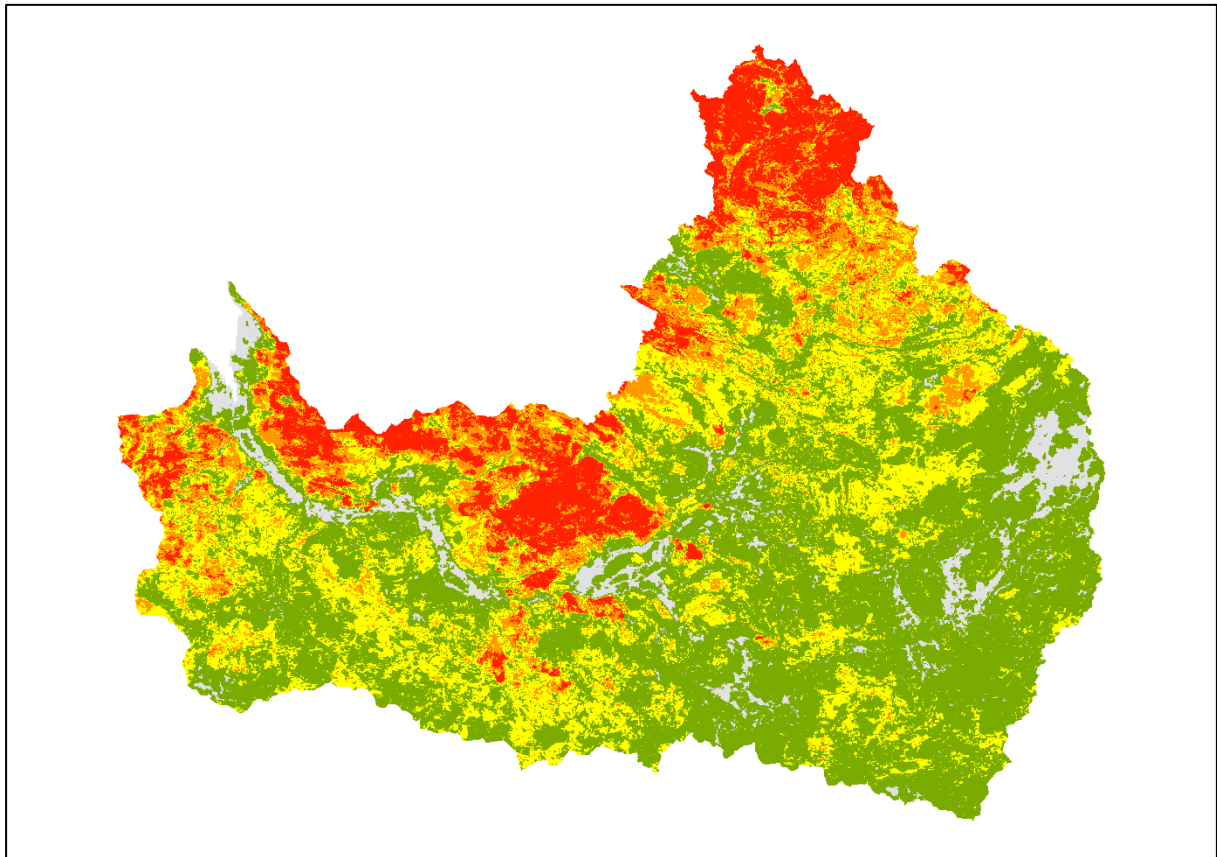
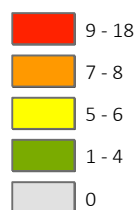


Figure 113. Fire frequency between 2000 to 2018.

#### Fire frequency (2000-2018)



The fire frequency map (Figure 113) shows how many times an area has burnt between 2000 to 2018 calculated using satellite-derived mapped fire scars from the Northern Fire Information (NAFI) website ([firenorth.org.au](http://firenorth.org.au)). The grey areas have not burnt at all, whilst the red areas have burnt 9 or more years out of the 18 years.

In the drop-down menu for images, this image is named 'NatHaz\_Martuwarra\_FireFreq.png'.



