Avon Wheatbelt 2 *(AW2 - Re-juvenated Drainage subregion)*

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Subregional description and biodiversity values

Description and area

The Avon Wheatbelt is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. Gently undulating landscape of low relief. Proteaceous scrub-heaths, rich in endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials and eluvials. Within this, AW2 is the erosional surface of gently undulating rises to low hills with abrupt breakaways. Continuous stream channels that flow in most years. Colluvial processes are active. Soil formed in colluvium or in-situ weathered rock. Includes woodland of Wandoo, York Gum and Salmon Gum with Jam and Casuarina. The climate is Semi-arid (Dry) Warm Mediterranean, and area is 3, 012, 977 ha.

Dominant land use

Mainly a mixture of (iv) Cultivation – dry land agriculture and (viii) Grazing – Improved pastures, dryland, with lesser areas of (xiii) Conservation (x) Crown reserves, (vi), (v) and (ii) Rural residential and (see Appendix B, key b).

Continental Stress Class

The Continental Stress Class for AW1 is 1.

Known special values in relation to landscape, ecosystem, species and genetic values

Critical Weight Range mammals: 35-7 000 g weight range mammals threatened by fox predation. Two species are now totally extinct; the Pig-footed Bandicoot and Crescent Nailtail Wallaby. Several species are subregionally extinct, and some are still extant.

Species	Current Conservation Status (WA)	Status in AW2 Subregion
Mala (*Lagorchestes hirsutus*)	Threatened (Extinct in the wild)	Subregionally Extinct
Red-tailed Phascogale (*Phascogale calura*)	Threatened (Endangered)	Threatened (Endangered)
Western Barred Bandicoot (*Perameles bougainville bougainville*)	Threatened (Endangered)	Subregionally Extinct
Chuditch (*Dasyurus geoffroii*)	Threatened (Vulnerable)	Subregionally Extinct
Numbat (*Myrmecobius fasciatus*)	Threatened (Vulnerable)	Subregionally Extinct
Bilby (*Macrotis lagotis*)	Threatened (Vulnerable)	Subregionally Extinct
Boodie (*Bettongia lesueur lesueur*)	Threatened (Vulnerable)	Subregionally Extinct
Banded Hare-wallaby (*Lagostrophus fasciatus fasciatus*)	Threatened (Vulnerable)	Subregionally Extinct
Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*)	Threatened (Vulnerable)	Threatened (Vulnerable)
Greater Stick-nest Rat (*Leporillus conditor*)	Threatened (Vulnerable)	Subregionally Extinct
Woylie (*Bettongia penicillata ogilbyi*)	Priority 4, Conservation Dependent	Subregionally Extinct
Tammar Wallaby (*Macropus eugenii derbianus*)	Priority 4, Conservation Dependent	Subregionally Extinct
Quenda (*Isoodon obesulus fusciventer*)	Priority 4, Conservation Dependent	Subregionally Extinct
Western Brush Wallaby (*Macropus irma*)	Priority 4, Conservation Dependent	Priority 4, Conservation Dependent
Brush-tailed Phascogale (*Phascogale tapoatafa*)	Priority 4, Conservation Dependent	Threatened
Common Brushtail Possum (*Trichosurus vulpecula*)	No listing	Conservation Dependent

Toolibin Lake: The principal breeding area for colonial waterbirds in the inland drainage systems of south-western Australia; a major breeding area for Freckled Duck *Stictonetta naevosa*; also an increasingly important breeding area for other waterbirds. The lake has been identified as a Critically Endangered Threatened Ecological Community.

Pingelly (Boyagin-Tutanning Reserves): High density of rare and geographically restricted flora (Fig. 12.1, Hopper and Muir 1984); supports populations of several Critical Weight Range (fox predation) marsupials (Numbat, Quenda, Woylie, Tammar, Red-tailed Phascogale, Brushtail Possum) that had disappeared from most of the Australian or Western Australian mainland.

Dryandra Woodland: Supports extant populations of several Critical Weight Range (fox predation) marsupials (Numbat, Woylie, Tammar, Red-tailed Phascogale, Brushtail Possum) that had disappeared from most of the Australian or Western Australian mainland. Dryandra State Forest has a vascular flora of at least 850 species, more than Mt Lesueur (a well recognised area of high species richness) (Keighery and Lyons 2001b).

South West Botanical Province (includes AW2): High species richness and endemicity; Proteaceae (632 spp, 99% endemic; 16 genera, 5 endemic) (Cowling and Lamont 1998);

Transitional Rainfall Zone (equivalent to the Mallee, Avon Wheatbelt and Geraldton Sandplains IBRA Regions): This zone contains the most species-rich areas, including the lateritic uplands of the western edge of the wheatbelt (Hopper 1992).

- *Acacia* and *Verticordia* (Hopper *et al.* 1996)
- *Lhotskya, Eriostemon, Wehlia, Baeckea, Melaleuca, Chamelaucium, Micromyrtus* and *Thryptomene* (Hopper 1979)

Eucalyptus Woodlands: High floristic diversity (Table 4;Yates *et al.* 2000), they contain a high proportion of Declared Rare Flora (around 25%) (Yates *et al.* 2000; Hopper *et al.* 1990).

Mallee eucalypts and *Melaleuca* for oil production: It is seen as vital to identify local *Eucalyptus* and *Melaleuca* species that can be introduced in commercial quantities to develop a plantation based oil mallee industry in the south west of Western Australia. The use of locally endemic species is seen as preferable to minimise the risk of eastern Australian species hybridising with local species and becoming environmental weeds. The use of local species is also seen as providing some fauna habitat benefits as well. Populations of mallee *Eucalyptus* species (Spathulata Group) contain individuals that produce higher than average quantities of cineole oil. Identifying these individuals in with natural populations, and introducing their genetic material into breeding programs is critical to the success of this program. The subregion supports significant populations of many of these species.

Wongan Hills Greenstone Belt and Associated Laterite-Capped Mesas: The Wongan Hills are a range of flat topped hills situated some 194km north-east of Perth in the northern wheat belt region of Western Australia. Mount Matilda (434m) and Mount Rupert (419m) are the highest points in the hills. The place has terrain typical of the Wongan Hills which comprise a series of laterite capped mesas generally trending north-south, dissected by numerous steep gullies in which exposures of greenstone and granite can be seen. The Wongan Hills Area is underlain by the Archaean rock of the Darling Plateau which is part of the Yilgarn Block, a stable nucleus composed mainly of granite and gneisses with some altered volcanics and sediments known as greenstone belts. The hills are formed on infolded beds of the altered volcanics and sediments which are more resistant to erosion than the country rock. The rocks at one time were eroded into low, rounded hills and became thickly crusted with laterite. Subsequently the laterite has been breached to form mesas bounded by breakaways and scarp slopes. The place is within the Avon botanical district of the South West Botanic Province. The Wongan Hills support a vegetation system which forms a small enclave within the Guangan Vegetation System.

The Wongan Hills Area is significant in maintaining ecological processes in the wheat belt region of south-western Australia. There is no other area of intact breakaway country of comparable size in the wheat belt region and the vegetated portion of Wongan Hills is the largest single area of natural vegetation remaining in the northern wheat belt. The place is one of the few pockets of uncleared land that is large and varied enough to continue to provide a habitat for the remaining species of the wheat belt. It therefore plays a critical role in the maintenance of the biodiversity in the wheat belt region. The place is important for maintaining a large number of bird species that have undergone major population declines throughout the wheat belt region. The Wongan Hills Area has remained a stable refuge for a number of bird species that are totally reliant on mallee and woodland habitats. This is of considerable importance as 53% of the bird species using woodlands and 63% of those in mallee habitats have declined since European settlement. The place is also important as a refuge for wheatbelt migrant and nomadic species. A number of plant species that are either Declared Rare Flora or Priority Flora in Western Australia have been collected in the Wongan Hills. These include *Acacia botrydion, Acacia cochlocarpa* subsp. *velutinosa, Acacia congesta* subsp. *Wonganensis, Acacia denticulosa, Acacia pharangites, Acacia pygmaea, Acacia semicircinalis, Calothamnus accedens, Conostylis wonganensis, Dampiera glabrescens, Daviesia spiralis, Dryandra comosa, Dryandra pulchella, Dryandra wonganensis, Eremophila ternifolia, Eucalyptus recta, Gastrolobium glaucum, Grevillea dryandroides* subsp. *Dryandroides, Grevillea kenneallyi, Hemigenia conferta, Loxocarya albipes, Lysiosepalum abollatum* ms, *Melaleuca sciotostyla, Microcorys eremophiloides, Philotheca wonganensis, Rhagodia acicularis, Stylidium coroniforme, Verticordia staminosa* subsp. *staminosa,* and *Verticordia wonganensis.*

With the exception of bats, the mammal fauna of the Wongan Hills is depauperate. The wheat belt region of Western Australia has suffered a considerable loss of faunal diversity in a relatively short period. In the last 100 years the Wongan Hills have probably lost at least ten mammal species. In recent times only nine species of native mammals have been collected in or near the Wongan Hills. Unlike mammals, however, the bird fauna is very rich, ninety species have been recorded in the Wongan Hills including several rare, threatened and regionally uncommon fauna species such as the Malleefowl (*Leipoa ocellata*), Peregrine Falcon (*Falco peregrinus*), and Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*). Four species of frog and twenty-two species of reptile have been collected in the Wongan Hills. Most species of reptiles and frog recorded here are within their known range. The fauna is of interest as it contains *Diplodactus pulcher, Underwoodisaura milii, Ctenophorus ornatus* and *Demansia psammophis* which are infrequently recorded on wheat belt reserves. Wongan Hill also contains an interesting assemblage of spiders, including the Shield-backed Trapdoor spider and the endemic Wongan Hills Wishbone Spider (*Dekana wonganensis*). Forty species from twenty-eight genera have been recorded in total, and includes both widely distributed species and species with a more restricted range. The Hills include vegetation types that have become rare and uncommon in the wheat belt of Western Australia. The salmon gum, York gum, gimlet and *Eucalyptus falcata* woodlands and *Acacia acuminata* low forest are rare woodland / forest types. Some 97% of York gum / jam woodlands and 78% of salmon gum / gimlet woodlands have been cleared in the south-west Botanical Province.

