

Regional Recovery Plan for the Southern Brown Bandicoot (*Isoodon obesulus obesulus*)

in the

**Mornington Peninsula and Western Port
Biosphere Reserve, Victoria, Australia**



David G. Nicholls & Terry Coates

for the

UNESCO Man and the Biosphere
Mornington Peninsula and Western Port Biosphere Reserve
Foundation Limited

June 2011

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Preface

The Southern Brown Bandicoot (eastern subspecies) *Isoodon obesulus obesulus* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act), Vulnerable under the South Australian *National Parks and Wildlife Conservation Act 1972* (NPWC Act), and Endangered under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act).

A National Recovery Plan for the species has been developed as a requirement of the EPBC Act. Originally published in 2004, a revised draft was provided for private comment in June 2009. A further draft was released for public comment in June 2010 and is currently awaiting finalisation.

This Regional Recovery Plan is intended to translate the recommendations of the National Recovery Plan to the area of interest for the Mornington Peninsula and Western Port Biosphere Reserve Foundation ('the Biosphere') in south-central Victoria, and provide a plan of action for the Biosphere to implement these recommendations. It has been produced by copying verbatim the Objectives and Actions (shown in grey boxes or grey text) proposed in the June 2009 draft of the National Recovery Plan (as the June 2010 draft was not yet available). The sections are expanded by describing the Biosphere's contributions thus far and defining specific actions for the Biosphere to implement over the next five years.

Background

The Mornington Peninsula and Western Port region was declared by UNESCO as a Biosphere Reserve in 2002 due to its outstanding natural values, including a Ramsar wetland of international significance, on the fringe of the expanding city of Melbourne (see Fig.1.). In 2003, the not-for-profit Mornington Peninsula and Western Port Biosphere Reserve Foundation ('the Biosphere') was established to foster conservation and sustainable development across the region.



Fig.1. The Mornington Peninsula and Western Port Biosphere Reserve (also referred to as the 'Western Port Biosphere Reserve') in south-central Victoria.

The Biosphere's Research Committee identified the Southern Brown Bandicoot Recovery as one of three initial projects to begin the Biosphere's program of research, education, community engagement, partnerships and on-ground conservation efforts. Dr. Terry Coates was appointed to lead the science and David G. Nicholls was designated as coordinator of the project. The Bandicoot Recovery project has made significant progress since 2006 and is envisaged to make a considerable contribution to the research and education aspects of the National Recovery Plan within this region.

More information about the Biosphere can be found on our website: www.biosphere.org.au.

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Recovery Objectives and Actions – Detail

Objective 1 Undertake research to determine key ecological, biological and demographic characteristics so as to inform assessments of conservation status.

Recovery Criterion: Acquire basic information on the life history attributes of the Southern Brown Bandicoot for conservation status assessments. Informed management actions are implemented as a result of the knowledge of the biology and ecology of the species.

Action 1.1 Evaluate the current reproductive status, fecundity, recruitment levels and longevity of the Southern Brown Bandicoot.

Both general and locality-specific management strategies need to be developed in order to maintain, enhance or restore processes fundamental to reproduction and survival in the Southern Brown Bandicoot. These strategies will depend on the collection of key biological and ecological information, including breeding biology, longevity, genetics, dietary preferences, microhabitat requirements and behaviour. These characteristics are useful in the further development of population models as well as the management of the species in the wild. The ecological impacts of management actions can be assessed from these baseline data. Such baseline data has been and is currently being collected from several populations, such as the Belair National Park (NP) population in South Australia (Sanderson and Kraehenbuehl 2006).

Responsibility: DECNSW, DSE, ARI, DEHSA, Universities.

Biosphere's Contributions

The Biosphere takes an active interest in scientific research regarding the Southern Brown Bandicoot. For example, in November 2006 the Biosphere facilitated a public workshop to consider how best to implement a conservation program for the Southern Brown Bandicoot across the region. This was the first meeting of its kind in Victoria and brought together over fifty scientists, government representatives and land managers. The forum assisted in the development of partnerships that have seen ongoing coordination of bandicoot recovery efforts between the Department of Sustainability and Environment (DSE), Parks Victoria, Melbourne Water, Royal Botanic Gardens Cranbourne (RBGC), City of Casey, Cardinia Shire, Western Port Swamp Landcare, Cardinia Environment Coalition and private landholders. The proceedings of the forum are available in report form (MPWP 2008) from <http://www.biosphere.org.au/projects/bandicoots/index.html>.

The Biosphere has also been a member of the Southern Brown Bandicoot Technical Reference Group (SBB TRG) since its inception in 2006. The SBB TRG is a non-financial,

independent group of scientists and conservation managers who meet on a quarterly basis to keep abreast of current research and conservation initiatives and to provide advice where necessary. The group has a constitution (see Appendix X) and is convened by Dr. Rolf Willig (Senior Forest and Biodiversity Officer - DSE).

Biosphere Action 1.1.1 Maintain the Biosphere's liaison with scientific researchers.

The Biosphere will maintain connections with scientific researchers at the Royal Botanic Gardens at Cranbourne (RBGC) and others through the SBB TRG.

Biosphere Action 1.1.2 Assist in the collection of ecological information.

The Biosphere will initiate and support scientific studies on ecology and genetics particularly through the RBGC and SBB TRG.

Action 1.2 Further clarify the taxonomy and genetic status of populations to enable an accurate conservation status assessment of the taxon.

Currently, there is confusion where the boundary between the Southern Brown Bandicoot and its common congener, the Northern Brown Bandicoot lies. The conservation status of known sub-populations, and the taxon as a whole, cannot adequately be assessed until the true distribution and the demography of the taxon is determined (and once the taxonomy is established). Genetic studies are required to clarify the northernmost extent of the Southern Brown Bandicoot distribution. This has been started with a study being completed to develop a rapid and reliable genetic test to identify each of the three potentially sympatric species of bandicoots found in the Sydney region (Zenger, Eldridge et al. 2003; Zenger, Eldridge et al. 2005).

It is not entirely clear if the Southern Brown Bandicoot, throughout its distribution, is a metapopulation or sub-populations separated by discrete geographical boundaries, with distinct genetic characteristics, though the existence of separate east and west taxonomic groupings is suggested (Wildlife Australia 1996). Information on the genetic relationship between sub-populations is useful for tracing past dispersal routes and determining levels of sub-population isolation. Research by Zenger *et al.* (2005) has revealed significant genetic division amongst *I. obesulus* individuals from the Sydney, East Gippsland and Mt. Gambier regions. The two Sydney populations could not be separated genetically, which suggests that translocations could be readily made between the two populations.

Genetic research is also an important component in the recovery objectives of the Southern Brown Bandicoot, for predictive and explanatory modelling and, thus, informing the management of populations. Modelling of population viability for other bandicoot taxa has revealed the potential to identify critical factors in the decline of a population (e.g. (Catling, Burt et al. 2002; Possingham and Gepp 1996; Todd, Jenkins et al. 2002). Research is currently being conducted into gene flow between populations of Southern Brown Bandicoot in fragmented habitats; this research, conducted by Adelaide University and the South Australian Museum, will aid management via knowledge of bandicoot movements through agricultural and pine forest matrices (S. Cooper pers. comm. 2009).

The taxonomic status of *Isoodon* needs clarification — morphological and genetic analyses of the taxon reveal different sub-structuring within the *Isoodon* genus (Close, Murray et al. 1990; Lyne and Mort 1981; Pope, Storch et al. 2001; Westerman and Krajewski 2000; Zenger, Eldridge et al. 2005) .

Responsibility: SBBRT to contract appropriate institution.

Biosphere's Contributions

As a first step towards any clarification of the taxonomy and genetic status of local populations, the Biosphere continues to collect distribution and abundance data of Southern Brown Bandicoots across the region. Reports from our members and other members of the public make up a large component of our records. These are captured via our customised 'Critter Sighting Sheet' (see Appendix). A concerted effort to collect records during 2006-8 lead to the following peer reviewed publication:

- Coates T., Nicholls D. and Willig R. (2008) The distribution of the Southern Brown Bandicoot *Isoodon obesulus* in south central Victoria. *Victorian Naturalist* **125**(5):128-139.

Since then, the Biosphere and its partners (RBGC, West Gippsland Catchment Management Authority and SBB TRG) have initiated further surveys across the region, from Melbourne to Wilson's Promontory. One survey component uses volunteers to deploy surveillance trail cameras to extend earlier trapping and manual searches. Additional publications that have been produced regarding the abundance and distribution of SBB across the region include:

- Flack S., Nicholls D. (2009) *Observations of animal tracks in a suburban reserve in south-eastern Melbourne*. MPWP Biosphere Reserve Foundation Ltd. Report.
- Nicholls D. (2009) *Survey of potential sites for the Southern Brown Bandicoot in West and South Gippsland Victoria in 2008*. Report to DSE West Gippsland.
- Nicholls D., Coates T. (2009) *Buried Bait Survey – an evaluation of a new technique to detect bandicoots*. Report to DSE West Gippsland.

The Biosphere has also been contributing directly to the clarification of the genetic status of local SBB populations by collecting samples for future genetic analysis. Namely, it has established collections of hair material and of road-killed specimens which are provided to the Museum of Victoria. To increase the collection of road-killed specimens, the Biosphere offers a road-kill collection service that provides members of the public with tough body bags and labels, a local collection point with temporary frozen storage (at the Chisholm Institute in Cranbourne) and information about why these specimens are important. The Biosphere then forwards the specimens to the Museum of Victoria.

By working with our partners at RBGC, the SBB TRG and universities to measure the genetic diversity of the Koo Wee Rup and other local populations within the region, we hope to be able to determine the relative importance of the RBGC, Mornington Peninsula-Frankston, Quail Island, Koo Wee Rup and Bass Coast populations. The Biosphere will also cooperate with others working on the West Gippsland populations including Wilsons Promontory.

Our partner Dr. Terry Coates (RBGC) supervised two university projects considering a Population Viability Analysis (Southwell *et al.* 2007, ref2) for populations within the Biosphere Reserve.

Biosphere Action 1.2.1 Monitor distribution and abundance of local populations.

Continue to monitor local populations with trail (digital surveillance) cameras and other non-intrusive techniques. Continue to collect records from members of the public and verify when necessary. Develop a program whereby people can report new records by using Google Map to pin the location onto a virtual map. Collate all records into a Biosphere GIS layer and submit regular updates to the SBB TRG database for inclusion in the DSE Atlas of Victorian Wildlife.

Biosphere Action 1.2.2 Continue to collect hair and tissue samples for genetic analysis.

Obtain permit to cover members of the public collecting road-killed specimens. Maintain and increase community knowledge of the Biosphere's road-kill collection service. Extend the program by including local veterinary practices, committees of management, field naturalist clubs and Friends groups.

Action 1.3 Determine the conservation status of the species in relation to environmental factors, with appropriate survey techniques.

The extant geographic distribution of the Southern Brown Bandicoot is relatively well-known, but the apparent recent rapid decline of the taxon means that an up-to-date assessment of the status of many populations is required. These assessments are especially needed in relation to environmental factors, such as habitat, disturbance processes and other potentially threatening processes (recently, fire). Hence, surveys are required at key localities across the historic range of the taxon to establish current distribution and patterns of decline.

The relative ability of different methods to detect and monitor the species is important in the inference of data collected for these status assessments. There is a need for reliable, yet cost effective methods of survey that allow for the detection of trends in status over time. An evaluation of different monitoring methods for the Southern Brown Bandicoot was conducted recently, and probabilities of detection associated with three survey methods (automated cameras, hair tubes and cage traps) inferred (Scroggie 2008). With respect to the relationship between survey effort and probability of detection, automated motion-sensing cameras were found to be the most efficient. However, this does not mean that the hair tubes and cage traps could not be employed in surveys and monitoring programs (Scroggie 2008). Other recent work to test the effectiveness of two types of hair tubes (Handiglaze and Faunatech) at detecting bandicoots was carried out in both South Australia and Victoria. Both found that Handiglaze to perform better (K. Long, DEH pers. comm. 2009; Andy Murray DSE pers. comm. 2009).

Surveys need to identify the area and extent of key populations, and give estimates of the number, size and structure of the populations. From these surveys, an inference or estimation of population change can be made. All database records should be updated and the distribution of the species accurately mapped. Existing locality records need to be validated with a reliability rating.