### 6.5.2 Annual fire maps from 2000

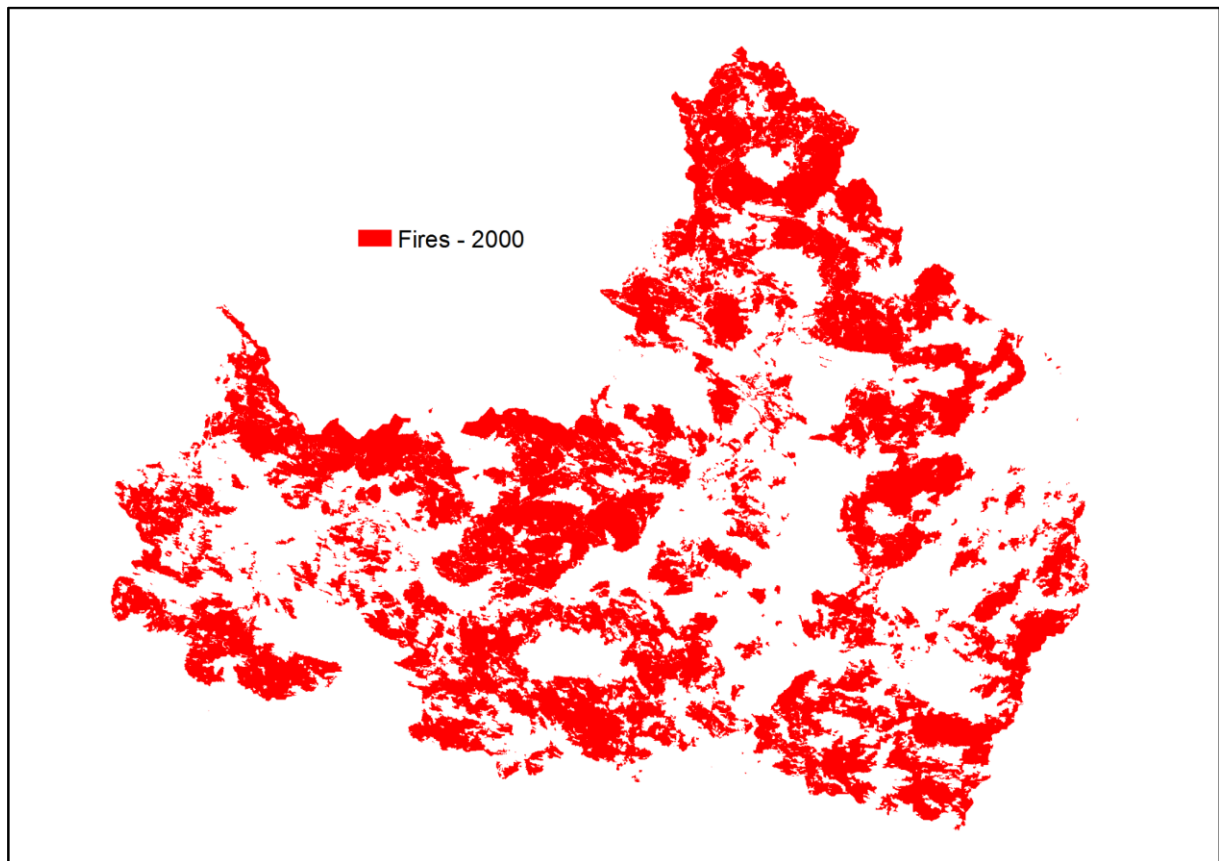


Figure 114. Fires in the year 2000.

There are many maps showing fires from the year 2000+ (e.g., Figure 114). The red displays the areas that had a fire during that year. This information was mapped from satellite images. This is good to combine with Google Maps Spatial Data.

In the drop-down menu for images, these are named 'NatHaz\_Martuwarra\_Fire00.png'. The last two numbers indicate the year e.g., 00 is 2000, 01 is 2001.

