Murchison 1 *(MUR1 – East Murchison subregion)*

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Subregional description and biodiversity values

Description and area

The northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton. Characterised by its internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. Salt lake systems associated with the occluded Paleodrainage system. Broad plains of red-brown soils and breakaway complexes as well as red sandplains. Vegetation is dominated by Mulga Woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and Halosarcia shrublands. Arid climate, with mainly winter rainfall (200 mm). The subregional area for MUR1 is 7, 847, 996 ha.

Dominant land use

(see Appendix B, key b)

(ix) Grazing – native pastures. This accounts for the vast majority of land use in the subregion – 85.47% (xi) UCL and Crown Reserves-11.34% (vii) Mining – Interest in nickel and gold mining are considerable, however most mining leases still come under the pastoral lands act and as such are still required to be stocked. (xiii) Conservation- the majority of conservation estate in the subregion falls outside the IUCN I-IV categories – 1.4%

Continental Stress Class

The Continental Stress class for MUR1 is 3.

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

Rare Features:
Calcrete aquifers in the northern part of the subregion are known to support a wide range of subterranean aquatic fauna that are short range endemics. Our understanding of biogeography for these groups is very limited but work by Humphries and Harvey (2001) suggests that there is significant stygofauna in the Lake Way system, at Jundee, Lorna Glen and Cunyu.

Rare species for the subregion include, Great Desert Skink (*Egernia kintorei*), Mallee Fowl (*Leipoa ocellata*), Alexandra's Parrot (*Polytelis alexandrae*) and Mulgara (*Dasycercus cristicauda*).

Vegetation Types That Have at Least 85% of Their Total Extent Confined to the Murchison 1 Subregion:

Beard Veg Code	Ecosystem Description
20	Low woodland; mulga mixed with *Allocasuarina cristata* & *Eucalyptus* sp (e6?)
105	Hummock grasslands, shrub steppe; mulga over soft spinifex
107	Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex
223	Succulent steppe with open scrub; scattered mulga over saltbush & bluebush
311	Succulent steppe with open low woodland; mulga & *Acacia sclerosperma* with saltbush & bluebush
312	Succulent steppe with very open shrubs; very sparse mulga and *Acacia sclerosperma* over saltbush & bluebush
313	Succulent steppe with open scrub; scattered *Acaica sclerosperma* & *A. victoriae* over bluebush
338	Hummock grasslands, mixed sandplain; bowgada, sugarbrother, mallee, *Triodia basedowii* & *Triodia* ?sp
339	Hummock grasslands, mixed sandplain; bowgada, sugarbrother, mallee, *Triodia scariosa* & *Triodia* ?sp
400	Succulent steppe with open low woodland; mulga over bluebush
417	Succulent steppe with open scrub; scattered wattles over saltbush
418	Low woodland; mulga, *Casuarina cristata* & cypress pine
484	Shrublands; jam thicket
485	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia basedowii*
504	Low woodland; mulga & red mallee
532	Hummock grassland, mixed sandplain - sparse low trees over sparse dwarf shrubs with spinifex; ?marble gum & red mallee mixed dwarf shrubs with *Triodia scariosa* & *Triodia* sp?
533	Low woodland; mulga & cypress pine
560	Mosaic: Shrublands; bowgada scrub/Succulent steppe; samphire
561	Succulent steppe with low woodland; mulga over saltbush

Beard Veg Code	Ecosystem Description
862	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*E. kingsmillii*) over hard spinifex *Triodia basedowii*
863	Hummock grassland, mixed sandplain - sparse low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia scariosa* & *Triodia* sp?
865	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia scariosa* & *Triodia* sp?
1127	Mosaic: Saltbush & bluebush/samphire
2121	Mosaic: Open low woodland; mulga/Succulent steppe; saltbush & bluebush on greenstone
2902	Medium woodland; *Allocasuarina cristata* & goldfields blackbutt
2903	Medium woodland; Salmon gum, goldfield blackbutt, gimlet & *Allocasuarina cristata*

Centres of Endemism:
The subregion is rich and diverse in both its flora and fauna however most species are wide ranging and usually occur in at least one, and often several, adjoining subregions.

The only subregional endemic species of vertebrate appears to be the Yellow-bellied Black Snake (*Pseudechis butleri*). It is likely that a number of subterranean aquatic fauna 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:
Lake Barlee - An intermittent salt lake that fills approximately every 10 years and persists for about 1 year. Banded stilts (*Cladorhynchus leucocephalus*) breed there and estimates of around 200,000 nests have been reported. Burbidge and Fuller (1982) suggest that it may be the most important breeding site for this species. Other water birds are also known to breed there.

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 a large component of Murchison 1, in the CTRC Green Book. Some recommendations, particularly those to do with acquisition of pastoral properties for conservation reserve have been implemented, however other recommendations were not addressed. 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, Report Submitted To EPA Red Book Task Force, 1990 (Henry-Hall *et al* 1990). This report made recommendations on a nature conservation reserve system for the southern and central Goldfields that incorporate MUR1. Most of the subregion is covered by a CALM Regional Management Plan (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 1994b).