The Wongan Hills Area is of biogeographical importance as it contains a high number of endemic, disjunct species of fauna and flora and a number of species at their limits of distribution. Plant species endemic to the Wongan Hills include *Acacia botrydion, A. pharangites, A. pygmaea, Calytrix stowardii, Clematis aff. microphylla, Dryandra pulchella, Eremophila ternifolia, Eriostemon wonganensis* and *Rhagodia acicularis*. Although the Wongan Hills do not constitute a natural barrier to birds a number of species have distributional limits in or close to the Hills. The place is therefore of biogeographical interest as it contains species of both the arid zone and south-west. Of particular biogeographical interest is that Wongan Hills is one of the few areas in the wheat belt where the Splendid Fairy-wren and Blue-breasted Fairy-wren occur sympatically. The place maintains an assemblage of reptiles on laterite hill country that is not represented anywhere else in the central wheat belt. It has a diverse bird fauna, with ninety species being recorded, compared with the average of about seventy-five species of birds recorded on most wheat belt reserves and bush remnants. The place is considered to be an excellent and intact representation of the landforms and vegetation characteristic of the breakaway country in the northern / central wheat belt. The Wongan Hills Area is important in contributing to a wider understanding of the ecology of the northern wheat belt and the place is the type for two species of spider and a number of plant species. Data gathered here serves as a base line for monitoring on-going ecological change within the region.

References for this section on Wongan Hills are Beard (1981), Beard and Sprenger (1984), Burbidge and McKenzie (1989), Carter and Lipple (1982), Chinnock (1982), Coates (1988), Conservation Through Reserves Committee (1974), Curry (1994), Dell and Harold (1977), Hobbs (1991), Kenneally (1977a; 1977b; 1977c; 1977d; 1982), Morris and Dell (1977), de Rebeira and de Rebeira (1977), Saunders and de Rebeira (1991), Saunders and Ingram (1987), Saunders, *et al.* (1985), Saunders *et al.* (1982), Smith (1987), Watkins (1993) and Main (1987).

Granite outcrops: important as seasonal resources and temporary refuge for fauna of surrounding habitats; 4 species of reptiles are restricted to granite outcrops; at least 1320, and possibly 2000 plant species occur on Western Australian granite outcrops – most diverse in the southwest with individual outcrops having up to 200 species, including many endemics; *Eucalyptus caesia* (Boyagin Nature Reserve); Yilliminning Rock has 36 recorded lichen species, including two restricted to this rock (*Paraparmelia sammyi, P. sargentii*); the mygalomorph genus *Teyl* shows extensive radiation in the southern half of WA (Harvey and Main, undated), is a Gondwanan relic of "wet" habitats (Main 1996). They occur in meadows on many granite outcrops (Main 2000) and are restricted to granite outcrops as are the larvae chironomid fly *Archaeochlus* (Withers and Edward 1997); recent surveys in the wheatbelt have identified at least 230 species of aquatic invertebrates from granite pools, they contribute significantly to endemism of aquatic fauna of the inland south-west and have particular conservation value for about 50 species restricted to them (Pinder *et al.* 2000).

Existing subregional or bioregional plans and/or systematic reviews of biodiversity and threats

There has been no comprehensive subregional or regional biodiversity planning process or systematic review of biodiversity or threats. Several publications have reviewed specific elements of biota at this scale, but not necessarily using IBRA boundaries:

- Beard's Vegetation Mapping at a scale of 1:250 000 – broad structural vegetation types covers all of the subregion (Beard 1979a, Beard 1979b, Beard 1979c, Beard 1979d, Beard 1980c, Beard 1980d, Beard 1980e)
- Conservation status of vegetation types throughout Western Australia. (Hopkins *et al.* 1996) – based on modified Beard vegetation mapping at 1:250 000.
- Birds of Southwestern Australia: An atlas of changes in distribution and abundance of the wheatbelt fauna (Saunders and Ingram 1995)
- SAP Biodiversity Survey of the Agricultural Zone (unpublished data; Frost *et al.* 2001) – a systematic, broadscale biogeographic survey of the biota (aquatic invertebrates, waterbirds, terrestrial vascular flora, ground-dwelling arachnids, scorpions, centipedes, small mammals, reptiles and frogs) occurring low in the landscape and under threat from salinity.
- Salinity Risk Mapping completed for the agricultural zone by the Land Monitor project showing both current and predicted extent (Frost *et al.* 2001).
- The Wheatbelt Region of the Department of Conservation and Land Management is currently drafting a Regional Plan that includes a broad analysis of biodiversity values, threatening processes and management priorities (unpublished).

Several other surveys have reviewed elements of the biota and threatening processes at smaller scales within the subregion, or have reviewed the biota of a selection of reserves within the subregion (but not necessarily using IBRA boundaries). This list does not include the numerous surveys that have been completed for individual reserves or single species:

- Biological Survey of the Western Australian Wheatbelt Part 5 (Chapman *et al.* 1978), and Part 7 (Dell *et al.* 1979).
- Conservation values of small reserves in the wheatbelt of Western Australia (Safstrom 1995; Safstrom *et al.* 1996; Ecoscape 2000) - brief survey of biological and human use values of numerous reserves using a standard methodology to assist with land use planning.
- Management of Granite Outcrops Symposium, Hyden, April 16-18, 1999 (Withers and Hopper 2000).
- Regional Assessment of the Wheatbelt of Western Australia: Central Wheatbelt (Wooller and Moore 2000) Part of AW2
- A review of grassy woodlands in the Western Australian Wheatbelt (Mattiske Consulting 1995) – literature review, survey of possible sites to document flora and a report detailing location and describing floristics.
- Production of habitat hollows by wheatbelt eucalypts (Rose 1993) – survey of tree diameter, age

and hollow formation of wandoo and salmon gum from across the major east-west rainfall gradient.

- Some nature reserves of the Western Australian wheatbelt Part 1-28 (Muir 1978-1979) – brief surveys of various reserves providing a vegetation map and description, and list of fauna, human uses and other values.
- "Native Vegetation Handbook" series for various Shires in the Avon and Blackwood Basins (eg. Weaving 1995) – contain basic information on and lists of native vegetation, wetlands, fauna and flora, land resources and land management and land degradation issues.

Wetlands

Wetlands of National significance (DIWA listings)

Name and Code	Description[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Process[5]
Coyrecup Lake, WA001	B7, B12	ii	iii	iii	ix, x (salinisation from surface inflow and rising water table in addition to excessive inundation, are killing the remaining live trees in the lake), xiii (siltation), xi (eutrophication from agricultural fertilisers)
Dumbleyung Lake, WA002	B7	ii	iii	iii	xi (eutrophication leading to algal blooms; increased siltation) ix (increased salt loads due to drainage and groundwater pumping in catchment), xii (excessive human disturbance, e.g. water-skiing among moulting shelducks in spring-summer)
Toolibin Lake, WA003	B14	ii	iii	iii	ix, x (salinisation has caused the loss of the Eucalypt component of the overstorey; increased inundation due to drainage of agricultural land (by earthworks construction) in the catchment; remaining lake vegetation, predominantly *C. obesa* and *M. strobophylla*, is showing signs of salt stress; loss of fringing vegetation, particularly rushes, appears to have reduced the numbers of the secretive species Australasian Bittern *Botaurus poiciloptilus* and Purple Swamphen *Porphyrio porphyrio*; numbers of Freckled Duck *Stictonetta naevosa* appear to be declining), xi (eutrophication due to agricultural fertilisers)
Yealering Lakes System, WA004	B8	ii	iii	iii	ix, x (salinisation and excessive inundation), xi (eutrophication)

[1]Appendix B, key d; [2]Appendix C, rank 2; [3]Appendix C, rank 3; [4]Appendix C, rank 1; [5]Appendix B, key e

Wetlands of Subregional significance (in addition to the DIWA listed wetlands)

Name	Location	Description[1]	Special Values[2]	Condition[3]	Trend[4]	Reliability[5]	Threatening Process[6]
Mortlock River System	477000E 6526000N Zone 50	B8 System appears to be less driven by gypsophilous soils, hence a very different flora. Many rare and potentially rare flora species. Largely freehold land. Has lost some fresh components, but much of the edging woodlands of Casuarina and York Gum are still relatively intact.	i	ii	iii	iii	ix, x

[1]Appendix B, key d; [2]Appendix B, key c; [3]Appendix C, rank 2; [4]Appendix C, rank 3; [5]Appendix C, rank 1; [6]Appendix B, key e

Riparian zone vegetation

All major watercourses within the AW2 are categorised as "very poor – land cleared of virtually all natural vegetation." (Fig. 18, Wallace and Higham 1998).

