Jarrah Forest

Jarrah (*Eucalyptus marginata*) understorey community in fire-managed forest near Collie, Jarrah Forest Bioregion, W.A. Photo: G.J. Keighery

Description

Bioregional description and biodiversity values

The Jarrah Forest Bioregion is dominated by a duricrusted plateau of the Yilgarn Craton and characterised by jarrah-marri forest on laterite gravels and, in the eastern part, by marri-wandoo woodlands on clayey soils.

Eluvial and alluvial deposits in the south support *Agonis* shrublands. In areas of Mesozoic sediments, jarrah forests and various species-rich shrublands occur in a mosaic.

The climate is classified as warm Mediterranean. There are two subregions within the bioregion – the Northern Jarrah Forest and the Southern Jarrah Forest.

The Northern Jarrah Forest overlies Archaean granite and metamorphic rocks capped by an extensive lateritic duricrust that has been dissected by later drainage. It is also interrupted by occasional granite outcrops in the form of isolated hills. The lateritic plateau has an average elevation of 300m, and is so deeply dissected in the east that it occurs as isolated hills. Rainfall ranges from 1100mm on its western edge (the Darling Scarp) to 700mm in the east and north. Vegetation comprises jarrah-marri forest in the west (with bullich and blackbutt in the valleys), and grades into wandoo woodlands in the east with powder bark on breakaways. There are extensive but localised sand sheets with *Banksia* low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east.

The lateritic plateau broadens in the Southern Jarrah Forest and slopes gently to the south coast. In the south-east it is almost entirely mantled by sands and is virtually level, which causes poor drainage and numerous wetlands, including Lake Muir. Rainfall is from 1200mm in the south west to 500mm in the east. Vegetation comprises jarrah-marri forest in the west grading to marri and wandoo woodlands in the east. Extensive areas of swamp in the south-east are dominated by paperbarks and swamp yate. The forest and woodland understory reflects the more mesic nature of this area.

Major landuses in the Northern Jarrah Forest region are forestry (native forest and plantation) and conservation, while grazing of improved pastures and dry land agriculture are more prevalent in the Southern Jarrah Forest. Other significant land uses include mining, rural residential, easements for roads and power lines, urban areas and irrigated horticulture.

The continental stress class is medium and ranges from three in the south to four in the north (see Glossary).

Rare or threatened species include:

- orchids (*Drakaea confluens, Caladenia bryceana* subsp. *bryceana*),
- birds (Muirs corella, western whipbird, western bristlebird, noisy scrub-bird),
- mammals (Gilberts potoroo, southern brown bandicoot, chuditch, red-tailed phascogale, brush-tailed phascogale, quokka, numbat, woylie, tammar and the western ring-tailed possum),
- frogs (critically endangered white-bellied frog, yellow-bellied frog and sunset frog) and
- the *Baumea* reed beds of freshwater wetland in forest areas.

The region is a centre of endemism for plants (e.g. *Eucalyptus marginata*), has a locally patchy biota despite the geological and geomorphic uniformity of the lateritic plateau, and provides refugia for many threatened species of flora and fauna.

Remnant populations of several critical weight range mammals are now centered in this region. Wandoo and wandoo/powder bark woodland communities persist in eastern parts of the region.

Overall condition and trend

Jarrah forest wetlands, riparian zones and terrestrial communities are mostly (about two-thirds) in good condition, although many are fair. Most are declining although many are static. There is a great variety of threatened ecosystems and species.

Conservation priorities

There are threatened ecosystems and populations of threatened species in reserves. There needs to be a focus on protecting remaining as well as translocated populations of threatened species, both on and off reserves. Reserves and other ecosystem remnants low in the landscape need to be protected from salinity and excessive inundation. Controls need to be established for weeds, fire, pathogens, feral herbivores and predators on and off-reserves, especially in remnants of near-cleared vegetation associations. Clearing existing vegetation remnants needs to stop.

Nationally important wetlands

The nine nationally important wetlands include swamps, lagoons, lakes, and a harbour. Most are ranked fair or good, but some range considerably along their length, with significant intervention being required for recovery.