Such surveys would augment recent and on-going local surveys (e.g. Ku-ring-gai Chase and Garigal National Parks, Mt Lofty Ranges, Portland). Data from these surveys could be modelled to assess the relative contributions of various environmental factors to the observed pattern of decline. Such surveys would also provide the basis for establishing appropriate population monitoring programmes.

The results of these surveys will be combined with historical data to establish a coordinated database containing distribution data and monitoring activities for use by the Southern Brown Bandicoot Recovery Team and agencies from each State.

Responsibility: DECC, DSE (ARI), DEHSA, Universities.

Biosphere's Contributions

The Biosphere understands the need to develop effective and appropriate monitoring techniques in order to investigate the impacts of environmental factors on conservation status, as well as other important questions. It therefore supported the SBB TRG-commissioned review of survey procedures (Scroggie 2008) mentioned in the National Recovery Plan, above.

Biosphere Action 1.3.1 Trial appropriate survey techniques.

The Biosphere currently has a program whereby landholders are provided with surveillance trail cameras to use on their properties. This is hoped to increase the detection rate on private land and monitor resident populations. The Biosphere will review the effectiveness of this strategy.

Objective 2 Identify habitat that is critical, common or potential.

Recovery Criterion: Identify the habitat requirements for the completion of essential life history stages, recruitment, and migration of the Southern Brown Bandicoot.

Action 2.1 Accurately survey known habitat and collect habitat and environmental information relevant to community ecology and condition.

The Southern Brown Bandicoot currently occupies several different habitat types. The specific determinants of bandicoot occurrence in each of these habitats are not well understood. Within these habitats, the Southern Brown Bandicoot uses some parts more frequently than others. Thus surveys are required to collect habitat and environmental information from known habitat sites, to evaluate the relative importance of preferred microhabitats for the completion of essential life history stages.

This action will measure and compare the habitat features of parts of bandicoot habitat at key locations. Patterns or differences found will be used to (i) identify preferred (high quality) microhabitat, (ii) determine the available potential (i.e. unoccupied) habitat with the intention of ear-marking for future translocation programmes or linking to existing habitat through vegetation enhancement programmes, (iii) provide a focus for vegetation enhancement and revegetation programmes, and (iv) assess the effects of burning and predator control trials for generating suitable habitat for Southern Brown Bandicoots. This action should build on recent research of the habitat preferences by the Southern Brown Bandicoot (e.g. Claridge 1988; Claridge and Barry 2000; Kimber 1997; Paull 1993; Paull 2004; Sanderson and Kraehenbuehl 2006; Wilson 2004). The results of these surveys should contribute to the mapping of habitat critical for survival (see Action 2.2).

Responsibility: DECC, DSE, DEHSA.

Biosphere's Contributions

The Biosphere is involved in the monitoring of known habitat areas within our region. Our partners at RBGC continue to monitor bandicoot numbers in the Gardens. We liaise with Parks Victoria to monitor the Quail Island population and populations within other nature reserves within the greater Biosphere Reserve. Through the SBB TRG we liaise with environmental consultants, the City of Casey and the Cardinia Shire Council regarding populations in the northern Westernport region.

The Biosphere continues to collect and evaluate all records from its members and friends for the greater Biosphere Region. We liaise with the Bass Coast Landcare Network, Friends of the Venus Bay and other community groups to ensure any new records are obtained. All valid records are collated and submitted to the SBB TRG for forwarding to the DSE Atlas of Victorian Wildlife.

The Biosphere also continues to maintain a Geographic Information System (GIS) layer of Southern Brown Bandicoot distribution, and this is reviewed and updated annually.

Our partner Dr. Terry Coates (RBGC) supervised a La Trobe University Honours project examining the relationship between fungi and bandicoots (K Sicha).

Biosphere Action 2.1.1 Continue to monitor populations in known habitat areas.

The Biosphere will continue to work with its partners to monitor known bandicoot habitat areas in its region.

Biosphere Action 2.1.2 Support collection of habitat and environmental information relevant to community ecology and condition.

The Biosphere will continue to assist where possible in the collection of scientific data to determine habitat/environmental aspects of community ecology and condition.

Action 2.2 Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference.

Quantitative methods should be developed to investigate the relationships between the occurrence and density of Southern Brown Bandicoots, and the structural and floristic characteristics of its current and historical habitat. This investigation should assist in identifying potential habitat. Such work was recently conducted at multiple scales, including continental, in relation to climate, geology and vegetation cover (Paull 2004). At the regional and local scales, only the south-east of South Australia was investigated (Paull 2004). This study revealed that the regional scale distribution of the Southern Brown Bandicoot is constrained by climate and also by soil and vegetation patterns. Predictive model(s) for potential habitat may need to be developed and tested at regional and local scales in other sections of the species distribution. These models should build on existing habitat models (in tandem with analyses of the impact of management regimes). The predictive power of these quantitative methods should be evaluated by ground-truthing — the unit description is extrapolated to other similar areas, allowing prediction of the occurrence of the taxon.

Responsibility: DECC, DSE, DEHSA, Universities.

Biosphere's Contributions

The Biosphere has developed a GIS layer of native vegetation appropriate to bandicoots and produced maps using TAFE students from the 'Conservation and Land Management Unit' at Chisholm Institute. We also provide volunteers to assist in the scientific floristic studies of the RBGC.

Biosphere Action 2.2.1 Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference.

Following its research plan, the Biosphere will facilitate the production of a strategic plan for the management of native vegetation across the greater Biosphere. This will aim to combine all the data from local governments, researchers and consultants.

The first stage will be to obtain copies of all studies and data sets and combine them into a single GIS layer. We will then identify and resolve scale, resolution and accuracy anomalies. With our partners, we hope to obtain funding to bring the map up to highest practical standard by the end of 2011. The Biosphere will also develop partnerships with DSE, the Arthur Rylah Institute (ARI) and universities in Melbourne to field test the validity of the model.

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Objective 3 Ensure that populations and their habitat are legally protected.

Recovery Criterion: Ensure that populations and their habitat are legally protected both on private and public land.

Action 3.1 Nominate for listing under Victorian FFG Act 1988 and prepare management documents (e.g. local or State recovery plans, Action Statements) as required.

Several actions will assist in the legal protection of the Southern Brown bandicoot: continue current management arrangements in NSW, as outlined in the NSW Recovery Plan (Department of Environment and Conservation 2006); in Victoria re-submit a revised nomination for FFG listing and develop an Action Statement for the taxon; in South Australia continue to implement the actions of the Species Recovery Project (Department of Environment and Conservation 2006), and establish or maintain links to NRM groups, a key requirement for obtaining funding for management in that State. Continued funding for the development and implementation of each of these recovery programmes is likely to be required over the long-term (>5 years).

Responsibility: DSE, DEHSA, DECC.

Biosphere's Contributions

Along with Monash University, the Biosphere and its partners at the SBB TRG initiated a nomination during 2008 for the Southern Brown Bandicoot to be listed as Threatened under the *Flora and Fauna Guarantee Act 1988*. On the 2nd of February 2009, the species' status was successfully changed.

The Biosphere contributed to funding proposals through the 2008-2009 Caring for our Country Business Plan to protect the RAMSAR values of Western Port Ramsar Site following the Westernport Ramsar Strategic Management Plan (DSE 2003). The Biosphere is specified as an agent of change to implement this plan.

The Biosphere strongly supported the Cardinia Shire Council initiative with City of Casey and Melbourne Water in their production of the Southern Brown Bandicoot Strategic Management Plan for the Greater Koo Wee Rup Region (Ecology Australia 2009).

Biosphere Action 3.1.1 Contribute to management documents.

The Biosphere will contribute to the SBB Action Statement (as required under the FFG Act) and to other legal documents (e.g. local or State recovery plans, and statutory planning overlays for Cardinia Shire Council and City of Casey). Namely, it will (through the SBB TRG) pursue development of the FFG Action Statement by the DSE; strengthen the relationship with the Port Philip and Western Port and West Gippsland Catchment

Management Authorities (CMA) to achieve a partnership to deliver on-ground actions throughout the Biosphere Reserve and CMA regions; and make submissions and applications to the DSE Port Phillip Region Threatened Species and Biodiversity Units regarding any actions that might threaten the Southern Brown Bandicoot.

Action 3.2 Protect populations on public land through management appropriate to Southern Brown Bandicoot requirements.

Most of the known distribution of Southern Brown Bandicoot currently lies on public land (i.e. Parks and Reserves, State Forest). The effects of logging, roads, planned burning and pest plant management on the Southern Brown Bandicoot are not clearly understood, but are likely to reduce populations, at least in the short-term. Therefore, it is crucial to maintain a mix of potential habitat in those areas on public land where activities such as logging and burning are premeditated, and until the specific habitat preferences of the Southern Brown Bandicoot are known. This can be achieved through the negotiation of Public Authority Management Agreements under relevant state and federal legislation (e.g. FFG Act 1988), as well as negotiation of Special Protection Zones in State Forest (NSW, Victoria). Population-specific key management actions should be developed where appropriate, for each major bandicoot population, as part of landscape-scale integrated public-land management. This NRP should dovetail with other management plans.

Responsibility: DECC, DSE, DEHSA.

Biosphere's Contributions

The Biosphere through the SBB TRG seeks to accurately understand the status of bandicoot populations on public land. The Biosphere has cooperated with the West Gippsland CMA to search 120 sites in 60 crown land reserves during 2007 and 2008. The Biosphere supported the West Gippsland CMA/DSE funded projects to trap Bandicoots at the Wonthaggi Heathlands Nature Conservation Reserve (Homan 2007, 2008).

The Biosphere, through the SBB TRG and principally through one of its members (Malcolm Legg, Mal's Ecological and Environmental Services), encouraged Parks Victoria to survey Quail Island Nature Conservation Reserve which resulted in finding a self-sustaining bandicoot population in 2008. This is the first and only new location discovered in recent years – elsewhere we have only recorded reductions and absences from historically known sites.

The Biosphere also plays a role in advocating for appropriate management of bandicoots on public land. For example, we have met with senior staff of Melbourne Water Waterways Program to seek ways of improving the conservation of the Southern Brown Bandicoot on Melbourne Water land (Biosphere papers). Our suggestions included greater protection for known habitat areas such as 'The Inlets', changes to vegetation management including phasing out cattle grazing and altering the mowing regimes, and implementation of a fox control program.

Biosphere Action 3.2.1 Monitor and develop a catalogue of public land reserves with current bandicoot populations and those that have had historical populations.

The Biosphere will maintain an inventory of such reserves and through its membership, maintain a watching brief on these populations.

Biosphere Action 3.2.2 Build and maintain relationships with public land managers.

The Biosphere will strengthen existing relationships with public land managers including Parks Victoria (Nature Conservation Reserves), Melbourne Water Waterways Division and Koo Wee Rup Operations Division (Koo Wee Rup drains), Vic Track, Port Philip and Western Port CMA, DSE Committees of Management for reserves in City of Casey, Shire of Mornington Peninsula (see Appendix for list of Committees of Management), and with the Conservation Management department for the CoA HMAS *Cerberus*. We will also establish relationships with Committees of Management in Cardinia Shire and Bass Coast Shire if they exist, or help form new ones if there are none. Finally, through the SBB TRG, we will maintain relationships with DSE, West Gippsland CMA and Parks Victoria regarding Wilsons Promontory National Park and West Gippsland public land areas.

Action 3.3 Protect populations on private land.

It is not feasible to protect all populations of the Southern Brown Bandicoot, outside of the provisions of the EPBC Act, because populations exist on private property. Protection of the bandicoot in these cases is best facilitated through effective extension activities, and the adoption of schemes that protect habitat or control clearing of native vegetation on private property (e.g. BushTender (VIC), Property Management Plans (VIC), covenants (VIC), Heritage Agreements (SA), Voluntary Conservation Agreements (NSW)). Liaison with local government and other government agencies regarding the mechanisms for conserving the Southern Brown Bandicoot on private land should also be used to facilitate the protection of the species.

Responsibility: DECC, DSE, DEHSA, CMAs, CMBs.

Biosphere's Contributions

The Biosphere through the RBGC and the SBB TRG seeks to accurately understand the status of present bandicoot populations on private land. With its partners - Western Port Swamp Landcare, its membership and the Cardinia Environment Coalition – the Biosphere documented the distribution of bandicoots across the Koo Wee Rup region and more broadly, throughout the Victorian south central region. This is nearly all private land. The results of this study were published by Coates *et al.* (2008).

