Gascoyne 2 *(GAS2 – Carnegie subregion)*

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Subregional description and biodiversity values

Description and area

Underlain by the Earaheedy Basin of the Capricorn Orogen (Proterozoic) and the south-eastern extension of the Bangemall Basin. Rugged low Proterozoic sedimentary and granite ranges divided by broad flat valleys. Shallow earthy loams over hardpan on the plains and shallow stony loams associated with the ranges. Extensive salt lake systems. Low Mulga communities occur on hills and plains. Samphire and saltbush steppes are associated with salt lakes while ranges are dominated by mulga scrub and *Eremophila* shrublands. Desert climate, with bimodal rainfall. Subregional area of GAS2 is 5, 260, 969ha.

Dominant land use

(see Appendix B, key b)

(ix) Grazing – native pastures. This accounts for the vast majority of land use in the subregion –66.06%

(xi) Unallocated Crown Land and Crown Reserves-32.19%

(vii) Lakes and major water courses-1.43%

Continental Stress Class

The Continental Stress Class for GAS2 is 5.

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

Calcrete Aquifers:
Found in part of the subregion and are likely to support a range of subterranean aquatic fauna as occur in aquifers of the adjoining Murchison 1 subregion. Our understanding of biogeography for these groups is very limited, but work by Humphries (2001) suggests that there is likely to be significant stygofauna in aquifers at Lorna Glen and Cunyu and these are frequently short range endemics.

Rare Species:
Include *Egernia kintorei* (Great Desert Skink), *Leipoa ocellata* (Mallee Fowl), *Polytelis alexandrae* (Alexandra's Parrot), *Dasycercus cristicauda* (Mulgara) and a priority gecko, *Diplodactylus kenneallyi*. There are no rare plants documented for the subregion but this may just reflect the lack of detailed work conducted in the area although the largely homogenous landscape is unlikely to support many endemic or restricted species.

Ecosystems:
Beard Vegetation Associations 97 (Hummock grasslands, shrub steppe: acacia species over *Plectrachne melvillei*) and 546 (Succulent steppe with low woodland: mulga over samphire) are endemic to Gascoyne 2.

Centres of Endemism:
There are no identified endemic taxa / groups within the subregion although the Gascoyne region supports at least two species of endemic reptiles- the gecko *Diplodactylus wilsoni* and the skink *Lerista stictopleura*.

It is likely that a number of subterranean aquatic fauna within calcrete aquifers are endemics but currently only the following are identified:

- Family Diosaccidae (marine family): *Schizopera* sp. nov. 4 - known only from Lake Way and Lorna Glen: *Schizopera* sp. nov. 5 known only from Jundee and Lorna Glen
- Family Ameiridae (mostly a marine family): *Nitocrella* n. sp. 4 Lorna Glen

Refugia: Although probably not recognised as a true refugia site, the Lake Carnegie System is documented as an important site for the breeding of Black Swans (*Cygnus atratus*). It is a large shallow, saline, internal drainage basin that is episodic in terms of inundation. In 1980 as many as 1000 breeding pairs of Black Swans were observed with 130 broods and numerous nests with eggs. This represents the highest numbers breeding at any site in WA. Another 24 species of waterbird have been documented from with several of them, including the Grey Teal and Australian Shelduck, also breeding.

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

In 1974 the Conservation Through Reserves Committee (CTRC) made recommendations for reserves within the Eastern Goldfields (System 11), which includes Gascoyne 2, in the CTRC Green Book (Environmental Protection Authority 1974). Some, but not all of these recommendations (with modification) were implemented over the following two years. A review of outstanding recommendations was initiated in 1988 and culminated in the production of a report – Nature Conservation Reserves in the Eastern Goldfields, Western Australia (Henry-Hall 1990). This report made recommendations on a nature conservation reserve system for the southern and central Goldfields, which incorporates GAS2. Most of the subregion is covered by a CALM Regional Management Plan, published in 1994 (Department of Conservation and Land Management 1994b), that provides an overview of the region's biota, addresses land and wildlife conservation issues, but was written to cover a third of WA and therefore was generalised in its attention to detail. The reviews and strategies therein (for reserve system development or management of weeds, fire, feral animals, mining, ecosystem rehabilitation & disease quarantine) do not address the specific needs of

subregions, or even bioregions, individually (Department of Conservation and Land Management 1994).