### 6.5.3 Annual fire season maps from 2000

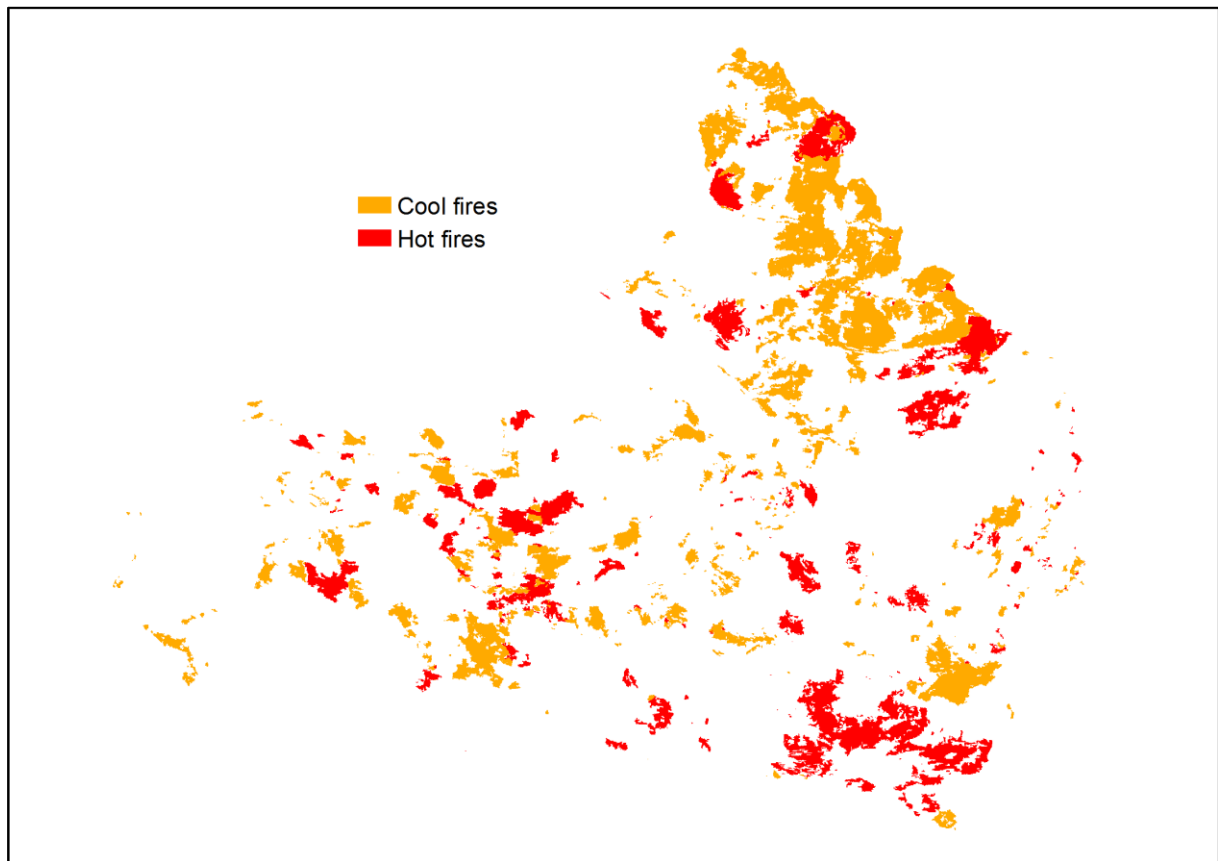


Figure 115. Fire seasons in the year 2000.

There are many maps showing cool fires (before the end of July) and hot fires (after July) from the year 2000+ (e.g., Figure 115). This information was mapped from satellite images. For those who are familiar with Google Maps, this image is good to combine with a Google Map.

In the drop-down menu for images, these are named 'NatHaz\_Martuwarra\_FireSeason00.png'. The last two numbers indicate the year e.g., 00 is 2000, 01 is 2001.

