DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

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The Newsletter of the Western Australian Threatened Species & Communities Unit

Critically Endangered ecological communities of the Swan Coastal Plain ~ John Blyth

Inside this Issue:

"Since around 1976 the water level at the top of the Gnangara Mound has dropped by about 5.0 metres"

The long period of below-average rainfall, from about 1970 and continuing, poses a major threat to Western Australia's biological diversity, particularly in association with human use of water. In most cases it is not presently possible to clarify whether low rainfall or human factors are the most important threat to the various elements of biological diversity. However, the species and ecological communities currently under threat have been present over very long periods during which dryer spells more severe than at present have occurred. It is therefore logical and prudent to assume that human use is a driving force in most threatening processes currently operating.

Since around 1976 the water level at the top of the Gnangara Mound has dropped by about 5.0 metres. The reason for this decline of water levels in the Gnangara Mound is thought to be a combination of a long period of below average rainfall, water abstraction for public and private use, and water-use greater than that of the original Banksia woodland by extensive pine plantations. There is still considerable uncertainty about the relative contribution of the three factors, and of how each of them influences the various wetlands and other ecosystems influenced by the Gnangara Mound. The Water and Rivers Commission and the Water Authority are conducting monitoring, analysis and modeling projects to help to clarify those contributions.

There are three Critically Endangered and one Endangered ecological communities on the Swan Coastal Plain wholly or partly maintained by the waters of the Gnangara Mound. These are the Yanchep Caves root mat community, the Muchea organic mound-springs community, the Perth to Gingin ironstone association and the Muchea limestone community.

The organic mound springs community, containing endemic species of invertebrates, is little behind the Yanchep root mat community (discussed below) in degree of threat. Both communities are totally dependent on Gnangara Mound water. One out of three occurrences of the organic mound-springs community has recently dried out.

The last two of these, the ironstone and limestone communities are Critically Endangered and Endangered respectively. They both depend on seasonal inundation, but the balance between surface water and groundwater in maintaining each of them is unclear. Continuing decline of rainfall is likely to put them under additional stress.

The root mat community, known from six or seven caves in the Yanchep National Park,

Yanchep Caves Photo: Val English

and dependent on waters of the Gnangara Mound, is probably the most threatened ecological community in Western Australia. The cave streams supporting the root mat community have all declined greatly in the last few years, with all but one of them now ceasing to flow every summer.

The root mat caves and Crystal Cave at Yanchep originally supported about 100 species of invertebrates. At least 30 of them were new to science and are still undescribed, and at least seven of these are Gondwanan forms and known from one cave only. Most of the thirty undescribed species are probably restricted to the Yanchep Caves system within and around Yanchep National Park. This is the most diverse fauna of any dark cave system known in the world.

A number of the species in the Yanchep caves, including the Gondwanan species, are unable to survive drying out of their habitat. Further, the root mats themselves, on which the fauna is dependent, die if dried out for long. For several years the Department has been artificially maintaining water in cave pools containing the root mat community throughout the summer.

The department has recently committed new resources to investigate and implement more robust systems that can maintain flowing water through cave pools and can be easily monitored to determine their health.

Very recently, Lex Bastian of the Western Australian Speliological Group and Paul Tholen a Ranger at Yanchep, examined an unnamed cave with two separate ponds of clear water and tree roots entering the cave. Although the two pools show evidence of having dropped in water level from about 1.2 metre to 0.5 metres the pools still appear to be in healthy condition. A significant number of animals of at least two species were seen and the cave and pools may extend beyond the area inspected. This is a promising sign that there may be other caves, perhaps inaccessible to people, that still support species of the root mat community. Such areas could act as sources of animals to recolonise caves that have dried out once the streams start flowing again.

The management of these priceless biodiversity assets, along with the management of the water resource itself, is extremely complex. The Department has recently appointed a consultant hydrologist, Dr Adrian Peck, to help analyse data and recommend management actions to help conserve these and other biodiversity values dependent on the Gnangara Mound.

The tasks with which Adrian Peck will deal largely relate to clarifying issues affecting the Yanchep caves, especially:

- liaising with scientists and agencies to assemble and interpret information on monitoring results and other appropriate data, including palaeoclimate and historical data on water levels in caves 1880 to 1920;
- interpreting, in relation to the Yanchep caves and other threatened aquatic systems, modeling and analysis for the Gnangara Mound conducted by Water and Rivers Commission and Water Corporation;
- clarifying the influence of loss of hydrostatic head (versus reduction in local water level) resulting from reduced height of water in the mound as a factor in loss of flow in Yanchep caves;
- clarifying whether, and how it might work, a 'thresh-hold effect' has operated to cause the comparatively rapid loss of water to Yanchep cave streams;
- helping to arrange and manage an expert forum to address the issue of managing the Gnangara Mound to minimise impacts on biological diversity;
- helping to prepare popular and scientific proceedings from the forum for publication;
- helping to draft Departmental submissions in relation to management of the Gnangara Mound.

For further information please contact John on 08 9405 5161 or email: johnb@calm.wa.gov.au

Improvements in conservation of threatened flora and communities ~ Val English

Through their links with local communities and through their own efforts, Conservation Officers have been responsible for relocating several presumed extinct flora including the Cranbrook pea (Nemcia lehmannii) and thick-margined leucopogon (Leucopogon marginatus). However, until recently these Officers have been employed on short-term contracts funded from the Department of Conservation and Land Management's (the Department's) annual budget, the Commonwealth's Natural Heritage Trust, the State Salinity Strategy and income from bio-prospecting.

Environment and Heritage Minister Dr Judy Edwards has approved the permanency of positions of Conservation Officers at eight of the Department's work centres from Geraldton to Esperance. The Officers are located at Geraldton, Jurien, Merredin, Narrogin, Katanning, Albany, Esperance and in the Department's Swan Coastal District.

The Officers are crucial to the Department's conservation efforts for threatened flora and threatened ecological communities (TECs) in regional centres. They are the cornerstone of many activities that involve the local community in conservation activities. Some of the activities they are involved in include

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SOUTH COAST THREATENED INVERTEBRATES GROUP ~ Sarah Comer

Members of the South Coast Threatened Invertebrates Group at the June 2002 meeting: L-R Alan Danks, Nicky Marlow, John Blyth, Sarah Barrett, Karlene Bain, Sandra Gilfillan, Roger Hearn (the Department) and Barbara York-Main (University of Western Australia) and Mark Harvey (West Australian Museum) Photo: Sarah Comer

Continued from page 2

fencing threatened flora and TECs, controlling weeds that impact threatened flora and ecological communities, translocating threatened flora to more suitable sites, monitoring known populations and surveying for new populations of threatened flora. Actions such as these are essential in preventing extinctions of threatened flora and TECs in this State.

Many of the threatened species and ecological communities in the south west of the state occur on privately owned land and other lands that are not held in conservation reserves. The full-time Conservation Officer positions will help ensure continuity of access to the knowledge and skills needed to implement conservation programs for threatened flora and communities on private land. This continuity is of particularly important for work with local community groups and landowners. The positions will also provide greater employment security and stability for the conservation officers.

