Avon Wheatbelt 1 *(AW1 - Ancient 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 bioregion, AW1 is an ancient peneplain with low relief, gently undulating landscape. There is no connected drainage; salt lake chains occur as remnants of ancient drainage systems that now only function in very wet years. Lateritic uplands are dominated by yellow sandplain. Climate is Semi-arid (Dry) Warm Mediterranean. Total area is 6,566,022 ha.

Dominant land use

Mainly a mixture of (iv) Cultivation – dryland agriculture and (viii) Grazing – Improved pastures, dryland, with lesser areas of (xi) UCL and Crown reserves, (xiii) Conservation, (ii) Rural residential and (vii) Mining (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 are threatened by fox predation. Two species are now totally extinct; the Pig-footed Bandicoot and Crescent Nailtail Wallaby. Several species are locally extinct, and some are still extant.

Species	Current Conservation Status (WA)	Status in AW1 Subregion
Mala (*Lagorchestes hirsutus*)	Threatened (Extinct in the wild)	Locally Extinct
Red-tailed Phascogale (*Phascogale calura*)	Threatened (Endangered)	Threatened (Endangered)
Western Barred Bandicoot (*Perameles bougainville bougainville*)	Threatened (Endangered)	Locally Extinct
Chuditch (*Dasyurus geoffroii*)	Threatened (Vulnerable)	Locally Extinct
Numbat (*Myrmecobius fasciatus*)	Threatened (Vulnerable)	Locally Extinct
Bilby (*Macrotis lagotis*)	Threatened (Vulnerable)	Locally Extinct
Boodie (*Bettongia lesueur lesueur*)	Threatened (Vulnerable)	Locally Extinct
Banded Hare-wallaby (*Lagostrophus fasciatus fasciatus*)	Threatened (Vulnerable)	Locally Extinct
Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*)	Threatened (Vulnerable)	Threatened (Vulnerable)
Greater Stick-nest Rat (*Leporillus conditor*)	Threatened (Vulnerable)	Locally Extinct
Woylie (*Bettongia penicillata ogilbyi*)	Priority 4, Conservation Dependent	Locally Extinct
Tammar Wallaby (*Macropus eugenii derbianus*)	Priority 4, Conservation Dependent	Locally Extinct
Quenda (*Isoodon obesulus fusciventer*)	Priority 4, Conservation Dependent	Locally Extinct
Western Brush Wallaby (*Macropus irma*)	Priority 4, Conservation Dependent	Priority 4, Conservation Dependent
Common Brushtail Possum (*Trichosurus vulpecula*)	No listing	Conservation Dependent

Yorkrakine Rock: A refuge for aquatic invertebrate species that are confined to the scattered granite rock pools of inland south-western Australia. Aquatic plants occur in the pools and mosses and ferns occur at the pool edges and in seepage areas on the rock. The rock outcrop is otherwise mostly bare and surrounding land is mostly cleared. A good example of the granite outcrop pools that occur patchily but broadly across inland south-western Australia, providing "islands" of freshwater habitat in a region dominated by salinised wetlands. A declared rare plant *Myriophyllum petraeum* (Sr) occurs in rock pools on outcrops east of the site. Plants that typically occur in silt in the floor of rock pools such as those at Yorkrakine include quillworts *Isoetes* spp. (six of the eight species in WA granite rock pools are endemic), mudmats *Glossostigma* spp., *Crassulas crassula* spp., mudworts *Limosella australis* and waterworts *Elatine gratioloides*. Edges and seepage areas typically support moss pillows, sundews *Drosera* spp., bladderworts *Utricularia* and *Polypompholyx* spp. and ferns *Ophioglossum* and *Phylloglossum* spp., some of which have special adaptations to their environment.

In the inland of the south-west, the aquatic and mat plant communities are generally confined to rock pools (McComb and Lake 1990; Bayly 1992). Ducks or herons may use the pools for drinking and/or feeding on occasions. The site is the type locality of the frog *Crinia pseudinsignifera* (Main) and other frogs such as *Limnodynastes dorsalis* and *Pseudophryne guentheri* also occur. A substantial diversity of aquatic invertebrates occurs, e.g. *Limnadia* and *Allotrissocladius* spp. Larval stages of the flies *Archaeochlus brundini* and *Archaeochlus* sp. (undescribed), which have their closest relatives in southern Africa, occur in seepages at the site. The black 'water flea' *Daphnia jollyi*, red calanoid copepod *Boeckella opaqua* and fairy shrimp *Branchinella longirostris*, which are endemic to granite rock pools of

WA, also occur at the site's wetlands (McComb and Lake 1990; Bayly 1992). The pseudoscorpion *Synsphyronus elegans* is known only from Yorkrakine Rock (Harvey 1987, cited in Main 2000). The threatened Yorkrakine Trapdoor Spider (*Idiosoma nigrum*) is also found in the reserve.

Granite Outcrops: Important as seasonal resources and temporary refuge for fauna of surrounding habitats; Black-flanked Rock Wallaby, 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; non-vascular flora – for example Yilliminning Rock (AW2) 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).

Gypsum Dunes: Plant species are generally unique to each IBRA Region and often smaller scales; several DRF and Priority flora species are restricted to gypsiferous habitats, and at least 80 species are likely to be gypsiphyllic (Mattiske Consulting 1995a).

Durokoppin Nature Reserve: High species richness and local endemism of mygalomorph trapdoor spiders. 23 species from 6 families and 12 genera, including several relictual species of "wet" Gondwanan (Mesozoic / Tertiary) heritage.

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 numerous mallee *Eucalyptus* species (Series: Oleosae, Cneoripholiae, Ovulares, Erythronemae, Loxophlebae, Calycogonae and the Spathulata Groups) and *Melaleuca uncinata* sens. lat. and *M. lateriflora* contain individuals that produce higher than average quantities of cineole oil. Identifying these individuals in native vegetation, 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.

