Warren

Karri forest and granite hills of
the Warren Bioregion, W.A.
Photo: G.J. Keighery

Description

Bioregional description and biodiversity values

The region is dissected undulating country forming part of land forms known as the Leeuwin Complex, the Southern Perth Basin (Blackwood Plateau), the Yilgarn Craton and western parts of the Albany Orogen.

A combination of hills, plateaux and plains, the bioregion features four main soil types:

- loamy soils supporting karri forest;
- red laterites supporting jarrah-marri forests,
- leached sandy soils in depressions and as plains supporting low jarrah woodlands and paperbark/sedge swamps, and
- Holocene marine dunes supporting *Agonis flexuosa* thickets, *Banksia* woodlands and heaths.

The climate is moderate Mediterranean. High rainfall coupled with low evaporation allows the growth of high forests and wetlands at a scale unique in Western Australia.

Many of the region's plants and animals are endemic, especially in plant groups such as Myrtaceae, Rutaceae, Proteaceae, Papillionaceae, Restionaceae, Stylidiaceae and Sterculiaceae. The bioregion is a biodiversity hot spot, with hundreds of taxa of vascular plants per square kilometre.

Warren is a refuge for relict species from wetter and milder climatic conditions. This is evidenced by groups and species of vascular and cryptic flora and invertebrates normally associated with rainforests or Nothofagus forests of South Eastern Australia, and now extinct elsewhere in the State.

Tingle forest provides a haven for relictual invertebrates, while peat or organic wetlands support relictual populations of aquatic invertebrates.

Barren limestone areas with underground drainage systems (karst regions) support an endemic invertebrate fauna.

The Warren Region is also the State's richest area for mosses and liverworts normally associated with rainforests. Notable values include the tall forests (karri, jarrah and the tingles), the limestone systems with their cave faunas, and the mound-forming microbial associations in the west of the region.

Gondwanan invertebrate fauna includes the Tingle *Moggridgea* trapdoor spider and Torndirrup's *Austrarchaea mainae* spider, *Dardarus* sp. millipede, *Cynotelopus notabilis* and velvet worms. A number of notable critical weight range mammals also persist in the region, including the southern brown bandicoot, the chuditch and the brush-tailed phascogale. Rare birds include the western whipbird and several cockatoos and parrots.

The dominant land uses are grazing, irrigated horticulture and conservation, with significant lesser areas of forestry.

Overall condition and trend

Although the Warren bioregion was assessed as having a Continental Stress Class of five, the original data used to obtain this ranking was flawed. The region should have a greater stress class (three).

The wetlands and river systems are generally in fair or good condition, though the trend is for these areas to decline. High numbers of ecosystems and species are at risk from a variety of threatening processes. The trends at both the ecosystem and species levels are either to remain static or to be declining.

Conservation priorities

The bioregion contains a high number of relatively small reserves and parks, but there is little opportunity to expand existing CALM estate as nearly all of the unreserved land has been cleared. Reserve management is generally good, with biodiversity issues being addressed although a large number of constraints still exist. Natural resource management policies are being implemented and achieving some biodiversity outcomes.

Nationally important wetlands

There are eight wetlands of national significance. These are the lower reaches of the Blackwood River, Cape Leeuwin System, Dogerup Creek System, Gingilup – Jasper Wetland System, Broke Inlet System, Maringup Lake System, Mt Soho Swamps and the Owingup Swamp System.

The condition of wetlands ranges from fair to near pristine, with most ranked as good and near pristine. The trend ranges from declining rapidly to static. Threatening processes include:

- wide vegetation clearing (now controlled but the impacts are still becoming aparent),
- feral animals (foxes, pigs, deer, horses, cats and rabbits),

- exotic weeds (Watsonia, east coast wattles, exotic grasses, blue gums, clovers and allies),
- changed fire regimes,
- pathogens (*Phytophthora* dieback in adjacent forests and heaths),
- changed hydrology (salinity and water levels),
- pollution from herbicides and fertilisers (agricultural and plantation),
- plantation harvesting (and the subsequent return to traditional agriculture on several significant holdings),
- illegal tea tree cutting (bean sticks, cray pots and brush fencing) and
- mining (which could affect a lake and groundwater).