The Biosphere regularly communicates with approximately 100 private landholders in the Koo Wee Rup region and with a larger number through the Cardinia Environment Coalition via a two way sharing of information regarding bandicoots. The Biosphere's Bandicoot Recovery officers attend regular meetings of the Western Port Swamp Landcare Group.

The Biosphere was successful at implementing two National Heritage Trust 'Envirofund' projects during 2007-2009 that restored and protected habitat across 23 private properties around Koo Wee Rup. The program involved installing 2.7km of fencing, distribution of over 250 pipes to provide bandicoots with shelter from foxes, and in 2009, the implementation of a comprehensive fox control program (see 4.3).

The Biosphere has also supported and advised private landowners regarding projects paid for by the City of Casey and by Melbourne Water Community Grants on private land during 2007-2009.

The Biosphere regularly liaises with the Cardinia Environment Coalition, Western Port Swamp Landcare Group and the Pearcedale Landcare Group. It has begun discussions on joint projects with Bass Coast Landcare and the Friends of Venus Bay. It has also had discussions with Blue Scope Steel, a large landholder with suitable bandicoot habitat.

Biosphere Action 3.3.1 Monitor populations on private land.

The Biosphere will continue to maintain our inventory of private properties with bandicoot populations and through our membership, maintain a watching brief on these. To further this, we will provide surveillance cameras to private landholders to document the presence of bandicoots, following advice from the World Wide Fund for Nature (*pers comm*) and Scroggie (2008).

Biosphere Action 3.3.2 Build and maintain relationships with private land managers.

The Biosphere will build and maintain relationships with private land managers by strengthening relationships with additional Landcare Groups and with Field Naturalist Clubs; providing information and support for Trust for Nature Covenants; and encouraging the uptake of Bush Tender and appealing to DSE to extend the trial in the Lang Lang district across the Biosphere Reserve.

Furthermore, in cooperation with local councils, we will instigate a study on the support given by the five local governments for on-ground conservation - i.e. biodiversity grants, rebates for pest control and planting and provision of free native plants. This will include recommendations on ways these programs might be expanded across the Biosphere Reserve to better support the Southern Brown Bandicoot and other native biodiversity.

Objective 4 Identify threats and implement management practices to assist in the recovery of the species.

Recovery Criterion: A reduction in mortality and an identifiable population increase in response to conservation management practices. No loss of key populations during fire plan period.

Action 4.1 Identify current and potential threats.

The status of bandicoots on public and private land should be determined, with a view to assessing the relative importance of populations under each of these tenures and current local management regimes. There is an urgent need to identify the most important populations, their key threats and determine the full range of management options that should be applied. State-based reports (e.g. Department of Environment and Conservation 2006) that identify priority threats and major causes of mortality or population decline for each key bandicoot population should be developed and key management actions identified and implemented.

Responsibility: DECC, DSE, PV, DEHSA.

Biosphere's Contributions

Coates *et al.* (2008) reported on the distribution of Southern Brown Bandicoots in south central Victoria (from south-east Melbourne to Wilsons Promontory) and defined the local threats. The Biosphere contributed to the Cardinia Shire initiative which produced the Strategic Management Plan for Greater Koo Wee Rup Region (Ecology Australia 2009) which defines the threats in the northern Western Port region. The Western Port Ramsar Site Strategic Management Plan (DSE 2003) recognises the Biosphere as a stakeholder and describes the threats surrounding Western Port and identifies the Southern Brown Bandicoot populations as a Ramsar value.

These reports and others (e.g. Biosis Research 2008) all identify habitat loss, habitat degradation and habitat fragmentation as key threats to the Southern Brown Bandicoot. The expansion of the Urban Growth Boundary, the Wonthaggi-Cranbourne desalination pipeline, the Westernport Transport Strategy, the Port of Hastings Expansion Plan and many other developments are likely to further fragment and destroy essential bandicoot habitat. At the same time, this infrastructure offers the opportunity to reconnect nature conservation reserves.

One of the Biosphere's roles is in advocating against threatening processes for the Southern Brown Bandicoot. For example, it participated in the development of the Environmental Impact Statement (EIS) for the Frankston Bypass and commented on its anticipated effect on the Pines Flora and Fauna Reserve.

The Biosphere ran a 'hypothetical forum' which explored future land management practices to achieve sustainability and mitigate climate change. A conservation zone replacing farming around northern Western Port was suggested. Such a solution would greatly aid linking bandicoot habitat from Yaringa Marine National Park to Yallock Creek and beyond south through the Bass Coast.

Biosphere Action 4.1.1 Review current and potential threats.

The Biosphere, through the SBB TRG, will review the current and potential threats to local bandicoot populations on an annual basis. The inventory of public and private properties (Biosphere Actions 3.2.1 and 3.3.1) and reports from the Biosphere's membership will be objectively analysed to provide quantitative judgments on the extent of threats to local Southern Brown Bandicoot populations.

Biosphere Action 4.1.2 Tackle loss of connectivity between the remaining habitats.

Biosphere Action 4.1.3 Tackle loss of native vegetation through illegal and misguided clearing of native vegetation in remaining reserves and private property.

Biosphere Action 4.1.2 Integrate current management guidelines and information.

The Biosphere will combine and integrate the available information, inventories, maps, plans of the State and Local government and other studies on vegetation policies, strategies and frameworks as they relate to the Biosphere Reserve. These may include the Victorian Native Vegetation Framework (DNRE 2002), the native vegetation policies of each of local governments, the City of Casey Native Revegetation Strategy (Brett Lane & Associates 2009), the statewide inventory of salt marsh and coastal vegetation (particularly the Biosis Research contribution on the Western Port section) and the many studies by ecological consultants (Ecology Australia 2009, Practical Ecology 2009, and numerous earlier studies). The Biosphere Research Committee has had two presentations (J Yugovic and G Walker) which were included in the Research Committee Strategy Plan (2010) and it has a policy and a draft discussion paper on this recommendation (Nicholls-Research Committee Papers February 2009).

In the longer term, the Biosphere hopes to combine and integrate the strategic management plans being developed within the Biosphere Reserve and beyond to Wilson Promontory into a single strategy. This will identify on-ground actions and implement those actions in conjunction with the local council, private landowners and public land managers.

Action 4.2 Ensure fire management activities consider the conservation requirements of the Southern Brown Bandicoot.

Fire, whether wild or deliberately employed for management purposes, is one of the major causes of habitat disturbance within the distribution of the Southern Brown Bandicoot. It

plays an important part in the creation of suitable habitat for this taxon, although the most appropriate fire regime (by frequency and intensity) for this taxon has proved difficult to ascertain.

Research is required to assess the impact of current planned burning regimes on this taxon, across the various geographic locations and vegetation communities that define its range. This research should fit with existing operational procedures, where possible, and be designed to evaluate the response of bandicoots to successional stage following fire. This could be investigated retrospectively (using sites of varying age post-fire) or opportunistically, by incorporating bandicoot sites that are subject to fire, either by deliberate or natural means (Department of Environment and Conservation 2006) . Such work has commenced in South Australia, examining the effects of prescribed burning on resident bandicoot populations and their ability to recolonise sites (K. Long DEHSA pers. comm. 2009).

Existing fire management measures, where they apply to bandicoot sites, should be reviewed by the local authority to ensure that they conform to the conservation requirements of the taxon; that is, to maintain or enhance floristic diversity and provide a suitably dense ground cover.

Responsibility: DECC, SFNSW, DSE, PV, DEHSA.

Biosphere's Contributions

The Biosphere has noted the extensive and long term (but unpublished) study of the response of bandicoots to fire regimes being undertaken by its partner, the Royal Botanic Gardens Cranbourne. Some of our members contribute to the data entry for this research.

Small fires are sometimes lit by vandals in reserves in Frankston and the effects of these on the Southern Brown Bandicoot are monitored by our local members.

Our partner Parks Victoria has a well structured mosaic fire regime at Wonthaggi Heathlands and a fire management strategy for Wilsons Promontory National Park. There is a complementary study of the mammals in the Wonthaggi Heathland Nature Conservation Reserve by RMIT (Homan 2008). There have been extensive fires at Wilsons Promontory in recent years - one of which severely damaged the northern part of the park that provides habitat for the bandicoot. This and the experience in the Grampians National Park emphasises the opportunity to study the effect on the fauna and the need to secure the Southern Brown Bandicoot in reserves beyond the large national parks.

Biosphere Action 4.2 1 Ensure fire management activities consider the conservation requirements of the Southern Brown Bandicoot.

Using the inventory of public and private properties (Biosphere Actions 3.2.1 and 3.3.1), the Biosphere will provide objective analysis and quantitative judgments on the extent of the fire threats to local populations. We will also determine the practicality of applying the studies of the Royal Botanic Gardens Cranbourne fire regimes to other reserves in the Biosphere Reserve. The Biosphere will also support the work on fire regimes and bandicoots at the Wonthaggi Heathlands and Wilsons Promontory.

Action 4.3 Implement effective control and monitoring methods for introduced predators.

The Red Fox, Wild Dog (Dingo and feral dog hybrid) and Feral Cat are recognised predators of the Southern Brown Bandicoot (NSW NPWS 2001; NSW NPWS 2003b; Wildlife Australia 1996). To ensure the short-term persistence and enhancement of bandicoot sub-populations already under pressure from predators, the implementation or continuation of predator control programmes is essential (Department of Environment and Conservation (NSW) 2006; Harley 2006). Such control programmes have already been implemented in many bandicoot localities (e.g. Victoria, Department of Natural Resources and Environment 2002a; Department of Natural Resources and Environment 2002b; NSW National Parks and Wildlife Service 2001). Assessing the effectiveness of such control programs is a significant component of the Glenelg and Southern Ark projects, two major initiatives by the Victorian Government (Robley et al. 2009), whose aim is to facilitate the recovery of native animals through large-scale intensive fox control programmes. The Glenelg and Southern Ark projects have adopted a joint research and management approach, through partnerships linking Victorian Government agencies (DSE, DPI, PV) Universities and the Invasive Animal CRC (Department of Sustainability and Environment 2004b). Other large-scale programmes are also in operation in other states, including the NSW Fox TAP project (NSW National Parks and Wildlife Service 2001). Predator control should be extended to cover other additional bandicoot sites as the opportunity allows. Priority of sites is to be based on known size of colonies and connectedness to nearby populations.

Responsibility: DECC, SFNSW, DSE, PV, DEHSA.

Biosphere's Contributions

Following advice from DSE Southern Ark (and using that project as a model), the Biosphere has undertaken a major 1080 baiting fox control program across the Koo Wee Rup region (Nicholls *et al.* 2009). Although large-scale 1080 programs are not new, implementing them across landscapes comprised of many small lifestyle, semi-rural and rural holdings posed some significant challenges – hence the program required three years of community consultation. Although the Biosphere supports a range of fox control measures such as shooting with and without hounds, soft-jaw trapping and den destruction, 1080 poisoning is still considered by far the most effective technique and has therefore been an essential under-pinning of the program. The Biosphere has been guided by the Victorian DPI 1080 guidelines and customised DEWHA guidelines for animal welfare (McPhee & Saunders, 2009) in utilising this technique.

The Biosphere feels the program has been very successful. Throughout 2009, the program involved successfully laying over 2000 baits, of which 399 baits were taken and an estimated 133 foxes were killed. The support of DSE, SBB TRG and Parks Victoria is acknowledged. This work was financed by the NHT-WWF Threatened Species Community Network, Round 10, and supplemented August 2009 – a total of \$20,000 plus matching in-kind). As of December 2010, this program continues to be sustained by the DSE Bandicoot Protection Program.

Although the Biosphere's initial program has targeted only foxes the Koo Wee Rup region, as resources become available, the goal is to implement additional control procedures and target further pest animals in an adaptive experimental management program. This program would be conducted in a staged process to tackle feral and free-ranging domestic dogs, feral and free-ranging domestic cats and black rats, and would obtain quantitative evidence of the relative impact of these species on Southern Brown Bandicoot populations.

The Biosphere has also partnered with Parks Victoria and the PPWCMA to maintain fox control and given strong support to local government programs (for example, fox shooting and soft jaw trapping on the Mornington Peninsula). The Biosphere's Mornington Peninsula Round Table with the Crib Point Committee of Management supports an innovative local program to control foxes and black rats.

The Biosphere has discussed with the Department of Primary Industries how best to implement an on-going 1080 program for the region. The present DPI 1080 guidelines are designed more for individual properties with intermittent deployment of 1080 baits, whereas the Southern Ark model (used by the Biosphere) relies on on-going deployment across a wide area across multiple properties.