During the last 10 years significant areas of the region have been added to the Conservation estate. The State Government's policy statement, Managing the Rangelands, broadly outlines the need to implement a CAR reserve system although no specific areas are targeted for reservation. An unpublished report by Department of Conservation and Land Management - "Gascoyne - Murchison Strategy, Establishment and Management of a Conservation Reserve System" outlines the broad techniques to implement a CAR reserve system but also does not target any specific areas. An outline of this report is given in the article *Filling the Gaps* (McNamara *et al.* 2000).

Wetlands

Wetlands of National significance (DIWA listings)

Name & Code	Description[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Lake Ballard WA058	B8	ii	iv	ii	iv, v (fox & cat predation)
Lake Barlee WA059	B8	ii	iv	ii	iv, v (fox & cat predation)
Lake Marmion WA060	B8	ii	iv	ii	iv

[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 MUR1.

Riparian zone vegetation

Name	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
All fringing vegetation of riparian zones	ii	iii-iv	ii	iv (particularly sheep), v (goats, rabbits), vi, x, vii

[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)

There are no Threatened Ecological Communities (TECs) in MUR1.

Other ecosystems at risk

Community	Status	NVIS[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Subterranean fauna of the Paroo Sub-Basin of the Lake Way Basin. Calcrete formations near Wiluna (B. Humphreys pers. comm.).	V	N/A	iii-iv	iv	iii	xi, ix
Mount Jumbo Range vegetation complex, Laverton area, northeast goldfields (G. Keighery and N. Gibson pers comm.; Hall, *et al*. 1994-not definitive; Beard 1974b-not definitive)	V	21	iii	iv	ii	iv, v (goats, rabbits), vii
Mount Linden Range banded ironstone ridge vegetation complex (G. Keighery and N. Gibson pers comm.)	V	21	ii	iv	ii	iv, v (goats, rabbits), vii
Microbialite community of Harpers Lagoon. NNE of Kalgoorlie (R. Sarti pers. comm.)	V	41	ii-iii	iii-iv	i	iv
Melaleuca sp. nov. Low Closed to Open Forest Strand Community Near Wiluna (Blackwell and Trudgen 1980)	V	15	ii	vi	iii	vii
Calcyphytic casuarina acacia woodlands/shrublands of the north-east Goldfields (Pringle *et al.* 1994 - site type 7)	V	26	ii-ii	vi	iii	vii
Calcrete platform woodlands/shrublands of the north-east Goldfields (Pringle *et al.* 1994 - site type 8)	V	21	ii-iii	vi	iii	iv, v (goats)
Plain mixed halophyte low shrublands of the north-east Goldfields (Pringle et al. 1994 - site type 9)	V	32	ii-iii	vi	iii	iv, v (goats)
Silver saltbush (*Atriplex bunburyana*) low shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 16)	V	31	ii-iii	vi	iii	iv
Mixed chenopod shrublands with mulga (*Acacia aneura*) overstorey of the north-east Goldfields (Pringle *et al*. 1994 - site type 18)	V	22	ii-iii	vi	iii	iv
Mulga (*Acacia aneura*) shrublands with scattered chenopod low shrubs of the north-east Goldfields (Pringle *et al*. 1994 - site type 19)	V	22	i-iii	vi	iii	iv
Mulga (*Acacia aneura*) drainage line shrublands/woodlands with chenopod understoreys of the north-east Goldfields (Pringle *et al*. 1994 - site type 20)	V	22	ii-iii	vi	iii	iv

Community	Status	NVIS[1]	Condition[2]	Trend[3]	Reliability[4]	Threatening Processes[5]
Calcyphytic pearl bluebush (*Maireana sedifolia*) shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 21)	V	31	ii-iii	vi	iii	iv, ii, xii (impacts from mining)
Stony bluebush (*Maireana* spp.) mixed shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 22)	V	31	ii-iii	vi	iii	iv, ii, xii (impacts by mining)
Upland small bluebush (*Maireana* spp.) species shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 23)	V	31	ii-iii	vi	iii	iv
Granite hill mixed shrublands of the north-east Goldfields Survey by Pringle *et al.* 1994 - site type 25 .	V	32	ii-iii	vi	iii	v (goats)
Stony ironstone mulga (*Acacia aneura*) shrublands of the north-east Goldfields Survey by Pringle *et al.* 1994 - site type 28)	V	20	ii-iii	vi	iii	iv
Depot Springs stygofauna community		N/A	Unknown	vi	ii	x (water drawdown), potential for mining in the area

[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)					
Macrotis lagotis	V	i	i	iii	v (foxes), vii; likely to be extinct in subregion
Notoryctes typhlops	V	i	ii-iii	ii	v (foxes & cats), vii
Dasycercus cristicauda	V	ii	iii	iii	v (foxes & cats), vii
Schedule 1; Rare/likely to become extinct, Div 2 (Birds)					
Leipoa ocellata	V	unknown	iii	iii	v (foxes, cats), iii, iv
Polytelis alexandrae	V	ii	iii	iii	vii, iv
Acanthiza iredalei iredalei	V	unknown	vi	ii	vii
SCHEDULE 1; RARE/LIKELY TO BECOME EXTINCT, DIV 3 (REPTILES)					
Egernia kintorei	V	i	ii	iii	v (foxes & cats), vii, iv
SCHEDULE 4; OTHER SPECIALLY PROTECTED FAUNA. DIVISION 2 (BIRDS)					
Falco peregrinus	SP	unknown	vi	ii	ii

