Global Re-introduction Perspectives: 2010

Additional case-studies from around the globe

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Woylie re-introduction as part of the Australian Wildlife Conservancy's endangered species recovery program at Scotia Sanctuary, far western New South Wales, Australia

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Introduction

Woylies (*Bettongia penicillata*) were recently reclassified as critically endangered from least concern-conservation dependent following a precipitous decline over 3-5 years (Orell, 2009). Of the two recognized subspecies, *B.p.penicillata* in eastern Australian is extinct, leaving *B.p.ogilbyi* extant in south-western Australia. Today, the woylie is restricted to the south-west of Western Australia, plus several re-introduced populations further east. Three of the re-introduced populations are managed by the Australian Wildlife Conservancy - a non-government organization whose mission is the effective conservation of Australia's wildlife and its habitats. Karakamia has a 251 ha fenced, feral-free area; Yookamurra has a 1,100 ha fenced, feral-free area and Scotia, a large property (64,653 ha) in far-western NSW includes the largest fenced, feral-free area on mainland Australia (8,000 ha in two contiguous blocks). At each location, introduced species (including European foxes, cats) were eradicated from the fenced areas before several highly threatened taxa, including Woylies, were re-introduced. Re-introduced species at Scotia are: boodie (*Bettongia lesueur*), bilby (*Macrotis lagotis*), bridled nailtail wallaby (*Onychogalea fraenata*), greater stick-nest rat (*Leporillus conditor*), numbat (*Myrmecobius fasciatus*) (all previously listed as extinct in NSW), and mala (*Lagorchestes hirsutus*). Translocations of black-eared miner (*Manorina melanotis*) bolstered an existing, small population.

Goals

- Goal 1: To establish a total woylie population in Scotia of over 150 individuals, that is part of a larger meta-population of over 500 individuals spread over at least two sites.
- Goal 2: To establish a woylie population in Scotia Stage 2 that is large enough to function as part of a larger Scotia woylie meta-population requiring minimal management, other than genetic supplementation once each generation to maintain genetic diversity (i.e. over 100 animals).
- Goal 3: To determine whether competition with boodies is a limiting factor for woylies in the more arid parts of their distribution.

Success Indicators

- Indicator 1: Population persistence for at least 50 years with supplementation occurring on a frequency equivalent to once each generation to maintain genetic diversity.
- Indicator 2: More than 35% of woylies' surviving one month after release, which have lost less than 30% of pre-release body mass.
- Indicator 3: Pouch young surviving to permanent pouch exit and young at foot evident nine months after release.
- Indicator 4: Independent sub-adults exceeding 10% of the population at 15 months post-release.
- Indicator 5: F_2 generation exceeding 5% of the population two years after release.
- Indicator 6: Average population size exceeding 150 three years after the release.

Close-up of a woylie

Project Summary

Feasibility: Existing distribution maps suggest woylies were found in a broad range of habitats. Scotia is within this distribution range; its habitats are dominated by mallee eucalypt vegetation atop red sand dunes, with *Casuarina pauper* woodland in the swales. The main agent of decline for Woylies (and other native mammals of similar size) is predation by introduced species, especially foxes and cats. For example, the Woylie made a promising, albeit short-lived recovery in southwest Australia during the 1980s following widespread poisoning programs that targeted foxes (Orell, 2009). The removal of introduced predators such as foxes (*Vulpes vulpes*), feral cats (*Felis catus*) and possibly also introduced herbivores such as rabbits (*Oryctolagus cuniculus*) and goats (*Capra hircus*) rather than habitat selection, are a pre-requisite for the Woylie's survival. Two feral-free, fenced contiguous reintroduction sites of 4,000 ha each are present at Scotia–Stages 1 and 2. Scotia is owned and managed by the Australian Wildlife Conservancy (AWC), which derives most of its operational funding from private donations.

Implementation: Woylies were re-introduced into Scotia Stage 1 in 2004 (172; Finlayson *et al.*, 2008) and have persisted until now. However recruitment has been poor and the population has declined. In contrast, the boodies that were also re-introduced to Stage 1 have increased strongly, and it seems likely that this congener is out-competing the woylies there. Consequently, another re-introduction of woylies was carried out into Stage 2 in 2008, this time in the absence of boodies. Fifty-seven woylies were captured overnight at Karakamia and flown to Scotia the following day. Males and females were then kept separated in quarantine pens for one month where they were fed and watered *ad libitum*, and thereafter they were released into Stage 2.

