



PROGRESS REPORT 2013

THE CONSERVATION AND MANAGEMENT OF THE BILBY (*MACROTIS LAGOTIS*) IN THE PILBARA

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This report summarises the work carried out on the conservation and management of the bilby (*Macrotis lagotis*) in the Pilbara during the period 2012 -13. This report details progress against activities outlined in the Project Plan supporting the Pilbara Bilby Trust (Marlow *et al.* 2011).

Work undertaken in the period 2012-13 included:

1. Refinement of the Project Plan and Experimental Design.
2. Employment of a Technical Officer.
3. Population Viability Analysis – How much land is required to support a viable bilby population?
4. Collation of current and historic distributional data.
5. Modelling the distribution of bilbies in the Pilbara.
6. Developing a fine-scale population monitoring technique.
7. Developing a broad-scale survey technique.

1. Refinement of the Project Plan and Experimental Design

The plan for the conservation and management of the bilby (*Macrotis lagotis*) in the Pilbara was extensively redesigned following a literature review and incorporation of rigorous experimental design into components of the plan. Table 1 summarizes the new project plan.

The aim of this project is to improve our understanding of the distribution, and demographics of bilbies in the Pilbara, and provide information to environmental regulators and resource development companies that will allow appropriate management to ensure the persistence of this species in the Pilbara.

Specifically, the objectives of this project are to:

- Gather recent and historic records in order to understand and predict the distribution of bilbies in the Pilbara;
- Develop and implement a broad-scale survey technique;
- Develop a fine-scale population monitoring technique and implement long-term population monitoring; and
- Understand the effects on demographics of bilby populations in the Pilbara.

The anticipated project outcomes include:

- Improved understanding of the distribution and conservation status of bilbies in the Pilbara;
- Information on which to base management decisions of populations in and around mining sites and other developments;
- Improvement to national impact guidelines being developed by the Commonwealth for bilbies; and
- Provision of a model for survey, monitoring and management of bilbies in other regions of WA.

The anticipated users of the knowledge gained include:

- Department of the Environment – provide guidance with bilby survey and monitoring protocols and the development of national impact guidelines.
- Pilbara mining industry - provide information to resource development proponents that will allow appropriate management of mining sites to ensure the persistence of bilby populations.
- Environmental consultants – provide information and guidance relating to bilby monitoring and survey protocols.
- Other researchers – provide opportunities to share knowledge with other participants for greater integration and collaborative research projects.

2. Employment of a Technical Officer

Fiona Carpenter was engaged from 24 September 2012 in a full time position as the Technical Officer for this project.

3. Population Viability Analysis – How much land is required to support a viable bilby population?

In 2012 it was noted that a need existed to know for offset conditions how much habitat is needed to support a viable bilby population. Using mortality and demographic data available from the literature, population viability analysis (PVA) was performed to determine a suitably sized area that would support self-sustaining populations of bilbies (*Macrotis lagotis*) without intervention or artificial management of the population.

Table 1. Refined Project Plan.