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 1972a, Beard 1972e, Beard 1976d, Beard 1979a, Beard 1980b, 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)
- Salinity Action Plan (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:

- Botanical values of gypsum dunes in the wheatbelt (Mattiske Consulting 1995a)
- Biological Survey of the Western Australian Wheatbelt Parts 6 (Muir *et al.* 1978), Parts 8 and 9 (Dell *et al.* 1979), Part 10 (Kitchener *et al.* 1979), Parts 11 and 12 (Chapman *et al.* 1980).
- Wallatin Creek (CSIRO) – numerous studies of elements of the biota and threatening processes within the Wallatin Creek catchment. See Saunders (1995) for a brief overview, however there are numerous other references to work from the study area.
- 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 AW1)
- A review of grassy woodlands in the Western Australian Wheatbelt (Mattiske Consulting 1995b) –

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 Basin (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]
Yorkrakine Rock Pools, WA005	B10	i	iii	iii	x (water diversion via low walls to water storage tanks; interest in further walling), xii (excessive human disturbance - damage by off-road vehicles to vegetation mats; vandalism), xi (fouling by stock and rabbits), vi (bridal creeper *Asparagus asparagoides*), ix

[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]
Mollerin Lake System	553000E 6627000N Zone 50	B8 (An area of lowland woodlands and northern gypsophilous communities in very good condition).	i	iii	iii	iii	x
Buntine to Marchagee Braided Saline Drainage Line	465000E 6681000N Zone 50	B8 (Covers the northern gypsophilous communities of these drainage systems).	i	ii	iii	iii	ix, x
Cowcowing Lake	531000E 6567000N Zone 50	B8 (Best area of extensive Atriplex shrublands with associated lowland woodland communities of the large lakes of this region).	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

According to the State of the Environment Report 1998, virtually all "fringing vegetation" along substantial streamlines (defined as any stream shown on a 1:50 000 topographic map) is in "very poor" condition (land cleared of virtually all natural vegetation) (Wallis and Higham 1998).

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

[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]
Plant Assemblages of the Billeranga System - *Melaleuca filifolia – Allocasuarina campestris* thicket on clay sands over laterite on slopes and ridges; open mallee over mixed scrub on yellow sand over gravel on western slopes; *Eucalyptus loxophleba* woodland over sandy clay loam or rocky clay on lower slopes and creeklines; and mixed scrub or scrub dominated by *Dodonaea inaequifolia* over red/brown loamy soils on the slopes and ridges.	V	15	iii	iii	iii	iv, vi
Plant assemblages of the Inering System (Beard 1976d) - *Allocasuarina campestris* scrub over chert and granite; *Allocasuarina campestris* thicket with scattered *Acacia acuminata* and *Allocasuarina huegeliana* over brown sandy loam over stony and lateritic summits and slopes; *Acacia* spp. mixed low woodland on red/brown sandy loam over granite on summits and slopes; *Melaleuca cardiophylla* thicket with scattered *Eucalyptus loxophleba* and *Eucalyptus salmonophloia* over granite on the lower slopes and foothills; and *Eucalyptus loxophleba* woodland over clay loam on the foothills.	V	26	ii	iii	iii	i, iv, vi, ii
Plant assemblages of the Koolanooka System (Beard 1976d) - *Allocasuarina campestris* scrub over red loam on hill slopes; Shrubs and emergent mallees on shallow loam red over massive ironstone on steep rocky slopes; *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* spp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* spp. scrub on granite.	V	26	ii	iii	iii	i, iv, vi, vii, xii (mining)
Plant assemblages of the Moonagin System (Beard 1976d) - Acacia scrub on red soil on hills; Acacia scrub with scattered *Eucalyptus loxophleba* and *Eucalyptus oleosa* on red loam flats on the foothills.	V	14	iii	iii	iii	i, iv, vi
Perched fresh-water wetlands of the northern Wheatbelt dominated by extensive stands of living *Eucalyptus camaldulensis* (River Red Gum) across the lake floor.	X	42	i	i	iii	i, vi, ix, x
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, i
Ferricrete floristic community (Rocky Springs type) - Tall shrublands on seasonally inundated red brown sandy loams over ironstone dominated by *Dryandra stricta, Allocasuarina campestris, Labichea lanceolata* and *Acacia blakelyi* on the Eneabba Plain. It also comprises a rich herbaceous layer.	EN	28	ii	iii	iii	viii, x, i, v, vi, vii
Assemblages of the organic mound springs of the Three Springs region	EN	N/A	ii	iii	iii	i, iv, vi, v, vii, 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]
Perched clay wetlands of the Wheatbelt region dominated by *Eragrostis australasica* and *Melaleuca strobophylla* across the lake floor	DD	42	ii	iii	iii	vi, ix, x, v, i
Dense thickets of *Melaleuca* spp. with emergent *Eucalyptus erythronema var. marginata* and *Eucalyptus transcontinentalis*.	P	15	ii	iii	iii	vi, ix, x, xii (recreation), v
Tall emergent *Eucalyptus salmonophloia* over *Allocasuarina huegeliana* tall closed forest over *Acacia acuminata* mid high	P	16	iii	iii	iii	x, v, vi

isolated trees over *Alyxia buxifolia* tall sparse shrubland over *Pteridium esculentum* very tall closed fernland over various sparse forbland. Occurs in a drainage line near the base of a granite inselberg.						
Microbial, invertebrate and plant assemblages of natural saline seeps.	V	N/A	ii	iii	iii	vii, ix, x, vi

