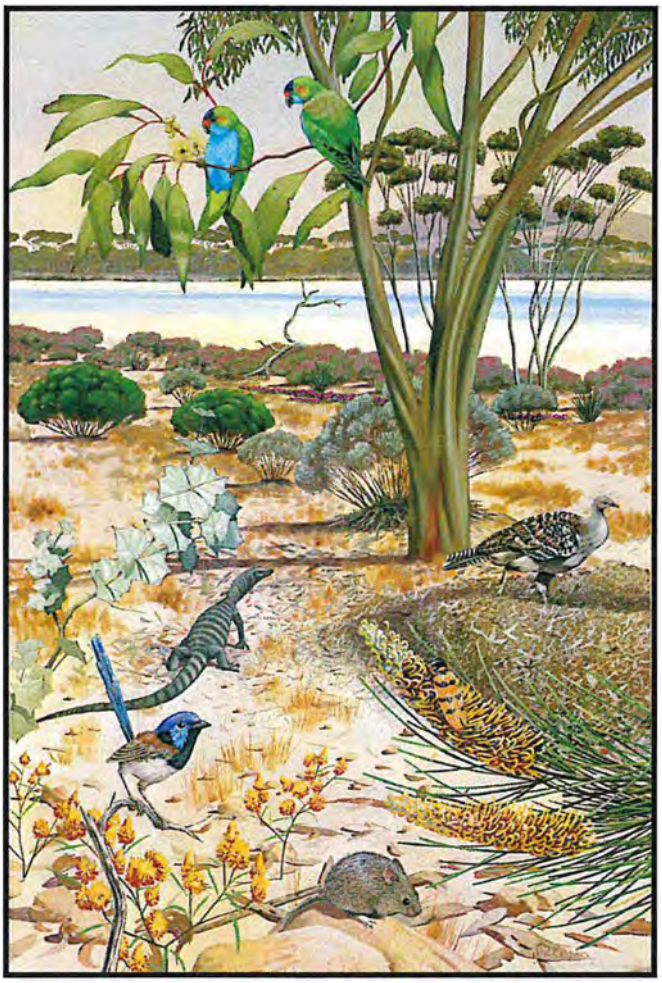
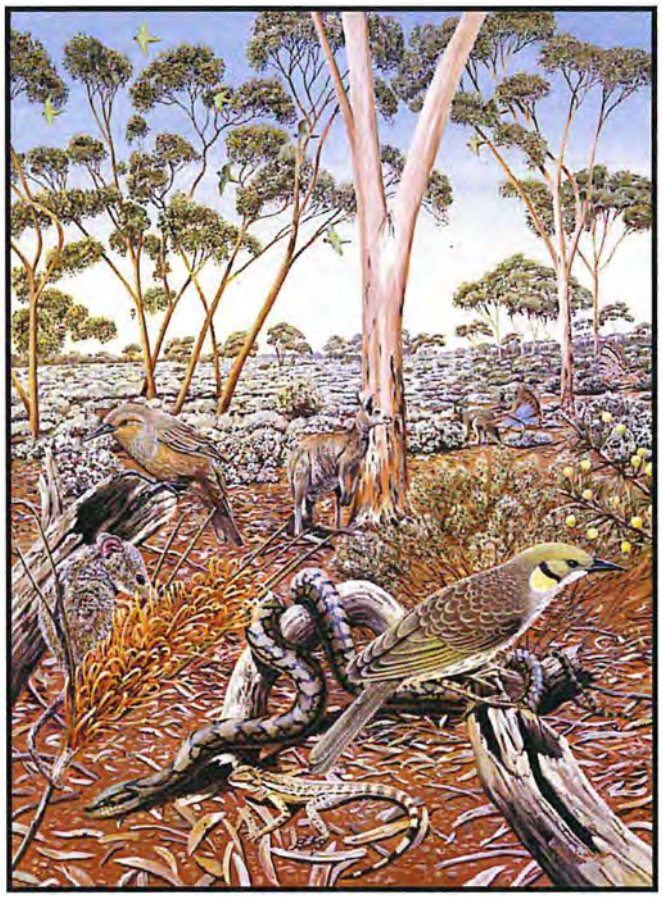
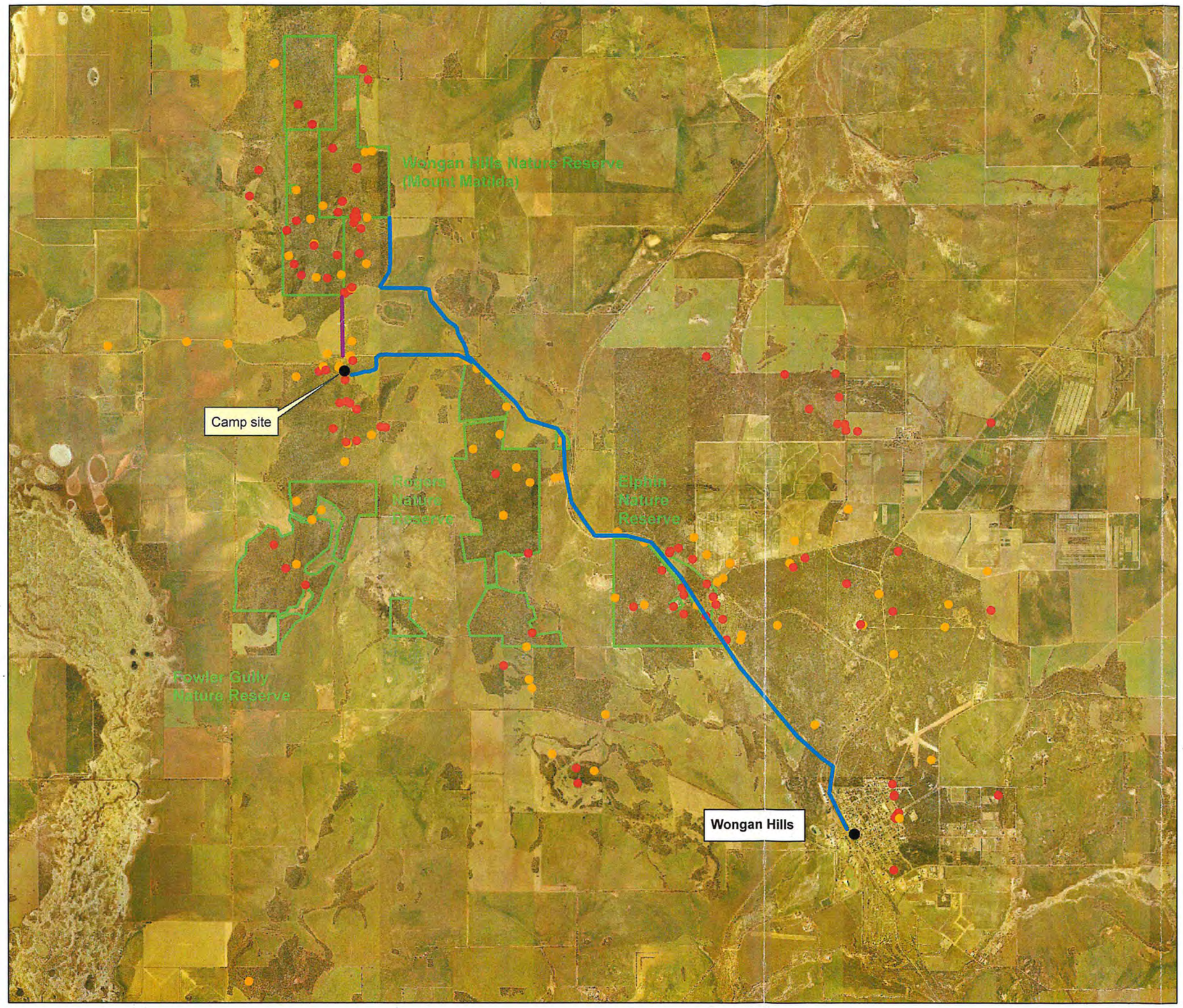
Nature Conservation Leaders Trip 2011

Wheatbelt Region






DAY 2
DAY 3
DAY 4
DAY 5
Mt Caroline
Lake Cronin
Lake Johnson
Tutanning
● - Overnight stay
O - Fuel available
Watheroo
Dalwallinu
Pithara
Kalannie
Mount Jackson
Wallaroo
Miling
Kulja
Mollerin
Beacon
Wialki
Bonnie Rock
Burakin
Moora
Ballidu
Badgerin Rock
Lake Margarette
Elachbutting
Mount Burges
Kondut
Cadoux
Koolyanobbing
Koojan
Mocardy
Koorda
Galbin
Bencubbin
Mukinbudin
Turkey Hill
Boorabbin
Coolgardie
Bullfinch
Wongan Hills
Manmanning
Koomberkine
Megumber
Bullsbulling
Wannamal
Calingiri
Konnongorring
Minnivale
Nungarin
Corinthia
Southern Cross
Ghooli
Dowerin
Wyalkatchem
Westonia
Yellowdine
Yellowdine Nature Reserve
Goomalling
Bodallin
Moorine Rock
Gingin
Bindoon
Walgoolan
Marvel Loch
Mount Palmer
Toodyay
Wyola West
Yorkrakine
Doodlakine
Merredin
Yanchep
Waeel
Hines Hill
Butler
Meckering
Kellerberrin
Joondalup
Northam
Cunderdin
Ellenbrook
South Tammin
Jibadji Nature Reserve
Duncraig
Bruce Rock
Cramphorne
York
High Wycombe
Perth
Shackleton
East Beverley
Wadderin
Mount Walker
Quairading
Ardath
Forrestfield
Fremantle
Thornlie
Mundaring State Forest
Narembeen
Canning Vale
Armadale
Beverley
Babakin
Kokeby
South Kumminin
Baldivis
Midgegooro National Park
Corrigin
Port Kennedy
Brookton
Aldersyde
Forrestania
Hyden
Kondinin
Greenfields
Pingelly
East Pingelly
Bullaring
Karlgarin
Lake Hope
Pinjarra
Popanyinning
Kulin
Holt Rock
Dragon Rocks Nature Reserve
Dwellingup
Boddington
Cuballing
Wickepin
Jitarning
Varley
Pingaring
Mount Shendan
Wareona
Dudinin
Narrogin
Yilliminning
Lake Camm
Yarloop
Williams
Boundain
Harrismith
Lake Biddy
Frank Hann National Park
Harvey
Lane Poole Conservation Reserve
Highbury
Lake Grace
Newdegate
Lake King
Binningup
Piesseville
South Newdegate
Lake King Nature Reserve
Moulyinning
Leschenault
Mount Madden
Collie
Darkan
Arthur River
Wagin
Dumbleyung
Dunn Rock
Peak Cha National F



Day 1
13 June 2011

Arriving in time for lunch at the Wongan Hills visitor centre (1200 hrs) we'll move onto the trip briefing before heading into the hills and the wealth of threatened flora species & projects.

Issues to be discussed:

1. Threatened Flora conservation in fragmented remnants
2. Threatened Flora disturbance (fire) trials
3. Caring for country - Protected Areas on Private Property (PAPL) project
4. Caring for country - Rabbit & Threatened Flora
5. Fire regime management in fragmented reserves

Bush camp – Adjacent to Mount O'Brien on Duncan & Sue Holmes' property

- Declared Rare Flora
- Priority Flora
- Nature Reserve
- Preferred route, about 20 km
- Alternative route, Mount Matilda walk trail (5 km return

N

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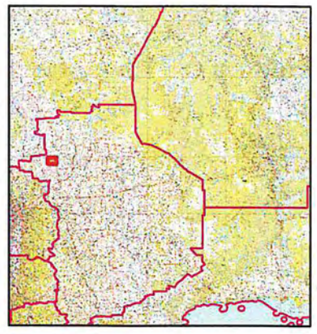
0 0.5 1 2 3 4
Kilometers

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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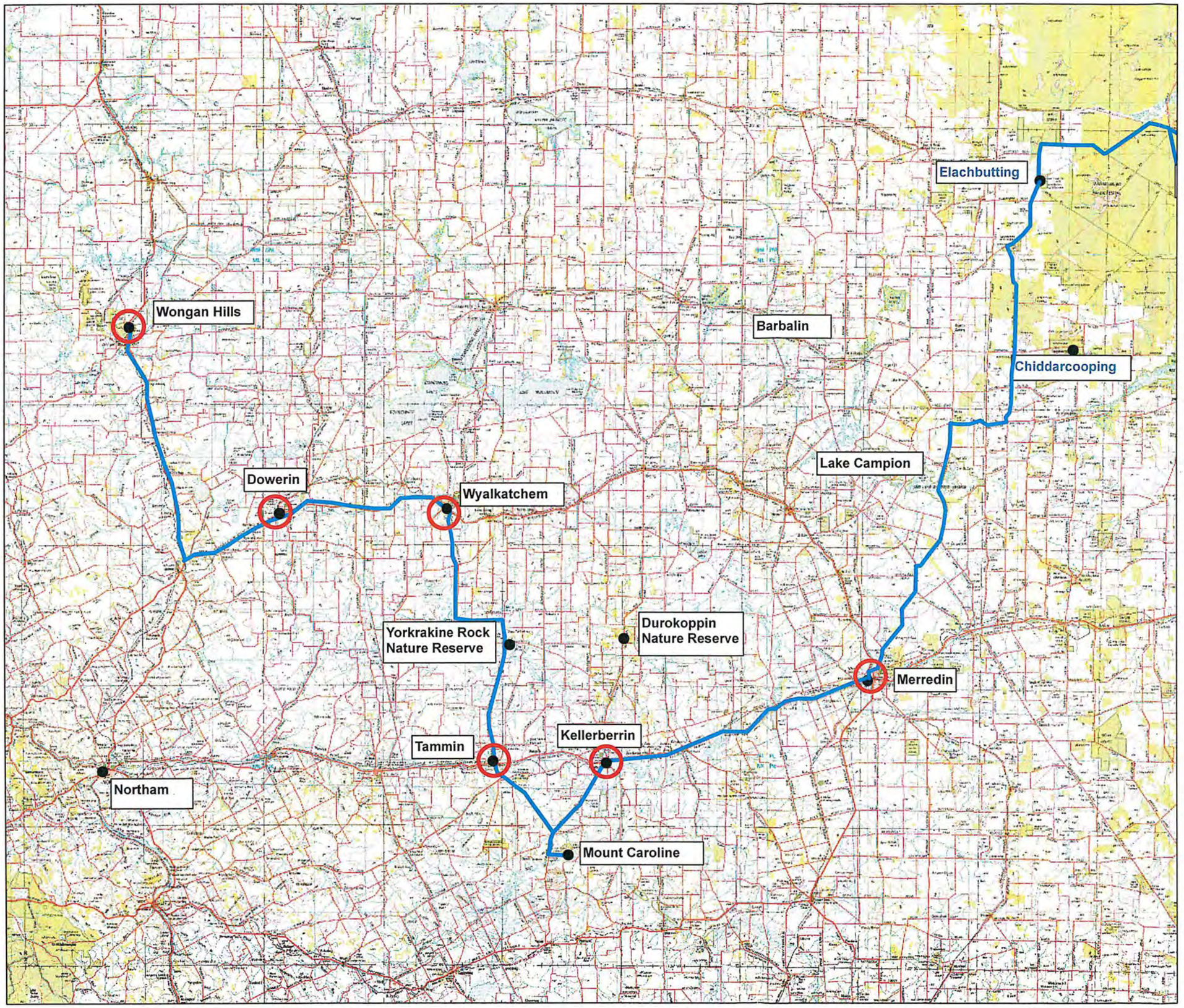
Day 2
14 June 2011

A good many kilometres will be covered today as we see a cross-section of the reserves and issues in the highly cleared parts of the region. At the end of the day we arrive at a rock formation some argue is better than Hyden's Wave Rock on the doorstep to the Great Western Woodlands.

Issues to be discussed:

1. The recent and dramatic decline of black-flanked rock wallaby populations in the wheatbelt
2. Threatened Flora conservation in fragmented remnants (Tetratheca deltoidea @ Mount Carolin Myriophyllum lapidicola @ Chiddarcooping & Elachbutting)
3. Granite rocks, climate change
4. Vegetation health throughout the wheatbelt
5. Conserving threatened invertebrates (Trapdoor spiders, Arid Bronze Azure Butterfly)
6. Gypsum communities – Lake Campion
7. Wheatbelt wetlands inc. aquatic invertebrates

Bush camp at Elachbutting Reserve



Preferred route, about 420 km

Fuel available

N

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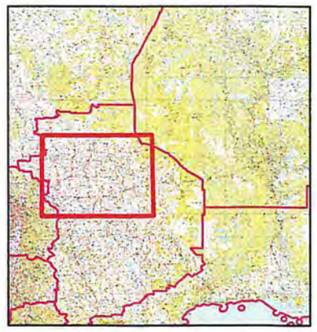
0 5 10 20 30 40 50

Kilometers

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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2011 Nature Conservation Leaders Trip – Wheatbelt Region

Day 1 (13 June)

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2. Threatened Flora disturbance (fire) trials
3. Caring for country - Protected Areas on Private Property (PAPL) project
4. Caring for country - Rabbit & Threatened Flora
5. Fire regime management in fragmented reserves

Bush camp – Adjacent to Mount O'Brien on Duncan & Sue Holmes' property

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2. Threatened Flora conservation in fragmented remnants (*Tetratheca* deltoidea @ Mount Caroline, *Myriophyllum lapidicola* @ Chiddarcooping & Elachbutting etc)
3. Granite rocks, climate change
4. Vegetation health throughout the wheatbelt
5. Conserving threatened invertebrates (Trapdoor spiders, Arid Bronze Azure Butterfly)
6. Gypsum TEC – Lake Campion
7. Wheatbelt wetlands inc. aquatic invertebrates

Bush camp at Elachbutting Reserve

Day 3 (15 June)

Departing the grandeur of Elachbutting, we enter into the Great Western Woodlands with a chance (no promises) of sighting major mitchell cockatoos. Taking the road less travelled we'll wind our way through a variety of vegetation communities making it to the state barrier fence. If the season is wet we have the opportunity to test our driving skills and recovery equipment.

Issues to be discussed:

1. Great Western Woodland Project
2. Cultural and conservation significance of rock outcrops
3. Granite Rock Highclere Hills PEC
4. Fire management in uncleared landscapes
5. Goldfields Region - Mining & conservation, research projects
6. Use of scrub rolling & prescribed burning
7. Mining

Bush camp at Mount Palmer

Day 4 (16 June)

By working our way through the 'greenstone belt' we'll see a landscape shaped by mining and large intense bushfires, if time permits we'll head out to Lake Johnson in the Esperance District before ending the day at the Hyden motel.

Issues to be discussed:

1. Banded Ironstone Formations & State Development Projects (Parker Range PEC)
2. Fire history of the Forrestania area
3. Conservation and recreation management of Lake Cronin Nature Reserve
4. Aerial prescribed burning in the GWW
5. Subject to time – travel to Lake Johnson (Esperance District)
6. Wild dog control

Motel accommodation – the costs for the evening meal & breakfast will be covered. Each person will need to settle their own room account.

Day 5 (17 June) Tutanning Nature Reserve
A lighter is planned day to conclude the trip. Following morning tea at Tutanning Nature Reserve we'll look at the adaptive management project before finishing with a barbeque lunch and a planned departure time of 1400 hours. Travel time to Perth is about 2 hours, Albany 3 hours.