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

Declared rare and priority flora

Species Name	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
DECLARED RARE FLORA					
Minuria tridens	Commonwealth	unknown	vi	unknown	Unknown threatening processes
Conospermum toddii	V	iii	iii-iv	iii	vii, small pop
Eucalyptus articulata	V	iii	iii-iv	iii	vii
PRIORITY 1					
*Acacia ependuncula*ta	1	unknown	vi	ii	vii, iv, v, vi
Apatophyllum macgillivrayi	1	unknown	vi	ii	vii, iv, v, vi
Baekea sp Melita Station	1	unknown	vi	ii	vii, iv, v, vi
Baekea sp Sandstone	1	unknown	vi	ii	vii, iv, v, vi
Calothamnus superbus	1	unknown	vi	ii	vii, iv, v, vi
Calytrix cresswellii	1	unknown	vi	ii	vii, iv, v, vi
Calytrix uncinata	1	unknown	vi	ii	vii, iv, v, vi
Calytrix verruculosa	1	unknown	vi	ii	vii, iv, v, vi
Dampiera plumosa	1	unknown	vi	ii	vii, iv, v, vi
Species Name	Status	Condition[1]	Trend[2]	Reliability[3]	Threatening Processes[4]
Eremophila annosocaule ms	1	unknown	vi	ii	vii, iv, v, v
Eremophila congesta ms	1	unknown	vi	ii	vii, iv, v, vi
Eremophila eversa ms	1	unknown	vi	ii	vii, iv, v, vi
Gnephosis intonsa	1	unknown	vi	ii	vii, iv, v, vi

Goodenia lyrata	1	unknown	vi	ii	vii, iv, v, vi
Homalocalyx grandiflorus	1	unknown	vi	ii	vii, iv, v, vi
Hyalosperma stoveae	1	unknown	vi	ii	vii, iv, v, vi
Jacksonia sp Cundeelee	1	unknown	vi	ii	vii, iv, v, vi
Millotia falcata	1	unknown	vi	ii	vii, iv, v, vi
Neurachne lanigera	1	unknown	vi	ii	vii, iv, v, vi
Philotheca deserti	1	unknown	vi	ii	vii, iv, v, vi
Philotheca tubiflora	1	unknown	vi	ii	vii, iv, v, vi
Ptilotus chortophytum	1	unknown	vi	ii	vii, iv, v, vi
Stenanthemum mediale	1	unknown	vi	ii	vii, iv, v, vi
Stenanthemum sp Mt Clifford.	1	unknown	vi	ii	vii, iv, v, vi
PRIORITY 2					
Acacia subrigida	2	unknown	vi	ii	vii, iv, v, vi
Dampiera ramosa	2	unknown	vi	ii	vii, iv, v, vi
Eremophila mirabilis ms	2	unknown	vi	ii	vii, iv, v, vi
Eucalyptus jutsonii	2	unknown	vi	ii	vii, iv, v, vi
Gonocarpus ephemerus	2	unknown	vi	ii	vii, iv, v, vi
Grevillea secunda	2	unknown	vi	ii	vii, iv, v, vi
Leucopogon breviflorus	2	unknown	vi	ii	vii, iv, v, vi
Malleostemon sp Adelong	2	unknown	vi	ii	vii, iv, v, vi
Micromyrtus serrulata	2	unknown	vi	ii	vii, iv, v, vi
Micromyrtus stenocalyx	2	unknown	vi	ii	vii, iv, v, vi
Newcastelia insignis	2	unknown	vi	ii	vii, iv, v, vi
Olearia mucronata	2	unknown	vi	ii	vii, iv, v, vi
Ptilotus tetrandrus	2	unknown	vi	ii	vii, iv, v, vi
Thryptomene sp Queen Victoria Springs	2	unknown	vi	ii	vii, iv, v, vi

[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	Ecosystem Description	IUCN I-IV	Non-IUCN Reserve	CALM Purchased Lease	Priority
8	Medium woodland; salmon gum & gimlet	X			L
10	Medium woodland; red mallee group		X		L
11	Medium woodland; coolibah (*E. microtheca*)				H
18	Low woodland; mulga (*Acacia aneura*)	X	X		M
19	Low woodland; mulga between sandridges	X	X		L
20	Low woodland; mulga mixed with *Allocasuarina cristata* & *Eucalyptus* sp (e6?)	X	X		L
24	Low woodland; *Allocasuarina cristata*	X			L
28	Open low woodland; mulga				H
29	Sparse low woodland; mulga, discontinuous in scattered groups				M
39	Shrublands; mulga scrub	X			L
40	Shrublands; acacia scrub, various species				M