[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)					
Phascogale calura	E	ii	iv	iii	v, i, ii
Petrogale lateralis lateralis	V	ii	v	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
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 1; RARE/LIKELY TO BECOME EXTINCT, DIV 7 (ARACHNIDS)					
Idiosoma nigrum	V	ii	iii	iii	i, ii, iv, vii
Kwonkan eboracum	CR	ii	vi	iii	i, ii
Teyl sp. (BY Main 195312683, 1984/13)	CR	i	ii	iii	iv, v, vii, x, xii (gravel extraction)
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 (south west population)	SP	i	ii	iii	i, iv, v
Morelia spilota imbricata	SP	ii	iii	iii	i, iv, v
OTHER SPECIES AT RISK WITHIN THE SUBREGION					
Acanthiza iredalei iredalei		ii	iv	iii	iv
Platycercus icterotis xanthogenys	2	ii	iii	iii	i, iv
Ninox connivens connivens	2	ii	iii	iii	i, ii,
Lerista viduata	1	ii	vi	ii	i, ii, iv, v, vii
Daphnia jollyi	1	ii	vi	iii	ix, x
Limnocythere porphyretica	1	ii	vi	iii	Unknown threatening processes

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

Flora

Species	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
DECLARED RARE FLORA					
Acacia aprica	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 lobulata	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Acacia sciophanes	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
Acacia volubilis	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Banksia cuneata	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Caladenia drakeoides	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Caladenia hoffmanii subsp. *hoffmanii*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Chorizema humile	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Cyphanthera odgersii subsp. *occidentalis*	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Daviesia bursarioides	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Daviesia cunderdin	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 nivea	CR	ii	iii	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 veneta	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Eremophila viscida	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
Hemiandra gardneri	CR	ii	iii	iii	i, ii, iv, vi, vii
Hemiandra rutilans	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Myriophyllum lapidicola	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Philotheca basistyla	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Symonanthus bancroftii	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Tetratheca deltoidea	CR	ii	ii	iii	i, ii, iv, vi, vii, ix, x
Thelymitra manginii ms	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Verticordia albida	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Verticordia spicata subsp. *squamosa*	CR	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia lanuginophylla	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Caladenia wanosa	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Conostylis wonganensis	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Darwinia acerosa	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Darwinia masonii	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Darwinia sp. Carnamah (J.Coleby-Williams 148)	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eremophila virens	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eucalyptus brevipes	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eucalyptus crispata	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eucalyptus crucis subsp. *crucis*	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Eucalyptus pruiniramis	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Gastrolobium glaucum	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Glyceria drummondii	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 dryandroides subsp. *hirsuta*	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Grevillea murex	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Hakea aculeata	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Jacksonia quairading ms	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Leucopogon marginatus	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Melaleuca sciotostyla	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
Verticordia hughanii	E	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia denticulosa	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Acacia recurvata	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
Boronia adamsiana	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 dielsii subsp. *teres*	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Darwinia chapmaniana	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
Eucalyptus synandra	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x

Halosarcia bulbosa	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Hensmania chapmanii	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Microcorys eremophiloides	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Pityrodia scabra	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Rhagodia acicularis	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
Roycea pycnophylloides	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
Wurmbea tubulosa	V	ii	iii	iii	i, ii, iv, vi, vii, ix, x
PRIORITY 1					
Acacia caesariata	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Acacia cochlocarpa subsp. velutinosa	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 tetraneura	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Dampiera scaevolina	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Eucalyptus myriadena subsp. *parviflora*	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Eucalyptus subangusta subsp. *virescens*	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Frankenia glomerata	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Gastrolobium diablophyllum	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Guichenotia seorsiflora	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
Acacia caesariata	1	ii	vi	ii	i, ii, iv, vi, vii, ix, x
PRIORITY 2					
Acacia cowaniana	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
Boronia ericifolia	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Eucalyptus recta	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
Fitzwillia axilliflora	2	ii	vi	ii	i, ii, iv, vi, vii, ix, x
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
	Plant Associations of the Billeranga System - *Melaleuca filifolia* – *Allocasuarina campestris* thicket on clay sands over laterite on slopes and ridges; open mallee over mixed scrub on yellow sand over gravel on western slopes; *Eucalyptus loxophleba* woodland over sandy clay loam or rocky clay on lower slopes and creeklines; and mixed scrub or scrub dominated by *Dodonaea inaequifolia* over red/brown loamy soils on the slopes and ridges.	100	1897	4	0	4	H
	Perched clay wetlands of the Wheatbelt region dominated by *Eragrostis australasica* and *Melaleuca strobophylla* across the lake floor	100	40	0	0	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
	Plant assemblages of the Inering System (Beard 1976d) *Allocasuarina campestris* scrub over chert and granite; *Allocasuarina campestris* thicket with scattered *Acacia acuminata* and *Allocasuarina huegeliana* over brown sandy loam over stony and lateritic summits and slopes; *Acacia* sp. mixed low woodland on red/brown sandy loam over granite on summits and slopes; *Melaleuca cardiophylla* thicket with scattered *Eucalyptus loxophleba* and *Eucalyptus salmonophloia* over granite on the lower slopes and foothills; and *Eucalyptus loxophleba* woodland over clay loam on the foothills.	100	650	0	0	0	H
	Plant assemblages of the Koolanooka System (Beard 1976d) *Allocasuarina campestris* scrub over red loam on hill slopes; Shrubs and emergent mallees on shallow loam red over massive ironstone on steep rocky slopes; *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* sp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the	100	5444	0	0	0	H