Name	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
All fringing vegetation of riparian zones	i	ii	iii	ii, iv, vi, ix, x, i, v, xi, iii

[1]Appendix C, rank 2; [2]Appendix C, rank 3; [3]Appendix C, rank 1; [4]Appendix B, key e

Ecosystems at risk

Threatened ecological communities (TECs)

Community	Status	NVIS[1]	Condition[2]	Trend[3]	Reliability [4]	Threatening Processes[5]
Heath dominated by one or more of *Regelia megacephala*,	E	30	ii	iii	iii	i, iv, vi, vii, xii (mining;

Kunzea praestans and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale floristic region.						recreation), ii
Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor.	CR	42	ii	ii	iii	v, vi, ix, x, ii
Herbaceous plant assemblages on bentonite Lakes	E	42	ii	iii	iii	iv, v, vi, ix, x, xii (mining)
Salt Flats Plant Assemblages of the Mortlock River (East Branch)	E		ii	ii	iii	i, iv, v, vi, ix, x

[1]Appendix B, key f; [2]Appendix C, rank 2; [3]Appendix C, rank 3; [4]Appendix C, rank 1; [5]Appendix B, key e

Other Ecosystems at risk*

Community	Status	NVIS[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Deep pools and natural braided sections of fresh to brackish rivers of the Avon Botanical District	P	N/A	i	iii	iii	iv, vi ix, x, xii (siltation), ii
Wheatbelt Mottlecah (*Eucalyptus macrocarpa* subsp. *macrocarpa*) dominated heathland on deep white sands.	-	29	ii	iii	ii	iv, vii, vii, ii
Plant assemblages of the Wongan Hills System - Mallee over *Petrophile shuttleworthiana/Allocasuarina campestris* thicket on shallow gravelly soils over ironstone on summit and slopes; Shrub mallee on slopes of lateritic hills; Mallee over *Allocasuarina campestris* thicket on the slopes of the laterite plateaus; Mallee over Melaleuca thicket on red brown loam over gravel on slopes below the plateau; Mallee over *Melaleuca coronicarpa* heath on shallow red soil on scarp slopes; *A. campestris/Calothamnus asper* thicket over red-brown clay/ironstone/greenstone on scree slopes; and in lower areas: *Eucalyptus longicornis/E. salubris* woodland, *E. salmonophloia* and *E. loxophleba* woodlands; *Acacia acuminata* low forest; *E. ebbanoensis* mallee over scrub; and open mallee of *E. drummondii*.	P	29	ii	iii	iii	iv, vi, vii, xii (mining), ii

Community	Status	NVIS[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Brown Mallet Communities in the western Wheatbelt on brown or grey clays on low slopes and valleys. Near York and on the Arthur River on grey clays the understorey is dominated by *Melaleuca viminea* over sedges (*Gahnia trifida*) and bunch grasses. At Kojonup and near Tambellup on brown clays sparse shrubs and succulent shrubs (*Disphyma crassifolium*) dominate the understorey (G. Keighery, pers. comm.)	-	8	ii	iii	ii	i, ii, ix, x, iv, vi, vii
Red Morrell woodland communities of the western wheatbelt. There appear to be at least three variants; the "normal" on calcareous clays in the valleys, another on dune rises around saline lakes, and a rare variant on massive laterites (Dongolocking and Brookton) (G. Keighery, pers. comm.)	-	8	ii	iii	ii	i, ii, iv, vi, ix, x, vii
Banksia prionotes and *Xylomelum angustifolium* on low level sandplains	-		iv	iv	iii	i, ii, iv, v, vi, vii, viii
Tamma-Dryandra-Eremaea shrubland on cream sands of the Ulva landform unit	-		iv	iv	iii	i, ii, iv, v, vi, vii, viii

[1]Appendix B, key f; [2]Appendix C, rank 2; [3]Appendix C, rank 3; [4]Appendix C, rank 1; [5]Appendix B, key e

**Specific communities are listed in the tables above, however vegetation types on dissection valley floors and lower slows are more than 90% cleared for agriculture and comprise about 1/3 of the total number of the vegetation types in the subregion. The remaining areas of valley floor woodlands are subject to secondary salinity. Therefore, a further 20 to 30 vegetation types in this subregion should be treated as being "at risk".*

Species at risk

Fauna

Species	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
SCHEDULE 1; RARE/LIKELY TO BECOME EXTINCT, DIV 1 (MAMMALS)					
Dasyurus geoffroii	V	ii	v	iii	v, i, ii
Myrmecobius fasciatus	V	ii	iv	iii	v, i, ii
Petrogale lateralis lateralis	V	ii	v	iii	v, i, ii
Phascogale calura	E	ii	iv	iii	v, i, ii
SCHEDULE 1; RARE/LIKELY TO BECOME EXTINCT, DIV 2 (BIRDS)					
Calyptorhynchus latirostris	E	ii	iii	iii	i, ii, ix, x, vi
Calyptorhynchus baudinii	V	ii	iii	iii	i, ii, ix, x, vi
Leipoa ocellata	V	ii	iii	iii	i, ii, vii, vi, iv
SCHEDULE 1; RARE/LIKELY TO BECOME EXTINCT, DIV 3 (REPTILES)					
Egernia stokesii badia	V	ii	iii	iii	i, ii, iv, v
SCHEDULE 4; OTHER SPECIALLY PROTECTED FAUNA. DIVISION 2 (BIRDS)					
Falco peregrinus	SP	ii	iv	iii	i, ii,
SCHEDULE 4; OTHER SPECIALLY PROTECTED FAUNA. DIVISION 3 (REPTILES)					
Aspidites ramsayi	1	i	ii	iii	i, iv, v
Morelia spilota imbricata	SP	ii	iii	iii	i, iv, v
OTHER SPECIES AT RISK WITHIN THE SUBREGION					
Psophodes nigrogularis oberon	Near threatened	ii	iii	iii	i, ii, vii
Acanthiza iredalei iredalei		ii	iv	iii	iv
Platycercus icterotis xanthogenys	2	ii	iii	iii	i, iv
Lerista viduata	1	ii	vi	ii	i, ii, iv, v, vii
Bothriembryon bradshawi	1	ii	vi	ii	i, ii
Parartemia contracta	1	ii	vi	ii	ix
Daphnia jollyi	1	ii	vi	ii	ix, x
Limnocythere porphyretica	1	ii	vi	ii	Unknown threatening processes

[1]Appendix C, rank 2; [2]Appendix C, rank 3; [3]Appendix C, rank 1; [4]Appendix B, key e

Declared rare and priority flora

Species	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
DECLARED RARE FLORA					
Acacia prismifolia	X	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia aphylla	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia ataxiphylla subsp. *magna*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia insolita subsp. *recurva*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia pharangites	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia subflexuosa subsp. *capillata*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia vassalii	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Adenanthos pungens subsp. *effusus*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x, vii (*Phytopthora* sp.)
Banksia cuneata	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x, vii (*Phytopthora* sp.)
Caladenia drakeoides	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Conostylis seorsiflora subsp. *trichophylla*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Darwinia carnea	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Daviesia euphorbioides	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Eremophila pinnatifida	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Eremophila resinosa	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Eremophila scaberula	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eremophila veneta	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Gastrolobium hamulosum	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Grevillea dryandroides subsp. *dryandroides*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Grevillea pythara	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Grevillea scapigera	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Roycea pycnophylloides	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Synaphea quartzitica	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Thomasia sp. Green Hill (S.Paust 1322)	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Verticordia fimbrilepis subsp. *fimbrilepis*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Verticordia staminosa subsp. *staminosa*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia aristulata	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia brachypoda	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia lanuginophylla	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia pygmaea	E	ii	iii	iii	i, ii, iv, vi, vii
Adenanthos pungens subsp. *pungens*	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x, vii (*Phytopthora* sp.)
Banksia oligantha	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x, vii (*Phytopthora* sp.)
Boronia capitata subsp. *capitata*	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Conostylis drummondii	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Conostylis wonganensis	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Daviesia dielsii	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eremophila ternifolia	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Gastrolobium appressum	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Gastrolobium glaucum	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Grevillea christineae	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Grevillea curviloba subsp. *incurva*	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Grevillea dryandroides subsp. *hirsuta*	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Grevillea involucrata	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Hakea aculeata	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Lasiopetalum rotundifolium	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Lechenaultia pulvinaris	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Melaleuca sciotostyla	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Orthrosanthus muelleri	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Philotheca wonganensis	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Rhizanthella gardneri	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Stylidium coroniforme	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia denticulosa	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Species	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
Acacia semicircinalis	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Allocasuarina fibrosa	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Asterolasia nivea	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Calectasia pignattiana	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Conostylis misera	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eucalyptus olivacea	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eucalyptus rhodantha var. *rhodantha*	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Grevillea flexuosa	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x

Microcorys eremophiloides	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Pultenaea pauciflora	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Rhagodia acicularis	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Stylidium merrallii	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Thomasia glabripetala	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Verticordia carinata	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Verticordia hughanii	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
PRIORITY 1					
Acacia cochlocarpa subsp. *velutinosa*	1	ii	vi	unknown	Unknown threatening processes
Acacia microneura	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia sclerophylla var. *teretiuscula*	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia trinalis	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Dampiera glabrescens	1	ii	vi	unknown	Unknown threatening processes
Dryandra lepidorhiza	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Guichenotia seorsiflora	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Lysiosepalum abollatum	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Paraparmelia sammyii	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Paraparmelia sargentii	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Thomasia dielsii	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Thomasia sp. Arthur River (H.F.& M. Broadbent 1409)	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Thysanotus sabulosus	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Verticordia huegelii var. *tridens*	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
PRIORITY 2					
Acacia congesta subsp. *wonganensis*	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia drewiana subsp. *minor*	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia gemina	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia sclerophylla var. *pilosa*	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia tuberculata	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Andersonia carinata	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Boronia ericifolia	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Caladenia luteola	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Chordifex ornatus	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Chordifex ornatus	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Conostylis seorsiflora subsp. Nyabing (A. Coates s.n.)	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Dryandra acanthopoda	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Dryandra rufistylis	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Eucalyptus recta	2	ii	vi	unknown	Unknown threatening processes
Eucalyptus sparsicoma	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Grevillea kenneallyi	2	ii	vi	unknown	Unknown threatening processes
Lasiopetalum cardiophyllum	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Leucopogon denticulatus	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Leucopogon florulentus	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Melaleuca ordinifolia	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Melaleuca pritzelii	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Species	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
Persoonia hakeiformis	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Phyllangium palustre	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Pimelea neokyrea	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Synaphea platyphylla	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Thysanotus acerosifolius	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Verticordia wonganensis	2	ii	vi	unknown	Unknown threatening processes
OTHER SPECIES AT RISK					
Boronia rhomboidea		ii	iii	iii	i, ii, iv, vi, vii, ix, x

[1]Appendix C, rank 2; [2]Appendix C, rank 3; [3]Appendix C, rank 1; [4]Appendix B, key e

Analysis of appropriate management scenarios

Reservation priorities of ecosystems

Beard Veg Assoc	Vegetation Association Description	% of total extent in IBRA subregion	Area in IBRA subregion (ha)	% in IUCN Reserve	% in Non-IUCN Reserve	Total % Area in CALM Estate	Priority