The Biosphere contributed to the Southern Brown Bandicoot Strategic Management Plan for the former Koo Wee Rup Swamp Area (Ecology Australia 2009) and strongly supports the recommendation for a pest predator control plan to be developed and initiated.

The Biosphere initiated and developed an inventory of the land holders and owners participating in fox control programs. This includes the fox control baiting deployments by DSE, RBGC, Phillip's Agribusiness, and the Biosphere. The Biosphere maintains the GIS layer and database on behalf of the partners.

As noted under Action 3.2, the Biosphere has encouraged senior staff of Melbourne Water Waterways Program to seek ways of improving the conservation of the Southern Brown Bandicoot on Melbourne Water land. One of the recommendations was to implement a fox control program. In spring 2009, the Koo Wee Rup Operational Division of Melbourne Water began plans for fox control.

The Biosphere notes the success of the Royal Botanic Gardens Cranbourne in supporting a flourishing diurnal population of bandicoots – a phenomenon attributed to its predator-proof fence and on-going fox control program within and surrounding the Gardens (Coates 2008, Coates 2009, Coates & Wright 2008, Edgar 2008, Coates *pers comm.*).

Biosphere Action 4.3.1 Implement effective control and monitoring of introduced predators.

Using the inventory of public and private properties (Biosphere Actions 3.2.1 and 3.3.1), the Biosphere will develop objective analysis and quantitative judgments on the extent of the different pest predator threats to local populations.

Using the supplementary funding from the NHT-WWF NHT-WWF Threatened Species Community Network grant, the Biosphere will measure the effectiveness of its 2009 1080 fox baiting program as per its works plan.

It will also try to improve coordination with other land managers to extend the program into the flood mitigation channels of Koo Wee Rup (managed by Melbourne Water) and known habitats within the Northern Western Port Nature Conservation Reserve (managed by Parks Victoria).

The Biosphere will seek funding to develop a regional pest predator program for the Biosphere Reserve to build on its initial program of 1080 baiting in the Koo Wee Rup region. The plan needs to be integrated with existing initiatives including: the successful on-ground actions of the Phillip Island Strategic Fox Elimination Strategy (McPhee & Bloomfield 2004, and revisions 2008); the recommendations of the Southern Brown Bandicoot Strategic Management Plan for the former Koo Wee Rup Swamp Area (Ecology Australia 2009); and the pest management programs of all five local government councils in the Biosphere. This program would use an adaptive experimental management process to obtain quantitative evidence of the relative importance of the various pest predator species and the cost-effectiveness of the various control measures available.

The Biosphere will maintain a GIS layer and database of the information required to run a large scale pest predator program. This will be integrated into the State Integrated Pest Management Scheme.

The presence of bandicoots across a number of different reserves offers an opportunity to compare the effectiveness of predator control measures, including cost-effectiveness and biodiversity outcomes (Reddiex & Forsyth 2005). The Biosphere hopes to engage RBGC, Parks Victoria, and Committees of Management in taking up this opportunity, following an experimental design prepared by the Biosphere and using recommendations from the Linking Melbourne Authority's EPBC Southern Brown Bandicoot Management Plan for the Frankston Bypass.

The Biosphere will assess the feasibility of applying recommendations from the studies of the control regimes at the Royal Botanic Gardens Cranbourne to other reserves in the Biosphere Reserve.

The Biosphere will seek to incorporate guidelines from the *Model Code of Practice for the Humane Control of Foxes* (Sharp & Saunders 2009) and the Victorian version of this code into all of its programs.

With the SBB TRG, the Biosphere will provide a fox forum presented in two stages:

- Stage 1: An initial small workshop where the Biosphere will present its successful fox control program for evaluation by the state's experts and to allow fellow practitioners to present their fox control programs so that each group can identify improvement for their own program.
- Stage 2: A large forum to allow dissemination of new and improved practices. See Coates – Discussion Paper, minutes SBB TRG.

The Biosphere will cooperate with the PPW CMA in their Ramsar Protection program which targets pest animals, the DSE Bandicoot Protection and the Royal Botanic Gardens integrated pest management. There is an opportunity to integrate these and Council programs achieving synergies and greater coverage..

Action 4.4 Evaluate the impacts of weed invasion and develop a protocol for managing weeds.

One important (though problematic) issue for bandicoots, at least in the Mt Lofty Ranges, is habitat degradation due to weed invasion (R. Incoll pers. comm. 2009). Much of the occupied habitat in the Mt Lofty Ranges is degraded through the occurrence of environmental weeds, notably Blackberry, Broom and Gorse. While landholders and land managers have a legal responsibility to control these weeds, these plants are known to provide habitat for bandicoots. In response, staged, 'minimal disturbance' weed control has been advocated, although the effectiveness of this management approach will need evaluation. The specific resources being used by Southern Brown Bandicoots in degraded blackberry habitats in the Mt Lofty Ranges is currently being investigated (K. Long (DEH) pers. comm. 2009).

Responsibility: DECC, SFNSW, DSE, PV, DEHSA, Universities.

Biosphere's Contributions

The Biosphere has noted that in this region the Southern Brown Bandicoot occurs both in high quality habitat and degraded natural habitat and man-made environments (Coates *et al.* 2008). In these degraded but valuable sites the removal of weeds should follow normal bushland reserve practices. However, in the Koo Wee Rup region for example there are bandicoots in habitats with excessive weeds. Removing these weeds would remove the cover for the bandicoots resulting in certain losses even local extinction. Therefore provision of new habitat of native species or maintaining habitat prior to a staged removal of weeds will be needed.

Consequently, the Biosphere supports programs that gradually remove weeds and encourage native vegetation. For example, the contractor for Vic Track regularly leaves clumps of non-native vegetation while clearing along the railway track. The Shire of Cardinia has identified roadsides with ecologically significant vegetation that is heavily infested with blackberries. The Shire has a rolling five-year plan to remove weeds from 20% of the patches of significant vegetation at Bayles (Rob Jones, Cardinia Shire Council *pers. comm.*). The Cardinia Environment Coalition is using a similar strategy in their Bandicoot Corner Reserve. The Biosphere believes there is a need for similar care along the flood mitigation channels of Melbourne Water and on private properties.

Biosphere Action 4.4 Evaluate the impacts of weed invasion and develop a protocol for managing weeds.

Using the inventory of public and private properties (Biosphere Actions 3.2.1 and 3.3.1), the Biosphere will provide objective analysis and quantitative judgments on the extent of weed threats to local populations.

Ecologically significant vegetation at Bayles, Melbourne Water flood mitigation channels, Vic Track railway lines and private properties are examples where a staged removal of weeds is

recommended. The Biosphere will offer advice and use its scientific expertise to monitor these and similar sites.

Action 4.5 Control (or at least reduce) threats from forest management.

A proportion of the suitable habitat for the Southern Brown Bandicoot in south-eastern Australia is subject to intensive (integrated) logging practices. There have been no long-term studies on the effects of logging practices on the species. (Richards, Bridges et al. 1990) considered that in the short-term the species was potentially at risk immediately following logging through loss of ground cover and increased predation. Other observations indicate that the Southern Brown bandicoot is capable of successfully recolonising previously logged forest, leading some authors to suggest a lack of deleterious impact (Recher et al 1980, Fanning and Mills 1989, Fanning and Rice 1989). There is a need to identify the key threats associated with timber extraction, and the extent or longevity of their impacts. This should inform the integration of habitat retention prescriptions with timber management.

Responsibility: DECC, SFNSW, DSE, PV, DEHSA

Biosphere's Contributions

The Biosphere has considered this Action with the SBB TRG and determined that this is not relevant to our area. Nevertheless we will continue to liaise with the SBB TRG on threats in the forested districts of the Biosphere Reserve such as in the Bunyip State Forest and the forests in Baw Baw Shire and the West Gippsland CMA region.

Action 4.6 Control (or at least reduce) threats from road mortality.

Animals may be harmed or killed by vehicular traffic when where roads intersect with suitable habitat and home ranges. Road deaths have been recorded in both NSW and SA populations (Department of Environment and Conservation (NSW) 2006; Haby and Long 2005). To address this issue, bandicoot 'hot spots' need to be identified and monitored. Available mitigation measures need to be reviewed and the most effective and feasible techniques identified. Implementation of mitigation methods needs to be conducted in consultation with local councils and road authorities. Sites should be monitored before and after implementation of mitigation methods to evaluate the effectiveness of such measures.

Responsibility: DECC, SFNSW, DSE, PV, DEHSA, VicRoads, RTA, DTEI

Biosphere's Contributions

The Biosphere maintains a database on the location of road-kills to identify sites of high risk for bandicoots. It also collects road-killed specimens to forward to the Museum of Victoria for formal identification and collection of genetic samples (see under Action 1.2).

The Biosphere's partner, DSE, with its Southern Brown Bandicoot Protection Program, has developed signage for roadsides. Deploying such signs is a recommendation by the Southern Brown Bandicoot Strategic Management Plan for the former Koo Wee Rup Swamp Area (Ecology Australia 2009).

Biosphere Action 4.6.1 Control (or at least reduce) threats from road mortality.

The Biosphere will continue to collect data on locations of road-kills through its road-kill collection service. With the SBB TRG we will analyse the pattern of road-kills to provide managers with recommendations on improved mitigation strategies. We will also advise the DSE and local councils on where to place the road signs.

Action 4.7 Improve the control of companion animals, particularly dogs and cats.

Domestic animals in urban or peri-urban areas can pose a threat of increased predation and disturbance to the Southern Brown Bandicoot, when in close proximity to populations. Dogs have been reported to attack bandicoots (Ecotone Ecological Consultants 2003) and to roam free within bandicoot habitat in New South Wales, including conservation reserves (Department of Environment and Conservation 2006). To minimise the threat posed by domestic animals, it is recommended that authorities in urban areas in close proximity to bandicoot populations improve the enforcement of regulations relating to responsible domestic/companion animal ownership and control.

Responsibility: DECC, DSE, DEHSA, Local Councils.

Biosphere's Contributions

The Biosphere advocates to the public on pet control through media such as the City of Casey Environmental Newsletter and its own publications.

Biosphere Action 4.7.1 Improve the control of companion animals, particularly dogs and cats.

Initiate a program with the five local councils to share knowledge and encourage the best techniques for enforcement into the other Councils as appropriate.

Objective 5 Evaluate population responses of the Southern Brown Bandicoot to recovery actions.

Recovery Criterion: Analyse population trends and responses against recovery actions. Produce an evaluation of the relative effectiveness of recovery actions with respect to population viability.

Action 5.1 Analyse and compare population census data with management histories.

Evaluation of the impacts of management actions on population trends of the Southern Brown Bandicoot can be achieved by collecting demographic information, including recruitment and mortality, timing of life history stages and morphological data. Regular monitoring of representative Southern Brown Bandicoot populations will enable the effects of forest management and other factors to be assessed as well as providing information on the condition, breeding biology, diet, population densities and dispersal characteristics of the taxon. Recent monitoring programmes could be extended or existing programmes expanded to incorporate additional populations and research foci.

Responsibility: DECC, DSE (ARI), DEHSA.

Biosphere's Contributions

The Biosphere's partner, the Royal Botanic Garden Cranbourne has conducted extensive monitoring of its resident bandicoot population by its own professional staff, through joint studies with university students and Chisholm Institute of TAFE students and by collecting observations from its Friends and public visitors using log-books at the interpretation/picnic site.

The Biosphere has established relationships with private landowners who monitor bandicoot populations on their land. Similar relations are being developed with the Koo Wee Rup Retirement Village, the Westernport Swamp Landcare Group and with the extensive network of the Cardinia Environment Coalition. New relationships are being established with the Bass Coast Landcare Network and the Friends of Venus Bay.

The Biosphere notes the work of the Federal Government on promoting the need to design scientifically robust monitoring tools to measure improvements in biodiversity following fox control (Reddiex & Forsyth 2005).

Biosphere Action 5.1.1 Analyse and compare population census data with management histories.

Initiate a program with the SBB TRG to collate, analyse and report on public observations of the Southern Brown Bandicoot. Adopt the guidelines set by Reddiex and Forsyth (2005) as the minimum acceptable standard.

Assess the impact of the Biosphere's 2009 fox control program in the Koo Wee Rup region by comparing treatment sites (1080 poison bait stations) with control sites (non-poison bait stations) during spring of 2009. Generate recommendations on how this program might better target the known populations of Southern Brown Bandicoot particularly on the public land of Melbourne Water and Parks Victoria Nature Conservation Reserves.

