



The Albany Regional Vegetation Survey

by Sarah Barrett

The Albany Regional Vegetation Survey (ARVS) (Sandiford & Barrett 2010) was undertaken in response to increasing demand for land for urban and peri-urban development in the Albany area. In 2007, funding for the project was provided by the EnviroPlanning project 'Integrating NRM into Land Use Planning', State Natural Resource Management (NRM) Program, City of Albany and South Coast Natural Resource Management Inc with the project based at the Department of Environment and Conservation (DEC) Albany.

The ARVS area encompasses 124,415 hectares that extends some 30 kilometres east and west of Albany and 20 kilometres north. It is situated at the junction of three biogeographic regions – the Warren, Jarrah Forest and Esperance Plains regions – and includes a variety of landforms from coastal dunes, granitic hills, gently undulating plains, lowland flats, rivers and drainage



lines, to estuarine fringes and lakes.

The project determined that 35% (44,093 hectares) of remnant vegetation remains within the ARVS area of which 19% occurs within formal conservation



Above left *Melaleuca striata*/Banksia spp. coastal heath, Gull Rock National Park.

Above *Evandra aristata* sedgeland, Bornholm Photos – Libby Sandiford

reserves and 39% in other Crown reserves. Two thirds (67%) of the vegetation is in excellent—very good condition with 21% in modified, and 12% in transformed states.

The flora and vegetation was very diverse and 67 native vegetation units were defined from analysis of floristic and structural data from 785 relevés. Extensive field work was essential in defining and mapping the vegetation due to high vegetation and landform diversity, low aerial photography interpretability and the absence of other data sets at a fine enough scale to reflect vegetation patterning.

The vegetation units included 32 upland units, 22 wetland units and 13 dampland or transitional units. Many units occur in small patches, with 49 units each occurring on less than 1% of the remnant vegetation within the ARVS area. The importance of these small units in terms of biodiversity is highlighted by the finding that 20% of all species recorded in the ARVS are restricted to these 49 units, and 78% of all species recorded in the ARVS occur within this group.

Over 800 species were recorded during the survey including six declared rare flora, 43 priority-listed species and 19 species occurring beyond their previously known distribution.

The botanical significance of the ARVS area is highlighted by the occurrence of over a

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half of the vegetation units at their range limit and over a quarter of units being likely to be restricted to the survey area, based on species distribution maps. Further survey outside the ARVS area is required to verify the entire extent of these units.

At least four vegetation units appear to have less than 30% of their total pre-clearing extent remaining in Western Australia with a further 17 units also likely to have less than 30% of their pre-clearing extent remaining within the ARVS area.

Over one quarter of vegetation units are poorly reserved, having less than 10% of their local extent within conservation reserves.

Major threats observed through the ARVS include dieback disease caused by *Phytophthora* species, hydrological change, weed invasion (particularly by *Acacia longifolia*), too frequent fire, land clearing, and grazing. Given the high number of vegetation units that occur at their range limit and the high number of wetland/dampland units, the potential for climate change to impact on the vegetation within the survey area is very high.

The ARVS has provided a local and regional overview of the native vegetation of the area to assist land-use and conservation planning in the region by describing, mapping and assessing the conservation status of the vegetation within the ARVS area.

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Above *Hakea* spp. Shrubland/Woodland Complex, Angove Water Reserve

Left Limestone Heath, Windfarm Photos – Libby Sandiford

Protection of rare flora from the impacts of rabbit grazing

by Melissa Okely

Impacts from rabbit grazing on the Swan Coastal Plain are increasingly seen as a significant issue, particularly in small reserves containing high conservation values such as threatened ecological communities and declared rare flora.

Macarthuria keigheryi, a perennial shrub bearing inconspicuous white flowers from September to March, is listed as declared rare flora (DRF) and endangered under the federal *Environment Protection and Biodiversity Conservation Act 1999*.

A population of this rare plant is located in DEC estate in Forrestfield where grazing by rabbits has been observed in recent years as a major threatening process to their survival. In 1992, the number of *M. keigheryi* plants recorded was in the hundreds within the Forrestfield reserve, however monitoring of the population in spring of this year by Swan Coastal District staff located a total of only 12 individuals, all of which have been subjected to some degree of grazing. With impacts from feral animals identified as a major current threat to this population, plant cages have been placed over the individual plants to provide immediate protection from rabbits and to assist in the overall recovery of the population.

Not only are shrubs such as *M. keigheryi* threatened by rabbit grazing, but another species of DRF is currently being impacted by this invasive species too. Commonly known as the dwarf bee orchid, *Diuris micrantha* occurs in winter wet swamps and bears yellow and brown flowers in September to early October. A significant decline in the population of this species on the Swan Coastal Plain,



Above *Macarthuria keigheryi*

Left Plant cages
Photos – Melissa Okely



specifically at a site in Bertram, may be attributed to the increase in rabbit numbers, in addition to weed invasion and a drying climate. With funding assistance received from the Australian Government in 2010, plant cages were constructed in

two different sizes and this spring have been placed over a small population of these orchids to protect them from rabbit damage.

Ongoing monitoring of the populations of both of the species will continue into future years to determine the effectiveness of the cages in providing protection from the impacts of rabbit grazing to WA's rare flora.

For further information contact Melissa Okely on (08) 9405 0740 or email melissa.okely@dec.wa.gov.au.

Biodiversity day – bringing the bushland to children

By Jill Pryde

Species and Communities Branch staff were invited to run the biodiversity segment of Science Day at Goollelal Primary School in Kingsley. The aim of Science Day is for the children to participate in science-related activities as part of the school's curriculum. Five classes participated with children's ages ranging from nine to twelve years. A range of activities ran concurrently throughout the day. This was seen as a good opportunity to inform the children of some activities that DEC staff undertake and to increase awareness of the biodiversity values of their neighbouring bushland.

Cadogan bushland is approximately three hectares in area and lies on the eastern boundary of the school. The vegetation is generally in very good condition, with some isolated degraded areas. The vegetation is described as *Banksia attenuata* (candlestick banksia) and *B. menziesii* (firewood banksia), *E. marginata* (jarrah) and *Allocasuarina fraseriana* (sheoak) woodlands with scattered *E. gomphocephala* (tuart). This important bushland area contains a diverse range of flora that provides important habitat for fauna. It is also an ecological linkage to a *Bush Forever* site nearby. The main threats to the bushland include too frequent fire, weeds, too many tracks and possibly dieback disease.

