Annex 2.3 Examples of trends in significant species and communities

1. Title

Non-marine Mammal Faunas: Change in indigenous mammal species at bioregional scale since European settlement. By N.L. McKenzie, A.A. Burbidge & K.D. Morris, Western Australian Department of Environment and Conservation.

2. Description

- Details about species/community: 305 non-marine mammal species are known to have been present in Australia at European settlement. Eighty-four per cent (257) of these are endemic to Australia. The remaining 48 species also occur in New Guinea and/or nearby islands. Thirty of the non-endemics are bats. The average Australian bioregion had 51 indigenous mammal species (SE = 1.5, range = 28 to 89, N = 85)

- Distribution: An average Australian mammal species originally occurred in 14 (SE = 0.8) bioregions. Four geographically distinct and compositionally dissimilar faunas are recognisable – 'Northern', 'Arid', 'South-eastern including Tasmania' & 'Southern semi-arid+south west'. This pattern is explainable in terms of Annual Average Temperature, Temperature Annual Range, and Longitude (Burbidge *et al.* in prep.).

- Relevant ecological characteristics: The high metabolic requirement of homeothermy is a deterministic factor in the biogeography and conservation status of Australian mammals. The large-mammal fauna extant at European settlement comprised the surviving remnants of the Pleistocene megafauna; the gaps allowed many exotic mammals to establish.

3. Significance

- Legislative listing: Many of the mammal species are listed as critically endangered, endangered or vulnerable, both IUCN (http://www.redlist.org) and EPBC Act (http://www.environment.gov.au/biodiversity/threatened/index.html) as well as under State/Territory legislation. In December 2007, the EPBC Act list included 1 terrestrial mammal species as critically endangered, 25 as endangered and 38 as vulnerable.

- Reasons for listing: Of the 305 non-marine mammal species present in Australia at European settlement, 22 are now extinct, 8 became restricted to continental islands, and 100 have been extirpated from at least one of Australia's 85 bioregions. This is 31% of the world's mammal extinctions since 1600 AD (www.iucnredlist.org). Unfortunately, Australia leads the world in mammal extinctions. Ninety-one species 'persist' (persist in >50% of former range within region) in less than 50% of the IBRA regions in which they originally occurred. Fifty-eight of these are marsupials, three are bats and 30 are rodents.

- Linkage to other species: Mammals are an important component of regional biodiversity in all of Australia's geoclimatic domains, as herbivores, omnivores and carnivores that forage in aerial, arboreal, surface and fossorial environments. In terms of body-size, an important determinant of ecosystem service roles, mammals exceed invertebrates, and range upwards from all other vertebrates by several orders of magnitude (Peters 1983).

4. Data/Information

- Sources of information: (a) Oral history research (e.g. Finlayson 1935; Burbidge and Fuller 1978; Johnson and Roff 1982; Burbidge *et al.* 1988; Tunbridge 1989; Copley *et al.* 1989). (b) Late Holocene subfossil deposit data (e.g. Lundelius 1957; Baynes 1987, 1990; Baynes and Jones 1993; Flannery 1995; Johnson and Baynes 1982; Menkhorst and Knight 2001; Morton and Baynes 1985, Baynes and Johnson, 1996; McKenzie *et al.*, 2000; McNamara 1997; Tunbridge 1989). (c) ongoing mammal surveys in combination with searches of historical and contemporary literature and reviews of museum collections for local and regional fauna summaries (eg, Parker 1973; Calaby and Keith 1974; Kitchener 1978; McKenzie and Youngson 1983, Baynes 1987; Baynes and Johnson 1996; Robinson *et al.* 2000; McKenzie *et al.* 2000) and preparation of mammal handbooks and field guides (eg, Strahan 1995; Churchill 1998,

Menkhorst and Knight 2001).

- Extent of knowledge: Data on the occurrence by bioregion of Australia's indigenous terrestrial mammals at the time of European settlement and their current conservation status is of high quality, although information on a few bioregions is sparse. By 2007 the geographical range of the average Australian mammal species had been reduced from 14 to 12 bioregions (SD= 0.7): from 13 to 10 for marsupials, 18 to 17 for bats, and 12 to 9 for rodents. Losses have been greatest in arid regions and least in areas of high rainfall.

- Information needs/gaps: More mammal surveys, more sub-fossil survey work in NT, Qld, NSW, WA & Tasmania, especially. Reviews of mammal re-introduction projects, especially those incorporating environmental management along with feral predator control.

5. Management requirements/Issues

- Nature of threats: One model comprising six variables explained 93% of the region-to-region variation in mammal fauna attrition (McKenzie *et al.*, 2006): rainfall (a surrogate for environmental productivity), environmental change (a measure of post-European disturbance), phylogenetic similarity, body weight distribution, area (a surrogate for extent of occurrence), and 'proportion of species that usually shelter on the ground rather than in rockpiles burrows or trees. Environmental changes included 'landscape degradation', 'introduced herbivore density' and 'time since foxes and cats first colonised region'. Attrition has been greater among species > 0.0035 & < 5.5 kg.

