Coolgardie

Mixed woodland of *Eucalyptus longicornis* and *E. corrugata* over *Eremophila*, *Scaevola* and *Dodonaea* shrub understorey in the Coolgardie Bioregion, W.A.
Photo N. Gibson

Description

Bioregional description and biodiversity values

The bioregion is within the Yilgarn Craton. Its granite basement includes Archaean Greenstone intrusions in parallel belts. Drainage is occluded. The climate is arid to semi-arid warm Mediterranean with 250-300mm of mainly winter rainfall.

Diverse woodlands, rich in endemic eucalypts, occur on low greenstone hills, on alluvial soils on the valley floors, around the saline playas of the region's occluded drainage system, and on broad plains of calcareous earths.

The granite basement outcrops at mid-level in the landscape. It supports swards of 'granite grass', wattle shrublands and York Gum. The playa lakes support dwarf shrublands of samphire. Sand lunettes are associated with playas along the broad valley floors, and sand sheets surround the granite outcrops.

Upper levels in the landscape are the eroded remnants of a Tertiary lateritic duricrust, with yellow (in the Southern Cross subregion) or red (in the Eastern Goldfields subregion) sandplains, gravel plains and laterite breakaways. These support scrubs and mallees. In the west, these scrubs are rich in endemic Proteaceae; in the east they are rich in endemic acacias.

Three subregions are defined:

The Mardabilla subregion is an Eocene marine limestone plain with, in its western parts, a granite basement. The main soils are red-brown loams and aeolian sands over sheet and nodular kankar. They support *Eucalyptus* woodland over broomebush/greybush, bluebush and saltbush.

The Southern Cross subregion comprises gently undulating uplands on granite strata and broad valleys with bands of low greenstone hills.

The Eastern Goldfields subregion comprises gently undulating plains interrupted in the west by low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying strata are eroded flat and covered with Tertiary sand and gravel soils, scattered exposures of bedrock, and plains of calcareous earths.

Rare species include:

- malleefowl,
- slender-billed thornbill,
- samphire thornbill,
- carpet python,
- western quoll,
- *Tetratheca harperi,*
- *T. aphylla,*
- *T. paynteri,*
- *Gastrolobium graniticum,*
- *Eremophila virens,*
- *Myriophyllum lapidicola,*
- *Pityrodia scabra,*
- *Daviesia microcarpa*, and
- *Eucalyptus platydisca*.

Rare features include:

- Rowles Lagoon,
- Fraser Range,
- Woodline Hills,
- Swan Lake and many ephemeral salt lakes, and
- banded ironstone hill flora.

The region is itself a major biogeographic interzone. Communities of acacia on sandplains and valley floors, and of ephemeral plants on Tertiary sandplains and in valley floor woodlands, are exceptionally rich.

The diversity in its eucalypt woodlands reflects a regional radiation in acacias and myrtaceae. For instance, 170 species of eucalypt occur in the region, and many of these are endemic. Other endemics include *Ctenotus xenopleura*, banded-ironstone hill communities, 21 eucalypt woodland associations, three succulent steppe associations and two acacia associations.

Overall condition and trend

The Mardabilla and Eastern Goldfields subregions, and the north eastern part of the Southern Cross subregion, are extensively degraded by pastoral activities. The western third of the Southern Cross subregion is cleared for dry-land agriculture, with salinity problems emerging. The region has been affected by mining activities and has weed and feral pest problems resulting in extinctions. Too frequent fires are a problem, especially in scrubs and mallees on duplex, sandy and laterite surfaces. The trend is static, although weed problems are increasing. On a scale of one (awful) to six (near pristine) the Coolgardie's continental stress class is between four and five, with the Southern Cross subregion being two.

Conservation priorities

Control of weeds, feral herbivores and carnivores is a priority. More ecologically sustainable development of rangelands is needed. The region has medium priority for reserve consolidation, but the system is highly biased with the Eastern Goldfields subregion having only 4.3 per cent of its area reserved.

Nationally important wetlands

One wetland of national significance is listed. Rowles Lagoon System is only in fair condition (its recovery requires significant management intervention) but its trend is static. Threatening processes include:

- feral rabbits,
- goats,
- foxes,
- cats,
- stray stock,
- weeds (saffron thistle, Bathurst burr, Brome grass, southern liquorice), and
- uncontrolled recreational use.