Issues to be discussed:

1. Salinity management – Natural Diversity Recovery Catchments, history of deep drainage.
2. Tutanning – Adaptive Management Project

Day 3
15 June 2011

Departing the grandeur of Elachbutting, we enter into the Great Western Woodlands with a chance (no promises) of sighting major mitchell cockatoos. Taking the road less travelled we'll wind our way through a variety of vegetation communities making it to the state barrier fence.
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Issues to be discussed:

1. Great Western Woodland Project
2. Cultural and conservation significance of rock outcrops
3. Granite Rock Highclere Hills PEC
4. Fire management in uncleared landscapes
5. Goldfields Region - Mining, conservation & research
6. Use of scrub rolling & prescribed burning
7. Mining

Showers avaialble at Yellowdine

Bush camp at Mount Palmer

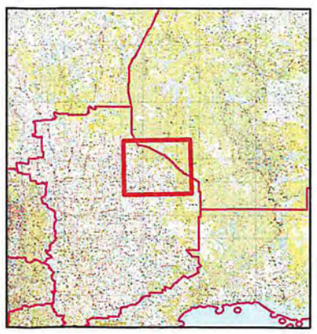
Preferred route, about 210 km

Alternative route, about 275 km

Fuel available

0 5 10 20 30 40
Kilometers

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



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Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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	Name	Position	mobile
1	Geoff Barrett	Regional Ecologist, Swant Region	0418 953 050
2	Brad Barton	Regional Nature Conservation Leader, Warren Region	0427 717 923
3	Paul Blechynden	Regional Operations Manager, Wheatbelt Region	0429 424 701
4	Rob Blok	District Manager, Central Wheatbelt District	0457 544 833
5	Karl Brennan	Regional Ecologist, Goldfields Region	
6	Margaret Byrne	Senior Principal Research Scientis	0407 193 594
7	Keith Claymore	A/Assistant Director Nature Conservation	0427 770 398
8	Dave Coates	Senior Principal Research Scientist	0439 969 404
9	Sandra Thomas	Wheatbelt Project Officer, Environmental Management Branch	0437 704 636
10	Sarah Comer	Regional Ecologist, South Coast Region	0418 912 280
11	Lesley Gibson	Research Scientist	0407 030 292
12	Neil Gibson	Principal Research Scientist	
13	Nev Hague	Regional Operations Manager, Goldfields Region	0429 084588
14	Ian Herford	Coordinator, Great Westrn Woodlands Project	0427 085 418
15	Norm McKenzie	Senior Principal Research Scientist	0408 553 950
16	Adrian Pinder	Research Scientist	
17	Jill Pryde	Acting Senior Ecologist	0427446995
18	Paul Drake	Ecophysiologist, Natural Resources Branch	
19	Cath Rummery	Regional Nature Conservation Officer, Pilbara Region	0438 903 746
20	Erica Shedley	Regional Nature Conservation Leader, Kimberley Region	0418 953 050
21	Deon Utber	Regional Nature Conservation Leader, South Coast Region	0429 080 243
22	Stephen van Leeuwen	Principal Research Scientist, Biogeography Program Leader & Partnerships Manager	0438 757 556
23	Gavan Mullen	Recovery Catchment Officer	0429 089 650
24	Kim Williams	Regional Nature Conservation Leader, South West Region	0409 109 792
25	David Pearson	Principal Research Scientist	0407 986 789
26	Colin Yates	Principal Research Scientist	
27	Stephen Thomas		
28	Gloria		

Attending part of the trip

Greg Durell	District Manager, Great Southern District	0427 478 953
Peter Lacey	District Nature Conservation Program Leader, GSD	0427 994 306
Peter White	Nature Conservation Officer, Great Southern District	
Natasha Moore	Conservation Officer, Flora / Fauna, Central Wheatbelt District	
Mark Moore	Senior Operations Officer	0417 412 488
David Jolliffe	District Nature Conservation Officer, Central Wheatbelt District	
Mike Fitzgerald	Protected Areas on Private Lands (PAPL) project	

Paul Blechynden	**Vehicle 1**	**1QBP 005 Ford Ranger Dual Cab / Canopy**	0429 424 701
Nev Hague	**Vehicle 2**	**4WD Wagon**	0427 085 418
Brad Barton	**Vehicle 3**	**Prado, 1QBK 405**	
Erica Shedley	Vehicle 3		
Kim Williams	Vehicle 4		
Deon Utber	**Vehicle 4**	**Pajero 1QBO 345**	0429 080 243
Sarah Comer	Vehicle 4		
Ian Herford	Vehicle 4		
Lesley Gibson	**Vehicle 5**	**Woodvale Prado**	0407 030 292
Dave Pearson	Vehicle 5		
Adrian Pinder	Vehicle 5		
Stephen van Leeuwen	**Vehicle 6**	**Pajero 1QBJ147**	0438 757 556
Jill Pryde	Vehicle 6		
Colin Yates	Vehicle 6		
Norm McKenzie	Vehicle 6		
Sandra Thomas	**Vehicle 7**	**Toyota Prado 1QBI963**	0437 704 636
Cath Rummery	Vehicle 7		
Karl Brennan	Vehicle 7		
Paul Drake	Vehicle 7		
Geoff Barrett	**Vehicle 8**	**Toyota Hilux Dual cab 1QBL 594**	0418 953 050
Keith Claymore	Vehicle 8		
Dave Coates	**Vehicle 9**	**Kensington Pajero 1QBI565**	0439 969 404
Margaret Byrne	Vehicle 9		
Neil Gibson	Vehicle 9		
Gavan Mullan	Vehicle 10	Vehicle to be moved from Wongan Hills to Narrogin, move to Tutanning on last day	

Project Teams

ARTEMIS TEAM	(a) Great Western Woodland: formulation of research questions and partnerships; and (b) Development of a draft adaptive management plan for Credo
Ian Herford (Team Leader)	
Neil Gibson	Dave Pearson
Sarah Comer	Karl Brennan
Stephen van Leeuwen	Norm McKenzie

HEGAMONE TEAM	Prioritisation and strategies for threatened flora recovery in highly fragmented landscapes
Dave Coates (Team Leader)	
Rob Blok	Gavan Mullan
Margaret Byrne	Lesley Gibson
Jill Pryde	Adrian Pinder

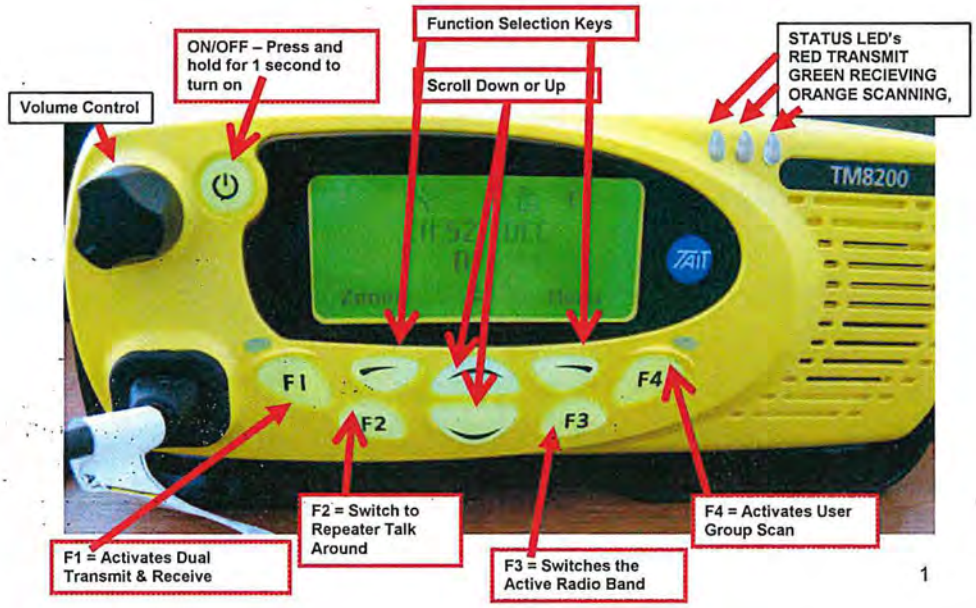
VULCAN TEAM	Development of ecological guidelines for fire management (including review of DEC's fire management policy)
Paul Blechynden (Team Leader)	
Colin Yates	Nev Hague
Erica Shedley	Deon Utber
Geoff Barrett	

ATHENA TEAM	Development of a framework for Nature Conservation Service annual operational plans that complements the five year nature conservation plans
Kim Williams (Team Leader)	
Brad Barton	Paul Drake
Sandra Thomas	Cath Rummery

Communications High Band Channel 623 – talk around
UHF Channel 23

Satellite telephone No. 0011 8816 214 10335
Note: when dialing out on satellite phone Dial 0061 8 & then the number

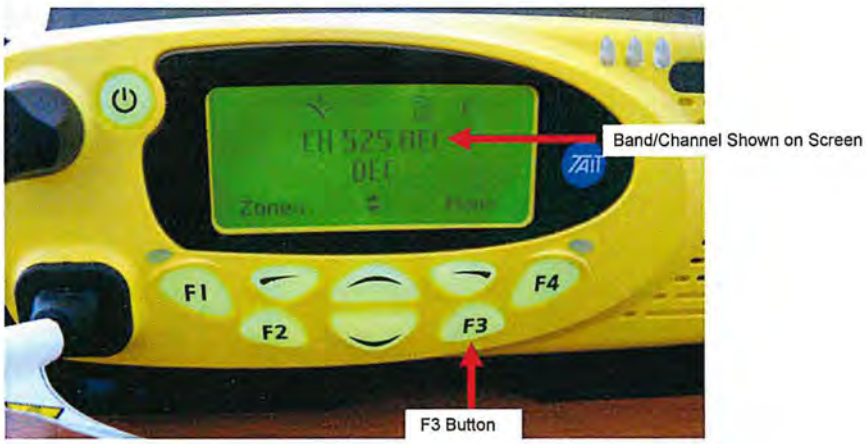
WAERN Radio Controls



1

- **Changing channels** in single band mode. Press the channel number on the handset and press select (right select key). Channel number and name is shown on screen. Zone is also shown.
- Changing channels in dual band mode is the same except the priority channel is the only one available to be changed. Use F3 button to change priority band
- Can also use the scroll buttons although this is very tedious.

Select Band



Use F3 button to swap between VHF & UHF.
If in dual band will swap primary band between VHF &

Radio display symbols

These are some of the symbols you may see on you radio display:

Symbol	Meaning
	Received signal strength indicator (RSSI): the more bars, the stronger the signal being received by your radio
	Transmit: your radio is transmitting
	Low-power transmit: your radio is transmitting on low power
	External alert: external alert is active
	Scanning: (rotating) your radio is monitoring a group of channels for activity, (flashing) your radio has detected activity on a channel, and has halted on this channel
	Monitor: the radio is in a call
	Repeater talkaround: your radio is operating in repeater talkaround mode
	Dual transmit mode: your radio will transmit on both channels shown in the display
	Cross-band repeater mode: received signals on one channel will be transmitted on the other channel, and vice versa
	Text messaging active: the radio can receive text messages
	Text message received: there is a text message waiting to be viewed

WHEATBELT REGION ANNUAL SNAPSHOT July 2010

	Great Southern District	Central Wheatbelt District	Wheatbelt Regional Office	Region Total
Area Statement	5.5 million ha	8.0 million ha		13.5 million ha
Total (hectares all tenures)	793 825	1 936 900		2 730 725
DEC-managed lands/waters (ha)				
National Parks	1 292	0		1 292
Conservation Parks	1 301	257		1558
Nature Reserves	368 903	682 370		1 051 273
Former pastoral leases	0	0		
State Forest	280 661	0		280 661
Other terrestrial	1279.3	162.5		1 441.8
Sub total DEC-managed lands (ha)	653 436	682 789.5		1 336 225 (687 reserves)
Marine Parks	0	0		0
Marine reserves	0	0		0
Sub total Marine (ha)	0	0		0
Total DEC-managed (ha)				
UCL/UMR (ha)	140 389	1 238 302		1 378 691
2015 proposals (ha)	0	15 809		15 809
Staff statistics				
Permanent salaried (FTE)	14.8	11	5	30.8
Permanent wages (FTE)	6	1		7
Casual, seasonal (FTE)	0.2	4.4	1	5.6
Total (FTE)	**21**	**16.4**	**6**	**43.4**
Aboriginal employees (FTE)	0	2 (contract)	0	2 (contract)
% Aboriginal staff	0	10%	0	4.3%
Occupational Safety and Health				
LTI Frequency Rate	0	31		0
LTI & MTI Frequency Rate	41	63		
Date of last LTA	1/4/2008	24/5/2010		24/5/2010
Environmental Protection Act statistics				
Licensed Premises	40	35		75
Registered Premises	55	53		109
Registered Contaminated Sites	1	15		16

	Great Southern District	Central Wheatbelt District	Wheatbelt Regional Office	Region Total
External Liaison				
Local Government Authorities	22	24		45
Aboriginal Corporations	1	2		3
Aboriginal Park Councils/Committees	0	0		0
National Park Advisory Committees	0	0		0
Other Advisory Committees	2	10		12
World Heritage Areas	0	0		0
2015 negotiations	0	2		2
Neighbouring properties	1 997 (freehold)	972 (freehold)		2 969
Shared boundary (km)	6 167	4 298		10 465
Water supply catchments/aquifers	3	0		
Budget ($million)				
Recurrent (2010/11)	$2.8	$1.5	$1.1	$5.4
Other (Grants, Recoup, etc) (2010/11)	$0.25	$0.35	$0.1	$0.7

General comments on service delivery

- The Wheatbelt Region has established a strategic planning process for the Nature Conservation Service which will provide greater alignment and accountability between on-ground outcomes and corporate goals.
- The Wheatbelt Region proactively engages stakeholders and neighbours. Success has been achieved in implementing the Department's Good Neighbour Policy.
- The highly fragmented nature of remnant vegetation / conservation estate increases the potential of losing biodiversity values, particularly threatened species.
- The size of the region results in considerable travelling and relatively high operational costs
- Attraction and retention of personnel in regional areas remains a critical Human Resources issue.
- The region has been successful in establishing partnerships with many NRM, community organisations and stakeholders; effective relationships with these stakeholders is critical for effective service delivery
- Two Natural Diversity Recovery Catchments are located within the Wheatbelt Region together with a number of other landscape scale conservation projects.

General comments on current issues and trends

- Key threatening processes include:
  - Altered hydrological processes (including salinity)
  - Inappropriate fire regimes
  - Impact of introduced plants & animals
  - Lack of ecological resources to support viable populations
- An effective nature conservation strategy is necessary to target key biodiversity outcomes and support effective resource allocation.
- The recent addition of Environmental Services staff based in the Wheatbelt Region has significantly improved the delivery of this program.
- Strategic fire operations have been enhanced through the use of State Government and Commonwealth Bushfire Mitigation funding.

Wheatbelt Region

The Wheatbelt Region comprises part or all of 45 local government authorities, covers an area of about 13.5 million hectares and accounts for about 6% of the State's total area. The region extends from the Goldfields in the east to the Darling Scarp in the west and from Dalwallinu in the north to the Stirling Range in the south.

The region contains 21 fauna species that are considered threatened and a further four species that are specially protected. Currently there are 117 threatened flora, 564 priority flora, three threatened ecological communities and 18 priority ecological communities. Three species of flora are thought to be extinct.

In 2010 the Region employed 45 permanent DEC employees, with nearly all being available for bushfire suppression. Five of these employees have been certified as able to perform key AIIMs IMT positions in level 2 or level 3 bushfire incidents. Three fire trucks and nine light units are normally available for fire suppression.

Figure 1. Wheatbelt Region

Vegetation

Over 6,000 species have been recorded in the South-West Botanical Province, with approximately 50 per cent found nowhere else. Over 4,000 species have been recorded in the Wheatbelt agricultural zone, with approximately 60 per cent found nowhere else.

The region has Australia's highest concentration of rare and endangered flora, with approximately 350 species listed, and ranks highly in this respect globally.

Interim Biogeographic Sub Regions (IBRA)

The region is biogeographically diverse and covers seven IBRA sub-regions although Geraldton Sandplains, Yalgoo and Esperance Sandplains constitute only three percent of the regional area. The Avon Wheatbelt and Mallee IBRA sub-regions compromise the majority of the Wheatbelt Region: the former is the most highly degraded sub-region in the State with over 90 per cent of native vegetation cleared and much of the remainder in very poor condition.

Figure 2. *Wheatbelt Region & IBRA regions*

Table 1. IBRA Regions within the Wheatbelt

IBRA Region	Area in the Wheatbelt Region (km^2)	% of Wheatbelt Region
Avon Wheatbelt	72,676	56%
Mallee	32,016	25%
Coolgardie	15,564	12%
Jarrah Forest	7,766	6%
Yalgoo	2,541	2%
Esperance Plains	363	<1%
Geraldton Sandplains	178	<1%

Avon Wheatbelt

The Avon Wheatbelt is the most diverse IBRA in the State, containing 152 vegetation types. Approximately 93% of its area is alienated and cleared for agriculture. Due to the high degree of clearing it is estimated that 84 per cent of Avon Wheatbelt vegetation types are under-represented in reserves.

The Avon Botanical District is situated on a poorly drained undulating plateau. A typical catenary sequence is illustrated in Figure 5. Halophytic vegetation is typical of saline areas where drainage is poorest (e.g. around salt lakes), especially in the east. Woodland is found on the better-drained valley floors and lower slopes, mallee on the mid-slopes, and kwongan on the sandy soils of the uplands. In the western Wheatbelt where the landscape is more undulating and drainage is better, halophytic vegetation is absent from well-drained valleys. As a result, the vegetation changes from east to west corresponding to increasing rainfall, improved drainage and changes in the soil catenae.

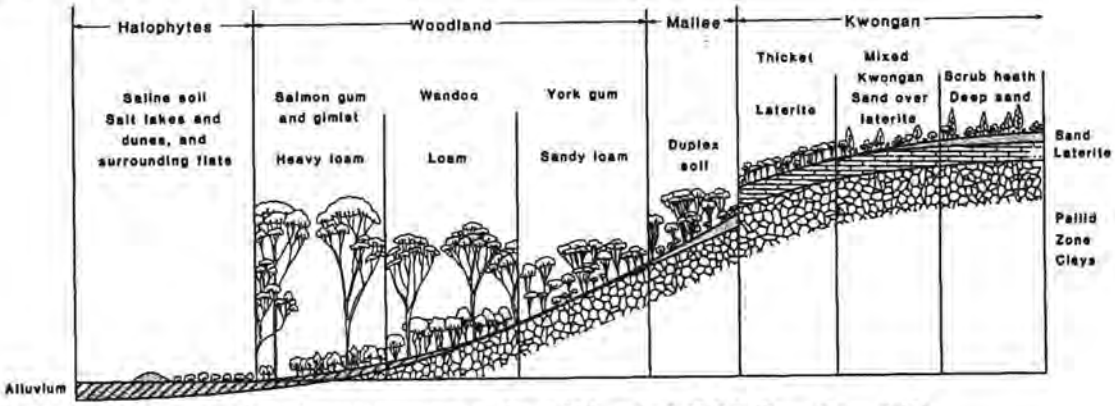


Figure 3: Diagrammatic catenary sequence, Avon Wheatbelt IBRA (from Beard JS).

Mallee

The landform of the Mallee comprises gently undulating country of low relief and, commonly, duplex soils. Approximately 45 per cent of its area has been cleared for agriculture. The vegetation is dominated by mallee eucalypts (i.e. multi-stemmed eucalypts with a lignotuber) on duplex soils (Figure 6).

The mallee habit is thought to be an adaptation to drought, although fire sensitive species can be found interspersed throughout Mallee vegetation. Following fire or other disturbance, mallees regenerate from a lignotuber, a stem adaptation (known as the mallee 'root'). Some mallee form eucalypts also have the capacity to form into single-stemmed trees in the absence of fire or other adverse site conditions. In contrast, Mallet eucalypts are not lignotuberous and regenerate only from seed. Mallet species are usually single-stemmed and can be heavily branched and spreading (marlock).

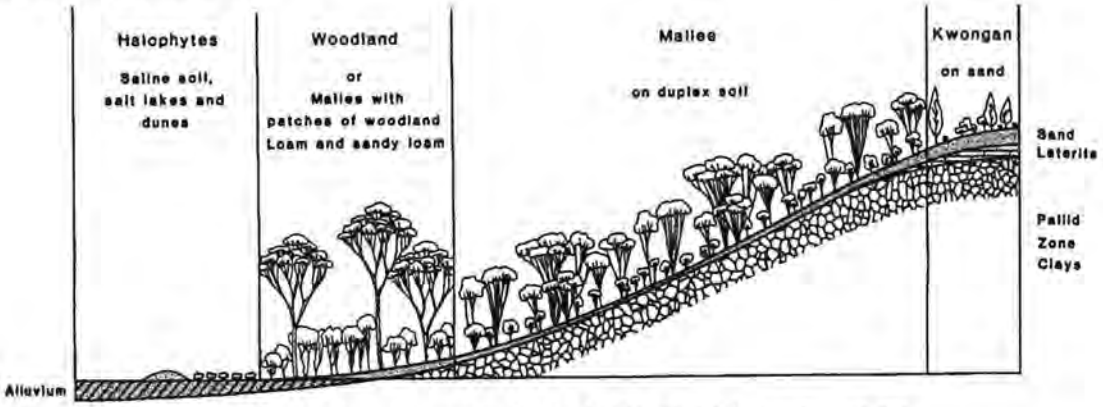


Figure 4: Diagrammatic catenary sequence for the Mallee IBRA (from Beard JS).

Coolgardie

The landforms of the Coolgardie bioregion include granite rocky outcrops, low greenstone hills, laterite uplands and broad plains. Numerous salt lakes also occur through the bioregion. The Coolgardie bioregion covers the interzone between mulga and spinifex country, and eucalypt environments. The climate of the Coolgardie bioregion is semiarid. Spatially averaged median (1890–2005) rainfall is 248 mm (April to March rainfall year).

The dominant vegetation in this region includes open eucalypt woodlands, mallee woodlands and acacia, allocasuarina or melaleuca shrublands.

