2. Bioregional biodiversity: An assessment of available data to determine the biodiversity within the bioregions

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Introduction

Biodiversity is the natural diversity of life: all species, their genetic composition, habitat and the ecosystems of which they form a part. Improving our knowledge of Australia's biodiversity and verifying existing information has been highlighted as a national objective for biodiversity conservation (Anon. 2001). However, biodiversity information is only useful if it is accessible. Maximising the availability of biodiversity information and providing access to databases and other storage facilities assists researchers and management teams to accurately assess, evaluate and report on the state of biodiversity. Where existing information is inadequate, quantitative field surveys provide an understanding of what biodiversity is present, how to conserve it, and what the gaps in knowledge might be (ANZECC and BDAC 2001). Identification of the knowledge gaps can then guide the research priorities. Knowledge of biodiversity is necessary when making important management decisions and for determining appropriate management requirements. For example, Biodiversity Action Planning contributes to bioregional planning and management, and depends on the availability of data on local, landscape and bioregional scales (ANZECC 2001; Platt and Lowe 2002). Bioregional Network Analysis and the Bioregional Conservation Status of threatened species (Platt and Lowe 2002) identify priority areas for management of native flora and fauna using biodiversity assessment databases developed by NRE. These databases include flora and fauna records across the state. When overlaid with land-use information, this information can lead to a priority ranking of species and priority management activities.

On a bioregional scale, Biodiversity Action Planning describes the significance of biodiversity assets and presents and identifies priorities for the protection, enhancement and restoration of native biodiversity (NRE 1997c). Biodiversity assessment databases developed by NRE were interrogated to document the extent and management requirements of biodiversity (including native, introduced and threatened species, and communities) in riparian zones and associated remnant native vegetation within the Gippsland Plain, Strzelecki Ranges, Otway Plain and Warrnambool Plain bioregions in the first year of this project. The documentation process aimed to determine whether the biodiversity present could be adequately identified using the mapping and database sources available in NRE, and if possible, to use these databases to locate suitable study sites within the project bioregions.

Biodiversity Data

Documentation of riparian biodiversity focussed on GIS to map broad biodiversity themes, BioMap for fine scale mapping and four flora and fauna databases containing all statewide records of flora and fauna (mammals, birds, reptiles, amphibians, fish, terrestrial and aquatic invertebrates) to extract community and species level information.

Geographical Information System (GIS)

Data from GIS provides a broad visual coverage and enables a relative estimate of biodiversity, particularly flora, using vegetation data layers such as Ecological Vegetation Classes (EVCs). The EVCs are the most commonly used vegetation typology developed and used by NRE. The EVCs are defined by their floristics and structure (Woodgate *et al.* 1994) and provide a useful comparative measure of broad-scale floral biodiversity both spatially and temporally. The GIS software package ArcView (ESRI 1999) can map various characteristics of each bioregion including hydrology, roads, land use and EVCs. Data is available at 1:25,000, 1:100,000 and 1:500,000 scales, however, layers from the 1:100,000 scale were obtained from the NRE Corporate Geospatial Data Library (NRE-CGDL).

BioMap

The BioMap web-based mapping system was developed by NRE to produce maps containing biodiversity information. BioMaps are a useful visual tool for the general assessment of biodiversity and provide information such as the location of threatened species, sites of biological significance, Land for Wildlife properties and threatening processes. This information can be overlayed with

themes that include land management and topography. Unlike GIS maps, BioMaps can only be produced at 1:25,000 and 1:100,000 scales. They also do not provide general flora and fauna survey site and record data. This information is located in several flora and fauna databases.

Flora and Fauna Databases

A number of databases that store flora and fauna records from across the state are managed by NRE. These include the Flora Information System (FIS), Victorian Fauna Display (VFD), Aquatic Fauna Database (AFD) and the Wildlife Atlas. The flora and fauna databases were used to determine the extent of biodiversity (flora and fauna records) contained in the study area. A description of each of the databases is presented below.

Flora Information System (FIS)

The FIS is a botanical, geographic information system that stores floristic data from a range of site-based and grid-based sources across Victoria. The system is designed for professional botanical use. The FIS has a number of background maps that can be used for the visual display of data. Most data has been collected by either NRE staff or the Royal Botanic Gardens, however, Parks Victoria, consultants, field naturalists and other departments and institutions have made additional contributions.

Wildlife Atlas

The Wildlife Atlas is an electronic database that stores fauna records collected across Victoria. It is updated regularly from fauna surveys across the state. The data can be quickly extracted in tabular form. The Atlas does not have a user-friendly graphical interface; hence, the Victorian Fauna Display was developed.

Victorian Fauna Display (VFD)

The VFD is an interactive database that combines distributional data for Victorian native and introduced fauna with a number of background maps such as topography, roads, hydrology and rainfall. Data is sourced from a range of organisations and individuals including NRE research and survey monitoring programs, the Museum of Victorian, local and state-wide conservation groups such as Birds Australia, field naturalist groups, environmental consultants and the general public.

Aquatic Fauna Display (AFD)

The AFD is a database that stores aquatic invertebrate and fish data from across Victoria. The development of the database has recently been completed and data is currently being inserted. Some aquatic fauna data is also represented in VFD.

This report describes the process and databases used for bioregional riparian biodiversity assessment in southern Victoria.

Methods

An assessment of the extent and management requirements of riparian biodiversity (native and introduced) in the four bioregions of this study was made using a number of computer-based tools and databases developed by NRE. The GIS software package ArcView (ESRI 1999) maps various characteristics of each bioregion including hydrology, roads, land use and EVCs, with the data available at 1:25,000, 1:100,000 and 1:500,000 scales. For this study data layers from the 1:100,000 scale were obtained from the NRE Corporate Geospatial Data Library (NRE-CGDL) and used to determine the broad-scale plant biodiversity and to identify potential project site locations. The selection criterion for project sites was determined to include areas adjacent to small (1st or 2nd order) streams in areas close to or adjoining quality patches of remnant native vegetation.

It was not possible to accurately describe the biodiversity across the entire four bioregions using GIS due to the extent of the study area, incomplete data for some bioregions and the impracticality of assessing such a large area of land. To overcome this problem, two catchments were selected as broadly representative of three out of the four bioregions and their riparian biodiversity documented

using the BioMap system and four flora and fauna databases. The two case-study catchments selected were the Cooriemungle Creek catchment, near Port Campbell, in the Warrnambool Plain bioregion; and the Bear Creek catchment, near Warragul, in the Gippsland Plain and Strzelecki Ranges bioregions.

The methods used for each biodiversity assessment tool are detailed below.

GIS mapping

- Maps of EVCs, locations, roads and hydrology for each bioregion were generated using the ArcView package (ESRI 1999). The NRE-CGDL layers used to develop maps for each bioregion are listed in Table 2.1.
- Maps were used to aid in identifying areas that may yield suitable project sites.
- Maps of pre- European settlement (pre-1750) and current vegetation extent were produced for each case-study catchment to highlight changes in biodiversity since European settlement. The data layers used to produce these maps were the EVC_CMP100, HYDRO100 and EVC1750_CMP – EVCs present in 1750.

Table 2.1. NRE-CGDL data layers used to develop maps in the ArcView application**.**

Layer	Description
VBIOREGION250	Victorian bioregions at the 1:250 000 scale
EVC_CMP100	A composite 1:100 000-scale layer of EVCs at the 1:100 000 scale
HYDRO100	Hydrological linear features at the 1:100 000 scale
ROAD100	Roads at the 1:100 000 scale
LOCN	Place names
LOCN500	Place names at the 1:500 000 scale
SVEG100	Structural vegetation as at 1995
THFAU500	Threatened fauna at the 1:500 000 scale
THFLOR500	Threatened flora at the 1:500 000 scale
TREEDEN25	Tree cover density at the 1:25 000 scale
WETLAND1994	Wetland extent and environments as at 1994

BioMap mapping

BioMap provided finer-scale biodiversity mapping (1:25,000) to assist the selection of the case-study catchments and project site areas and to document the biodiversity and threatened species present within the two case-study catchments.

- BioMaps were created for project site areas at 1:100 000 and 1:25 000 scales (where information was available at this scale).
- The themes used on the BioMaps included threatened species, EVCs, hydrology, sites of biological significance and threatening processes.
- Cooriemungle Creek and Bear Creek were selected as case-study catchments.
- The maps enabled a visual assessment of available biodiversity information of the case-study catchments.

Flora and Fauna databases

GIS and BioMap mapping provided a visual assessment of biodiversity of the case-study catchments. Survey locations and species records within the catchments were obtained using FIS and VFD flora and fauna databases.

- A graphical interface (1:100,000 base landuse map) was used as the starting point for searching for existing flora and fauna surveys within the case-study catchments.

- The databases were searched for flora and fauna records within a 15 x 18 km area (also known as 10 minute-grid information) and within the catchment (as defined by drawing a polygon within the application).
- Restricting the search area to include only those areas close to streams, such as riparian zones, was possible, however, the accuracy of the data was decreased such that it was not known as to whether a site occurred within the search area or not.
- Flora and fauna records were reviewed by wildlife and plant ecologists to determine riparian species.
- Lists of flora and fauna species of conservation significance (both state and national level) that occur within the bioregions of this study were determined using biodiversity databases. The distribution of these was mapped using a Wildlife Atlas mapping tool.

Results and Discussion

Maps of the dominant EVCs, hydrology and land use for each bioregion were produced using the ArcView package, and are presented in Figures 2.1(a) through to (i). Observations on the vegetation patterns are located in boxes within each figure. Figures 2.2 and 2.3 compare present-day EVCs and hydrology with EVCs from pre-European settlement (pre-1750) for the Bear Creek and Cooriemungle Creek case-study catchments respectively.

Bioregions

GIS mapping - EVCs
Cleared agricultural and private landscapes dominate in all four bioregions with plantations also dominant in the Gippsland Plain and Strzelecki Ranges bioregions. Lowland forest comprise the major EVCs of all bioregions with Herb-rich Foothill Forest in the Warrnambool Plain and Heathy Woodland in the Otway Plain. Remnant vegetation patches are primarily coastal in the Warrnambool Plain, in the Otway Ranges foothills and to the east of the Gippsland Plain and Strzelecki Ranges.

GIS mapping – Land use
Dryland (rainfed) pasture constitutes over 60% of the land use of all bioregions, with some irrigated pasture occurring to the north east of the Gippsland Plain. Recorded remnant native vegetation comprises a very small percentage of the land area with the lowest occurrence in the Warrnambool Plain.

GIS mapping - Hydrology
The Strzelecki Ranges has the most extensive stream network of the four bioregions due to the high rainfall and steep topography, while the Warrnambool Plain has the least extensive network. Streams in the Warrnambool Plain are concentrated to the east with tributaries running parallel (NW-SE) to each other, primarily due to the karst (limestone) formations occurring in the west. Most streams in the Otway Plain flow in an easterly and northeasterly direction except for some southerly flowing streams to the south of the bioregion. In the easterly bioregions, most streams drain to the southwest into Western Port Bay or to the east into the La Trobe River.