Component	Milestones	Completion	Outputs
Collate current and historic distributional data	<ul style="list-style-type: none"> Set up a database Complete search of all published and unpublished literature and interviews with landholders and managers Set up database as NatureMap theme and online user contributable input interface 	Dec 2013	<ul style="list-style-type: none"> Accurate database of bilby records in the Pilbara NatureMap theme as portal to database with online user contributable interface to keep database current
Model distribution of bilbies in the Pilbara	<ul style="list-style-type: none"> Habitat model of bilbies in Pilbara completed and written up for publication 	Dec 2013	<ul style="list-style-type: none"> Publication in scientific journal
Develop broad-scale survey technique	<ul style="list-style-type: none"> Select sites to trial survey techniques Compare survey techniques and select most efficient 	2014	<ul style="list-style-type: none"> Publication in scientific journal Survey protocols for DoE and DPaW
Develop fine-scale population monitoring technique	<ul style="list-style-type: none"> Select sites to trial monitoring techniques Develop and test DNA extraction and PCR with developed bilby microsat primers from faecal samples Compare monitoring techniques and select most efficient 	2014	<ul style="list-style-type: none"> Publication in scientific journal Population monitoring protocols for DoE and DPaW
Broad-scale survey of Pilbara	<ul style="list-style-type: none"> Select areas to survey based on habitat modelling Selected areas surveyed Data imported into online database 	2015-ongoing	<ul style="list-style-type: none"> Publication in scientific journal Dataset available online via NatureMap theme portal
Long-term population monitoring	<ul style="list-style-type: none"> Select sites/functional populations for long-term monitoring Annual monitoring 	2015-ongoing	<ul style="list-style-type: none"> Annual technical report Periodic publications in scientific journals of the status of bilbies in the Pilbara Information for the basis of development and management decisions
Understand effects on demographics	<ul style="list-style-type: none"> Determine population genetic structure of bilbies in the Pilbara and elsewhere Investigate potential impacts of mining activities and development on populations 	2014+	<ul style="list-style-type: none"> Publication in scientific journals Information for the basis of development and management decisions Protocols for bilby management on mining and other development sites

This analysis indicated that a minimum area of approximately 50,000 ha of suitable bilby habitat is required to be able to support a viable population with a low probability (<0.1) of extinction over 100 years (Figure 1). In this area and under the lowest mortality rate scenario, if 15 bilbies were used as

founder stock, a population of approximately 120 could be sustained after 30 years. If 50 bilbies were used as founder stock, 200 bilbies could be sustained after 20 years. A 1,000 ha area is considered unsustainable in the long term as it provides home range space for only six bilbies which the PVA predicts would persist for less than five years. This study is currently being drafted for publication.