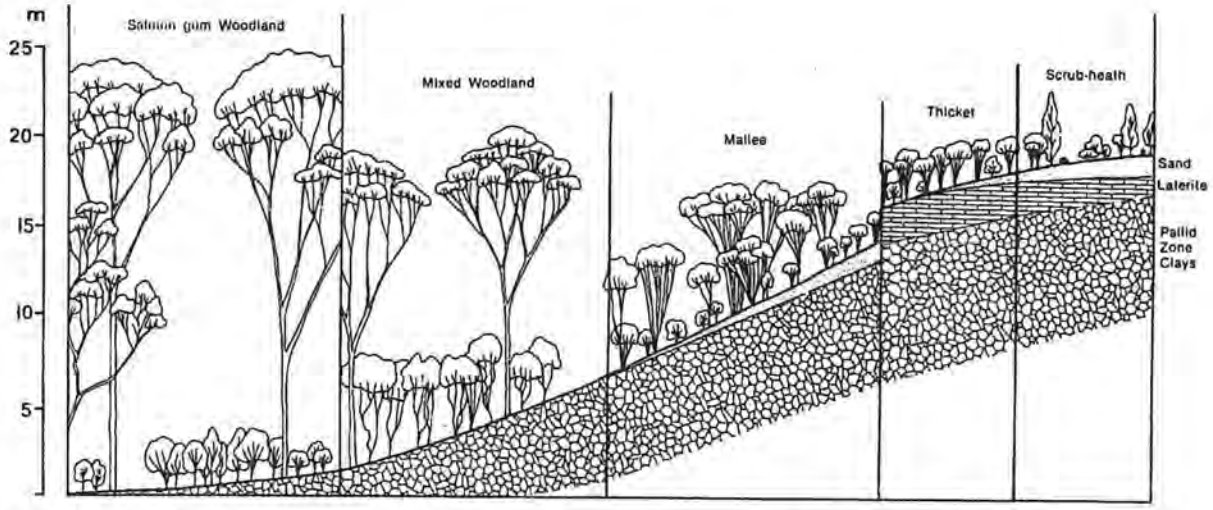


Figure 5: Diagrammatic catenary sequence for the Coolgardie 002 IBRA subregion (from Beard JS).

Land Use & People

The region has a widely dispersed population, with Northam being the largest town. In contrast with other regions in Western Australia, half the Wheatbelt population is spread across more than 30 urban centres. The economy is based on agriculture dominated by cereal crops, particularly wheat, livestock enterprises are more common in the southern and western parts of the region. The area encompasses productive wheat fields and is regarded as the main 'food bowl' in Western Australia.

In the region the demand for tourism is generally low and recreation demand is local.

Mining operations include nickel, gold and gypsum on a variety of scales. Mining and pastoral land use typically occurs in the eastern and northern parts of the region. The main concentration of mining is located in the north eastern part of the region along the 'green stone belt'.

Figure 6 **Map showing distribution of Wheatbelt towns**

DEC Estate

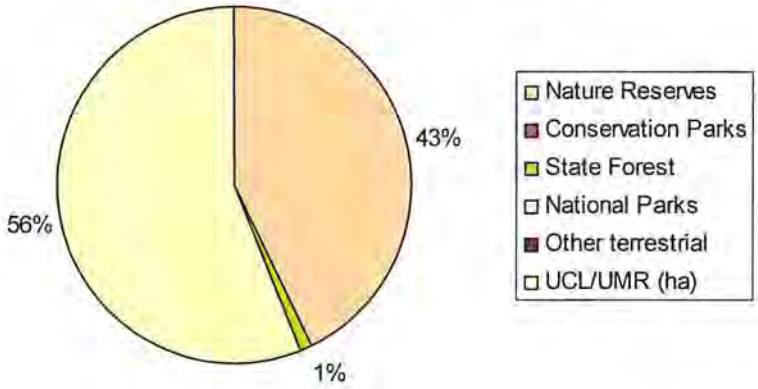
There are 694 DEC managed conservation reserves within the Wheatbelt Region with a total area of 1,083,938 hectares. Nature reserves represent the majority of this estate (1,051,273 hectares); 28,374 hectares of State forest; and 1,442 hectares of various other reserves. The majority of these reserves occur in the highly cleared agricultural areas and as a result are small and highly fragmented. 81% of the reserves are less than 500ha.

On 1 July 2003, the on-ground management of non-metropolitan, non-townsite unallocated Crown land and unmanaged reserves (UCL) was transferred from the Department of Land Administration (now the Land Asset Management Services, Department for Planning and Infrastructure) to DEC. Under these arrangements, DEC's main management focus will be fire prevention and the control of declared weeds and animals, FESA, Local Government Authorities / Brigades retain the responsibility for bushfire suppression on UCL.

The Wheatbelt Region contains 1 235 753 ha of UCL and 143 084 ha of unmanaged reserves (UMR).

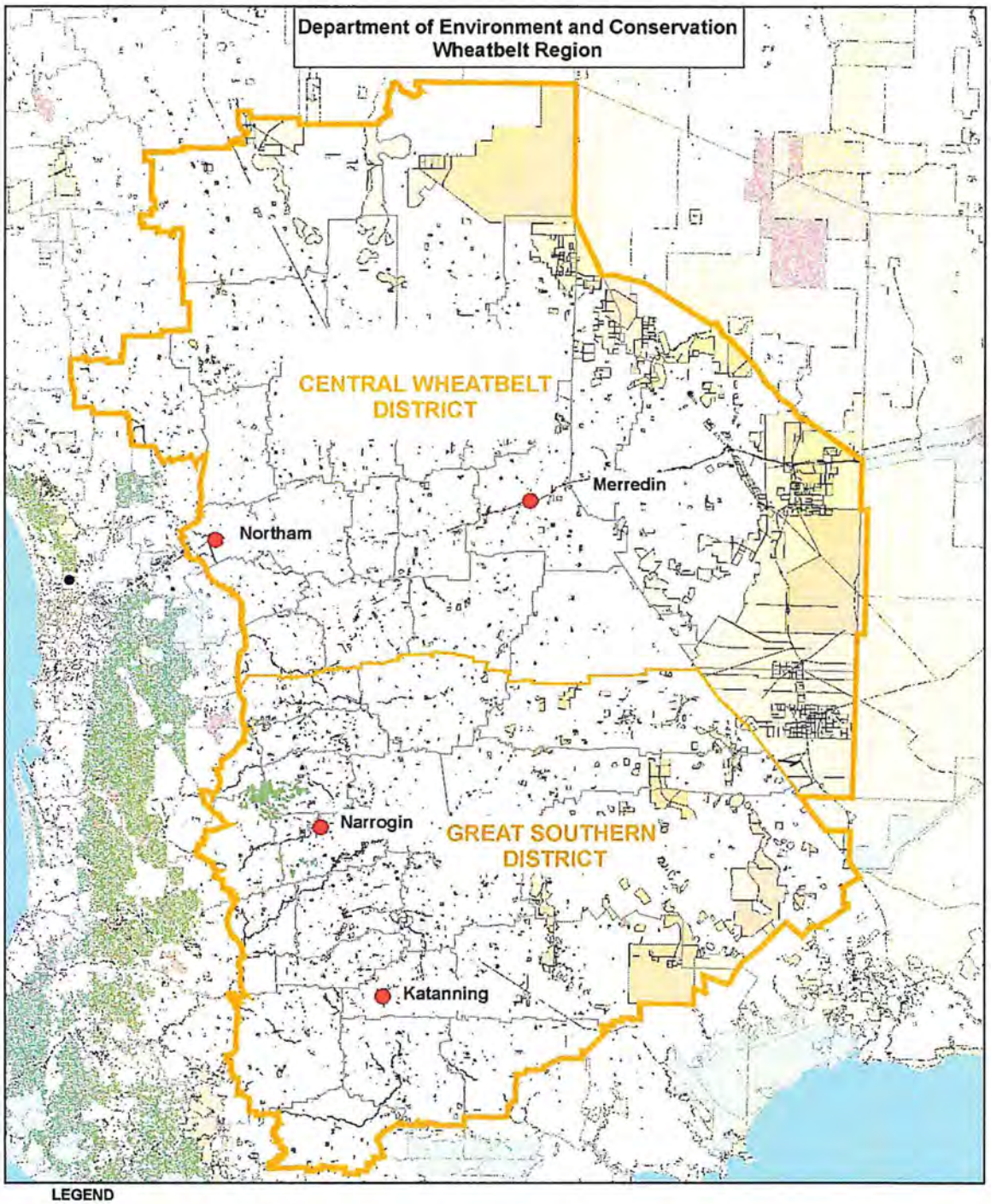
The DEC Wheatbelt Region includes two districts, namely the Great Southern and Central Wheatbelt District. DEC offices are located in Narrogin, Northam, Katanning and Merredin, with a regional office in Narrogin.

Wheatbelt Region
Area of DEC Managed Estate



DEC-managed lands/waters	Area (ha)
National Parks	1,292
Conservation Parks	1,558
Nature Reserves	1,051,273
State Forest	28,374
Other terrestrial	1,442
DEC Conservation estate	**1,083,938**
UCL/UMR (ha)	1,378,837
Sub total DEC-managed lands (ha)	**2,462,775**

Figure 7. DEC managed lands – Wheatbelt Region



LEGEND

- Conservation Park
- National Park
- Nature Reserve
- State Forest
- Unmanaged Reserves
- Unallocated Crown Land
- Department of Environment and Conservation office

N

0 25 50 75 100
Kilometers

Projection: Universal Transverse Mercator
MGA Zone 50, Datum: GDA94

Department of Environment and Conservation
Our environment, our future

Produced by Paul Blechynden
Under the Direction of
Keiran McNamara
Director General, Department of
Environment and Conservation

The Dept. of Environment and Conservation does not guarantee that this map is free of any kind and disclaims liability for any loss, but not all liability, or any other consequence to which may arise from relying on any information supplied.

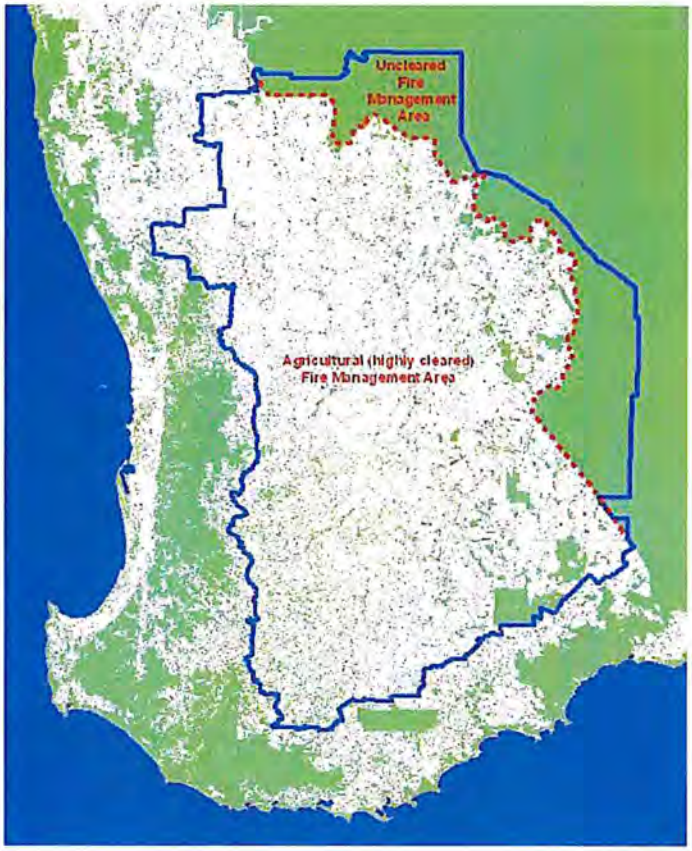
Figure 8. Wheatbelt Region

A Synopsis of Fire Management – DEC Wheatbelt Region

The Wheatbelt Region contains 694 DEC managed reserves and about 1.4 million hectares of Unallocated Crown Land / Unmanaged Reserves.

Most of the region occurs within the highly cleared agricultural zone, as a consequence the majority of DEC reserves are small and highly fragmented (81% of reserves are less than 500 hectares). Inappropriate fire regimes have resulted in fire being excluded from these reserves which poses a significant threat to biodiversity conservation.

The eastern part of the region contains about 2 million hectares of uncleared vegetation. Inappropriate fire regimes in the form of large (up to 500,000 ha) intense bushfires represent a threat to biodiversity values and life and property values such as the life line corridor along the Great Eastern Highway.



Fire management within the Wheatbelt Region aims to:

1. Manage fire regimes to deliver effective biodiversity outcomes and protect life and priority property values from bushfire.
2. Improve our understanding of fire ecology and to be recognised as a leader in fire management in this environment.
3. To maintain and enhance existing partnerships with FESA, Bushfire brigades, LGAs and communities.

Staff structure

Figure 2

Fire History
FMA 2 Northern section

No data sourced for this area

1977

Dalwallinu

2002

Beacon

No data sourced for this area

2002 & 2006

1980

Koolyanobbing

1977 & early 2000's

Mukinbudin

2004 ~ 20 000 ha

Southern Cross

1970

Mount Palmer

Merredin

Northam

2002 ~ 175 000 ha

1970

2008 ~ 35 000 ha

Legend

Wheatbelt_20_km_buffer_Non_Forest_Fire_Freq_draft
MAX_YEAR1

- 2009 - 2010
- 2008 - 2009
- 2007 - 2008
- 2006 - 2007
- 2005 - 2006
- 2004 - 2005
- 2003 - 2004
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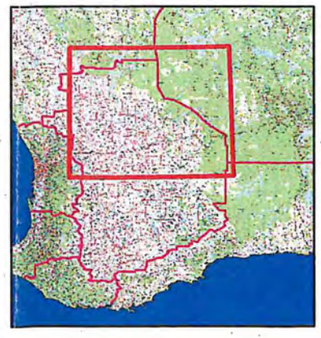
- 1976 - 1977
- 1975 - 1976
- 1970 - 1975
- 1963 - 1970
- 1961 - 1963
- 1949 - 1961
- 1945 - 1949
- 1941 - 1945
- 1941

0 12.5 25 50 75 100
Kilometers



N

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Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

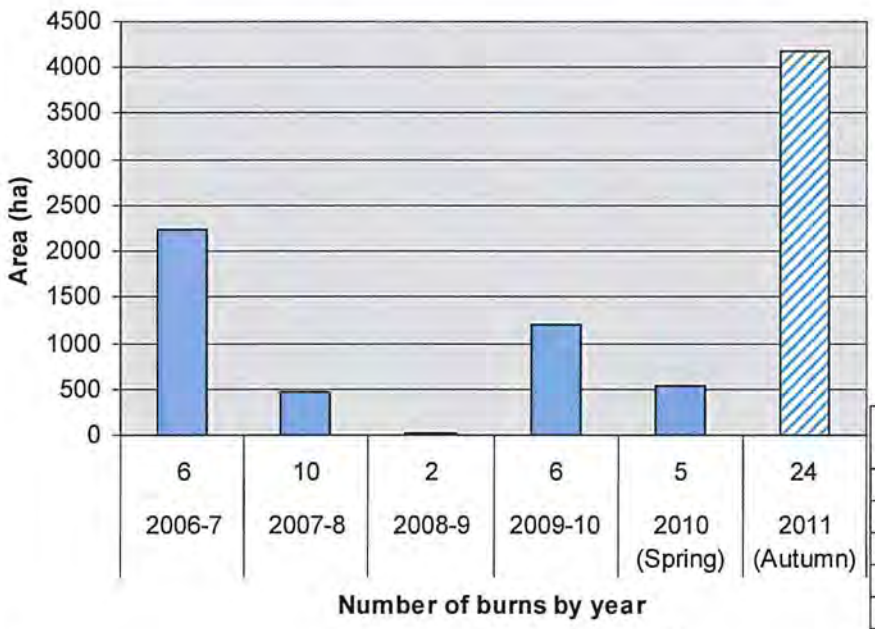
Prescribed burning
Over the last two years the Wheatbelt Region has significantly increased its prescribed burning program to achieve a range of objectives with particular focus on biodiversity outcomes.

The autumn 2011 program (attached) is particularly ambitious with 24 burns planned. Within this program are a number of lower priority burns that will be completed as weather and resources allow. In addition to achieving the individual burn objectives this program has resulted in benefits through more personnel nominating burns and junior staff gaining experience in preparing and implementing burn prescriptions.

Relative to the forest regions, the wheatbelt contains fewer life and property values threatened by fire and numerous small nature reserves managed for the purpose of conservation of flora and fauna. As a result this program's success is measured in terms of conservation outcomes achieved and rather than total areas burnt.

Notable prescribed burning achievements include:

- The Tutanning Adaptive Management project that aims to maintain the floristic diversity of the kwongan shrub lands through the application of a modified fire regime.
- The extensive use of fire disturbance trials to regenerate Declared Rare Flora species.
- Significant work has been achieved in establishing and burning about 80 km of scrub rolling adjacent to the Great Eastern Highway. The majority of this work has been in cooperation with the Goldfields Region.
- Prescribed burning with FESA & local brigades



Year	No of burns	Area (ha)
2006-7	6	2,250
2007-8	10	466
2008-9	2	22
2009-10	6	1,212
2010 (Spring)	5	543
2011 (Autumn)	24	4,179

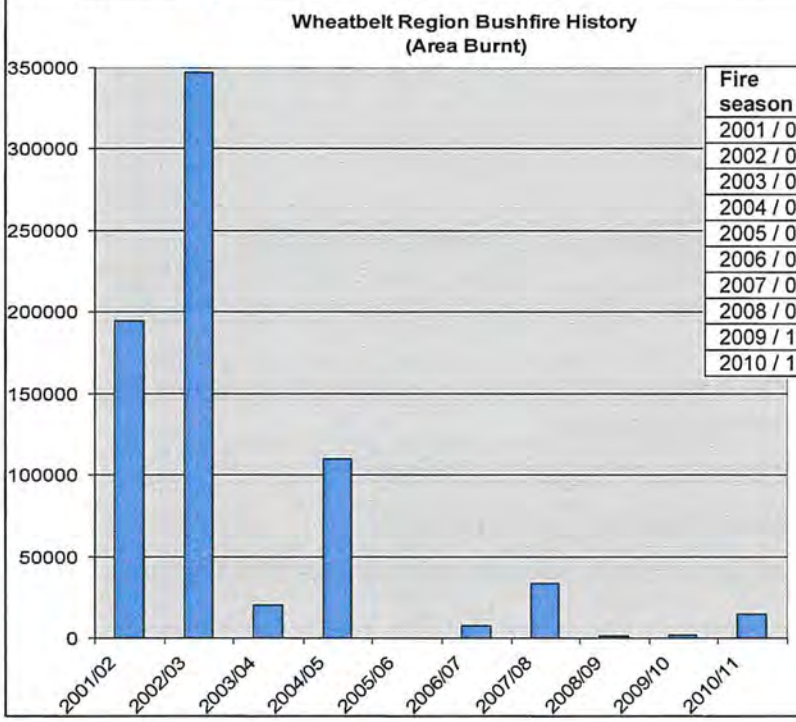
Figure 3

Bushfire suppression

Capacity

- Six Duty Officers
- Seven FEA Officers (ten FEA in-training)
- Six Conservation Employees
- Three trucks, six light units, two flame throwers

Bushfire history



Fire season	Area Burnt	No. of Fires	Comments
2001 / 02	194,911	9	Jilbadji - 175 000 ha
2002 / 03	347,001	13	UCL fires - 300 000ha
2003 / 04	20,419	5	
2004 / 05	110,000	3	Pt of 452 000 ha bushfire
2005 / 06	330	2	
2006 / 07	7,879	17	
2007 / 08	33,741	10	Jilbadji - 34 000ha
2008 / 09	1,632	9	
2009 / 10	2,221	15	
2010 / 11	14,412	8	

Figure 4

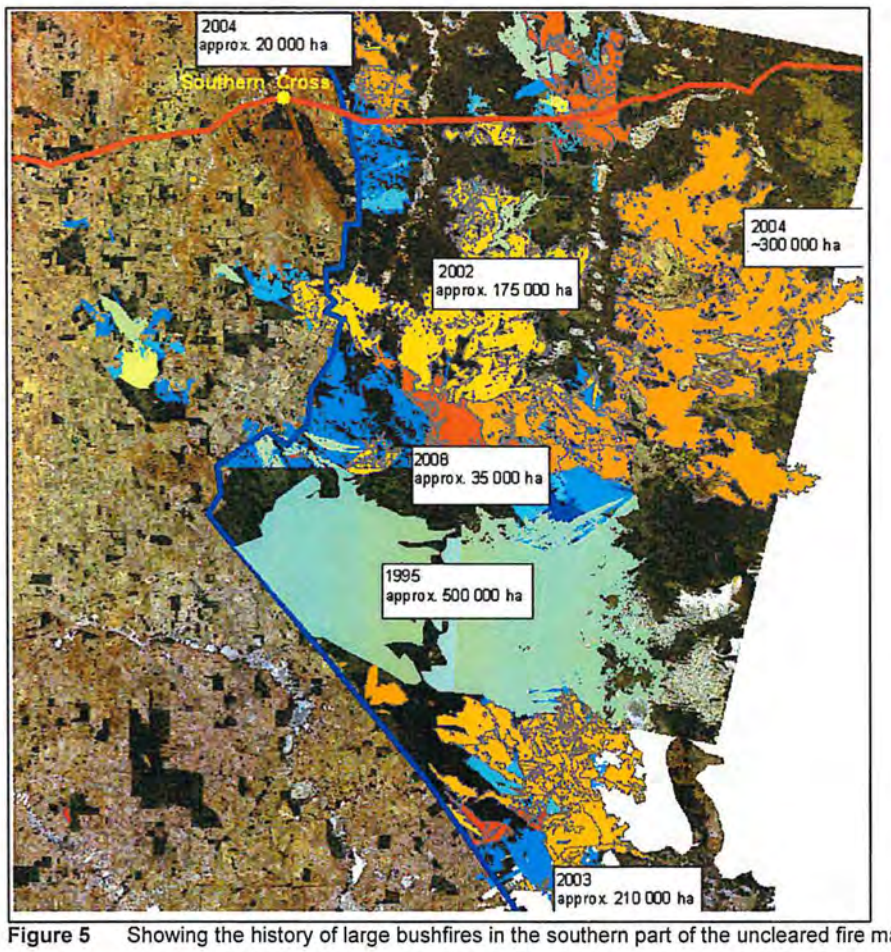


Figure 5 Showing the history of large bushfires in the southern part of the uncleared fire management area

SWOT analysis - Fire Management in the Wheatbelt Region

Strengths

- Very good relationships with FESA - Narrogin & Northam
- Strong planning history Katanning District Fire Management Plan, Fire & Biodiversity Guidelines (Shedley 2007) & current Draft Regional Fire Management Plan
- Significant work has been achieved in establishing over 1000 km of strategic fire access tracks, low fuel areas including strategic scrub-rolling.
- Effective partnerships with the Goldfield's Region in respect to on-ground operations in the Great Western Woodlands

Weaknesses

- High staff turnover creates difficulties in building fire experience & capacity

Opportunities

- The Region is committed to the Great Western Woodland project and will use prescribed burning to deliver important biodiversity outcomes.
- Improve the level of engagement with Fire Management Services
- Establish a new standard for Regional Fire Management Plans
- The region has a contract GIS position and is looking for opportunities to make this a permanent position.

