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victorian centre for climate change adaptation research

Working paper

Developing draft base maps of the Barmah-Millewa for integration of Indigenous and conventional knowledge

A report from the VCCCAR project Learning from Indigenous Natural Resources Management in the Barmah-Millewa

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Introduction

The Barmah-Millewa region on the floodplain of the River Murray is the heart of Yorta Yorta Traditional Tribal Lands. The project "Learning from Indigenous Natural Resources Management in the Barmah-Millewa" aims to create a framework that will enable inclusion of Yorta Yorta knowledge into sustainability science, in effective and ethically appropriate ways, in order to improve management of the Barmah-Millewa region. We are building this framework, layer upon layer, with data and maps, stories and relationships, images and sound, all directed at creating a new paradigm for integrating Western and Indigenous knowledge. The framework will offer ways to create a safe repository for cultural knowledge, an opportunity for skill and capacity building among Yorta Yorta youth, and a voice for the Yorta Yorta in resource management processes affecting the region.

The framework is being implemented through a geographical infomation system (GIS) that will contain data on the ecological, climatic, cultural, legal and policy environment of the region. To date the research team has been working on gathering relevant base data for the region, which, as the project progresses, will be augmented and combined with Yorta Yorta information to inform decision making.

The team has contacted a variety of organisations to obtain data, including Victorian Government departments, NSW Government departments, the Murray-Darling Basin Authority, and catchment management authorities in Victoria and NSW. Data has also been downloaded from various websites, including the Australian Bureau of Meteorology, Australian Bureau of Statistics, and the Australian Bureau of Agricultural and Resource Economics and Sciences.

The process for collecting data for the base maps has been drawn out, despite many organisations being very responsive and helpful with providing data. In addition, some types of data require considerable processing before input into a GIS-readable format. The process of acquiring and adding base data into the GIS is ongoing.

The remainder of this report lists the types of data we have been able to access so far and gives examples of what these maps look like for the Barmah-Millewa and wider Yorta Yorta region.

Draft base maps of the Barmah Millewa

Geographical features

Geographical features data we have obtained includes:

- Places, roads, railways
- Topography
- Aerial imagery
- Digital elevation map (DEM)

As an example, Figure 1 shows an aerial image of the Yorta Yorta area. Additional fly-over aerial imagery will be provided by NSW Land & Property once they complete processing of images for this region.

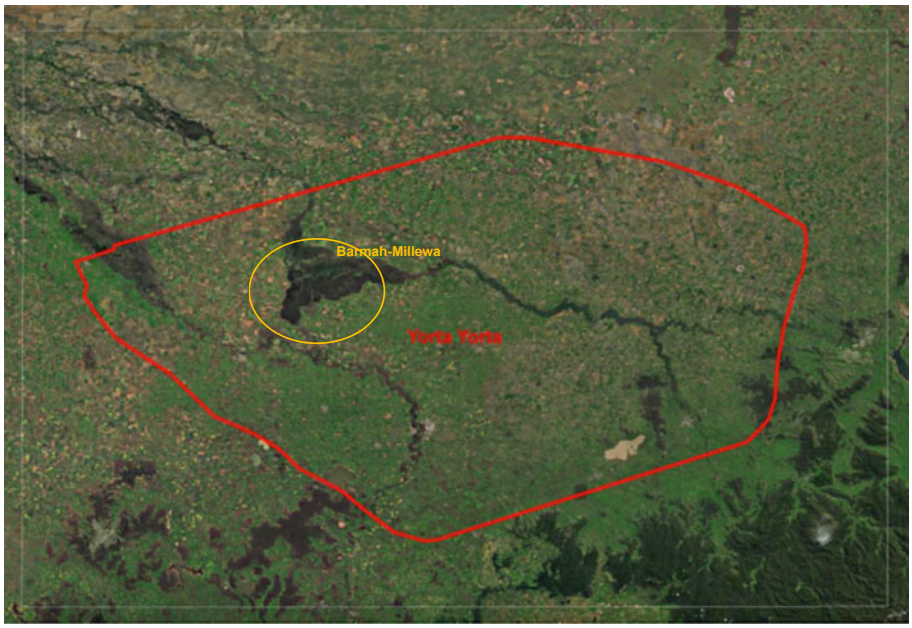


Figure 1:
Aerial image of the Yorta Yorta area. The Yorta Yorta boundary is marked in red. The dark area demarcated by the yellow oval is the Barmah-Millewa.
Source: ESRI