The Science Day session began in the classroom with an introduction to biodiversity, ecosystems, soil types, vegetation survey methods, and questions to the children about what may occur in the bushland. The children then set up a quadrat on the lawn. The location was recorded using a hand-held global positioning system (GPS). The children then went into the bushland where they were shown dieback hygiene procedures, which included a demonstration of spraying the soles of shoes with a disinfectant. The children looked at a



Top Filling in the bushland recording form
Photo – Tom Pryde

Above Introducing biodiversity

Above right Measuring a quadrat
Photos – Jill Pryde

range of soils in sample bags and each child filled in a 'bushland recording sheet'. The children were asked to look at the soils and landscape, structure of the vegetation, to identify native flora and weeds, and explore the threats and management needs of the bushland.

After discussion the children were asked to rate the 'condition' of the bushland. Participants had the opportunity to fill out survey sheets, use a GPS and identify plant species. Feedback was very positive and a number of teachers were interested in teaching students how to set up quadrats in their bushland areas as part of their own monitoring programs.

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An update on *Acacia leptoneura* and *Acacia torticarpa* in the Central Wheatbelt District

By Joel Collins

Last year the rediscovery of two very rare wattles (*Acacia leptoneura* and *A. torticarpa*) in the DEC Central Wheatbelt District provided the unique chance to widely communicate the threatened flora message to the broader community (DEC media release 28 October 2009 available at www.dec.wa.gov.au/content/view/full/5553/1560/).

A. leptoneura is currently listed as a 'priority one' taxon (poorly known or in need of further survey) and is known from a single population north of Dowerin. Further surveys took place this year in the surrounding area of the known population leading to another

plant being found, doubling the number of known plants! Remnant vegetation on adjoining private property, owned by Russell Sutherland, was targeted. Russell became very interested in the plant and was more than happy for DEC to survey all his small remnants. He could not believe that the wattle went unknown for so long.

Discovering the second plant involved a lucky break. After surveying a larger fenced remnant without success, a small patch of about five hectares of bush was noticed near his house. Further investigation revealed that the remnant was also fenced from

livestock but partially disturbed through a history of rubbish dumping. The presence of a small lateritic breakaway, which merged into a calcareous soil type, provided for an interesting geological site. A walk through revealed a solitary plant of *A. leptoneura* in flower. Russell was particularly excited by the find on his property and has now provided permission for rabbit-proof fencing to be installed around the population.

The discovery has provided more information on the species' ecology and preferred habitat. Further surveys in the wider Dowerin and Bolgart area during 2010 have not resulted

Right Russell Sutherland at the newly discovered *Acacia leptoneura* plant north of Dowerin
Photo – Joel Collins

in locating any further new populations. The species will be nominated for DRF at next year's Threatened Species Scientific Committee (TSSC) meeting.

Further survey work is still required for *A. torticarpa* (priority one). The only known population occurs just north of Cunderdin and is associated with the Mortlock Flats system. A significant amount of survey work targeting the sandy rises would need to be completed before further assessments can be made on the species' conservation status.

For more information contact Joel Collins on (08) 9622 8940 or email joel.collins@dec.wa.gov.au.



Remarkable Lake Thetis

By Wendy Chow and Nick Casson

Lake Thetis, near Cervantes, is promoted for its stromatolites, but is remarkable for a range of features. These features are being highlighted in the drafting of a recovery plan for the threatened microbial community that occurs in the lake ("Stromatolite community of hypersaline coastal lakes – Lake Thetis").

The brine in the lake is an interesting brew that has the potential to form limestone, dolomite, gypsum or even small amounts of bone-like hydroxyapatite. This is due to elevated levels of calcium carbonate, magnesium and sulphur, and pockets of phosphorus. The saturation with these compounds and hyper-salinity tend to exclude a range of eukaryotes (organisms with cells with a true nucleus – includes fungi, plants and animals) and this limits predation and competition for the microbes that occur in the lake.

As a consequence of these conditions, the microbial community in the lake is diverse. Besides stromatolites, the lake is home to four other broad types of microbial mats. The most extensive of these is the gelatinous flocculent mat that blankets the basin and helps regulate the lake ecosystem.

Much work has been done to limit threats to the lake. Lake Thetis has been incorporated into Nambung National Park, and DEC has removed rubbish, controlled weeds, rehabilitated an old quarry and tracks, restricted vehicle access, established boardwalks to control pedestrian access and installed information boards. The surrounding vegetation and land forms a buffer that protects the hydrology of the lake, and this buffer needs to be quite extensive in order to maximise protection as some contaminants can readily travel through the underlying limestone. Anything that affects regional groundwater quality and quantity may also impact the lake, and DEC is working with the Department of Water in



Top Lake Thetis

Above Lake Thetis stromatolites
Photos – Val English

investigating the lake's hydrological processes. Feral fish also threaten the lake system and microbes, and will require control.

There is much scope for further study of the diversity of the organisms that make up the Lake Thetis 'system', including

the indigenous fish and invertebrates, and elaborating the full detail of microbial diversity in the system. The recovery plan will include recommendations about the work required to increase our understanding and to allow the unique soup of organisms that make up Lake Thetis to be managed in perpetuity.

For more information contact Wendy Chow on (08) 9334 0554 or email wendy.chow@dec.wa.gov.au.

Monitoring of declared rare Synaphea species

By Anne Harris

Surveys to update information on the declared rare flora (DRF) *Synaphea stenoloba*, *Synaphea* sp. Fairbridge Farm and *Synaphea* sp. Pinjarra were completed this spring by staff from DEC's Swan Coastal District. Tuition on field identification, provided by the department's *Synaphea* specialist taxonomist, proved invaluable during subsequent surveys.

Information on population and plant numbers, habitat composition and condition, current and potential threats as well as population and individual plant health, were recorded. A total of 34 populations and subpopulations were monitored. The majority of them were concentrated around North Dandalup, Serpentine and Pinjarra with outliers in Kenwick, Waroona and South Yunderup. Populations occurred on a variety of land tenures including DEC and shire-managed reserves, rail reserves and road verges, as well as on private property.