Wetlands

Wetlands of National significance (DIWA listings)

Name and Code	Description[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Lake Carnegie system, WA032	B8	iii	iv	iii	iv (grazing on adjoining lands)
Windich Springs, WA033	B17	ii	iii-iv	iii	iv, v (camels)

[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)

There are no wetlands of subregional significance in GAS2.

Riparian zone vegetation

Name	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
Gascoyne Catchment Area	ii	iii-iv	ii	iv (cattle),v (camels), vi, x, vii

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

As all water courses within the subregion are only episodically inundated there is really almost no vegetation that can be described is riparian. However, internal drainage systems are frequently degraded by stock use and through feral herbivores and thus may alter drainage patterns which may in turn alter vegetation structures and contribute to eutrophication downstream after rainfall events.

Ecosystems at risk

Threatened ecological communities (TECs)

There are no Threatened Ecological Communities (TECs) within GAS2.

Other ecosystems at risk

Community	Status	NVIS[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Lake Carnegie	V	41	iii	iv	iii	No specific threatening processes other than much of the surrounding land is pastoral lease and there may be some impacts from stock grazing (iv, v, x)
Windich Springs	V	42	ii-iii	iii	iii	iv (grazing by cattle, horses and camels has been causing damage to creek bed and some decline in dense sedgelands which fringed the pools), v, x (faeces from stock and feral animals may fowl the water, vii
Subterranean fauna of Calcrete aquifers	V	N/A	iii-iv	iv	iii	Potential threats: ix, x, xi, vi, i.

[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

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)					
Dasycercus cristicauda	V	ii	iii	iii	v (foxes & cats), vii
SCHEDULE 1; RARE/LIKELY TO BECOME EXTINCT, DIV 2 (BIRDS)					
Polytelis alexandrae	V	ii	iii	iii	vii, iv
SCHEDULE 1; RARE/LIKELY TO BECOME EXTINCT, DIV 3 (REPTILES)					
Egernia kintorei	V	i	ii	iii	v (foxes & cats), vii, iv
OTHER SPECIES AT RISK WITHIN THE SUBREGION					
Acanthiza iredalei iredalei	Commonwealth	ii-iii	iii	ii	vii, iv
Diplodactylus kenneallyi	P2	ii-iii	vi	iii	iv, vii

[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

There are no DRF or Priority plant species listed due to lack of knowledge and survey information, however the risks through grazing are considerable.

Analysis of appropriate management scenarios

Reservation priorities of ecosystems

Beard Veg Code	Ecosystem Description	IUCN I-IV	Non-IUCN	CALM Purchased Lease	Priority
11	Medium woodland; coolibah (*E .microtheca*)				L
18	Low woodland; mulga (*Acacia aneura*)			X	M
19	Low woodland; mulga between sandridges				L
24	Low woodland; *Allocasuarina cristata*				L
29	Sparse low woodland; mulga, discontinuous in scattered groups			X	M
39	Shrublands; mulga scrub			X	M
95	Hummock grasslands, shrub steppe; acacia & grevillea over *Triodia basedowii*			X	M
96	Hummock grasslands, shrub steppe; acacia species (+grevillea) over *Triodia basedowii* often between sandridges				M
97	Hummock grasslands, shrub steppe; acacia species over *Plectrachne melvillei*			X	M
107	Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex				L
111	Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex				L
125	Bare areas; salt lakes			X	M
134	Mosaic: Hummock grasslands, open low tree steppe; desert bloodwood and feathertop spinifex (on) sandhills/Hummock grasslands, shrub steppe; mixed shrubs over spinifex between sandhills				L
139	Hummock grasslands, patchy shrub steppe; mulga over hard spinifex on laterite				M
142	Medium woodland; York gum & salmon gum				M
178	Hummock grasslands, grass steppe; hard spinifex *Triodia basedowii*				M
182	Low woodland; mulga & bowgada (*A. ramulosa*)				H
202	Shrublands; mulga & *Acacia quadrimarginea* scrub				M
204	Succulent steppe with open scrub; scattered mulga & Acacia sclerosperma over saltbush & bluebush			X	M
508	Succulent steppe with open scrub; scattered mulga over saltbush				H
546	Succulent steppe with low woodland; mulga over samphire			X	M
Beard Veg Code	Ecosystem Description	IUCN I-IV	Non-IUCN	CALM Purchased Lease	Priority
547	Mosaic: Low woodland; mulga & bowgada/Succulent steppe; samphire				H
676	Succulent steppe; samphire			X	M

