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Woylie Conservation Research Project

The woylie has been hailed as one of the success stories of wildlife conservation programs like DEC's Western Shield. In 1996, it was the first endangered species to be removed from listing under the Commonwealth *Endangered Species Protection Act 1992* as a direct result of a recovery program.

However, a dramatic decline in woylie numbers has been observed over the past few years.

With funding from Saving our Species, the State Government's biodiversity conservation initiative, research is now under way to determine possible causes.

Juvenile woylie (Photo: Sabrina Trocini)"

On 22nd January 2008 the then Environment Minister, David Templeman, re-listed the woylie as endangered under Schedule 1 of the State *Wildlife Conservation Act 1950*.

The assessment of the conservation status of the woylie and the Woylie Conservation Research Project are funded through Saving our Species.

About the woylie

What is a woylie?

Woylies (*Bettongia penicillata ogilbyi*) are small marsupials that weigh between 1 and 1.5kg. They are distantly related to kangaroos. They are also known as brush-tailed bettongs because of the distinctive black brush they have at the end of their tail.

'Woylie' is the indigenous Nyoongar name which refers to their ability to carry leaves and

sticks with their tail.

Woylie at Keninup forest

Woylies are nocturnal and forage primarily for underground fungi (native truffles). They also eat seeds, tubers and bulbs.

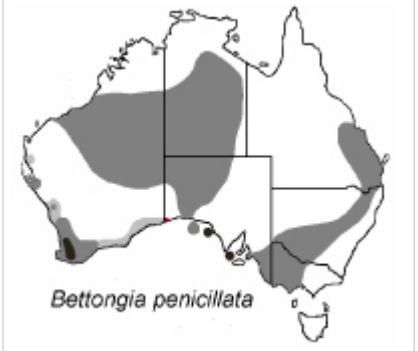
What important role does the woylie play in the environment?

Woylies make many diggings in search of their favourite food, underground fungi. These diggings help water seep into the ground and move nutrients in the soil.

Fungal spores survive being eaten by woylies and are dispersed around the forest in woylie scats (droppings). As fungi help plants to grow, woylies play an important role in the re-establishment of native vegetation. Woylies are also known to disperse and store seeds which also affect the recruitment and regeneration of vegetation.

Original Distribution

Where did the woylie originally exist?



Key

- Subfossil Evidence (light grey)
- Historical Distribution (grey)
- Current Distribution (black)

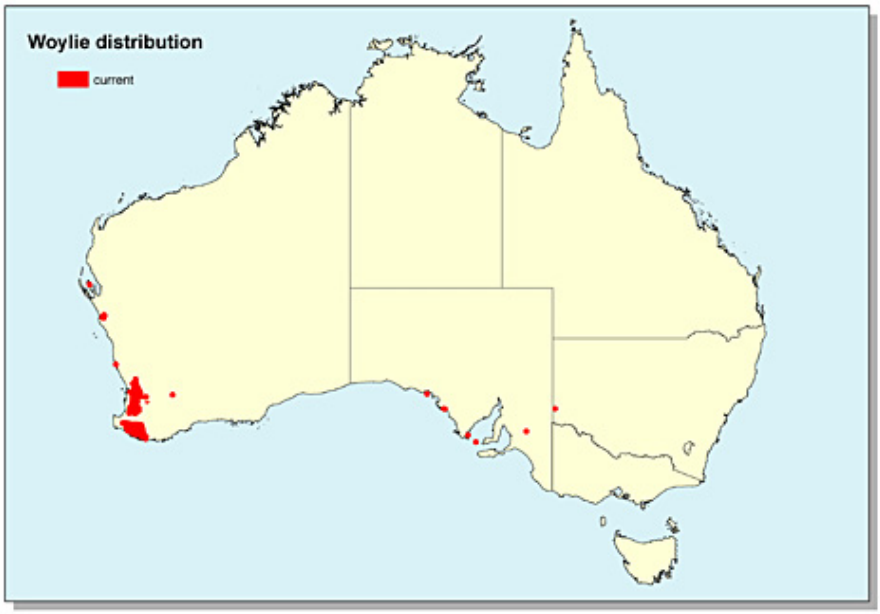
Woylies once occupied most of the Australian mainland south of the tropics including the arid and semi-arid zones of Western Australia, the Northern Territory, New South Wales

and Victoria.

However, by the 1970s their occupancy was reduced to three locations in Western Australia; Tutanning Nature Reserve, Dryandra Woodland and the Perup/Lake Muir area.

Current distribution

Where is the woylie found now?