For further information please contact Val on 08 9405 5169 or email: vale@calm.wa.gov.au

Invertebrates are often overlooked when people think of threatened fauna, even though they are some of the most exciting and unusual animals you are likely to see. On the south coast there are a high number of relictual Gondwanan species, including spiders, snails, millipedes and velvet worms, that are believed to be relicts of the Jurassic and earlier, when Africa was connected to Australia. Many of these invertebrates have very specific habitat requirements, needing long-unburnt vegetation that characteristically remains damp and humid throughout the year. Areas with these characteristics provide refugia for invertebrates that are incapable of existing in the much dryer areas across much of today's landscape.

In December 2001 the South Coast Region of the Department of Conservation and Land Management convened a meeting to discuss the formation of a South Coast Threatened Invertebrates Group. People attending included staff from the South Coast Region, the WA Museum, the University of Western Australia and the Department's Threatened Species and Communities Unit. The second meeting of this group was held in June this year. Also at the second meeting was Nicky Marlow (working on the Department's Invertebrate Conservation Strategy) and Roger Hearn (Ecologist from the Department's Warren Region).

Management issues relating to these special creatures are complicated, with exclusion of fire from their habitat one the most important factors, and identifying the critical areas of suitable habitat is essential. The Threatened Invertebrates group was successful in obtaining funding to identify and map known areas of high value for relictual invertebrates, which will enable interim management guidelines to be developed for these areas. In addition, the group aims to identify previously unsurveyed sites that may also provide refugia for relictual invertebrates. An important additional task is to raise the profile of these special creatures in the local community, and illustrated posters and stories to the local media are planned.

For further information contact Sarah Comer, of the Department's South Coast Region on (08) 9842 4513 or by email: sarahc@calm.wa.gov.au

AUSTRALIAN MAMMAL AUDIT ~ Norm McKenzie and Andrew Burbidge

Of all the reasonably well-known groups of plants and animals in Australia, mammals have been most sensitive to environmental change. As part of the National Land and Water Resources Biodiversity Audit, we recently concluded a report on the status of Australia's mammals. The report will soon be available on the Australian Natural Resources Atlas Home Page at http://audit.ea.gov.au/ANRA/atlas_home.cfm.

The objectives of the project were to:

1. *Develop a national database that shows original distribution of Australia's terrestrial mammals and their current status by Interim Bioregionalisation of Australia (IBRA) Region.*
2. *Analyse the database to reveal centres of endemism and patterns of decline.*
3. *Attempt to correlate the patterns of mammal decline with environmental changes and with attributes of the mammals concerned.*

To develop the database, we worked with colleague mammalogists in each State and the Northern Territory. Collaborators were:

Northern Territory

John Woinarski, Department of Infrastructure, Planning and Environment, PO Box 496, Palmerston, NT 0831

Queensland

Greg Gordon, Queensland Parks and Wildlife Service, PO Box 155, Brisbane Albert St, Qld 4002

New South Wales

Mike Cavanagh, New South Wales National Parks and Wildlife Service, PO Box 1967, Hurstville, NSW 2220

Victoria

Peter Menkhorst, Department of Natural Resources and Environment, PO Box 500, East Melbourne, VIC 3002

Tasmania

Raymond Brereton, Department of Primary Industries, Water & Environment, 134 Macquarie Street, GPO Box 44 HOBART 7001, Tasmania

South Australia

Tony Robinson, National Parks and Wildlife, South Australia, Department for Environment and Heritage, GPO Box 1047, Adelaide SA 5001

Western Australia

Norman McKenzie and Andrew Burbidge, Department of Conservation and Land Management, PO Box 51, Wanneroo, WA 6849, and Alexander Baynes, Western Australian Museum, Francis St, Perth WA 6000.

After agreeing on a list of 305 species of native terrestrial mammals and 26 species of exotic mammals, a status was allocated to each species for each of the 85 IBRA regions in Australia in which it occurred at European settlement. The main codes used were as follows:

P Persists in >50% of former range within Region;

D Declined in Region: a decline 50-90% of former range within Region;

SD Severe Decline: extant within Region but declined by >90% of former range within Region (range equates to 'extent of occurrence', not 'area of occupancy' (IUCN 2000));

EX Extinct in Region: when there is no reasonable doubt that the last individual has died.

We also recorded species that had naturally extended their range since settlement and species that had been translocated into regions where they did not naturally occur or where they had become extinct or had seriously declined. Once the data from each State and the Northern Territory were combined we generated maps for each species using GIS software showing presence/absence in each IBRA Region plus status. This was followed by interaction with the State coordinators to ensure maximum consistency in status allocation across jurisdictions.

The data were then analysed and compared with attributes of the mammals and the IBRA Regions.

Selected Results

- The analyses confirm that Australia's terrestrial mammal fauna is particularly susceptible to declines and extinction. Twenty-two species of mammals are extinct in Australia (excluding External Territories), with eight other species remaining only on continental islands. A further two, possibly three, species have become extinct on Christmas Island (Indian Ocean), an Australian External Territory: *Rattus macleari*, *R. nativitatis* and possibly the shrew *Crocidura attenuata*.
- Of the 305 indigenous species recognised for this study, 258 (85%) are endemic to Australia. The remaining 47 species also occur in New Guinea and/or nearby islands. Thirty of the species shared between Australia and islands to its north are bats. Taxonomic research, particularly among bats, may change these figures.
- Nine species have been successfully translocated into 12 Regions. Many additional translocations have taken place in recent years but have not been established long enough to meet our definition, which required establishment for > 10 years.
- Some of the 26 exotic species are very widespread, with *Felis catus* (Feral Cat) occurring in all 85 regions, *Mus domesticus* (House Mouse) occurring in 76 regions, and *Vulpes vulpes* (European Red Fox) occurring in 60 regions. Others are highly restricted,

eg, *Funambulus pennantii* (Five-striped Palm Squirrel) occurs only in the Perth Metropolitan area near Perth Zoo. It previously occurred in Sydney suburbs near Taronga Park Zoo. *Rattus exulans* (Polynesian Rat) (two regions) has been recorded only on islands of Australia's northern coastline, while *Mustela putorius* (Polecat; domesticated individuals are known as Ferrets) have established in four regions. Polynesian Rats and Polecats are considered by us to be at high risk of increasing their range to the detriment of the indigenous fauna.

- Map 1 displays the relative richness of Australia's regional mammal faunas as best we can re-construct them from a combination of modern, historical and recent sub-fossil specimens. The 85 data values were normally distributed. The mesic regions of north and eastern Australia had the richest faunas, while the poorest were in the cool temperate regions of Tasmania, the southwestern tip of Western Australia and some remote and sparsely-settled regions. For this last group, only localised mammal surveys have been undertaken (Gulf Plains, Desert Uplands and Mulga Lands of Queensland and Yalgoo of Western Australia, in particular).