Threats

- Experience of senior fire personnel struggle to maintain currency with their red carded roles.
- The demands on managers and personnel to deliver a range of non-fire programs limit the capacity to develop fire experience and deliver fire outcomes.

CENTRAL WHEATBELT DISTRICT

BIODIVERSITY STATISTICS OF THE FRAGEMENTED LANDSCAPE

- The Central Wheatbelt District has 92 Declared Rare Flora species – represents 24% of the total of DRF in Western Australia)
- CWD has the highest proportion of DRF species when compared with other DEC districts.
- CWD has a very high proportion of endemic species – over 40% of the 92 DRF species are endemic
- CWD manages 1 threatened ecological Community and 14 Priority Ecological Communities
- CWD has 22 threatened and priority fauna species which includes 3 critically endangered; 2 endangered and 6 vulnerable species
- The 24 Shires in the CWD on average only have between 2% and 9% of their original native vegetation remaining resulting in a highly fragmented landscape
- Approximately 95% of the 305 DEC managed Nature Reserves are less than 50ha in size which increases impact of edge effect and management interventions

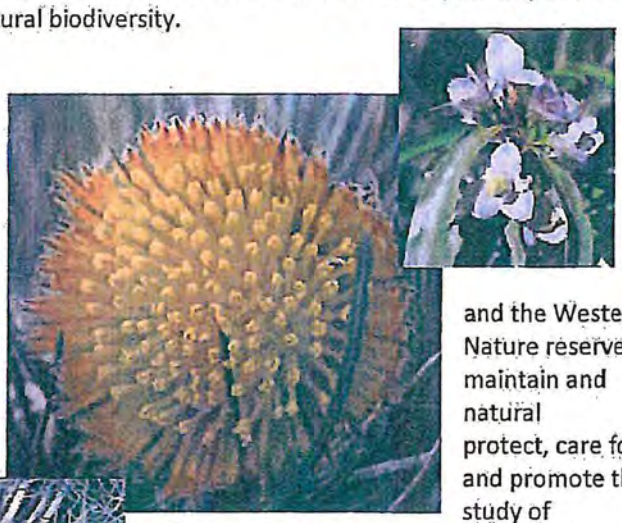
Central Wheatbelt District – A Snapshot July 2010

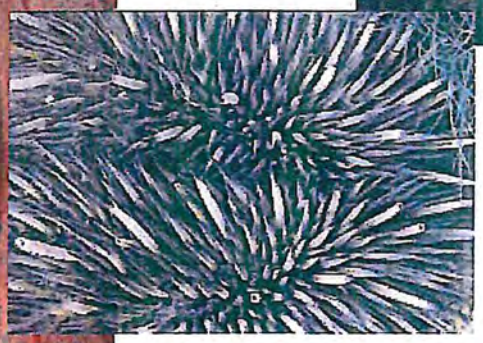
The Department of Environment and Conservation's mission is: *Working with the community, we will ensure that Western Australia's environment is valued, protected and conserved, for its intrinsic value, and for the appreciation and benefit of present and future generations.*


DEC Volunteers – Make a Difference

The DEC Central Wheatbelt District is located within the Central and Eastern Avon Wheatbelt. The district contains a wealth of natural biodiversity and is located within one of the fifteen nationally recognised biodiversity hotspots.

The Central Wheatbelt District covers an area of 8,080,698 ha which includes 27 shires and 695,065 ha of conservation reserves and 1,145,409 ha of Unallocated Crown Land. The work undertaken by DEC Central Wheatbelt District staff is aimed primarily at the conservation of natural biodiversity.





The 305 nature reserves within the district are managed by DEC on behalf of the Conservation Commission of Western Australia and the Western Australian public. Nature reserves are set aside to maintain and restore the natural environment, to protect, care for and promote the study of indigenous flora and fauna, and to preserve any feature of archaeological, historical or scientific interest.

As of the 1st July 2003, DEC was allocated responsibility for the management of weeds, pest animals and pre-fire suppression operations on non-townsite areas of Unallocated Crown Land (UCL). In the Central Wheatbelt District, this area of UCL is approximately 1.1 million ha.

The Departments corporate goal/objective for conserving biodiversity is: To protect, conserve and, where necessary and possible restore Western Australia's natural biodiversity.

The work undertaken in the Central Wheatbelt District aims to conserve natural biodiversity assets including:

- Threatened fauna species
- Threatened flora species
- Threatened ecological communities
- Managing conservation estate
- Encouraging the conservation of remnant vegetation on private property

To conserve biodiversity assets it is necessary to address a range of threats including:

- Altered biogeochemical processes (water logging & salinity)
- Lack of ecological resources to support viable populations (restricted gene pool)
- Altered fire regimes (wildfires that are either too frequent or too infrequent)
- Competing resources use
- Impacts of introduced plants and animals

Threatened Flora

The Central Wheatbelt District contains many unique flora species including 94 species of declared flora (DRF), 11 of which are critically endangered.

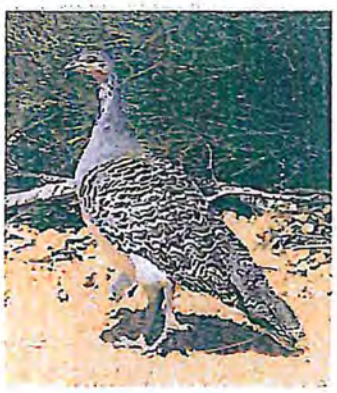
DEC Officers undertake a number of operations to promote the survival of these species including:

- Monitoring known populations and conducting field surveys to find new populations

- The Collecting and preserving seed and genetic material
- Establishing new populations with cultivated plants
- Controlling weeds and pest animals
- Restoring habitat and ecosystems by soil disturbance and prescribed burning
- Use if prescribed burning to minimise wildfire risk
- Developing information to improve the public's understanding of these species

Threatened Fauna

Twenty nine threatened fauna species have been collected or sighted in the Central Wheatbelt District including:



- Malleefowl (*Leipoa ocellata*)
- Black Flanked Rock Wallaby (*Petrogale lateralis lateralis*)
- White tailed Black Cockatoo (*Calyptorhynchus latirostris*)
- Numbat (*Myrmecobius fasciatus*)
- Bilby (*Macrotis lagotis*)
- Chuditch (*Dasyurus geofroyii*)
- Several trapdoor spider species (such as the Yorkrakine Trapdoor Spider)

The Departments Western Shield program aims to recover threatened fauna species by controlling predators. Through this program the re-establishment of locally extinct populations of threatened fauna becomes possible.

Western Shield has had a number of significant successes in the Central Wheatbelt District including the Mt Caroline Nature Reserve population of black flanked rock wallabies. This population had recovered to the point that individuals are now being translocated to other areas in the state to establish new populations where they had become locally extinct.

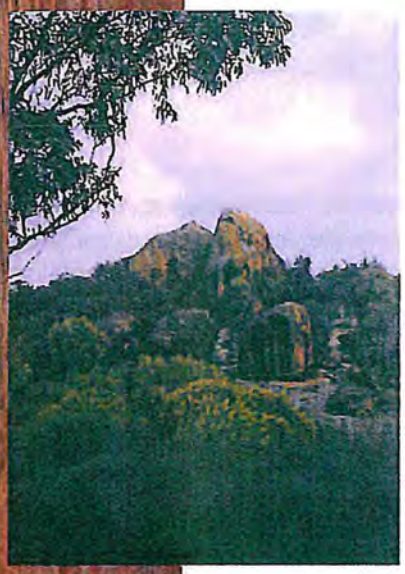
Threatened Ecological Communities

There are three ecological communities in the Central Wheatbelt District, which are listed as Threatened on the Threatened Ecological Communities (TEC) database and an additional five communities, which have been listed as priority.

Recreation Management

The Departments objective for creating sustainable community benefits is to generate social, cultural and economic benefits through the provision of a range of services that are valued by the community and are consistent with the principles of ecological sustainability.

The enjoyment of natural areas contributes to the quality of life. Managing these areas and enhancing visitor experiences are particularly important in the Wheatbelt, where more than 90% of the land has been cleared.



Many remnants contain unique feature including granite formations, wetlands, gnamma holes, salt lakes, eucalypt woodlands and seasonal wildflower displays.

The natural historical and cultural values of these areas are important for locals and tourists.

DEC's Central Wheatbelt District manages recreation on Nature Reserves to:

- Ensure that recreational activities do not adversely impact on the conservation values
- Provide valuable recreational facilities in a predominantly cleared landscape where recreational opportunities are limited and;
- Take the opportunity to provide conservation, cultural and natural
- biodiversity information

These recreation site include:

- Yorkrakine Rock Nature Reserve
- Korrelocking Nature Reserve
- Sandford Rocks Nature Reserve
- Mt Matilda Nature Reserve
- Totadgin Conservation Park
- Kokerbin Rock Nature Reserve
- Dingo Rock Nature Reserve
- Frog Rock Nature Reserve
- Gathercole Nature Reserve
- Lake Cronin Nature Reserve
- Durakoppin Nature Reserve
- Bruce Rock Nature Reserve

Land For Wildlife

Remnant vegetation contributes to both the conservation of natural biodiversity and the achievement of sustainable land use. Both the Salinity Action Plan and the Salinity Strategy have identified the importance of conserving remnant vegetation occurring on private property. The Land for Wildlife program is one of many that assist private land owners protect and manage their remnant vegetation.

The Land For wildlife Officer based in the Central Wheatbelt district has over 100 properties registered with this program as part of an ongoing system of assessing new properties and supporting existing properties.

Community Liaison

Central Wheatbelt staff work with a range of individuals, community groups, shires and other agencies to conserve natural biodiversity. These constructive relationships are instrumental in achieving positive nature conservation outcomes.

DEC staff are also involved with other programs that benefit the protection of community and agricultural values including bush fire mitigation and the control of wild dogs on UCL.

Central Wheatbelt DEC Staff

Rob Blok	District Manager
Mark Moore	Senior Operations Officer
David Jolliffe	District Nature Conservation Officer
Chris Phoebe	Wildlife Officer
Joel Collins	Conservation Officer (flora)
Natasha Moore	Conservation Officer (flora & fauna)
Nerys Wilkins	Operations Officer
Hayden Cannon	Assistant Operations Officer
Charissa Marwick	Reserves Officer
Ian Steward	GIS Analyst
Jill Symington	CFoC Project Officer
Mike Fitzgerald	PAPL Project Officer
Allan Wolfenden	Conservation Employee
Mal Harper	Land For Wildlife Officer
Chrissy Harper	Administration Officer
David Gill	Administration Officer
Rebecca Gearing	Assistant Administration Officer
Shelley Geier	Assistant Administration Officer
Vivian McHugh	Assistant Administration Officer
Gordon & Sharon Anderson	Contract Doggers

Acacia semicircinalis
Acacia semicircinalis
Grevillea kenneallyi
Acacia semicircinalis
Microcorys eremophiloides
Acacia semicircinalis
Grevillea kenneallyi
Acacia congesta subsp. wonganensis
Acacia pygmaea
Campsite
Acacia pharangites
Philotheca wonganensis
Acacia pygmaea
Acacia pharangites
Eremophila ternifolia
Eremophila ternifolia
Phebalium brachyca

Graticule shown at 6 seconds intervals
Grid shown at 250 metre intervals

Legend

Central Wheatbelt DEFL

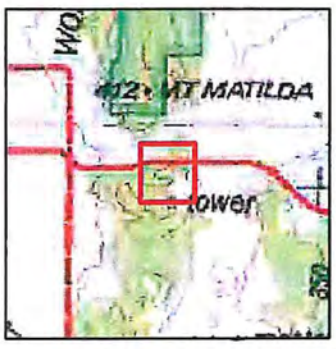
- R
- P1
- P2
- P3
- P4

N

1:5,000 (A4)

0 25 50 100 150 200
Meters

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



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Environment and Conservatic

Produced at 15:44pm, on June 7, 20

Graticule shown at 6 seconds intervals
Grid shown at 250 metre intervals

Legend

Central Wheatbelt DEFL

- R
- P1
- P2
- P3
- P4

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1:13,993 (A4)

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Meters

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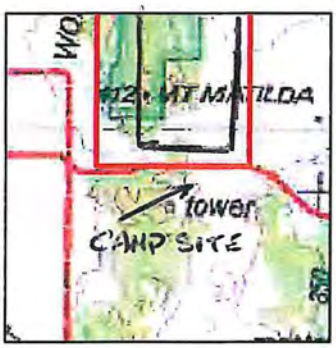

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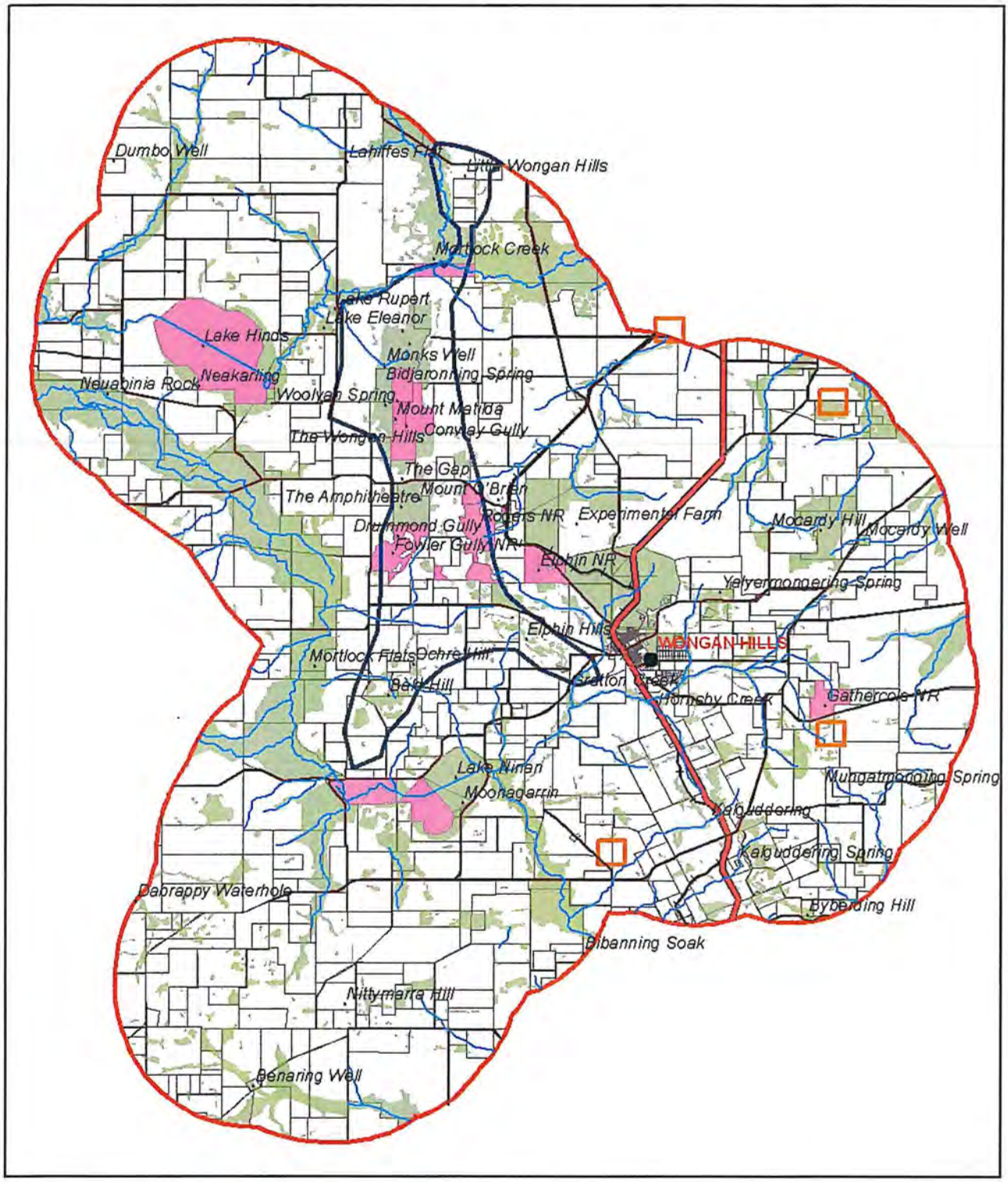
Produced at 15:44pm, on June 7, 20

THE WONGAN HILLS ECOSCAPE

Wongan Hills Ecoscape - History and Physiography



Legend

- WHE_hydro
- Principal Road
- Secondary Road
- Minor Road
- Track
- Rail
- Wongan Hills Ecoscape
- Wongan Hills Formation
- Aboriginal Sites
- DEC Reserves
- Remnant Habitat
- Tenure

0 1.5 3 6 9 12 Kilometers

N

HUMAN HISTORY

- Pre-European: The Wongan Hills area was occupied Yuat and Ballardong tribal groups. They provided early colonial explorers with the area's current place name. The Noongar words "Wongan Katta", are thought to mean "talking hills". An alternative explanation may be "hills rising out of the sandplain". There are 17 other aboriginal place names within the Ecoscape (3 hills, 14 water features) and 4 Registered Sites (all man made structures).
- Colonial Period: The region was first explored in 1836 by JS Roe with GE Moore in 1836. Naturalist J Gilbert and Botanist J Drummond collected specimens from the area in November 1842.
- Pastoralism and Mining: The 1860's and 1870's saw several extensive pastoral leases granted over the Wongan Hills area to the monks of the New Norcia Mission, and to private graziers. Some of these lessees and their shepherds prospected and found low-grade gold, copper and silver deposits. The entire area around the Wongan Hills was pegged for mining by 1888, but abandoned shortly after the discovery of the far richer eastern Goldfields.
- Agricultural settlement: Pastoral leases expired in 1901. Agricultural settlement had commenced by 1905, and was further facilitated by developments in railways and township (1911), school (1913) and local government (1916). By 1920 most of the preferred farming land (Salmon Gum, Gimlet and Morrel woodlands) had been taken up. An Experimental Farm was established in 1923 to facilitate agriculture on the "light lands". Further expansion of agriculture was delayed by the Depression and WWII, but resumed in the post war period.