During the spring surveys, it was apparent that many of the populations were in declining health and infestations of the sap-sucking insects, from the *Pseudococcus* and *Planococcus* genera (mealy bugs), were covering many of the plants. In addition to the general population decline observed across the three species, numerous plant deaths and extinct populations were also recorded, especially for *S. stenoloba*. The drying climate is thought to be a threat to this species as it prefers seasonally wet heathland areas and margins of seasonal wetlands and woodlands. It is possible that the drying climate is causing plant stress that weakens resistance to insect attack.

The locations of individual plants and, when necessary, clumps of plants, were accurately recorded using a differential GPS for downloading onto a geographic information system. These are important data for reviewing the species' conservation status, identifying potential land use issues, and for providing information to other government agencies and private landowners that manage the lands where the plants occur.

For further information contact Anne Harris on (08) 9405 0713 or email anne.harris@dec.wa.gov.au.



Top *Synaphea stenoloba*
Photo – Anne Harris

Above *Synaphea* sp., Fairbridge Farm
Photo – Melissa Okely

Significant bushland purchased for conservation

By Val English

Two bushland areas in Wanaping Road in Kenwick and Sultana Road in High Wycombe have just been acquired for future addition to the reserve system. These bushland acquisitions are part of the implementation of *Bush Forever* – a strategic plan for the conservation of important bushland in the Perth metropolitan area.

The bushland at Wanaping Road in Kenwick contains some very significant values including two threatened ecological communities (TECs) associated with claypans. These are the vulnerable herb-rich shrublands in clay pans and the endangered shrublands on dry clay flats. This important bushland also contains two DRF (*Lepidosperma rostratum* and *Eleocharis keigheryi*), as well as two 'priority one', one 'priority two', and three 'priority four' flora.

This crucial land purchase is part of the planned acquisition of a series of linked lots in the Kenwick area that form the Greater Brixton Street wetlands. These wetlands contain an incredible 555 plant species, which makes it one of the most floristically diverse sites on the Swan Coastal Plain. The greater wetland area is known to contain at

least four TECs, and one 'priority' ecological community, in addition to six DRF, three 'priority one', five 'priority two', nine 'priority three', and six 'priority four' flora.

The rehabilitation of the Wanaping Road site is considered very important in the implementation of *Bush Forever*. Large volumes of rubbish are currently being removed from the eight-hectare site and it will be fenced in the near future. It is hoped that an open drain can be piped and the surface water levels restored on this site, and on the adjoining property previously purchased by the Western Australian Planning Commission (WAPC).

A second bushland area in Sultana Road West in High Wycombe contains the endangered '*Banksia attenuata* woodlands over species rich dense shrublands'. The site contains 15 hectares of the TEC, and also contains the declared rare flora *Conospermum undulatum* (wavy-leaved smokebush), and two 'priority' flora. This bushland site is in excellent condition, with a few weeds such as pine trees (*Pinus* sp.) and Victorian tea-tree (*Leptospermum laevigatum*) along the edges. This area has already been fenced by



Top *Calcectasia narragara* at Sultana Road bushland

Above *Lambertia multiflora* var. *darlingensis* at Sultana Road West
Photos – Val English

the WAPC to help preserve these highly significant bushland values.

The WAPC has been acquiring regionally significant bushland areas such as these two sites since the publication of *Bush Forever* in 2000. DEC, and the previously entitled Department of Environmental Protection, have provided advice about biodiversity values contained on the lands, and about urgent land management actions required to maintain these crucial bushland areas.

Previous land acquisitions under *Bush Forever* that also contain TECs include:

- White Road bushland Orange Grove (*Banksia attenuata* woodlands over species-rich dense shrublands')
- Abernethy Road bushland Oakford

(‘Critically endangered *Corymbia calophylla* – *Kingia australis* woodlands on heavy soil’ and ‘Herb-rich shrublands in clay pans’)

- Rapids Road bushland, Peel Estate (*Corymbia calophylla* – *Kingia australis* woodlands on heavy soil; ‘Herb-rich shrublands in claypans’, and ‘Shrublands on dry clay flats’)
- Anstey/Keane Dampland and adjacent bushland, Forrestdale (Herb-rich shrublands in clay pans and Shrublands on dry clay flats).

For more information contact Val English on (08) 9334 0409 or email val.english@dec.wa.gov.au.



Above Wannaping Road bushland
Photo – Val English

Food for thought

by Teagan Johnston



What do *Banksia attenuata*, *B.menziesii* and *B.sessilis* all have in common, besides being in the same genus?

They all occur on the Swan Coastal Plain and Carnaby's cockatoo (*Calyptorhynchus latirostris*) find them irresistible as a food resource.

High in energy, banksia species form more than 50% of the birds' diet. However, remnant bushland containing these food resources has largely been removed from the landscape for urban development and establishment of exotic crops (for example commercial pines).

Managing anthropocentric values to achieve an acceptable balance between conservation and socioeconomic objectives is often complex and challenging for conservation agencies and managers. The Carnaby's cockatoo is no exception, as over the past 60 years populations have declined following the loss of feeding habitat in non-breeding areas. Understanding the availability of food resources in relation to the cockatoo's population size is critical for making informed decisions about future urban planning and the importance of different habitat patches for the species.

A research program aimed at increasing knowledge and assisting in the recovery of the Carnaby's cockatoo has been funded as part of the conservation initiatives associated with the development of the Fiona Stanley Hospital. This funding is being used by DEC to determine the



abundance and density of food resources for Carnaby's cockatoo in banksia woodlands on the Swan Coastal Plain, and to examine how threatening processes such as fire and dieback disease (*Phytophthora cinnamomi*) influence the availability of these resources.

At present 21 research sites have been identified and 84 quadrats established in banksia woodlands across the Swan Coastal Plain. Sites vary in banksia species composition, remnant size, distance to roosts, fire age and health. Site assessments will be undertaken to collect data on:

- biodiversity characteristics (for example vegetation assemblage, health)
- landscape characteristics (for example landform, soil)
- food resources (for example species, density, productivity)
- threats (for example fire, dieback).

Vegetation identified as a 'major' food resource will be analysed to relate plant size (for example height and stem diameter) with flower and seed production and variation in productivity due to soil type, fire age and disease. This information will be used to determine the number of birds that can be supported in a given area based on food resource density and seed productivity.