- Some species have contracted from more than 90% of the regions that they originally occupied in Australia. Map 2 shows how many such species occur in each region, thereby indicating regions whose faunas have been susceptible to changes: the arid and semi-arid regions of Northern Territory, South and Western Australia, particularly the desert and cereal crop regions. The species that have declined most are hare- and nail-tailed wallabies, potoroids (rat kangaroos), numbat, bandicoots and large rodents (*Notomys, Leporillus*, large *Pseudomys* and *Zyzomys*). All such species had ranges centred on the continent's arid and semi-arid zone. In general, bats and small mammals (< 35 g mean adult body weight (MABW)) show little range contraction. High range contractions among species from Australia's medium to high rainfall regions were confined to *Conilurus albipes, Macropus greyi, Potorous platyops* and the Basalt Plains Mouse, all of which had geographic ranges confined to regions that are now intensively settled or virtually cleared. *Thylacinus cynocephalus* may be a special case, as it was a relatively large obvious animal that became extinct in Tasmania, an island where it was selectively hunted.

- 'New endemism'. We identified regions that still have a relatively large number of declined species (Map 3). The regions with extant populations of the greatest variety of new endemics (>5 species) are Carnarvon Basin, Avon Wheatbelt, Jarrah Forest and Esperance Plains in Western Australia, Stony Plains in South Australia, and Channel Country, which straddles the South Australia – Queensland border. Ignoring translocations, some 'new endemic' species rely entirely on a single region for their persistence. These are:

1. Carnarvon Basin (Western Australia): *Lagostrophus fasciatus, Lagorchestes hirsutus, Bettongia lesueur*, *Perameles bougainville* and *Pseudomys fieldi* (Barrow, Bernier and Dorre Islands);

2. Jarrah Forest (Western Australia): *Potorous gilbertii* and *Myrmecobius fasciatus*;

3. The Gulf Coastal Plain (Northern Territory): *Pseudantechinus mimulus* (Pellew Islands);

4. MacDonnell Ranges (Northern Territory): *Zyzomys peduncula*tus;

5. Eyre-Yorke Block (South Australia): *Leporillus conditor* (Franklin Island).

6. Brigalow Belt North (Queensland): *Lasiorhinus krefftii* and *Onychogalea fraenata*

7. Wet Tropics (Queensland): *Bettongia tropica*.

- We calculated a Faunal Attrition Index (FAI) for each region. A very high value means most species are extinct or have declined in the Region. FAI was used as a basis for comparing status of regional mammal faunas and relating the level of decline/extinction to regional attributes (changes to regional environments since European settlement and average annual rainfall as an approximate surrogate of 'productivity'). Map 4 shows the pattern of FAI for Australia as a whole. It resembles rainfall patterns; the drier the region the greater its mammal attrition. One visible modifier of the pattern is that the cereal-growing regions show higher-than-expected attrition indices.

- We compared the FAI with the rainfall and 'environmental stress' (the Continental Landscape Stress Class devised by Gethin Morgan for the 'Landscape Health Project') of each region and attributes of the region's mammals: the proportion of Critical Weight Range (CWR) species and the proportion of species able to fly (ie, bats), as these factors have been previously shown to be significant modifiers of mammal decline. This was done by forward stepwise, fixed non-linear regression analysis.

- Thus rainfall, 'environmental stress', CWR and ability to fly accounted for 81% of the variation in the data. Variation in rainfall explained 48% of the accounted-for variation in the pattern; while body weight and the ability to fly together explained 37%. Individual variation in regional environmental stress explained only 15% of the accounted-for variation.

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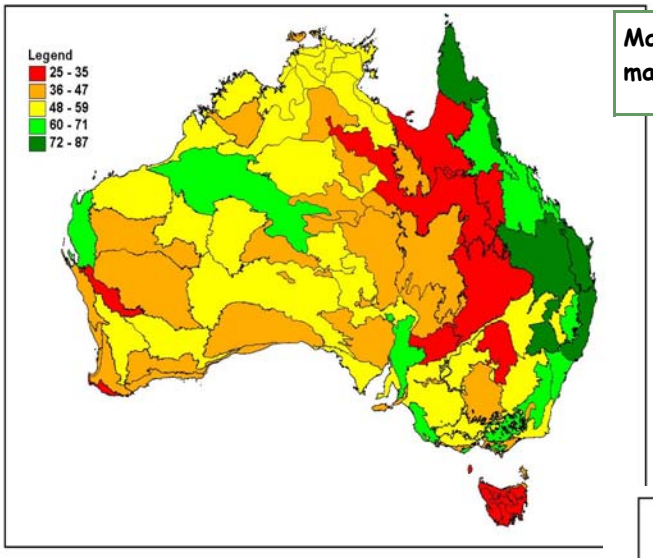
CONCLUSIONS

Two major conclusions emerge from this study:

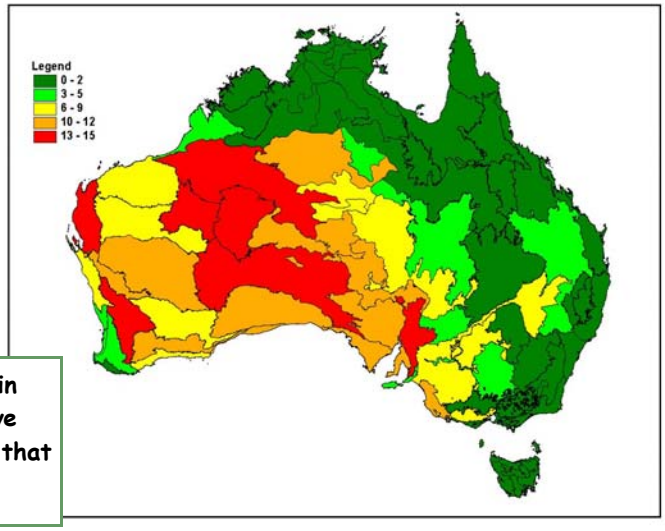
1. There has been a massive contraction in the geographical ranges and species composition of Australia's indigenous mammal fauna. This is unparalleled in any other component of Australia's biodiversity, or anywhere else in the world; one third of the world's extinct mammals since 1600 AD are Australian.
2. Available evidence suggests that the wave of mammal extinctions in Australia is continuing. John Woinarski and co-workers have documented recent massive declines in abundance of a variety of mammal species in the mesic regions of the Northern Territory. Equivalent changes have been observed in the North Kimberley where all ground-dwelling CWR mammal records during the last two decades have come from the northwestern fringe of the region, less than 20 km from its coast. Over the last 30 years this region has suffered massive changes in vegetation composition and structure due to increased fire frequency and the recent arrival of large exotic herbivores that have now penetrated to the coast. If this change is not halted and reversed, we expect that some of the region's mammals will become extinct, while others will persist only on islands. The 'top end' of the Northern Territory and the North Kimberley have been considered to be refugia for a range of mammal species—this belief appears to be false. Similar recent declines are evident elsewhere in Australia, for example *Myrmecobius fasciatus* and *Dasyurus geoffroii* have disappeared from the Avon Wheatbelt during the last 25 years.