	upper slopes and summits; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* sp. scrub on granite.						
	Dense thickets of *Melaleuca* spp. with emergent *Eucalyptus erythronema* var. *marginata* and *Eucalyptus transcontinentalis*.	100	15	0	15 (100%)	0	H
	Plant assemblages of the Moonagin System (Beard 1976d) Acacia scrub on red soil on hills; Acacia scrub with scattered *Eucalyptus loxophleba* and *Eucalyptus oleosa* on red loam flats on the foothills.	100	1435	0	0.4 (<1%)	0	H
	Perched fresh-water wetlands of the northern Wheatbelt dominated by extensive stands of living *Eucalyptus camaldulensis* (River Red Gum) across the lake floor.	100	28	0	0	0	H
	Assemblages of the organic mound springs of the Three Springs region	100	11.97	0	0.049	0	H
	Tall emergent *Eucalyptus salmonophloia* over *Allocasuarina huegeliana* tall closed forest over *Acacia acuminata* mid high isolated trees over *Alyxia buxifolia* tall sparse shrubland over *Pteridium esculentum* very tall closed fernland over various sparse forbland. Occurs in a drainage line near the base of a granite inselberg.	100	0.125	0	0.125 (100%)	0	M
	Microbial, invertebrate and plant assemblages of natural saline seeps.	100	25	0	0	0	H
	Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor.	97	421	100	0	100	H
2048	Shrublands; scrub-heath in the Mallee Region	0.0	4.1	0.0	0.0	0.0	L
37	Shrublands; teatree thicket	0.0	10.6	0.0	0.0	0.0	L
365	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	0.0	14.2	0.0	0.0	0.0	L
949	Low woodland; banksia	0.0	14.6	0.0	0.0	0.0	L
1059	Mosaic: Medium woodland; salmon gum & gimlet/Shrublands; mallee *Eucalyptus longicornis* & *E. sheathiana* scrub	100.0	15.7	0.0	0.0	0.0	H
1164	Mosaic: Shrublands; scrub-heath on sandplain (banksia-xylomelum alliance) in the Geraldton Sandplain & Avon-Wheatbelt Regions/Shrublands; *Allocasuarina campestris* thicket	100.0	22.6	0.0	0.0	0.0	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
412	Succulent steppe with scrub; teatree (*Melaleuca thyioides*?) over samphire	0.4	24.5	0.0	0.0	0.0	L
1025	Mosaic: Medium woodland; York gum, salmon gum & morrel/Succulent steppe; saltbush & samphire	81.8	34.5	0.0	0.0	0.0	H
1080	Succulent steppe with mallee & thickets; Mallee and *Melaleuca uncinata* thickets on salt flats	54.1	49.9	0.0	0.0	0.0	H
695	Shrublands; *Allocasuarina campestris* scrub	100.0	52.3	0.0	0.0	0.0	H
538	Shrublands; *Acacia brachystachya* scrub	0.0	57.5	0.0	0.0	0.0	L
392	Shrublands; *Melaleuca thyioides* thicket	7.4	115.4	0.0	0.0	0.0	M
438	Shrublands; dodonaea scrub	100.0	178.1	0.0	0.0	0.0	H
1156	Shrublands; *Allocasuarina campestris* thickets with scattered jam & casuarina	100.0	197.0	0.0	0.0	0.0	H
358	Shrublands; bowgada & *Acacia quadrimarginea* on stony ridges	0.3	197.3	0.0	0.0	0.0	L
936	Medium woodland; salmon gum	0.0	236.0	0.0	0.0	0.0	L
404	Shrublands; bowgada & *Acacia murrayana* scrub	0.1	282.6	0.0	0.0	0.0	L
1058	Shrublands; York gum & *Eucalyptus gonglocarpa* mallee scrub	100.0	296.4	0.0	0.0	0.0	H
385	Shrublands; bowgada & jam scrub with scattered York gum	0.9	321.9	0.0	0.0	0.0	L
516	Shrublands; mallee scrub, black marlock	0.1	350.8	0.0	0.0	0.0	L

1063	Medium-Low woodland; York gum & cypress pine (*Callitris columellaris*)	0.3	387.1	0.0	0.0	0.0	L
145	Mosaic: Medium woodland; York gum & salmon gum/Shrublands; thicket, acacia-casuarina-melaleuca alliance	100.0	402.1	0.0	0.0	0.0	H
2081	Shrublands; bowgada and associated spp. scrub	0.0	715.8	0.0	0.0	0.0	L
40	Shrublands; acacia scrub, various species	0.2	723.7	0.0	0.0	0.0	L
691	Shrublands; *Dryandra quercifolia* & *Eucalyptus* spp. thicket	1.7	736.1	0.0	0.0	0.0	L
1271	Bare areas; claypans	1.0	984.8	0.0	0.0	0.0	L
960	Shrublands; mallee scrub, redwood & black marlock	6.4	1,033.6	0.0	0.0	0.0	M
314	Succulent steppe with open woodland; York gum over saltbush	16.8	1,448.5	0.0	0.0	0.0	M
1155	Mosaic: Medium woodland; York gum /Shrublands; *Allocasuarina campestris* thicket	100.0	3,300.2	0.0	0.0	0.0	H
693	Mosaic: Low woodland: *Allocasuarina huegeliana* over mallee and acacia scrub/*Allocasuarina campestris* thicket	100.0	3,494.0	0.0	0.0	0.0	H
325	Succulent steppe; saltbush & samphire	6.2	3,795.9	0.0	0.0	0.0	L
355	Shrublands; bowgada & jam scrub with scattered York gum & red mallee	6.5	4,266.0	0.0	0.0	0.0	L
1067	Medium woodland; salmon gum, morrel, gimlet & rough fruited mallee	30.9	4,849.1	0.0	0.0	0.0	M
519	Shrublands; mallee scrub, *Eucalyptus eremophila*	0.4	5,226.5	0.0	0.0	0.0	L
419	Shrublands; bowgada, jam and *Melaleuca uncinata* thicket	2.0	6,580.5	0.0	0.0	0.0	L
1198	Mosaic: Succulent steppe with thicket; *Melaleuca thyioides* over samphire/Shrublands; bowgada open scrub	52.8	9,705.8	0.0	0.0	0.0	M
495	Shrublands; thicket, Jam & *Allocasuarina acutivalvus* on ironstone	100.0	9,774.2	0.0	0.0	0.0	M
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
552	Shrublands; *Casuarina acutivalvus* & calothamnus (also melaleuca) thicket on greenstone hills	35.6	13,450.6	0.0	0.0	0.0	L