DRAFT

Objective 6 Assess the requirement for captive populations.

Recovery Criterion: The completion of a feasibility report that assesses the need for, as well as the function and management of, a captive breeding population.

Action 6.1 Assess the need for and feasibility of a captive breeding population.

Recent genetic studies have explored the population structure of the Southern Brown Bandicoot in south-eastern Australia using two different molecular genetic analyses of select bandicoot populations (Pope, Storch et al. 2001; Zenger, Eldridge et al. 2005; Zenger and Johnston 2001). Zenger *et al.* (2005) grouped the bandicoot populations into three regions (Sydney region, NSW; East Gippsland region on the border of north-eastern Victoria and south-eastern NSW, and the Mt Gambier region of SA), and demonstrated the Sydney population to have experienced significant reductions in microsatellite diversity. It appears, on the basis of this recent work, that translocations between the Sydney populations, which are the most endangered of all, are possible and may ultimately be necessary, on genetic grounds (K. Zenger pers. comm. 2004).

There are currently no plans to develop a captive breeding programme as a source of animals for re-introduction to the wild, though such a programme has potential in NSW if the sub-populations there decline further. It is wise to determine the requirement and the time-frame for implementing such a strategy. The main objectives of holding and breeding Southern Brown Bandicoots in captivity are to (i) maintain husbandry skills required to successfully breed Southern Brown Bandicoots, (ii) promote public education, and (iii) provide ongoing field and captive management research opportunities.

Responsibility: SBBRT, consultant, Taronga Zoo?

Biosphere's Contributions

Coates *et al.* (2008) researched past distribution of Southern Brown Bandicoots on the Mornington Peninsula with a view to providing the best available information for any recovery program. A draft discussion paper for translocations and a breeding program is in preparation by the SBB TRG. The Biosphere's Research Committee, following an approach from a large landholder at Tootgarook, discussed the opportunities for translocations to this site. It has also held discussions with the Geelong Field Naturalists who are considering similar issues.

Woodleigh School has made significant investment in a predator-proof compound with the intention of contributing to wildlife breeding programs. Southern Brown Bandicoots are a candidate for their efforts. Richard Frances (wildlife consultant) is advising their program.

While a Southern Brown Bandicoot breeding program might provide surplus individuals, it is considered that these individuals would only be released within their original distribution and

only when there was a management regime in place that made their survival likely in the short and long term.

The Biosphere has also had discussions with private landholders regarding the improvement of habitat for wild bandicoots using artificial shelters to provide refuge from predators, perhaps with the addition of supplementary food.

The Minister for the Environment (who is considering the future for the Pines Flora and Fauna Reserve) requires a Management plan for the Southern Brown Bandicoot. This is to include a translocation program; see Australian Government Department of Environment, WH & the Arts. Approval EPBC 2007/3480 20 August 2009).

Biosphere Action 6.1.1 Assess the need for and feasibility of a captive breeding population.

The Biosphere will continue to work with the SBB TRG to develop a discussion paper on the feasibility and the risks of a captive breeding program.

The Biosphere will work with DSE, Parks Victoria and the SBB TRG to develop procedures and identify opportunities for translocation and breeding programs. The Biosphere acknowledges that translocations are contentious; however reconnecting isolated populations and restocking reserves that have suffered local extinctions (such as in Langwarrin, Tootgarook, the Pines and the Northern Western port Conservation Natures Reserves) needs investigation. The legality, methods, source and destination of translocated animals – as well as preparatory and on-going management - all need to be explored. The genetic structure of the extant populations should be determined. The success of fox control and the effect of pest predators must be determined. Discussion with scientists, managers and the broader community is needed.

Meanwhile the Biosphere will continue to work with DSE, the SBB-TRG and local landholders to provide wild bandicoots with secure breeding shelters and/or supplementary feeding stations.

Woodleigh School and Moonlight Sanctuary are local organisations with an interest in the opportunities for a breeding program.

Objective 7 Build a network of government and non-government organisations and individuals to facilitate recovery.

Recovery Criterion: The formation of a National Southern Brown Bandicoot Recovery Team (SBBRT), that meets at least annually. Regular coordinated communication with local and interstate government agencies and other organisations involved in the recovery. Promotion and support of scientific research into Southern Brown Bandicoot biology and recovery issues.

Action 7.1 Form a National Recovery Team which meets regularly.

The distribution of the Southern Brown Bandicoot incorporates three Australian States and a relatively large number of disjunct populations across south-eastern Australia. Consequently, management of the taxon is primarily the responsibility of several different state-based government agencies, and its status of interest to a range of non-government conservation groups. The taxon has been the subject of various local recovery plans and strategies, and research programmes. A national Recovery Team has an important role in overseeing and coordinating the implementation of all these recovery actions, evaluating their effectiveness, and planning and directing future actions. The Recovery Team should be comprised of representatives of key management, conservation and research groups. It should oversee the coordinated management of the species by developing and maintaining a network of relevant organisations and individuals. This network should be used to consolidate historical information and to monitor current management, research activities and the implementation of legislation and policies.

A Recovery Team already exists for the Southern Brown Bandicoot in New South Wales, and this model could easily be adapted to accommodate issues and actions across the whole range of the bandicoot. Many of the threatening processes and recovery actions that must be addressed by the Southern Brown Bandicoot Recovery Team are also relevant to the conservation of other terrestrial mammals, some of which already have Recovery Plans and Recovery Teams, developed or adopted under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (e.g. Long-footed Potoroo *Potorous longipes*, Eastern Barred Bandicoot *Perameles gunnii*). These Recovery Teams could inform the function and direction of the National Southern Brown Bandicoot Recovery Team.

Responsibility: SBBRT, DECC, DSE, DEHSA, CMAs, CMBs.

Biosphere's Contributions

The Biosphere is an active member of the Southern Brown Bandicoot Technical Reference Group (SBB TRG) which is convened by DSE and is primarily concerned with the south-central Victorian population. This group meets on a quarterly basis.

Interest in the species appears to be growing, and with it, a greater number of organisations are becoming involved in conservation, management and research activities. The Biosphere supports the notion of a Regional Recovery Team to bring together all parties in order to ensure smooth coordination of related activities.

The Biosphere would also participate in a National Recovery Team that met annually, as suggested in the draft National Recovery Plan.

The Biosphere's public meeting held on 14th November 2006 recorded the community's wish to be involved in the Southern Brown Bandicoot recovery program. Since then the Biosphere has worked to include the public in recovery actions.

Biosphere Action 7.1.1 Form a Regional Recovery Group that meets regularly.

Make a submission to the national Department of Environment seeking that the formation of Regional Recovery Groups be included in the National Recovery Plan (NRP). The NRP recognises the existence of a State Recovery Team in NSW and Regional Recovery Groups for other threatened mammal species.

The Biosphere believes that a Regional Recovery Group for the Southern Brown Bandicoot is of great importance as on-ground actions are necessarily local in scope, and where private landowners are involved and/or there are multiple government agencies, there needs to be a local forum for coordination of local action.

The Biosphere suggests that a Regional Recovery Team initially covers the Biosphere Reserve, although in the longer term the group could be expanded or included into a broader Recovery Team to further the conservation of the species further afield across the entire south-central Victorian population from south east Melbourne to Wilsons Promontory ([see discussion paper, Appendix](#)). To this end the Biosphere has called meetings with DSE and others in 2010 and prepared a Terms of Reference and a Memorandum of Understanding for such a group.

Action 7.2 Encourage and support research and disseminate results at scientific meetings and in journals.

The SBBRT and state management agencies have a responsibility to ensure that knowledge on the ecology, biology and management of the taxon is assembled in a scientifically credible and cost-effective manner, and that this knowledge is disseminated in appropriate forums, notably via extension and education activities and through the publication of peer-reviewed scientific papers. Such extension and education activities should include conference and workshop presentations within the appropriate stakeholder groups. The SBBRT and state management agencies should also assist in the preparation of funding applications for research and the formation of collaborative research partnerships. Such assistance could take the form of ensuring funding submissions are organised through appropriate management agencies (with input from regional NRM groups) each year.

Responsibility: DECC, DSE (ARI), DEHSA, CMAs, and research scientists (e.g. Museums, universities).

Biosphere's Contributions

The Biosphere and its partner the Royal Botanic Gardens Cranbourne has published a number of reports and contributed to scientific journal publications (see papers listed in references by Coates and/or Nicholls). It contributed to the Australian Government DEWHA Southern Brown Bandicoot workshop in March 2010 and has presented its work at an international scientific conference, the Australasian Wildlife Management Society, in December 2010. The Biosphere has a strong interest in supporting scientific research and has partnerships with research organisations such as the RBGC and universities.

Biosphere Action 7.2.1 Encourage and support research and disseminate results at scientific meetings and in journals.

The Biosphere will continue to publish its scientific and conservation findings and present these at scientific meetings when possible. It will also strengthen and maintain its relationships with research organisations including the Royal Botanic Gardens Cranbourne, universities and with the SBB TRG.

Objective 8 Manage Recovery Plan implementation.

Recovery Criterion: Ensure Southern Brown Bandicoot funding is included in annual funding applications. Contract an external evaluator to prepare a review and evaluation of the recovery programme.]

Action 8.1 Undertake a formal review and evaluation of the implementation of this Recovery Plan.

The Southern Brown Bandicoot Recovery Team will conduct a regular review (every 1-2 years) to assess progress towards the implementation of the Recovery Plan and success in achieving the Plan's objectives. The review should ensure that successes and failures in implementation are identified, and that a process to overcome failures is developed. In the final year of the Plan, the team will commence planning for the revised Recovery Plan (2010-2014). The SBBRT will also engage an external evaluator to undertake a formal review and evaluation at the termination of this Recovery Plan. (NRP, June 2010)

Responsibility: SBBRT, consultant.

Biosphere's Contributions

The Biosphere has an important role in advocating for policy and funding to implement the NRP successfully.

Biosphere Action 8.1.1 Ensure funding for the implementation of the Southern Brown Bandicoot NRP and its consequential on-ground local actions.

Advocate that threatened species including the Southern Brown Bandicoot are included in the Caring for our Country Business plan.

Advocate for improvements in the delivery of State funding for threatened species and the mitigation of the affects of fragmentation and loss of habitat exacerbated by climate change.

Biosphere Action 8.1.2 Encourage and support implementation of the NRP in all states and through the Victorian CMAs.

Initiate a program with DSE and the Port Phillip and Western Port CMA to encourage the formation and success of such actions.

Biosphere Action 8.1.3 Encourage and support implementation of the NRP in the MPWP Biosphere Reserve.

Develop a one-year Action Plan based on the NRP and this Regional Recovery Plan to cover the region of the Biosphere Reserve.

DRAFT

Objective 9 Promote public awareness of and involvement in the Southern Brown Bandicoot recovery program.

Recovery Criterion: Community awareness and access to information about the recovery programme should be facilitated through presentation(s) to community, the provision of bandicoot ‘stories’ to local media and the creation and maintenance of a Bandicoot web-page. Community involvement should be coordinated and Southern Brown Bandicoot references should be given out to local communities. Communities should be encouraged to contribute to official registers (e.g. Atlas of Victorian Wildlife, NSW NPWS Wildlife Atlas) through bandicoot sightings (including road-kill records).

Action 9.1 Engage Community Education Facilitators (CEF).

To coordinate the implementation of the Recovery Plan and the development of new extension and education material (e.g. website, signs, references), part-time state-based Community Education Facilitators (CEFs) should be engaged and made members of the SBBRT. The CEFs will provide the formal administrative links between the Recovery Team, major stakeholders, and NRM and extension groups in each State. This will ensure the exchange of information between States, and encourage the implementation of key Recovery Plan actions in regions where the chief management agencies are not active. Thus, while relevant information is distributed to each key stakeholder in each State, the ultimate ‘message’ is delivered in the appropriate local context.

Responsibility: SBBRT.

Biosphere’s Contributions

The Biosphere supports the notion of engaging a Community Education Facilitator for the local area. It has some experience employing coordinators both on a long term basis and short term contracts.

Biosphere Action 9.1.1 Support local Community Education Facilitator (CEF).

The Biosphere will work with the CEF to achieve local results for the Southern Brown Bandicoot. It will assist the CEF to develop community education and on-ground works plans.

Action 9.2 Undertake community extension by encouraging individuals to report sightings of Southern Brown Bandicoots to regional government personnel.