A combination of fox baiting and translocation has helped increased the number of locations that the woylie can now be found.

In Western Australia, scattered woylie populations may be found throughout the jarrah forest in the south west corner of the state. Isolated populations also occur at Francois Peron National Park, Kalbarri National Park, Nambung National Park, Julimar Forest, Avon Valley National Park, Dryandra Woodland, Boyagin Nature Reserve, Tutanning Nature Reserve and North Karlgarin Nature Reserve.

In South Australia, they are found on several islands including St Peter Island and Wedge Island. On the mainland in South Australia they are found at Venus Bay Conservation Park.

Woylies are also found in fenced sanctuaries that are effectively managed as wild populations in Western Australia, South Australia and New South Wales.

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Conservation status

Why was the species de-listed in 1996?

In 1996 the State and Federal Governments announced that the woylie would be the first species to be removed from the State and Commonwealth threatened species lists as a direct result of a recovery program.

At the time it was considered the conservation status of the woylie had improved considerably. The woylie was no longer threatened by small population sizes and the extent of its occurrence and area of occupancy exceeded minimum requirements for listing.

The conservation status of the woylie continued to improve following delisting, with populations sizes increasing and many additional translocations being undertaken to return woylies to parts of their former range.

The woylie population size reached a peak of approximately 40,000 individuals in 2001.

Why is the woylie being re-listed?

Woylie being released

A rapid decline in woylie numbers has recently been observed, with the population size being reduced by about 75 percent in the last five years to around 10,000 individuals.

The cause for the decline, which seems to have affected the largest populations in the Perup/Lake Muir, Batalling and Dryandra areas the most, is currently unknown.

The decline is not restricted to Western Australia with the Venus Bay Peninsula population in South Australia also experiencing a rapid decline.

So far, the decline has not resulted in the loss of occurrences. This means that the woylie is fewer in numbers but still has a similar distribution to before the decline.

The woylie is again listed as Endangered under the Western Australian Government Wildlife Conservation Act 1950 and Federal Government Environment Protection and Biodiversity Act 1999 (EPBC Act), and Critically Endangered by the International Union

for Conservation of Nature (IUCN Red list of threatened species).

Research and monitoring

What is DEC doing to help the woylie?

Population monitoring

Data gathered through population monitoring provides valuable information to assess the conservation status of the species.

There are currently 42 sites throughout the south-west of WA where woylies are monitored. The majority of these sites are part of the Western Shield program.

Research

Under the State Government's Saving our Species initiative, an intensive Woylie Conservation Research Project began in 2006, when it first became apparent that declines in numbers were continuing and not isolated to a single location.

The Woylie Conservation Research Project is focused on an area east of Manjimup where the greatest amount of information is available, but is also gathering information from other locations. It compliments the standard fauna monitoring being undertaken through the Western Shield program.

The project aims to determine the underlying factors responsible for the recent woylie decline in the upper Warren region of south-western WA. It is also identifying management strategies required to reverse these declines.

Woylie demographics are being researched by trapping animals and radio-telemetry is being used to monitor their survival. Possible causes for the decline can be placed into three main categories; limits on food resources, disease and predation.

Results are inconclusive at this stage, but it is intended that there will be immediate management implications and a revised woylie recovery plan will be developed when results are known.

Scientists will also establish adequate mammal monitoring protocols that will enable future changes in population numbers to be quantified and explained.

Key collaborators of the Saving our Species research project are:

- Science Division (DEC)
- Warren Region/Donnelly District (DEC)
- Murdoch University

- Perth Zoo
- Australian Wildlife Conservancy
- University of Western Australia

Students have also been especially important collaborators, including eight Honours students and nine PhD students.

Completed Student Projects

Honours

- Cherriman, C. (2007). Territory size and diet throughout the year of the Wedge-tailed Eagle *Aquila audax* in the Perth region, Western Australia. Honours thesis, Curtin University.
- Hunt, H. (2010). A temporal assessment investigating the effects of population declines on genetic diversity, in the critically endangered woylie (*Bettongia penicillata ogilbyi*). Honours Thesis, Murdoch University.
- Madon, E. (2006). Mating systems and reproductive anatomy in marsupials: explaining the evolution of the anterior vaginal expansion of *Bettongia penicillata*. Honours Thesis, University of Western Australia.
- Rogers, P. (2009). Predator profiling as a tool for the conservation of the woylie (*Bettongia penicillata*). Honours thesis, University of Western Australia.
- Rong Ho, J. (2009). Investigation of the potential pathogenicity of the erythrocyte piroplasm *Theileria penicillata* (Clark & Spencer, 2007). Honours Thesis, Murdoch University.