1195	Mosaic: Low woodland; mulga in valleys/Hummock grasslands, shrub steppe; acacia species over *Triodia basedowii*				M
1446	Succulent steppe with scrub; mulga over bluebush			X	M

Subregional constraints in order of priority
(see Appendix B, key g)

Competing Land Uses: In that pastoralism occupies more than 65% of the subregion.

Economic Constraints: In terms of the cost of land and the cost of subsequent management.

Other: Difficulties in identifying biodiversity values due to a distinct lack of resolution of data; level of degradation of much of the subregion is significant due to pastoral practices and the impacts of feral herbivores.

Bioregional and subregional priority for reserve consolidation

GAS is reservation class 3 (see Appendix D, and Appendix C, rank 4) with only 1.93% of area in conservation reserve (IUCN I-IV) At the subregional level GAS1 has 2.84% in reserve (IUCN I-IV) while GAS2 has nothing in IUCN I-IV conservation reserve and GAS3 has 2.53% in IUCN I-IV reserve. The current reserve system is highly biased in terms of CAR criteria and is not comprehensive or representative in terms of ecosystem representation so Class 2 as a primary classification is more appropriate.

Reserve management standard

In GAS, no feral predator programs are in place yet. Wildfire management facilities are limited by resources, except for fire breaks and fire-access tracks which are installed and maintained. Feral herbivore grazing activities still pose a conservation risk in some areas and no feral predator control is being undertaken. Therefore, the overall reserve management rank for GAS is (ii) (see Appendix C, rank 5).

Name	Category	Reserve Management Rank[1]
Earaheedy	Unallocated Crown Land (now managed for conservation)	ii-iii
Lorna Glen	Unallocated Crown Land (now managed for conservation).	ii-iii

[1]Appendix C, rank 5

Off reserve conservation

Priority species or groups and existing recovery plans

Species	Beard Vegetation Association or Ecosystem	Specific Recovery Plan	General Recovery Plan
Stygofauna	Calcrete aquifers	No	No
Polytelis alexandrae	39 – Shrublands: mulga scrub; 95 – Hummock grasslands, shrub steppe: acacia and grevillea *over Triodia basedowii*; 96 – Hummock grasslands, shrub steppe: acacia species (+ grevillea) over *Triodia basedowii* often between sand ridges; 97 - Hummock grasslands, shrub steppe: acacia species over *Plectrachne melvillei*; 107 – Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex; 111 – Hummock grasslands, shrub steppe: *Eucalyptus gamophylla* over hard spinifex; 11 – Medium woodland: red mallee group; 24 – Low woodland: *Allocasuarina cristata*.	No	Action Plan for Australian Birds
Acanthiza iredalei iredalei	676 – Succulent steppe: samphire; 508 – Succulent steppe with open scrub: scattered mulga over saltbush; 546 – Succulent steppe with low woodland; mulga over samphire; 144 – Medium woodland: wandoo, salmon gum, morrel, gimlet & rough fruited mallee.	No	Action Plan for Australian Birds
Dasycercus cristicauda	18 – Low woodland: mulga (*Acacia aneura*); 39 – Shrublands: mulga scrub; 107 – Hummock grasslands, shrub steppe: mulga and *Eucalyptus kingsmillii* over hard spinifex.	Yes - National Threatened Species Recovery team	Action Plan for Australian Marsupials and Monotremes