The Mount Soho Swamps complex is in good to pristine condition. Other wetlands are either declining or declining rapidly and the rest are static. Threatening processes include:

- salinity,
- erosion,
- siltation,
- pollution (eutrophication from fertilisers and herbicides),
- feral animals (foxes, pigs, deer, horses, cats, rabbits, cattle and exotic fish),
- exotic weeds (watsonia, east coast wattles, exotic grasses, blue gums, various clovers and their allies),
- changed fire regimes, and
- pathogens (particularly *Phytophthora* dieback in forests and heaths).

The changed hydrology has reduced the seasonal fluctuations in water level, with wetlands becoming permanent water bodies and forests and heaths becoming wetlands. Many are also subject too illegal ti-tree cutting for bean sticks, cray pots and brush fencing.

Lake Muir is used illegally by motor vehicles and horse riders and is adjacent to a peat mining area.

Wetlands of regional significance

The 15 wetlands of regional importance are all in the Southern Jarrah Forest region. They include rivers, streams, floodplains, lakes, pools, swamps and marshes. Permanent and seasonal or intermittent examples, as well as brackish, saline and fresh water examples of all types, are present. Peatlands and springs are also present. They range in condition from near pristine to fair-to-degraded.

Drainage systems such as the Denmark/Hay River are generally near pristine in their upper reaches, but fair in their middle and lower sections. Margaret River Swamps, St John's Conservation Park, Milyeannup Brook-Red Gully Floodplain System and Perup Swamps System are all static. Powlalup Nature Reserve, Tone River Floodplains-Talvewelup Wetland System, Frankland River and Kent River Wetland System, Frankland/Gordon Rivers Wetland System and Upper Kent River Wetland System are all declining. Arthur River is declining rapidly. Their threatening processes are:

- feral animals (foxes, pigs),
- changed fire regimes,
- pathogens (particularly *Phytophthora cinnamomi*),
- exotic weeds (bridal creeper, blackberry, Pinus radiata, gorse, pasture species),
- changed hydrology (salinity and altered flow regimes),
- pollution (fertilisers, pesticides),
- broadscale vegetation clearing,
- increasing fragmentation and
- firewood collection.

Riparian zone

The main streams are the Avon, Murray, Collie, Blackwood, Kent, Denmark and Frankland. They each belong to a catchment of the same name. Within the region, all these systems have dams and/or reservoirs to provide an urban water supply, and water for irrigation, horticulture and agriculture.

Of the 39 riparian zones recognised in the region, about two-thirds have vegetation that is in pristine or good condition (recovery would occur in the short term with minimum intervention) and the rest are fair (requiring significant management intervention for recovery). Most are declining, with 12 continuing as static. The main threatening processes are altered flow patterns (caused by damming) and increasing salinity. Vegetation clearing and fragmentation, feral animals (particularly pigs) and grazing pressure are also widespread problems.

Ecosystems at risk

Five Threatened Ecological Communities are listed under WA State legislation.

- Two are critically endangered - *Eucalyptus calophylla-Xanthorrhoea preissii* woodlands and shrublands and shrublands on southern Swan Coastal Plain Ironstones.
- One is endangered - *Banksia attenuata* and/or *Eucalyptus marginata* woodlands.
- Two are vulnerable - *Eucalyptus calophylla* - *Eucalyptus marginata* woodlands on sandy clay soils and *Calothamnus* graniticus heaths on south west coastal granites.

All are located in the western edge of the bioregion on the interface with the Swan Coastal Plain. Threatening processes include:

- weeds (kikuyu, watsonia and pasture grasses),
- salinity,
- ecosystem fragmentation,
- changed fire regimes,

- pathogens (particularly *Phytopthora cinnamoni*),
- feral animals (pigs and horses),
- recreational use of vehicles,
- damming of rivers,
- grazing pressure and
- urban development.

The condition or TECs is fair to good, but declining.

A further 22 other ecosystems are considered to be at risk in the bioregion, with most being in fair or good condition. However, the wheatbelt lowland mallet communities are in poor condition. Four ecosystems are at risk, all on the region's eastern border (with the wheatbelt). They are declining rapidly due to salinity and changed hydrology. Most other ecosystems at risk are declining or unknown in trend.

A wide range of threatening processes affect ecosystems at risk. These include weeds, changed fire regimes, pathogens, feral animals (particularly pigs in wetland areas), clearing, grazing, clearing, fragmentation, human recreational activities, salinity and changed hydrology.