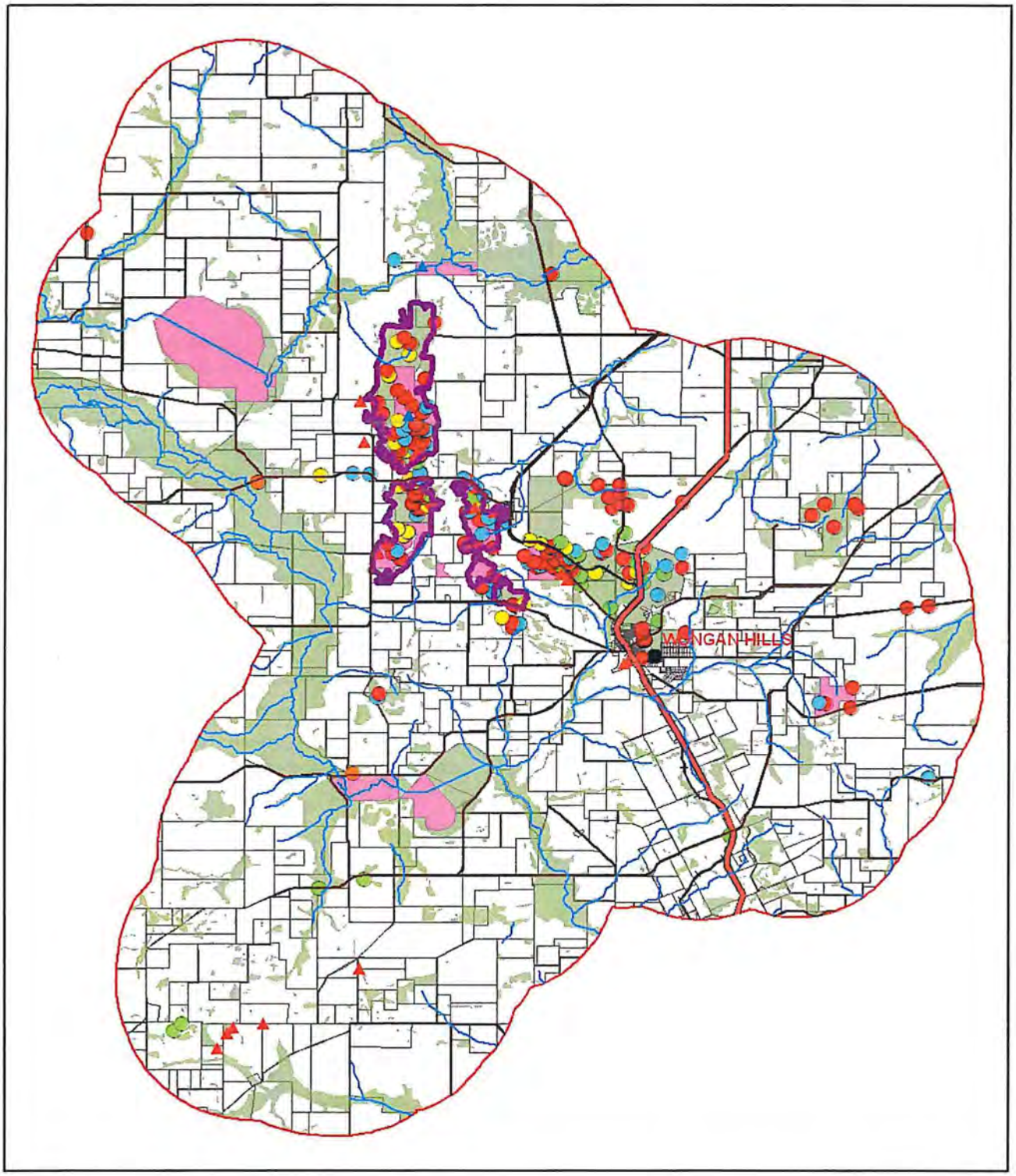
PHYSIOGRAPHY

- Geology: The Wongan Hills Formation is 3.2 billion years old. It is an outlier of the Murchison "greenstone belt". It contains a variety volcanic rocks, chert, banded iron formations and schist, gneiss and small ultramafic intrusions. These are arranged in a sequential series of linear deposits and distributed on three different axes (N, SE, SW). Many of these rock types are not exposed as they are capped by a thick lateritic duricrust.

  The geology of the area surround the Hills is more typical of the Avon Wheatbelt. It comprises Achaean granites, gneisses and dolerite dykes many of which have been subsequently weathered down to tertiary sandplain and gravels, and colluvial valley fill.
- Landforms: The Wongan Hills' appear as a series of flat-topped mesas, segmented by deep gullies containing concave scree slopes and greenstone "domes". Sections of the western side of these hills have been weathered, by rainfall impact and surface water flow, into steep scree slopes and exposed greenstone outcrops. The eastern side of these hills tend to slope much more gradually to a colluvial foot slope.

  The areas surrounding the Hills contain typical Avon Wheatbelt landforms.
  - Gently undulating granitic hills feature strongly in the area east of the Northam-Pithara Road.
  - The area between the Wongan Hills and these granitic hills is occupied by a tertiary sandplain upland containing minor breakaways.
  - The valleys which lie adjacent to these features are broad and shallow sloped, and contain the stagnant floodplains, playas and saline lakes typical of the Zone of Ancient Drainage. However, below Lake Ninan, the drainage system enters the Zone of Rejuvenated Drainage and most of these features are lost, as well-formed stream channels proliferate.

Wongan Hills Ecoscape - Biodivesity Assets



Legend

PECs

PECs

Listed Fauna

DECLARED THREATENED FAUNA

OTHER SPECIALLY PROTECTED FAUNA

PRIORITY FAUNA

Listed Flora

R

1

2

3

4

0 1.5 3 6 9 12 Kilometers

N

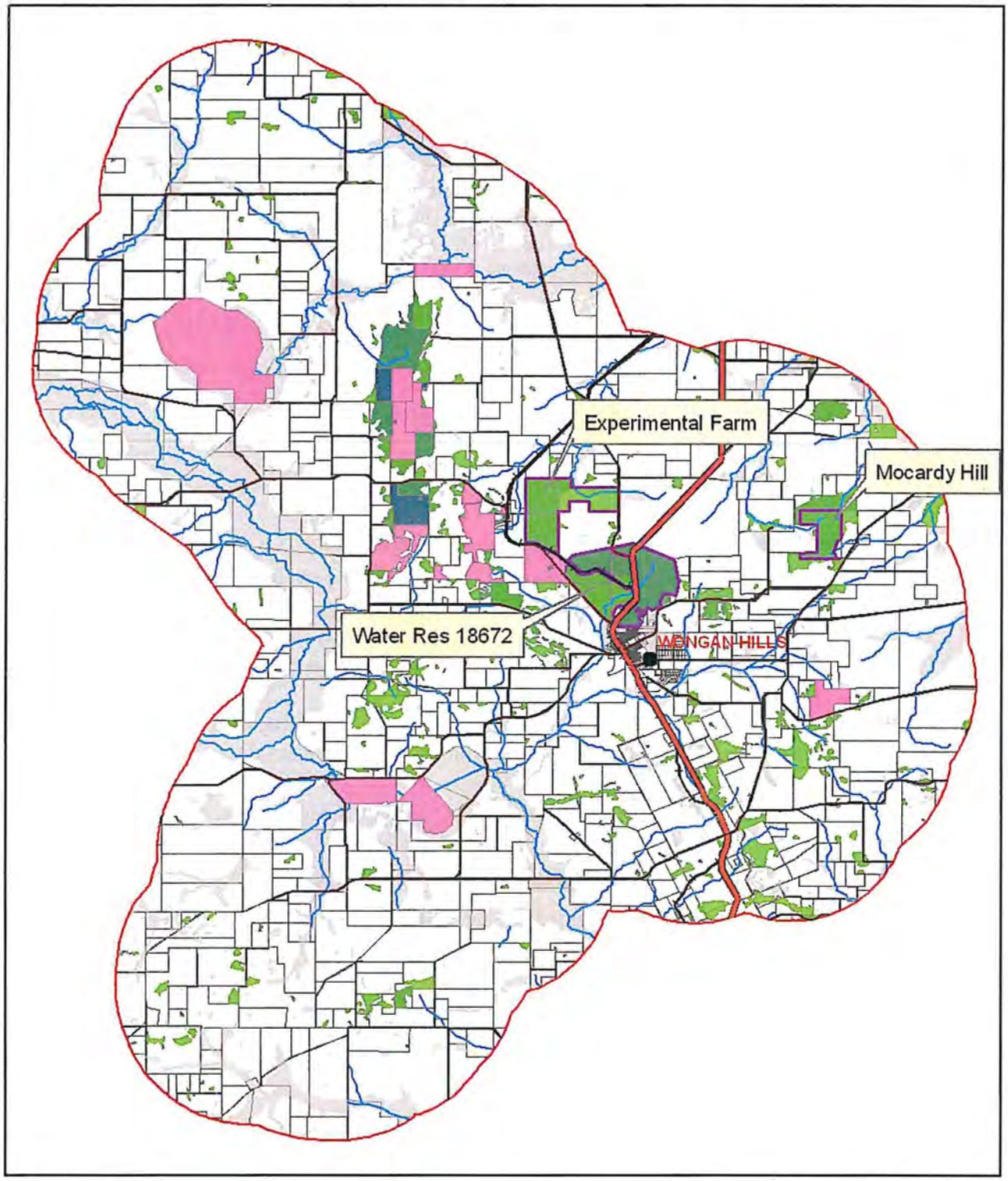
BIODIVERSITY ASSETS

- Flora.
  - The Herbarium currently holds about 3800 plant specimens collected from the Wongan Hills Ecoscape area. These specimens cover 1054 formally described taxa and a further 42 provisionally recognised but not yet described taxa.

    The major plant families include Myrtaceae (155 taxa), Fabaceae (122) Proteaceae (80), Asteraceae (64) Orchidaceae (39) and Chenopodiaceae (34).
  - 23 plant taxa are endemic to the Ecoscape. 19 are endemic to the Wongan Hills "precinct" which has an area of 26 square kilometres (0.73 endemics per sq km). This density is equivalent to key biodiversity areas such as Mt Lesueur, the Stirling Range, and parts of the northern and southern near-coastal sandplains, but the Wongan Hills precinct is much small in extent than the other sites.

    3 taxa are known only from the sandplain habitat adjacent to the Hills, and 1 taxa is endemic to a granitic hill.
  - Threatened and Priority Flora
    - 19 DRF occur within the Ecoscape – 9 CR, 5 EN, 5 VU
    - 59 Priority Flora – 7 P1, 15 P2, 24 P3, 13 P4
    - No taxa are listed as Presumed Extinct.
- Fauna.
  - No vertebrate fauna are endemic to the Wongan Hills Ecoscape
  - 281 vertebrate fauna species have been recorded in the Wongan Hills Ecoscape:
    - 43 Mammals. 15 native mammals are thought to be extant within the Ecoscape, with some doubts about the 8 bat species previously recorded. 17 species are considered locally extinct and 6 are listed as Presumed Extinct. 5 introduced species can be found in bushland.
    - 177 Birds. 161 native and 3 introduced bird species have extant populations within the Ecoscape. 13 species are locally extinct – woodland specialists, those sensitive to fragmentation and "edge of range" taxa.
    - 51 Reptiles. 49 species extant. 2 python species considered locally extinct.
    - 9 Amphibians. All thought to be extant.
    - 1 Fish. Sporadically recorded following flooding events.
  - Extant threatened, specially protected or other listed fauna
    - Endangered: Carnaby's Black-Cockatoo,
    - Vulnerable: Malleefowl, Shield-backed Trapdoor Spider.
    - Migratory Birds: 8 taxa.
    - Specially Protected: Peregrine Falcon.
    - Priority 4: 6 bird taxa, 1 spider
- Vegetation and Communities.
  - Approximately 28% of the Wongan Hills Ecoscape is occupied by remnant vegetation or other forms of remnant habitat (wetlands, rock outcrops).
  - This habitat contains elements of 11 Beard-Hopkins Vegetation Associations. 9 are poorly conserved or very poorly represented on IUCN I-IV in Avon Bio-Region.
  - BHVA's 125 (Salt Lakes) and 2047 (Tamma, Dryandra Shrublands) both well conserved and well represented in IUCN I-IV in Avon Bio-Region.
  - BHVA 2047 is endemic to the Ecoscape and is listed as a PEC (P4).
  - Detailed vegetation mapping was undertaken by A Coates (1988,1991) of the major Wongan Hills and associated sandplain remnants NW of township.

Wongan Hills Ecoscape - Conservation Focus



Legend

- DEC Reserves
- Proposed NR's
- Other Remnant Habitat

Priority Remnant Habitat

PRIORITY

- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 - 6

0 1.5 3 6 9 12 Kilometers

N

NATURE CONSERVATION ACTIVITIES IN THE WONGAN HILLS ECOSCAPE:

- Land Acquisitions and Management: Ongoing.
  - The "Red Book" process in the 1970's led to the acquisition of the Mt Matilda (↑33530) and Elphin (↑25808) NR's.
  - Land purchases have included Rogers NR (↑39145) and Fowler Gully NR (↑42375).
  - Wetland and waterfowl conservation initiatives featured in the acquisition of Lake Hinds (↑16305) in the 1960's and Lake Ninan (↑27026 & ↑402547) NR's in the 1970's
  - Other reserves were acquired through other processes.
  - Lands under negotiation include parts of the Experimental Farm Reserve 18672 (ex Red Book), Water Reserve 16418 and Water Reserve 15702, Mocardy Hill.
- Threatened Flora Recovery: 1989 – 2011.
  - 1991 Merredin District TFMP covered many of the Wongan Hills species, but not those which were endemic to the Ecoscape. Implementation has been ongoing.
  - 1997-2002 saw the development of a TFMP for the threatened and priority flora which were endemic to the Shire of Wongan-Ballidu. Implementation ongoing.
  - 2006 - Joint NRW funded publication on Wongan Hills threatened flora.
  - The CfOC Rabbit Project commenced in 2010. It is aimed at reducing rabbit populations to facilitate the recovery of populations and critical habitat. Because of the major concentration of populations and the diversity of habitat at Wongan Hills, many of the trial sites are concentrated in this area.
- Ecoscapes project: 2000 – 2011.
  - The Target Landscapes approach, developed within the Wheatbelt Region, focused conservation investment towards major concentrations of remnant vegetation where long-term retention of species was most likely to be successful.
  - In 2006, Avon Natural Diversity Alliance (comprising Avon Catchment Council, CALM/DEC, Greening Australia and WWF) using NHT funds redefined and reprioritised the 12 Target Landscapes, and relabelled them as Ecoscapes.
  - The four highest priority Ecoscapes were selected for investment. These were then subject to "necessary" on-ground actions and conservation planning. The Wongan Hills Ecoscape was later assigned exclusively to DEC.
  - Key on-ground activities on Private property in Priority Remnant Habitat areas included:
    - Fencing remnant vegetation – 39.6 km/667 ha
    - Revegetation projects – 29.2 ha
    - Hydrological works – various
    - Feral animal control
    - Weed control
  - Community engagement, through awareness raising, skills development, public participation activities and schools program also played an important role.
- PAPL Project: 2010-2011.
  - The "Protected Areas on Private Lands" project is a CfOC funded extension to the NC Covenant program, focussing on heavily cleared bioregions, particularly the Avon Wheatbelt and the Wongan Hills area as a focal site.
  - Landowners have been provided with conservation assessments, management guidelines, and incentive funding in exchange for a negotiated conservation covenant covering their bushland.
  - Due to prior investment in the core of the Ecoscape, PAPL has had most interest from landowners on the periphery of the Ecoscape area.

THE FUTURE MANAGEMENT OF THE WONGAN HILLS ECOSCAPE:

There are a number of critically important biodiversity management issues still to be addressed within the Wongan Hills Ecoscape:

- Landscape Fragmentation.

  While the Ecoscape contains a major concentration of remnant vegetation in the Avon Wheatbelt Bioregion, many of the larger parcels are poorly connected with each other, or are dependent on small, unviable parcels as "stepping stones" for connection.

  A prioritised reintegration plan is required. It will be critically dependant on private landowner support, as well as external funding.

- Disturbance Regimes.

  Inappropriate fire regimes represent the 'elephant in the room" for key parts of the Ecoscape, much of which is long-unburnt. Plant communities and populations are senescing, and recruitment is lagging. Application of controlled burns is problematic at key sites due to threatened species, difficult terrain, recreational values, and mixed tenure.

  While the Hills precinct represents a significant challenge, the sandplain reserves represent a real opportunity. Key issues will be
  - Integrating outcomes of fire trials conducted on threatened flora (ie Rabbit Project)
  - Approval from the reserve's current managing authorities and
  - Gaining sufficient fire resources to implement an expanded prescribed burning program.

- Climate Change.

  It represents a direct threat to biodiversity values, but the significance of impacts is uncertain. It also represents an indirect threat to biodiversity by causing uncertainty amongst landowners about the future viability of farming. Its may reduce their support for conservation while they focus on and adjust to climate change.

  Ongoing engagement with the community and the ability of DEC to offer and contribute to solutions, either within the Ecoscape or in the wider Wheatbelt, will be crucial if we are to retain established community support for conservation initiatives.

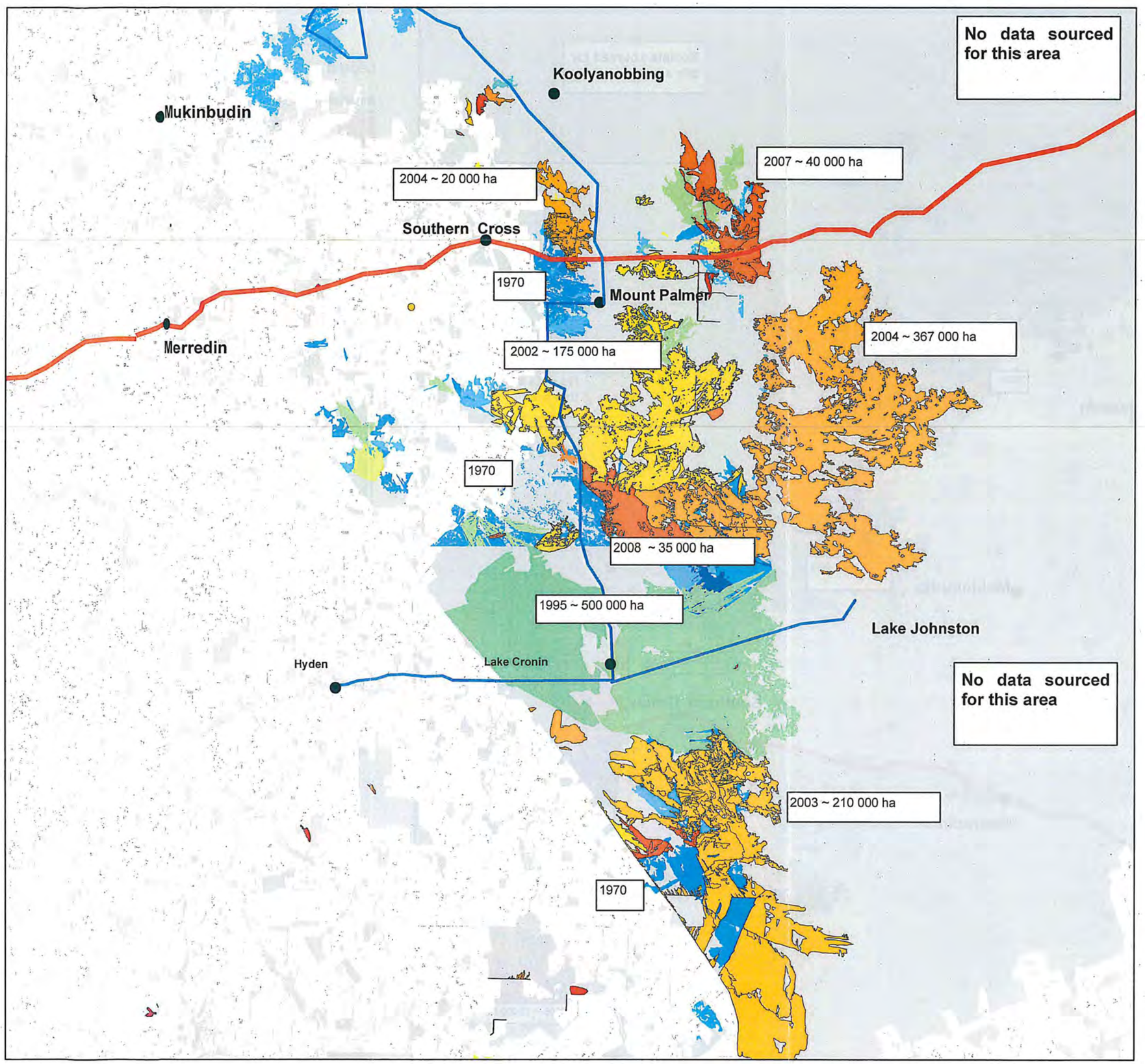
- Working with the Community.

  There are several aspects to community engagement in the Ecoscape which warrant careful attention:
  - It is sometimes difficult to disassociate DEC's conservation projects from the Department's enforcement role, especially in relation to land clearing prosecutions.
  - Indigenous engagement – a requirement in some CfOC projects – has been problematic due to the difficulty in identifying anyone who can "speak for country".
  - Lack of continuity with external funded projects has made it difficult to maintain a consistent commitment to the DEC – community relationship.

- Other Issues.

  Other threats to biodiversity include competing land use, introduced fauna and flora species, problem native species and hydrological issues. These currently tend to be dealt with as "maintenance" issues, as they have lower impact or because they can be less easily resolved.