Administrative boundaries

The administrative boundary layers that we have collected include:

- Yorta Yorta Boundary
- State boundaries
- Local government areas (LGA)
- ABS Census Collection District (CCD)
- Postcode areas

An example of the Yorta Yorta area in relation to localities and state and local government boundaries is shown in Figure 2. Additional administrative boundary layers that will be obtained include catchment management authority boundaries, and surface and ground water management zones.

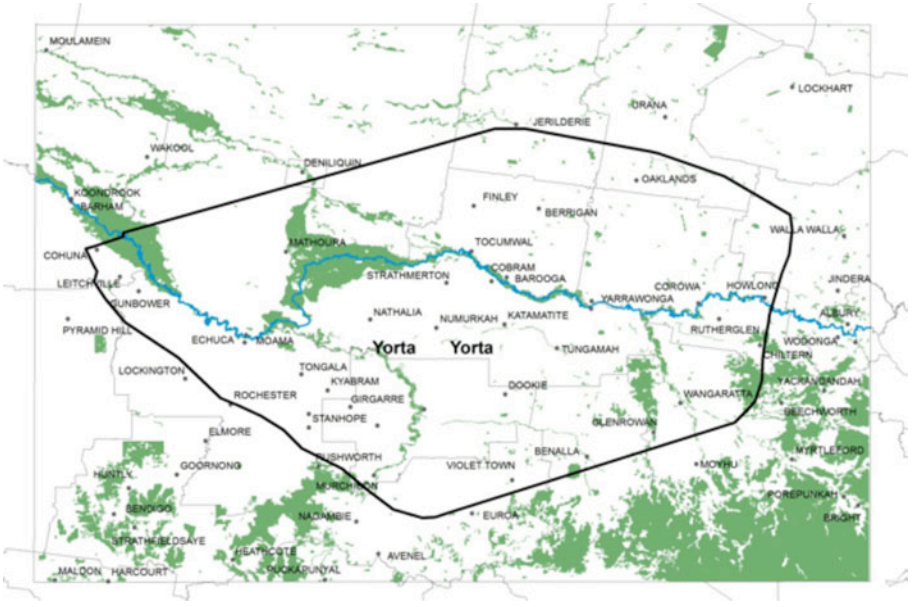


Figure 2:
The Yorta Yorta area with towns, local government areas (grey lines), native vegetation areas (green), and the *Victoria-NSW* border (blue line). *Sources: City and town locations and native vegetation – Geoscience Australia; LGA boundaries – Australian Bureau of Statistics, 1259.0.30.001 - Australian Standard Geographical Classification (ASGC) Digital Boundaries, Australia, July 2011.*