Species	Beard Vegetation Association or Ecosystem	Specific Recovery Plan	General Recovery Plan
Diplodactylus kenneallyi	unknown	No	Action Plan for Australian Reptiles
Egernia kintorei	39 – Shrublands: mulga scrub, 96 - Hummock grasslands, shrub steppe: acacia species (+ grevillea) over *Triodia basedowii* often between sand ridges; 107 - Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex; 111 - Hummock grasslands, shrub steppe: *Eucalyptus gamophylla* over hard spinifex; 178 – Hummock grasslands, grass steppe; hard spinifex *Triodia basedowii*.	Yes - National Threatened Species Recovery team	Action Plan for Australian Reptiles

Appropriate species recovery actions

Species	Recovery Actions[1]	Recovery Descriptions
Polytelis alexandrae	i, ii, iii, vii	habitat retention through reserves or on other State lands or on private lands. Possibly control of feral predators as well as habitat degradation through grazing pressure and by feral herbivores
Acanthiza iredalei iredalei	i, ii, iii, vii	The loss of habitat through grazing of chenopod shrubland by sheep and rabbits
Dasycercus cristicauda	i, ii, iii, vii, ix, xii	CWR species that requires specific fire age spinifex habitat. Predated upon by foxes and cats. Ecological research currently being conducted by D. J. Pearson
Egernia kintorei	i, ii, iii, vii, ix, xii	It is likely that reduction has occurred through direct predation (cats, foxes) as well as habitat alteration through changed fire regimes as well as grazing impacts.

[1]Appendix B, key h.

Ecosystems and appropriate recovery actions

Community	Recovery Actions[1]	Recovery Descriptions
Lake Carnegie	i, ii, iii, xiii, vii, vi	Habitat retention through reserves or on other State lands or on private lands. Capacity building required with industry. Feral animal control: cats, foxes, and camels. Weed control.
Windich Springs	i, ii, iii, xiii, vii, vi	Habitat retention through reserves or on other State lands or on private lands. Capacity building required with industry. Feral animal control: cats, foxes, and camels. Weed control.
Subterranean fauna of Calcrete aquifers	i, ii, iii, xiii, vii, vi	Habitat retention through reserves or on other State lands or on private lands. Weed control.

[1]Appendix B, key h.

Existing ecosystem recovery plans

There are no recovery plans relevant to ecosystems at risk in GAS2, however the subregion is included in Goldfields Regional Management Plan (Department of Conservation and Land Management 1994b).

Subregion priority for off reserve conservation

The priority for off park conservation in GAS2 is (ii) (see Appendix C, rank 6), indicating that there is a significant off park effort needed, and resource constraints and limited community capacity exist.

Conservation actions as an integral part of NRM

Existing NRM actions

Threat Abatement Planning as Part of NRM: e.g. Vegetation management plans, pest management.

Industry Codes of Practice: Particularly in relation to mining and exploration activities.

Environmental Management Systems and Ecologically Sustainable Product Marketing.

Feasible opportunities for NRM

Legislation: Including duty of care for leasehold and other lands.

Institutional Reform: e.g. rural reconstruction, industry reconstruction, new tenure and management arrangements.

Other Planning Opportunities: Including local government planning and National Action Plan for Water Quality and Salinity.

Environmental Management Systems and Ecologically Sustainable Product Marketing: Some pastoral areas already attempting to identify and implement ecologically sustainable practices through the EMU process developed by AgWA. Needs a greater level of support to be successful.

Impediments or constraints to opportunities

A number of impediments exist including the Land Administration Act and operations of the Pastoral Land Board, and Conservation Through Reserves is limited through mining leases and tenements. There needs to be an increase awareness of conservation values through education of various industries (mining and pastoral) and the public in general. Limited financial resources are also a major constraint.

Subregions where specific NRM actions are a priority to pursue

The NRM priority in GAS2 is (i) (see Appendix C, rank 7), which indicates that there are major constraints to implement effective NRM actions and achieve biodiversity outcomes. Much of GAS2 is severely degraded through past agricultural practices (primarily cattle grazing) and feral herbivores. Under the pastoral lands act leases are still required to maintain certain stock levels that do not necessarily fit with conservation values. Pastoral Industry reform is essential to achieve desired conservation outcomes.