	Deep pools and natural braided sections of fresh to brackish rivers of the Avon Botanical District	100	17	0	0	0	H
	Heath community on chert hills of the Coomberdale Floristic Region - Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale floristic region.	100	630	45 (7%)	0	7	M
	Wheatbelt Mottlecah (*Eucalyptus macrocarpa* subsp. *macrocarpa*) dominated heathland on deep white sands.	100	2	0	0	0	H
	Plant assemblages of the Wongan Hills System - Mallee over *Petrophile shuttleworthiana/Allocasuarina campestris* thicket on shallow gravelly soils over ironstone on summit and slopes; Shrub mallee on slopes of lateritic hills; Mallee over *Allocasuarina campestris* thicket on the slopes of the laterite plateaus; Mallee over Melaleuca thicket on red brown loam over gravel on slopes below the plateau; Mallee over *Melaleuca coronicarpa* heath on shallow red soil on scarp slopes; *A campestris/Calothamnus asper* thicket over red-brown clay/ironstone/greenstone on scree slopes; and in lower areas: *Eucalyptus longicornis/E. salubris* woodland, *E. salmonophloia* and *E. loxophleba* woodlands; *Acacia acuminata* low forest; *E. ebbanoensis* mallee over scrub; and open mallee of *E. drummondii*.	100	2410	759 (32%)	0	32	M
	Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor.	3	13	0	0	0	H
	Herbaceous plant assemblages on bentonite Lakes	100	65.25	0	65.25 (100%)	0	H
	Salt Flats Plant Assemblages of the Mortlock River (East Branch)	100	6310.2	0	438.86 (6.9%)	0.05	H
	Banksia prionotes and *Xylomelum angustifolium* on low level sandplains	100	58.38	0	58.38 (100%)	0	H
Beard Veg Assoc	Vegetation Association Description	% of total extent in IBRA subregion	Area in IBRA subregion (ha)	% in IUCN Reserve	% in Non-IUCN Reserve	Total % Area in CALM Estate	Priority
	Tamma-Dryandra-Eremaea shrubland on cream sands of the Ulva landform unit	100	93	8.1	60.2 (64.7%)	19.46	H
49	Shrublands; mixed heath	0.2	55.8	0.0	0.0	0.0	L
392	Shrublands; *Melaleuca thyioides* thicket	0.2	3.3	0.0	0.0	0.0	M
551	Shrublands; *Allocasuarina campestris* thicket	0.8	807.7	0.0	0.0	0.0	M
631	Succulent steppe with woodland and thicket; York gum over *Melaleuca thyoides* & samphire	0.7	303.4	0.0	0.0	0.0	M
948	Medium woodland; York gum & river gum	100.0	138.8	0.0	0.0	0.0	H
950	Medium woodland; *Casuarina obesa*	98.8	222.2	0.0	0.0	0.0	H
954	Shrublands; thicket, Jam & *Allocasuarina huegeliana*	0.5	5.4	0.0	0.0	0.0	M
962	Medium woodland; mallet (*E. astringens*)	83.8	208.0	0.0	0.0	0.0	H
1022	Succulent steppe with woodland; *Casuarina obesa* & samphire	100.0	211.7	0.0	0.0	0.0	H
1025	Mosaic: Medium woodland; York gum, salmon gum & morrel/Succulent steppe; saltbush & samphire	18.0	7.6	0.0	0.0	0.0	H
1040	Medium woodland; York gum & *Casuarina obesa*	0.7	5.0	0.0	0.0	0.0	M
1042	Succulent steppe with low woodland; sheoak over samphire	100.0	13.5	0.0	0.0	0.0	H
1044	Mosaic: Medium woodland; York gum & salmon gum/Shrublands; *Melaleuca thyioides* thicket	6.7	9.2	0.0	0.0	0.0	H
1046	Succulent steppe with woodland; York gum & samphire	100.0	65.0	0.0	0.0	0.0	H
1048	Mosaic: Shrublands; melaleuca patchy scrub/Succulent steppe; samphire	0.4	9.6	0.0	0.0	0.0	M
1077	Medium woodland; jarrah & river gum	50.0	718.8	0.0	0.0	0.0	M
1080	Succulent steppe with mallee & thickets; Mallee and *Melaleuca uncinata* thickets on salt flats	45.9	42.3	0.0	0.0	0.0	H

1088	Medium woodland; mallet & blue mallet	82.8	158.8	0.0	0.0	0.0	H
1094	Mosaic: Medium woodland; York gum & salmon gum/Shrublands; mallee scrub *Eucalyptus eremophila* & black marlock	5.1	251.6	0.0	0.0	0.0	L
1095	Medium woodland; York gum, yate & salmon gum	10.0	34.2	0.0	0.0	0.0	M
1149	Shrublands; scrub-heath Acacia-Ecdeiocolia association in the south-east Geraldton Sandplain Region	1.3	7.5	0.0	0.0	0.0	M

Subregional constraints in order of priority

(see Appendix B, key g)

Irreplacibility and Limited Opportunity to Meet CAR Criteria: The majority of ecosystems have been extensively cleared well below CAR thresholds, generally below 10%. Within the agricultural zone virtually all remnants are important for biodiversity conservation and building towards CAR thresholds.

Other: Many ecosystems low in the landscape are under threat from rising watertables. Most lowland communities, including tall woodlands, mallee and Melaleuca shrublands, freshwater and naturally saline wetland systems will be lost. These systems support over 1500 plant species, of which 450 are endemic to the agricultural zone and in danger of extinction due to rising saline groundwaters.

Economic Constraints: Insufficient resources to acquire and manage an increased conservation estate.

Competing Land Uses: Whilst some opportunities exist to add to the conservation estate through the vesting of unallocated Crown land and the re-vesting of other Crown reserves, there is some competition with other government agencies and local government for these areas. The process is also lengthy and somewhat ad hoc.

Other: Inadequate systematic knowledge of biodiversity values at an appropriately fine scale.

Bioregional and subregional priority for reserve consolidation

Avon Wheatbelt
Category 1 IBRA Reservation Class 1 (<2% and <30% of native vegetation cover remaining (all subregions) (Appendix D). There is no change recommended for this class.

AW2 – 1b (Appendix C, rank 4) Clearing has been extensive, and rising saline groundwater threatens up to 30% of the landscape.

Reserve management standard

The Reserve Management Standard is Poor (see Appendix C, rank 5). A significant threatening process i.e. rising saline groundwater, is not managed (except in very localised circumstances) and is currently and projected to cause major declines and extinctions in lowland communities, including tall woodlands, mallee and Melaleuca shrublands, freshwater and naturally saline wetland systems. Several reserves are routinely fox baited (part of Dryandra Woodland, Tutanning Nature Reserve, Boyagin Nature Reserve, Mt Caroline Nature Reserve, Mt Stirling Nature Reserve, Nangeen Hill Nature Reserve, Dongolocking Nature Reserve, Gundaring Nature Reserve, East Yornanning Nature Reserve, Weam Nature Reserve, Pingeculling Nature Reserve, Jaloran Nature Reserve – approximately 9.7% (17 600 ha) of the conservation estate is baited). Biodiversity values are poorly identified. The recent Salinity Action Plan Biodiversity Survey project represents the first systematic overview of the region's biota, and is due for publication in late 2002. However there is no systematic fine scale vegetation mapping (1:25 000 or better); the best available is Beard's at 1:250 000. Some reserves have had vegetation maps prepared, but there is little consistency between methodologies. Inappropriate fire regimes are also a major threat to biodiversity, but little is known of the response of individual species to fire. Fire histories for all reserves are also poorly known and documented.

Off reserve conservation

Priority species or groups

CWR mammals

Species	Current Conservation Status (WA)	Status in AW2 Subregion	Recovery Plan
Mala (*Lagorchestes hirsutus*)	Threatened (Extinct in the wild)	Locally Extinct	No
Red-tailed Phascogale (*Phascogale calura*)	Threatened (Endangered)	Threatened (Endangered)	No
Western Barred Bandicoot (*Perameles bougainville bougainville*)	Threatened (Endangered)	Locally Extinct	National?
Chuditch (*Dasyurus geoffroii*)	Threatened (Vulnerable)	Locally Extinct	State
Numbat (*Myrmecobius fasciatus*)	Threatened (Vulnerable)	Locally Extinct	National & State
Bilby (*Macrotis lagotis*)	Threatened (Vulnerable)	Locally Extinct	National
Boodie (*Bettongia lesueur lesueur*)	Threatened (Vulnerable)	Locally Extinct	No
Banded Hare-wallaby (*Lagostrophus fasciatus fasciatus*)	Threatened (Vulnerable)	Locally Extinct	No
Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*)	Threatened (Vulnerable)	Threatened (Vulnerable)	No
Western Ringtail Possum (*Pseudocheirus occidentalis*)	Threatened (Vulnerable)	Locally Extinct	No

Greater Stick-nest Rat (*Leporillus conditor*)	Threatened (Vulnerable)	Locally Extinct	No
Woylie (*Bettongia penicillata ogilbyi*)	Priority 4, Conservation Dependent	Locally Extinct	No
Tammar Wallaby (*Macropus eugenii derbianus*)	Priority 4, Conservation Dependent	Locally Extinct	No
Quenda (*Isoodon obesulus fusciventer*)	Priority 4, Conservation Dependent	Locally Extinct	No
Western Brush Wallaby (*Macropus irma*)	Priority 4, Conservation Dependent	Priority 4, Conservation Dependent	No
Common Brushtail Possum (*Trichosurus vulpecula*)	No listing	Conservation Dependent	No

Western Wheatbelt Coordinated Conservation Plan for 14 bird species (Garnett and Crowley 2000) – only 11 of these occur in the AW2 and one is subregionally extinct.