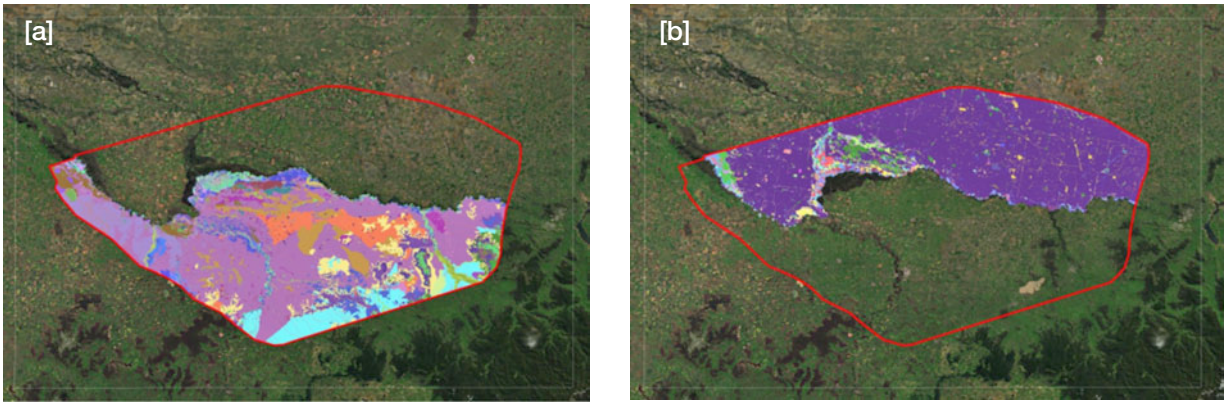
Biodiversity

Biodiversity base layers include:

- Vegetation classes
- Endangered flora and fauna (Victoria)

Examples of vegetation mapping done by each state for the Yorta Yorta area are shown in Figure 3. Additional data being sought includes flora and fauna for NSW, turtle and bird monitoring in the Barmah-Millewa Icon Site, and vegetation condition.

Figure 3:
Vegetation mapping for the Yorta Yorta area: (a) Native vegetation – modelled 2005 ecological vegetation classes (EVCs) with bioregional conservation status for Victoria. *Source: Victorian Department of Sustainability and Environment;* (b) Vegetation mapping for the Murray Catchment Management Authority area. *Source: NSW Office of Environment and Heritage.* Partial legends are shown because of space constraints. *Background: aerial imagery source: ESRI.*



EVCs (partial)

- Aquatic Herbland
- Aquatic Herbland/Floodplain Grassy Wetland Moscaic
- Aquatic Herbland/Floodway Pond Herbland Moscaic
- Aquatic Herbland/Riverine Swamp Forest Mosaic
- Aquatic Herbland/Tall Marsh Mosaic
- Billabong Wetland Aggregate
- Billabong Wetland/Red Gum Swamp Mosaic
- Box Ironbark Forest
- Box Ironbark Forest/Grassy Woodland Complex
- Brackish Lake Aggregate
- Cane Grass Wetland
- Chenopod Grassland
- Creekline Grassy Woodland
- Creekline Grassy Woodland/Red Gum Swamp Mosaic
- Drainage-line Aggregate
- Drainage-line Aggregate/Riverine Swamp Forest Mosaic

Vegetation type (partial)

- Black Box - Lignum Woodland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina and Murray Darling Depression Bioregions)
- Black Box grassy open woodland of rarely flooded depressions in South-western NSW (mainly Riverina and Murray Darling Depression Bioregions)
- Black Box open woodland with chenopod understorey mainly on the outer floodplains in South-western NSW (mainly Riverina and Murray darling Depression Bioregions)
- Blakelys Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland on clay loam soils on undulating hills of central NSW Southern-western Slopes Bioregion
- Blakelys Red Gum - Yellow Box grassy tall woodland of the NSW Souther-western Slopes Bioregion
- Buloke - Moonah Black Box open woodland on sandy rises of semi arid (warm) climate zone (mainly Riverina and Murray darling Depression Bioregions)
- Canegrass swamp tall grassland of drainage depressions, lakes and pans of the inland plains
- Cotton Bush open shrubland of the semi-arid (warm) zone
- Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion
- Cypress Pine woodland of source-bordering dunes mainly on the Murray and Murrumbidgee River floodplains
- Dwayers Red Gum - Black Cypress Pine - Currawang shrubby low woodland on rocky hills mainly in the NSW Southern-western Slopes Bioregion
- Forb-rich Speargrass - Windmill Grass - White Top grassland of the Riverina Bioregion
- Inland Grey Box - Cypress Pine shrubby woodland on stony footslopes in the NSW South-western Slopes and Riverina Bioregions