To understand the diversity and composition of each food resource being consumed by these



Left Carnaby's cockatoo in flight

Centre *Banksia attenuata*

Right Banksia woodland
Photos – Teagan Johnston

birds, surveys will be undertaken to identify:

- the proportion of time each area is being used
- the change in food resource use throughout the year
- seed maturation rates and phenological status of food resources (seasonal timing of life cycle events, such as budding and flowering).

Surveys will identify the number of eaten fruits, uneaten fruits, pruned green twigs and pruned flower spikes on the ground. The birds' feeding activities will also be observed, such as foraging for invertebrates, feeding on fruits or feeding on flowers (nectar).

The outcomes from this research will provide a greater understanding of the food resource availability for Carnaby's cockatoo on the Swan Coastal Plain, identify limitations and impact of threats, and develop a method of ranking remnant vegetation quality and importance. All of this will guide future management decisions for the sustainability and persistence of these iconic birds.

For more information regarding this project please contact Teagan Johnston on (08) 9334 0196 or by email teagan.johnston@dec.wa.gov.au.

Department's work showcased at Wildflower Festival

By Val English

The Wildflower Society's Eastern Hills Branch held their spring Wildflower Festival on 18 and 19 September 2010 at the Octagonal Hall in Glen Forrest. They presented a colourful display of local wildflowers, artwork and beautiful educational books. The festival included a range of exhibits by local community groups including friends groups of the western swamp tortoise, Star Swamp, Blue Wren Reserve and Jane Brook Catchment. The organisers also kindly offered the DEC free display space at the event.

DEC's Species and Communities Branch had poster displays about a search tool to select garden plantings that produce food for Carnaby's cockatoo. This was well complemented by a Wildflower Society display that included information about woody plants the birds have been sighted on in local gardens. Other DEC displays included information about threatened ecological communities and declared rare flora that occur in the Perth metropolitan area. Regional Parks Branch provided flags and displays with photographs and maps that covered a suite of parks in the area. Queries from the public included interest in hands-on educational programs available for schools and other festival events in the local area, and the locations of local threatened ecological communities that could be visited.

The weekend produced sunny days, and the festival was well attended by people from across metropolitan Perth along with visitors from other states of Australia and overseas.

For more information contact Val English on (08) 9334 0409 or email val.english@dec.wa.gov.au.



Above DEC's display at the Wildflower Society festival.



Left Barrow full of weeds at the Wildflower Festival
Photos – Val English

Plants for Carnaby's 'search tool'

By Christine Groom

A new online search tool has been created to encourage the planting of species used by Carnaby's cockatoo for feeding, night roosting and/or nesting. The online search tool enables users to describe their site, purpose for planting or desired plant characteristics and match this to suitable plant species. By planting the species suggested by the search tool, the food and habitat available to the cockatoos will increase and contribute to improving their conservation status.

It is hoped the search tool will also help to identify and retain suitable habitat for Carnaby's cockatoo and improve knowledge of the habitat needs of the species.

The search tool is available from the department's website at www.dec.wa.gov.au/plantsforcarnabys.



Above Carnaby's eating protea seeds. Photo – Christine Groom

Threatened Species and Communities recovery teams' summaries of 2009 annual report

Recovery team chairs are responsible for writing annual reports on recovery action progress specified in recovery plans or interim recovery plans. Summaries from reports received are reproduced below. Annual reports are placed in the department's Wildlife Sciences Library.

Carnaby's cockatoo

Carnaby's cockatoo is a charismatic visitor to the Perth metropolitan area and promotes significant public interest. A collaborative project was begun between DEC and Birds Australia to monitor Carnaby's cockatoos at their night roost sites across the greater Swan Region. Around 40 volunteers assisted with the summer 2009 roost counts on the Swan Coastal Plain, and the ground work was laid for a continuation of the roost monitoring project which has recently been repeated again in 2010.

DEC has received state natural resource management (NRM) funding for a number of projects relating to improving our knowledge about Carnaby's cockatoo, including:

- the mapping and assessment of critical habitat in the Wheatbelt and Swan Coastal Plain
- a survey of artificial hollows (nest boxes)
- the development of an online tool for informing land owners and developers on which species to plant that are preferred by Carnaby's and will directly benefit them by providing fodder, roosting and nesting sites.

Dibbler

The breeding colony at Perth Zoo produced 38 young dibblers last year, with 31 surviving to weaning. Dibbler recovery moved ahead in 2009, with the continuation of the reintroduction to Peniup proposed nature reserve, which saw the release of 34 dibblers from Perth Zoo in October and November. During 2009, dibblers continued to be caught in Peniup, including three in March and seven in September. A December monitoring trip resulted in the capture of six of those animals and a new dibbler, all in good condition.

Dugong

Significant numbers of dugongs inhabit the Kimberley region of Western Australia but until recently little was known about the distribution and behavior of this species. A project investigating the movement behaviour and habitat usage of dugongs in the West Kimberley region has found that dugongs have shown a high degree of site fidelity to Beagle Bay. Four dugongs were tagged in Beagle Bay 16–19 July 2009 with

only one leaving the bay and travelling 500 kilometres south. Dive patterns were also recorded as part of this project.

The project has a strong community involvement. The traditional usage of dugong is high and local communities have strong relationships with this species. This project will build capacity among local Indigenous communities throughout the West Kimberley area to conduct research on dugong movements, behaviour and habitat requirements using GPS satellite telemetry. Information gathered from GPS tags will assist the local communities in the management of dugong as well as provide much needed conservation management data for the appropriate assessment of proposed large-scale industry within the region.

This project is being led by David Holley and Daniel Oades and is a collaborative effort between Edith Cowan University, DEC, Kimberley Land Council and North Australia Indigenous Land and Sea Management Alliance. This project was made possible through funding from the Australian Marine Mammal Centre. Conservation effort for this species is also at a national level with recovery team members attending a technical workshop with the aim of developing a national dugong conservation plan.