### 6.5.4 Flood potential

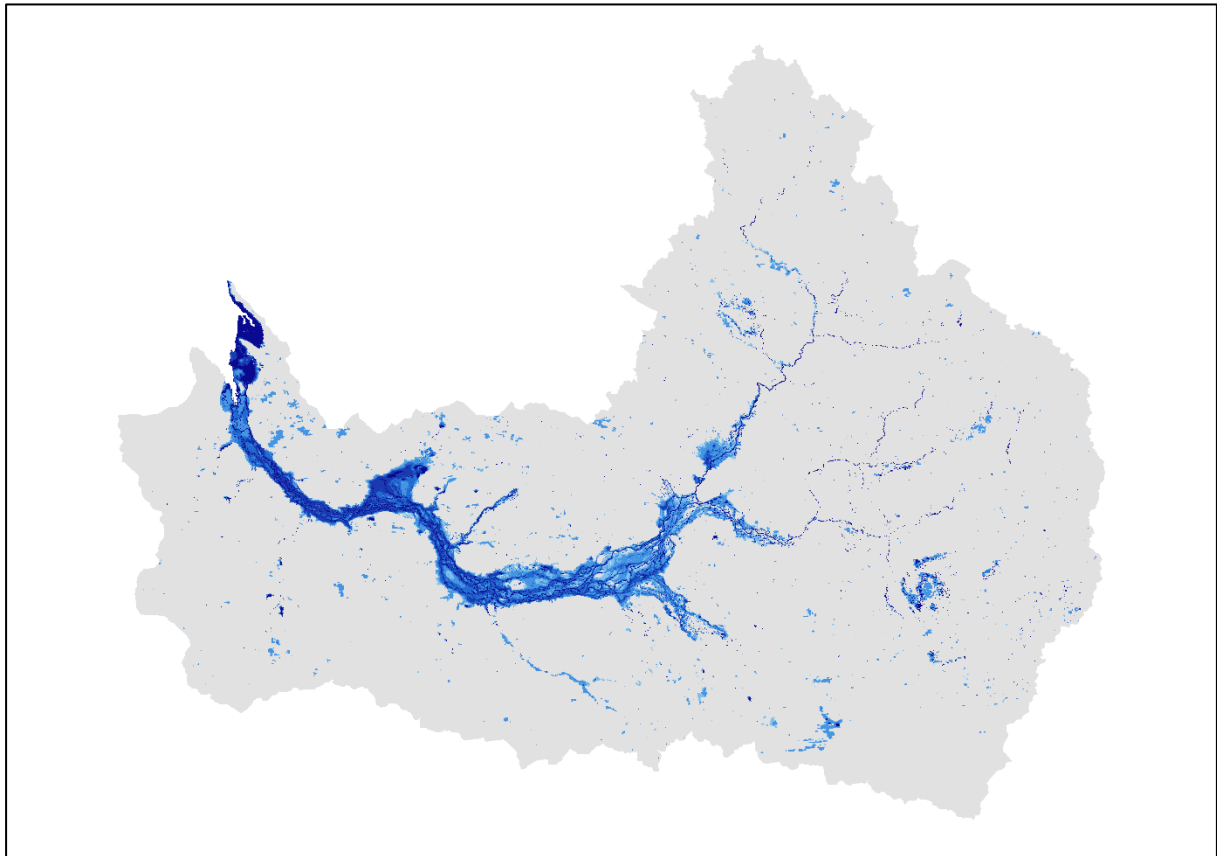
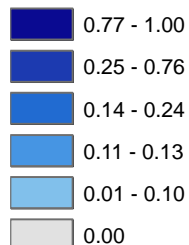


Figure 116. Flood potential.