Catchments

GIS – EVCs and Hydrology
The extent of vegetation shows a predominance of agricultural pasture in both catchments and a substantial change from woody plants to grassy pasture post European settlement. Both catchments contain EVCs near streams that are likely to contain riparian plant species. Remnant riparian vegetation in the Bear Creek Catchment is largely restricted to the upper parts of the catchment, where it is closely associated with streams. Remnant vegetation in the Cooriemungle Creek Catchment is present along some sections of watercourses in the lower part of the catchment, partly associated with a flora reserve, and also in the upper part of the catchment.

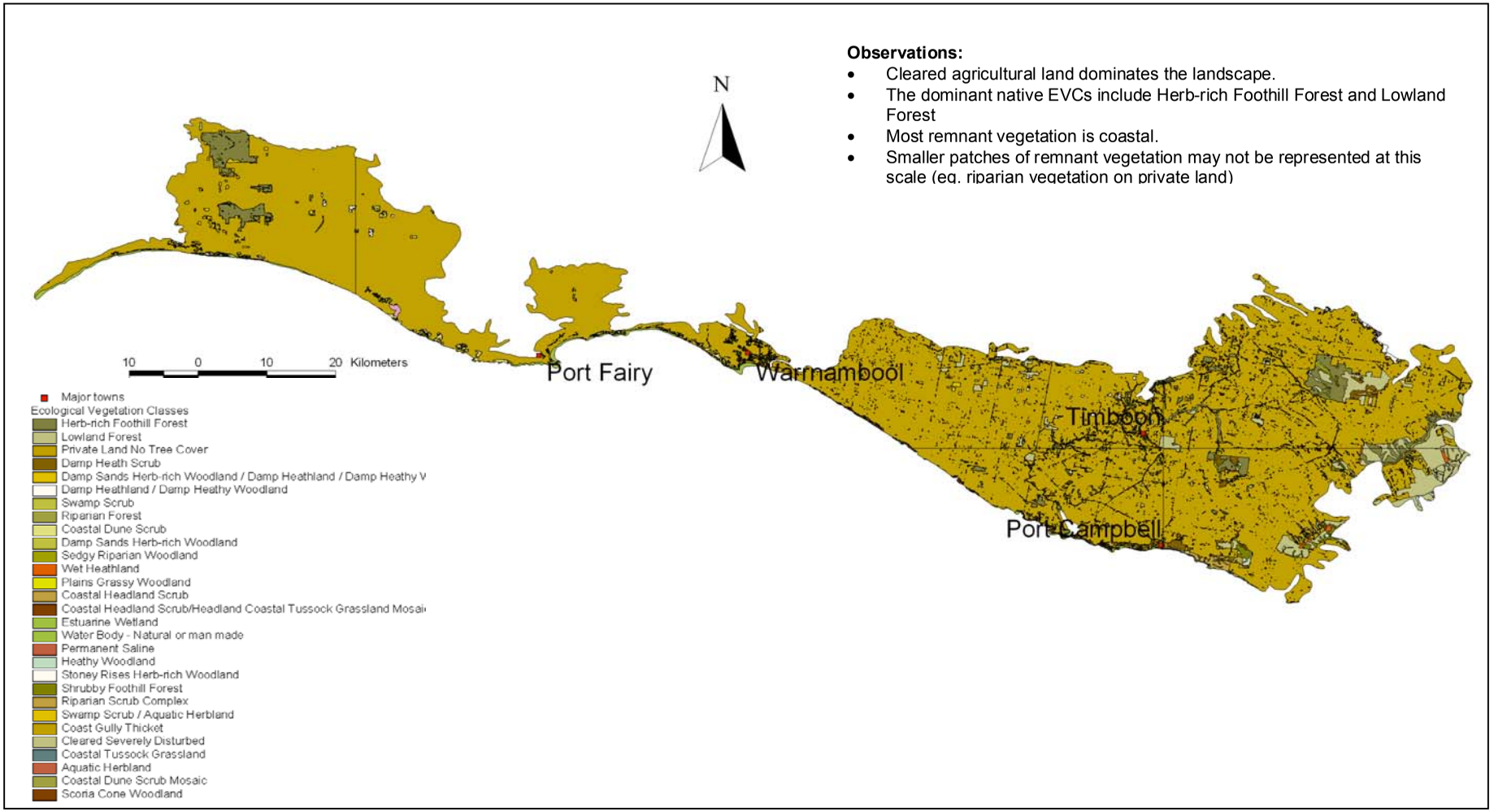


Figure 2.1a. Ecological Vegetation Classes for the Warrnambool Plain (derived from the EVC100_CMP CGDL data layer).

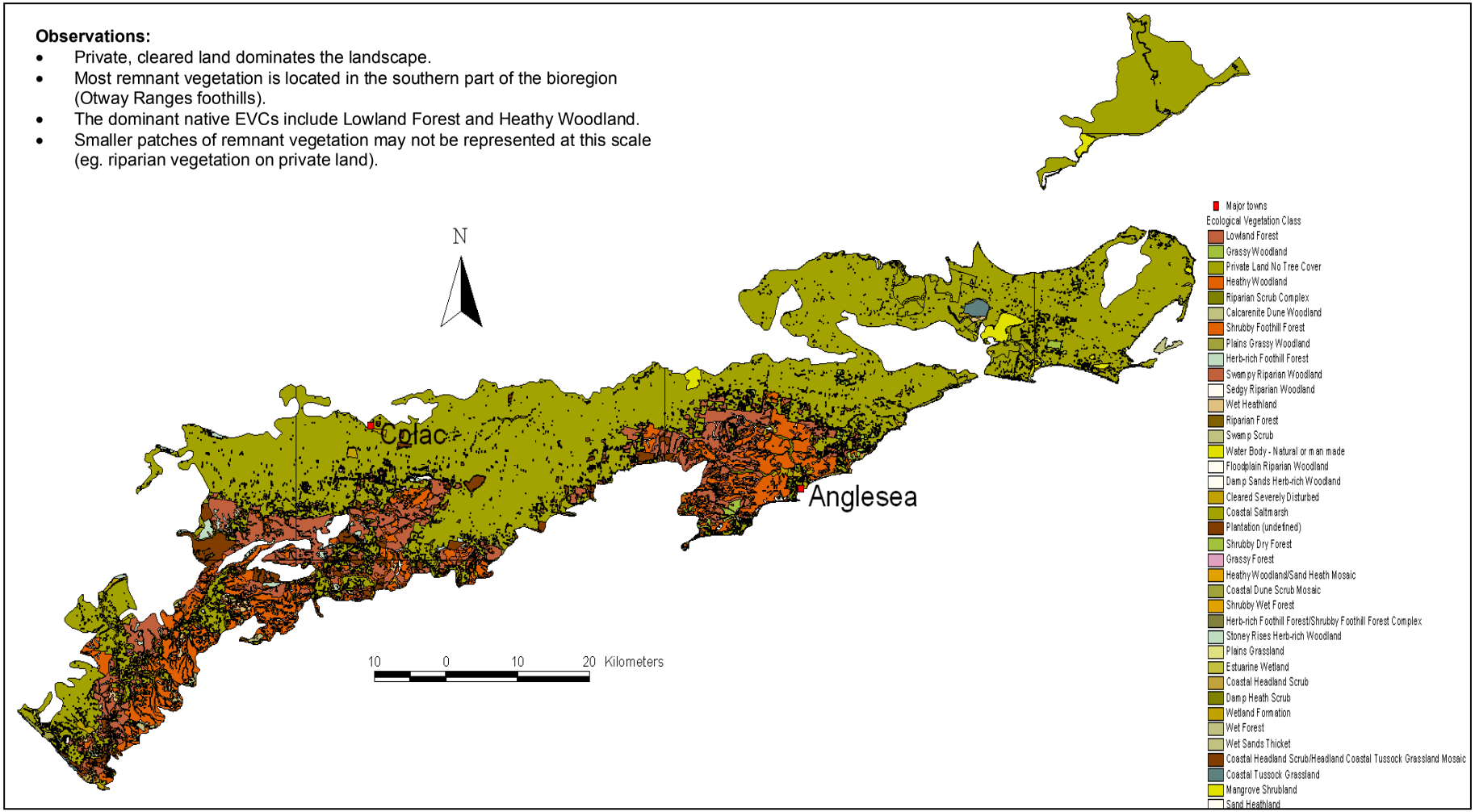


Figure 2.1b. Ecological Vegetation Classes for the Otway Plain bioregion (derived from the EVC100_CMP CGDL data layer).