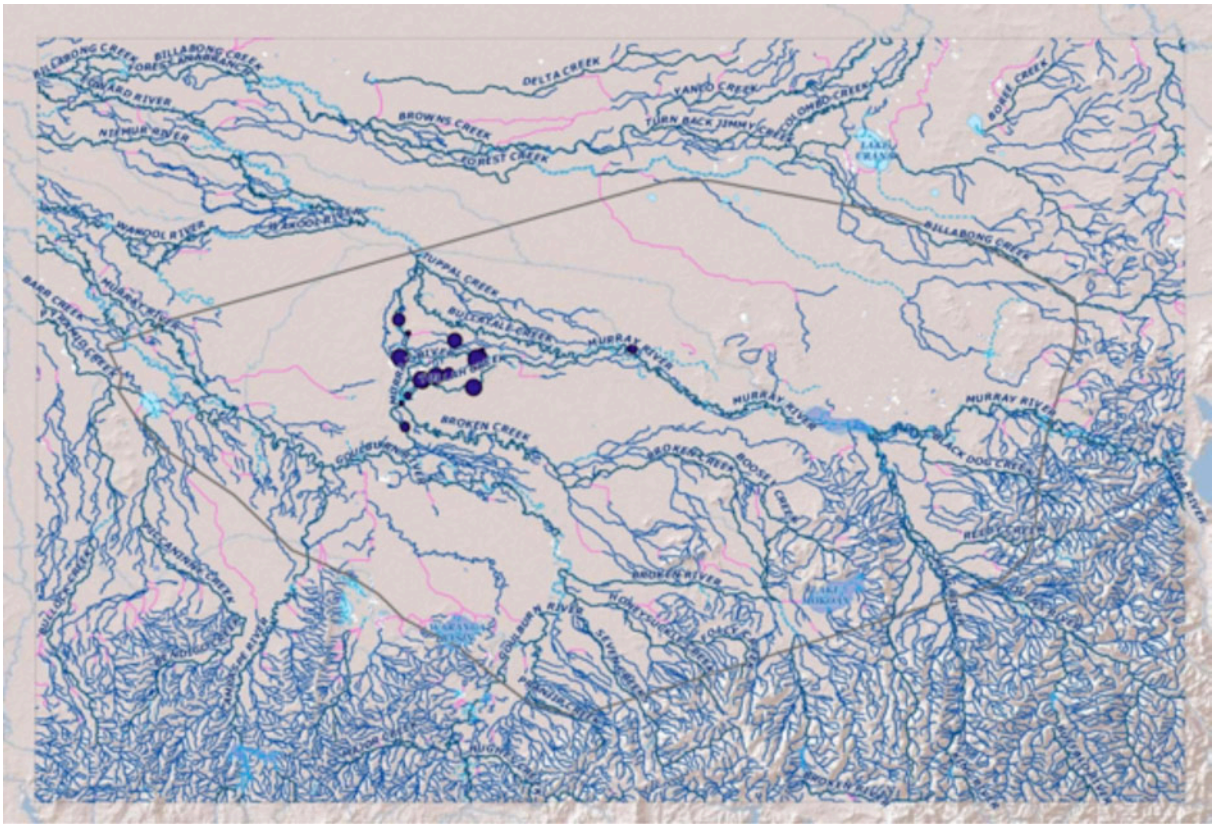
Hydrology

The hydrology base data collected for this project includes:

- Stream network
- Waterbodies
- Flood extent
- Ground water quality and quantity
- Surface water quality and quantity

The stream network and an example of daily groundwater measurements are shown in Figure 4. Additional data about river basin boundaries, wetland mapping, water diversion infrastructure and diversion amounts will be added. Further work will be done on how to incorporate the hydrological time-series data into the mapping.

Figure 4:
Stream network and waterbodies in the Yorta Yorta areas (Source: Australian Hydrological Geospatial Fabric (Geofabric), Australian Bureau of Meteorology) and groundwater bore water levels on 10 June 2010
Source: Groundwater Management System (GMS), Rubicon Systems Australia and DSE.