Beard Veg Assoc	Ecosystem Description	IUCN I-IV	Non-IUCN Reserve	CALM Purchased Lease	Priority
84	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*Eucalyptus youngiana*) over hard spinifex Triodia basedowii between sandhills				L
105	Hummock grasslands, shrub steppe; mulga over soft spinifex				H
107	Hummock grasslands, shrub steppe; mulga and *Eucalyptus kingsmillii* over hard spinifex	X			M
109	Hummock grasslands, shrub steppe; *Eucalyptus youngiana* over hard spinifex	X			L
110	Hummock grasslands, shrub steppe; red mallee over spinifex *Triodia scariosa*				M
120	Succulent steppe with open low woodland; mulga & sheoak				L
125	Bare areas; salt lakes	X	X		L
128	Bare areas; rock outcrops	X	X		L
141	Medium woodland; York gum, salmon gum & gimlet		X		M
143	Medium woodland; York gum, salmon gum & *Allocasuarina cristata*				M
166	Low woodland; mulga & *Acacia victoriae*				L
169	Shrublands; mulga & minnieritchie scrub				L
182	Low woodland; mulga & bowgada (*A. ramulosa*)				H
188	Shrublands; mulga & *Acacia sclerosperma* scrub				H
202	Shrublands; mulga & *Acacia quadrimarginea* scrub		X		M
204	Succulent steppe with open scrub; scattered mulga & *Acacia sclerosperma* over saltbush & bluebush				H
207	Hummock grasslands, shrub steppe; red mallee over hard spinifex				L
221	Succulent steppe; saltbush				M
223	Succulent steppe with open scrub; scattered mulga over saltbush & bluebush				H
240	Succulent steppe with open scrub; scattered *Acaica sclerosperma* & bowgada over saltbush & bluebush				H
251	Low woodland; mulga & *Allocasuarina cristata*	X	X		L
267	Succulent steppe with open scrub; scattered *Acaica sclerosperma* & *A. victoriae* over saltbush & bluebush				M
268	Succulent steppe with open scrub; scattered *Acacia sclerosperma* over saltbush & bluebush				H
311	Succulent steppe with open low woodland; mulga & *Acacia sclerosperma* with saltbush & bluebush				H
312	Succulent steppe with very open shrubs; very sparse mulga and *Acacia sclerosperma* over saltbush & bluebush				H
313	Succulent steppe with open scrub; scattered *Acaica sclerosperma* & *A. victoriae* over bluebush				H
338	Hummock grasslands, mixed sandplain; bowgada, sugarbrother, mallee, *Triodia basedowii* & *Triodia* ?sp				H
339	Hummock grasslands, mixed sandplain; bowgada, sugarbrother, mallee, *Triodia scariosa* & *Triodia* ?sp				H
385	Shrublands; bowgada & jam scrub with scattered York gum		X		M
389	Succulent steppe with open low woodland; mulga over saltbush	X	X		M
395	Hummock grasslands, mixed sandplain; bowgada, mallee, heath and spinifex				M
400	Succulent steppe with open low woodland; mulga over bluebush				H
404	Shrublands; bowgada & *Acacia murrayana* scrub				L
411	Succulent steppe with open scrub; scattered bowgada & jam over saltbush				H
415	Succulent steppe with open scrub; scattered mulga & other wattle(s) over saltbush & bluebush		X		H
416	Low woodland; mulga mixed with cypress pine & york gum	X			L
417	Succulent steppe with open scrub; scattered wattles over saltbush	X	X		L
418	Low woodland; mulga, *Casuarina cristata* & cypress pine		X		M
420	Shrublands; bowgada & jam scrub				M
Beard Veg Assoc	Ecosystem Description	IUCN I-IV	Non-IUCN Reserve	CALM Purchased Lease	Priority
437	Shrublands; Mixed acacia thicket on sandplain	X	X		L
441	Succulent steppe with open low woodland; mulga & sheoak over bluebush	X			M
460	Succulent steppe; bluebush with saltbush in depressions		X		L