While mammal decline is being addressed in some parts of Australia through detailed species and fauna recovery programs, many areas and many species are not the subject of effective recovery programs. Unless Australia provides more resources to mammal conservation and unless the nation is willing to address the continuing massive changes to mammal habitat, species will continue to be lost.

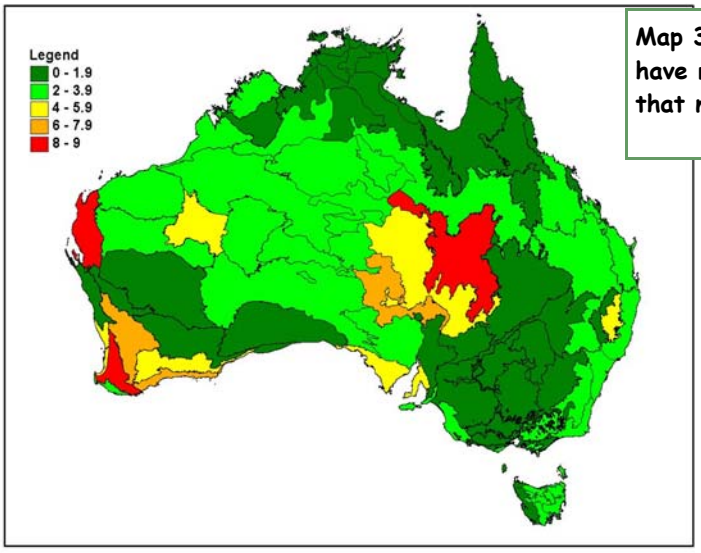
For further information contact Norm McKenzie (the Department's Science Division) on 08 9405 5144 or email nornm@calm.wa.gov.au or Andrew Burbidge on 08 9405 5103 or email andrewb@calm.wa.gov.au



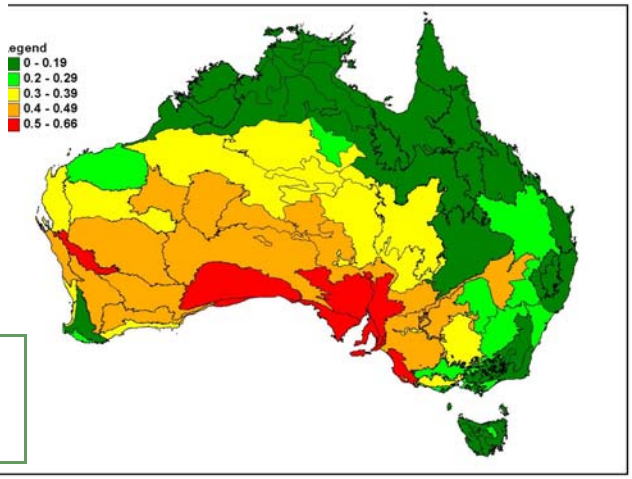
Map 1. Species richness of the original mammal fauna in each IBRA region



Map 2. 'Range contraction'. Number of species in the original fauna of each IBRA region that have contracted from more than 90% of the regions that they originally occupied in Australia



Map 3. 'New endemism'. IBRA regions that have retained the greatest number of species that now occur in only a few regions



Map 4. 'Faunal Attrition'. The pan-Australian pattern of attrition in Australia's regional mammal faunas (regional FAI values)

Translocations of threatened fauna and flora ~ Jill Pryde

Since our last issue of *WATSNU*, four new translocations and four extensions of previously approved translocation proposals have been endorsed by the Department. The following provides details of the translocations.

Species	Translocation	Proponent/s
Symonanthus bancroftii Bailey's Symonanthus	From seedlings raised at Botanic Gardens and Parks Authority to two reserves	Greg Durell and Andrew Brown (the Department), Dr Kingsley Dixon (Botanic Gardens & Parks Authority) and Daley Walker, (Bruce Rock Land Care District Committee)
Shark Bay Mouse, *Pseudomys fieldi*	Captive bred animals from Perth Zoo to Faure Island (Shark Bay WA)	Andre Schmitz on behalf of the Australian Wildlife Conservancy
Burrowing Bettong, *Bettongia lesueur*	Heirisson Prong to Faure Island	Andre Schmitz on behalf of the Australian Wildlife Conservancy
Norseman pea, *Daviesia microcarpa*	From seed sourced from populations around Norseman and Southern Cross and introduced to sites located nearby in a water catchment reserve	Leonie Monks, Sarah Barrett, Klaus Tiedemann (the Department)
Brachysema papilio, Darwinia sp. Williamson,	Extension to Translocation Proposals approved in 2001	Leonie Monks (the Department)
Grevillea maccutcheonii	Extension to Translocation Proposal approved in 2000	Leonie Monks (the Department)
Grevillea calliantha	Extension of translocations approved 1998 and 1999	Leonie Monks (the Department)

Negotiations on proposed mine near Ironstone Community ~ Val English

The Critically Endangered 'Shrublands on southern Swan Coastal Plain Ironstones' community (otherwise known as the Busselton ironstones) is a Threatened Ecological Community (TEC) that is known from only 13 very small areas. Of the 1,200 hectares of the ironstone soil type mapped for the Busselton area, only about 90 ha remains uncleared.

A new titanium mine is proposed in Busselton. The proponent's Public Environmental Review noted that the proposed mine site occurs adjacent to an area of the Busselton Ironstones. This particular site contains considerable biological values including the only known populations of three Critically Endangered Flora taxa. There are a total of nine Declared Rare Flora (DRF) taxa and four Priority taxa within the occurrence of the TEC.

The main issue recognised in the proponent's Public Environmental Review included the need to maintain the hydrology of the wetland plant community adjacent to the proposed mine site.

Issues were discussed at a meeting at Bunbury in May this year between staff of the Department of Conservation and Land Management, Department of Environmental Protection, Water and Rivers Commission, Department of Mineral and Petroleum Resources, a private groundwater consulting company, and the mineral developers - Cable Sands. Issues mainly centred on any risks associated with their proposal to place a groundwater reinjection trench, or artificial recharge system (ARS) immediately adjacent to an occurrence of the TEC. The artificial recharge system is intended to mitigate predicted groundwater drawdown under the TEC as a result of pit dewatering.

A back-up systems of applying surface water directly to the site in times of drought stress caused by altered hydrology is proposed if the ARS does not function as planned. The disease implications of this on this dieback prone site are unclear.

Issues that need to be dealt with include the requirement that seasonal water levels of the TEC should not be modified by the proposal, and that post-mining recovery of the watertable would need to be well understood. One possible way that these issues may able to be dealt with is an extended buffer that ensures no changes to hydrology of the adjacent wetland plant community. Discussions are continuing between all stake holders as to how the likely impacts of the proposal could be dealt with.