Stream network hierarchy

- NetworkWaterAreaSegment, Minor
- NetworkWaterAreaSegment, Major
- NetworkArtificialFlowSegment, Major
- NetworkArtificialFlowSegment, Minor
- NetworkFlowSegment, Minor
- NetworkFlowSegment, Major

Water body type

- Reservoir
- Lake
- Swamp

Groundwater levels (m)

- -0.277000 - 0.700000
- 0.700001 - 1.939000
- 1.939001 - 3.785000
- 3.785001 - 7.494000
- 7.494001 - 92.217000
- 92.217001 - 93.878000
- 93.878001 - 95.235000
- 95.235001 - 96.739000
- 96.739001 - 98.508000
- 98.508001 - 100.183000

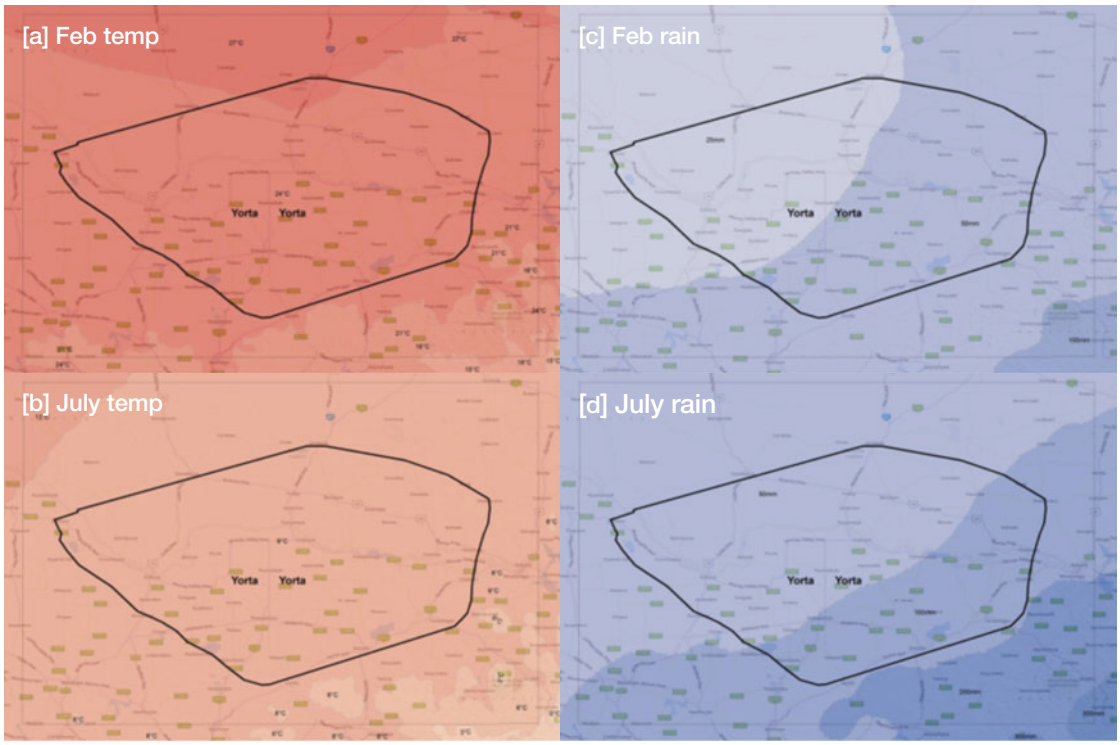
Climate

For the moment the team has incorporated climatological average data from the Australian Bureau of Meteorology into the database, including:

- Average monthly rainfall
- Average monthly temperature
- Average humidity
- Average evaporation

An example of monthly temperature and rainfall climatologies are shown in Figure 5. There are few climatological monitoring stations in this area, limiting the spatial resolution of these maps. In addition the team is developing indices and other ways of incorporating climatic trends and variability data.