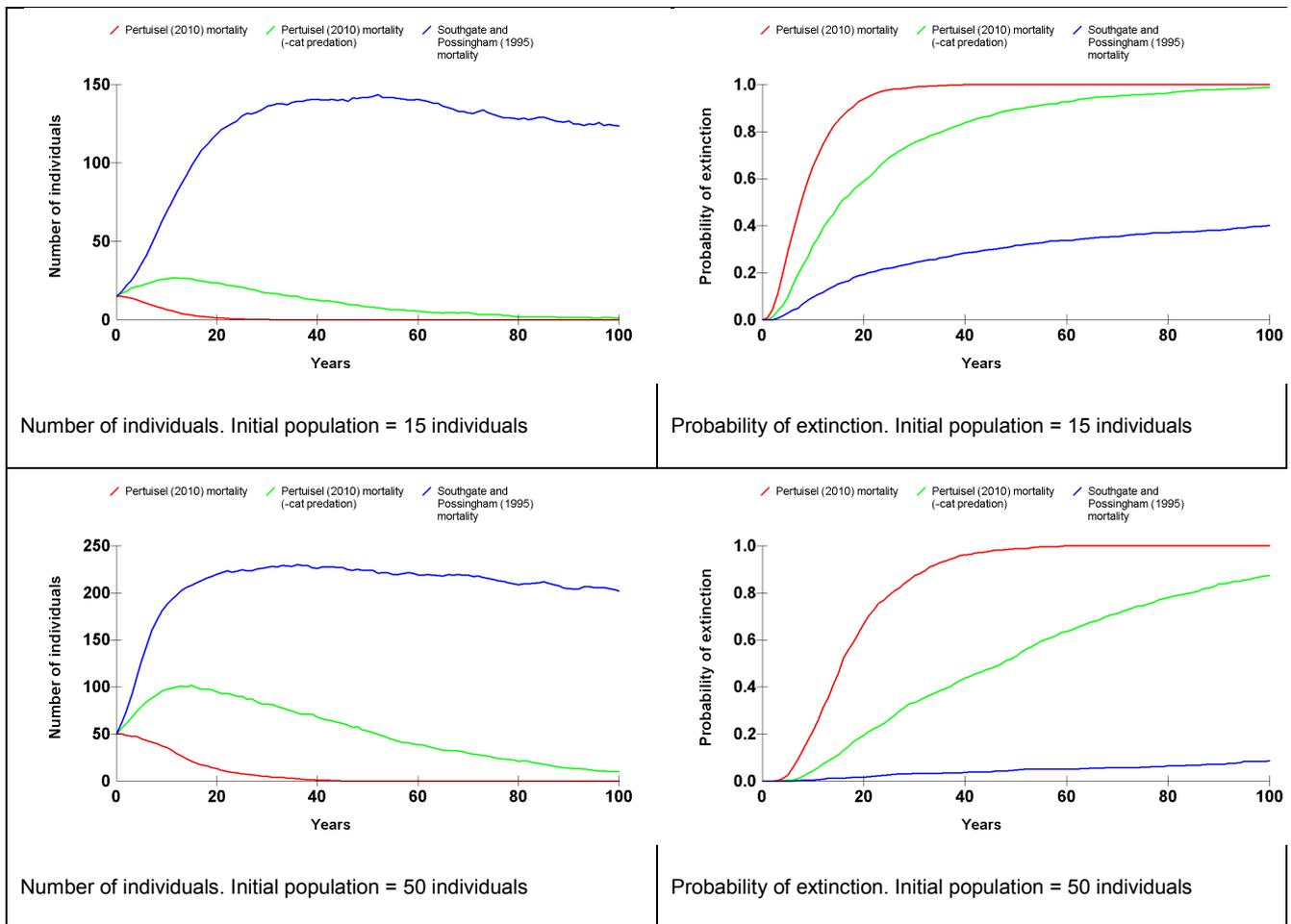


Figure 1. Population viability of bilbies in 50,100 ha of habitat. (Southgate & Possingham, 1995; Pertuisel, 2010).

4. Collation of current and historic distributional data.

Current and historic records of bilbies in the Pilbara have been accessed from the following sources:

- Published literature
- “Grey” literature (including consultant and DEC/DPaW reports)
- WA DEC (DPaW), WAM and other national databases
- Liaison with DPaW staff, ecologists, consultants and land holders/users

- Field trips to the Pilbara region

514 records of bilbies have been collected from 1930 to 2013.

An online portal through DPaW's NatureMap webpage has been designed and set up to access the database of bilby records. This has been developed as an internal collaboration with DPaW Science Applications. An online user-contributable data entry site has also been developed to provide the ability to maintain the database and keep it current with the addition of new records. This has been developed using the open source Atlas of Living Australia Biological Data Recording System (ALA, 2013) in collaboration with Gaia Resources and DPaW Science Applications. The Pilbara Threatened Fauna is now online at: <http://naturemap.dec.wa.gov.au/default.aspx> under the dropdown menu: "Themes" (Figure 2).