For further information please contact Val on 08 9405 5169 or email: vale@calm.wa.gov.au

New Recovery Plans and Interim Recovery Plans recently approved ~ Jill Pryde

Since the last issue of *WATSNU*, one new recovery plan has been published and five new interim recovery plans have been endorsed, two for threatened flora and three for threatened ecological communities.

Recovery Plan

- *Sunset Frog Recovery Plan 2001-2006* by Andrew A Burbidge and J Dale Roberts, Wildlife Management Program No. 35.
  This plan was approved by the Department, the Conservation Commission and the Minister for the Environment.

Interim Recovery Plans

- Foote's Grevillea *Grevillia calliantha* Interim Recovery Plan No. 102 by Robyn Phillimore, Diana Papenfus, Val English and endorsed on 23 March 2002
- Pythara Grevillea, *Grevillea pythara* Interim Recovery Plan No. 103 by Robyn Phillimore, Diana Papenfus, Felicity Bunny, Andrew Brown and endorsed on 23 March 2002
- Plant assemblages of the Moonagin System Interim Recovery Plan No. 105 by Sheila Hamilton-Brown and endorsed on 22 May 2002
- Lesueur-Coomallo Floristic Community A1.2 Interim Recovery Plan No. 106 by Sheila Hamilton-Brown and endorsed on 22 May 2002
- Plant assemblages of the Inering System Interim Recovery Plan No. 107 by Sheila Hamilton-Brown and endorsed on 22 May 2002

Copies of these plans can be requested from Jill on 08 9405 5151 or email jillp@calm.wa.gov.au, or from the senior author of each plan

Conserving Threatened Ecological Communities on the Swan Coastal Plain ~ Robyn Phillimore

The three year project titled 'Implementation of Interim Recovery Plans for Critically Endangered Threatened Ecological Communities (TECs)' is in its final year. The aim of this Natural Heritage Trust (NHT) funded project is to coordinate the implementation of recovery actions for 11 Critically Endangered TECs and two Endangered TECs, most of which are located on the Swan Coastal Plain (SCP). Twelve of these TECs have Interim Recovery Plans in place already. The TECs covered by the project are as follows:

- Shrublands on southern Swan Coastal Plain ironstones (SCP 10b)
- Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (SCP 19)
- Stromatolite-like microbialite community dependent on fresh ground water of coastal brackish lakes (Lake Clifton, Yalgorup)
- Stomatolite-like microbialite community of coastal freshwater lakes (Lake Richmond, Rockingham)
- Communities of Tumulus Springs (Organic Mound Springs, SCP)
- Shrublands and woodlands of the eastern side of the SCP (SCP 20c)
- Perth to Gingin ironstone association
- *Eucalyptus calophylla – Kingia australis* woodlands on heavy soils (SCP 3a)
- *Eucalyptus calophylla – Xanthorrhoea preissii* woodlands and shrublands (SCP 3c)
- Aquatic root mat community number 1 of caves of the SCP (Yanchep caves)
- Aquatic root mat community number 1-4 of caves of the Leeuwin Naturaliste Ridge
- Shrublands and woodlands on Muchea limestone (Endangered)
- Scott River ironstone heaths (Endangered)

Some of the highlights from the project completed since the last WATSNU article (December 2001) include:

Shrublands and woodlands on Muchea Limestone

The largest occurrence of this community type occurs at Bootine Rd Nature Reserve in Gingin. In January 2002, introduced weed trees were notched and poison injected into their trunks by the Department's Perth Coastal District. Other weeds including Japanese pepper and grape vines were removed by hand.

Communities of Tumulus Springs

In March 2002 grassy weeds on the western side of Faull St Nature Reserve were sprayed with herbicide by the Department's Swan Coastal District. Blackberry plants at Neaves Reserve in Bullsbrook were also sprayed by district staff in December 2001. A survey of Tumulus Springs on Bush Forever site 22 was undertaken in April 2002 by WATSCU and Swan Coastal District staff to map the boundaries of the occurrence and review the threats.

Stromatolite-like microbialite community of coastal brackish lakes (Lake Clifton)

The first recovery team meeting for Lake Clifton thrombolites was held in May 2002 at the Department's Swan Region office. The role of the recovery team is to oversee the recovery of the Lake Clifton thrombolites, through the drafting of a recovery plan and directing the implementation of actions within the plan. The recovery team is a group of stakeholders who can contribute to the recovery of the community including people from the Department, Water and Rivers Commission, Agriculture WA, University of WA, City of Mandurah, CSIRO, Peel Preservation Group and Lake Clifton Landcare Group. An Interim Recovery Plan is also currently being drafted for the Lake Clifton thrombolites.

Shrublands and woodlands of the eastern side of the SCP (SCP 20c)

An additional occurrence of this community was identified in Bush Forever at Stirling Crescent, Hazelmere (Bush Forever site 481). This occurrence was surveyed by WATSCU staff in December 2001. Several occurrences of the community were mapped and the threats for each area noted on the TEC database.

Building on the success of a previous Green Corps project, through implementation of the management plan, an NHT grant was obtained by the Friends of Talbot Rd group to restore Talbot Rd bushland (Bush Forever site 306). Actions such as weed control, track closure and planting for rehabilitation are currently underway at the reserve. An application for funding to continue this work at Talbot Rd bushland in 2003 has also been made to the Threatened Species Network.

Eucalyptus calophylla – Kingia australis woodlands on heavy soils (SCP 3a)

Lambert Lane Nature Reserve (Bush Forever site 264)

Previously a section of this reserve had been used as a dumping ground with numerous soil mounds and other rubbish present. Following the change of tenure to a Nature Reserve, restoration work has been initiated by the Swan Coastal District. A dozer was hired for three days in December 2001 to remove the soil mounds and landscape the area. Other rubbish, including asbestos, paint tins and car

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tyres were also removed by district staff. A previously unfenced part of the reserve was then fenced and signs were erected to attempt to reduce the amount of rubbish being dumped. Weeds that germinated following the dozer work were also sprayed with herbicide. This is in preparation for planting of the cleared area by a Conservation Volunteers team in July 2002.

Brixton Street Wetlands (Bush Forever site 387)

A fire management and response plan was produced for the Greater Brixton St Wetlands in consultation with Fire and Emergency Services Authority and staff from the Department's Swan Coastal District. This plan was put to good use when a fire went through the southern end of the wetlands in March 2002.

Mundijong Rd bushland (Bush Forever site 360)

A meeting was held in March 2002 between Department staff, Shire of Serpentine-Jarrahdale, the local Bushcare Officer, and the Friends of Mundijong Rd to discuss the writing of a management plan for this bushland area. The plan will be completed this year.

Dundas Road bushland (Bush Forever site 319)

In January 2002, exotic trees that had been planted along a firebreak on Western Power land were cut down and the stumps poisoned by contractors. Seed was then collected from the bushland in March by APACE for future rehabilitation.

Aquatic root mat communities numbers 1-4 of caves of the Leeuwin-Naturaliste Ridge

A detailed resurvey of the invertebrate fauna in the root mats of the Leeuwin Caves is currently being undertaken by the University of WA. This is funded from Departmental sources. Four caves are being surveyed; Calgardup, Kudjal Yolgah, Strongs and either Lake or Mill caves. Hydrological monitoring is also being undertaken within these caves by Departmental staff to determine the extent and impact of hydrological changes on the invertebrate community.