Fire History
FMA 2 Southern section



Legend

Wheatbelt_20_km_buffer_Non_Forest_Fire_Freq_draft
MAX_YEAR1

- 2009 - 2010
- 2008 - 2009
- 2007 - 2008
- 2006 - 2007
- 2005 - 2006
- 2004 - 2005
- 2003 - 2004
- 2002 - 2003
- 2001 - 2002
- 2000 - 2001
- 1999 - 2000
- 1998 - 1999
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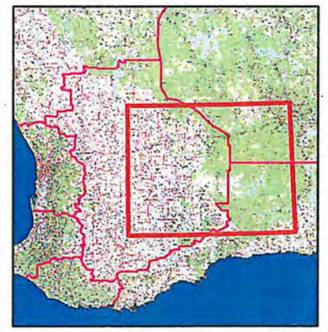
- 1996 - 1997
- 1995 - 1996
- 1994 - 1995
- 1993 - 1994
- 1992 - 1993
- 1991- 1992
- 1990- 1991
- 1977- 1990
- 1976 - 1977
- 1975 - 1976
- 1970 - 1975
- 1963 - 1970
- 1961 - 1963
- 1949 - 1961
- 1945 - 1949
- 1941 - 1945
- 1941

0 12.5 25 50 75 100
Kilometers



N

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Produced by the Department of Environment and Conservation

Produced at 10:31am, on June 7, 2011

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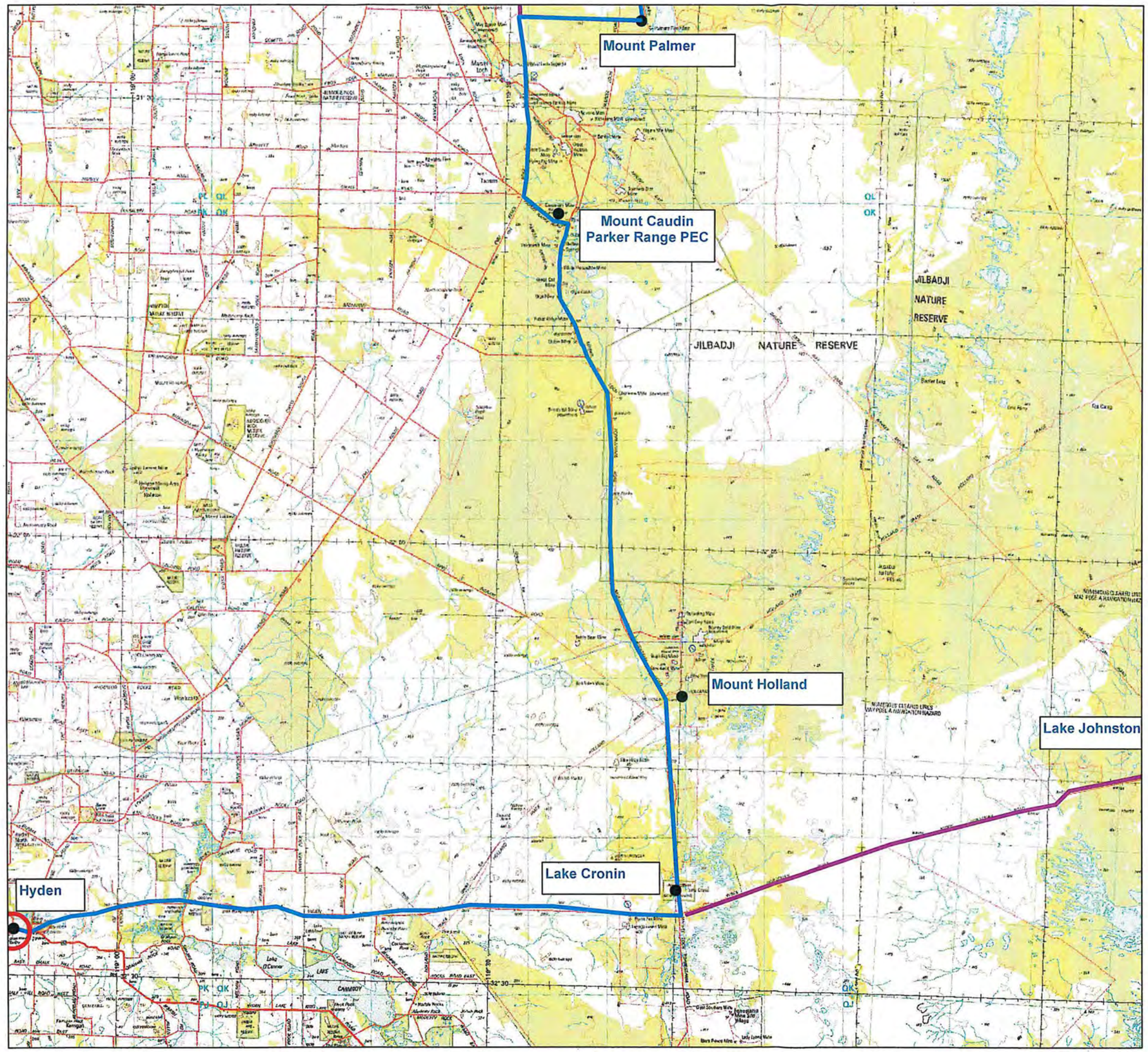
Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



Day 4
16 June 2011

By working our way through the 'greenstone belt' we'll see a landscape shaped by mining and large intense bushfires, if time permits we'll head out to Lake Johnson before ending the day at the Hyden motel.

Issues to be discussed:

1. Banded Ironstone Formations & Mining (Parker Range PEC)
2. Fire history of the Forrestania area
3. Conservation and recreation management of Lake Cronin Nature Reserve
4. Aerial prescribed burning in the GWW
5. Subject to time – travel to Lake Johnston (Esperance District)
6. Wild dog control

Motel accommodation – the costs for the evening meal & breakfast will be covered.

Please note that each person will need to settle their own room account.

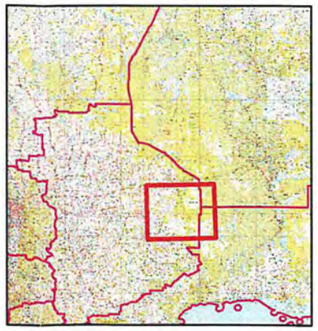
Preferred route, about 220 km

Additional trip to Lake Johnson, extral 170 km (round trip)

Fuel available

0 5 10 20 30 40
Kilometers

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



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(A3)

Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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Our environment, our future

Arid Bronze Azure Butterfly – Barbalin

The DEC Central Wheatbelt District is home to the Critically Endangered (IUCN) Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*). This Butterfly which had not been seen for close to 15 years was rediscovered in the Wheatbelt in 2008. The Wheatbelt population is the only known active population.

The dark brown to black Butterfly with bronze / purple flushes of colour on its upper wings is endemic to WA. They are seen flying from September to May with a late summer peak. The Arid Bronze Azure Butterfly has an interesting symbiotic relationship with a Sugar Ant spp (*Camponotus* spp). The ants and the Butterfly larvae benefit from living together. The female Butterfly will seek out a Sugar Ant nest to lay her eggs. The larvae receive protection from the ants against predators and the Ants are rewarded with sugary nectar produced by the larvae.

A number of collaborative partnerships have been developed with a range of stakeholders to ensure that recovery actions are scientific-based, practical and take into account local knowledge and expertise. These stakeholders include the Mukinbudin Conservation Group (a prominent central wheatbelt community group), DEC Science and the Shire of Mukinbudin. Recovery actions include surveys for new populations; regular monitoring of the only known population; promoting awareness amongst the community (media releases, have you seen this species flyers, posters etc; and further research into habitat preferences and the relationship between the Sugar Ant, the Butterfly larvae a Leaf Hopper (*Pogonoscopus myrmex*), all which occur together in a single sugar ant nest.

Figure 1: Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*)

Figure 2: Known Arid Bronze Azure Butterfly habitat in the Shire of Mukinbudin (Photo David Jolliffe).
Not much is currently known on the habitat preferences of this species but they do appear to favour disturbed Areas that contain smooth-barked Eucalyptus spp such as *Eucalyptus salubris* (Gimlet) and Sugar Ants nests are present.

Mygalomorph species diversity in the Wheatbelt:

Four threatened and poorly known Trapdoor Spiders (Mygalomorphs) occur in the Central Wheatbelt District (CWD). Mygalomorphs, commonly known as "Trapdoor" or "Funnel-web" spiders, are primarily terrestrial burrowing which occasionally may make turbular silk nests. Two of these spiders, the Minnivale Trapdoor Spider (*Teyl* spp & IUCN Critically Endangered) and the Yorkrakine Trapdoor Spider (*Kwonkan eboracum* & IUCN Critically Endangered) are endemic to this district and occur nowhere else. These short range endemic species are characterized by their sedentary lifestyle, poor dispersal ability (low mobility) and long life cycle. The Shield-backed Trapdoor Spider (*Idiosoma nigrum* IUCN Vulnerable), and the Tree-Stem Trapdoor Spider (*Aganippe castellum* Priority 4) are more widespread and not restricted to the Wheatbelt.

Conservation recovery work undertaken under the Commonwealth-funded "Back from the Edge" project (2006-2009), in partnership with external stakeholders, resulted in the discovery of a number of new Tree-Stem and Shield-Backed Trapdoor Spiders in the CWD. In addition, a conservation plan was drafted for each of the four Trapdoor Spider species under the "Back from Edge" project. The outcomes of these surveys contributed towards the Tree-Stem Trapdoor Spider being down listed from IUCN Endangered to Priority 4 listed fauna in 2010. Unfortunately surveys have not been able to locate additional populations for the Yorkrakine and Minnivale Trapdoor Spiders. These two species are a very high priority for the CWD, and continuous efforts are being made to improve our knowledge of their ecology and biology and distribution.

The Durrokoppin Nature Reserve near Kellerberrin is home to a significant community of 23 species of Trapdoor spider which includes relic and more "modern" Mygalomorph Trapdoor spider species. This community was discovered by Professor Barbara York-Maine in 1996 who grew up in Kellerberrin. A Conservation Plan to manage and protect this Mygalomorph community from threatening processes, was drafted under the Commonwealth-funded Back from the Edge

Figure 1: Female Tree-stem trapdoor spider (*Aganippe castellum*). P4
(Photo: Monica Russell)

Figure 2: Photograph of Shield-Backed Trapdoor Spider (*Idiosoma nigrum).* Vul
(Photograph: Barbara York Main)

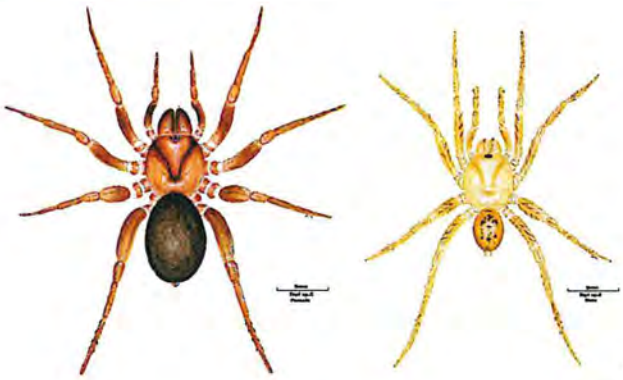


Figure 3: Illustration of a female (left) and a male (right) CR
Minnivale Trapdoor Spider *Teyl* spp (*Brad Durrant*)

Figure 4: Yorkrakine Trapdoor Spider (*Kwonkan eboracum*). CR
(Photo: *Barbara York Main*)

Issue: Emergency recovery action for threatened black-flanked rock wallaby populations.

Background:

- The black-flanked rock wallaby (*Petrogale lateralis lateralis)* is a threatened species found on two Western Australian islands, three isolated mainland populations at Cape Range and Calvert Range and seven wheatbelt sites. Most of the wheatbelt sites are small reserves with small populations. The two largest populations are at Nangeen Hill and Mount Caroline nature reserves which have held over 112 and over 300 animals respectively.
- The Nangeen Hill and Mount Caroline populations have been critical in providing animals to establish new populations through translocations into the Avon Valley [Walyunga National Park, Avon Valley National Park and Paruna Sanctuary (Australian Wildlife Conservancy)] and in Cape Le Grande National Park under the 'Western Shield' program.
- Black-flanked rock wallabies are an iconic species in the wheatbelt with significant community interest in their survival and management. The Department of Environment and Conservation (DEC) has actively engaged the local community, universities and other conservation groups through a range of research, monitoring and management operations.
- In October 2010 DEC personnel, the World Wide Fund for Nature and researchers became concerned that the poor season in the wheatbelt could have an adverse impact on the wallabies. A November 2010 assessment of the Nangeen Hill population determined that the animals were in reasonable condition, however, concerns remained that the population may be in decline. A further comprehensive survey of this population occurred in April 2011 which showed that the condition of the animals had deteriorated and the numbers had decreased significantly, with only 14 animals present, compared to 112 animals in 2007.
- DEC is concerned that this decline in Nangeen Hill may continue and the population will be lost. An assessment of the Mount Caroline population has recently been completed and found that 72 animals were present compared to 183 in 2009.

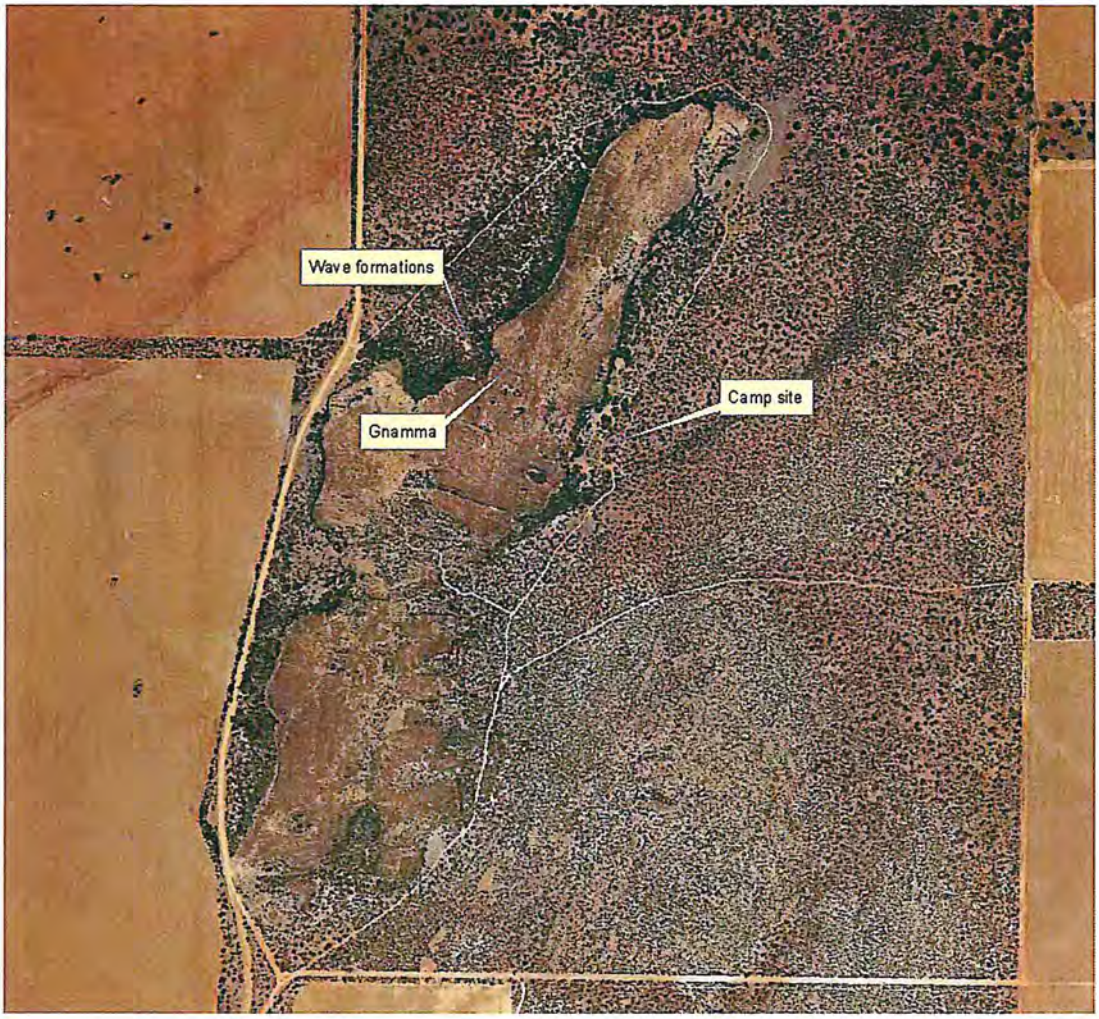
Current situation:

- The exact cause of the decline is not known. Predation by foxes, the poor seasons, weed invasion and weed toxicity are among the causes being considered.
- DEC has responded to the population declines in Nangeen Hill and Mount Caroline by:
  - increasing the frequency of fox baiting from four weekly to fortnightly;
  - providing supplementary food and water; and
  - engaging researchers and conservation groups to determine the condition of other populations and potential causes for this decline.

Elachbutting

Elachbutting Rock is a spectacular natural rock formation with similar features to Wave Rock. The rock has a number of large cavern areas and is surrounded by natural bushland.

The name Elachbutting is thought to mean "that large thing standing" which is quite feasible as the large granite rock formation is a prominent landmark standing out from the surrounding countryside.



Sandalwood within Central Wheatbelt District

Introduction

The Central Wheatbelt District has a large contingent of sandalwood licensees that require annual inspection prior to recommendations being made as to suitable quantities.

Background

In 2010 the responsibility of inspecting private properties for quantity and suitability of sandalwood removal was passed on from Nature Protection Branch to regions. Owing to the unscrupulous nature of the industry, 2 wildlife officers are ideally allocated the task of conducting inspections for corroboration.

Summary: 2010-2011 Works Program

In 2010-2011 season there were 15 licensees requesting inspections of over 140 properties within CWD and GSD. The inspections were carried out over 3 weeks and the recommendations forwarded to NPB in a timely manner for endorsement.

Of the large number of properties nominated only about 40 were inspected, as they extend over the entire Wheatbelt. From this the recommendations were then forwarded to NPB for endorsement.

Challenges and Successes

Prior to commencing the inspections regional wildlife officers were required to train each other in conducting sandalwood inspections.

Given that only 1 wildlife officer is currently available in 2011 for the upcoming season other staff have been required to participate which provides opportunities for learning.

According to the licensees the 2010 inspections were conducted more thoroughly and accurately than in the past. Staff took written notes and GPS coordinates of trees so that historical data is preserved, and the process is accountable.

Prior to 2010 inspections were often abbreviated and in some cases done by desk top. CWD has reviewed the inspection process and instigated a sandalwood workshop to address uncertainties in the processes. The intention is to 'fine tune' the process to become more accountable, and attempt to manage sandalwood better as a species.

The workshop is likely to include all staff across the state responsible for sandalwood inspections.

Chris Phoebe ~ District Wildlife Officer

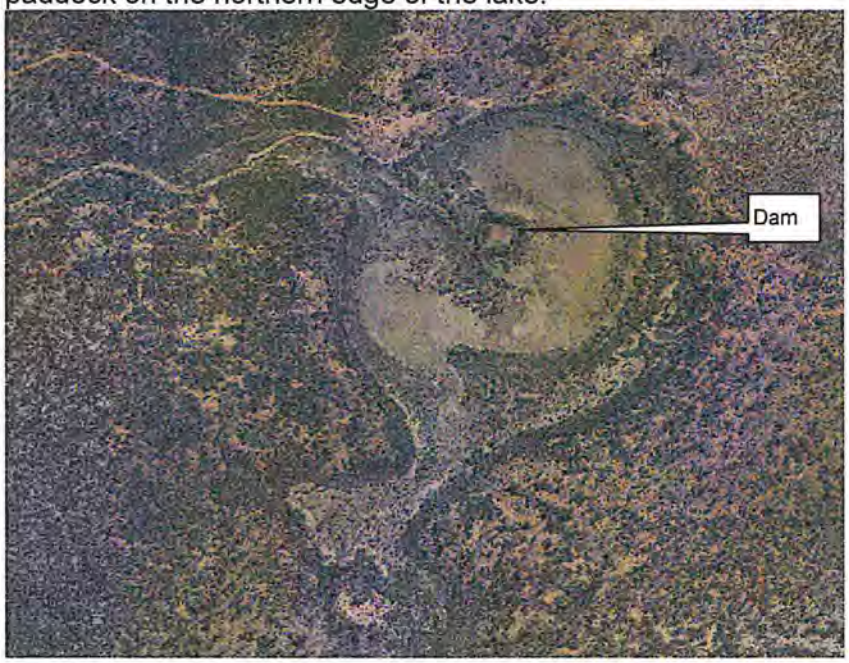
Mount Palmer was a town founded in 1934 after the discovery of gold in the area. The Mount Palmer Gold Mine operated from 1934 to 1944, when it closed due to labour shortages cause by World War II. The town's existence was entirely dependent on the mine such that when the mine closed, the town was abandoned soon after.

The first 43 town blocks were auctioned in the Southern Cross courthouse raising £3969, with a further 24 block auction after surveyors had reserved areas for public amenities. At its peak, the population of Mt Palmer was estimated to have exceeded 500. The town had three hotels, two-up rings, a bakery, butcher and two boarding houses.

Lake Cronin

Despite a relatively dry climate with variable rainfall, the Lake Cronin Region (LCR) has diverse vegetation patterns which are regulated by geology and a long history of erosion in an ancient landscape (Newbey and Hnatiuk 1988, Beard 1990). Lake Cronin is a seasonal freshwater lake filling, on average, only once every ten years or so. A delicate balance between runoff, evaporation and leakage maintains the fresh water conditions of the lake which is in contrast to other lakes in the region that are either naturally brackish or saline when they contain water.