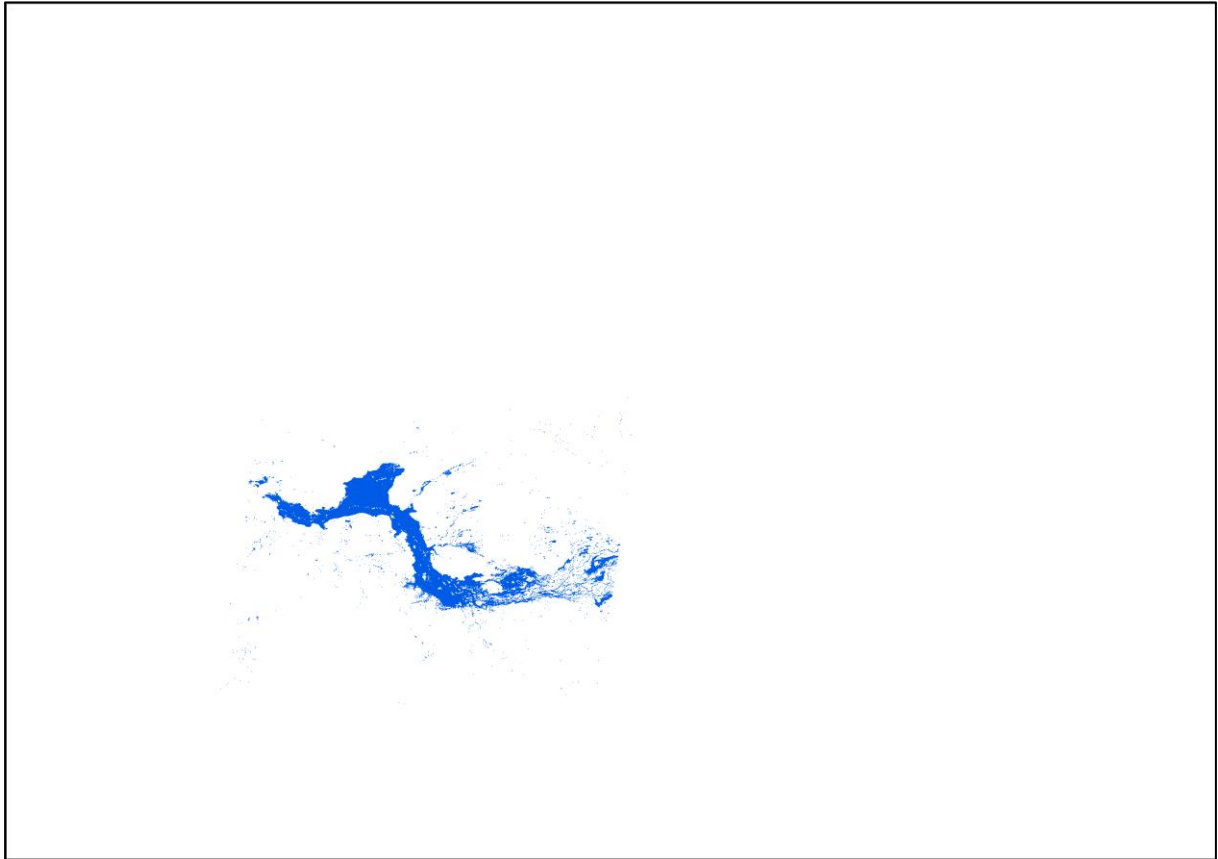
#### Flooding potential



This image (Figure 116) shows areas prone to flooding. It was created from a flood prediction model and satellite imagery that counts how many times water has been seen in an area (Water Observations from Space). The darkest blue areas have water most of the time (87 – 100%). The lighter blues show areas that are prone to flooding from the mid blues that are flooded about half the time (38 – 60%) to the lightest blue showing areas that have flood less frequently (1-20% of the time). The values were standardised from 0 (no flooding potential) to 1 (very high flooding potential) to simplify interpretation and allow combining or comparing with others maps.

In the drop-down menu for images, these are named 'NatHaz\_Martuwarra\_PotFlood.png'.

### 6.5.5 Discrete flood events



*Figure 117. Flooding of the Martuwarra on 26 February 2001.*

This image (Figure 117) is of a discrete flood on the river on 26 February 2001. There are 11 images of discrete flood events between 2001 and 2014.

In the drop-down menu for images, this image is named 'NatHaz\_Martuwarra\_Flood\_2001-02-26.png'. The last numbers indicate the date. Some of the images only have the year, not the day and month.



## 7. Using the 3D Map for classes

### 7.1 Examples of classes held during the *Showing and sharing knowledge* project

The map was set up in the performance space of the Fitzroy Valley District High School in September 2018. Classes from all age groups were invited to spend 20–30 minutes looking at the model. A CSIRO team member gave a small talk explaining concepts such as:

- What is a catchment? Where does the rain go? Which way does the water flow?
- Geography and locating towns within the catchment (Fitzroy Crossing, Derby, Halls Creek).
- Allowing kids to discuss what their favourite part of the river is, where that can be found and why that is their favourite part.

Traditional Owners Mary Aiken and Marmingee Hand attended and stimulated a lot of discussions including:

- Around animal and plant life along the river.
- Around fire and the importance of fire and rangers on Country .
- About language and using the proper name for certain things on the river. Explaining the Bunuba and Gooniyandi names for the Fitzroy River and the language names for the different animals along the river.