Species	Status
Thick-billed Grasswren (western) (*Amytornis textilis textilis*)	Locally Extinct
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	Endangered
Malleefowl (*Leipoa ocellata*)	Vulnerable
Australian Bustard (*Ardeotis australis*)	Near Threatened
Bush Stone-curlew (*Burhinis grallarius*)	Near Threatened
Hooded Plover (western) (*Thinornis rubricollis tregellasi*)	Near Threatened
Western Rosella (wheatbelt) (*Platycercus icterotis xanthogenys*)	Near Threatened
Barking Owl (southern) (*Ninox connivens connivens*)	Near Threatened
Shy Heathwren (western) (*Hylacola cauta whitlocki*)	Near Threatened
Rufous Fieldwren (western wheatbelt) (*Calamanthus campestris montanellus*)	Near Threatened
White-browed Babbler (western wheatbelt) (*Pomatostomus superciliosus ashbyi*)	Near Threatened
Crested Shrike-tit (western) (*Falcunculus frontatus leucogaster*)	Near Threatened

Other groups at risk include:
Flora and fauna of granite outcrops – for example *Eucalyptus rhodantha* var. *rhodantha*, *Verticordia staminosa* subsp. *staminosa*

District Threatened Flora Recovery Teams – the Katanning, Narrogin, Merredin and Moora District TFRT, and the Swan Regional TFRT cover the following species with IRPs - *Acacia pharangites, Acacia pygmaea, Adenanthos pungens* subsp. *effusus, Darwinia carnea, Daviesia euphorbioides, Drakonorchis drakeoides, Eremophila scaberula, Eremophila veneta, Grevillea curviloba* subsp. *incurva, Grevillea dryandroides* subsp. *dryandroides, Grevillea scapigera, Orthrosanthus muelleri, Sphenotoma drummondii, Synaphea quartzitica, Thomasia* sp. Green Hill (S.Paust 1322), *Verticordia staminosa* subsp. *staminosa.*

Wongan-Ballidu Threatened Flora Management Program - covers the following 28 flora taxa:

Species	Status EPBC Act	Status WA
Acacia botrydion	-	P 4
Acacia cochlocarpa subsp. *velutinosa*	-	P 1
Acacia congesta subsp. *wonganensis*	-	P 2
Acacia pharangites	CR	CR
Acacia pygmaea	E	E
Acacia semicircinalis	V	V
Calothamnus accedens	X	X
Conostylis wonganensis	E	E
Dampiera glabrescens	-	P 1
Daviesia spiralis	-	P 4
Dryandra comosa	-	P 4
Dryandra pulchella	-	P 4
Dryandra wonganensis	-	P 4
Eremophila ternifolia	E	V
Eucalyptus recta	-	P 2
Gastrolobium glaucum	E	CR
Grevillea dryandroides subsp. *dryandroides*	CR	CR
Grevillea kenneallyi	-	P 1
Hemigenia conferta	-	P 4
Loxocarya albipes	-	P 4
Lysiosepalum abollatum ms	-	P 1
Melaleuca sciotostyla	E	E
Microcorys eremophiloides	V	V

Species	Status EPBC Act	Status WA
Philotheca wonganensis	E	E
Rhagodia acicularis	V	V
Stylidium coroniforme	E	E
Verticordia staminosa subsp. *staminosa*	CR	CR
Verticordia wonganensis	-	P 2

Threatened flora of roadsides – for example *Banksia cuneata* and *Hakea aculeata*.

Threatened flora of lowland communities, including tall woodlands, mallee and Melaleuca shrublands, freshwater and naturally saline wetland systems. Eg. *Drakonorchis drakeoides*.

Declared Threatened Flora Species	Status EPBC Act	Status WA
Acacia aphylla	V	CR
Acacia aristulata	E	-
Acacia ataxiphylla subsp. *magna*	E	CR
Acacia brachypoda	E	E
Acacia denticulosa	V	V
Acacia insolita subsp. *recurva*	E	CR
Acacia lanuginophylla	E	E
Acacia pharangites	E	CR
Acacia prismifolia	NO STAT	-
Acacia pygmaea	E	E
Acacia semicircinalis	V	V
Acacia subflexuosa subsp. *capillata*	E	CR
Acacia vassalii	E	CR
Adenanthos pungens subsp. *effusus*	E	CR
Adenanthos pungens subsp. *pungens*	V	E
Allocasuarina fibrosa	V	V
Asterolasia nivea	V	-
Banksia cuneata	E	CR
Banksia oligantha	E	-
Boronia capitata subsp. *capitata*	E	E
Boronia rhomboidea	NO STAT	-
Calectasia arnoldii	V	-
Chordifex chaunocoleus	V	-
Conostylis drummondii	E	E
Conostylis misera	E	
Conostylis seorsiflora subsp. *trichophylla*	E	CR
Conostylis wonganensis	E	E
Darwinia carnea	E	CR
Darwinia macrostegia	V	-
Darwinia meeboldii	V	-
Darwinia oxylepis	E	-
Daviesia dielsii	V	-
Daviesia euphorbioides	E	CR
Daviesia spiralis	V	-
Drakonorchis drakeoides	E	-
Eremophila pinnatifida	E	CR
Eremophila resinosa	E	CR

Declared Threatened Flora Species	Status EPBC Act	Status WA
Eremophila scaberula	E	-
Eremophila ternifolia	E	E
Eremophila veneta	E	CR
Eucalyptus olivacea	V	V
Eucalyptus rhodantha var. *petiolaris*	E	-
Eucalyptus rhodantha var. *rhodantha*	V	-
Gastrolobium appressum	V	-
Gastrolobium glaucum	E	E
Gastrolobium hamulosum	E	CR
Grevillea christineae	E	E
Grevillea curviloba subsp. *incurva*	E	-
Grevillea dryandroides subsp. *dryandroides*	E	CR
Grevillea dryandroides subsp. *hirsuta*	E	E
Grevillea flexuosa	V	-
Grevillea involucrata	E	E
Grevillea pythara	E	CR
Grevillea scapigera	E	CR
Hakea aculeata	V	E
Hemigenia viscida	V	-
Lasiopetalum rotundifolium	E	E
Lechenaultia pulvinaris	E	E
Melaleuca sciotostyla	E	E
Microcorys eremophiloides	V	V
Orthrosanthus muelleri	E	-
Philotheca wonganensis	E	E
Pultenaea pauciflora	V	V
Rhagodia acicularis	V	V
Rhizanthella gardneri	E	E
Roycea pycnophylloides	E	CR
Sphenotoma drummondii	E	-
Stylidium coroniforme	E	E
Stylidium merrallii	V	V
Synaphea quartzitica	E	-
Thomasia glabripetala	V	-
Thomasia sp. Green Hill (S.Paust 1322)	E	-
Verticordia carinata	V	-
Verticordia fimbrilepis subsp. *fimbrilepis*	E	CR
Verticordia hughanii	E	V
Verticordia staminosa subsp. *staminosa*	E	CR

Priority 1 and 2 flora

Species	Priority
Acacia cochlocarpa subsp. *velutinosa*	1
Acacia congesta subsp. *wonganensis*	2
Acacia drewiana subsp. *minor*	2
Acacia gemina	2
Acacia microneura	1
Acacia sclerophylla var. *pilosa*	2
Acacia sclerophylla var. *teretiuscula*	1
Acacia trinalis	1

Species	Priority
Acacia tuberculata	2
Andersonia carinata	2
Boronia ericifolia	2
Caladenia luteola	2
Chordifex ornatus	2
Chordifex ornatus	2
Conostylis seorsiflora subsp. Nyabing (A. Coates s.n.)	2
Dampiera glabrescens	1
Dryandra acanthopoda	2
Dryandra lepidorhiza	1
Dryandra rufistylis	2
Eucalyptus recta	2
Eucalyptus sparsicoma	2
Grevillea kenneallyi	2
Guichenotia seorsiflora	1
Lasiopetalum cardiophyllum	2
Leucopogon denticulatus	2
Leucopogon florulentus	2
Lysiosepalum abollatum	1
Melaleuca ordinifolia	2
Melaleuca pritzelii	2
Paraparmelia sammyii	1
Paraparmelia sargentii	1
Persoonia hakeiformis	2
Phyllangium palustre	2
Pimelea neokyrea	2
Synaphea platyphylla	2
Thomasia dielsii	1
Thomasia sp. Arthur River (H.F.& M. Broadbent 1409)	1
Thysanotus acerosifolius	2
Thysanotus sabulosus	1
Verticordia huegelii var. *tridens*	1
Verticordia wonganensis	2

Existing recovery plans

Species/Group	Specific Recovery Plan	General Recovery Plan (Action Plans)	Other Management Plans
Western Barred Bandicoot (*Perameles bougainville bougainville*)	Yes – unpublished IRP	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Chuditch (*Dasyurus geoffroii*)	Yes – State	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Numbat (*Myrmecobius fasciatus*)	Yes – National unpublished	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Bilby (*Macrotis lagotis*)	Yes – National	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Boodie (*Bettongia lesueur lesueur*)	No	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Banded Hare-wallaby (*Lagostrophus fasciatus fasciatus*)	No	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Greater Stick-nest Rat (*Leporillus conditor*)	Not in WA	No	Western Shield Fauna Recovery Program
Species/Group	Specific Recovery Plan	General Recovery Plan (Action Plans)	Other Management Plans
Woylie (*Bettongia penicillata ogilbyi*)	Yes – RP (now out of	Action Plan for Australian Marsupials and	Western Shield Fauna