PhD

- O'Brien, R. Christopher, B.A., M.F.S. (2008). Forensic animal necrophagy in the south-west of Western Australia: Species, feeding patterns, and taphonomic effects. PhD thesis, University of Western Australia.
- Pacioni, C (2010). *A conservation conundrum: the population and epidemiological dynamics associated with recent decline of woylies (Bettongia penicillata) in Australia.* PhD thesis, Murdoch University.
- Parameswaran, N. (2008). *Toxoplasma gondii* in Australian marsupials. PhD thesis, Murdoch University.

Current Student Projects

- Abdad, Y. (PhD, MU) - Rickettsial infections in wildlife and humans in Western Australia
- Burmej, H. (PhD, MU) - Ectoparasites of woylies and other native mammals in Western Australia
- Eckleboom, T. (Honours, UWA) - A comparison of survey methods in providing

population estimates for the woylie (Bettongia penicillata) at Karakamia Sanctuary, Western Australia.
- Kaewmongkol, G. (PhD, MU) - Bartonella infections in wildlife and domestic animals in Western Australia
- Pan, S. (PhD, MU) - *Toxoplasma gondii* infection and atypical genotypes in Western Australian wildlife species.
- Parkar, U. (PhD, MU) - Blastocystis in humans and other mammals
- Yeatman, G. (Honours, UWA) - Population demographics of a fenced population of woylie
- Zosky, K. (PhD, MU) - Food resources and woylie declines in south-western Australia

How you can help

Learn

Learn more about Western Australia's wildlife and spread the word that we have some very unique animals, like the woylie, that need our help.

Report sightings

If you have sighted a woylie please make a note of where the sighting was and report this to DEC Conservation Officer Kellie Mantle on 9334 0579. Sightings help determine the current distribution of woylies. Any woylies found dead may be collected and handed in to your nearest DEC Office or the WA Museum.

News and publications

Latest findings and news

Online:

- http://www.abc.net.au/local/videos/2010/05/26/2910250.htm?site=southwestwa
- http://www.abc.net.au/local/stories/2010/05/24/2908101.htm?site=southwestwa
- http://www.abc.net.au/local/stories/2009/06/24/2607653.htm?site=southwestwa

Information Sheets

Woylie declines: what are the causes?
Science Division Information Sheet February 2009 (PDF 154 KB)

DEC media releases:

- June 22 2009
- June 5 2009

- October 2006
- July 2006

Recent publications

- Garkaklis MJ (2001). Diggings by the woylie, *Bettongia penicillata* (Marsupialia) and its effect upon soil and landscape characteristics in a Western Australian woodland. PhD thesis. Murdoch University.
- Garkaklis MJ, Bradley JS and Wooller RD (2003). The relationship between animals foraging and nutrient patchiness in south-west Australian woodland soils. Australian Journal of Soil Research 41: 665-673.
- Hide A (2006). Survival and dispersal of the threatened woylie *Bettongia penicillata* after translocation. Honours thesis. University of Western Australia.
- James H, Acharya AB, Taylor JA and Freak MJ (2002). A case of bitten bettongs. The Journal of Forensic Odonto-Stomatology 20(1): 10-12.
- Martin S, Bull S and Peeters P (2006). Reintroduction of the brush-tailed bettong (*Bettongia penicillata ogilbyi*) into Lincoln National Park. Department for Environment and Heritage, South Australia.
- Murphy MT, Garkalis MJ and Hardy G (2005). Seed caching by woylies *Bettongia penicillata* can increase sandalwood Santalum spicatum regeneration in Western Australia. Austral Ecology 30: 747-755.
- Orell P (2004). Fauna monitoring and staff training: Western Shield review - February 2003 . Conservation Science Western Australia 5(2): 51-95.
- Priddel D and Wheeler R (2004). An experimental translocation of brush-tailed bettongs (*Bettongia penicillata*) to western New South Wales. Wildlife Research 31: 421-432.
- Smales LR (2005) *Potorostrongylus woyliei* n. sp. (Nematoda: Cloacinidae) from the brush-tailed bettong *Bettongia penicillata* (Marsupialia) from Western Australia, Australia, with comments on Potoroid-Potorostrongylid associations and a key to the species of *Potorostrongylis*. Comp. Parasitol. 72(1): 28-32.