Wetlands of regional significance

Nine more wetland areas are regionally significant. Conditions vary widely from degraded (Scott River Wetland System) to intermediate, between good and near pristine (Bolghinup Lake Swamp, Black Point and Lake Charley-Donnelly Estuary Wetland System). Others, such as the Kordabup River/Parry Inlet Wetland System, change in condition from near-pristine at their source, becoming progressively worse until they are degraded at the mouth or in agricultural areas.

Trends for all the wetlands are static except for the Scott River Wetland System, which is declining. The threatening processes that affect wetlands of regional significance are the same as those affecting the wetlands of national significance.

Riparian zone vegetation

There are 13 riparian systems in the Warren bioregion. However, only six (Scott, Gardner/Canterbury, Shannon, Inlet, Deep/Weld, and Walpole) have their main catchments in the bioregion. Seven (Margaret, Blackwood, Donnelley/Barlee/Beedalup, Warren, Frankland, Bow and Kent/Styx) have only their lower reaches in the bioregion.

Most riparian systems are in a degraded or fair condition but the Shannon, Inlet and Deep/Weld rivers are in a good to near pristine condition. The trend for all river systems is declining or static. Threatening processes that affect riparian systems include:

- wide vegetation clearing in agricultural zones,
- increasing remnant vegetation fragmentation,
- exotic weeds (blackberry, arum lily, Victorian tea tree, pasture species),
- changed fire regimes,
- changed water levels,
- salinity,
- pollution,
- water damming and diversion,
- eutrophication (rivers or lakes with a high rate of algae growth resulting from fertiliser runoff),
- mining,
- feral animals (pigs, horses, deer), and
- recreational use.

Ecosystems at risk

Eight ecological communities have been declared threatened, critically endangered or vulnerable.

Four aquatic root mat communities of the caves of the Leeuwin Naturaliste Ridge have been declared critically endangered under Western Australian legislation. Three communities – the extant marine shoreline stromatolitic community, Scott River ironstone heaths and the Mount Lindesay vegetation complex – are listed as endangered, while one – the *Calothamnus graniticus* heath on south west coastal granites at Meelup – is listed as vulnerable.

A further 14 ecosystems are at risk. The condition of ecosystems at risk varies from near pristine for the aquatic root mat communities to degraded for the sphagnum communities of the tingle forest. Most are currently in fair or good condition.

All ecosystems at risk are either declining or static with the shoreline stromatolitic community declining rapidly. Threatening processes include:

- changed fire regimes,
- salinity,
- ground water nutrient loads,
- weeds (arum, kikuyu, pasture grass),
- vegetation clearing and fragmentation,
- pathogens,
- roadside disturbance,
- mining activities,
- climate change,
- urban development,
- feral animals (pigs),
- human recreation and tourism, and
- pollution from agricultural activities.

Species at risk

Twenty per cent of Warren's original mammal fauna is now extinct in the region.

Two plant species and the white-bellied frog have been declared as critically endangered under State legislation. Thirteen plants and one mammal (dibbler) are endangered while 10 plants, three mammals (chuditch, western ring-tailed possum and quokka), six birds (malleefowl, Australasian bittern, Baudin's cockatoo, Muir's corella, western bristlebird and western whipbird), one amphibian (sunset frog) and two invertebrates (*Austroassiminea letha* and *Austrarchaea mainae*) are classed as vulnerable.

Most species are currently in fair or good condition, though there are a significant number of degraded populations. The trend is for species to remain static or to decline. Two birds (noisy scrub-bird and western ground parrot) were formerly found in the bioregion and have the potential to be translocated back into the area.

A wide variety of threatening processes affect species at risk. These are:

- small population sizes,
- restricted distribution,
- changed fire regimes,
- pathogens,
- vegetation clearing and fragmentation,
- feral animals (rabbits, pigs, foxes, cats),
- weeds (pasture grass, watsonia, marrum grass),
- roadside disturbance and roadworks,
- grazing pressure,
- salinity,
- timber harvesting (and poor logging practices),
- altered water levels,
- recreation activities,
- urban development,
- climate change, and
- lack of recruitment.

Management responses

Reserve system

There are 25 nature reserves and four national parks in the Warren bioregion. Nature Reserves range in size from 12 to 4300 hectares, with the management standards rank being fair. Although biodiversity values and/or management issues are poorly identified, they show resource degradation is occurring, although it is retrievable.

Most reserves (20) are less than 100 hectares in size. There is a noticeable absence of nature reserves in the central part of the bioregion.