	date)	Monotremes - Taxon Summary	Recovery Program
Tammar Wallaby (*Macropus eugenii derbianus*)	No (old draft)	Action Plan for Australian Marsupials and Monotremes - Taxon Summary	Western Shield Fauna Recovery Program
Quenda (*Isoodon obesulus fusciventer*)	No	Action Plan for Australian Marsupials and Monotremes - Taxon Summary	Western Shield Fauna Recovery Program
Mala (*Lagorchestes hirsutus*)	Yes – National (unpublished)	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Red-tailed Phascogale (*Phascogale calura*)	No	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Common Brushtail Possum (*Trichosurus vulpecula*)	No	Action Plan for Australian Marsupials and Monotremes - Taxon Summary	Western Shield Fauna Recovery Program
Thick-billed Grasswren (western) (*Amytornis textilis textilis*)	Yes – Interim Recovery Plan	Action Plan for Australian Birds - Coordinated Conservation Plan & Taxon Summary	No
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	Yes - State	Action Plan for Australian Birds - Coordinated Conservation Plan & Recovery Outline	No
Western Whipbird (western mallee) (*Psophodes nigrogularis*)	No	Action Plan for Australian Birds – Taxon Summary	Research Plan for the Western Ground Parrot, Western Whipbird and Western Bristlebird.
Western Rosella (wheatbelt) (*Platycercus icterotis*)	No	Action Plan for Australian Birds – Taxon Summary	No
Barking Owl (southern) (*Ninox connivens*)	No	Action Plan for Australian Birds - Coordinated Conservation Plan & Taxon Summary	No
Western Wheatbelt Birds	Some	Action Plan for Australian Birds - Coordinated Conservation Plans and individual Action Plans	No
Western Spinytailed Skink (*Egernia stokesii badia*)	No	Action Plan for Australian Reptiles - Recovery Outline	No
Aspidites ramsayi (south west population)	No	Action Plan for Australian Reptiles - Recovery Outline	No
Morelia spilota imbricata	No	Action Plan for Australian Reptiles - Recovery Outline	No
Lerista viduata	No	No	No
Idiosoma nigrum	No	No	No
Kwonkan eboracum	No	No	No
Threatened Flora on roadsides e.g. *Boronia adamsiana, Acacia volubilis*	Few	N/A	Roadside Conservation Strategies (Roadside Conservation Committee and Shires)
Flora and fauna of granite outcrops e.g. *Eucalyptus rhodantha* var. *rhodantha*, *Verticordia staminosa* subsp. *staminosa*	Few	N/A	No
Threatened flora of lowland communities, including tall woodlands, mallee and Melaleuca shrublands, freshwater and naturally saline wetland systems.	Few	N/A	Eg. Buntine-Marchagee Recovery Catchment
450 flora species endemic to the agricultural zone and in danger of extinction due to rising saline groundwaters.	No	N/A	Salinity Action Plan Biological Survey of the Agricultural Zone
Wongan-Ballidu Threatened Flora Management Program	Draft in prep.	N/A	No
Priority 1 and 2 flora (41 species)	No	N/A	No

Species/Group	Specific Recovery Plan	General Recovery Plan (Action Plans)	Other Management Plans
General Declared Rare Flora without an IRP (60 species)	No	N/A	No
Acacia pharangites	Yes - IRP	N/A	No
Acacia pygmaea	Yes - IRP	N/A	No
Adenanthos pungens subsp. *effusus*	Yes - IRP	N/A	No
Darwinia carnea	Yes - IRP	N/A	No
Daviesia euphorbioides	Yes - IRP	N/A	No
Drakonorchis drakeoides	Yes - IRP	N/A	No
Eremophila scaberula	Yes - IRP	N/A	No
Eremophila veneta	Yes - IRP	N/A	No
Grevillea curviloba subsp. *incurva*	Yes - IRP	N/A	No
Grevillea dryandroides subsp. *dryandroides*	Yes - IRP	N/A	No
Grevillea scapigera	No – draft RP	N/A	No
Orthrosanthus muelleri	Yes - IRP	N/A	No
Sphenotoma drummondii	Yes - IRP	N/A	No
Synaphea quartzitica	Yes - IRP	N/A	No
Thomasia sp. Green Hill (S.Paust 1322)	Yes - IRP	N/A	No
Verticordia staminosa subsp. *staminosa*	Yes - IRP	N/A	No

Appropriate species recovery actions

Species/Group	Recovery Actions[1]	Recovery Description	Major Constraints
Western Barred Bandicoot (*Perameles bougainville bougainville*)	vii, i, x, xiv, ix, xii	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – Captive breeding and monitoring; Fire management; Research.	Locally extinct, lack of suitably large habitat areas, predator control
Chuditch (*Dasyurus geoffroii*)	vii, i, x, xiv, ix	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – monitoring; Fire management.	Lack of survey data, lack of suitably large habitat areas, predator control
Numbat (*Myrmecobius fasciatus*)	vii, i, x, xiv, xii, ix	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – Captive breeding and monitoring; Research; Fire management.	Lack of suitably large habitat areas, predator control
Bilby (*Macrotis lagotis*)	vii, i, x, xiv, ix, xii	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – Captive breeding and monitoring; Fire management; Research.	Locally extinct, lack of suitably large habitat areas, predator control
Boodie (*Bettongia lesueur lesueur*)	vii, i, x, xiv, ix, xii	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – Captive breeding and monitoring; Fire management; Research.	Locally extinct, lack of suitably large habitat areas, predator control
Banded Hare-wallaby (*Lagostrophus fasciatus fasciatus*)	vii, i, x, xiv, ix, xii	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – Captive breeding and monitoring; Fire management; Research.	Locally extinct, lack of suitably large habitat areas, predator control
Greater Stick-nest Rat (*Leporillus conditor*)	vii, x, i	Feral animal control (particularly predators); Translocation; Habitat retention through reserves.	Locally extinct, lack of suitably large habitat areas, predator control
Woylie (*Bettongia penicillata ogilbyi*)	vii, i	Feral animal control (particularly predators); Habitat retention through reserves.	Lack of suitably large habitat areas, predator control

Species/Group	Recovery Actions[1]	Recovery Description	Major Constraints
Common Brushtail Possum (*Trichosurus vulpecula*)	vii, i	Feral animal control (particularly predators); Habitat retention through reserves;	Lack of suitably large habitat areas, predator control
Thick-billed Grasswren (western) (*Amytornis textilis textilis*)	x, i, iii, vii, xiv	Translocation; Habitat retention through reserves and on other state lands; Feral animal control (particularly predators); Other - survey and monitoring.	Locally extinct
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	i, ii, iii, xiv, xii	Habitat retention through reserves, on private lands and on other state lands; Other - Protect known nesting trees and breeding areas, survey work, captive breeding and public awareness	Lack of survey data on breeding and habitat areas

		programme; Research.	
Western Whipbird (western mallee) (*Psophodes nigrogularis*)	i, iii, ii, viii, xiv, xii	Habitat retention through reserves, on other state lands and on private lands; Revegetation; Other – monitoring; Research.	Lack of knowledge on habitat requirements
Western Rosella (wheatbelt) (*Platycercus icterotis*)	xiv, xii, i, ii, iii	Other – monitoring, promote community nestbox program, and mitigate food limitations; Research; Habitat retention through reserves, on private lands and on other state lands.	Lack of survey data
Barking Owl (southern) (*Ninox connivens*)	i, iii, ii, xii, xiv, xiii, viii, vii	Habitat retention through reserves, other state lands and on private lands; Research; Other – survey work; Capacity building - extension to promote habitat management; Revegetation; Feral animal control (particularly predators).	Lack of survey data, lack of resources to manage fire regimes
Western Wheatbelt Birds	i, iii, ii, viii, vii, v, vi, xi, xiv	Habitat retention through reserves, on other state lands and on private lands; Revegetation; Feral animal control (particularly predators); Fencing; Weed control; Reinstatement of hydrology; Other – tree hollow protection and monitoring.	Lack of survey data, lack of knowledge on causes of declines
Western Spinytailed Skink (*Egernia stokesii badia*)	i, iii, ii, vii, v, xiv	Habitat retention through reserves, other state lands and on private lands; Feral animal control (particularly predators); Fencing; Other – Survey and monitoring.	Lack of survey data, lack of knowledge on causes of declines
Aspidites ramsayi (south west population)	i, iii, ii, xiv, vii, xiii, x	Habitat retention through reserves, on other state lands and on private lands; Other – survey and captive breeding; Feral animal control (particularly predators); Capacity building - develop guidelines and incentives to manage population outside reserves; Translocation.	Possibly locally extinct, lack of survey data
Morelia spilota imbricata	i, iii, ii, xiv, vii, xiii, x	Habitat retention through reserves, on other state lands and on private lands; Other – survey and captive breeding; Feral animal control (particularly predators); Capacity building - develop guidelines and incentives to manage population outside reserves; Translocation.	Lack of survey data
Lerista viduata	Unknown	Unknown	Lack of knowledge and data
Idiosoma nigrum	i, iii, vii, xiv, vi, ix	Habitat retention through reserves and on other state lands; Feral animal control (particularly predators); Other - minimise soil disturbance and survey; Weed control; Fire management.	Lack of survey data
Kwonkan eboracum	Unknown	Unknown	Lack of survey data
Threatened Flora on roadsides e.g. *Boronia adamsiana, Acacia volubilis*	iii, xiii, vi, v, x, viii	Habitat protection on other state lands; Capacity building - Shire officers; Weed control; Translocation; Revegetation.	Competing land use; loss of permanent staff and increased use of contractors makes the education process more difficult

Species/Group	Recovery Actions[1]	Recovery Description	Major Constraints
Flora and fauna of granite outcrops e.g. *Eucalyptus rhodantha* var. *rhodantha*, *Verticordia staminosa* subsp. *staminosa*	i, iii, ii, xi, vi, vii, ix, xiii, xii	Habitat retention through reserves, other state lands and on private lands; Reinstatement of hydrology; Weed control; Feral animal control (particularly predators); Fire management; Capacity building with landholders; Research.	Competing use of water for supply purposes; loss of fringing vegetation in many instances.
Threatened flora of lowland communities, including tall woodlands, mallee and Melaleuca shrublands, freshwater and naturally saline wetland systems.	xi, xiii, viii, x, xiv	Reinstatement of hydrology; Capacity building with landholders; Revegetation; Translocation; Other - germplasm storage.	Response to rising groundwater is unlikely to be of the magnitude required, lack of resources to collect and store sufficient germplasm, lack of resources to propagate and lack of suitable habitat to translocate sufficient numbers of all species.
450 flora species endemic to the agricultural zone and in danger of extinction due to rising saline groundwaters.	xi, x, xiv, i, iii, ii	Reinstatement of hydrology; Translocation; Other - germplasm storage; Habitat retention through reserves, other state lands and on private lands.	Response to rising groundwater is unlikely to be of the magnitude required, lack of resources to collect and store sufficient germplasm, lack of resources to propagate and lack of suitable habitat to translocate sufficient numbers of all species.
Wongan-Ballidu Threatened Flora Management Program	i, iii, ii, vii, v, vi, xiv, x, ix, xii	Habitat retention through reserves, on private land and on other state lands; Feral animal control; Fencing; Weed control; Other - survey work; Translocation; Fire management; Research.	
Priority 1 and 2 flora (41 species)	xiv (additional survey to locate new populations)	Other - additional survey to locate new populations.	Insufficient number of qualified staff to undertake the extensive fieldwork required.
General Declared Rare Flora without an IRP (60 species)	General – iii, ii, i, vi, xi, v, viii, ix, xiii (Shires, landholders, Utilities), xiv (additional survey work to locate new populations), x	Other – additional survey work to locate new populations.	General - Insufficient qualified staff and resources to undertake the extensive fieldwork required for survey, monitoring and management actions
Acacia pharangites	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control; Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Acacia pygmaea	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control; Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Adenanthos pungens subsp. *effusus*	i, xiv, x, xi, xiv	Habitat retention through reserves; Other - protect from mining, disease management *Phytophthora* sp. and seed collection; Translocation; Reinstatement of hydrology.	Refer DRF General above
Darwinia carnea	ii, iii, v, vii, x, xii, xiv	Habitat protection on private lands and on other state lands; Fencing; Feral animal control; Translocation; Research; Other - survey and monitoring.	Refer DRF General above
Daviesia euphorbioides	iii, i, ix, x, xiii, xii, xiv	Habitat protection on other state lands and through reserves; Fire management; Capacity building with the Shire and Westrail; Research; Other - survey and monitoring.	Refer DRF General above