Data gaps

Gaps in Data Needed for the Identification of Biodiversity Values and Management Responses

Vegetation and Regional Ecosystem Mapping: Regional survey of flora has not been conducted and regional ecosystem mapping has only been conducted at 1:1000000 scale by Beards vegetation mapping. Mabbutt *et al.* (1963) produced land system mapping for the Wiluna-Meekatharra area at a scale of 1:500000. The Western Australian Department of Agriculture has also produced Land system mapping at the 1:500000 scale for much of the rangelands but the information was developed to reflect pastoral value rather than conservation or ecosystem status.

Systematic Fauna Survey: There has been no systematic fauna surveys conducted in the subregion and as such the majority of data has been opportunistically collected and sampling sites are sparse and probably restricted to areas of good access.

Ecological and Life History Data: There are few data on habitat requirements of virtually all invertebrate species, most ephemeral plants, persisting CWR mammals, and uncommon vertebrate and plant species. There are no data to provide a regional context on life-history (including population-trend) of any species.

Other Priority Data Gaps Include:

- No quantitative data on the effect of exotic predators, weed colonisation, fire, mineral-extraction etc.
- There is no regolith mapping for any of the subregion at better than 1:250,000.

Source

References cited

No.	Author	Date	Title	Publication Details	Pub. Type
181	Cogger, H., Cameron, E., Sadlier, R. and Eggler, P.	(1993).	The Action Plan for Australian Reptiles.	Australian Nature Conservation Agency, Canberra.	R
231	Department of Conservation and Land Management	(1994b).	Goldfields Region Management Plan 1994-2004. Management Plan No. 27.	Department of Conservation and Land Management.	R
278	Environmental Protection Authority	(1993).	Conservation Reserves for Western Australia. Red Book Status Report. EPA Report 15.	Environmental Protection Authority. Perth, Western Australia.	R
271	Environmental Protection Authority	(1974).	Conservation Reserves in Western Australia - Report of the Conservation through Reserves Committee to the Environmental Protection Authority "CTRC Green Book".	Environmental Protection Authority, Perth.	R
298	Garnett, S.T. and Crowley, G.M.	(2000).	The Action Plan for Australian Birds.	Environment Australia, Canberra.	R
354	Henry-Hall, N.J., Hopper, S.D., McKenzie, N.L. and Keighery, S.D.	(1990).	Nature Conservation Reserves in the Eastern Goldfields, Western Australia - Southern Two Thirds of CTRC System 11.	Report submitted to EPA Red Book Task Force.	R
391	Humphreys, W.F.	(2001).	Groundwater calcrete aquifers in the Australian arid zone: the context to an unfolding plethora of stygal biodiversity. Pp 63 - 83 in Subterranean Biology in Australia 2000, W.F. Humphreys and M.S. Harvey (eds).	Records of the Western Australian Museum, Supplement No. 64.	B
461	Mabbutt, J.A., Litchfield, W.H., Speck, N.H., Sofoulis, J., Wilcox, D.G., Arnold, M., Brookfield, M. and Wright, R.L.	(1963).	General Report on Lands of the Wiluna-Meekatharra area, Western Australia, 1958.	CSIRO Land Research Series No 7.	J
483	Maxwell, S., Burbidge, A. A. and Morris, K. (eds).	(1996).	The 1996 Action Plan for Australian Marsupials and Monotremes. Wildlife Australia Endangered Species Program Project Number 50.	Environment Australia, Canberra.	R
484	McAlpin, S.	(2001).	A Recovery Plan for the Great Desert Skink (*Egernia kintorei*) 2001-2011.	Arid lands Environment Centre.	R
545	Pearson, D.J.	(1991).	First record of the Mulgara *Dasycercus cristicauda,* from the Gibson Desert and Queen Victoria Springs nature Reserves.	Western Australian Naturalist 18: 159-161.	J

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

Other relevant publications

See reference numbers 040, 065, 067, 075, 090, 098, 099, 101, 118, 211, 232, 241, 258, 260, 272, 278, 279, 313, 370, 394, 395, 406, 450, 459, 507, 519, 526, 560, 561, 577, 584, 647, 648, 680, 685 and 686 in Appendix A.