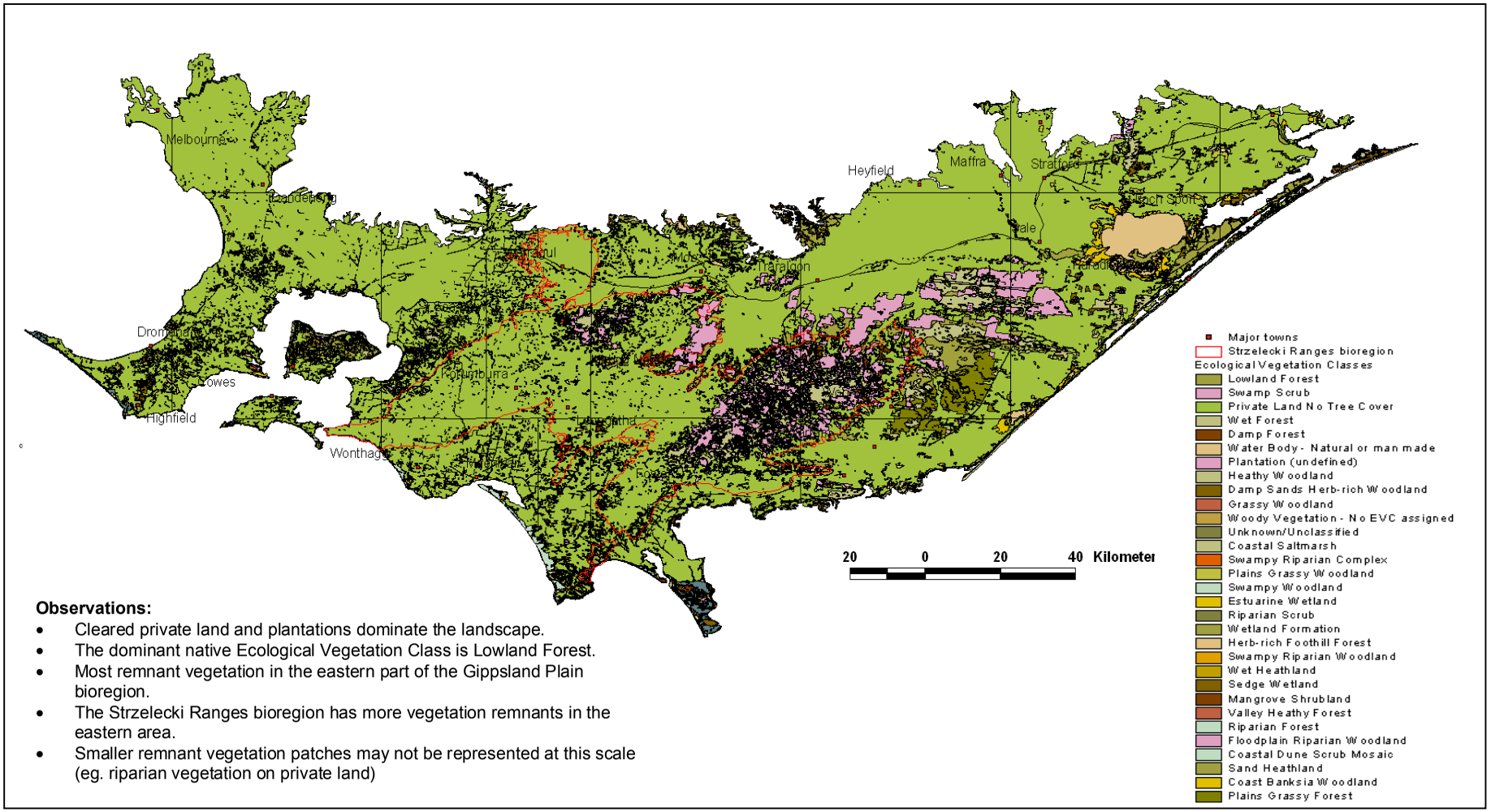
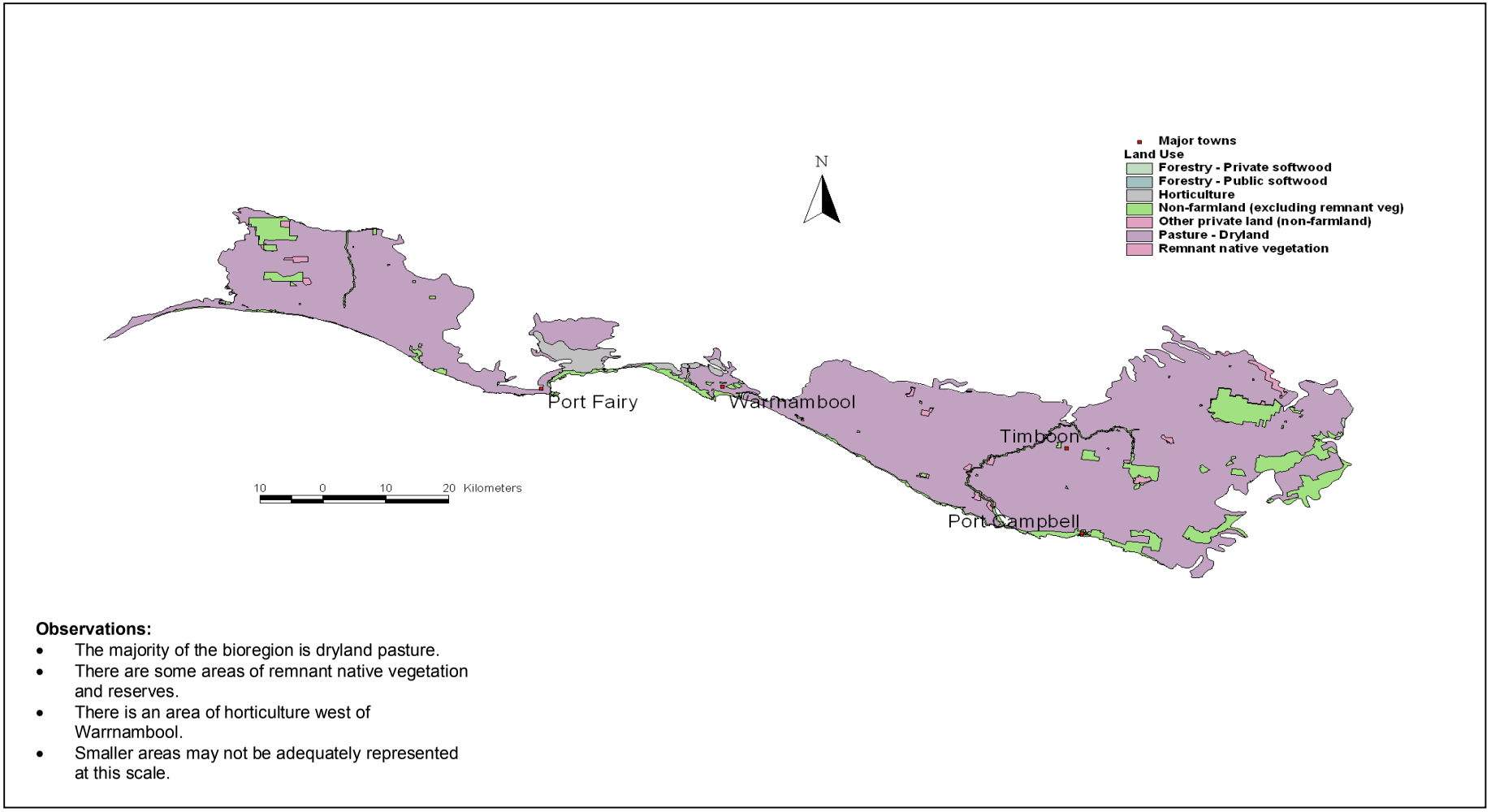


Figure 2.1c. Ecological Vegetation Classes for the Gippsland Plain and Strzelecki Ranges (derived from EVC100_CMP data layer).



Observations:

- The majority of the bioregion is dryland pasture.
- There are some areas of remnant native vegetation and reserves.
- There is an area of horticulture west of Warrnambool.
- Smaller areas may not be adequately represented at this scale.

Figure 2.1d. Land use map for the Warrnambool Plain (derived from the LUSE250 CGDL data layer).

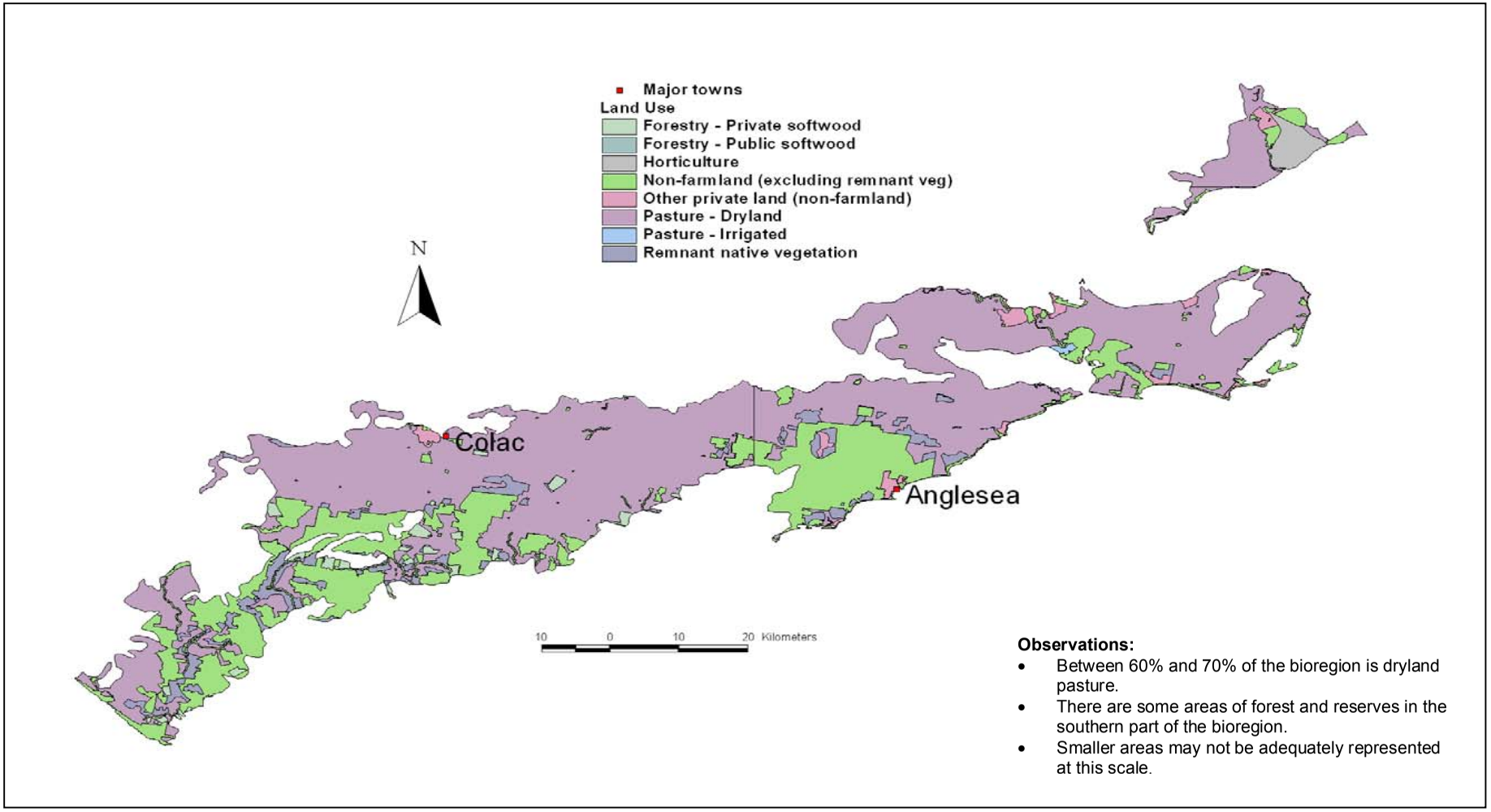


Figure 2.1e. Land use map for the Otway Plain (derived from the LUSE100 CGDL data layer).