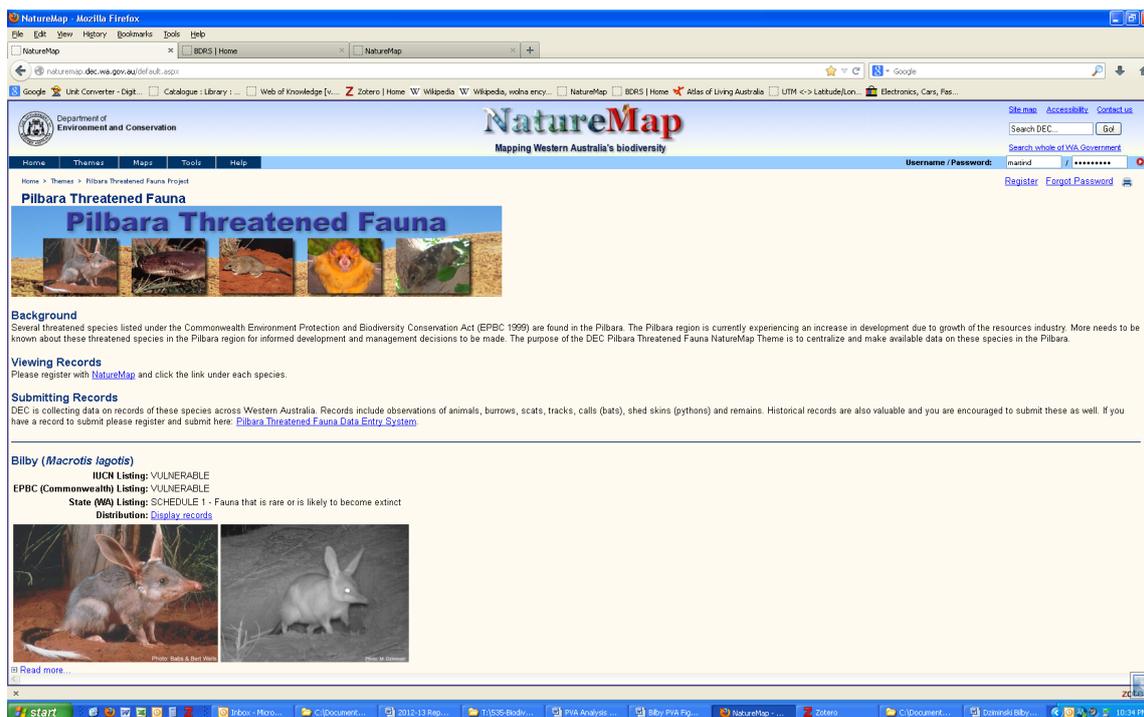


Figure 2. Screen capture of the Pilbara Threatened Fauna theme on DPaW's NatureMap site.

The online user-contributable data entry site (Figure 3) is still being finalized and will be fully functional shortly. A preview can be accessed here: <http://core.gaiareources.com.au/bdrs-core/df/home.htm>

5. Modelling the distribution of bilbies in the Pilbara

The distributional data collected in Section 4 will be used in conjunction with GIS layers to create a model of predicted distribution of bilbies in the Pilbara. Modelling will be completed using various software packages and will be drafted for publication.



Figure 3. Screen capture of the Pilbara Threatened Fauna online user-contributable data entry site.

6. Developing a fine-scale population monitoring technique

Since no reliable method of estimating bilby densities exists, and bilbies are not suitable for efficient mark-release-recapture studies, the combination of using distance sampling (Buckland *et al.*, 2001, 2004) and molecular markers is being investigated. Reliable techniques exist for the extraction of DNA from bilby scats (Smith *et al.*, 2009), and polymorphic microsatellite markers have been developed for bilbies (Moritz *et al.*, 1997; Smith *et al.*, 2009) that are useful for identifying individuals.

A pilot study incorporating distance sampling and molecular markers has been undertaken at Lorna Glen where a reintroduced population of bilbies exists. Nine 1 km transects were sampled for bilby scats in a 10,000 ha area. Twenty-three scat samples were collected. We have managed to extract DNA and successfully genotype individuals from scats. The analysis and refinement of this pilot study is progressing with the expectation of expanding the survey area at Lorna Glen, and implementing pilot monitoring sites in the Pilbara.

7. Developing a broad-scale survey technique

Remote sensing techniques may have the potential of detecting bilby burrows in the landscape. LiDAR (Light Detection and Ranging) has recently been used to measure the height, shape and density of termite mounds across a landscape (Levick *et al.*, 2010) and detect old gold mine shaft entrances across a landscape (Utting *et al.*, 2010). This technique has the potential to be able to detect bilby burrow entrances across a landscape, through vegetation.

Another potential technique, SfM (Structure from Motion; Il-Kyun Jung & Lacroix, 2003; Kanade *et al.*, 2004) is being investigated. A collaboration with Dr James Kellner (Brown University) has been initiated to trial the use of LiDAR and SfM in detecting burrows from a UAV. Furthermore, the use of this technique extends beyond bilby burrows (eg rabbit burrows, boodie warrens) and has the potential to become an important land and pest management tool that land managers can benefit from.

Funding opportunities for this work are currently being pursued with the goal of deploying these instruments at several pilot sites in the Pilbara and at Lorna Glen.

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