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. 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 1,500 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

Category 1 IBRA Reservation Class 1 (<2% and <30% of native vegetation cover remaining – see Appendix D. AW1 – 1a (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 for the bioregion is poor. 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 mammal Species	Current Conservation Status (WA)	Status in AW1 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*)		Locally Extinct	National & State
Bilby (*Macrotis lagotis*)	Threatened (Vulnerable)	Locally Extinct	National
Boodie (*Bettongia lesueur lesueur*)	Threatened (Vulnerable)	Locally Extinct	No

CWR mammal Species	Current Conservation Status (WA)	Status in AW1 Subregion	Recovery Plan
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

Coordinated Conservation Plan – Western Wheatbelt (Action Plan for Australian Birds 2000)

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 (*Burhinus grallarius*)	Near Threatened
Hooded Plover (western) (*Thinornis rubricollis tregellasi*)	Near Threatened
Western Rosella (wheatbelt) (*Platycercus icterotis*)	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
Western Whipbird (western mallee) (*Psophodes nigrogularis oberon*)	Near Threatened
Crested Bellbird (southern) (*Oreoica gutturalis gutturalis*)	Near Threatened

Other priority groups and action plans include:

Western Wheatbelt Coordinated Conservation Plan for 14 bird species (Garnett and Crowley 2000)

Flora and fauna of granite outcrops – numerous species including Black-flanked Rock-wallaby, *Teyl* spp.,

Caladenia hoffmanii subsp. *graniticola*, and *Daphnia jollyi*.

District Threatened Flora Recovery Team – the Moora, Merredin and Katanning District TFRT already cover the following species with IRPs - *Acacia aprica, Acacia sciophanes, Chorizema humile, Cyphanthera odgersii* subsp. *occidentalis, Daviesia cunderdin, Daviesia euphorbioides, Drakonorchis drakeoides, Eremophila nivea, Eremophila veneta, Grevillea curviloba* subsp. *incurva, Grevillea dryandroides* subsp. *Dryandroides, Grevillea scapigera, Hemiandra gardneri, Symonanthus bancroftii,* and *Tetratheca deltoidea.*

Threatened flora of roadsides – for example *Boronia adamsiana* and *Acacia volubilis.*

Threatened flora of lowland communities - including tall woodlands, mallee and Melaleuca shrublands, freshwater and naturally saline wetland systems e.g. *Eremophila viscida, E. resinosa.*

Threatened Flora Species	Status EPBC Act	Status WA
Acacia aprica	E	CR
Acacia ataxiphylla subsp. *magna*	E	CR
Acacia denticulosa	V	V
Acacia lanuginophylla	E	E
Acacia lobulata	E	CR
Acacia recurvata	E	-
Acacia sciophanes	E	CR
Threatened Flora Species	Status EPBC Act	Status WA
Acacia semicircinalis	V	V
Acacia subflexuosa subsp. *capillata*	E	CR
Acacia vassalii	E	CR
Acacia volubilis	E	CR
Allocasuarina fibrosa	V	V
Banksia cuneata	E	CR
Boronia adamsiana	V	V
Boronia rhomboidea	NO STAT	-
Caladenia hoffmanii	E	CR
Caladenia wanosa	V	-
Calectasia arnoldii	V	-
Chorizema humile	E	-
Conostylis dielsii subsp. *teres*	E	-
Conostylis wonganensis	E	E
Cyphanthera odgersii subsp. *occidentalis*	E	CR
Darwinia acerosa	E	-
Darwinia chapmaniana	E	-
Darwinia masonii	V	-
Darwinia sp. Carnamah (J.Coleby-Williams 148)	E	-
Daviesia bursarioides	E	-
Daviesia cunderdin	E	CR
Daviesia euphorbioides	E	CR
Drakonorchis drakeoides	E	-
Eremophila nivea	E	-
Eremophila pinnatifida	E	CR
Eremophila resinosa	E	CR
Eremophila veneta	E	CR
Eremophila virens	E	E
Eremophila viscida	E	CR
Eucalyptus brevipes	E	E
Eucalyptus crispata	V	-
Eucalyptus crucis subsp. *crucis*	V	-

Eucalyptus pruiniramis	E	-
Eucalyptus rhodantha var. *petiolaris*	E	-
Eucalyptus rhodantha var. *rhodantha*	V	-
Eucalyptus synandra	V	V
Gastrolobium glaucum	E	E
Glyceria drummondii	E	-
Grevillea christineae	E	E
Grevillea curviloba subsp. *incurva*	E	-
Grevillea dryandroides subsp. *dryandroides*	E	CR
Grevillea dryandroides subsp. *hirsuta*	E	E
Grevillea murex	E	-
Grevillea pythara	E	CR
Grevillea scapigera	E	CR
Hakea aculeata	V	E
Halosarcia bulbosa	V	-
Hemiandra gardneri	E	CR
Hemiandra rutilans	E	CR
Threatened Flora Species	Status EPBC Act	Status WA
Hemigenia viscida	V	-
Hensmania chapmanii	V	-
Jacksonia quairading	E	
Leucopogon marginatus	E	E
Melaleuca sciotostyla	E	E
Microcorys eremophiloides	V	V
Myriophyllum lapidicola	E	CR
Philotheca basistyla	E	CR
Philotheca wonganensis	E	E
Pityrodia scabra	E	V
Rhagodia acicularis	V	V
Rhizanthella gardneri	E	E
Roycea pycnophylloides	E	-
Stylidium coroniforme	E	-
Stylidium merrallii	V	V
Symonanthus bancroftii	E	CR
Tetratheca deltoidea	E	CR
Thelymitra manginii	E	-
Thomasia glabripetala	V	-
Verticordia albida	E	-
Verticordia hughanii	E	E
Verticordia spicata subsp. *squamosa*	E	-
Wurmbea tubulosa	E	-