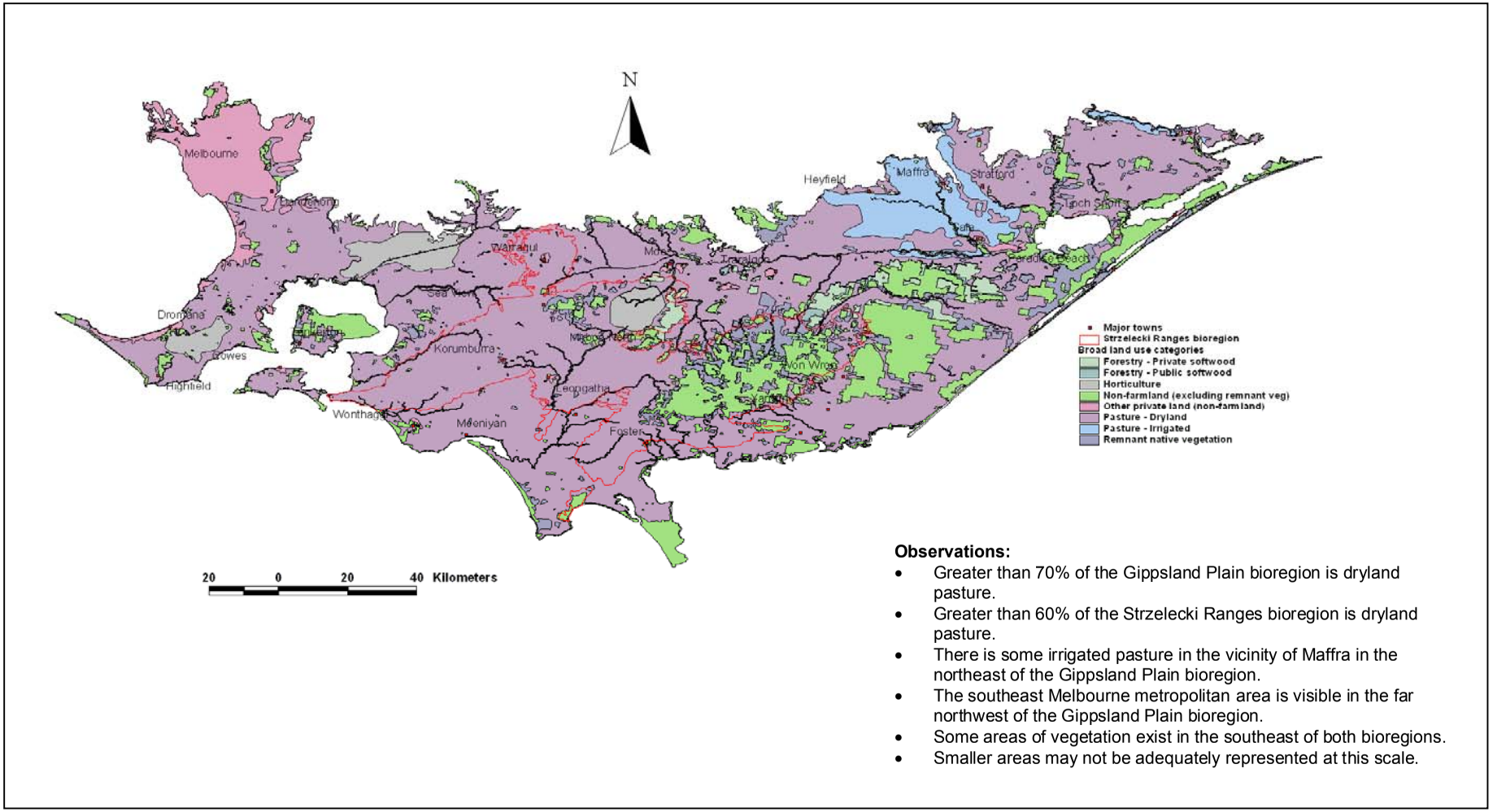


Figure 2.1f. Land use map for the Gippsland Plain and Strzelecki Ranges (derived from the LUSE100 CGDL data layer).

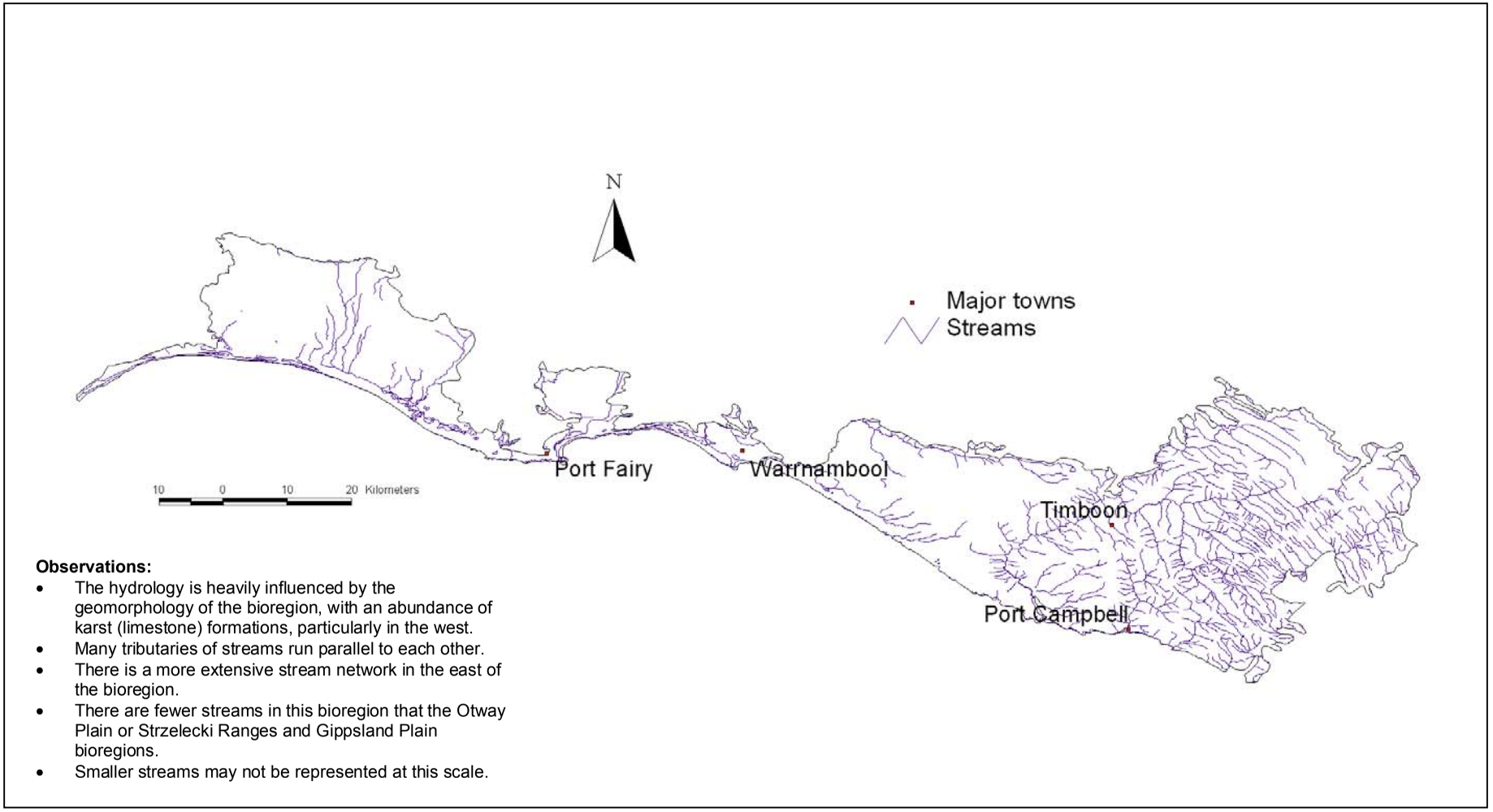


Figure 2.1g. Hydrology map of the Warrnambool Plain (derived from the HYDRO100 CGDL data layer).

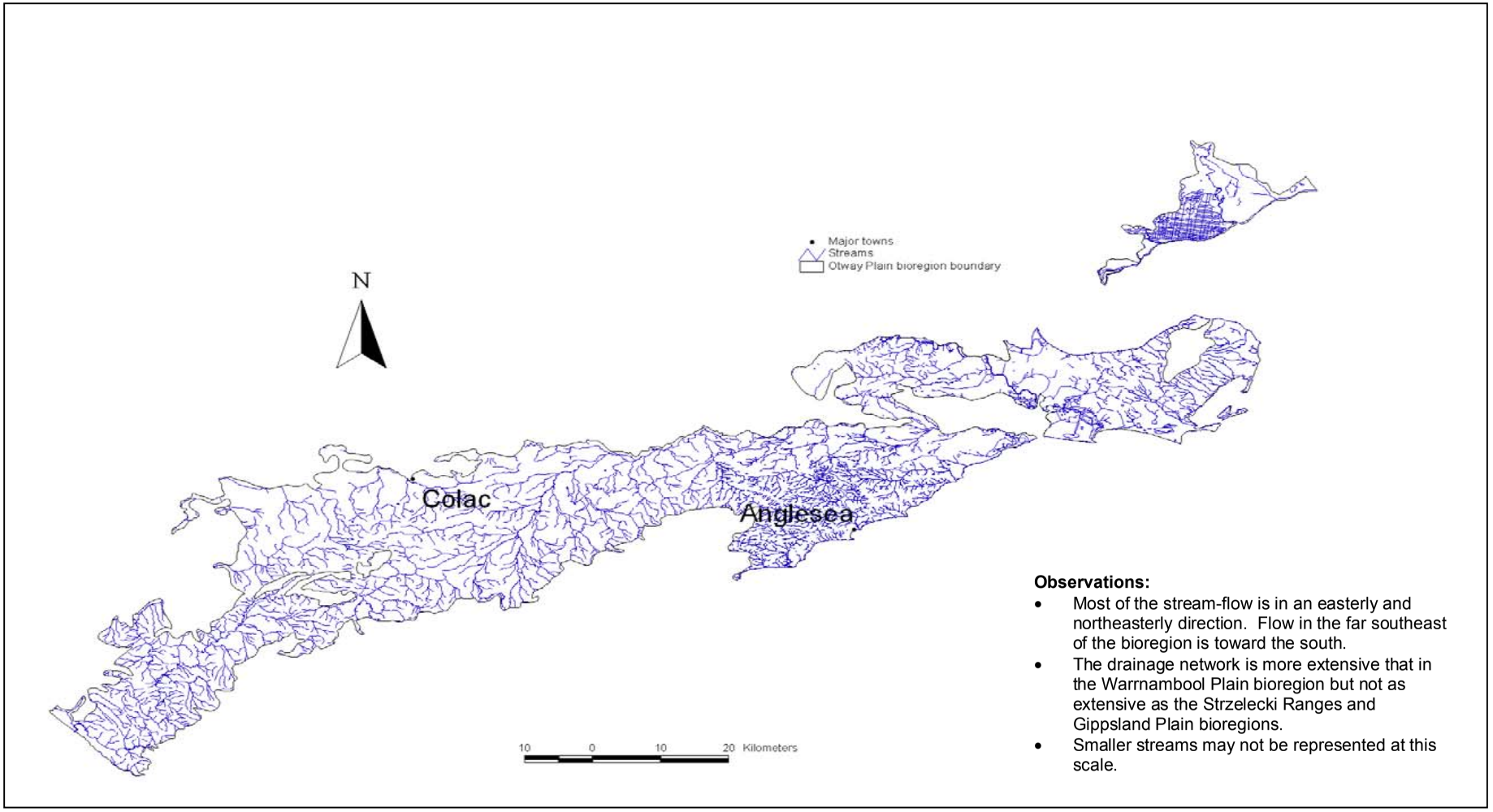


Figure 2.1h. Hydrology map for the Otway Plain (derived from the HYDRO100 CGDL data layer).