468	Medium woodland; salmon gum & goldfields blackbutt				L
480	Succulent steppe with open low woodland; mulga & sheoak over salt bush	X	X		L
481	Mosaic: Medium woodland; salmon gum & red mallee/Hummock grasslands, mallee steppe; red mallee over spinifex *Triodia scariosa*				L
483	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	X	X		M
484	Shrublands; jam thicket	X	X		M
485	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia basedowii*		X		M
501	Medium woodland; goldfields blackbutt				L
502	Medium woodland; goldfields blackbutt & red mallee				M
504	Low woodland; mulga & red mallee		X		L
508	Succulent steppe with open scrub; scattered mulga over saltbush		X		L
520	Shrublands; *Acacia quadrimarginea* thicket				L
521	Medium woodland; salmon gum & red mallee	X	X		L
529	Succulent steppe with open low woodland; mulga & sheoak over bluebush		X		H
532	Hummock grassland, mixed sandplain - sparse low trees over sparse dwarf shrubs with spinifex; ?marble gum & red mallee mixed dwarf shrubs with *Triodia scariosa* & *Triodia* sp?				H
533	Low woodland; mulga & cypress pine		X		H
538	Shrublands; *Acacia brachystachya* scrub		X		L
540	Succulent steppe with open low woodland; sheoak over saltbush		X		L
547	Mosaic: Low woodland; mulga & bowgada/Succulent steppe; samphire				H
555	Hummock grasslands, mallee steppe; red mallee over spinifex *Triodia scariosa*		X		M
560	Mosaic: Shrublands; bowgada scrub/Succulent steppe; samphire				H
561	Succulent steppe with low woodland; mulga over saltbush				H
676	Succulent steppe; samphire				M
862	Hummock grasslands, open low tree & mallee steppe; marble gum & mallee (*E. kingsmillii*) over hard spinifex *Triodia basedowii*				H
863	Hummock grassland, mixed sandplain - sparse low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia scariosa* & T. sp?				M
865	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia scariosa* & T. sp?				H
936	Medium woodland; salmon gum		X		L
1127	Mosaic: Saltbush & bluebush/samphire				H
1239	Hummock grasslands, open medium tree & mallee steppe; marble gum & mallee (*E. youngiana*) over hard spinifex *Triodia basedowii* on sandplain				L
1271	Bare areas; claypans				L
1413	Shrublands; acacia, casuarina & melaleuca thicket		X		L
1446	Succulent steppe with scrub; mulga over bluebush				H
2081	Shrublands; bowgada and associated spp. scrub				L
2121	Mosaic: Open low woodland; mulga/Succulent steppe; saltbush & bluebush on greenstone				H
2902	Medium woodland; *Allocasuarina cristata* & goldfields blackbutt				H
Beard Veg Assoc	Ecosystem Description	IUCN I-IV	Non-IUCN Reserve	CALM Purchased Lease	Priority
2903	Medium woodland; Salmon gum, goldfield blackbutt, gimlet & *Allocasuarina cristata*				H
2904	Medium woodland; York gum, goldfield blackbutt, gimlet & *Allocasuarina cristata*				M
	Subterranean fauna of the Paroo Sub-Basin of the Lake Way Basin. Calcrete formations near Wiluna (B. Humphreys pers. comm.).			X	M
	Banded Ironstone Hills with *Dryandra arborea*. (A. Brown pers. comm.).				H
	Mount Jumbo Range vegetation complex, Laverton area, northeast goldfields (G. Keighery and N. Gibson pers comm.; Hall *et al*. 1994-not definitive; Beard 1974-not definitive)				H
	Mount Linden Range banded ironstone ridge vegetation complex (G. Keighery and N. Gibson pers comm.)				H
	Mt Gibson vegetation complex (G. Keighery and N. Gibson pers. comm.; Beard map).				H

	Microbialite community of Harpers Lagoon. NNE of Kalgoorlie (R. Sarti pers. comm.)				L
	Melaleuca sp. nov. Low Closed to Open Forest Strand Community Near Wiluna (Blackwell and Trudgen 1980)				?
	Calcyphytic casuarina acacia woodlands/shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 7)	?			?
	Calcrete platform woodlands/shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 8)				M
	Plain mixed halophyte low shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 9)	X			M
	Silver saltbush (*Atriplex bunburyana*) low shrublands of the north-east Goldfields (Pringle *et al.* 1994 - site type 16)				M
	Mixed chenopod shrublands with mulga (*Acacia aneura*) overstorey of the north-east Goldfields (Pringle *et al*. 1994 - site type 18)				M
	Mulga (*Acacia aneura*) shrublands with scattered chenopod low shrubs of the north-east Goldfields (Pringle *et al.* 1994 - site type 19)				L
	Mulga (*Acacia aneura*) drainage line shrublands/woodlands with chenopod understoreys of the north-east Goldfields (Pringle *et al.* 1994 - site type 20)				M
	Calcyphytic pearl bluebush (*Maireana sedifolia*) shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 21)				M
	Stony bluebush (*Maireana* spp.) mixed shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 22)	X			M
	Upland small bluebush (*Maireana* spp.) species shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 23)	X			L
	Granite hill mixed shrublands of the north-east Goldfields Survey by Pringle *et al*. 1994 - site type 25				M
	Stony ironstone mulga (*Acacia aneura*) shrublands of the north-east Goldfields Survey by Pringle *et al*. 1994 - site type 28)	X			M

Subregional constraints in order of priority

(see Appendix B, key g)

Competing Land Use: The primary issue is that pastoralism occupies more than 85% of the region and mining also has considerable interests.

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

Other: Difficulties in identifying biodiversity values in some areas due to 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

MUR is reservation class 2 (see Appendix D, and Appendix C, rank 4) with only 1.39% of the area in a conservation reserve (IUCN I-IV) At the subregional level MUR1 has 1.82% in reserve (IUCN I-IV) while MUR2 has only 0.053% in conservation 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 with possibility of changing to a higher primary classification is appropriate.

Reserve management standard

In MUR, 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. Mining activities (exploration) are supervised (except for old exploration drill holes which often remain open). Feral herbivore grazing activities still pose a conservation risk in some areas. Therefore, the overall reserve management rank is (ii) (see Appendix C, rank 5).