Species/Group	Recovery Actions[1]	Recovery Description	Major Constraints
Drakonorchis drakeoides	ii, i, xi, ix, vi, vii, xiv, xiii	Habitat protection on private lands and through reserves; Reinstatement of hydrology; Fire management; Weed control; Revegetation; Other - survey and monitoring; Capacity building with land holders.	Refer DRF General above
Eremophila scaberula	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Eremophila veneta	i, iii, xiii, ix	Habitat retention through reserves and on other state lands; Capacity building with Westrail; Fire management.	Refer DRF General above
Grevillea curviloba subsp. *incurva*	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Grevillea dryandroides subsp. *dryandroides*	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Grevillea scapigera	iii, x, vi, xii	Habitat protection on other state lands; Translocation; Weed control; Capacity building with local community groups.	Refer DRF General above
Orthrosanthus muelleri	iii	Habitat protection on other state lands.	Refer DRF General above
Sphenotoma drummondii	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Synaphea quartzitica	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Thomasia sp. Green Hill (S.Paust 1322)	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above
Verticordia staminosa subsp. *staminosa*	i, iii, ii, vii, v, vi, xiv, x, ix, xi, xii	Habitat retention through reserves, other state lands and private lands; Revegetation, Fencing; Weed control; Other – survey work; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer DRF General above

[1]Appendix B, key h

Ecosystems and existing recovery plans

Community	Specific Recovery Plan	General Recovery Plan
Deep pools and natural braided sections of fresh to brackish rivers of the Avon Botanical District	No	Wheatbelt Management Plan (draft)
Heath community on chert hills of the Coomberdale Floristic Region - Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale floristic region.	Yes - IRP	Wheatbelt Management Plan (draft)

Community	Specific Recovery Plan	General Recovery Plan
Plant assemblages of the Wongan Hills System - Mallee over *Petrophile shuttleworthiana /Allocasuarina campestris* thicket on shallow gravelly soils over ironstone on summit and slopes; Shrub mallee on slopes of lateritic hills; Mallee over *Allocasuarina campestris* thicket on the slopes of the laterite plateaus; Mallee over Melaleuca thicket on red brown loam over gravel on slopes below the plateau; Mallee over *Melaleuca coronicarpa* heath on shallow red soil on scarp slopes; *A. campestris/Calothamnus asper* thicket over red-brown clay/ironstone/greenstone on scree slopes; and in lower areas: *Eucalyptus longicornis/E. salubris* woodland, *E. salmonophloia* and *E. loxophleba* woodlands; *Acacia acuminata* low forest; *E. ebbanoensis* mallee over scrub; and open mallee of *E. drummondii*.	No	Wheatbelt Management Plan (draft)
Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor.	Yes	Wheatbelt Management Plan (draft)
Herbaceous plant assemblages on bentonite Lakes	Yes - IRP	Wheatbelt Management Plan (draft)
Salt Flats Plant Assemblages of the Mortlock River (East Branch)	No	Wheatbelt Management Plan (draft)

Appropriate ecosystem recovery actions

Community	Ecosystem Recovery Actions[1]	Recovery Descriptions	Constraints
Deep pools and natural braided sections of fresh to brackish rivers of the Avon Botanical District	xi, vi, vii, xii	Reinstatement of hydrology; Weed control; Feral animal control (stock); Research.	The extent of hydrological reinstatement required
Heath community on chert hills of the Coomberdale Floristic Region - Heath dominated by one or more of *Regelia megacephala, Kunzea praestans* and *Allocasuarina campestris* on ridges and slopes of the chert hills of the Coomberdale floristic region.	ii, i, iii, xiii, v, vi, xiv, ix, xii, viii	Habitat protection on private lands, through reserves and on other state lands; Capacity building with landholders, Water Corporation; Fencing; Weed control; Other - survey and monitoring; Fire management; Research; Revegetation.	Further research needs to undertaken
Wheatbelt Mottlecah (*Eucalyptus macrocarpa* subsp. *macrocarpa*) dominated heathland on deep white sands.	iii, vii, ix, xiv, xiv	Habitat protection on other state lands; Feral animals control (control); Fire management; Other – survey work and prevention of the introduction of *Phytophthora* sp	Further research needs to undertaken
Plant assemblages of the Wongan Hills System - Mallee over *Petrophile shuttleworthiana /Allocasuarina campestris* thicket on shallow gravelly soils over ironstone on summit and slopes; Shrub mallee on slopes of lateritic hills; Mallee over *Allocasuarina campestris* thicket on the slopes of the laterite plateaus; Mallee over Melaleuca thicket on red brown loam over gravel on slopes below the plateau; Mallee over *Melaleuca coronicarpa* heath on shallow red soil on scarp slopes; *A. campestris/Calothamnus asper* thicket over red-brown clay/ironstone/greenstone on scree slopes; and in lower areas: *Eucalyptus longicornis/E. salubris* woodland, *E. salmonophloia* and *E. loxophleba* woodlands; *Acacia acuminata* low forest; *E. ebbanoensis* mallee over scrub; and open mallee of *E. drummondii*.	i, iii, ii, vii, ix, vi, xiv	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (stock); Fire management; Weed control; Other - controls on mining activities.	Further research needs to undertaken

Community	Ecosystem Recovery Actions[1]	Recovery Descriptions	Constraints
Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor.	xi, i, xiii, viii, xii, xiv	Reinstatement of hydrology; Habitat retention through reserves; Capacity building with landholders; Revegetation; Research; Other - groundwater pumping.	Extent of revegetation required to manage groundwater in the long-term
Herbaceous plant assemblages on bentonite Lakes	i, ii, v, vi, xii	Habitat retention through reserves and on private lands; Fencing; Weed control; Research.	Further research needs to undertaken
Salt Flats Plant Assemblages of the Mortlock River (East Branch)	i, ii, v, vi, vii, x, xi, xii, xiii	Habitat retention through reserves and on private lands; Fencing; Weed control; Feral animal control; Translocations; Reinstatement of hydrology; Research; Capacity building.	Further research needs to undertaken

[1]Appendix B, key h

For all the unreserved vegetation types listed (page 45), the following recovery actions would generally apply: i, iii, ii, xi, vii, vi, ix, xiii (landholders).

Subregion priority for off reserve conservation

There are major constraints (see Appendix C, rank 6) to achieve conservation outcomes due to the level of habitat loss and degree of fragmentation leaving insufficient resources across most of the landscape to support viable populations of many species, significant landscape scale threatening processes such as salinity (affecting up to 30% of the landscape) and fox / cat predation, and competing land uses i.e. broadacre cropping and grazing.

Conservation actions as an integral part of NRM

Existing NRM actions

Incentives: There are incentives for a range of on-ground actions through State, Federal and some other programs. These incentives generally involve revegetation and remnant vegetation fencing, but in some cases (State government in particular) may involve earthworks. Examples include:

- State funding through recovery catchments and other components of the Salinity Program, such as the Crown Reserves Program (refer to Wallace 2001 for summary);
- Land for Wildlife Program (managed by Department of Conservation and Land Management);
- Bushcare funding, through joint projects with State government (who contribute significant dollars) projects and regional NRM groups;
- The Search Project (State-Federal program), for example, significant funding of commercially prospective native species of regional provenance;
- Other NHT programs (National Landcare, Endangered Species).

Three main options also exist to derive a financial benefit from on-farm remnant vegetation:

- Land purchase by government agencies, Australian Bush Heritage fund, interested individuals through the Bush Brokers scheme etc.
- Land revaluation as unproductive, or differential rating by covenanting, and
- Gifting of the land to a tax conservation body for taxation deductions.

Legislation: Most relevant legislation is Wildlife Conservation Act and Conservation and Land Management Act. There is no "duty of care" legislation, and no evidence that such legislation is practicable.

Institutional Reform: The purchase of bushland by CALM is a very real contribution to helping to re-align land use and free up money for landholders. This is a form of new tenure. Operation of regional NRM groups in a state of flux, but represents an on-going case of institutional reform. (See also recommendations in Frost *et al.* 2001 and Wallace 2001). Some State agencies in NRM area have been restructured and re-oriented over the past 12 months, and this is continuing.

Capacity Building with Landholders: In September 1999 Bush Brokers was established with a formal Memorandum of Understanding by all partners. The MOU sets out a range of projects to be undertaken within the next twelve months. These include:

- A united base for promoting improvements to government policies, particularly subdivision policies and procedures so as to streamline the separation of bush from agricultural titles and placement on a separate title.
- A web site register of properties / blocks currently for sale, and buyers seeking bushland.
- Research on the size of the bushland market, and the most cost-effective measures to stimulate that market.
- A case studies handbook of individuals and groups who have already bought bush.
- "Marketing Bushland" Information Seminars for rural agents.
- A "Marketing Bushland" component included in the accredited REIWA course.