Forest black cockatoos (Baudin's *Calyptorhynchus baudinii* and forest red-tailed black cockatoo *C. banksii naso*)

Forest black cockatoo conservation work has continued in 2009 focusing on removal of feral honey bees from nesting hollows. The then Department of Water, Heritage and the Arts (DEWHA) has committed \$65,000 to a research program which will control feral bee hives at Minyulo Nature Reserve, private property near Cataby (for the benefit of Carnaby's cockatoos), key sites in the northern Jarrah forest and the private property west of Lake Muir. WWF have committed \$30,000 to the development of a feral bee control training course at Challenger TAFE. Work continues on determining and promoting non-lethal means of mitigating fruit damage by Baudin's cockatoo in commercial apple orchards. Trials with newly developed noise emitting devices continue in various areas. Orchards are also trialling various forms of netting to protect from bird damage as well as hail and sun damage. It is hoped that these efforts will be adopted elsewhere and help to reduce illegal shooting by orchardists.

Baudin's cockatoos are sometimes admitted to the Perth Zoo to receive treatment from veterinary staff on shooting wounds.

Perth Zoo supported postgraduate research documenting the injuries to black cockatoos (three species) and the outcomes of rehabilitation of these injured cockatoos. The zoo has recording the demography of the birds admitted for examination and has tested the use of a range of transmitter attachment techniques on these individuals in aviaries. The results of these tests on captive cockatoos will assist in the evaluation of the collar, harness and tail mounted transmitters with the intention of these transmitters being deployed on cockatoos in the wild.

The Western Australian Museum has continued their research on determining flocking, breeding, feeding, social organisation, movements and distribution of Baudin's cockatoo. Ron Johnstone of the Western Australian Museum has documented 20 pairs of forest red-tailed black cockatoos breeding in the Wungong area in 2009, where no breeding was recorded in the previous year.

Geocrinia

Population monitoring of the two species of frog *Geocrinia alba* and *G. vitellina* was undertaken in late 2009, covering 71 sites and 300 hours' work. Creek systems were generally found to be quite moist and/or flowing after receiving good winter rainfalls compared to previous years. A small increase in calling males was recorded at most larger sites and calling at small sites was steady. Only one additional site was elevated to the extinct category. Collaborative work between DEC and the Perth Zoo continues with *G. alba* specimens and egg masses collected for use in their captive breeding program. The translocation of captive-bred *G. alba* metamorphs and one-year animals is planned for this field season in late August or early September 2010.

Additional NRM funding has been secured and has been used to enhance the intensity and expand the monitoring of both *G. alba* and *G. vitellina* sites for pig impacts in 2010. NRM funds have also been used in weed control on private lands containing frog fences to assist in maintaining the integrity of these fences and the frog habitat. A revised and updated recovery plan has been prepared by the recovery team, and, now completed, will be endorsed by DEC and submitted to DEWHA later this year.

Gilbert's potoroo

The Gilbert's potoroo program has made great progress with another success in the Bald Island translocation and removal of foxes and cats from the recently constructed 380-hectare enclosure at Norman's Beach in Waychinicup National Park. Trapping on Bald Island proved that in less than five years, the population had grown from 10 founders

to at least 29 animals by November 2009, despite the removal of seven individuals from the island in 2008 and early 2009. These seven potoroos were briefly held in captivity at Two Peoples Bay until conditions were suitable for their release into the Norman's Beach enclosure.

In 2009, the Gilbert's potoroo recovery program received major funding from the Australian Government's Caring for our Country interim funding scheme, through South Coast NRM, providing staff for maintenance of captive breeding and cross-fostering facilities and operational funds for monitoring the Two Peoples Bay population. This funding ceased, however, on 30 September 2009. During 2009–10 the project has also received \$30,000 from the WA state NRM for 'critical recovery actions' to continue the monitoring of the wild population at Two Peoples Bay. Major funding was also received from DEC for two projects under the specific nature conservation projects program including the:

- 1) Gilbert's potoroo enclosure
- 2) Bald Island translocation.

This continues the support received from the predecessors of this program, the Biodiversity Conservation Initiative and Saving our Species program.

Lancelin Island skink

Monitoring continued of captive-bred Lancelin Island skinks on Favorite Island in March 2010. Cool and rainy weather meant that overall captures were low with only a few adults and recently reproductive skinks captured. The Lancelin Island population has not been formally monitored recently but regular patrols and maintenance of boardwalks was undertaken by Ian Anderson on Lancelin Island as part of actions to minimise impacts of visitors to the island.

Marine turtles

Improvements were made in data collection, management and communication for impact assessment that pertains to marine turtles. A total of 30 turtles were fitted with GPS satellite transmitters by Pendoley Environmental over the 2009–10 summer. These turtles were selected from the hundreds of flatback turtles that returned to nest at Barrow Island last summer. The turtles were released from Barrow Island (on behalf of Chevron Gorgon Gas project) and from Cemetery Beach (on behalf of BHP Billiton). These tracks can be seen online at www.seaturtle.org/tracking.

This tagging operation is part of a long-term flatback turtle tagging program at Barrow Island and Mundabullangana Station (a reference site on the mainland). Surveys, tagging, beach track count, hatchling success, nest predation, hatchling orientation, predation and dispersal studies are ongoing at a range of locations in WA from Dirk Hartog Island to Cape Domett.

There is an increasing demand for the

department to provide advice on minimising the impacts of development. DEC's Environmental Management Branch have devised the *Marine turtle impact assessment guidelines* that are currently under review for mitigating activity around marine turtles.

Muir's corella

Muir's corella (*Cacatua pastinator pastinator*) is endemic to the south-west. It once occurred across most of the south-west but is now confined to a single population that ranges across Lake Muir, Boyup Brook, Perup River, Frankland and Rocky Gully. Annual censuses have recorded a promising increase in population size. Survey sites include the Tonebridge–Unicup area and covered properties in the shires of Manjimup, Boyup Brook, Kojonup, Plantagenet and Cranbrook. Revegetation programs have also been completed and met with varying success due to the destructive nature of Muir's corella.

DEC's Warren Region has received \$32,000 from the South West Catchment Council to fund a conservation officer position in Donnelly District to coordinate the annual survey and progress mapping and to eradicate feral bee hives from key breeding areas. Feral bee eradication is a collaborative project between DEC and the Western Australian Museum.