For further information on the threatened ecological communities mentioned above, contact Robyn (see below).

Acacia cochlocarpa subsp. *cochlocarpa*
Photo: Bruce Maslin

RARE FLORA AND THREATENED COMMUNITY POSTERS ~ Robyn Phillimore

A suite of Western Australia's Critically Endangered plants and ecological communities are featured in a series of 14 new posters developed by WATSCU. Posters provide information such as time of flowering, habitat, approximate locations; and a description and general location for communities. The posters also contain information on threats and recovery actions that are underway. The posters can be viewed on the Department's *NatureBase* at http://www.calm.wa.gov.au/index.html.

Photographs and descriptions of the posters may help people identify Critically Endangered species and communities, and lead to the discovery of new areas where they occur. The posters will also help spread the message about the need for conservation of these extremely important plants and communities by reducing threats to their survival.

The posters were produced with funding from WATSCU and the Natural Heritage Trust.

The 11 flora species featured in the posters are:

Quartz-loving synaphea (*Synaphea quartzitica*)

Spiral fruited wattle (Acacia cochlocarpa subsp. *cochlocarpa*)

Split-leaved grevillea (*Grevillea althoferorum*)

Spreading grevillea (*Grevillea humifusa*)

Tufted plumed featherflower (*Verticordia plumosa* var. *ananeotes*)

Abba bell (*Darwinia* sp. Williamson)

Blunt wattle (*Acacia aprica*)

Butterfly-leaved brachysema (*Brachysema papilio*)

Hook-point poison (*Gastrolobium hamulosum*)

Ironstone petrophile (*Petrophile latericola*)

Mt Leseur grevillea (*Grevillea batrachioides*)

The four threatened ecological communities featured in the posters are:

Plant communities on ironstone and Muchea limestone (near Perth)

Woodlands of the Swan Coastal Plain (eastern side)

Thrombolites of Lake Clifton and Lake Richmond

For further information on threatened communities on the Swan Coastal Plain, or to obtain copies of the posters, contact Robyn.

For further information contact Robyn Phillimore on (08) 9405 5165 or by email: robynp@calm.wa.gov.au

Adopt a TEC program ~ Sheila Hamilton-Brown

One of my briefs in the previous project - identifying and conserving Threatened Ecological Communities (TECs) in the Wheatbelt with funding from NHT was to liaise with members of the local community to help identify TECs. In the course of my 4 1/2 years working in the Wheatbelt, I have come across dedicated, enthusiastic, and knowledgeable members of the local community who have worked alongside me, and in many cases, know more about the TECs than I.

Concentrating solely on TECs affected by salinity/ waterlogging, and with a lack of a comparable position in the Districts/Regions, I did not want to leave owners with particular TECs (those with few or no examples in the conservation estate or where recovery actions are already in place) without any on-ground support, nor did I want any new knowledge to be lost by WATSCU and the District/Regions. To keep the continuity, I have developed a volunteer program called *Adopt a TEC.*

Most of the adoptive parents are already members of District Threatened Flora Recovery Teams, and are familiar with the workings of their team. All members of the program will work closely with WATSCU and the Districts/Regions with respect to any actions required on the TECs. The members can take on as much or as little activity as they like, but are not expected to carry out activities that should be carried out by WATSCU and the Districts/Regions. Members have been actively collecting flora defining the TEC for lodgment in the WA Herbarium; encouraging landholders to fence TECs; re-scoring quadrats; seeking more occurrences; and advising the Department if any of the properties come on the market.

Plant assemblages of the Inering System
Photo: Sheila Hamilton-Brown

There are a total of 20 endorsed TECs, of which 11 are currently being looked after in this programme. Another 7 TECs have yet to be endorsed; and if all goes well, another 4 will be added to this programme. Below is the list of members of this program and their respective TECs. Please give them every support possible as they are doing an invaluable job.

Robert & Beth Boase
Perched wetlands of the Wheatbelt region with extensive stands of living sheoak and paperbark across the lake floor (occ. 2)

Jenna Brooker
Acacia rostellifera low forest with scattered *Eucalyptus camaldulensis* on Greenough River Alluvial Flats

Rebecca Carter
Microbialite wetland (Lake Thetis)

Fiona Falconer
Plant assemblages of the Inering System

Robyn Stephens
Plant assemblages of the Billeranga, Koolanooka and Moonagin Systems

Allan Tinker
Organic mound springs (Three Springs region); Ferricrete floristic community (Rocky Springs type)

Joy & Don Williams
Lesueur-Coomallo Floristic Communities A1.2 & M2

For further information contact Sheila on (08) 94055 167 or email sheilahb@calm.wa.gov.au

Threatened Ecological Communities documented ~ Melissa Hoskins

The survey and recording of threatened ecological communities (TECs) on the Swan Coastal Plain is continuing, with a number of new occurrences of Endangered and Vulnerable TECs added to the database since the last issue.

A total of 56 occurrences of TECs in Bush Forever sites from both public and privately owned land, have now been surveyed and are included on the Department's TEC database. Important information collected during survey includes any threatening processes acting on the community. This type of information allows the development of recovery actions necessary to reduce threats to the community. Remnant pieces of bushland, particularly on the Swan Coastal Plain, are often at risk of being destroyed by clearing, particularly for the development of urban areas. Other threatening processes common to bushland areas on the Swan Coastal Plain include the invasion of weeds into the bushland; inappropriate fire regimes; dieback caused by the plant pathogen *Phytophthora cinnamomi*; disturbance due to recreational activities; and illegal rubbish dumping.

In addition to those communities described in the last issue of *WATSNU*, the new data added to the database include information on areas of the following floristic communities:

- the Endangered community 'Melaleuca huegelii – Melaleuca acerosa shrublands on limestones ridges' ('limestone ridges Swan Coastal Plain community 26a')
- the Endangered community 'Southern wet shrublands, Swan Coastal Plain' ('Swan Coastal Plain Community 2')
- the Endangered community 'Shrublands and woodlands on Muchea Limestone' ('Muchea Limestone')
- the Vulnerable 'Herb rich saline shrublands in clay pans' ('Swan Coastal Plain community type 7').
- A few sites thought to contain floristic community type 15, 'forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain' need to be surveyed in springtime when the herb layer species are present, so that the community type can be properly determined. This community is classified as Vulnerable.