Additional scientific publications

- Burbidge AA, Johnson KA, Fuller PJ and Southgate RI (1988). Aboriginal knowledge of the mammals of the central deserts of Australia. Australian Wildlife Research 15: 9-39.
- Burbidge AA and McKenzie NL (1989). Patterns in the modern decline of Western Australia's vertebrate fauna: Causes and conservation implications. Biological Conservation 50: 143-198.
- Christensen PES (1980). The biology of *Bettongia penicillata* (Gray 1837) and *Macropus eugenii* (Demarest 1817) in relation to fire. Forests Department of Western Australia, Bulletin No. 91.
- Christensen P (1995). Brush-tailed bettong, *Bettongia penicillata*. In: The Mammals of Australia. Ed: R Strahan. Pp292-3. Reed Books, Chatswood.
- Christensen P and Leftwich T (1980). Observations on the nest-building habits of the brush-tailed rat-kangaroo or woylie (*Bettongia penicillata*). Journal of the

Royal Society of Western Austrlia 63(2): 33-38.

- Finlayson HH (1957). Preliminary description of two new forms of *Bettongia* (Marsupialia). Annals in Magazine of Natural History 10: 552-554.
- Hall GP, Nelson L, Storr R and Robinson AC (1991). Recovery plan for the brush-tailed bettong or woylie (*Bettongia penicillata*). A report submitted to Australian National Parks and Wildlife Service, Endangered Species Program (Project 149). Department of Conservation and Land Management, Perth, WA.
- Harvey N (1999). The impact of ecotourism upon the well-being of woylies at Dryandra Woodland village. Honours thesis. University of Western Australia.
- Lamont BB, Ralph CS and Christensen PES (1985). Mycophagous marsupials as dispersal agents for ectomycorrhizal fungi on *Eucalyptus calophylla* and *Gastrolobium bilobum*, New Phytologist 101: 651-656.
- Lee J (2003). The importance of hypogeous fungi in the diet of the re-introduced brush-tailed bettong (*Bettongia penicillata*), at Venus Bay Conservation Park, South Australia. Honours Thesis. School of Earth and Environmental Sciences, Adelaide University.
- Nelson L (1989). Behavioural ecology of the woylie, *Bettongia penicillata* Gray, 1837, on Island A, Venus Bay, South Australia. PhD Thesis. Canberra College of Advanced Education.
- Nelson LS, Storr RF and Robinson AC (1992). Plan of management for the brush-tailed bettong, *Bettongia penicillata* Gray 1837 (Marsupialia, Potoroidae) in South Australia. Department of Environment and Planning, South Australia.
- Sampson JC (1971). The biology of *Bettongia penicillata* Gray, 1837. PhD thesis, University of Western Australia.
- Sharman GB, Murtagh CE, Johnson PM and Weaver CM (1980). The chromosomes of a rat-kangaroo attributable to *Bettongia tropica* (Marsupialia: Macropodidae). Australian Journal of Zoology 28: 59-63.
- Shortridge GC (1909). An account of the geographical distribution of the marsupials and monotremes of southwest Australia having special reference to the specimens collected during the Balston expedition of 1904-1907. Proceedings of the Zoological Society of London 55: 803-848.
- Smith MJ (1989). Release of embryonic diapause in the brush-tailed bettong, *Bettongia penicillata*. In ‘Kangaroos, Wallabies and Rat-Kangaroos' Eds: G Grigg, P Jarman and I Hume. Pp 317-21. Surrey Beatty: Sydney.
- Smith MJ (1996). Duration of embryonic diapause in the brushtailed bettong, *Bettongia penicillata* (Potoroidae): Effect of age of quiescent corpus luteum. Reprod. Fertil. Dev. 8: 807-10.
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- Start AN, Burbidge AA and Armstrong D (1995). Woylie recovery plan. Wildlife Management Program No. 16. Western Australian Department of Conservation and Land Management and South Australian Department of Environment and Natural Resources. Perth.
- Start AN, Burbidge AA and Armstrong D (1998). A review of the conservation status of the woylie, *Bettongia penicillata ogilbyi* (Marsupialia: Potoroidae) using IUCN criteria. CALMScience 2(4): 277-289.

- Vernes K (1999). Fire, fungi and a tropical mycophagist: ecology of the northern bettong (*Bettongia tropica*) in fire-prone sclerophyll forest. PhD thesis, James Cook University.
- Wakefield NA (1967). Some taxonomic revision in the Australian marsupial genus *Bettongia* (Macropodidae), with description of a new species. Victorian Naturalist 84: 8-22.