The ill-fated '3500 farm scheme' began in the early 1920s. Clearing of vegetation between Southern Cross and Salmon Gums commenced including plots around the Lake Cronin area. Horse and carts were used to construct a dam to hold the water in for the town's water supply. The hard labour was in vain, the water was not permanent. Dry years and the Depression forced the agricultural enterprise to fail and the scheme collapsed in 1929. All that is left is the remains of the dam wall here at Lake Cronin and the camp nearby with rusting petrol tins and the old horse paddock on the northern edge of the lake.



On top of greenstone rock, the lake becomes a temporary refuge for nomadic waterfowl such as the Hoary-headed grebe (*Poliocephalus poliocephalus*), Pink-eared duck (*Malacorhynchus membranaceus*), Red-necked avocet (*Recurvirostra novaehollandiae*) and Grey teal (*Anas gracilis*). The numbers of freckled duck (*Stictoneta naevosa*) breeding in melaleuca swamps can fluctuate significantly when conditions are suitable here.

During the drying phase, small pools are left behind which are used by local frogs such as the false western froglet (*Crinia pseudinsignifera*). When dry the lakebed becomes a herbland dominated by goodenia and native licorice. Over 20 species of jewel beetles are found in the Lake Cronin area, many which feed on the melaleuca when they are flowering. Four species of bats use the melaleuca areas for foraging and roosting.

The LCR supports extensive shrubland, sandplain and woodland environments, including excellent representation of a range of vegetation types that are now extensively cleared in the Wheatbelt. These areas provide very important habitats for fauna species that are now largely absent or suffering declining populations in the Wheatbelt.

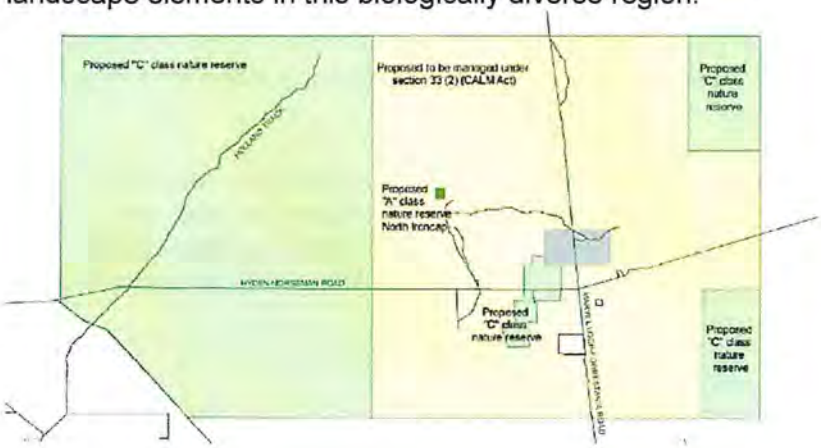
Photo Mark Brundrett

The LCR possesses significant values in terms of wetland, flora and fauna habitat, however the area also contains mineral wealth and exploration and mining leases have claim to the majority of Unallocated Crown Land (UCL) within the Coolgardie IBRA Region. The potential for large scale clearing for mineral exploration and extraction is the most significant threat in the LCR. Threats may include management issues such as the introduction of weeds and pathogens from vehicle movement and introduced materials, and hydrological changes that may occur from dewatering.

Habitats in the LCR are known to support a rich and diverse vertebrate fauna (How *et al.* 1988a and 1988b). The amphibian community is the richest known in the Eastern Goldfields which is undoubtedly related to Lake Cronin itself, which is both freshwater and semi-permanent, and its associated drainage areas. Some winterbreeding species recorded at Lake Cronin are at the inland extremes of their distribution, while summer-breeding species are close to their southern limits. The reptile fauna of the area is similarly rich and diverse with 35 species recorded during the limited surveys by How *et al.* (1988a and 1988b). The number of species actually present is likely to be far greater as the WA Museum collections (DEC 2009) includes an additional 22 species from the region around Lake Cronin. Although not fully documented, the bird assemblage in the Lake Cronin area is both rich and diverse with 90 species recorded during the surveys by How *et al.* (1988a and 1988b).

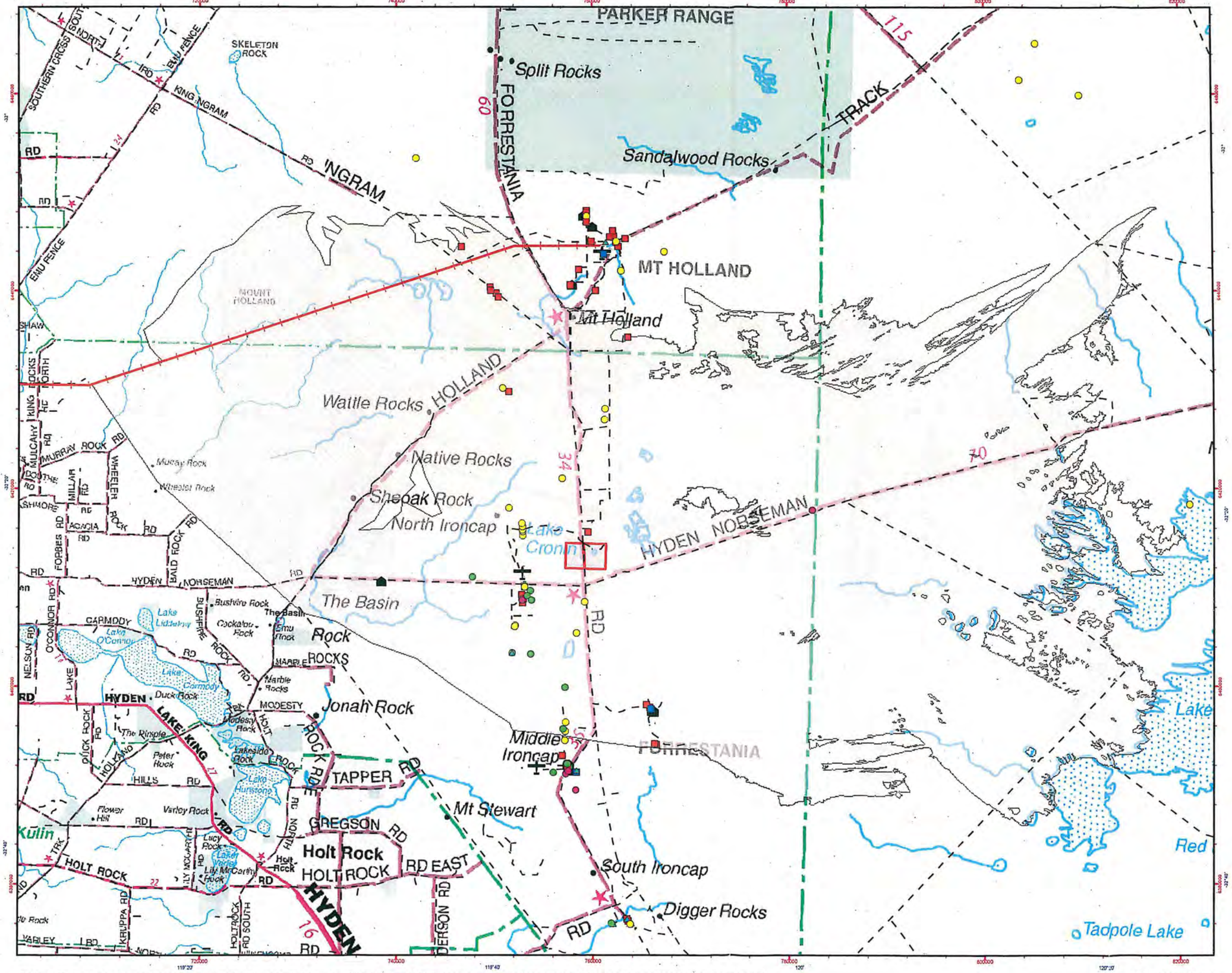
However the number of species actually present in the area is likely to be far greater as the wider regional survey outlined in How *et al.* (1988a and 1988b) included 105 species. In a species conservation sense, it is also significant that population numbers of many species in the Lake Cronin area are considerably higher than recorded in other areas in the region with the mean number of birds recorded per observation day in the Lake Cronin area being nearly double that recorded at McDermid Rock further east (How *et al.* 1988a and 1988b). The mammal assemblage in the Lake Cronin area is relatively rich with 15 species recorded (How *et al.* 1988).

Creation of nature reserves in the LCR provides an opportunity to conserve a portion of this extensive and contiguous environment representing the full catena of landscape elements in this biologically diverse region.



Lake Cronin Region

Context



Legend

- Lake Cronin NR
- Buildings
- Airfield
- Powerline

Mining Operations

- Operating
- Under Development
- Care and Maintenance
- Proposed
- Undeveloped
- Shut

1994 Fire Scar

N

1:350,000 (A3)

0 7.5 15

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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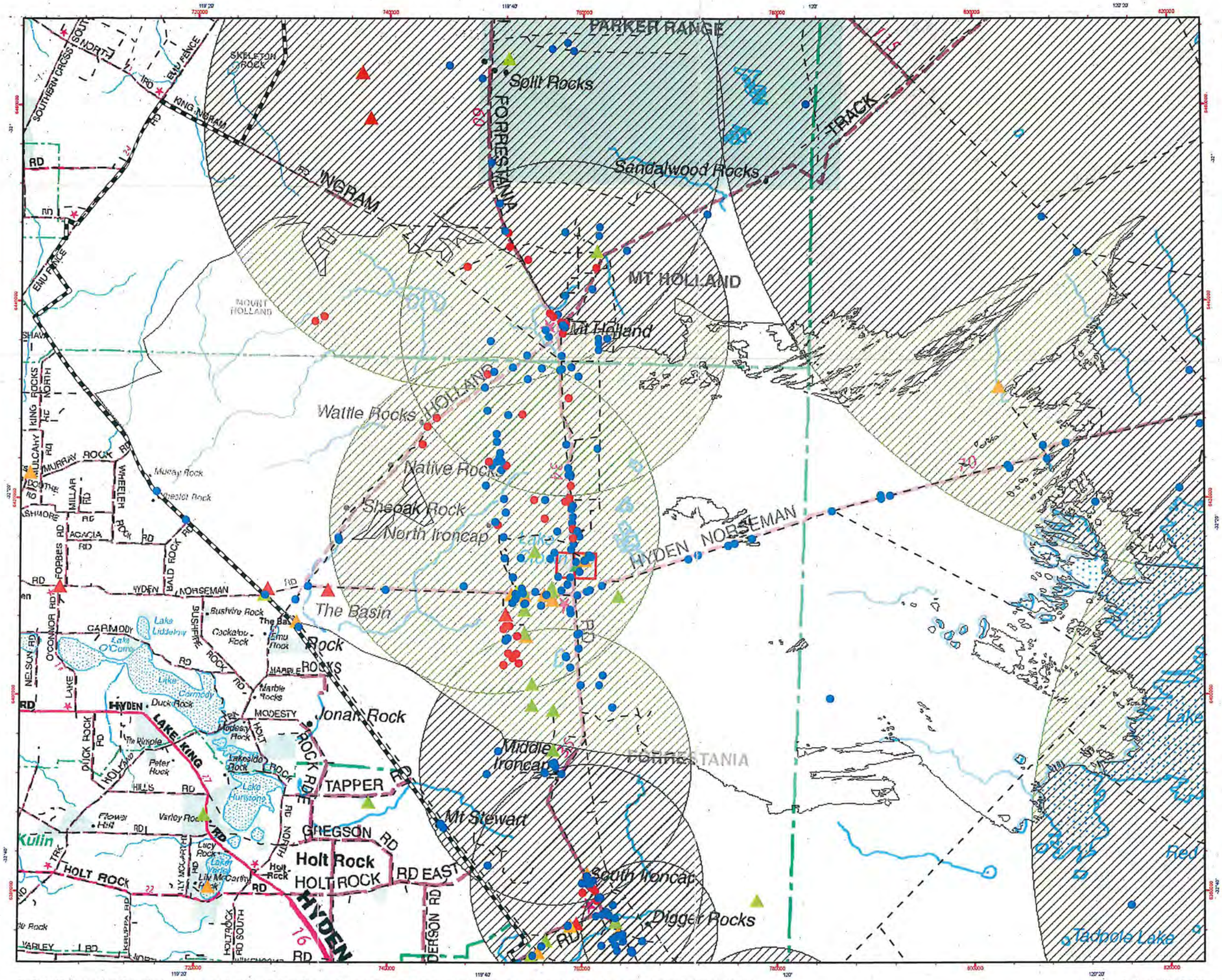
Produced on May 2, 2011

Lake Cronin Region

Biodiversity Assets



Legend

- Lake Cronin NR

DEFL

- Priority
- Rare

RARE FAUNA

- Endangered
- Vulnerable
- Priority
- Other

TECs - Buffered

- Priority
- Threatened
- 1994 Fire Scar

N

1:350,000 (A3)

0 7.5 15

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

Graticule shown at 20 minutes intervals

Grid shown at 20000 metre intervals

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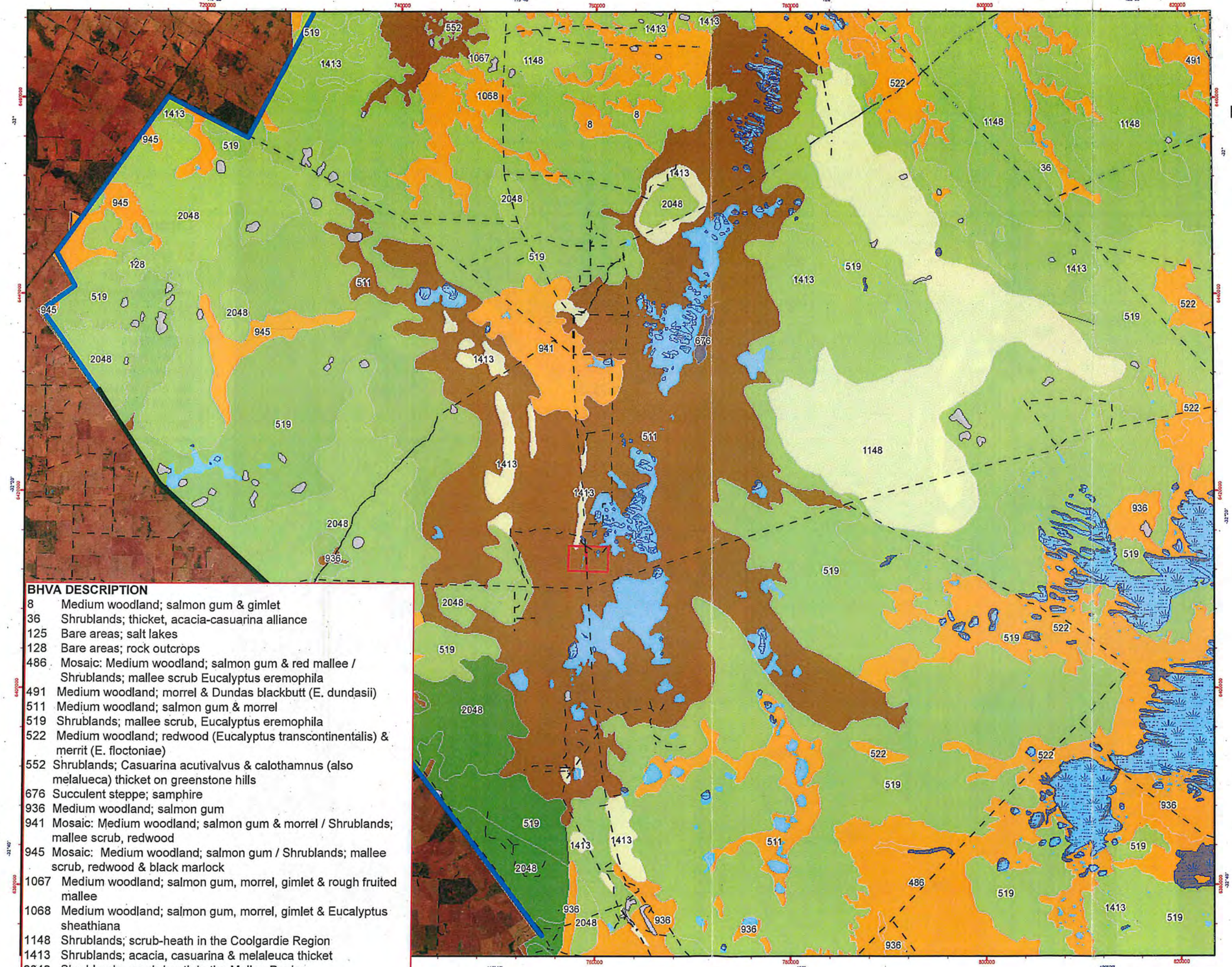
Lake Cronin Region

Vegetation Fire Fuel Classification (2)



BHVA DESCRIPTION

8	Medium woodland; salmon gum & gimlet
36	Shrublands; thicket, acacia-casuarina alliance
125	Bare areas; salt lakes
128	Bare areas; rock outcrops
486	Mosaic: Medium woodland; salmon gum & red mallee / Shrublands; mallee scrub Eucalyptus eremophila
491	Medium woodland; morrel & Dundas blackbutt (E. dundasii)
511	Medium woodland; salmon gum & morrel
519	Shrublands; mallee scrub, Eucalyptus eremophila
522	Medium woodland; redwood (Eucalyptus transcontinentalis) & merrit (E. floctoniae)
552	Shrublands; Casuarina acutivalvus & calothamnus (also melalueca) thicket on greenstone hills
676	Succulent steppe; samphire
936	Medium woodland; salmon gum
941	Mosaic: Medium woodland; salmon gum & morrel / Shrublands; mallee scrub, redwood
945	Mosaic: Medium woodland; salmon gum / Shrublands; mallee scrub, redwood & black marlock
1067	Medium woodland; salmon gum, morrel, gimlet & rough fruited mallee
1068	Medium woodland; salmon gum, morrel, gimlet & Eucalyptus sheathiana
1148	Shrublands; scrub-heath in the Coolgardie Region
1413	Shrublands; acacia, casuarina & melaleuca thicket
2048	Shrublands; scrub-heath in the Mallee Region

Legend

- Lake Cronin NR
- Fuel Category (2)
  - B
  - H1
  - H2
  - S1
  - S2
  - S3
  - S4
  - S5
  - W1
  - W2
  - W3
  - W4
- Scrub Rolling
  - 2003
  - To be confirmed
- BHVA Boundary
- Salt Lakes
- Rock Outcrops
- Waterbodies
- Principal Road
- Minor Road / Track
- 34 BHVA Code

N

1:350,000 (A3)

0 7.5 15

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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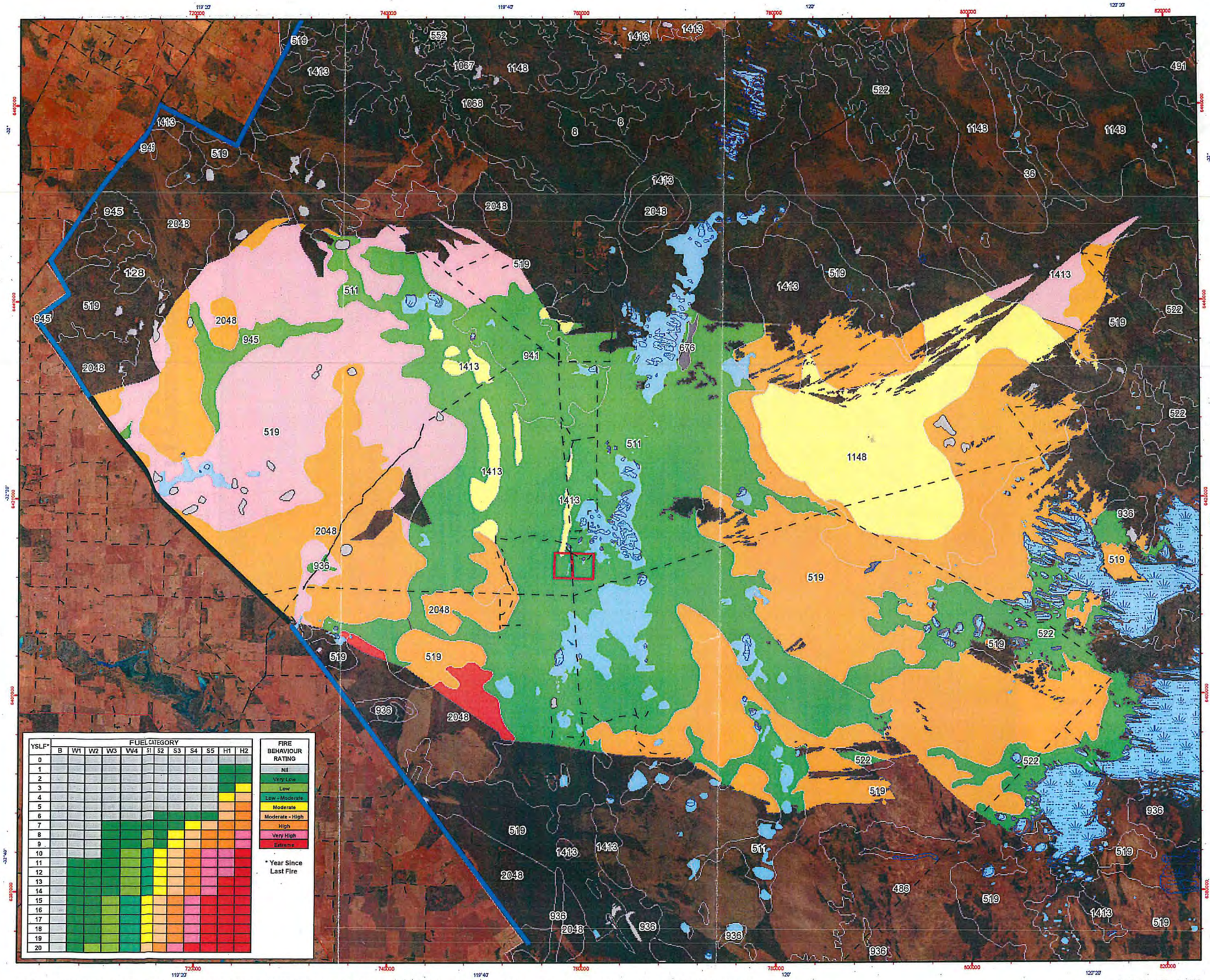
Lake Cronin Region

Vegetation Fire Fuel Classification (3)



YSLF*	B	W1	W2	W3	W4	S1	S2	S3	S4	S5	H1	H2
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

FUEL CATEGORY

FIRE BEHAVIOUR RATING
- Nil
- Very Low
- Low
- Low - Moderate
- Moderate
- Moderate - High
- High
- Very High
- Extreme

* Year Since Last Fire

Legend

- Lake Cronin NR

1994 Fire Scar

Fire Behaviour Rating
- B
- S1 (Moderate)
- S3 (High)
- S4 (Very High)
- S5 (Extreme)
- W1 (Very Low)
- W3 (Very Low)

Scrub Rolling
- 2003
- To be confirmed

34 BHVA Boundary / Code
- Salt Lakes
- Rock Outcrops
- Waterbodies
- Principal Road
- Minor Road / Track

N

1:350,000 (A3)

0 7.5 15

Kilometres

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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Day 5
17 June 2011

A lighter day is planned to conclude the trip.