Southern wet shrublands, Swan Coastal Plain (Floristic Community Type 2)
Photo: Val English

For further information contact melissa on (08) 9405 5170 or email melissah@calm.wa.gov.au

WATSNU

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Adoption of Interim Recovery Plans under the *Environment Protection and Biodiversity Conservation Act* 1999 ~ Jill Pryde

The following Western Australian threatened flora and communities interim recovery plans have now been adopted under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999.*

IRP No.	Title	adoption date
20	Wongan Gully Acacia, *Acacia pharangites*	16/07/2000
21	Western Woolly Cyphanthera, *Cyphanthera odgersii*	16/07/2000
22	Blunt Wattle, *Acacia aprica* ms	9/03/2001
23	Orange-flowered Wattle, *Acacia auratiflora* ms	9/03/2001
24	Spiral Fruited Wattle, *Acacia cochlocarpa* subsp. *cochlocarpa* ms	9/03/2001
25	Spreading Grevillea, *Grevillea humifusa*	14/07/2001
26	Green Hill Thomasia, *Thomasia* sp. Green Hill	14/07/2001
27	Gingin Wax, *Chamelaucium* sp. Gingin	9/03/2001
28	Rough Emu Bush, *Eremophila scaberula*	9/03/2001
29	Hinged Dragon Orchid, *Drakonorchis drakeoides* ms	9/03/2001
30	Giant Andersonia, *Andersonia axilliflora*	9/03/2001
31	Prostrate Flame Flower, *Chorizema humile*	9/03/2001
32	Pungent Jackson, *Jacksonia pungens* ms	14/07/2001
33	Trigwell's Rulingia, *Rulingia* sp. Trigwell Bridge	14/07/2001
34	Abba Bell, *Darwinia* sp. Williamson	9/03/2001
35	Winged-fruited Lasiopetalum, *Lasiopetalum pterocarpum* ms	14/07/2001
36	Western Prickly Honeysuckle, *Lambertia echinata* subsp. *occidentalis*	14/07/2001
37	Cunderdin Daviesia, *Daviesia cunderdin*	9/03/2001
38	Milky Emu Bush, *Eremophila lactea*	9/03/2001
39	Dwarf Spider Orchid, *Caladenia bryceana* subsp. *bryceana*	9/03/2001
40	Pinnate-leaved Eremophila, *Eremophila pinnatifida* ms	9/03/2001
41	Scott River Boronia, *Boronia exilis*	9/03/2001
42	Split-leaved Grevillea, *Grevillea althoferorum*	14/07/2001
43	Mallee Box, *Eucalyptus cuprea*	14/07/2001
44	Shrubland Association on Southern Swan Coastal Plain Ironstone (Busselton area) (Southern Ironstone Association)	5/10/2001
45	Cinnamon Sun Orchid, *Thelymitra manginii* ms.	14/07/2001
46	Small-flowered Snottygobble, *Persoonia micranthera*	14/07/2001
49	Scaly-leaved Featherflower, Verticordia spicata subsp. squamosa	14/07/2001
50	Quartz-loving Synaphea, *Synaphea quartzitica*	14/07/2001
51	McCutcheon's Grevillea, *Grevillea maccutcheonii*	14/07/2001
52	Montane Thicket and heath of the South West Botanical Province, approximately 900 m above sea level	26/03/2002
53	Aquatic Root Mat Communities numbers 1-4 of caves of the Leeuwin-Naturaliste Ridge	5/10/2001
54	Ironstone Grevillea, *Grevillea elongata*	14/07/2001
55	Thick-billed Grasswren (western subspecies), *Amytornis textilis textilis*	9/03/2001
56	Community of Tumulus Springs (organic mound springs) of the Swan Coastal Plain	5/10/2001
57	Shrublands and Woodlands on Muchea Limestone	5/10/2001
58	Eastern shrublands and woodlands (Swan Coastal Plain community 20c)	5/10/2001
59	Corymbia calophylla - *Kingia australis* woodlands on heavy soils	5/10/2001
60	Corymbia calophylla - *Xanthorrhoea preissii* woodlands and shrublands	5/10/2001
61	Shrublands and woodlands on Perth to Gingin ironstone	5/10/2001
63	Elegant Spider Orchid, *Caladenia elegans* ms	9/03/2001
64	Phalanx Grevillea, *Grevillea dryandroides* subsp. *dryandroides*	26/03/2002
67	Narrow Curved-leaf Grevillea, *Grevillea curviloba* subp. *Incurva*	26/03/2002
69	Blue Babe-in-the-cradle Orchid, *Epiblema grandiflorum* var. cyaneum ms.	9/03/2001
70	Wongan Cactus, *Daviesia euphorbioides*	26/03/2002
72	Curved-leaf Grevillea, *Grevillea curvoloba* subsp. *curviloba*	26/03/2002
74	Aquatic Root Mat Community of Caves of the Swan Coastal Plain	26/03/2002
79	Gillham's Bell, *Darwinia oxylepis*	26/03/2002
80	Late Hammer Orchid, *Drakaea confluens* ms	26/03/2002
82	Albany Cone Bush, *Isopogon uncinatus*	26/03/2002
83	Stirling Range Beard Heath, *Leucopogon gnaphalioides*	26/03/2002

SUMMARIES OF THE 2001 ANNUAL REPORTS OF RECOVERY TEAMS

NARROGIN THREATENED FLORA MANAGEMENT PLAN ANNUAL REPORT

By
Kim Kershaw and Greg Durell for the Narrogin Threatened Flora Recovery Team

- The Department of Conservation and Land Management's (the Department) Threatened Flora Seed Centre has collected seed from *Darwinia carnea* (CR) translocation sites and tests on seed viability have shown that they are producing viable seed.
- Cross-pollination studies have been conducted on plants of *Symonanthus bancroftii* (CR) grown from cuttings of at the Botanic Gardens and Parks Authority (BGPA). Further experiments are under way to access the viability of seeds collected following these studies. Some seed will be cryostored to assess the efficacy of long term storage.
- The re-discovery of 3 populations *Caladenia hoffmanii* subsp. *graniticola* (CR) in Dragon Rocks Nature Reserve. (The exact location details were not previously known or recorded).
- Final approval has been given to the Interim Recovery Plan for *Symonanthus bancroftii* (CR) which was prepared by the Recovery Team.
- The Recovery Team, in a joint project with BGPA, has prepared a Translocation Proposal for *Symonanthus bancroftii* (CR).
- Monitoring of *Dryandra ionthocarpa* (CR) populations resulted in the discovery of further plants within three populations and allowed the collection of flowering material which had not previously been held at the WA Herbarium.
- 15 new populations of *Roycea pycnophylloides* (CR) were found in two nature reserves.
- 1 new population of *Lasiopetalum rotundifolium* (EN) was found in Boyagin Nature Reserve.
- 2 new population of *Thomasia montana* (VU) were found, one in Boyagin Nature Reserve and the other on a Shire road verge.
- *Cryptandra intonsa* (P1), *Lasiopetalum* sp. Ironcaps (P1), *Daviesia rhizomata* (P2), *Synaphea flabelliformis* (P3) and *Schoenus calcatus* (P3) were removed from the Priority List following the discovery of many more populations in the Narrogin District.
- The Recovery Team has nominated a threatened community for listing.