Numbat

In September 2009 the Numbat Recovery Team approved a fourth release of numbats at Cocanarup Timber Reserve, near Ravensthorpe. On 6 Dec 2009, 13 numbats bred at Perth Zoo were released to supplement the three previous releases. Eight numbats from previous releases were still alive and transmitting in the area as well as one young born and radio-collared at Cocanarup in 2009.

Monitoring of the numbat population at Dryandra in 2009 produced disturbing results, with the lowest sighting rate since the early 1980s and mounting evidence that predation by cats is increasing and having a significant effect on this important numbat population. Dryandra has the most genetically diverse numbat population and for this reason has been used as the original source of stock for all translocations and captive breeding so far. It is critical that cat control is implemented at Dryandra very soon or this population is likely to become extinct in the next two years.

Shark Bay marsupials

A cost-effective monitoring program for the wild Shark Bay marsupial populations on Bernier and Dorre island populations has been devised and implemented and this program will be updated within an adaptive management framework. Biodiversity Conservation Initiative funding has been used to continue the mammal monitoring program for the wild populations of boodies, banded hare-wallabies, western barred

bandicoots and mala on Bernier and Dorre islands.

Five western barred bandicoots were successfully translocated from Faure Island to Roxby Downs in South Australia to augment the genetics of the resident population at Roxby. Breeding of burrowing bettongs at Faure Island and Heirisson Prong has been very successful. Western barred bandicoots and banded hare-wallabies are also fairing well on Faure Island.

Boodies have been translocated from Barrow Island Nature Reserve to Lorna Glen for their conservation now that development of this high conservation, iconic reserve has been authorised. Boodies at Roxby were breeding extremely well, before going through a significant decline, but now seem to be recovering again.

South Coast birds

There have been more recent developments in the conservation of South Coast threatened bird species. An integrated predator management program has been introduced, primarily focusing on minimising the threat of predation to the critically endangered western ground parrot. Research of operational and monitoring methodologies will assist the management of habitat of other threatened bird species on the south coast in the future. Baiting as part of the *Western Shield* program is being conducted quarterly throughout habitat essential for threatened birds on the south coast. Strategic hand baiting has also occurred on a smaller scale as frequently as monthly in some critical areas. A western ground parrot captive management program has been established to provide research and insurance as wild populations continue to decline.

The Friends of the Ground Parrot group have been extremely active producing and distributing their two-monthly newsletter and fundraising. Money continues to be raised from the sales of ground parrot merchandise. The group have also been instrumental in securing funding from Exetel to further recovery actions.

Western bristlebird, western whipbird and noisy scrub-bird censuses have been conducted in the past year. Results suggest a relatively stable population trend over the past few years.

South Coast invertebrates

A recovery plan for the Stirling Range rhytidid snail (undescribed rhytidid species (WAM 2295-69)) and Stirling Range trapdoor spider (*Moggridgea* sp. S (BY Main 1990/24, 25)) has been drafted and is close to endorsement by the department. The recovery team has considered nominating further invertebrates as threatened species, but this is difficult due to the limited survey effort for most species and the uncertain taxonomy for others. Eula's planthopper (*Budginmaya eulae*) from the Ravensthorpe Range was described and nominated for

listing but not accepted as threatened due to insufficient survey effort. It remains listed as a 'priority one' species until further surveys can be conducted. Mark Harvey has drafted nominations of 10 species of millipede of the *Atelomastix* genus for listing on the threatened and 'priority' species list.

The team is looking at taking a different angle and investigating the possibility of nominating the relictual invertebrates habitat in the Stirling Range as a threatened ecological community. By recognising the entire community, rather than listing individual species, it is hoped that this will offer more protection to these species and their habitat collectively and progress conservation efforts more quickly. A brochure entitled *Gondwanan invertebrates of the South Coast* has also been completed by DEC to raise community awareness of threatened invertebrates in this region.

Sunset frog

Perth Zoo and DEC combined funds and forces to undertake an intensive survey of known populations of sunset frog (*Spicospina flammocaerulea*) in 2008 in an effort to improve our knowledge of environmental factors affecting the detection of the frogs during population census work.

Each known population was surveyed at least three times per year under each specified combination of factors. The results were concerning and suggested that low groundwater and subsequent acidification associated with low winter recharge in 2008 had resulted in a low number of calling males and potentially declining populations.

The census was repeated at select sites in 2009 following a wet winter and the number of calling males was higher and more consistent with pre-2008 records. In total, 29 sites containing sunset frog have been located between 1996 and 2009 and 22 have been substantiated during field census work. Calling behaviour patterns were observed to be influenced by moon phase, cloud cover and water parameters, but the data has yet to be analysed to determine whether the observations are statistically significant. There was no observed relationship between calling behaviour and recently burnt habitat.

Western swamp tortoise

The recovery team has held regular meetings in the past year. More hatchlings have been produced at Perth Zoo. Thirty of these captive bred tortoises have been translocated to swamps within Moore River

Nature Reserve. A significant achievement is the release of the 500th captive-bred tortoise!

Works to improve water flow to key areas has been achieved with a bore upgrade at Twin Swamps Nature Reserve in 2010 to supplement key swamps in dry years. Further hydrological modifications have also been completed at Moore River Nature Reserve. Population monitoring continues at Ellen Brook, Twin Swamps, Mogumber and Moore River nature reserves.

There has been further success in securing funding to help conserve the western swamp tortoise:

- The Friends of Western Swamp Tortoise received a Threatened Species grant of \$5,000 to fund activities assisting the habitat creation at Mogumber Nature Reserve.
- DEC received a grant from the Perth Zoo totalling \$4,790 as part of the WA Threatened Fauna Project.
- DEC, in conjunction with the Perth Zoo and The University of Western Australia, were successful in obtaining the ARC Linkage Project – Animals on the move: An integrated response to selecting conservation reserves under climate change.

Albany Threatened Flora Recovery Team

New populations of the following threatened flora were located: *Calectasia cyanea* (CR), *Banksia brownii* (CR), *Persoonia micranthera* (CR), *Andersonia pinaster* (EN), *Caladenia bryceana* subsp. *bryceana* (EN), *Chordifex abortivus* (VU).

Known numbers of *Eucalyptus burdettiana* (East Mt Barren) and *Verticordia helichrysantha* (VU) (Trigelow Beach) were substantially increased following survey.