Class	Purpose	Name	Category	Reserve Management[1]
		Black Range	Unallocated Crown Land	ii-iii
		Lake Mason	Unallocated Crown Land	ii-iii
		Burnerbinmah	Unallocated Crown Land	ii-iii
		Mt.Elvire	Unallocated Crown Land	ii-iii
		Goongarrie	Unallocated Crown Land	iii
C	Conservation Of Flora And Fauna And Water	Niagara Dam Nature Reserve	Nature Reserve	ii-iii
C	Timber-Sandalwood	Bullock Holes Timber Reserve	Section 5(g) reserve	ii-iii
A	Conservation Of Flora And Fauna	Queen Victoria Spring Nature Reserve	Nature Reserve	ii-iii
A	Conservation Of Flora And Fauna	Wanjarri Nature Reserve	Nature Reserve	iii
A	National Park	Goongarrie National Park	National Park	iii
C	Conservation Of Flora And Fauna	Mount Manning Nature Reserve	Nature Reserve	ii-iii
C	Conservation Of Flora And Fauna	Malcolm Dam	Nature Reserve	ii-iii

C	Conservation Of Flora And Fauna	De La Poer Range Nature Reserve	Nature Reserve	ii-iii

[1]Appendix C, rank 5

Off reserve conservation

Priority species or groups

Species	Beard Vegetation Association or Ecosystem	Specific Recovery Plan	General Recovery Plan
Stygofauna	Calcrete aquifers	No	Goldfields Regional Management Plan
Falco peregrinus	Open woodlands, inland cliff and gorges	No	Goldfields Regional Management Plan
Macrotis lagotis	18 – Low woodland: mulga (*Acacia aneura*); 28 – Open low woodland: mulga; 29 – Sparse low woodland: mulga, discontinuous scattered groups	Recovery Plan for the Greater Bilby	1996 Action Plan for Australian Marsupials and Monotremes; Goldfields Regional Management Plan
Leipoa ocellata	20 – Low woodland: mulga mixed with *Allocasuarina cristata* & *Eucalyptus* sp (e6?)	Recovery Plan for Mallee Fowl	The Action plan for Australian Birds 2000; Goldfields Regional Management Plan
Polytelis alexandrae	Mulga over spinifex, casuarina, *E. camaldulensis*	No	Goldfields Regional Management Plan
Acanthiza iredalei iredalei	Chenopod shrublands	No	The Action plan for Australian Birds 2000; Goldfields Regional Management Plan

Species	Beard Vegetation Association or Ecosystem	Specific Recovery Plan	General Recovery Plan
Notoryctes typhlops	18 - Low woodland: mulga (*Acacia aneura*); 84 – Hummock grasslands, open low tree & mallee steppe: marble gum & mallee (*E. youngiana*) over hard spinifex *Triodia basedowii* between sandhills; 96 – Hummock grasslands, shrub steppe: acacia species (+grevillea) over *Triodia basedowii* often between sandridges; 134 – Mosaic: Hummock grasslands, open tree steppe-desert bloodwood and feathertop spinifex on sandhills/Hummock grasslands, shrub steppe-mixed shrubs over spinifex between sandhills.	No	1996 Action Plan for Australian Marsupials and Monotremes; Goldfields Regional Management Plan
Dasycercus cristicauda	18 - Low woodland: mulga (*Acacia aneura*); 39 – Shrublands: mulga scrub; 107 – Hummock grasslands, shrub steppe: mulga and *Eucalyptus kingsmillii* over hard spinifex	No	1996 Action Plan for Australian Marsupials and Monotremes; Goldfields Regional Management Plan
Egernia kintorei	39 - Shrublands: mulga scrub	A recovery Plan for the Great Desert Skink 2001-2011	The Action Plan for Australian reptiles; Goldfields Regional Management Plan
Minuria tridens	Nothing known about this plant	No	Goldfields Regional Management Plan
Conospermum toddii	39 - Shrublands: mulga scrub; 84 - Hummock grasslands, open low tree & mallee steppe: marble gum & mallee (*E. youngiana*) over hard spinifex *Triodia basedowii* between sandhills	No	Goldfields Regional Management Plan
Eucalyptus articulata	20 – Low woodland: mulga mixed with *Allocasuarina cristata* & *Eucalyptus* sp (e6); 84 – Hummock grasslands, open low tree & mallee steppe: marble gum & mallee (*E. youngiana*) over hard spinifex *Triodia basedowii* between sandhills	No	Goldfields Regional Management Plan

There are no specific regional recovery plans for any of the above biota / systems however, in broad terms, they are covered under the Goldfields Regional Management Plan. Other Recovery Plans include National Recovery Plan for Malleefowl; The Action Plan for Australian Birds, 2000; Action Plan for Australian Marsupials and Monotremes; and The Action Plan for Australian Reptiles.

Appropriate species recovery actions

Species	Recovery Actions[1]	Recovery Descriptions
Falco peregrinus	i, ii, iii	Habitat retention through reserves or on other State lands or on private lands.
Macrotis lagotis	i, ii, iii, vii, ix, xii	Habitat retention through reserves or on other State lands or on private lands. CWR species that is no longer extant in the subregion. Control of feral animals, notably foxes, as well as fire management are essential.
Leipoa ocellata	i, ii, iii, vii	Habitat retention through reserves or on other State lands or on private lands. Control of foxes and cats. Reduction in habitat degradation through grazing pressure.
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	Cessation of the loss of habitat through grazing of chenopod shrubland by sheep and rabbits.
Notoryctes typhlops	i, ii, iii, xii	Little is known of habitat requirements or general natural history for this species so further research is important to determine its true status.
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 (pers. comm.).
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.
Species	Recovery Actions[1]	Recovery Descriptions
Minuria tridens	xii	Research – nothing is known about this plant.
Conospermum toddii	i, ii, iii, vii, xii, xiii	habitat retention through reserves or on other State lands or on private lands. Invasive weeds may pose a threat. Control of herbivores such as rabbits and goats may be required. Understanding of life history requirements for all rare flora very limited and needs additional research.
Eucalyptus articulata	i, iii, ix, xii	habitat retention through reserves or on other State lands or on private lands. Research into the effects of fire as well as the species general biology.