Priority 1 and 2 flora species	Priority
Acacia caesariata	1
Acacia cochlocarpa subsp. *velutinosa*	1
Acacia sclerophylla var. *teretiuscula*	1
Acacia tetraneura	1
Dampiera scaevolina	1
Eucalyptus myriadena subsp. *parviflora*	1
Eucalyptus subangusta subsp. *virescens*	1

Frankenia glomerata	1
Gastrolobium diablophyllum	1
Guichenotia seorsiflora	1
Verticordia huegelii var. *tridens*	1
Acacia cowaniana	2
Acacia sclerophylla var. *pilosa*	2
Boronia ericifolia	2
Eucalyptus recta	2
Fitzwillia axilliflora	2

Priority species or groups and existing recovery plans

Species or 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
Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*)	No	Action Plan for Australian Marsupials and Monotremes - Recovery Outline	Western Shield Fauna Recovery Program
Western Ringtail Possum (*Pseudocheirus occidentalis*)	Yes – Interim Recovery Plan	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
Woylie (*Bettongia penicillata ogilbyi*)	Yes – RP (now out of date)	Action Plan for Australian Marsupials and Monotremes - Taxon Summary	Western Shield Fauna 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
Heath Mouse (*Pseudomys shortridgei*)	No	Action Plan for Australian Rodents	No
Thick-billed Grasswren (western) (*Amytornis textilis textilis*)	Yes – Interim Recovery Plan	Action Plan for Australian Birds - Coordinated Conservation Plan for the Western Wheatbelt & Taxon Summary	No
Carnaby's Cockatoo (*Calyptorhynchus latirostris*)	Yes - State	Action Plan for Australian Birds - Coordinated Conservation Plan for the Western Wheatbelt & 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 - Taxon Summary	No

Species or Group	Specific Recovery Plan	General Recovery Plan (Action Plans)	Other Management Plans
Malleefowl (*Leipoa ocellata*)	National Recovery Plan for Malleefowl	Action Plan for Australian Birds - Coordinated Conservation Plan for the Western Wheatbelt & Recovery Outline	Malleefowl Preservation Society
Western Wheatbelt Birds	Some	Action Plan for Australian Birds - Coordinated Conservation Plan for the Western Wheatbelt and individual Action Plans	No
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
Teyl sp. (BY Main 195312683, 1984/13)	Yes – Interim Recovery	N/A	No

	Plan		
Cyphanthera odgersii subsp. *occidentalis*	Yes – IRP	N/A	No
Daviesia cunderdin	Yes – IRP	N/A	No
Daviesia euphorbioides	Yes – IRP	N/A	No
Drakonorchis drakeoides	Yes – IRP	N/A	No
Eremophila nivea	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
Hemiandra gardneri	Yes – IRP	N/A	No
Symonanthus bancroftii	Yes – IRP	N/A	No
Tetratheca deltoidea	Yes - IRP	N/A	No

Appropriate species recovery actions

Species or 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.	Locally extinct?, 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.	Locally extinct, 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
Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*)	vii, i, ii, x, xiv	Feral animal control (particularly predators); Habitat retention through reserves and on private lands; Translocation; Other – monitoring.	Lack of suitably large habitat areas, predator control

Species or Group	Recovery Actions[1]	Recovery Description	Major Constraints
Western Ringtail Possum (*Pseudocheirus occidentalis*)	vii, x, i	Feral animal control (particularly predators); Translocation; Habitat retention through reserves.	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.	Locally extinct, lack of suitably large habitat areas, predator control
Tammar Wallaby (*Macropus eugenii derbianus*)	vii, i, x, xiv, ix	Feral animal control (particularly predators); Habitat retention through reserves; Translocation; Other – monitoring; Fire management.	Locally extinct?, lack of survey data, lack of suitably large habitat areas, predator control
Quenda (*Isoodon obesulus fusciventer*)	vii, i, ii, x	Feral animal control (particularly predators); Habitat retention through reserves and on private lands; Translocation.	Locally extinct, lack of suitably large habitat areas, predator control
Mala (*Lagorchestes hirsutus*)	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
Red-tailed Phascogale (*Phascogale calura*)	i, ii, vii, ix, x	Habitat retention through reserves and on private lands; Feral animal control (particularly predators); Fire management; Translocation.	Locally extinct?, lack of survey data, lack of suitably large habitat areas, predator control
Common Brushtail Possum (*Trichosurus vulpecula*)	vii, i	Feral animal control (particularly predators); Habitat retention through reserves;	Locally extinct?, lack of suitably large habitat areas, predator control
Heath Mouse *Pseudomys shortridgei*	vii, i, xiv, ix	Feral animal control (particularly predators); Habitat retention through reserves; Other - survey and monitoring; Fire management.	Lack of knowledge of distribution.
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 programme; Research.	Lack of survey data on breeding and habitat areas
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 survey data
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 knowledge on habitat requirements
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
Malleefowl (*Leipoa ocellata*)	ix, vii, i, iii, ii, xiv	Fire management; Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly predators); Other – survey, monitoring and captive breeding.	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
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.	