Observations from the Fitzroy classes:

- Children in pre-primary and primary school remained the most engaged with the map throughout each of the sessions. The map's bright changing colours excited the children and kept them interested in learning about the catchment in which they live. They also greatly enjoyed touching the map and placing different objects on it.

The map was set up in the performing arts space of the Derby School in October 2018.

A similar presentation was made by a CSIRO staff member, with students learning first about a catchment, where the water flows, Native Title, fire and floods. Traditional Owner Gordon Smith Junior attended and gave a small talk about why knowing Country is important and how communities need young respectful leaders who are willing to take on responsibility.

Observations from the Derby classes:

- Indigenous and non-Indigenous students were interested in the map, its use, and the various layers it could show.
- One class with a mix of Indigenous and non-Indigenous kids had a big conversation around the times they have been fishing, where they went, what they caught, and why it was important to them. They joked around and told stories – and the team expressed that telling personal stories about time on Country was one of the goals of the map.
- One group of Indigenous children were especially interested to see all the Native Title boundaries and were excellent at naming all the language groups in the catchment. They also were able to see the difference between Native Title determinations and

Native Title claimant groups and wrap their head around land rights and usage in the catchment.

The map was also put on display at the community centre in Halls Creek in October 2018 and 3 classes from the school attended, with similar positive responses as at Fitzroy and Derby. Schoolchildren who were quick to point out things on the map and add stations and communities that were not labelled. Students from the school groups also wanted to add swimming holes that were closer to Halls Creek (as they didn't know the main Martuwarra as well).

Several Traditional Owners visited the map while it was in Halls Creek and some brought their children back to interact with it. A couple of the Traditional Owners, after spending a while looking at the map, said that the mountains seem too high, and the rivers are too close together – the height exaggeration and broad scale make the map difficult to understand for some people.

Children showed a lot of interest in the 3D Map at the Kimberley Land Council Annual General Meeting (AGM) in 2018. The map was in a tent to provide sufficient darkness for the image displays to be visible, and so the doors were shut. In the evenings, when the tent was dark, and we opened the doors the map became a huge attraction for the children. They were interested in the different colours and projections which the map could show and gradually got to know how and why the map was built. By the end of the AGM, they were experts in presenting the map to any visitors present. Children also were invested in adding characters (fish and people) drawn onto paddle-pop sticks onto the map and role playing around the various locations. Most often, children wanted to see where they lived, where they were and how far they had travelled to arrive at the AGM.

One attendee expressed the desire to bring old people around the map and have them tell stories about country.

A short video about the Road Trip with the 3D Map can be downloaded here:

[3D Map road trip](#)<sup>13</sup>

A short video about children working with the 3D Map during these classes can be downloaded here:

[Children working with the Fitzroy River 3D Map](#)<sup>14</sup>

## 7.2 Next steps and ongoing support

To be useful for teachers, curriculum material and lessons plans are needed to support the 3D Map. The Fitzroy Valley District High School staff are planning to develop a Two-Way Science curriculum and can access support from the Western Australian Government for this. The 3D Map can play an important role in such a curriculum.

The major repository for information about the *Showing and sharing knowledge* project is the [Knowledge brokering for Indigenous land management](#) NESP webpage, which continues to be maintained. Similarly, the major repository for information about most of the spatial data is the [Multi-objective planning in northern Australia](#)<sup>15</sup> NESP webpage.

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<sup>13</sup> <https://vimeo.com/324906077>

<sup>14</sup> <https://vimeo.com/296330850>

<sup>15</sup> <https://www.nespnorthern.edu.au/projects/nesp/multi-objective-planning-northern-australia/>

CSIRO and NESP are both long-term national research organisations. Nevertheless, the projects that supported the development of the 3D Map are now finished and the staff allocated to work on those projects have moved on to other roles. CSIRO and NESP as organisations may lack the detailed specific knowledge of various aspects of the 3D Map and may not be able to assist with specific enquiries. We encourage you to reach out to the following individuals with an ongoing pro-bono capacity for support:

Dr Ro Hill [rohill2421@gmail.com](mailto:rohill2421@gmail.com) +61 448 810 941