Figure 5:
Average February and July mean temperature (a & b) and rainfall (c & d) in the Yorta Yorta area over the period 1961–1990. *Source: Australian Bureau of Meteorology.*



Temp (°C)

-3
0
3
6
9
12
15
18
21
24
27

Rainfall (mm)

5
10
25
50
100
200
300
400

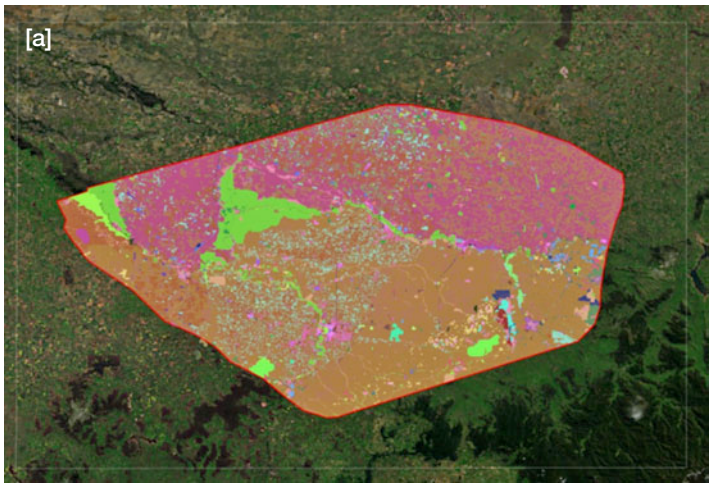
Socio-economic

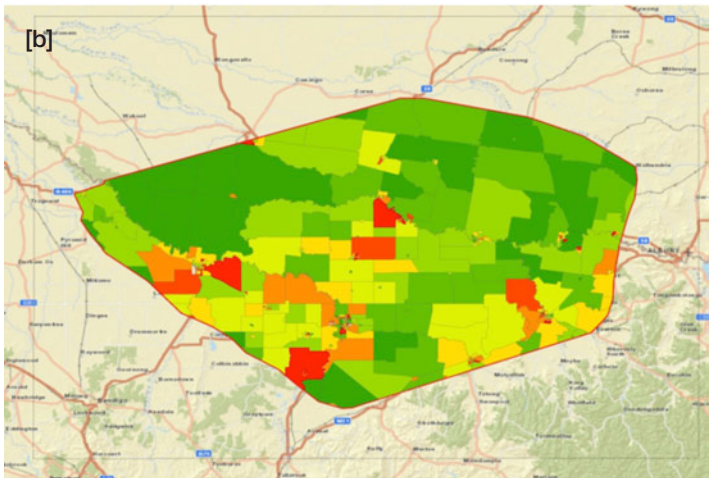
Socio-economic data includes:

- Land use
- Total population
- Regional population growth
- Indigenous population
- Indigenous language spoken at home

Two examples of socio-economic data are shown in Figure 6. While the team has incorporated data from the 2006 Census, it has not yet had the chance to incorporate the 2011 Census data, which is only now being made available.

Figure 6:
Examples of socio-economic data for the Yorta Yorta region: (a) Catchment scale land use data. *Source: Australian Collaborative Land Use and Management Program*. Partial legend is shown because of space constraints. *Background aerial imagery source: ESRI.* (b) Census 2006 total persons by place of usual residence by Census Collection District. *Source: Australian Bureau of Statistics.*





Land use category (partial)

- 1.1.0 Nature conservation
- 1.1.1 Strict nature reserves
- 1.1.3 National park
- 1.1.4 Natural feature protection
- 1.1.5 Habitat/species management area
- 1.1.7 Other conserved area
- 1.2.0 Managed resource protection
- 1.2.2 Surface water supply
- 1.2.4 Landscape
- 1.2.5 Traditional indigenous uses
- 1.3.0 Other minimal use
- 1.3.1 Defence
- 1.3.2 Stock route
- 1.3.3 Residual native cover
- 1.3.4 Rehabilitation
- 2.1.0 Grazing natural vegetation
- 2.2.0 Production forestry
- 2.2.1 Wood production
- 3.1.0 Plantation forestry
- 3.1.1 Hardwood production
- 3.1.2 Softwood production

Population

- 0 - 200
- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 700
- 700 - 800
- 800 - 1000

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