Species at risk

More than 10 per cent of the Jarrah Forest Bioregion's original mammal fauna is now regionally extinct.

Under State legislation, 17 plant species have been declared as critically endangered, 30 as endangered and 25 as vulnerable. One mammal and one amphibian are critically endangered. One mammal, two birds and two native bees are endangered. Four mammals, nine birds, and two amphibians are listed as vulnerable.

Existing populations of mammals are in fair or good condition and the trend for some of them is to improve.

Plant populations vary in condition and considerably. Some are poor (five critically endangered species) but most are fair or good. Survey work has found that some are improving. The condition and trend data for invertebrates is unknown. Threatening processes for plants are:

- vegetation clearing,
- fragmentation of vegetation,
- grazing pressure,
- feral animals,
- exotic weeds (particularly pasture grass),
- changed fire regimes,
- pathogens,
- altered flow regimes and water table,
- dissection due to roads,
- mining,
- illegal harvesting of some species,
- recreational vehicle users and
- small numbers of individuals and populations.

Native animals are adversely affected by:

- feral animals (fox, cats, rabbits, pigs and rats),
- changed fire regimes,
- habitat fragmentation and
- salinity.

Some species (particularly birds) are threatened by illegal culling and destruction of nesting sites in dead trees (logging).

Management responses

Reserve system

The jarrah bioregion has 149 nature reserves, 13 national parks and nine conservation parks. There are government proposals for an additional 35 national parks, which are in the early stages of implementation (March 2002), but information on these parks has not been included here.

The reserve system includes examples of most vegetation in the bioregion, and is dominated by jarrah and wandoo communities, granite outcrops and, on the south coast, by coastal shrublands and heaths.

The management standard for most nature reserves and conservation parks is fair while the standard for most national parks is good. Most nature reserves and conservation parks are small (less than 500 hectares), and are scattered across the bioregion with no resident staff and management visitation averaging once a year. Only one has a management plan.

Some of the national parks have resident staff, most have a management plan and service day-recreation for visitors. Even so, targeted ecological monitoring programs on the national parks are either absent or inadequate.

The small size and remnant vegetation function of most reserves has led to significant weed invasion, especially by pasture grasses. Reserves which have drainage lines and water courses are increasingly affected by salinity or rising water tables. Feral animals (foxes, rabbits and increasingly in the western sections, pigs) in all but the largest reserves are not controlled.

In the southern parts of the region, *Phytophthora* disease is degrading vegetation. This is compounded by the rising water tables. In the east, the understorey species composition on reserves has often lost many species found in similar habitats elsewhere, because of grass weed invasion, grazing, salinity and/or extended fire

frequencies. Fire regimes based on biodiversity outcomes are absent; deliberately lit wildfires can and do occur frequently depending on the proximity of the reserve to urbanisation.

There are two vegetation associations that are not reserved anywhere in the Northern Jarrah Forest. Four in the Southern Jarrah Forest are of high priority to include in the reserve system. Nine other vegetation associations have less than 10 per cent of their total area held in reserve and are also considered of high reservation priority in the Southern Jarrah Forest. All are woodland or low forests containing species of marri, wandoo, jarrah, banksia, yate, paperbark, mallet and/or river gum. Most are low in the landscape and threatened in some way.

The Regional Forest Agreement (RFA) reserve recommendations are already in the process of being implemented, a process that overlaps and may supersede the above reserve consolidation priorities. Nevertheless, large areas of the bioregion have already been cleared for agriculture, and remaining areas of certain ecosystems already fall below CAR thresholds.

Major parts of the landscape are also covered by mines, mining tenements or exploration leases. In particular, the central-eastern and northern portions of the bioregion (below the 600-700mm annual rainfall levels) are poorly represented in conservation reserves. This is the woolbelt and wheatbelt portion of the region which has had extensive clearing for agriculture.

The 500-800mm rainfall zone is showing rapid rises in ground water levels - up to one metre per year - which is affecting riparian vegetation and contributing to accelerated *Phytophthora* disease impacts. If IUCN I-IV reserves are used to calculate the priority for reservation rank, it is three (5.8 per cent reserved and 56.4 per cent of region's vegetation cover remains uncleared). However if IUCN V-VI are included in the calculations, it is class six (36.4 per cent). Both subregions have equal priority for reserve consolidation.