[1]Appendix B, key h

Ecosystems and appropriate recovery actions

Community	Recovery Actions[1]	Recovery Descriptions
Subterranean fauna of the Paroo Sub-Basin of the Lake Way Basin. Calcrete formations near Wiluna (B. Humphreys pers. comm.).	i, ii, iii, xi, xiii	Habitat retention and protection through reserves, on private land or on other state lands. Reinstatement of hydrology. Capacity building with industry and landholders.
Mount Jumbo Range vegetation complex, Laverton area, northeast goldfields (G. Keighery and N. Gibson pers comm.; Hall, *et al*. 1994-not definitive; Beard 1974b-not definitive)	i, ii, iii, v, vi, vii, ix, xiii	Habitat retention and protection through reserves, on private land or on other state lands. Fencing. Weed control. Feral animal control. Fire management. Capacity building with industry and landholders.
Mount Linden Range banded ironstone ridge vegetation complex (G. Keighery and N. Gibson pers comm.)	i, ii, iii, v, vi, vii, ix, xiii	Habitat retention and protection through reserves, on private land or on other state lands. Fencing. Weed control. Feral animal control. Fire management. Capacity building with industry and landholders.
Mt Gibson vegetation complex (G. Keighery and N. Gibson pers. comm.; Beard map).	i, ii, iii, v, vi, vii, ix, xiii	Habitat retention and protection through reserves, on private land or on other state lands. Fencing. Weed control. Feral animal control. Fire management. Capacity building with industry and landholders.
Microbialite community of Harpers Lagoon. NNE of Kalgoorlie (R. Sarti pers. comm.)	v, xiii	Fencing. Capacity building with industry and landholders.
Melaleuca sp. nov. Low Closed to Open Forest Strand Community Near Wiluna (Blackwell and Trudgen 1980)	i, ii, iii, ix	Habitat retention and protection through reserves, on private land or on other state lands. Fire management.
Calcyphytic casuarina acacia woodlands/shrublands of the north-east Goldfields (Pringle *et al.* 1994 - site type 7)	i, ii, iii, ix	Habitat retention and protection through reserves, on private land or on other state lands. Fire management.
Calcrete platform woodlands/shrublands of the north-east Goldfields (Pringle *et al.* 1994 - site type 8)	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Plain mixed halophyte low shrublands of the north-east Goldfields (Pringle et al. 1994 - site type 9)	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Silver saltbush (*Atriplex bunburyana*) low shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 16)	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Mixed chenopod shrublands with mulga (*Acacia aneura*) overstorey of the north-east Goldfields (Pringle *et al*. 1994 - site type 18)	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Mulga (*Acacia aneura*) shrublands with scattered chenopod low shrubs of the north-east Goldfields (Pringle *et al*. 1994 - site type 19)	vii, v	Feral animal control. Fencing.
Mulga (*Acacia aneura*) drainage line shrublands/woodlands with chenopod understoreys of the north-east Goldfields (Pringle *et al*. 1994 - site type 20)	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Calcyphytic pearl bluebush (*Maireana sedifolia*) shrublands of the north-east Goldfields (Pringle *et al.* 1994 - site type 21)	i, ii, iii, xiii, xii	Habitat retention and protection through reserves, on private land or on other state lands. Capacity building with industry and landholders. Research.
Stony bluebush (*Maireana* spp.) mixed shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 22)	i, ii, iii, xiii, xii	Habitat retention and protection through reserves, on private land or on other state lands. Capacity building with industry and landholders. Research.

Community	Recovery Actions[1]	Recovery Descriptions
Upland small bluebush (*Maireana* spp.) species shrublands of the north-east Goldfields (Pringle *et al*. 1994 - site type 23)	vii, v	Feral animal control. Fencing.
Granite hill mixed shrublands of the north-east Goldfields Survey by Pringle *et al.* 1994 - site type 25.	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Stony ironstone mulga (*Acacia aneura*) shrublands of the north-east Goldfields Survey by Pringle *et al.* 1994 - site type 28)	i, ii, iii, vii, v	Habitat retention and protection through reserves, on private land or on other state lands. Feral animal control. Fencing.
Depot Springs stygofauna community	i, ii, iii, xi, xiii	Habitat retention and protection through reserves, on private land or on other state lands. Reinstatement of hydrology. Capacity building with industry and landholders.

[1]Appendix B, key h

Existing ecosystem recovery plans

There are no specific recovery plans for ecosystems at risk in MUR1, however the Goldfields Regional Management Plan is applicable in a general sense.