Following morning tea at Tutanning Nature Reserve we'll look at the adaptive management (fire) project before finishing with a barbeque lunch and a planned departure time of 14OO hours.

Travel time to Perth is about 2 hours, Albany 3 hours.

Issues to be discussed:

1. Salinity management – Natural Diversity Recov Catchments, history of deep drainage.
2. Tutanning – Adaptive Management Project

Preferred route, about 175 km

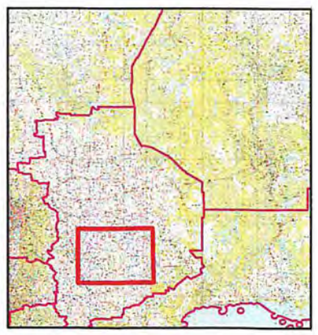
Fuel available

1:500,000 (A3)

0 5 10 20 30 40

Kilometers

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

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Triple test: recovering natural biodiversity at **Toolibin Lake** and **Lake Bryde**

Catchment management is a complex challenge facing land managers across southern Australia. Large-scale recovery actions at two natural diversity recovery catchments in the heart of the southern Wheatbelt of Western Australia are taking a multi-pronged approach to protecting biodiversity from the threats of altered hydrology, particularly rising water tables and increasing salinity.

by Greg Durell, Natalie Nicholson and Ray McKnight

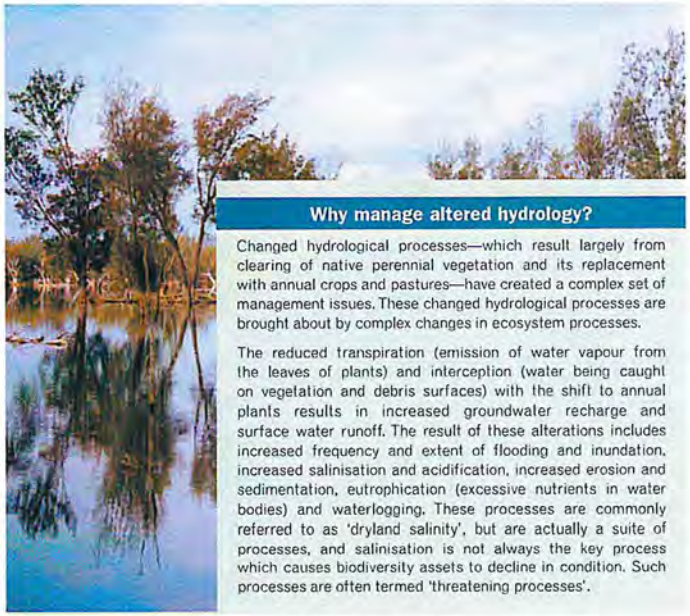
Wetland biodiversity managers in the low-medium rainfall zone of southern Australia face three main challenges. The first is a lack of knowledge about the complex interactions between natural biodiversity assets and the ecosystem processes, including altered hydrology, that will determine management success. The second is variability. Both the climate of these areas and their catchment landscapes are highly variable and often each situation requires site-specific research and actions. Finally, successful management in these variable areas requires a long-term commitment, over decades, to active management.

Recovery catchments: managing altered hydrology

Altered hydrology refers to changes in the way water is stored and moves through the landscape. Broad-scale replacement of native perennial vegetation with annual crops and pastures has significantly altered hydrology in agricultural areas, with significant impacts on natural resources.

There are various approaches to dealing with altered hydrology. These include surface water management, ground water management, the protection of remnant vegetation and revegetation. It has taken some 100 years for altered hydrology to develop to its current degraded condition in some areas; hence, it may require decades to address the issue effectively.

Western Australia is the Australian state most affected by altered hydrology. It has been estimated that about one million hectares of WA are affected by salinity and this is increasing at 14,000 hectares each year. The area with 'salinity hazard'—land at risk from salinity because groundwater is predicted to rise close to the surface—was estimated to be between 2.9 and 4.4 million hectares. While about 80 per cent of this is on cleared agricultural land, salinity also threatens important public assets such as water resources, infrastructure and biodiversity, particularly in the valley floors.



Why manage altered hydrology?

Changed hydrological processes—which result largely from clearing of native perennial vegetation and its replacement with annual crops and pastures—have created a complex set of management issues. These changed hydrological processes are brought about by complex changes in ecosystem processes.

The reduced transpiration (emission of water vapour from the leaves of plants) and interception (water being caught on vegetation and debris surfaces) with the shift to annual plants results in increased groundwater recharge and surface water runoff. The result of these alterations includes increased frequency and extent of flooding and inundation, increased salinisation and acidification, increased erosion and sedimentation, eutrophication (excessive nutrients in water bodies) and waterlogging. These processes are commonly referred to as 'dryland salinity', but are actually a suite of processes, and salinisation is not always the key process which causes biodiversity assets to decline in condition. Such processes are often termed 'threatening processes'.

A threat to biodiversity

Altered hydrology is a major threat to the biodiversity of WA. Many of the State's wetlands and streams have become salty, and more continue to become so. *A Biodiversity Survey of the Western Australian Agricultural Zone* was an important project funded through the 1996 *Western Australian Salinity Action Plan* and carried out by the Department of Environment and Conservation (DEC) and the Western Australian Museum. This work documented biota in the inland south-west agricultural zone and the extent to which it was threatened by salinity. This survey revealed that salinity has already had a significant effect on the native plants and animals of this area, particularly those in wetlands. It estimated that 450 plant species were at risk of global extinction and 400 animal species were at risk of global or regional extinction.

The Natural Diversity Recovery Catchment (NDRC) Program also arose from the Salinity Action Plan. The program targets six key catchments to ensure that critical and regionally significant natural areas, particularly wetlands, are protected in perpetuity.

The great southern NDRCs

DEC is responsible for the recovery of biodiversity in six NDRCs in the south-west of WA. Toolibin Lake NDRC and Lake Bryde NDRC fall within the Great Southern District, which forms the heart of the southern Wheatbelt.

Toolibin Lake NDRC is 20 kilometres south-east of Wickepin and Lake Bryde NDRC sits 35 kilometres south-east of Lake Grace. Both occur in broad, relatively flat valleys—Toolibin in the headwaters of the Blackwood River and Lake Bryde in the headwaters of the Avon-Swan River system. Both recovery catchments contain remnants of a once extremely rich natural landscape. They retain a significant proportion of their original values including threatened species, threatened ecological communities (TECs) and other high value biodiversity assets.

Previous page
Main Yate Swamp, a small swamp offset from Lake Bryde in Lakelands Nature Reserve in Lake Bryde Natural Diversity Recovery Catchment.
Photo – Natalie Nicholson/DEC

Insets (left to right) A waterway under construction at Toolibin; a waterway in use following a rainfall event in Toolibin NDRC; monitoring water flows at Toolibin.

Left background Water reflection on Toolibin Lake.
Photos – Sam MacWilliams/DEC

Above Taarblin Lake succumbed to altered hydrology particularly after a prolonged period of inundation in the 1950s and 1960s.
Photo – Jiri Lochman

Rich biodiversity

Lake Bryde NDRC covers an area of about 140,000 hectares. It was formally selected as a recovery catchment in July 1999 to protect a TEC as well as threatened species and important wetland and terrestrial ecosystems.

Toolibin Lake is the largest remaining area representing a habitat of which only a handful survive today: inland, fresh water wooded wetlands. This critically endangered TEC was a relatively common lake community until the threat of too-frequent inundation and salinity began to take its toll from about the 1940s.

Both areas also provide habitat for a wide range of waterbirds. Lake Bryde has up to 23 waterbird species occurring, with up to seven species breeding. Toolibin Lake is well known for its waterbird richness, with up to 41 species of waterbirds being recorded there and as many as 24 species known to breed on the lake. The rare freckled duck (*Stictonetta naevosa*) has been recorded at Toolibin Lake, Lake Bryde, East Lake Bryde and Lake Walbyring, just south of Toolibin Lake.

Toolibin Lake is listed under the Ramsar Convention as a Wetland of International Importance and is also listed on the Register of the National Estate. Lake Bryde and East Lake Bryde are listed on the Directory of Important Wetlands at a State and Commonwealth level, hence they are considered to be of local, national and international significance.

The first main phase of agricultural development at Toolibin occurred in the period 1900-1910, whereas at Lake Bryde clearing began in earnest much later, during the mid-1960s. This means that while the threats are similar at the two systems, at Lake Toolibin the altered hydrology is in a later, more advanced state.

Recovery actions

The primary aim of recovery catchments is to protect their biodiversity from threatening processes brought about by altered hydrology. To achieve this, long-term monitoring and research is required to determine the optimal management strategies. Various techniques are being applied to tackle threats, including water diversion, upper catchment management, the creation of waterways and the pumping of saline groundwater.

Groundwater pumping

Several threatening processes affect Toolibin Lake's health and condition, particularly excess groundwater. A groundwater pumping program began at Toolibin Lake in earnest in 1997 when six air displacement pumps were added to a trial pump already present on the lake floor. This system pumps an average of 230,000 litres of saline groundwater a day from beneath the lake. This water

Top left background The pink-eared duck feeds in the shallow waters of the catchments.
Photo – Jiri Lochman

Top Constructing a waterway in Lake Bryde NDRC.
Photo – Natalie Nicholson/DEC

Above Water inflows at Toolibin NDRC.
Photo – Lance Mudgway/DEC

is transferred by a pipeline to Taarblin Lake, a large lake that has unfortunately succumbed to salinity. One result of continued pumping is that in some areas vegetation is recovering.

Waterways

Major projects to manage surface water runoff are being implemented in each catchment. The main component of this is the installation of shallow waterways in the valley floors. The aim of these waterways is to relieve the immediate impacts of minor flooding on native vegetation. The waterway acts as a surface water conveyance through the valley floor to enable the typical smaller, annual water flows to pass through without causing ponding or waterlogging, preventing additional groundwater recharge and salinisation. Increasing surface flows is one of the outcomes from clearing native vegetation.

The waterways are 300 to 400 millimetres deep and up to 30 metres wide. These structures are designed to accommodate the water generated from an average runoff event (from a one-in-three year rainfall event). In a large flood event (a one-in-25 year rainfall event), water volumes far exceed what the waterway is designed to handle and the fresh water will spill out into the surrounding vegetation as would normally occur. However, after flooding the waterway helps water levels recede more quickly, by accelerating water drainage to the disposal sites.

At Lake Bryde NDRC, 12 kilometres of a proposed 20-kilometre waterway is constructed, and design and construction of the remainder is underway. The waterways in both catchments will also reduce the impacts of waterlogging on farmland and help protect the system of local roads.

Funding for the work on the two recovery catchments comes from a range of organisations including the State Government and the Australian Government's Natural Heritage Trust program through the South West Catchment Council and Wheatbelt Natural Resource Management (formerly the Avon Catchment Council). Construction work on stage four of the valley floor waterway began in 2007 and was completed in 2009. Design for construction of the final stages will occur in 2010.

Other solutions

In addition to waterways, other surface water management techniques are required for upper catchment water management. This can include the construction of water storage dams higher in the catchment and graded contour banks to control flows from agricultural land into remnant vegetation and valley floors.

Improving the condition of existing vegetation remnants in reserves and on private property is also important, along with revegetation with perennial vegetation on both public and agricultural lands. Revegetation work usually has direct biodiversity conservation benefits and in some cases potential commercial applications. For example, providing incentives for landowners to plant oil mallees will contribute to a resource base that may lead to a biofuels industry.

Working in partnership

Many operations in recovery catchments, such as waterways and revegetation, involve work on private land. Effective partnerships with landholders are essential to achieving management success in recovery catchments. Their support, and that of a number of government agencies and other institutions, is integral to the overall success of these large-scale catchment projects.

Integrating a wide range of management actions with a variety of partners is a challenging but rewarding process. Funding for this work also presents difficulties due to the large scale of projects, long time frames and high cost of engineering and earth moving.

Left A groundwater pump at Toolibin Lake.
Photo – Marie Lochman

Below Declared rare flora *Muehlenbeckia horrida* subsp. *abdita*.
Photo – DEC

The future

Large-scale recovery actions are making a difference to managing the altered hydrology in recovery catchments. At Toolibin Lake and Lake Bryde, a complex set of actions are aimed at ensuring the long-term protection of the wetlands and their surrounding nature reserves. There is no quick or easy solution: managing altered hydrology will only be successful where an integrated package of recovery actions is implemented over decades.

Although the main objective of these two recovery catchments is to conserve the unique plants and animals that occur there, there are added benefits in protecting these areas. The development of new initiatives that work towards sustainable agricultural practices will also help enhance production in the catchments over the coming years. Both these projects offer a unique opportunity to develop new ideas to solve problems using a range of biological, engineering and agricultural solutions. Through the work being done at Toolibin Lake and Lake Bryde, as well as at the other four natural diversity recovery catchments, WA will continue to be a model for conservation and sustainable land use now and into the future.

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Ray McKnight is the recovery catchment officer for the Toolibin Lake Natural Diversity Recovery Catchment. He can be contacted on (08) 9881 9206 or by email (raymond.mcknight@dec.wa.gov.au).

TARIN ROCK ECOSCAPE

Ecoscapes seek to capture areas where (a) substantial amount of native vegetation remains and (b) areas where our biological heritage is richest. An analysis by Terry Walshe provided a systematic method of selecting large areas that had the greatest remaining natural biodiversity (Walshe, 2006).

The Tarin Rock Ecoscape is located in the south-eastern wheatbelt of Western Australia, approximately 308 km south-east of Perth. The majority of the Ecoscape is situated in northeast of the Dumbleyung Shire while a small part (6%) of the north-west corner lies in the Shire of Kulin. Kukerin townsite is included in the south-west corner of the Ecoscape. Roads were chosen to define the project area's boundaries.

The Tarin Rock Ecoscape straddles the Avon and Blackwood catchment divide, with almost half the Ecoscape located in each catchment. This landscape position means it has an elevated position in the landscape compare to neighbouring catchments. The Tarin Rock Ecoscape is located in the Western Mallee, one of the 53 biogeographical sub-regions of Western Australia. Within this sub-region, 5-10% of the area is in the conservation reserve system, yet it contains a very high number of endemic flora species (Beecham and Danks,2001).

The Tarin Rock Ecoscape consists of 44 812 hectares of which 9839 hectares (22%) is native vegetation. The management of 6255 hectares (64% of the total area) of the native vegetation in the Tarin Rock Ecoscape is vested with the State Government as Crown Reserves.

The aspirational goal of the Ecoscapes project is

"For the next 20 years, maintain the 2008 richness, distribution, abundance and condition of biodiversity assets threatened by the lack of ecological resources within the Tarin Rock Ecoscape."

Biodiversity Assets of the Tarin Rock Ecoscape

Flora

There is a very diverse flora within the Tarin Rock Ecoscape. While recent vegetation surveys did not record all species present, they still recorded significant numbers of taxa. The 2003 vegetation survey only recorded up to the three dominant species in each strata at each site, but this still resulted in 163 taxa being recorded in the smaller remnants of the Ecoscape as 687 records in 99 quadrats (Ecoscape, 2003). Previously 158 taxa were recorded at 15 quadrants in a survey of the larger remnants (Woodman, 2002).

Declared rare and priority flora

There are 54 locations of threatened flora within the Tarin Rock Ecoscape. Three species (*Acacia depressa, Calectasia pignattiana and Conostylis rogeri*) have been declared as rare flora (DRF) under the Wildlife Conservation Act (1950).

Thirty seven species of flora within the Tarin Rock Ecoscape are listed on DEC's Priority List (DEC corporate data, Katanning DRF data).

Thirteen previously recorded priority flora sites in the Tarin Rock Ecoscape were resurveyed by Anne Rick, a Consultant Botanist in October 2005. Populations at 8 of the priority flora sites were found and resurveyed. Four new populations of priority flora; *Jacksonia debilis*, *Microcorys lenticularis*, *Dryandra meganotia* and *Baeckea sp* Hyden were found during this survey. Three new populations *of Dryandra fasciculata* were also found at three sites.

Mammals

Fifteen native mammal species have been recorded in the Tarin Rock Ecoscape.

Most of the listed mammal species were last recorded in the Western Australian Museum's 1971 fauna survey (Muir, 1976) and have not been sighted since. Therefore it is likely that several mammal species may now be extinct from the Tarin Rock Ecoscape or vulnerable to extinction.

Mammal species found in the Tarin Rock Ecoscape and are not common in other Wheatbelt areas include the Ash Grey Mouse (*Pseudomys albocinereus*), Red-tailed phascogale (*Phasgogale calura*), Common Dunnart (*Sminthopsis murina)* and Honey Possum (*Tarsipes spencerae*). Other mammal species that are regularly sighted in the Tarin Rock Ecoscape include the Western Grey Kangaroo (*Macropus fuglinosus*), Fat-tailed Dunnart (*Smithopsis crassicaudata*) and Echidna (*Tachyglossus aculeatus*).

Reptiles

The number of reptile species recorded in the Tarin Rock and North Tarin Rock Reserves are 23 and 19 respectively (Kitchener *et al.*, 1976). The full reptile species list for the Tarin Rock Ecoscape is included in Table 7. One species, *Tiliquia occipitalis* (blue tongued lizard) is considered vulnerable and at risk in the central Wheatbelt if no management actions are undertaken (Lambeck, 1999).

Frogs

Six species of frogs have been recorded in the Tarin Rock Ecoscape. Five of these species (*Heleioporus albopunctatus, Myobatrachus gouldii, Limnodynastes dorsalis, Pseudophryne guentheri* and *Neobatrachus kunapalari*) are considered to be vulnerable and potentially at risk in the central Wheatbelt (Lambeck, 1999).

Birds

One hundred and four different bird species have been recorded in the Tarin Rock Ecoscape. A total of 58 species of birds were recorded for the Tarin Rock Ecoscape in a survey carried out on DEC Reserves in October 2002. In previous opportunistic recordings, 94 species have been sighted on DEC Reserves within the area (DEC, unpublished).

Thirteen of the bird species recorded during the 2002 survey have rare or extinct status in the Wheatbelt (Saunders and Curry, 1990). Five of these species, along with the mallee fowl and bush stone curlew, were given vulnerable status for the Tarin Rock Ecoscape and their presence suggests that the Tarin Rock Ecoscape is a significant refuge for birds in the southern Wheatbelt.

Seven of the bird species recorded during the 2002 survey are considered vulnerable in the Wheatbelt due to loss and isolation of habitat. These species are the Blue Breasted Fairy-wren, Chestnut Rumped Thornbill, Golden Whistler, Grey Shrike Thrush, Painted Buttonquail, Shy Hylacola and Western Yellow Robin (Saunders and Curry, 1990). It is interesting that four out of the five most commonly occurring species in the 2002 survey of the area are considered focal species by previous researchers (Lambeck, 1999). These species are the Blue Breasted Fairy Wren, Inland Thornbill and Southern Scrub-robin for heath/ shrub/ mallee habitat and the Grey Currawong for woodland habitats.