Wetlands of regional significance

Most of the 14 wetlands of regional significance are intermittent or seasonally inundated, and most are salt lakes. Two are permanent fresh water wetlands: Swan Lake and Wallagne Soak (an artificial wetland).

These wetlands are important for nomadic species and as a drought refuge for waterbirds. They differ in condition and trend: Swan Lake is surrounded by grazing land and in degraded condition, while Wallagne Soak is situated in uncleared vegetation and is in near pristine condition.

Nearly all wetlands of subregional significance are in good condition and static in trend. Threats affecting wetlands include:

- grazing,
- feral predators and herbivores,
- weeds,
- mining and related changed hydrology, and
- the recreational activities of people.

Riparian zone

Riparian systems comprise only the headwaters of the now occluded regional drainage system. They are in good condition, static, and would recover if feral herbivores and stock, exotic weeds, changed fire regimes, feral predators and firewood collection could be controlled.

Ecosystems at risk

A variety of ecosystems are currently proposed for listing as vulnerable, and need significant management intervention if they are to recover.

- Ephemeral wetland communities (saline, brackish and fresh-water) are threatened by exotic herbivores and mining but static at present.
- Succulent steppe (bluebush, saltbush, samphire) communities on calcareous plains are threatened by grazing, weeds and feral predators, and declining as Wards weed spreads.
- Granite outcrops, including apron woodlands, herbfields, moss sheet communities, Jam-Sheoak thickets, ephemeral pools aquatics are declining under pressures from human recreation, and rabbits.
- Twelve flora complexes of banded ironstone, greenstone and other isolated ranges are static, but small, grazed by rabbits and subject to mining.
- Valley-floor woodlands of species such as York and salmon gum are 97 per cent alienated across their Western Australian ranges and the remnants are threatened by fire and feral predators.
- Melaleuca scrubs are 70 per cent alienated but static.
- Three mallee formations are threatened by fire and feral predators.

Species at risk

- One bird (Carnaby's cockatoo) is endangered, but the Coolgardie bioregion represents the edge of its range.
- Two birds (malleefowl and slender-billed thornbill) and one critical weight range mammal (western quoll) are vulnerable.
- All vertebrates are in a degraded or fair condition and are likely to decline further, with the exception of the western quoll which is thought to be extinct in the bioregion. In fact, more than 40 per cent of Coolgardie's original mammal fauna is regionally extinct.

The threatening processes affecting fauna at risk include:

- feral predators,
- grazing (by stock and rabbits),
- fragmentation and
- changed fire regimes.

Declared Rare Flora (DRF) includes one critical, two endangered and nine vulnerable species. Overall DRF condition is fair to good or is not known, with the trends believed to be static or unknown. Threats affecting flora include:

- grazing,
- fragmentation or lack of recruitment,
- changed fire regimes,
- mining,
- changed hydrology,
- limited distribution and
- a small number of individuals.

Management responses

Reserve system

The reserve system comprises 46 reserves, including some of the largest in Western Australia, with three levels of protection:

A-class - three national parks, 11 nature reserves, one conservation park and one state forest.

B-class - one nature reserve.

C-class - 14 nature reserves, one conservation park, nine Section 5(g) reserves and three timber reserves.

In addition, two pastoral leases were recently acquired for conservation. A total of 1.8 million hectares is in this conservation estate, taking in 56 of the region's 106 vegetation associations, and comprising 13.7 per cent of the region's area.

In general, reserves are biased towards sandplains, gravel surfaces, granite outcrops and erosional surfaces high in the landscapes, although saltlake systems and calcareous plains are represented in eastern areas.

Vegetations include scrubs, mallees, mallets, a variety of eucalypt woodlands, samphire and communities with a Greybush understorey.

The Southern Cross and Eastern Goldfields subregions have 21 ecosystems at risk. Seventeen Beard vegetation associations are not currently represented on reserves and are a high priority for aquisition. The Mardabilla subregion has eight unreserved vegetation associations, seven of which are listed as being at risk. Gaps in the conservation estate include:

- ephemeral wetland communities (saline, brackish and fresh-water),
- succulent steppe (bluebush, saltbush, samphire) communities on calcareous plains and broad valley floors,
- granite outcrops, including apron woodlands, herbfields, moss sheet communities, jam-sheoak thickets, and ephemeral pools aquatics,
- flora complexes of banded ironstone, greenstone and other isolated ranges, including various *Allocasuarina cristata*, blackbutt, gimlet and Salmon Gum woodlands, and a variety of shrubland complexes,
- valley-floor and lower-slope woodlands of species such as York and salmon gum, Gimlet and Morrel,
- melaleuca scrubs and mallee communities on dunes peripheral to salt lakes, and
- red mallee and acacia shrublands.