Subregion priority for off reserve conservation

The priority for off park conservation in MUR1 is (ii) (see Appendix C, rank 6), indicating that a significant off park effort needed, however 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. Conservation Through Reserves is limited through mining leases and tenements. There is a need to increase awareness of conservation values through education of various industries (mining, 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 for MUR1 is (i) (see Appendix C, rank 7), indicating that there are major constraints to implement effective NRM actions to achieve biodiversity outcomes. Much of MUR 1 is severely degraded through past agricultural practices (primarily sheep 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 and vertebrate fauna has been published, but is based on very sparse sampling (Goldfields Regional Surveys conducted 1984 to 1995 including Burbidge *et al* (1995), Dell *et al* (1992), Dell *et al* (1998), Hall *et al* (1994), How *et al* (1992) and McKenzie and Hall (1992)). Regional ecosystem mapping has been produced at the broad scale, 1:1000000 for Beard's vegetation, and 1:500000 for Landsystems by the Western Australian Dept. Agriculture (Payne *et al*. 1998, Pringle *et al.* 1994).

Systematic Fauna Survey: Data is confined to vertebrates and is sparse, quadrats only positioned on widespread surface-types, and only 3 – 4 quadrats per surface-type, few quadrats have been sampled on more than three occasions.

Floristic Data: Data is sparse, quadrats positioned on widespread surface-types as well as some of the localised substrates of particular interest. Inventory sites were surveyed by the Departments of Agriculture and Land Administration in the Murchison rangelands for plant identification purposes. Condition sites were examined to see the effects of grazing on various plant species and the data set is essentially perennials and some other palatable species (Payne *et al.* 1987).

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, even rabbits.

Other Priority Data Gaps Include:

- No quantitative data on the affect of exotic predators, weed colonisation, fire, mineral-extraction on greenstone surfaces, changes in fire regime, water extraction etc.

Sources

References cited

No.	Author	Date	Title	Publication Details	Pub. Type
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090	Benshemesh, J.	(2000).	National Recovery Plan for Malleefowl.	Department of Environment and Heritage, South Australia.	R
716	Blackwell, M.I. and Trudgen, M.E.	(1980).	Report on the flora and vegetation of the Lake Way Joint Venture uranium project area : together with an assessment of the impact of this project upon the landscape, flora and vegetation of this area and its regeneration potential		R
715	Burbidge, A.A and Fuller, P.J.	(1982).	Banded stilt at Lake Barlee, Western Australia	Emu. - Vol. 82 (1982) p. 212-215	J
130	Burbidge, A.A., Hall, N.J., Keighery, G.J. and McKenzie, N.L. (eds.)	(1995).	The biological survey of the eastern Goldfields of Western Australia. Part 12. Barlee-Menzies Study Area.	Records of the Western Australian Museum Supplement No. 49, 169-312. Perth, WA.	J
181	Cogger, H., Cameron, E., Sadlier, R. and Eggler, P.	(1993).	The Action Plan for Australian Reptiles.	Australian Nature Conservation Agency, Canberra.	R
215	Dell, J., How, R.A. and Milewski, A.V.	(1992).	The biological survey of the eastern Goldfields of Western Australia. Part 6. Youanmi-Leonora Study Area.	Records of the Western Australian Museum Supplement No. 40, 1-63. Perth, WA.	J
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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
298	Garnett, S.T. and Crowley, G.M.	(2000).	The Action Plan for Australian Birds.	Environment Australia, Canberra.	R
332	Hall, N.J., McKenzie, N.L. and Keighery, G.J. (eds.)	(1994).	The biological survey of the eastern Goldfields of Western Australia. Part 10. Sandstone-Sir Samuel and Laverton-Leonora Study Areas.	Records of the Western Australian Museum Supplement No. 47, 1-166. Perth, WA.	J

332	Hall, N.J., McKenzie, N.L. and Keighery, G.J. (eds.)	(1994).	The biological survey of the eastern Goldfields of Western Australia. Part 10. Sandstone-Sir Samuel and Laverton-Leonora Study Areas.	Records of the Western Australian Museum Supplement No. 47, 1-166. Perth, WA.	J
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
389	How, R.A., Dell, J., Milewski, A.V. and Keighery, G.J.	(1992).	The biological survey of the eastern Goldfields of Western Australia. Part 7. Duketon-Sir Samuel Study Area.	Records of the Western Australian Museum Supplement No. 40, 67-131. Perth, WA.	J
402	Humphreys, W.F. and Harvey, M.S. (Ed's).	(2001).	Subterranean biology in Australia 2000.	Records of the Western Australian Museum, Supplement 64. Western Australian Museum, Perth	R
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
491	McKenzie, N.L. and Hall, N.J. (eds.)	(1992).	The biological survey of the eastern Goldfields of Western Australia. Part 8. Kurnalpi-Kalgoorlie Study Area.	Records of the Western Australian Museum Supplement No. 41, 1-125. Perth, WA.	J
498	McNamara, P., Brandis, T and Hopkins, A.	(2000).	Filling the gaps.	Landscope. 15 (4) 43 - 49.	J
561	Pringle, H.J.R., Van Vreeswyk, A.M.E., and Gilligan, S.A.	(1994).	Technical Bulletin No 87. An inventory and condition survey of the north-eastern Goldfields, Western Australia.	Department of Agriculture, Perth.	R

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

Other relevant publications

See reference numbers 040, 065, 067, 075, 098, 101, 118, 166, 211, 235, 241, 258, 260, 268, 272, 278, 279, 313, 395, 406, 450, 459, 461, 507, 519, 526, 542, 560, 577, 584, 647, 650, 678, 680, 685, 686 and 718 in Appendix A.