Recent WCRP Publications

- Averis, S., Thompson, R. C. A., Lymbery, A. J., Wayne, A. F., Morris, K. D. and Smith, A. (2009). The diversity, distribution and host-parasite associations of trypanosomes in Westerna Australian Wildlife. *Parasitology*.
- Bennett, M. D., A. Reiss, H. Stevens, E. Heylen, M. Van Ranst, A. F. Wayne, M. Slaven, J. N. Mills, K. S. Warren, A. J. O'Hara, and P. K. Nicholls. (2010). Genomic characterization of a novel marsupial papillomavirus: Bettongia penicillata papillomavirus type 1. *Journal of Virology* **84**:5448-5453.
- Clark, P., and P. B. S. Spencer. (2007). Description of three new species of *Theileria* Bettencourt, Franca & Borges, 1907 from Macropodidae in Western Australia. *Transactions of the Royal Society of South Australia* **131**:100-106.
- Groom, C. (2010). Justification for continued conservation efforts following the delisting of a threatened species: A case study of the woylie, *Bettongia penicillata ogilbyi* (Marsupialia: Potoroidae). *Wildlife Research.* **37**: 183-193.
- Richards, J., Gardner, T. and Copley, M. (2009). Bringing back the animals. *Landscope* **24(3)**, 54 - 61.
- Smith, A., P. Clark, S. Averis, A. J. Lymbery, A. F. Wayne, K. D. Morris, and R. C. A. Thompson. (2008). Trypanosomes in a declining species of threatened Australian marsupial, the brush-tailed bettong *Bettongia penicillata* (Marsupalia: Potoroidae). *Parasitology* **135**:1-7.
- Smith, A., Lymbery, A. and Thompson, A. (2009). Meet the parasites. *Landscope* **24(4)**, 24 - 29.
- Thompson, RCA, Kutz, SJ, Smith, A. (2009). Parasite zoonoses and wildlife: Emerging issues. *International Journal of Environmental Research and Public Health* **6**: 678-693.
- Thompson, RCA, A. Smith , A. J. Lymbery, S. Averis, K. D. Morris A. F. Wayne (2010). *Giardia* in Western Australian wildlife. *Veterinary Parasitology* **170**: 207-211.
- Mitchell, S., and A. F. Wayne. (2008). Down but not out: solving the mystery of the woylie population crash. *Landscope* **25**:10-15.
- Pacioni, C. and Spencer, P. (2010). Capturing genetic information using non-target species markers in a species that has undergone a population crash. *Australian Mammalogy* **32**: 33-38.
- Parameswaran, N., O'Handley, R. M., Grigg, M. E., Wayne, A. F. and Thompson, R. C. A. (2009). Vertical transmission of *Toxoplasma gondii* in Australian Marsupials. *Parasitology* **136**:939-44.
- Parameswaran, N., A. Thompson, N. Sundar, S. Pan, and M. Grigg. (in press). Nonarchetypal Type II-like and atypical strains of *Toxoplasma gondii* infecting

marsupials of Australia. *International Journal for Parasitology*.
- Wayne, A. F. (2009). 'Woylie declines: what are the causes? Science Division Information Sheet 7/2009.' Department of Environment and Conservation, Perth, Western Australia.
- Wayne, A. F. (2010). Woylie Conservation Research (Fact Sheet). South Coast Natural Resource Management. Albany, Western Australia
- Zosky, K., Bryant, K., Calver, M., and Wayne, A. F. (in press). Do preservation methods affect the identification of dietary components from faecal samples? A case study using a mycophagous marsupial. *Australian Mammalogy*. **XX**: XXX

Recent WCRP Prizes

- Pacioni, C., Best post graduate introductory student poster, first year (2006). (Sponsored by Oz Biotech). Post-graduate poster day, Murdoch University
- Caccianaga, Rian. EJG Pitman Prize, Australian Statistical Conference (2008). Analysis of upper warren woylie data.
- Pacioni, C. (2008). Best student presentation. Wildlife Disease Association (Australasian section). Kioloa, New South Wales.
- Australian Wildlife Conservancy, Biodiversity Conservation Award, Western Australian Environment Awards (2009).

The progress report

The document *Progress Report of the Woylie Conservation Research Project* is available in two ways.

It can be downloaded in full . . .

Progress Report of the Woylie Conservation Research Project (full) (9.49 Mb)

. . . or you can choose to view/print/download individual sections.

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Potential postgraduate projects

A list of potential postgraduate projects relating to research on woylies can be found at Science Division Postgraduate Projects.

Woylie Conservation Research Project Prospective Student Projects - 2009 (**602.19 kB**)