The main constraints on filling gaps in the reserve system are economic — the ironstone and greenstone ranges are mining tenements or exploration leases, and the succulent steppes and wetlands are highly productive for stock.

The region is IBRA Reservation Class 3 (11.3 per cent of its area reserved in IUCN I-IV reserves). Ephemeral fresh water wetland communities, succulent steppe, ironstone and greenstone range and valley-floor woodland communities have priority, especially in the Eastern Goldfields subregion. Only 4.35 per cent of this subregion's area is in reserves and there is a strong bias in the comprehensiveness of its reserve system.

The standard of reserve management is ranked as fair because there are no feral predator programs in place; wildfire management facilities are limited by resources. Even so, fire breaks and fire-access tracks are installed and maintained, mining activities (exploration) are supervised (excepting old exploration drill holes which often remain open), and feral herbivore grazing activities are now minimal (e.g. rabbit populations reduced by Callicivirus and there are few goats). In addition, vegetation and soils are probably stable or regenerating from grazing (now light) and from timber removal early in the twentieth century.

Off-reserve conservation for species and ecosystem recovery

Main recovery actions required for ecosystems at risk and species include:

- habitat retention by reservation or by agreements with landholders,
- excluding stock from sensitive areas (e.g. Rowles Lagoon, Swan Lake, Fraser Range, Woodline Hills, examples of succulent steppe),
- weed and feral animal control (Wards weed, rabbits, cats, foxes, stock),
- capacity building with industry in the Eastern Goldfields subregion,
- the reintroduction of regionally extinct and declining critical weight range mammals through translocation programmes,

- better inventory and life history data for nearly all species at risk, and
- an understanding of ecological interactions between grazing, fire regime and ecosystem biodiversity.

Limited off-reserve measures for the various species and ecosystem conservation and recovery efforts listed above are needed in all three subregions, but are equally constrained by limited funding, equipment, knowledge base and community capacity.

Integrated natural resource management (NRM)

Existing natural resource management initiatives include the Wildlife Conservation Act (1950), Pastoral Lands Act (1998) and the Mining Acts (1978). The last two include clauses related to the protection of land and natural vegetation.

Pest management including feral animal control is a priority in threat abatement planning. There are industry Codes of Practice guidelines on the extent of vegetation that should be removed during mineral exploration and restorative actions to mitigate damage.

Opportunities include reviews of the Wildlife Conservation, Pastoral and Mining Acts to strengthen protection of biodiversity, and duty-of-care in relation to mining, pastoral or other activities.

Grazing of arid woodlands and savannas provides only marginal benefits when related to economic, social and environmental costs; initiatives to restructure the pastoral industry under the Gascoyne-Murchison Strategy are better integrating the activities of conservation, pastoral and mining agencies and industries, minimising environmental costs. However, the region's remoteness and absence of infrastructure adds to the costs of implementing natural resource management. Other impediments include the Land Administration Act, the extent of mining leases and tenements, and limited financial and staff resources. These natural resource management priorities apply equally to all subregions.

Data gaps and research priorities

- No regolith mapping is available.
- Vegetation mapping and surfacial lithology resolution is 1:250,000 scale at best.
- Data on biodiversity is sparse.
- Systematic biodiversity survey data is confined to vertebrates and plants at 200 quadrats (400 for plants) across region.
- These quadrats were only positioned on widespread surface-types. There were only three to four quadrats on each surface-type.
- Few quadrats have been sampled on more than three occasions.
- Additional flora quadrats have been sampled on some localised substrates of particular interest.
- There is limited data on the habitat requirements of virtually all invertebrate species, most ephemeral plants, persisting critical weight range mammals, and uncommon vertebrate and plant species.
- There is no data to provide a regional context on life-history (including population-trend) of any species (even rabbits).
- There is no quantitative data on the affect of exotic predators, weed colonisation, fire on biodiversity, and effect of mineral-extraction on greenstone communities.