New translocations were completed for the CR taxa *Gastrolobium luteifolium* and *Latrobea colophona* at a new site recently purchased by DEC, while further translocations to existing sites were undertaken for *Banksia anatona*, *B. brownii*, *Lambertia fairallii* and *B. montana*.

The Albany aerial phosphite program for control of *Phytophthora* dieback continued in 2009. Monitoring indicates that species decline and disease spread has been reduced particularly at *B. anatona* population two, *Daviesia*

pseudaphylla population one and *D. glossosema* (P1).

The status of four 'priority' flora was evaluated following survey for nomination as DRF: *Asterolasia* sp. Kagan (P1), *Calochilus pruinosum* (P1), *Banksia rufa* ssp. *pumila* and (P2) *Gastrolobium vestitum* (P2).

Acacia awestoniana was re-surveyed after fire in 2006 and a change in status from VU to CR recommended.

A new population of *Calectasia cyanea* (CR), previously known from only one population of 100 plants, was located near the Albany wind farm by local volunteer Keith Smith. Extensive survey has been conducted around Albany for this species with efforts made to retrace the steps of Robert Brown who first collected the species in 1801. Keith was looking for the Queen of Sheba orchid (*Thelymitra variegata*) whose coloration resembles that of the *Calectasia*, a possible case of floral mimicry to attract pollinators.

Central Wheatbelt District Threatened Flora Recovery Team

The Central Wheatbelt District achieved many noteworthy flora recovery actions during 2009. These include the publication of the book *Threatened flora of the Western Central Wheatbelt* and associated book launch.

Through routine monitoring and surveying, new populations were discovered for nine critically endangered taxa, five endangered taxa and vulnerable taxa. New populations were also surveyed for priority flora with 15 'priority one' taxa recording new populations. These include the rediscovery of *Acacia leptoneura*, *A. torticarpa* and *Scholtzia eatoniana*, last collected 160, 60 and 30 years ago respectively.

New populations were discovered for six 'priority two' taxa, nine 'priority three' taxa and four 'priority four' taxa. A new translocation was implemented for the critically endangered *Lysiosepalum abollatum* and re-stocking of existing translocations with new seedlings for the species *Daviesia cunderdin*, *D. euphorbioides* and *Acacia subflexuosa* subsp. *capitata*.

Recruitment burns were implemented for the species *D. euphorbioides*, *Philotheca basistyla* and *Cyphanthera odgersii* subsp. *occidentalis* with the successful recruitment of seedlings.

Esperance District Threatened Flora Recovery Team

Major recovery actions implemented involved surveys and monitoring of threatened and priority populations, surveys of new habitat, implementing and monitoring translocations, phosphite application, seed collection, mapping of critical habitat and developing fire management strategies.

With over 300 species of 'priority' flora, key works have focused on systematically surveying these species to determine an appropriate conservation status so that resources can be directed appropriately to those species most in need. This has initially involved desktop work to collate species information (such as descriptions, images and location details) that will assist surveys.

Geraldton District Threatened Flora and Communities Recovery Team

A trial to induce recruitment at a population of *Styliidium amabile* was conducted during winter 2009. The trial was monitored in late 2009 and a total of 425 new recruits were recorded, with the majority in burnt plots and several in one smoked plot. Monitoring following an exceptionally dry summer indicated a 44% survival rate.

New seedlings of *Verticordia spicata* subsp. *squamosa* were planted out into an existing translocation site, which was the fourth round of planting for this translocation site since 2002. The most recent monitoring data for this site indicates a survival rate of approximately 45% over an eight-year period.

Extensive survey and location of many new populations of *Eucalyptus blaxellii* during 2008 was followed by a nomination for this species to be removed from the threatened flora list in 2009 and the species has now been downgraded to 'priority four'.

Extensive survey was carried out for several 'priority' flora in 2008 with some follow up in 2009, for flora thought to be at a high risk of extinction in the short term. Nominations for threatened flora listing were prepared for three of these 'priority' flora and one was submitted to the scientific committee for assessment (*Commersonia adenothalia*).

Goldfields Threatened Flora Recovery Team

One of the biggest issues facing flora conservation in the Goldfields Region is the need for further survey for 'priority' species. In the northern Yilgarn area, this has been addressed with the Cliffs/DEC Land Management Project and the employment of a full-time botanist to work solely on 'priority' flora in the greater Mt Manning area for two years. Project Botanist Scott Reiffer has more than 80 'priority' species to concentrate on during his two-year contract, and in the first four months of field work had either found new records of, or re-visited previous collections for 22 of these species. This is a great effort leading into spring, indicating that the project should achieve some great results for flora conservation in the area.

The interim recovery plan for *Leucopogon spectabilis* has been finalised and is awaiting final approvals. The interim recovery plan for *Ricinocarpus brevis* is being drafted.

Funding has been received to carry out a reintroduction of the declared rare flora (DRF) *Gastrolobium graniticum* to Gnarlbine Rock, using fire to induce germination from seeds. A translocation proposal has been approved for this work. Seed was collected from one population in December 2009 for this project, with close to 16,000 seed to be stored at the Threatened Flora Seed Centre for *ex situ* conservation.

Conospermum toddii was downgraded from DRF to 'priority four' flora. Monitoring plots have been set up at three populations to monitor the impacts of fire on the species.

Cliffs have commenced a translocation of *Ricinocarpus brevis* at Windarling Range.

Warren Threatened Flora Recovery Team

Frankland District

Threatened ecological communities (TECs)

'Mt Lindesay-Little Lindesay Vegetation Complex' was burnt in 2009 according to a pre-determined strategic plan and the post-burn survey of Mt Lindesay TEC plots has begun. The Mt Lindesay-Little Lindesay Vegetation Complex TEC draft interim recovery plan is under review and nearing completion.

Priority ecological communities

The first round of post-burn monitoring of installed plots of 'Southwest coastal grassland dominated by *Austrostipa flavescens*, *Poa porphyroclados* and *Desmodcladus fascicularis*' was completed in November 2009.

The vegetation composition of 'Lake Surprise relictual peat community' has now been mapped.

Two new populations of 'Sphagnum communities of the tingle forest' have been found – one not associated with tingle.

Declared rare flora (DRF)

One new population of *Banksia verticillata* has been located, and two new sub-populations of *Diuris drummondii* have been mapped on private property.