Other Planning Opportunities (with Local Government): Draft Statement of Planning Policy made under Section 5AA of the *Town Planning and Development Act* (1928). This policy may be cited as the

Draft Statement of Planning Policy: Environment and Natural Resources Policy. The purpose of this policy is to inform local governments and the Town Planning Appeals Tribunal of those aspects of State-level planning policy concerning the environment and natural resources which should be taken into account in planning decision-making. The policy will also guide the WAPC in undertaking its planning responsibilities, and in integrating and coordinating the activities of the many State agencies which influence the use and development of land. This policy includes a section on biodiversity

Valuing Ecosystem Services & Tradable Rights: Are following testing of these in the eastern states with great interest. Will await the outcome of work there.

Threat Abatement Planning: Actual action is largely through CALM, and there are internal reports and policies on threats such as dieback, feral animal control, fire, etc. However, note also:

- CALM's salinity review (Wallace 2001).
- State Salinity Strategy (State Salinity Council 2000).
- Report of the Salinity Taskforce (Frost *et al.* 2001).
- Weed management strategies (Department of Conservation and Land Management 1999b; Department of Agriculture 2001; Agriculture & Resource Management Council of Australia & New Zealand *et al.* 2000a; Agriculture & Resource Management Council of Australia & New Zealand *et al.* 2000b; and Agriculture & Resource Management Council of Australia & New Zealand *et al.* 2001).
- Local government dieback guidelines document (Lewis and Colquhoun 2000).
- Local government dieback guidelines document (Lewis and Colquhoun, 2000).

Also, specialist plans, for example, those related to management of locust control and interaction of control measures on conservation lands.

Industry Codes of Practice: Such as the following:

- Environmental Code of Practice – Extractive Industries (Environmental Protection Authority 1991).
- Environmental Management in the WA Mining Industry (Chamber of Mines and Energy of Western Australia 1993).
- Code of Practice for Timber Plantations in Western Australia
- Roadside Conservation Committee – Code of Practice for Roadside Conservation in Road Construction and Road Maintenance. The aim of this code is to balance road design and road safety requirements with all other values associated with roadsides in each Shire.

Environmental Management Systems & Ecological Sustainable Product Marketing: The Wheatbelt Region of CALM is preparing an EMS to identify values, threats, goals and prioritise management across the landscape.

Capacity Building: There is significant interaction between State agencies, regional NRM groups (eg. Avon Catchment Network), Greening Australia (WA) (for example, Living Landscapes) and Worldwide Fund for Nature (through Woodland Watch in particular). These groups are also interacting jointly and independently to contribute to capacity building amongst landholders. Other groups such as the Threatened Species Network and Malleefowl Preservation Society also make significant contributions to capacity building in the community.

Other Planning Opportunities: Examples include:

- Department for Planning and Infrastructure is developing relevant rural land use plans.
- Some local governments are acting together to produce joint programs – for example, Kondinin Bush Heritage Committee.
- Regional NRM planning processes continue.
- CALM's Wheatbelt Regional Plan in development.
- National Action Plan for Water Quality and Salinity in development.

Integration with Property Management Planning, Catchment Planning and Landcare: Integration occurring in various ways. Examples include:

- Contribution to property planning by Land for Wildlife;
- Aglets Land Management (Department of Agriculture) includes soil survey, land capability assessment and farm planning.
- Catchment planning through recovery catchments (natural diversity, water resources and rural towns);
- Rapid Catchment Appraisal process managed by Department of Agriculture.
- Regional planning through State agency plans, NRM regional group plans
- Department for Planning and Infrastructure rural land use planning.

Other: Actual on-ground actions by Department of Conservation and Land Management represent the most significant single, focussed contribution to biodiversity conservation in the subregions. One of the most significant aspects of this is in developing new industries based on native biota, particularly plants, that ameliorate threats without jeopardising conservation values. This includes the oil mallees, melaleucas, and a range of other species being investigated as part of the Department's Search program. This is a vital element of success in NRM.

Feasible opportunities for NRM and impediments or constraints to opportunities

Given opportunities and impediments / constraints are often different sides of the same issue, both are covered in this section.

A key constraint overall is the lack of resources – including human and infrastructure resources – for implementation. This point reflects the relative importance of biodiversity conservation and environmental issues in general in the public and political mind. Unless there is much wider recognition that biodiversity conservation makes a vital contribution to each individual's quality of life, this situation is unlikely to change. See Burbidge and Wallace (1995) for a discussion of some of the relevant issues.

A second generic issue is that NRM is variously and poorly defined. This is a significant impediment to

progress, and reflects a much wider lack of rigour in the NRM area, and the generally very poor understanding of the relevant Soc-political processes. One example of these issues is documented in Wallace (submitted for publication). A range of problems, opportunities and constraints in relation to salinity are dealt with in Wallace (2001). Many of these are relevant to the broader field of NRM.

Incentives: Potential changes in the taxation laws for philanthropy exist. It is important to note that in many important cases – such as salinity – it is not an incentive that is require, but technical solutions that are economically viable to implement. While the lack of technical solutions is a barrier, it is also an opportunity. CALM is, particularly in the case of revegetation, working hard to find economically viable technical solutions. Resources are an impediment to doing this faster. It is also essential to note that, if we do not develop economically viable solutions using regional plants and animals, there is a severe risk that new invasive weeds and pest animals (eg, through aquaculture and more aggressive grazing animals) will be introduced. Financial measures are a significant issue; Priority 1-5 years.

Legislation: The Proposed re-writing of the Wildlife Conservation Act is a key opportunity for change. More effective legislation and regulation in relation to land clearing and drainage would assist to combat some existing threats. This is both an opportunity and a barrier. Note the existing MOU is being reviewed. Financial measures are a significant issue (enforcement); Priority 1-20 years.

Institutional Reform: While institutional reform is an issue, even greater opportunities for progress lie in improving the current institutions and ensuring that they are staffed at a sufficient level and with appropriate people. Put simply, bad operators will still be bad irrespective of institutional reform, good operators will generally do comparatively well despite institutional structures. This does not deny the need for institutional reform in some cases. However, it has become clear that the recruitment, training and management of an effective NRM "group" is a far more significant impediment to progress than institutional structures and arrangements. Institutional reforms that would help include:

- To minimise institutional change, and certainly to avoid more frequent structural change to organisations than 8-10 year timeframes without very good reason. Significant structural changes cause organisational inefficiencies that last for a minimum of three years.
- Only implement institutional reform where there is a clearly articulated and convincing case that there is a well-identified problem to be fixed and that the proposed reform has a high probability of success.
- Wherever practicable, appoint contract officers to minimum terms of five years.
- Reverse the current trend of increasing duplication of service delivery in the NRM area.

Financial measures are a significant issue; Priority 1-20 years.

Valuing Ecosystem Services & Tradable Rights: Are following testing of these in the eastern states with great interest. Will await the outcome of work there.

Threat Abatement Planning as Part of NRM: The environmental management system being developed by CALM for the subregions should, for these areas, provide a greatly improved platform for threat abatement planning. Wallace and Beecham (submitted for publication) presents the generalised framework for this.

Environmental Management Systems & Ecologically Sustainable Product Marketing: See comment above under threat abatement.

Capacity Building: The most important opportunity here is the need to re-define capacity building, and to more clearly state goals, objectives and strategies.

Other Planning Opportunities: To date there has been a tendency to over-plan, for example, there are a series of over-lapping planning processes for biodiversity conservation in the south-west. This has, and remains, a barrier. A key opportunity is to proceed implement plans and monitor their value in a more strictly "adaptive management" style than has been the practice to date.

Integration with Property Management Planning, Catchment Planning and Landcare: See comment under Other Planning above.

Other: One of the most significant aspects of this is in developing new industries based on native biota, particularly plants, that ameliorate threats without jeopardising conservation values. This includes the oil mallees, melaleucas, and a range of other species being investigated as part of the Department's Search program. This is a vital element of success in NRM.

Subregions where specific NRM actions are a priority to pursue

There are major constraints (see Appendix C, rank 7) to implement effective NRM actions to achieve biodiversity outcomes.

Data gaps

Gaps in data needed for the identification of biodiversity values and management responses

Vegetation and Regional Ecosystem Mapping: At present little mapping has been done of vegetation remnants to the sub-association level at this scale. To compliment this approach we also require equivalent scale mapping of soil-landscape units to facilitate revegetation of cleared lands, and to provide an alternative biodiversity surrogate, particularly for small terrestrial vertebrates and invertebrates. A standardised database and GIS application is also essential for data querying and management.

Ecological and Life History Data: It is critical to identify priorities and appropriate management responses in the fragmented and largely cleared landscape of the subregion. Data on various population demographic parameters, resource requirements and landscape variables are required to model population viability for a range of species with different life history strategies. This is essential to ensure that management actions are of an appropriate magnitude to achieve the desired biodiversity conservation goals.

Systematic Fauna Surveys: Required for birds, small terrestrial mammals, reptiles and select invertebrate groups across the landscape; also measures of various habitat and landscape variables. A standardised database and GIS application is also essential for data querying and management. The assumption that vegetation characteristics can be used as habitat surrogates for fauna needs to be investigated more thoroughly in conjunction with vegetation and ecosystem mapping above. The continued use of the focal species approach (Lambeck 1997; Lambeck 1999) and a modified version (Lambeck 1998) for biodiversity conservation planning across the subregion requires further research and survey data to address the following:

- the validity of vegetation as a habitat surrogates for all fauna,
- the validity of using birds as indicators for all fauna,
- what constitutes a viable population (Lambeck 1998) and an understanding of metapopulation dynamics for various flora and fauna species in a fragmented landscape

Other Priority Data Gaps Include:
Fire – A knowledge of fire regimes and histories for reserves and areas of remnant vegetation, and data on the effects of fire on flora and fauna based on their life history attributes. This information is essential if the role of altered fire regimes in biodiversity conservation is to be understood and managed.

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R = Report; J = Journal article; O = Other.

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