Typical woylie habitat © Matt Hayward

Post-release monitoring: The two populations have been surveyed (by trapping) four times a year since 2005. The Stage 1 population increased initially because of successive translocations, but after these were completed, the population declined steadily. In contrast, following a single translocation, the Stage 2 population has increased. Individuals from the initial re-introduction are still being trapped (i.e. post-release survival is high) and females invariably have pouched young and breeding amongst F_1 individuals has been detected. In contrast, females in Stage 1 (in the presence of boodies) are successfully reproducing, but they are failing to raise young to independence; this indicates a nutritional constraint during lactation, probably due to competition with boodies.

Major difficulties faced

- **Drought:** Scotia has experienced below average rainfall (<250 mm) for the past decade. This is likely to limit the growth of plants, and exacerbate nutritional constraints of woylies.

Fig. 1: Population estimates for woylies in Stages 1 and 2 and boodies (*Bettongia lesueur*) in Stage 1.

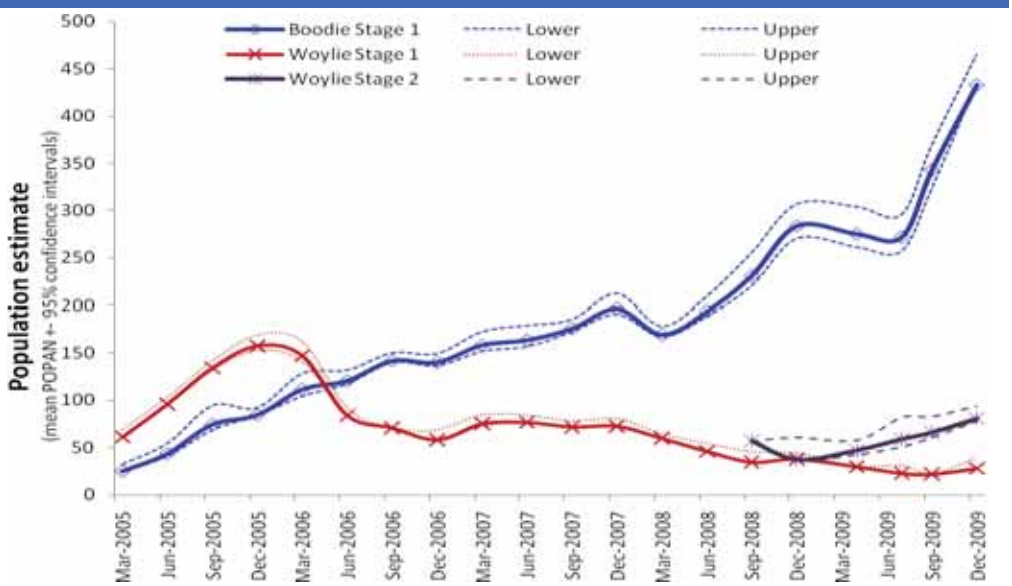
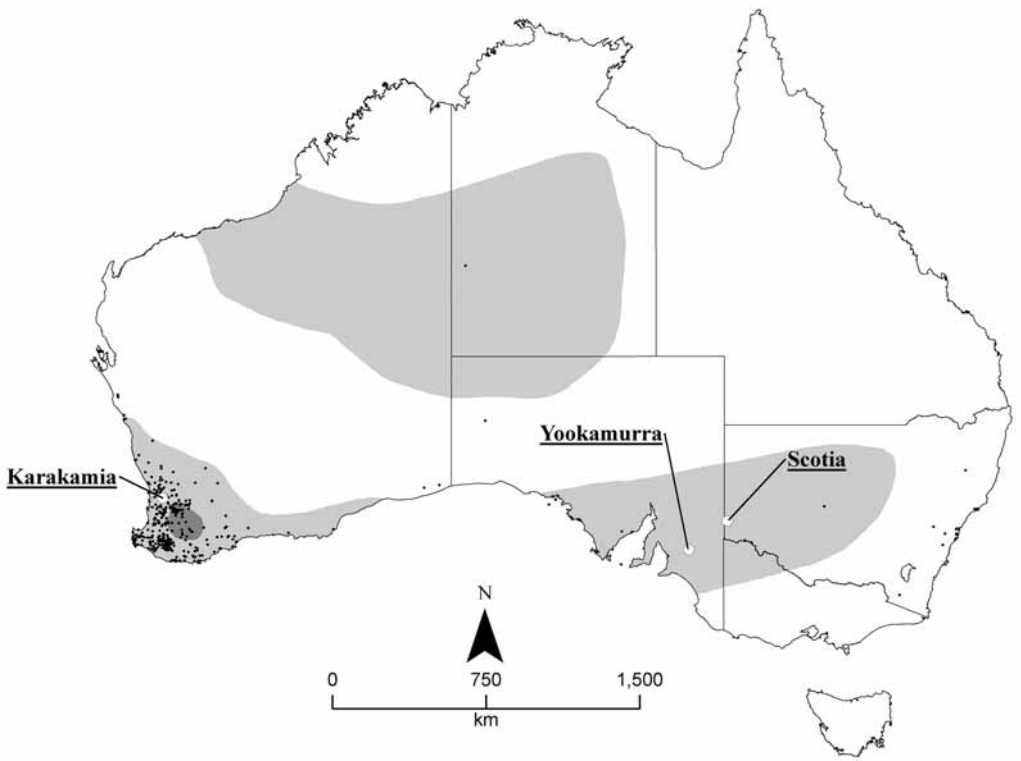