Off-reserve conservation for species and ecosystem recovery

Priority groups for off-reserve conservation include:

- threatened flora on farmland in the eastern and northern zone of the subregion (Interim Recovery Plans are in place for critically endangered species, but limited work has been undertaken on other species),
- riparian vegetation in eastern parts of the region (rising water tables and /or salinity - State Salinity Strategy is being implemented), and
- understorey vegetation complexes in small woolbelt and wheatbelt remnant vegetation patches (threatening processes are weeds, grazing by sheep, rabbits and kangaroos, and absence of fire or overly extended fire regimes that impede the regeneration of certain plant species).

Off-reserve species recovery in the eastern area of the Jarrah Forest Bioregion is dependant on substantial and significant change in land use, supported by large scale revegetation programs to lower ground water levels.

Recovery and interim recovery plans have been written for all three declared frogs, most critical weight range mammals, some birds, some critically endangered plants and one threatened ecological community.

Some vertebrates, invertebrates and lesser priority plants are not covered by recovery plans. Both subregions require a large off-reserve effort, as resource constraints have limited the community's capacity to deal with salinity and rising water levels, habitat loss and habitat fragmentation.

Integrated natural resource management (NRM)

Current natural resource management activities are:

- institutional reform of the hardwood timber industry (via the RFA process) that has resulted in gains for biodiversity conservation,
- threat abatement planning (State Salinity Strategy),
- feral animal control programs (for example, CALM's Western Shield program) with cooperative participation by landholders that has allowed populations of several threatened mammals to increase,
- industry codes of practice for blue gum plantations and
- limited integration with property management planning.

Opportunities for NRM include:

- institutional reform (rural reconstruction, industry reconstruction, new tenure and management arrangements in the woolbelt and wheatbelt),
- planning (local government planning and the National Action Plan for Water Quality and Salinity) and
- integration with property management planning (catchment planning).

However, there are constraints on NRM activities. These are:

- limited agency funding and staffing resources,
- limited community understanding of biodiversity and processes of integrating conservation practices into other forms of land management, and
- the extent of clearing and degradation that has occurred in the past.

Major data gaps and research priorities

John Beard's vegetation mapping is available at a resolution of 1:100,000 or 1:250,000, while other mapping is available at a resolution of 1:50,000 and published at 1:250,000.

Community identification based on floristics has been done for most of the bioregion but the complexity of pattern on the landscape (hence cost of mapping) has prevented vegetation and ecosystem mapping based on community types, although localised areas have been mapped at finer scale.

Invertebrate plots are confined to SAP survey and noisy scrub bird sites in the southern sections of the Northern Jarrah Forest. Data on Southern Jarrah Forest invertabrates is confined to SAP survey quadrats, some wetlands and to selected taxa.

Vertebrate fauna data is sparse and patchy, being limited to SAP survey quadrats, Operation Foxglove quadrats and roadside cage trap transects associated with Western Shield monitoring. No systematic fauna surveys (vertebrate or invertebrate) have been conducted across the Jarrah Forest Bioregion.

Most reserves don't have long-term survey data on species' presence or absence, even for vertebrates.

A regional survey of flora has been completed, based on patchy sampling quadrats positioned on widespread surface-types as well as some of the localised substrates of particular interest. Non-vascular flora appears to be poor compared to equivalent community types in Tasmania, Victoria and New South Wales. Fungi surveys of the region have not been completed.

Rare flora surveys and monitoring are ongoing, but the work is limited by resources and the status of many living organisms (taxa) remains in doubt.

There is some data on population ecology and biology of persisting critical weight range mammals but less is available for all other vertebrates, particularly the uncommon ones. No data is available to provide a regional context on life-history (including population-trend) of most species, including predators (foxes, cats), invertebrates and reptiles.

There are data gaps in many other areas:

- There is no consistent regolith mapping available at better than 1:250,000 scale.
- There is no quantitative data on the affect of exotic predators, weed colonisation, fragmentation and farm clean-up, mineral-extraction on heavy metals, etc.
- Fire effect/response data is limited to few communities and taxa.
- An understanding of the effect of salinity/inundation on species and communities (including saline wetlands) is limited or lacking.
- Detailed *Phytophthora* mapping is lacking for most of the region. Detailed data on its impacts on individual species and communities is limited.
- There is no map showing the location of peat communities.