Species or Group	Recovery Actions[1]	Recovery Description	Major Constraints
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
Teyl sp. (BY Main 195312683, 1984/13)	iii, i, vii, xiv, v, xi, ix	Habitat retention through reserves and other state lands; Feral animal control (particularly predators); Other - management of competing land uses and survey work; Fencing; Reinstatement of hydrology; Fire management.	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
Flora and fauna of granite outcrops e.g. *Teyl* spp., *Caladenia hoffmanii* subsp. *graniticola*, *Daphnia jollyi*	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. e.g. *Eremophila viscida*, *E. resinosa.*	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.
Priority 1 and 2 flora	xiv	Other - additional survey to locate new populations.	Insufficient numbers of suitably qualified and experienced staff to undertake the extensive fieldwork required.
Declared Rare Flora (general)	xiv	Other – additional survey work to locate new populations.	Insufficient numbers of suitably qualified and experienced staff to undertake the extensive fieldwork required for survey, monitoring and management actions

Species or Group	Recovery Actions[1]	Recovery Description	Major Constraints
Acacia aprica	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 (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Acacia sciophanes	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Chorizema humile	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Cyphanthera odgersii subsp. *occidentalis*	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Daviesia cunderdin	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Daviesia euphorbioides	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Drakonorchis drakeoides	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Eremophila nivea	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Eremophila veneta	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Grevillea curviloba subsp. *incurva*	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Grevillea dryandroides subsp. *dryandroides*	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Grevillea scapigera	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above

Species or Group	Recovery Actions[1]	Recovery Description	Major Constraints
Hemiandra gardneri	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Symonanthus bancroftii	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above
Tetratheca deltoidea	i, iii, ii, vii, v, vi, xiv (survey), x, ix, xi, xii	Habitat retention through reserves, on other state lands and on private lands; Feral animal control (particularly herbivores); Fencing; Weed control; Other – survey; Translocation; Fire management; Reinstatement of hydrology; Research.	Refer to DRF General above

[1]Appendix B, key h

Ecosystems and existing recovery plans

Community	Specific Recovery Plan	General Recovery Plan
Plant Associations of the Billeranga System - *Melaleuca filifolia – Allocasuarina campestris* thicket on clay sands over laterite on slopes and ridges; open mallee over mixed scrub on yellow sand over gravel on western slopes; *Eucalyptus loxophleba* woodland over sandy clay loam or rocky clay on lower slopes and creeklines; and mixed scrub or scrub dominated by *Dodonaea inaequifolia* over red/brown loamy soils on the slopes and ridges	Yes - IRP	Wheatbelt Management Plan (draft)
Perched clay wetlands of the Wheatbelt region dominated by *Eragrostis australasica* and *Melaleuca strobophylla* across the lake floor	No	Wheatbelt Management Plan (draft)
Plant assemblages of the Inering System (Beard 1976d) - *Allocasuarina campestris* scrub over chert and granite; *Allocasuarina campestris* thicket with scattered *Acacia acuminata* and *Allocasuarina huegeliana* over brown sandy loam over stony and lateritic summits and slopes; *Acacia* sp. mixed low woodland on red/brown sandy loam over granite on summits and slopes; *Melaleuca cardiophylla* thicket with scattered *Eucalyptus loxophleba* and *Eucalyptus salmonophloia* over granite on the lower slopes and foothills; and *Eucalyptus loxophleba* woodland over clay loam on the foothills.	Yes - IRP	Wheatbelt Management Plan (draft)
Plant assemblages of the Koolanooka System (Beard 1976d) - *Allocasuarina campestris* scrub over red loam on hill slopes; Shrubs and emergent mallees on shallow loam red over massive ironstone on steep rocky slopes; *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* sp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* sp. scrub on granite.	Yes - IRP	Wheatbelt Management Plan (draft)
Melaleuca thicket - Dense thickets of Melaleuca spp. with emergent Eucalyptus erythronema var. marginata and Eucalyptus transcontinentalis.	No	Wheatbelt Management Plan (draft)
Plant assemblages of the Moonagin System (Beard 1976d) - Acacia scrub on red soil on hills; Acacia scrub with scattered *Eucalyptus loxophleba* and *Eucalyptus oleosa* on red loam flats on the foothills.	Yes - IRP	Wheatbelt Management Plan (draft)
Perched fresh-water wetlands of the northern Wheatbelt dominated by extensive stands of living *Eucalyptus camaldulensis* (River Red Gum) across the lake floor.	No	Wheatbelt Management Plan (draft)
Tall emergent *Eucalyptus salmonophloia* over *Allocasuarina huegeliana* tall closed forest over *Acacia acuminata* mid high isolated trees over *Alyxia buxifolia* tall sparse shrubland over *Pteridium esculentum* very tall closed fernland over various sparse forbland. Occurs in a drainage line near the base of a granite inselberg.	No	Wheatbelt Management Plan (draft)
Microbial, invertebrate and plant assemblages of natural saline seeps.	No	Wheatbelt Management Plan (draft)

Community	Specific Recovery Plan	General Recovery Plan
Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor. (occurrences other than Toolibin Lake).	Yes - IRP	Wheatbelt Management Plan (draft)
Ferricrete Floristic Community (Rocky Springs type)	No – draft IRP	Wheatbelt Management Plan (draft)
Assemblages of the organic mound springs of the Three Springs region	No	Wheatbelt Management Plan (draft)