- Need to manage species/community: Some species of non-threatened large kangaroos are commercially exploited under national management plans.

- Need to manage at the landscape scale: Where large areas of protected habitat can be managed, there is value in undertaking multi species translocations for fauna reconstruction programs rather than single species recovery. This approach, in association with others such as appropriate fire regimes, restores ecological processes to areas such as the rangelands, as well as improving the conservation status of threatened species.

6. Management actions/responses

- Timeframe: Immediate

- Recovery plan: It is clear from the combination of historical and analytical evidence that mammal extinctions do not have a single causal factor. Long-term recovery of many mammal populations will require control of introduced predators in combination with extensive habitat management that includes control of feral herbivores and other factors that reduce landscape productivity, such as inappropriate fire regimes. These programs should restore facets of productivity relevant to the types of species at risk, and ensure continual availability of suitable refuges from physiological stressors.

- NRM plans or species management plans: Recovery plans have been produced for many of the listed species, but degree of implementation varies. Specific NRM plans are few and/or localised.

- Stage of implementation: Following a surge in the preparation of recovery plans for threatened mammals in the early 1990s, implementation followed over the next 10 years or so. Currently many of these are being reviewed and revised if necessary e.g. Chuditch (*Dasyurus geoffroii*) Recovery Plan. A strategic review by the Commonwealth and the States on the progress on implementation and need for revision is required.

- Reservation: The acquisition of large areas of rangelands to improve the coverage of the conservation estate will allow fauna reconstruction programs to proceed and reverse the landscape degradation that has occurred over the last 100 years.

- Amount of investment: Recovery of a single species usually takes in the order of 10-15 years and a total cost of about $1M. Critically Endangered species such as Gilbert's Potoroo require significantly more resources than less threatened species. Fauna reconstruction projects can potentially achieve species recovery more efficiently, as several species may be translocated at once, providing economy of scale. There are still several species that require recovery plans prepared and implemented e.g Antina (Central Rock-rat *Zyzomys pedunculatus*).

- Community involvement: Volunteers can play an important role in fauna recovery programs. It is very important to have supportive neighbours when management actions such as burning and pest animal control are being conducted. Non government organisations such as Australian Wildlife Conservancy and WWF-Australia contribute significantly to mammal conservation.

7. Outcomes

- Recent trends: Significant broad-scale predator control and mammal recovery programs are underway in Western Australia, ('Western Shield' (Start and Mawson 2004), South Australia ('Arid Recovery' at Roxby (Hill 2004) and 'Bounceback' in the Flinders Ranges), and Victoria (Project Deliverance, Murray *et al.* 2006). The Australian Wildlife Conservancy has acquired several properties around Australia and fauna recovery is a key objective of many of these (eg Faure Island in Shark Bay and Paruna in the Avon Valley, WA). Recovery Plans for individual species are being implemented around the country. The establishment of foxes in Tasmania would lead to decline of some species, including some restricted to that State, and eradication/control work is important.

- Monitoring of change: Mammal surveys and reviews of conservation status provide ongoing appraisal of status.

- Some analysis of effectiveness of action: Most terrestrial mammal species are comparatively well known; however, information of the distribution and conservation status of some species is of poor quality eg, *Notoryctes*, *Sminthopsis butleri*, *Phascogale tapoatafa* southwest and northern sub species.

8. Future scenario

- Predicted change in status: Continuing decline. The medley of factors that have transformed the ecology of this continent over the last 200 years still operate, in some cases with unprecedented severity.

- Emerging/new management issues: Given the importance of temperature and rainfall attributes to mammal distribution and conservation status, global warming will exacerbate the already critical problem of survival for indigenous mammals in much of Australia. In the Wet Tropics, for example, bioclimatic modelling suggests that several mammals will decline and some may become extinct (Williams *et al* 2003)). In the Australian Alps, the mountain pygmy-possum is predicted to become extinct as temperatures rise, snowfall diminished and feral cats and foxes invade the area (Brereton *et al* 1994).

  The issue of mesopredator release and the impact of lower order predators on native mammals in the presence of effective fox control is being investigated. There have also been suggestions that dingos/wild dogs may be possible regulators of foxes and feral cats and provide subsequent benefits to fauna conservation e.g. Glen and Dickman (2005), Glen *et al* (2007).   An experimental approach to assess this is required.

- Broader implications: Introduced predator control, appropriate fire management and translocations will need to expand if further declines and extinctions are to be avoided.

- Way(s) forward: Mammal recovery will benefit greatly from better integrated introduced predator control and fire management. Broadscale feral cat control methodology may soon become reality, allowing much better introduced predator control than is currently available.

9. Images

- Location map: The 85 bioregions of Australia shaded according to the attrition in their mammalian faunas (from McKenzie *et al.* 2006)

- Photograph of species: Bilby and Chuditch

- Photograph of management activity: Loading baiting aircraft at Lorna Glen

10. References

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Aerial fox baiting

Dalgyte

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