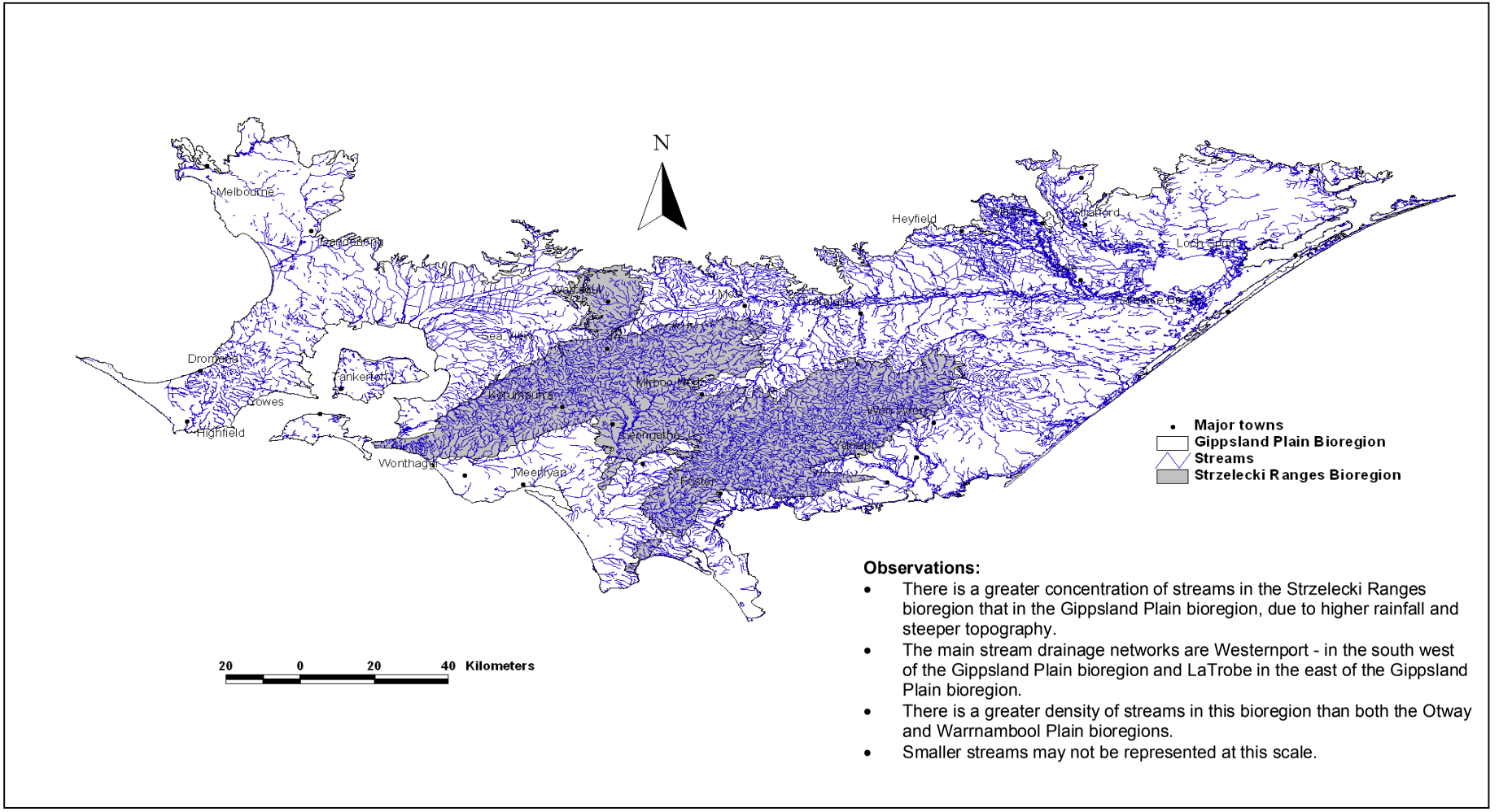


Figure 2.1i. Hydrology map for the Gippsland Plain and Strzelecki Ranges (derived from the HYDRO100 CGDL data layer).

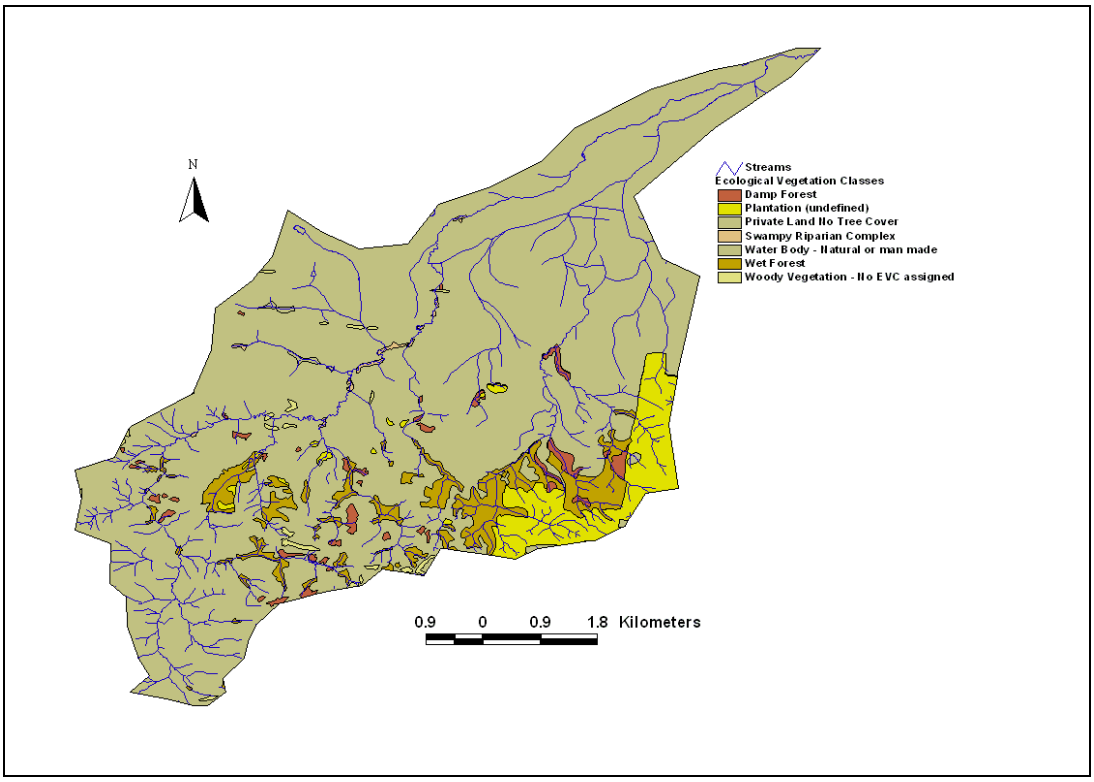


Figure 2.2a. Hydrology and EVCs of the Bear Creek Catchment (using 1:100 000 EVC data layer)

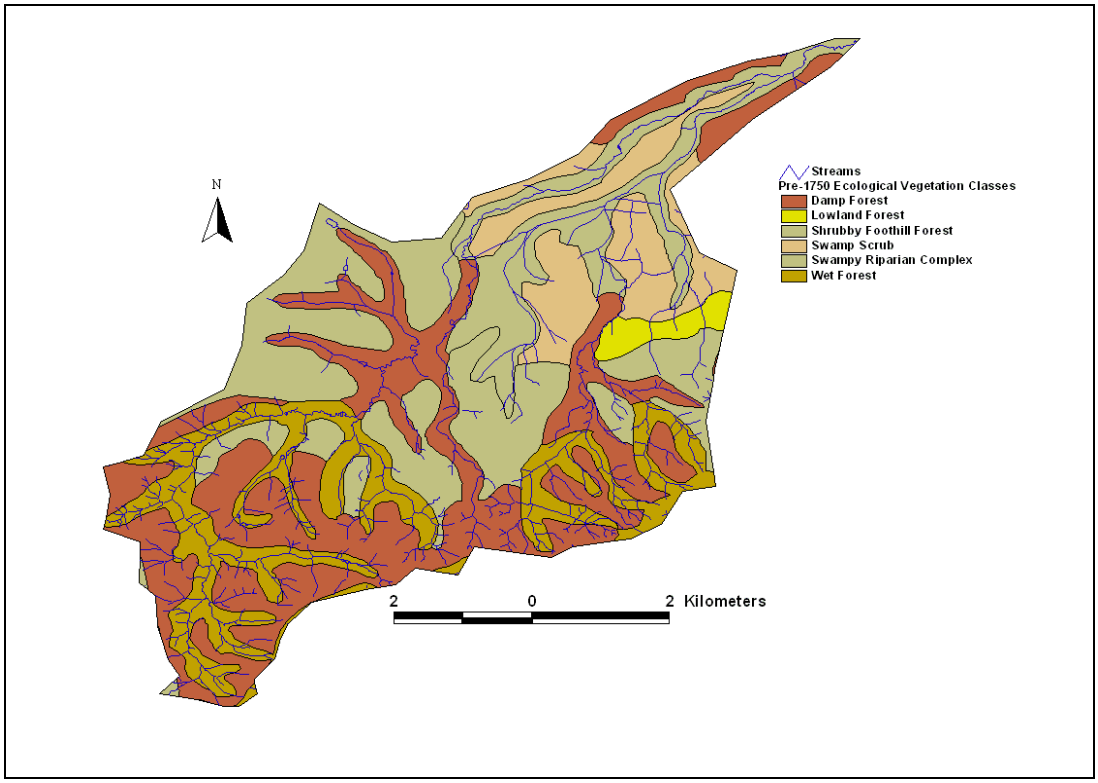


Figure 2.2b. Hydrology and pre-1750 EVCs of the Bear Creek Catchment (using 1:100 000 pre-1750 EVC data layer).

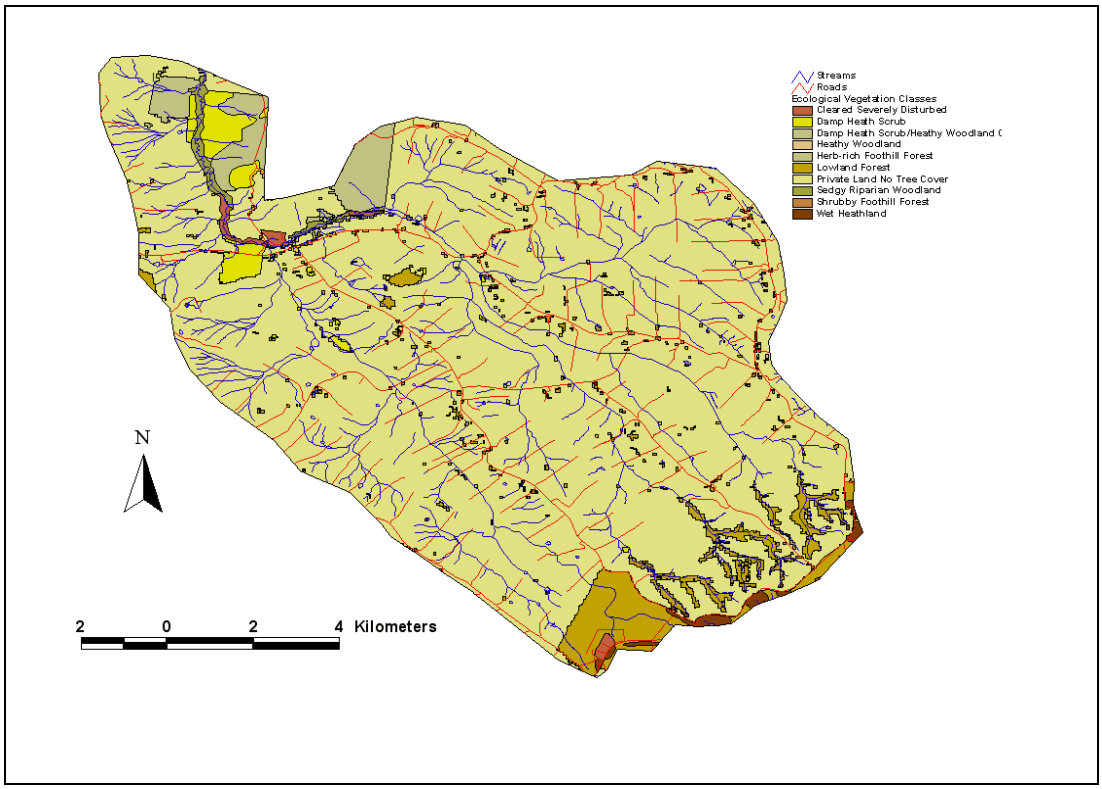


Figure 2.3a. Hydrology and present-day EVCs of the Cooriemungle Creek Catchment (using 1:100 000 EVC data layer).