Fig. 2: Current distribution of the woylie (dark grey) with historical distribution (light grey) and locations (points) - Adapted from Nelson (1992).



- **Finding a source population:** By definition, it is difficult to find sources of highly threatened species. The woylie has declined dramatically in the past three years (95% decline; Orell, 2009); the only high density population that has not declined is the AWC-owned Karakamia Sanctuary population in the northern jarrah forest of Western Australia, making it the only population available to use in a re-introduction. Monitoring at Karakamia has demonstrated that it was unaffected by the removal of 57 individuals for the re-introduction to Scotia.

Major lessons learned

- **Confirming the historic distribution and habitat preferences of the species to be re-introduced:** Existing woylie distribution maps are extrapolated from a handful of observations by early European explorers (see figure 1, Nelson *et al.*, 1992) and memories of Aboriginal people (Burbidge *et al.*, 1988). The accuracy of these extrapolations is probably poor, and overlooks finer-scale habitat preferences and community ecology. The poor performance of woylies in Stage 1 compared with Stage 2 suggests that in the particular environment of Scotia, boodies have a competitive edge over

woylies. Ecological niche modeling is required to develop a more thorough understanding of the pre-European distribution of the woylie and probably the majority of Australia's arid zone fauna. This knowledge is critical for conservation management.

- **Re-introduction success relies on removing the original agent of a species decline:** In Australia, numerous re-introduction programs have failed because of predation by introduced foxes and cats. The recent decline of the woylie in Western Australia suggests reducing the density of introduced predators is insufficient, especially if it leads to meso-predator release. Fencing for conservation is an essential tool to separate biodiversity from the threat of predation, and can be integrated into programs with a variety of different conservation management approaches.
- **Adequate monitoring is a critical element of conservation activities:** The decline of the woylie over the past three years has been described via an index of capture success (Orell, 2009). There are several reviews assessing the value of indices compared to population estimates. When animals are to be removed from populations, it is crucial to know how many individuals are available to ensure the source population is not decimated by the re-introduction project. Techniques such as mark-recapture or distance sampling are fundamental to modern conservation biologists and should be employed wherever feasible rather than index methods.
- **Continued research into the autecology of the woylie is required:** Despite being the subject of intensive study for over a decade (via Western Shield), we lack information about critical aspects of woylie ecology, such as:
  - ⇒ Pre-European distribution of the woylie.
  - ⇒ Population limitation factors in the absence of introduced predators (e.g. competition and disease).
  - ⇒ Nutrient requirements, particularly during the late stages of lactation.
  - ⇒ Methods to estimate carrying capacity via the availability of food resources.
  - ⇒ Diet compared to resource availability.
  - ⇒ Ecology outside the jarrah forest.

Success of project

Highly Successful	Successful	**Partially Successful**	Failure
		√	

Reason(s) for success/failure:
The woylie re-introduction to Scotia was carried out in two stages; the monitoring information below relates specifically to the population in Stage 2:

- Reason 1: It is too early to determine whether the re-introduction project to Stage 2 has been entirely successful.
- Indicator 1: total Scotia population exceeds 150 individuals, however evidence to date (persistence, recruitment, and population increase in the absence of boodies) suggests the re-introduction will be successful.

- Reason 2: All other applicable indicators have been met well before their deadlines. For example:
- Indicator 2: More than 35% of woylies' survived the first month after release into Stage 2: 84% of these founder individuals have been recaptured in the five trapping sessions post release. These founder individuals have not declined in body mass, easily exceeding the 30% threshold allowed for in the indicator.
- Indicator 3: Pouch young have survived to permanent pouch exit and young at foot were evident six months after the release.
- Indicator 4: Independent sub-adults (new recruits) exceeded 10% of the population at 12 months post-release.
- Indicator 5: F_2 generation does not exceed 5% of the population yet; however, the existing population growth and recruitment suggest they will within two years of release.
- Thus, three of the five re-introduction success indicators have been satisfied well before the deadlines, suggesting the re-introduction is likely to be ultimately successful.

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