The NSW Recovery Plan (Department of Environment and Conservation 2006) advocates the establishment of a mortality register to monitor road kills on public roads in the northern Sydney metropolitan area, a useful concept that could be extended to include appropriate localities (e.g. Portland, Mt Lofty Ranges, Kangaroo Island) within the entire distribution of the bandicoot. Suitable road-killed specimens could be collected, and their morphological, biological and genetic information recorded.

Responsibility: DECC, DSE, PV, DEHSA, CMAs and regional NRM groups.

Biosphere's Contributions

The Biosphere has a program for collecting road-killed bandicoot specimens and submitting these to the Museum of Victoria. It encourages members of the public to participate in this program as described under Action 1.2.

The Biosphere also encourages its members and the wider community to report bandicoot sightings via its customised Bandicoot Observation Sheet (see Appendix) which is distributed through its networks and available on the internet. The Biosphere verifies new sightings when necessary and then submits them to the SBB TRG for inclusion into the Atlas of Victorian Wildlife.

Biosphere Action 9.2.1 Improve public awareness of the Biosphere's Bandicoot Atlas program.

Produce a fact sheet and a website that refers to the Bandicoot Observation Sheet. Develop a program that uses Google Map to pin the location with a virtual Map Pin and capture these points into the Biosphere GIS layer for subsequent inclusion the DSE Atlas of Victorian Wildlife.

Action 9.3 Heighten public awareness of the Southern Brown Bandicoot recovery programme.

There is a need for greater public awareness of the Southern Brown Bandicoot and its status which will assist in the recovery of the taxon. Public awareness could be increased in a number of effective but relatively economical ways. These include the development of a Southern Brown Bandicoot home page on the World Wide Web, the erection of interpretive signs and high visibility warning signs at key bandicoot localities, and local media coverage of management and research activities. Increasing public awareness of bandicoots can be relatively effective where bandicoots inhabit urbanised environments (e.g. Mt Lofty Ranges, Portland). Local residents can be educated about such issues as weed control and

responsible pet ownership. Landholders close to known colonies will be encouraged to undertake predator control work, as part of a coordinated community programme, and should receive support to do this work.

Opportunities also exist to involve people outside the conservation agencies in field management of the species. This could be through the establishment of 'Friends' type groups or enlist the support of existing voluntary community action groups — the localisation of major bandicoot populations makes it a suitable taxon for this. This type of community involvement has benefited the taxon in the Mt Lofty Ranges (Aldgate Valley Landcare Group 2004).

Southern Brown Bandicoot reference material should be collated and distributed to local libraries, schools and other information providers at key localities within the bandicoot's distribution.

Responsibility: CEFs, SBBRT, DECC, DSE, PV, DEHSA, CMAs, CMBs, shires, local councils and regional NRM groups.

Biosphere's Contributions

Community education is one of the strengths of the Biosphere's Southern Brown Bandicoot Recovery project. The Public Meeting of November 2006 established that there was substantial community interest and concern in the plight of the species. The resolutions at that meeting (Biosphere Foundation 2008) have driven the extensive actions by the Biosphere's Bandicoot Recovery project since that time.

The Biosphere regularly communicates to its members via a newsletter and its website. The 100+ participants in the fox control program are regularly contacted by letter.

The Biosphere played an advocacy role during the planning of the Frankston Bypass – a freeway now known as Peninsula Link. These activities resulted in considerable newspaper coverage (both state and local), radio interviews and Council newsletters to ratepayers.

The Frankston Round Table (one of the five Biosphere community forums as defined in its constitution) remains aware of the Biosphere's Bandicoot Recovery project. Through the Frankston Round Table, the Biosphere's partners include the Friends of the Pines Flora and Fauna Reserve and The Pines Protectors who regularly work in the Pines Flora and Fauna Reserve. These groups regularly liaise with schools, both secondary and primary. They have organised street parties, community days (e.g. the Pines Pride Day), information days and evenings, political rallies and workshops. They distributed 2000 Southern Brown Bandicoot brochures and an attitude survey for the neighbours of the Pines. They also collected 1700 signatures in a petition to the Victorian Parliament to prevent destructive works from being undertaken in the Pines. The Save the Pines group has a website with a page dedicated specifically to bandicoots.

Biosphere Action 9.3.1 Heighten public awareness of the Biosphere's Southern Brown Bandicoot Recovery programme.

Actions may include:

- Contributing articles on the Bandicoot Recovery to the Biosphere's newsletters;

- Expanding the webpage with factual information on the Bandicoot Recovery;
- Using a list server and or a blog site to allow two-way exchange between the Biosphere community, Friends and the general public with the Biosphere's Bandicoot Recovery;
- Encouraging reporting of bandicoot sightings by members of the public;
- Supporting the Bandicoot Buddy program (launched August 2009) with press releases, a fact sheet and a supporting statement;
- Continuing to support the Connies program with the swap-cards on environmental themes;
- Ensuring participation by the Friends of The Pines Flora and Fauna Reserve and other Reserves through their Committee of Management in the Recovery program;
- Building on the relationships with Western Port Swamp Landcare and the Cardinia Environment Coalition. Activities with these organisations need to be organised for habitat improvement and fox control.
- Following up introductions to Bass Coast Landcare groups;
- Establishing contact with Mornington Peninsula Landcare Groups (e.g. Paul Bertuch, Mornington Landcare, Red Hill Landcare)
- Expanding the relationships with schools, e.g. building on planting days with North Frankston Pines Secondary and Primary Schools, Cardinia Primary School, Bayles Regional Primary School, etc.
- Contributing to environmental newsletters of the local councils.

Priority, Feasibility & Estimated Costs of Recovery Actions

Priority categories follow NRP 2009, and NSW NPWS (2003b): 1 (Essential), 2 (Highly Desirable), 3 (Desirable).

Authorities are **NRP May 2009 (NRP)**, MP&WP Biosphere RP 2009 (BRP) 2010-2012 only, **Southern Brown Bandicoot Strategic Management Plan for the Greater Koo Wee Rup Region (Ecology Australia 2009)**, **Port Phillip & Westernport CMA Regional Catchment Strategy 2011-5 (CMA)**.

Regional areas include Biosphere Reserve (Stage 2), Greater Koo Wee Rup, South Central Southern Brown Bandicoot Region (Coates 2008).

Action	Authority	Region	Description	Priority	Feasibility %	Responsibility	National Recovery Plan Cost Estimates mid 2009 draft					
							Biosphere Cost estimate 2009(\$'000s)					
							2010	2011	2012	2013	2014	Total
1.1	NRP	A	Acquire baseline population data	2	90		120	50				170
1.1.1	BRP	S	Maintain our Foundation's liaison with scientific researchers. Through the RBG Cranbourne and the SBB Technical Reference Group the Biosphere will remain informed on and support research that will assist the on-ground conservation program managed through the Research Committee.			Biosphere & SBBTRG	10	5	5			20

1.1.2			Ensure the collection of base line ecological information The Biosphere will initiate and support scientific studies on ecology and genetics particularly through the Royal Botanic Gardens and the SBB Technical Reference Group.										
1.2	NRP	A	Clarify genetic status	2	90		35/	20					55
1.2.1	BRP	S	Monitor distribution and abundance of local populations Continue to monitor local populations with trail (digital surveillance) cameras and non-intrusive techniques.			Bandicoot Recovery	25	25	10				60
1.2.2			Measure the genetic diversity the Koo Wee Rup populations and other populations of the Biosphere Reserve with the RBGC, the SBB-TRG and our university partners. Continue collection of Roadside kill DNA material; store with Museum Vicotria Determine the relative importance of the RBGC, Mornington Peninsula-Frankston, Quail Island, Koo Wee Rup and Bass Coast populations. Cooperate with others working on the West Gippsland populations including Wilsons Promontory.			Biosphere, RBGC, TRG & Museum Vic University	5	5	5				15
1.3	NRP	A	Determine conservation status in regards to environmental factors	2	90		100	40					140
1.3.1	BRP	S	The Biosphere continues to monitor the distribution and abundance local. The Biosphere through the SBB TRG will liaise with the Scientific Officer of the F&FG Act 1988.			Bandicoot Recovery	4	4	4				12
1.3.2			The Biosphere will contribute to the production of the F&FG Act Action Statement. It will contribute to implementing the actions specified in the Action Statement. The Biosphere through the SBB TRG will liaise with the Scientific Officer of the F&FG Act 1988.			Bandicoot Recovery							
2.1	NRP	A	Identify & map key habitat	1	100		30	15/ 5					45/ 10

2.1.1	BRP	S	<p>Monitor distribution and abundance of local populations with accurate surveys of known habitat. Collect habitat and environmental information relevant to community ecology and condition.</p> <p>The Biosphere's partner RBGC continues to monitor bandicoot numbers in the Gardens.</p> <p>The Biosphere liaises with Parks Victoria to monitor Quail island population and other populations in NC and F&F Reserves within the Greater Biosphere Reserve.</p> <p>The Biosphere through the SBB-TRG liaises with Environmental Consultants and the City of Casey and the Cardinia Shire Council for northern Westernport region.</p> <p>The Biosphere continues to collect, evaluate all records and reports from its members and friends for the Greater Biosphere Region (See Map). The Biosphere Recovery liaises with Bass Coast Land Care, Friends of Venus Bay and other community groups.</p> <p>Valid records continue to be reported to the SBB-TRG for forwarding to DSE Atlas of Victorian Wildlife.</p> <p>A Geographic Information System of the Southern Brown Bandicoot distribution continued to be maintained by the Biosphere Recovery. Annual review. The GIS database be maintained on the Chisholm Institute and the Biosphere Servers).</p>			<p>Bandicoot Recovery,</p> <p>TRG, W Gippsland CMA, RBGC, Parks Victoria, Councils & Consultants</p> <p>Bandicoot Recovery, TRG, Bass Coast partners. Chisholm Institute GIS.</p>	10	11	11			32
2.2	NRP	A	<p>Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference. Predictive modelling</p>	1	100	DSE, Universities	15		12	12	39	
2.2.1 2.2.1.1	BRP	S	<p>Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference.</p> <p>Following its Research plan, the Biosphere will facilitate the production of a strategic plan for the native vegetation for the Greater Biosphere. This aims to combine all the data from the Local Government Councils naturalists, researchers and consultants. Local Government Project ownership required.</p> <p>Stage 1: Obtain copies of the data sets and combine all studies and data sets into a single GIS. Identify and resolve scale, resolution and accuracy anomalies. With partners obtain funding to bring the map up to</p>			<p>Bandicoot Recovery</p> <p>5 LG Councils</p> <p>Bandicoot</p>	5	9 (60)	7		21	

2.2.2			a common standard at the highest practical level by January 2011. Develop partnership with DSE ARI & Victorian Universities in Melbourne to apply the DSE – ARI in the Biosphere to field test the validity of vegetation – SBB habitat model.			Recovery							
						DSE, - ARCUE Bandicoot Recovery		DSE Melb Univ					
3.1	NRP	A	Prepare and local Recovery Plan/Action Statement and other legal processes	1	100		20	5					25
3.1.1	BRP	S	Contribute to the management documents FFG Act Action Statement (as required under the FFG Act) and to other legal documents (e.g. local or State recovery plans, and statutory planning overlays for Cardinia Shire Council and City of Casey). Through the SBB TRG, the Biosphere Foundation will pursue development of the FFG Action Statement by the DSE;			Bandicoot Recovery		5	4	2			
3.1.2	BRP	BR	Support local government actions to use and develop legal planning tools to provide protection to bandicoots.			Bandicoot Recovery							
3.1.3	SMP	KWR	Action 1.1: Revise local planning schemes to ensure core habitats and links identified in Sections 7 & 8 (see Figure 8) are secured and protected for conservation			CoC, Cardinia Councils							
3.2	NRP	A	Protect populations on public land	1	80		35	15			10	60	
3.2.1	BRP	S	Maintain and inventory and through the Biosphere's membership maintain a watching brief on these populations.			Bandicoot Recovery	15	13	13				41
3.2.2			Strengthen existing relationship with Parks Victoria, the manager for local NCRs.										
3.2.3			Strengthen Biosphere's existing relationship with Melbourne Water Waterways Division and Koo Wee Rup Operations Division.										
3.2.4			Strengthen existing relationships with DSE Committees of Management for in City of Casey, Shire of Mornington Peninsula Shire and with Conservation Management for the CoA HMAS Cerberus. See Appendix for list of Committees of Management.										