Multiple populations of *Cryptandra congesta*, *Grevillea fuscolutea* and *Laxmannia grandiflora* ssp. *brendae* were taken in the Mt Lindesay burn (October 2009). These DRF species have been included in the post-

burn monitoring project. Interim recovery plans (IRPs) have been approved for *C.congesta* and *G.fuscolutea*. The IRP for *L.grandiflora* ssp. *brendae* has been completed and is awaiting approval.

Priority flora

Approximately 76 new populations of 'priority' flora have been recorded and 108 known populations of 'priority' flora have been surveyed.

Donnelly District

Priority ecological communities

Three new records of the '*Reedia spathacea*-*Empodisma gracillimum*- and *Schoenus multiglumis*-dominated peat paluslopes and sandy mud floodplains of the Warren Biogeographical Region' have been found within the Donnelly District, which had previously been incorrectly listed in the Frankland District. An occurrence on Chesapeake Brook has been surveyed, with at least eight hectares containing *R.spathacea*. Two records of this community at Mt Chudalup are yet to be located and surveyed.

Mapping and scoring the condition of each occurrence of the 'priority three' ecological community 'epiphytic cryptogams of the karri forests of south-west Western Australia' within the Dombakup and Warren forest blocks is in progress.

A vegetation survey has been undertaken of the 'priority two' community 'basalt association of the Warren Region' at Black Point to determine possible unique candidate communities suspected to be associated with the Bunbury Basalt.

Declared rare flora (DRF)

Annual monitoring of *Andersonia annelsii* indicated that the overall population is stable, although seedlings tagged in 2007 and 2008 have not yet produced flowers.

One new population of *Caladenia christineae* has been recorded, and another population has been monitored for burning in autumn.

Monitoring of *C.winfieldii* indicated 22 flowering plants in 2008, almost doubling in 2009 with 43 plants in flower.

One new population of *Diuris drummondii* has been located on private property but needs to be verified.

A translocation of *Grevillea acrapogon* has resulted in a 90% survival rate. A second potential translocation site has been found on privately owned remnant vegetation adjacent to a proposed national park.

Priority flora

Approximately 40 new populations of 'priority' flora have been recorded and 128 known populations of 'priority' flora have been surveyed.

Lake Clifton Recovery Team

Thrombolite (stromatolite-like-microbialite) community of a coastal brackish lake

The Minister for the Environment, Heritage and the Arts, has listed the Lake Clifton threatened ecological community as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The purpose of listing this ecological community is to help prevent its decline and to provide support to on-ground efforts that ensure its long-term survival. Listing this ecological community as endangered under the EPBC Act means that any new activity that is likely to have a significant impact on the ecological community will need to be referred to the Australian Government for assessment and approval. Funding may also now be available to landholders and the community through the Australian Government's Caring for our Country program.

A field day was held in April for the team and other interested people with the aim of providing a forum to enable informal discussion and to visit sites of interest which some members had not had the opportunity to see in the past. Discussion areas included locations of monitoring the health of the thrombolites and related water sampling activities; data loggers, a rain gauge and hydrological sampling sites; tuart revegetation trial sites; where limestone was extracted in the past from the lake bed; and weeding and revegetation areas. The group was also briefed on a new project to gather information for the coastal strip (west of Old Coast Road) between Dawesville and Binningup with the aim of the Office of the Environmental Protection Authority developing a position on land use in the area.

Sedgeland in Holocene dune swales Recovery Team

Members of the recovery team for the 'sedgeland in Holocene dune swales' dealt with a series of issues in 2009 including negotiations and advice about areas that contain the sedgeland community and are the subject of proposals for reservation or development.

Under the direction of DEC's Regional Parks Branch, work was continued on controlling the weeds *Juncus acutus* (sharp rush), *Gomphocarpus fruticosus* (cotton bush) and *Cortaderia selloana* (pampas grass) at Lake Cooloongup and Lake Walyungup. Weed control focusing on *Euphorbia terracina* (Geraldton carnation weed) and *Trachyandra divaricata* (dune onion weed) continued at Port Kennedy Scientific Park within occurrences of the sedgeland, in conjunction with Urban Nature and Greening Australia. Urban Nature also produced a report on managing *Euphorbia terracina* in the sedgeland community at the park.

Maintenance of fencing was continued at Port Kennedy Scientific Park to help control illegal four-wheel drive access, and pedestrian access has been improved at the major park entrance on Port

Kennedy Drive. Significant works involving the placement of limestone boulders interspersed with vegetation have been undertaken to help control vehicle access into the park and new heavy duty boom gates have been manufactured and installed at management access points into the park.

With funding assistance from the Australian Government's Natural Heritage Trust, Swan Coastal District mapped weed infestations, mapped condition, determined priority areas for weed control, and undertook manual control of *Euphorbia terracina* at the Lake Richmond occurrence.

Liaison continued between DEC staff and Landcorp. Landcorp maintained fences, replaced gates, installed new gates and removed rubbish at the Bakewell Drive Port Kennedy occurrences of the sedgeland following advice from DEC.

Species and Communities Branch investigated possible additional occurrences of the community in Yalgorup National Park.

Recovery plans approved

Five interim recovery plans (IRPs) for flora have recently been endorsed by DEC's Director of Nature Conservation. These plans have been written with the assistance of DEC's Specific Nature Conservation Project funding. The plan for the underground orchid is a revised plan that includes undated information on recent research done on this orchid.

No.	Title	Prepared by	DEC region/districts involved
299	<i>Gastrolobium luteifolium</i>	Robyn Luu, Andrew Brown, Kym Pryor	Albany, South Coast
300	<i>Leucopogon spectabilis</i>	Robyn Luu, Jennifer Jackson, Andrew Brown	Goldfields
301	<i>Latrobea colophona</i>	Robyn Luu, Andrew Brown	South Coast
302	Underground orchid, <i>Rhizanthella gardneri</i>	Andrew Brown, Andrew Batty, Mark Brundrett, Jeremy Bougoure and Kingsley Dixon	South Coast, Wheatbelt
303	Bremer marianthus, <i>Marianthus aquilonaris</i>	Robyn Luu, Andrew Brown	South Coast

The plans are available on DEC's website at www.dec.wa.gov.au/content/view/842/2007.



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