GERALDTON DISTRICT THREATENED FLORA AND ECOLOGICAL COMMUNITIES RECOVERY TEAM ANNUAL REPORT

By
A M Chant for the Geraldton District Threatened Flora Recovery Team

This report covers progress made in the implementation of the Threatened Flora Management Plan for the Department's Geraldton District, NHT Project Number 446, and Recovery Plans for Critically Endangered Species and Threatened Ecological Communities, from January 2001 to January 2002.

There has been one meeting of the Recovery Team during the year and members have continued to contribute to survey work and recovery actions.

A large amount of productive fieldwork has been undertaken during the year. This has resulted in several species having improved conservation status and the rediscovery of three presumed extinct species in the District.

Promotion of Threatened Flora conservation within the community has continued, including a series of local newspaper articles and the production of a "Threatened Flora of the Midwest" bush book. A *Landscope* Magazine article on threatened flora recovery in the Midwest is also in progress and is intended for the autumn 2002 issue.

Wildlife Management Program No. 26 Declared Rare and Poorly Known Flora in the Geraldton District has been completed. This document has now been published and is being implemented.

Interim Recovery Plans or draft plans for the following have been produced and are being implemented, *Caladenia elegans* 2000 - 2003, *Pterostylis* sp Northampton 2000 - 2003, *Verticordia spicata* subsp *squamosa* 1999 - 2002, *Eucalyptus cuprea* 1999 - 2002, *Beyeria lepidopetala* 1999 - 2001, *Caladenia bryceana* subsp. *cracens* 1998 - 2001, *Eremophila viscida* 1997 - 2000, *Conostylis micrantha* 1996 - 1999, *Eremophila nivea* 1996 - 1999, *Leucopogon marginatus* 1998 - 2000, *Grevillea phanerophlebia* 2001 - 2004 and *Hypocalymma longifolium* 2001 - 2004, *Acacia Rostelifera* Low Forest with scattered *Eucalyptus camaldulensis* on Greenough River Alluvial Flats 1999 - 2002, Plant Assemblages of the Moonagin System 2001 - 2006, Plant Assemblages of the Billeranga System 2001 - 2006.

WESTERN SWAMP TORTOISE RECOVERY TEAM ANNUAL REPORT

By
Andrew Burbidge, Gerald Kuchling, Lyndon Mutter and Dean Burford for the Western Swamp Tortoise Recovery Team

Progress continued towards implementing the actions contained in the Western Swamp Tortoise Recovery Plan and that implementation of most recovery actions continues to be on or ahead of schedule. Highlights of the year included:

- Monitoring of the population at Ellen Brook Nature Reserve continues to suggest a gradual increase in the number of tortoises over the past decade, but many of these are juvenile animals.
- Perth Zoo currently holds 165 tortoises comprising 16 breeding males, 14 breeding females and 135 other tortoises comprising hatchlings, juveniles, sub-adults and non-breeding adults. Forty-three hatchlings were obtained in 2001 from eggs laid in 2000.
- Groundwater was pumped to North West Swamp, Twin Swamps Nature Reserve for most of winter 2001, as winter rains were insufficient to fill the swamps. The pump failed in October and was not fixed until the swamps had dried.
- A trial translocation of six captive-bred tortoises was carried out in 2000 to swamps within land near Lake Wannamal at Mogumber, being acquired by CALM for a nature reserve. Growth rates have been satisfactory and three were known to have survived the 2000/2001 summer, suggesting that the Mogumber site is suitable for the Western Swamp Tortoise.
- Twenty tortoises, bred and raised to about 100 g body weight at Perth Zoo, were released at Mogumber and nine at Twin Swamps Nature Reserve.
- A rat control program at Twin Swamps Nature Reserve was continued during 2000. Evidence suggesting rat predation at Ellen Brook Nature Reserve was first found in 2000.

Of continuing concern is the lack of further translocation sites to release captive-bred tortoises. The Recovery Team's preferred site, Perth Airport, was the subject of a hydrological study by Westralia Airports Corporation during 1999 and 2000 to clarify whether future runway extensions may deleteriously affect the target swamps. Westralia Airports Corporation advised the recovery team that they were not prepared to agree to a translocation to this area; however, the recovery team has asked them to reconsider. The Team has investigated another possible site at Caversham, owned by the Department of Defence and intends to approach the Commonwealth to see if part of this area can be set aside for the swamp tortoise.

NOISY SCRUB-BIRD RECOVERY, Phase 2

By
Sarah Comer and Alan Danks For the South Coast Threatened Birds Recovery Team.

The establishment of a Noisy Scrub-bird population in a Western Management Zone continued this year with the translocation of a further 17 birds from the Manypeaks and Normans areas to the Darling Range. Three females were released at King Jarrah West and Sixty-one Form, and 14 males were released at three new sites, Chasede Rd, Tiger Rd and West Samson.

Following the 2000 wildfires in the Albany Management Zone a full survey of singing males was conducted in 2001. This survey was conducted between May and early November. A total of 765 territorial males were counted. Significant increases from 1999 numbers were observed in the Manypeaks, Waychinicup and Mermaid sub-populations. The Mt Gardner population index was 164, showing a definite reversal of the previous three years declining trend. The number of singing males on Bald Island was 37, the same as in 2000.. Scrub-bird habitat in the Angove-Normans sub-area was severely impacted by the 2000 wildfires, despite this 79 singing males were counted during the 2001 survey.

Management of the Two Peoples Bay Nature Reserve continued under the guidelines provided by the Management Plan (Department of Conservation and Land Management, 1995). Over 6000 people visited the Visitors Centre during the year. Fox baiting was carried out regularly in the Reserve and on adjoining Crown Reserves throughout the year.

Full copies of these reports are lodged in the Department's Wildlife Sciences Library at Woodvale

New projects funded through the Bankwest *LANDSCOPE* Conservation Visa Card, 2001-2002 ~ Jill Pryde

Every time you make a purchase by using your Bankwest *LANDSCOPE* Conservation Visa Card, a contribution is made to the Department's Endangered Species Trust Fund.

The following new projects have been selected to receive support from the Trust Fund. Once completed, summaries of these projects will be reproduced in *WATSNU*.

Title	Supervisor of project
Gilbert's Potoroo Recovery - Nutrient analysis of hypogeal fungi	Tony Friend
Assessment of salinisation risk to Western Swamp Tortoise habitat within the Mogumber Nature Reserve	Ben Giovanetti
Identifying an improved water source to supplement root mat communities in Twilight Cave YN 194 and other Root Mat community caves	Paul Tholen
Statistical analysis and publication of 12 year data on *Daviesia euphorbioides*	Paul Brown
Seedbank dynamics and response to disturbance of the Critically Endangered *Grevillea maxwellii* (Proteaceae)	Anne Cochrane & Sarah Barrett
Aquatic Root Mat communities Nos 204 of caves of Leeuwin Naturaliste Ridge	Tracey Robins
Dieback survey and mapping in two Threatened Ecological Communities on the Swan Coastal Plain	Robyn Phillimore
Taxonomic genetics on *Grevillea phanerophlebia*	Dave Coates

Gilbert's potoroo

Photo: Tania Butler