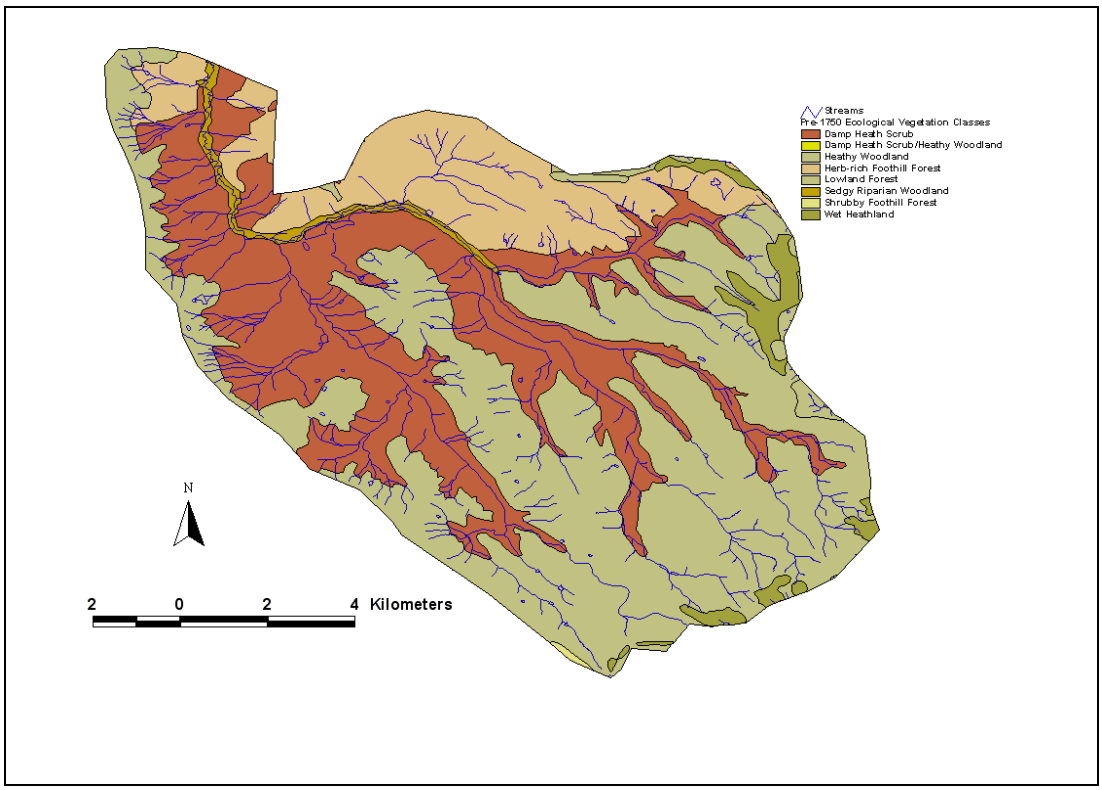


Figure 2.3b. Hydrology and pre-1750 EVCs of the Cooriemungle Creek Catchment (using 1:100 000 pre-1750 EVC data layer).

BioMap

The BioMaps (Figures 2.4 and 2.5) provide a relatively simple visual display of vegetation types and patterns and threatened species information, overlayed onto stream hydrology and topography. The BioMaps were used as a visual aid in the workshops to stimulate discussion on the hydrology and biodiversity of the bioregions. EVCs and hydrology displayed on the BioMaps was consistent with the GIS-produced maps, as the sources of data were the same for both. Sites of biological significance and threatening processes were not evident on the BioMaps, most likely due to the lack of survey data within these areas.

Biodiversity databases

Two database search procedures were employed to extract flora and fauna records from the FIS and VFD for the case-study catchments, (a) catchment based search and (b) ten-minute grid information. The catchment-based search provided records from within each case-study catchment, whilst the ten-minute grid information provided a means to predict potential flora and fauna species within each catchment. However, due to the limitations of each search, neither procedures could directly infer the presence of a particular species (a) within the riparian zone, or (b) that the species recorded within the ten-minute grid area were actually present in each catchment.

The number of flora and fauna species recorded in both the case-study catchments and ten-minute grid area incorporating the case-study catchment is shown in Table 2.2. Complete species lists can be found in Appendix II.

Table 2.2. Flora and fauna records for the Bear Creek and Cooriemungle Creek catchments using a catchment based search and ten-minute grid.

Catchment	***Flora***		***Fauna***	
	Catchment	*Ten-minute grid*	*Catchment*	*Ten-minute grid*
Bear Creek	6	307	38	156
Cooriemungle Creek	102	601	61	192

Only six plant species were identified in the FIS from the Bear Creek catchment, with all of these being introduced pasture weeds. The low number of species recorded is likely to be an under-representation of the flora present within the catchment due to the limited number of surveys undertaken to-date within this area, as is common on private land. In contrast, many more surveys have been undertaken within the Cooriemungle Creek catchment owing to the Cooriemungle Creek Flora reserve, an area of crown land that has been surveyed intensively.

The larger number of fauna records in Cooriemungle Creek catchment is also most likely a reflection of the presence of the flora reserve and larger number of surveys. Birds, some of which frequent the riparian zone, dominated the fauna records in both catchments. One fish and two invertebrates were also recorded in the catchment. The Bear Creek catchment had no record of introduced mammals. This result is most likely due to restricted surveying as foxes and rabbits are known to occur in this area (J. Laidlaw, pers.comm.).

Data from the case-study catchments indicate there is a paucity of information in the biodiversity databases for areas predominantly consisting of private land. Furthermore, the majority of surveys have been conducted in areas away from the riparian zone. Therefore, it is likely that on-ground surveys will be required at project sites to supplement the data obtained from these databases.

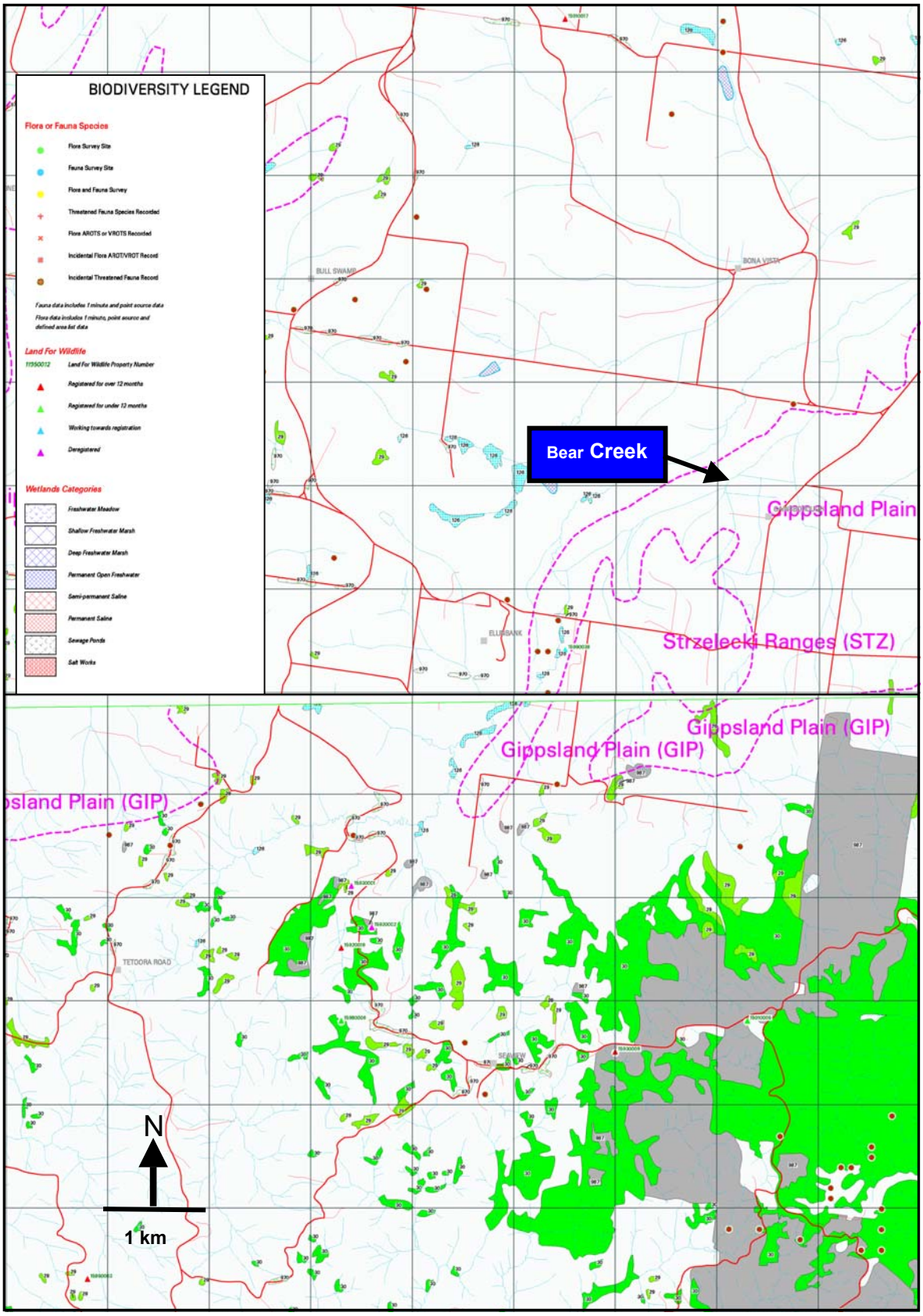


Figure 2.4. A composite map of the Bear Creek Catchment in Gippsland, Victoria. Formed from excerpts of the Warragul and Mt Worth BioMaps.