Appropriate ecosystem recovery actions

Community	Ecosystem Recovery Actions[1]	Recovery Description	Constraints
Plant Associations of the Billeranga System - *Melaleuca filifolia* – *Allocasuarina campestris* thicket on clay sands over laterite on slopes and ridges; open mallee over mixed scrub on yellow sand over gravel on western slopes; *Eucalyptus loxophleba* woodland over sandy clay loam or rocky clay on lower slopes and creeklines; and mixed scrub or scrub dominated by *Dodonaea inaequifolia* over red/brown loamy soils on the slopes and ridges	i, ii, vi, vii, v, ix, xiv, xiii, xiv	Habitat retention through reserves and on private lands; Weed control; Revegetation; Fencing; Fire management; Other - survey, monitoring, mapping and land acquisition; Capacity building using incentives for landholders to conserve the community.	Further research needs to undertaken
Perched clay wetlands of the Wheatbelt region dominated by *Eragrostis australasica* and *Melaleuca strobophylla* across the lake floor	Unknown	Unknown	Further research needs to undertaken
Plant assemblages of the Inering System (Beard 1976d) - *Allocasuarina campestris* scrub over chert and granite; *Allocasuarina campestris* thicket with scattered *Acacia acuminata* and *Allocasuarina huegeliana* over brown sandy loam over stony and lateritic summits and slopes; *Acacia* spp. mixed low woodland on red/brown sandy loam over granite on summits and slopes; *Melaleuca cardiophylla* thicket with scattered *Eucalyptus loxophleba* and *Eucalyptus salmonophloia* over granite on the lower slopes and foothills; and *Eucalyptus loxophleba* woodland over clay loam on the foothills.	ii, xiv, xiii, vii, v, i, vi, viii, ix, xii	Habitat protection on private lands; Other – survey work; Capacity building using incentives for landholders to conserve the community; Feral animal control; Fencing; Habitat retention through reserves; Weed control; Revegetation; Fire management; Research.	Further research needs to undertaken
Plant assemblages of the Koolanooka System (Beard 1976d) - *Allocasuarina campestris* scrub over red loam on hill slopes; Shrubs and emergent mallees on shallow loam red over massive ironstone on steep rocky slopes; *Eucalyptus ebbanoensis* subsp. *ebbanoensis* mallee and *Acacia* spp. scrub with scattered *Allocasuarina huegeliana* over red loam and ironstone on the upper slopes and summits; *Eucalyptus loxophleba* woodland over scrub on the footslopes; and mixed *Acacia* spp. scrub on granite.	i, ii, iii, vi, vii, v, ix, xiv, xiii	Habitat retention through reserves, on private lands and on other state lands; Weed control; Feral animal control; Fencing; Fire management; Other - survey, monitoring, mapping and land acquisition; Capacity building using incentives for landholders to conserve the community.	Further research needs to undertaken
Melaleuca thicket - Dense thickets of *Melaleuca* spp. with emergent *Eucalyptus erythronema* var. *marginata* and *Eucalyptus transcontinentalis.*	xiv	Other - survey for additional occurrences.	Further research needs to undertaken
Plant assemblages of the Moonagin System (Beard 1976d) - Acacia scrub on red soil on hills; Acacia scrub with scattered *Eucalyptus loxophleba* and *Eucalyptus oleosa* on red loam flats on the foothills.	i, ii, xiii, v, xiv, vi, viii	Habitat retention through reserves and on private lands; Capacity building using incentives for landholders to conserve the community; Fencing; Other - survey and monitoring; Weed control; Revegetation.	Further research needs to undertaken
Perched fresh-water wetlands of the northern Wheatbelt dominated by extensive stands of living *Eucalyptus camaldulensis* (River Red Gum) across the lake floor.	xiv	Other - survey for occurrences.	Presumed totally destroyed.

Community	Ecosystem Recovery Actions[1]	Recovery Description	Constraints
Tall emergent *Eucalyptus salmonophloia* over *Allocasuarina huegeliana* tall closed forest over *Acacia acuminata* mid high isolated trees over *Alyxia buxifolia* tall sparse shrubland over *Pteridium esculentum* very tall closed fernland over various sparse forbland. Occurs in a drainage line near the base of a granite inselberg.	xiv	Other - survey for any additional occurrences.	Need to determine if *P. esculentum* is a natural component of the community
Microbial, invertebrate and plant assemblages of natural saline seeps.	xiv, xii	Other - surveys for additional occurrences; Research.	Further research needs to undertaken
Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor (occurrences other than Toolibin Lake).	ii, xi, xiv, vi, viii	Habitat protection on private lands; Reinstatement of hydrology; Other - survey and monitoring of flora, surface water and groundwater; Weed control; Revegetation.	Further research needs to undertaken
Ferricrete Floristic Community (Rocky Springs type)	i, vi, ix, xii, xiv	Habitat retention through reserves; Weed control; Fire management; Research; Other - hydrological investment; dieback disease prevention.	Further research needs to undertaken
Assemblages of the organic mound springs of the Three Springs region	ii, v, xii	Habitat protection on private lands; Fencing; Research.	Further research needs to undertaken

[1]Appendix B, key h

For all the unreserved vegetation types listed (pages 14-16), 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, rank = 1) 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 & 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 2000). 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 who influence the use and development of land. This policy includes a section on biodiversity.

Valuing Ecosystem Services & Tradable Rights: Testing of these NRM methods is currently being undertaken in other states, and results will be examined for their relevance in Western Australia.

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).

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 & Ecologically 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;
- Agwest 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 subregion.

Feasible opportunities for 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.

Legislation: 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.

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.

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) present 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.

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 socio-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.

Subregions where specific NRM actions are a priority to pursue

AW1 has a subregional NRM priority of (i), indicating that the subregion faces major constraints to implement effective NRM actions to achieve biodiversity outcomes (see Appendix C, rank 7).

Data gaps

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

Vegetation and Regional Ecosystem Mapping: Systematic vegetation mapping of all vegetation remnants is required to the sub-association level. At present little mapping has been done 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

Floristic Data: Need for the structural vegetation mapping above. Whilst structural units are easiest to map, it is important to also document the floristic variation within and between vegetation sub-associations, particularly for management purposes

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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