3.2.5			Establish relationships with existing or help form Committee of Management in Cardinia Shire and Bass Coast Shire Council.										
3.2.6			Maintain, through the SBB TRG, the relationship with DSE and West Gippsland CMA and Parks Victoria Wilsons Promontory NP and West Gippsland.										
			Strengthen the relationship with the Port Phillip & Westernport CMA.										
3.2.7			Strengthen the relationship with the Vic Track										
3.2.8			Implement actions in the SBB GKWR SMP relating to native vegetation.										
3.2.9	SMP	KWR	Action 2.1: Avoid slashing and the removal of roadside vegetation when not essential and prevent vegetation slashing along important roads identified in Figure 9 GKWR SMP 2009										
			Action 2.2: Cease vegetation slashing and clearance along waterways (Figure 9) GKWR SMP 2009										
3.2.10			Action 4.1: Cease livestock grazing in riparian Crown land parcels and prohibit stock access to riparian remnant vegetation (Figures 2 and 9)										
			Action 4.2: Discourage livestock grazing in vegetation remnants on private property and encourage landholders to fence vegetation remnants from livestock										
3.2.11			Action 4.3: Continue to implement the Shire of Cardinia Weed Management Strategy and integrate actions for staged weed control. Develop similar actions in the City of Casey where they will protect SBB habitat.										
3.2.12			Actions 4.5: Fence off reserves and remnant vegetation in known and potential habitat to prevent access by trail bikes and other vehicles										
3.2.13			Action 9.1: Enhance vegetation along suitable habitat links identified in Figure 9										
			Action 9.2: Revegetate potential habitat links along watercourses identified in Figure 9										
3.2.14			Action 9.3: Revegetate potential habitat links along roads identified in Figure 9										
			Action 9.4: Enhance vegetation along the South Gippsland Railway Line from Tooradin Station Road to Monomeith										
3.2.15			Implement actions in the SBB GKWR SMP relating to public land.										
3.2.16			Action 10.1: Enhance existing core habitat and other habitat patches through targeted revegetation and restoration										
3.2.17			Action 10.2: Revegetate disused and informal tracks in remnants of known and potential habitat										

3.2.18			Action 11.1: Collaborate with stakeholders and government agencies outside the former Koo Wee Rup Swamp area to develop bio-links to Cranbourne, Drouin, Quail Island and Wonthaggi (Table 8) to increase connectivity between populations in these areas and the former Koo Wee Rup Swamp area									
3.2.19			Action 15.1: Increase the area of suitable habitat for the Southern Brown Bandicoot through habitat restoration on public land focused around core habitat and habitat links									
3.2.20			Action 15.3: Develop and implement a revegetation and management strategy to rehabilitate a habitat link to Lang Lang along the South Gippsland Railway Line from Monomeith to Lang Lang									
3.2.21			Action 15.4: Investigate the possibility of Southern Brown Bandicoot reintroduction to suitable habitats in Lang Lang and develop a management plan.									
3.3	NRP	A	Protect populations on private land	1	60		35	15			10	60
3.3.	BRP	BR	Identify private land with bandicoot populations and public land reserves that historically have had Southern Brown Bandicoot populations.				10	10	5			25
3.3.1			Maintain the Biosphere inventory of properties and though its membership maintain a watching brief on these properties and their bandicoot populations.									
3.3.2			Provide surveillance cameras to private land holders to document presence of bandicoots, following advice from WWF (pers comm) and Scroggie (2008);									
3.3.3			Strengthen contacts with additional Landcare Groups, and with Naturalist Clubs;									
3.3.4			Provide to membership, information on and support for Trust for Nature Covenants;									
3.3.5			Encourage the uptake of Bush Tender and have the DSE trial ventures in the Lang Lang district extended across the Biosphere Reserve;									
3.3.6			Cooperating with the local councils, instigate a study on the support given by the five local governments for on-ground conservation; biodiversity grants, rebates for pest control, tree planting and free trees and native plants. Recommend ways these programs might be expanded across the Biosphere Reserve to target Southern Brown Bandicoot and biodiversity.									
			Action 2.3: Ensure that informed planning decisions and environmental assessments are made where proposed developments have the potential to impact upon Southern Brown Bandicoot									

3.3.7			<p>habitat. GKWR SMP 2009</p> <p>Action 3.1: Implement a specific Southern Brown Bandicoot Overlay over suitable habitat on private land</p> <p>Action 3.2: Extend the coverage of Vegetation Protection Overlays on private land</p>									
3.3.8			Action 3.3: Continue to provide incentives for landholders to retain and manage remnant vegetation on private property									
3.3.9			Action 3.4: Continue to promote schemes to secure private land parcels for conservation									
3.3.10			Action 4.4: Provide funding and other incentives for strategic revegetation and follow up weed control on private property									
3.3.11			Action 15.2: Increase the area of suitable habitat for Southern Brown Bandicoots through habitat restoration on private land									
3.3.12												
4.1	NRP	A	Identify threats	1	90		30					30
4.1.1	BRP	BR	Confirm and annually review the identification current and potential threats. Confirm advice from the scientific community and the SBB-TRG that loss of connectivity of the habitat and loss of habitat are two of the three main threats.				5	5	5			15
4.1.2			Identify current and potential threats; namely the loss of connectivity between the remain habitats (Coates et al. 2008), relative importance of pest predators (red fox, cats, dogs), competitive herbivores removing understorey habitat (rabbit, deer spp.), fire regimes for vegetation.									
4.1.2.1			Using the inventory of public and private properties (Biosphere Actions 3.2 1 & 2) and warnings from the Biosphere's membership provide objective analysis and quantitative judgments on the extent of the new threats of habitat loss to local Southern Brown Bandicoot populations.									
4.1.2.2			Combine and integrate the available information, inventories, maps, plans of the State and Local Government and other studies on vegetation policies, strategies and frameworks as they relate to the Biosphere Reserve. These include Victorian Native Vegetation Framework, the native vegetation policies of each of the Local Government Councils, City of Casey Native Revegetation Strategy, Statewide									

4.1.2.3			Inventory of salt marsh and coastal vegetation (particularly the Biosis Research contribution on the Western Port section) and the many studies by ecological consultants (Ecology Australia 2009, Practical Ecology 2009, and many other earlier studies. The Biosphere RC has had two presentations (J Yugovic, G Walker) and it has a policy and a draft discussion paper on this recommendation (Nicholls-Research Committee Papers February 2009). In the longer term, combine and integrate the Strategic Management plans being developed within and beyond the Biosphere Reserve to Wilson Promontory into a single strategy. Identify on-ground actions and implement those actions in conjunction with the local council, private land owners and the public land managers.									
4.1.2.4			The Biosphere meet with Melbourne Water Waterways Program and Melbourne Water Koo wee Rup operations to continue improving the conservation of the Southern Brown Bandicoot on Melbourne Water land including advocating protection of known habitat including The Inlets, changes to the vegetation management including phasing out cattle grazing and altering the mowing regimes and fox control – see Action 4.3 (Research Committee 2008, Yugovic & Biosis Research 2009).									
4.1.3.1			Act on the identified threat, the loss of native vegetation through illegal and misguided clearing of native vegetation in remaining reserves and private property. Implement SBB GKWR Strategic Management Plan actions relating to climate change threat.									
4.2.1			Action 12.6: Support research into the possible effects of drought and climate change on Southern Brown Bandicoot habitat and survivorship in the former Koo Wee Rup Swamp area									
4.2	NRP	A	Ensure fire management considers the species conservation requirements	1	70		150	150	110	110	120	640
4.2	BRP	BR	Ensure fire management activities consider the conservation requirements of the Southern Brown Bandicoot Using the inventory of public and private properties (Biosphere Actions 3.2 1 & 2) provide objective analysis and quantitative judgments on the extent of the fire threats to local populations. Determine the practicality of applying the studies of the Royal Botanic Gardens fire regimes to other reserves in the Biosphere Reserve. Support the work on fire regimes and bandicoots Bass Coast and Wonthaggi Heathlands NCRs and				5	2	2			9

			Wilsons Promontory NP.									
4.3	NRP	A	Implement and monitor introduced predator control	1	90		120	120	60	60	100	460
4.3	BRP	BR	Implement effective control and monitoring methods for introduced predators in partnership with DSE Bandicoot Protection, CMAs and local government Councils.			Bandicoot Recovery	10	10	10			30
4.3.1			Using the inventory of public and private properties (Biosphere Actions 3.2 1 & 2) develop objective analysis and quantitative judgments on the extent of the different pest predator threats to local populations.									
4.3.2			Using the supplementary NHT-WWF TSNC Grant measure the effectiveness of the 2009 program (Works Plan 2009).									
4.3.3			The number of different reserves offers and opportunity to compare management and its effectiveness for control of predators, the cost-effectiveness and the biodiversity outcomes (Reddix & Forsyth 2005). This opportunity be implanted with RBGC, Parks Victoria, and Committees of Management following an experimental design prepared by the Bandicoot Recovery and the EPBC Southern Brown Bandicoot Management plan for the Frankston ByPass.			Bandicoot Recovery & partners						
4.3.4			Seek funding to expand the regional pest predator program for the Biosphere Reserve. This builds on the Biosphere's plans and its 1080 program control. This plan is to be integrated with a wide number of initiatives including									
4.3.4.1			DSE Bandicoot Protection Program (2008-2010) and PPWCMA Ramsar Threats Program 2009, 2010									
4.3.4.2			the successful on-ground actions of the Phillip Island Strategic Fox Elimination Strategy (McPhee & Bloomfield 2004, & revisions 2008),									
4.3.4.3			the recommendations of the Greater Koo Wee Rup Strategic Management Plan (Ecology Australia 2009);									
4.3.4.4			the pest management programs of all five local government councils in the Biosphere;									
4.3.4.5			implementing the adaptive experimental management process to obtain quantitative evidence of the relative importance of the pest predator species and the cost-effectiveness of the various control measures available;									
			improving by coordination with the existing Fox Control program in the Koo Wee Rup to protect the flood mitigation channels of Koo WEE Rup and the known habitats of Park Victoria Northern Western port NCR;									

			<p>incorporating the standard operating guides of the Model Code of Practice for the humane control of foxes (Sharp & Saunders 2009) and the Victorian version of this code into the Biosphere's programs.</p> <p>Implement Greater Koo Wee Rup Strategic Management Plan (Ecology Australia 2009);</p> <p>Action 5.1: Determine the abundance and density of the Red Fox in the former Koo Wee Rup Swamp area</p> <p>Action 5.2: Develop a broad-scale integrated Red Fox control program around core areas</p> <p>Action 5.3: Implement the Red Fox control program developed in Action 5.2</p> <p>Action 5.4: Protect important areas with predator-proof fences and the creation of small mammal refuges</p> <p>Determine the practicality of applying the studies of the Royal Botanic Gardens control regimes to other reserves in the Biosphere Reserve.</p> <p>Maintain a GIS and Database of the information required to run a large scale pest predator program. Integrate this program into the State Integrated Pest Management Scheme.</p> <p>With the SBBTRG, the Bandicoot Recovery provide a fox forum presented in three stages. Stage 1: An initial small workshop for the Biosphere to present its successful fox control program for evaluation by the State's experts and to allow fellow practitioners to present their fox control programs so that each group can identify improvement for their program. Stage 2: A forum for professional fox control contractors. Stage 3. A large forum to allow dissemination new and improved practices. See Coates – Discussion Paper, minutes SBBTRG.</p>									
4.4	NRP	A	Evaluate impact of weeds and develop protocol	2	80		40	30		20		90
4.4.1	BRP	BR	Using the inventory of public and private properties (Biosphere Actions 3.2 1 & 2) provide objective analysis and quantitative judgments on the extent of the pest weed threats to local populations.				3	3	3			9
4.4.2			Bayles Ecological Significant Vegetation, Melbourne Water Flood Mitigation Channels, Vic Track Rail lines and private properties are examples where a staged removal of weeds is required. The Bandicoot Recovery offer advice and use its scientific expertise to monitor these and similar sites.									
4.5	NRP	A	Control threats from forest management	2	90		50	50		40	40	180