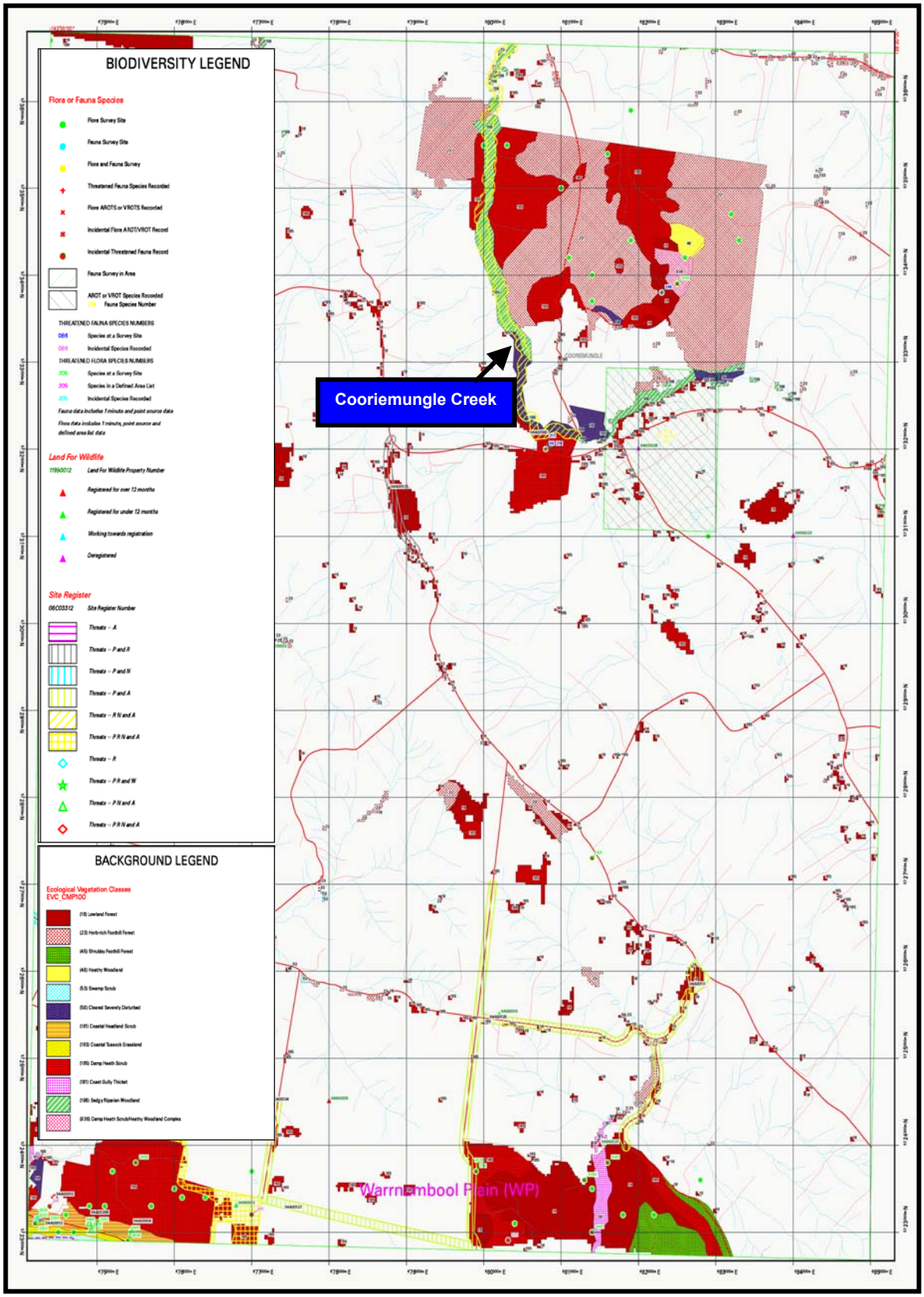


Figure 2.5. Excerpt from a BioMap of the Cooriemungle Creek catchment in south-west Victoria.

Threatened species in the bioregions

The fauna species of conservation significance that occur in the bioregions of this study and are known to inhabit riparian land are presented in Tables 2.3a and b. Distribution maps of the spot-tailed quoll, *Dasyurus maculatus*, (Figure 2.6) and the swamp skink, *Egernia coventryi*, (Figure 2.7) have been provided as examples. The distribution maps of all threatened fauna known to occur within the riparian zone of the four bioregions are located in Appendix III.

Table 2.3a. Fauna of conservation significance in Victoria and nationally.

Common Name	Scientific Name	CST[1]	FFG[2]
Fish			
Australian Grayling	*Prototroctes maraena*	Vul	L
Australian Mudfish	*Galaxias cleaveri*	End	L
Dwarf Galaxias	*Galaxiella pusilla*	LR	L
Yarra Pigmy Perch	*Edelia obscura*	LR	L
River Blackfish	*Gadopsis marmoratus*	Ins	
Striped Gudgeon	*Gobiomorphus australis*	Vul	
Cox's Gudgeon	*Gobiomorphus coxii*	End	L
Terrestrial invertebrates			
Giant Gippsland Earthworm	*Megascolides australis*	Vul	L
Large Ant Blue	*Acrodipsas brisbanensis*	R/R	L
Small Ant Blue	*Acrodipsas myrmecophila*	End	L
Caddisfly	*Archaeophylax canarus*	R/R	L
Aquatic invertebrates			
Caddisfly	*Orphinotrichia justini*	Ins	
Caddisfly	*Plectrotarsus gravenhorstii*	Ins	
Caddisfly	*Tanjistomella verna*	Vul	
Calanoid copepod	*Boekella nyoraensis*	R/R	
Narracan Burrowing Cray	*Engages phyllocercus*	R/R	L
Strzelecki Burrowing Cray	*Engaeus rostrogaleatus*	R/R	L
Warragul Burrowing Cray	*Engaeus sternalis*	End	L
South Gippsland Spiny Cray	*Euastacus neodiversus*	R/R	L
Amphibians			
Martin's Toadlet	*Uperoleia martini*	Ins	
Mountain Dragon Anglesea form	*Tympanocryptus diemensis Anglesea*	CEn	
Reptiles			
Swamp Skink	*Egernia coventryi*	Vul	
Glossy Grass Skink	*Pseudemoia rawlinsoni*	LR	
Lace Monitor	*Varanus varius*	Ins	
Mammals			
Spot-tailed Quoll	*Dasyurus maculatus*	End	L
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vul	
Swamp Antechinus	*Antechinus minimus*	LR	
Broad-toothed Rat	*Mastacomys fuscus*	LR	
Southern Myotis	*Myotis macropus*	LR	
Long-nosed Potoroo	*Potorous tridactylis*	LR	

[1] CST = Conservation Status in Victoria. Categories: CEn = Critically Endangered, End = Endangered, Vul = Vulnerable, R/R = rare, LR = Lower risk, Ins = Insufficiently known.

[2] FFG = Flora and Fauna Guarantee listed. L = listed.

Table 2.3b. Fauna of conservation significance in Victoria and nationally.

Common Name	Scientific Name	CST[1]	FFG[2]	ANZECC[3]	Riparian associated?
Birds					
Intermediate Egret	*Ardea intermedia*	CEn	L		yes
King Quail	*Coturnix chinensis*	CEn	L		possibly/partial
Little Egret	*Egretta garzetta*	CEn	L		possibly/partial
Orange-bellied Parrot	*Neophema chrysogaster*	CEn	L	E	possibly/partial
Regent Honeyeater	*Xanthomyza phrygia*	CEn	L	E	possibly/partial
Magpie Goose (reintroduced)	*Anseranas semipalmata*	End			possibly/partial
Great Egret	*Ardea alba*	End	L		yes
Australasian Bittern	*Botaurus poiciloptilus*	End	N		yes
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	End	L		yes
Little Bittern	*Ixobrychus minutus*	End	N		yes
Swift Parrot	*Lathamus discolor*	End	L	V	possibly/partial
Helmeted Honeyeater	*Lichenostomus melanops cassidix*	End	L	E	yes
Square-tailed Kite	*Lophoictinia isura*	End	N		possibly/partial
Barking Owl	*Ninox connivens*	End	N		possibly/partial
Powerful Owl	*Ninox strenua*	End	L		possibly/partial
Superb Parrot	*Polytelis swainsonii*	End	L	V	possibly/partial
Grey-crowned Babbler	*Pomatostomus temporalis*	End	L		possibly/partial
Lewin's Rail	*Rallus pectoralis*	End	N		yes
Painted Snipe	*Rostratula benghalensis*	End			yes
Gull-billed Tern	*Sterna nilotica*	End	N		possibly/partial
Freckled Duck	*Stictonetta naevosa*	End	L		possibly/partial
Masked Owl	*Tyto novaehollandiae*	End	L		possibly/partial
Australasian Shoveller	*Anas rhynchotis*	Vul			possibly/partial
Hardhead	*Aythya australis*	Vul			possibly/partial
Musk Duck	*Biziura lobata*	Vul			possibly/partial
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vul	L		possibly/partial
Cape Barren Goose	*Cereopsis novaehollandiae*	Vul			possibly/partial
Rufous Bristlebird (Otways)	*Dasyornis broadbenti broadbenti*	Vul	L		possibly/partial
Diamond Dove	*Geopelia cuneata*	Vul			possibly/partial
Painted Honeyeater	*Grantiella picta*	Vul	L		possibly/partial
Brolga	*Grus rubicunda*	Vul	L		possibly/partial
Nankeen Night Heron	*Nycticorax caledonicus*	Vul			yes
Blue-billed Duck	*Oxyura australis*	Vul	N		possibly/partial
Ground Parrot	*Pezoporus wallicus*	Vul	L		possibly/partial
Royal Spoonbill	*Platalea regia*	Vul			yes
Glossy Ibis	*Plegadis falcinellus*	Vul			yes
Baillon's Crake	*Porzana pusilla*	Vul	N		yes
Caspian Tern	*Sterna caspia*	Vul	N		possibly/partial
Red-backed Kingfisher	*Todiramphus pyrropygia*	Vul			possibly/partial
Sooty Owl	*Tyto tenebricosa*	Vul	L		possibly/partial
Grey Goshawk	*Accipiter novaehollandiae*	LR			possibly/partial
Whiskered Tern	*Chlidonias hybridus*	LR			yes
Pectoral Sandpiper	*Calidris melanotos*	Ins			possibly/partial
Long-toed Stint	*Calidris subminuta*	Ins			possibly/partial
Brown Quail	*Coturnix ypsilophora*	Ins			possibly/partial
Chestnut-rumped Heathwren	*Hylacola pyrrhopygia*	Ins			possibly/partial

[1] CST = Conservation Status in Victoria: Categories: CEn = Critically endangered, End = Endangered, Vul = Vulnerable, LR = Lower risk, Ins = Insufficiently known.

[2] FFG = Flora and Fauna Guarantee listed. Categories: L = listed and N= nominated for listing.

[3] ANZECC = Australian and New Zealand Environment Conservation Council. Categories: E = endangered and V = vulnerable.

A total of 77 fauna species of conservation significance have been recorded within the riparian zones of the four bioregions. The majority of these are birds, of which a large proportion are likely to be transient visitors to the riparian zone.