No staff are resident on reserves and management visitation is generally limited to a minimum of once a year. Few reserves have formal approved management plans or interim management guidelines. Most reserves have significant weed invasion (e.g. pasture grasses and clovers) and feral animal (fox, rabbit and pig) problems.

Phytophthora is infecting native vegetation communities in all parts of the region and this is compounded by seasonal inundation. Very small reserves often have a poor composition of understorey species and are in a degraded state because of grazing impacts, extended fire frequencies and grass invasion from surrounding farmlands.

Warren contains 11 national parks and a major portion of three others. The parks range in size from 50 to approximately 117,000 hectares. Management plans exist for Leeuwin Naturaliste, Shannon, D'Entrecasteaux and Walpole-Nornalup national parks.

Staff reside at four parks (Leeuwin Naturaliste, Walpole Nornalup, Torndirrup and William Bay) and other parks are serviced as needed from the nearest CALM office. The management standards rank is good for all parks except Scott, which is classed as fair because of *Phytophthora* and feral pig impacts.

Factors that have an impact on conservation values are:

- the linear design of Sir James Mitchell, Leeuwin Naturaliste and William Bay national parks;
- semi rural land developments and an intensification of agricultural practices on adjoining lands impacting surface water; and
- routine feral animal (fox, some limited rabbit) control undertaken in all of the national parks.

Weeds are subject to annual control programs in the most accessible areas but the spread of some weeds (the African thistle) is being exacerbated by high recreational visitor numbers.

Fire regimes are strongly influenced by high numbers of visitors and the protection of adjoining land uses in parks close to urban and semi rural developments. The development and implementation of fire regimes consistent with biodiversity goals is absent from all these parks.

Fifty of the bioregion's 54 vegetation associations are well represented in conservation estate. However, two vegetation associations (jarrah-marri medium forest and low jarrah forest mosaic and jarrah-marri low forest) that only have small areas of their distributions in reserve remain a high priority.

The overall reservation priority class is five because most of the bioregion's vegetation associations are reserved to the maximum extent, and only minor additions to the system are feasible.

Constraints to the acquisition of new reserves include irreplacibility, limited opportunity to meet the comprehensive, adequate reserve (CAR) system requirements, economic constraints (the price of land) and competing land uses such as mining and agricultural land.

Off-reserve conservation for species and ecosystem recovery

Most vertebrates in the bioregion are within reserves but some are also found outside reserves. A large number of priority species of plants are found on freehold land and non-conservation reserves, and general recovery actions are appropriate for the whole group.

Off-reserve recovery actions required for all species at risk are:

- the restoration of hydrological systems (including adjacent bioregions);
- data gathering on individual plant life histories and development of fire regimes (frequency, timing, intensity) designed to maintain taxa and ecosystems;
- the mapping of peat communities;
- maintaining and expanding existing baiting/control programs for foxes and developing better control techniques for cats, rabbits, and other feral animals;
- the continuing development of disease management systems (particularly in relation to *Phytophthora*),
- identifying assessment systems for ecosystems and taxa at risk, and developing remedies;
- working with the community and others to reverse the impacts of agricultural fertilisers and pesticides and herbicides on aquatic systems; and
- finding resources for environmental weed control programs both on and off reserves.

Integrated natural resource management (NRM)

Existing NRM actions include:

- threat abatement (the Salinity Action Plan, Western Shield, and Weed Action Groups),
- industry codes of practice (timber industry regulation),
- environmental management systems,
- planning with local governments and
- integration with property management planning, catchment planning and Landcare for land clearing controls.

Feasible opportunities include:

- institutional reform (e.g. finalise reservation actions for the Salinity Action Plan that have been pending for many years),
- environmental management systems (greater inclusion of tertiary institutions in research with student funding assistance), and
- further control over the process to prevent further land clearing.

The main constraints are limited financial resources, and a lack of staff trained in conservation biology. Warren has an NRM rank of four, indicating that NRM instruments are in place and achieving some biodiversity outcomes.

Major data gaps and research priorities

The primary gaps are environmental mapping and biodiversity survey work. In particular there needs to be more consistent vegetation mapping, longer term fauna, invertebrate and rare flora surveys, detailed studies of the habitat requirements of uncommon species and quantitative data on threatening processes, especially detailed *Phytophthora* mapping.