4.5.1	BRP	BR	Continue to liaise with SBB TRG on threats in the forested districts of the Biosphere Reserve – in the Bunyip State Forest and the forests in Baw Baw Shire and the West Gippsland CMA				0.33	0.33	0.33			1
4.6	NRP	A	Control or reduce threats from road mortality	3	80		50	30	30	30	30	170
4.6.1	BRP	S	Maintain and increase the community knowledge of the Biosphere's road kill collection service. This service provides body bags, a local collection point, temporary frozen storage and information about the value of the road kill specimens. It will forward the specimens to Museum of Victoria. Through the SBB-TRG, ensure where ever possible, the genetic information in these specimens is valued and included into the scientific body of knowledge.				3	3	3			9
4.6.2.			Extend the Southern Brown Bandicoot by including the local veterinary clinical practices, Committee of Management, Naturalist Clubs into the specimen collection service.									
4.6.3.			With the SBB TRG analyse the pattern of road kills to recommend improved mitigation strategies.									
4.6.3			Advise the DSE and local councils where to place the DSE Road signs									
4.7.1.1			Implement the SBB Greater Koo Wee Rup Strategic Management Plan (Ecology Australia 2009); Action 8.1: Establish a mortality register for roads in the former Koo Wee Rup Swamp area to assess current impacts and mortality patterns									
4.7.1.2			Action 8.2: Investigate need for road kill mitigation measures and implement where necessary									
4.7.1.3			Action 8.3: Erect bandicoot warning signs on roads within and adjoining core habitats and on roads identified to be high risk in Action 8.2									
4.7	NRP	A	Improve control of companion animals	3	80		30	20	10	10	10	80
4.7.1	BRP	BR	Initiate a Biosphere Coordinated program with the five Councils to apply the best individual council actions into the other Councils as appropriate.				1	1	1			3
	SMP	KWR	Implement the SBB GKWR SMP for companion animals. Action 7.3: Enforce responsible pet ownership laws and implement curfews Action 7.4: Devise an education program to raise awareness of responsible cat and dog ownership									

			and the threats of domestic pets to Southern Brown Bandicoots										
4.8			Integrate all pest animal management										
4.8.1	BRP	BR	Submit to the DEWHA a revision to the Recover Plan to include management of other pest as they impact the survival of the Southern Brown Bandicoot.			Biosphere Recovery	3	3	3				9
4.8.2			Determine the relative contribution of pest predators and develop necessary control actions. These may include domestic and feral dogs, feral and domestic cats, black rats.			With partners: LG Councils, Melbourne Water, Vic Track and private land owners							
4.8.3			Implement actions of the SBB GKWR SMP on rabbit control, namely,										
4.8.3.1			Action 6.1: Determine the density of the European Rabbit in the former Koo Wee Rup Swamp area										
4.8.3.2			Action 6.2: Develop a control program for the European Rabbit to be integrated with the Red Fox control program										
4.8.3.3			Action 6.3: Implement the European Rabbit control program developed in Action 6.2 concurrently with the Red Fox control program										
4.8.4.1			Implement actions of the SBB GKWR SMP on feral cats, namely,										
4.8.4.2			Action 7.1: Determine the presence and abundance of feral cats in the former Koo Wee Rup Swamp area Action 7.2: Undertake targeted control of feral cats if they are identified as a threat in the former Koo Wee Rup Swamp area										
5.1	NRP	A	Measure population trends, impact of recovery actions	1	80			90	150	150	90	480	
5.1.1	BRP	S	Maintain program with SBBTRG to collated and analyse and report the public observations as they contribute to understanding the biology of the Southern Brown Bandicoot. The standard set by Reddix & Forsyth is the minimum standard that must be achieved.				4	4	4			12	
5.1.2			Complete a monitoring of the success of the Biosphere's 2009 fox control program in the Koo Wee Rup region by comparing treatment sites (1080 poison of 60-80 bait stations) with non-treatment (no poisoning) during Spring of 2009. Recommend how this program might better target the known populations of Southern Brown Bandicoot particularly on the public land of Melbourne Water and PV Nature Conservation										

			Reserves.										
6.1	NRP	A	Assess requirement for captive population	2	100		25				25	50	
6.1.1	BRP	BR	The Biosphere work with the SBB-TRG to develop a discussion paper on the feasibility and the risks with a breeding and translocation program.				1	5	2			8	
6.1.2			The Bandicoot Recovery work with DSE, Parks Victoria and the SBBTRG to develop procedures and identify opportunities for translocation and breeding program to improve genetic diversity, dispersal and recolonisation to former distribution and abundance. Investigate the opportunity and the legality of translocations. Translocations are contentious; nonetheless reconnection our populations and restocking isolated reserves, Langwarrin, Tootgarook, The Pines and the Northern Western port Conservation Natures Reserves need investigation. The legality, the methods, the source and destination of translocated animals, preparatory and on-going management all need to be defined. Discussion within the scientific, management and community is needed.										
6.1.3			Work with local land holders and owners to provide free – range bandicoots with secure breeding and/or supplementary feeding stations.										
6.1.4			Investigate with Woodleigh School and others, the opportunities for a breeding program, consistent with 6.1.1.										
6.1.5			Work with land owners of Snake Island, S Gippsland to determine the merit of using this island to provide a refuge population.										
6.1.6			Develop a policy for assistance to free – range populations of SBB in rural agricultural regions.										
6.1.7			Implement SBB GKWR Strategic Manangement Plan relating to assistance to free-range breeding										
6.1.8			Action 12.7: Evaluate the feasibility of creating artificial dens for Southern Brown Bandicoots and investigate their likely effectiveness and use by bandicoots in urbanised areas										
7.1	NRP	A	Form Recovery Team	1	100		20	20	25	25	25	115	
7.0	BRP	S	Make a submission to the Department of Environment seeking the addition to the EBPC National Recovery			Bandicoot	5	5	5			15	

7.1.1			Plan to include the formation of Regional Recovery Groups into the National Recovery Plan (NRP). The Draft May 2009 NRP recognises the existence of State Recovery Team in NSW and other NRP support Regional Recovery Groups. On-ground actions are necessarily local in scope and where private land owners are involved and/or there are multiple government agencies, it needs a local forum for resolution and action.			Recovery						
7.1.2			Initiate Regional Recovery Group for the Biosphere. See Discussion paper; Appendix			Bandicoot Recovery, DSE and partners						
			In the longer term the Biosphere Recovery Group needs to be expanded or included into a Recovery Group to further the conservation of the south central population of Southern Brown Bandicoots from south east Melbourne to Wilsons Promontory.			Biosphere Foundation						
7.2	NRP	A	Disseminate research findings and coordinate funding submissions	2	70		20	20	25	25	30	120
7.2.1	BRP	A	The Biosphere publish its scientific and conservation findings			Bandicoot Recovery	2.5	2.5	2.5			7.5
7.2.2			The Biosphere maintain and strengthen its relationship with the Royal Botanic Gardens, Universities and with the SBBTRG.									
8.1	NRP	A	Ensure Southern Brown Bandicoot funding is included in annual funding applications. Contract an external evaluator to prepare a review and evaluation of the recovery programme.	2	100						40	40
			Review recovery process									
8.0	BRP	BR	Secure Funding for Biosphere Bandicoot Recovery			Bandicoot Recovery	2	2	2			6
8.0.1			Ensure Threatened Species including the SB Bandicoot are included in Caring for our Country Business plan.									
8.0.2			Improve the delivery of State funding for threaten species and to mitigate the affects of fragmentation and loss of habitat exacerbated by climate change.									

8.1.1	BRP	A	Encourage and support research and disseminate results at scientific meetings and in journals.									
8.2.1			Encourage and support implementation of NRP in all states and through the Victorian CMAs									
8.3.1			Encourage and support implementation of NRP in the Catchment of the Biosphere Reserve of the MP&WP Biosphere Reserve Foundation.									
8.3.2			Develop a one year Action plan based on the NRP and this Recovery Plan.									
9.1	NRP	A	Engage Community Education Officer (CEF)	2	100		45	45	60	60	60	270
9.1.1	BRP	BR	Initiate a program with the EPBC CEFs to achieve local results				33	33	33			100
9.1.2			Develop with the CEFs a regional Community Education and On-ground Works plan.									
9.2	NRP	A	Community extension	2	70		20	20	15	15	15	85
9.2.1	BRP	BR	Undertake community extension by encouraging individuals to report sightings of Southern Brown Bandicoots to regional government personnel.				5	5	5			15
9.2.2			Consolidate and strengthen the Biosphere's Bandicoot Atlas program with – DSE SBB-TRG Atlas of Victorian Wildlife. Produce a fact sheet and a website that refers to the observation sheet (available See Appendix). Use Google Map with the opportunity to pin the location with a virtual Map Pin and capture these points into the Biosphere GIS and into the DSE Atlas of Victorian Wildlife.									
9.3	NRP	A	Promote public awareness	3	70		30	30	30	35	350	160
9.3.0	BRP	BR	Initiate a program with the Facilitator and the Executive officer, Communication Cmtee, Education Cmtee.				5	5	5			15

9.3.1			Contributing to the Biosphere's newsletters;									
9.3.2			Expanding the web page with factual information on the Bandicoot Recovery;									
9.3.3			Using a list server and or a blog site to allow two way exchange between the Biosphere community, friends and general public and the Biosphere's Bandicoot Recovery;									
9.3.4			Encouraging of reporting bandicoot sightings;									
9.3.5			Supporting the Bandicoot Buddy – launched August 2009 with press release, fact sheet and its supporting statement;									
9.3.6			Continuing the Connies programme with the swap cards on environmental themes;									
9.3.7			Inviting participation in the Friends of The Pines Flora and Fauna Reserve and the other Reserves through their Committee of Management;									
9.3.8			Building on the relationships with Swamp Landcare and the Cardinia Environment Coalition. Activities with these organisations need to be organised for habitat improvement and fox control.									
9.3.9			Following up introductions to Bass Coast Landcare groups;									
9.3.10			Establishing contact with Mornington Peninsula LandCare Groups (Paul Betouche Mornington Landcare, Red Hill Landcare, ...)									
9.3.11			Expanding the relationships with schools building on planting days with North Frankston Pines Secondary and Primary Schools, Cardinia PS, Bayles Regional PS, ...									
9.3.12			Contributing to Environmental News letters of the Councils									
9.3.13	SMP	KWR	<p>Implement the SBB GKWR SMP actions relating to community education and involvement.</p> <p>Action 13.1: Educate the community on the conservation status, the importance and benefits of retaining the Southern Brown Bandicoot</p> <p>Action 13.2: Design and install uniform signage for conservation reserves to promote awareness of Southern Brown Bandicoot habitats</p> <p>Action 14.1: Compile and distribute simple guidelines and facts about ways individual landholders can help the Southern Brown Bandicoot on their land</p>									

			<p>Action 14.2: Establish a 'Friends of' group for Southern Brown Bandicoots in the former Koo Wee Rup Swamp area</p> <p>Action 14.3: Involve community groups and increase participation by the wider community in on-ground management actions for the Southern Brown Bandicoot</p> <p>Action 4.6: Develop a community education program to promote public stewardship of reserves, waterways and remnant vegetation in the former Koo Wee Rup Swamp area</p> <p>Action 13.1: Educate the community on the conservation status, the importance and benefits of retaining the Southern Brown Bandicoot</p> <p>Action 13.2: Design and install uniform signage for conservation reserves to promote awareness of Southern Brown Bandicoot habitats</p> <p>Action 14.1: Compile and distribute simple guidelines and facts about ways individual landholders can help the Southern Brown Bandicoot on their land</p> <p>Action 14.2: Establish a 'Friends of' group for Southern Brown Bandicoots in the former Koo Wee Rup Swamp area</p> <p>Action 14.3: Involve community groups and increase participation by the wider community in on-ground management actions for the Southern Brown Bandicoot</p>									
			National Recover Plan Costs			TOTALS	1020	785	527	580	967	3564
			Biosphere Reserve Recovery Plan Costs			TOTALS						

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Appendices

Constitution of Southern Brown Bandicoot Technical Reference Group Dr Rolf Willig (Biodiversity Officer - DSE)

Scientific Advisory Committee, Flora and Fauna Guarantee Act 1988 Southern Brown Bandicoot. July 2009, listing #805.

List of Committees of Management for Crown Land and other Reserves in the Western Port Biosphere Reserve.

Nicholls-Research Committee Papers February 2009 Native Vegetation Strategy – draft

Nicholls, DG Fox Control Works Plan 2009, 2010

Coates – Discussion Paper Fox Forum

Department of Environment, W H & the Arts. 2009. Approval EPBC 2007/3480 20 August 2009.

Research Committee 2009 Structure and Function of proposed Regional Recovery Group for the Biosphere. See Discussion paper

Critter ID Sheet and SBB Google Earth map with pins.