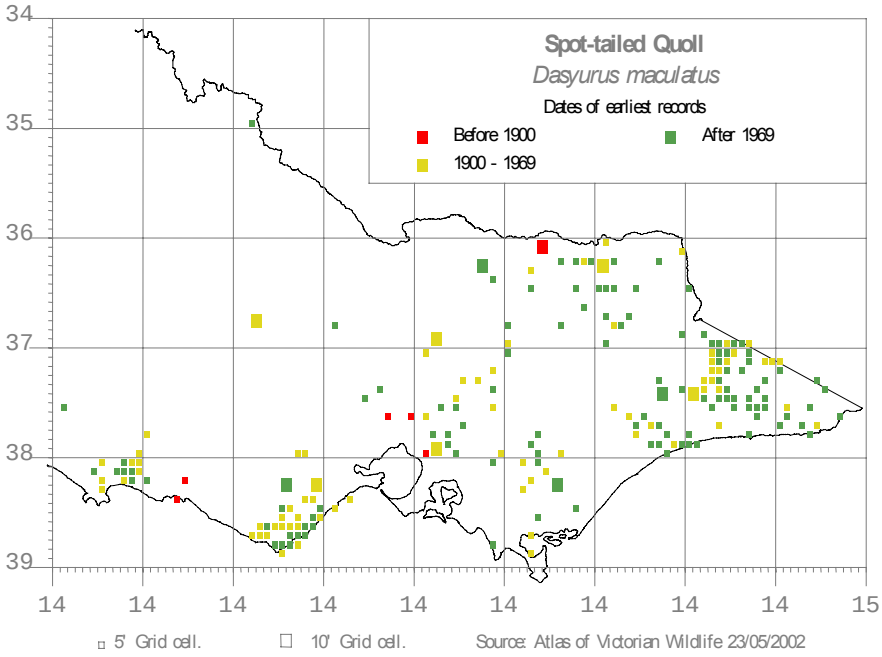


Figure 2.6. Distribution of the spot-tailed quoll in Victoria. Source: Wildlife Atlas, (NRE 2002a).

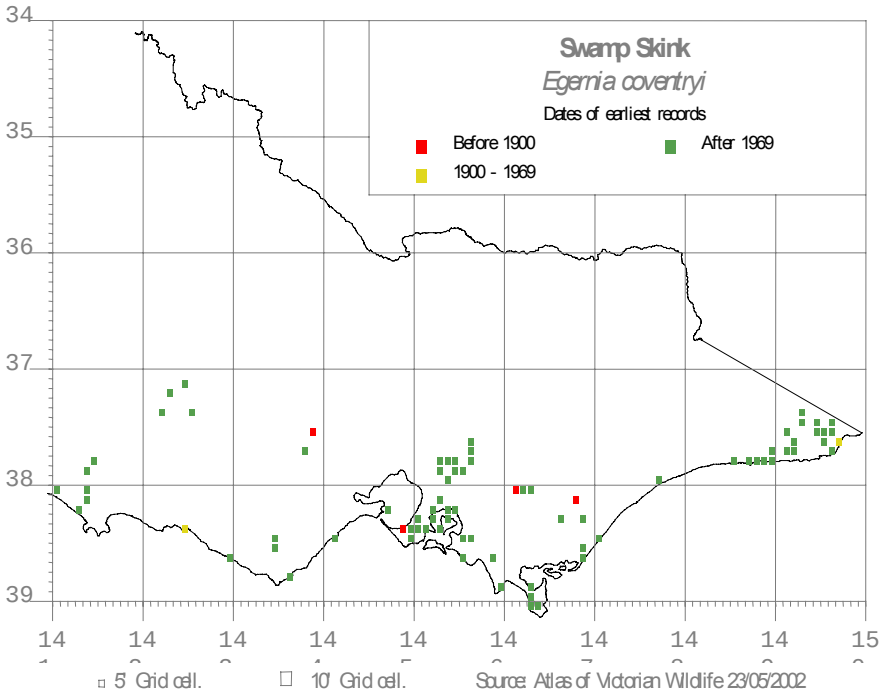


Figure 2.7. Distribution of the swamp skink in Victoria. Source: Wildlife Atlas, (NRE 2002a).

The distribution maps produced provide a means to visually assess the distribution of the fauna species and the change in distribution over time. A reduction in the records of the spot-tail quoll after 1969 is clearly evident (Figure 2.6) unlike that for the swamp skink (Figure 2.7) where fewer records exist before 1969.

Table 2.4. Flora of conservation significance categorised according to bioregion.

Common Name	Scientific Name	Vrots[1]	Arots[2]	Habitat[3]
Warrnambool and Otway Plain				
Blue Prickly Tussock-grass	*Poa labillardierei (Volcanic Plains form)*	k		E
Branching Groundsel	*Senecio cunninghamii var. cunninghamii*	k		(W)
Brooker's Gum	*Eucalyptus brookeriana*	r		F
Currant-wood	*Monotoca glauca*	r		E
Glenelg Pomaderris	*Pomaderris halmaturina ssp. continentis*	r	R	E
Gorae Leek-orchid	*Prasophyllum diversiflorum*	e	E	(W)
Lime Fern	*Pneumatopteris pennigera*	e		R
Pale Swamp Everlasting	*Helichrysum aff. rutidolepis* (Lowland Swamps)	v		W,R
Ruddy Bent	*Agrostis rudis*	r		W,R
Showy Lobelia	*Lobelia beaugleholei*	r	R	W
Small Scurf-pea	*Cullen parvum*	e	E	E
Spiny Pepper-cress	*Lepidium aschersonii*	e	V	W,S
Square Raspwort	*Haloragis exalata ssp. exalata var. exalata*	v	V	R
Squat Picris	*Picris squarrosa*	r		R
Swamp Billy-buttons	*Craspedia paludicola*	v		W,R
Tufted Club-sedge	*Isolepis wakefieldiana*	r		E
Wavy Swamp Wallaby-grass	*Amphibromus sinuatus*	v		W
Yarra Gum	*Eucalyptus yarraensis*	k	R	R
Gippsland Plain and Strzelecki Ranges				
Annual Bitter-cress	*Cardamine paucijuga s.s.*	v		R
Beech Finger-fern	*Grammitis magellanica ssp. nothofageti*	v		F
Creeping Rush	*Juncus revolutus*	r		W,C,S
Currant-wood	*Monotoca glauca*	r		E
Dark Mignonette-orchid	*Microtis orbicularis*	v		W
Dwarf Kerrawang	*Rulingia prostrata*	e	E	W
Filmy Maidenhair	*Adiantum diaphanum*	e		F
Forde Poa	*Poa fordeana*	k		R
Green Scentbark	*Eucalyptus fulgens*	v		E
Green-top Sedge	*Carex chlorantha*	k		R
Grey Billy-buttons	*Craspedia canens*	e		W
Grey Spike-sedge	*Eleocharis macbarronii*	k		W,R
Japanese Lady-fern	*Deparia petersenii ssp. congrua*	r		R,F
Limestone Pomaderris	*Pomaderris oraria ssp. calcicola*	r	R	E
Netted brake	*Pteris comans*	r		F
Open Marshwort	*Nymphoides geminata*	r		W
Oval Fork-fern	*Tmesipteris ovata*	r		F
River Hook-sedge	*Uncinia nemoralis*	r		R,F
River Swamp Wallaby-grass	*Amphibromus fluitans*	k	V	R,W
Rough-grain Love-grass	*Eragrostis trachycarpa*	r		(W)
Ruddy Bent	*Agrostis rudis*	r		W,R
Shingle Fireweed	*Senecio diaschides*	r		R
Silky Golden-tip	*Goodia lotifolia var. pubescens*	r		E
Slender Fork-fern	*Tmesipteris elongata ssp. elongata*	v		F
Slender Tree-fern	*Cyathea cunninghamii*	v	R	F
Striped Pomaderis	*Pomaderris pilifera*	r		E
Strzelecki Gum	*Eucalyptus strzeleckii*	v	V	E,F
Swamp Billy-buttons	*Craspedia paludicola*	v		W,R
Swamp Bush-pea	*Pultenaea weindorferi*	r	R	(W)
Swamp Everlasting	*Bracteantha palustris*	v	V	W
Veiled Fringe-sedge	*Fimbristylis velata*	r		L,R
Venus-hair Fern	*Adiantum capillus-veneris*	e		E
Wavy Swamp Wallaby-grass	*Amphibromus sinuatus*	v		W
White Mangrove	*Avicennia marina ssp. australasica*	r		E
Yarra Gum	*Eucalyptus yarraensis*	k	R	R

[1] Vrots: Victorian Rare or Threatened Status. Categories: e = endangered; r = rare; v = vulnerable; k = insufficiently known.

[2] Arots: Australian Rare or Threatened Status. Categories: E = endangered; R = rare; V = vulnerable.

[3] Habitat codes: C = coastal saltmarsh; E = extending to riparian including slopes & outcrops (ie partially riparian); F = fern gullies/rainforest including riparian situations (ie wettish forest habitats); L = lakes; W = wetlands (to brackish), including outer zones/margins; (W) = extending to marginal wetlands, but not primary habitat (ie damp/wet heath); S = inland saline (incl. to gypseous); R = riparian (including riverine, floodplains & wetlands on floodplains).

A larger number of plant species of conservation significance exist in the Gippsland Plain and Strzelecki Ranges bioregions of Victoria, with some of these species being of national significance. These species occur in a range of riparian habitats from lakes to streams and floodplains.

Conclusion

GIS mapping provided a useful visual assessment to determine broad-scale biodiversity across the four bioregions. However, due to the extensive area covered by these bioregions, this mapping technique was restricting and time consuming. The GIS data for private land is extremely limited and therefore an underestimation of biodiversity is likely for these areas. The EVC data layers on the NRE-CGDL are continually updated as new data becomes available. This data is collected from on-ground surveys and aerial photography assessments by trained botanists within NRE and consultancy firms. Finer-scale EVC mapping, for example at the catchment scale, is a useful tool for biodiversity planning and land management. Once the data is made available to NRE through the CGDL, it can be readily extracted and provided to NRM agencies such as the CMAs. EVC data layers on the NRE-CGDL will be updated as new data is made available.

The BioMaps provided a relatively simple and fast means for a visual assessment of biodiversity, principally vegetation, at a smaller scale. Despite this, the scale of mapping used was inadequate for determining riparian biodiversity, as riparian land is often very small in area. No additional information was obtained from the BioMaps to that obtained from the GIS analysis and the biodiversity databases. There were no threatening processes or sites of biological significance highlighted by BioMap within the case-study catchments.

The flora and fauna databases, FIS and VFD, provided species-level information using two searching techniques, a ten-minute grid search and catchment-based search. The databases did not, however, provide information as to the location of the species in the landscape, and it was not possible to determine whether these species were present in the riparian zone without assistance from experts in the flora and fauna ecology fields. There is currently a lack of information in private agricultural land systems, as historically Crown Land has been subject to intensive flora and fauna surveys. However, there has been a recent change in focus to private land that will see more data collected from these regions and made available through the databases.

A summary of the key outcomes from this study are as follows:

- Available biodiversity information is limited to flora and fauna records and vegetation mapping
- There is limited biodiversity information on private land, particularly in agricultural landscapes
- The information contained within the biodiversity databases is a result of historical intensive surveying within public land areas
- The resolution of EVC data does not sufficiently map small vegetation remnants such as those associated with riparian lands; therefore, biodiversity information at this level could not adequately be determined
- There is a need for flora and fauna surveys in private land areas
- Some tools used to determine biodiversity information are not readily available to some land management agencies such as Catchment Management Authorities, ie. BioMap