

AUSTRALIAN MAMMAL AUDIT ~ Norm McKenzie and Andrew Burbidge

Of all the reasonably well-known groups of plants and animals in Australia, mammals have been most sensitive to environmental change. As part of the National Land and Water Resources Biodiversity Audit, we recently concluded a report on the status of Australia's mammals. The report will soon be available on the Australian Natural Resources Atlas Home Page at http://audit.ea.gov.au/ANRA/atlas_home.cfm.

The objectives of the project were to:

1. Develop a national database that shows original distribution of Australia's terrestrial mammals and their current status by Interim Bioregionalisation of Australia (IBRA) Region.
2. Analyse the database to reveal centres of endemism and patterns of decline.
3. Attempt to correlate the patterns of mammal decline with environmental changes and with attributes of the mammals concerned.

To develop the database, we worked with colleague mammalogists in each State and the Northern Territory. Collaborators were:

Northern Territory

John Woinarski, Department of Infrastructure, Planning and Environment, PO Box 496, Palmerston, NT 0831

Queensland

Greg Gordon, Queensland Parks and Wildlife Service, PO Box 155, Brisbane Albert St, Qld 4002

New South Wales

Mike Cavanagh, New South Wales National Parks and Wildlife Service, PO Box 1967, Hurstville, NSW 2220

Victoria

Peter Menkhorst, Department of Natural Resources and Environ-

ment, PO Box 500, East Melbourne, VIC 3002

Tasmania

Raymond Brereton, Department of Primary Industries, Water & Environment, 134 Macquarie Street, GPO Box 44 HOBART 7001, Tasmania

South Australia

Tony Robinson, National Parks and Wildlife, South Australia, Department for Environment and Heritage, GPO Box 1047, Adelaide SA 5001

Western Australia

Norman McKenzie and Andrew Burbidge, Department of Conservation and Land Management, PO Box 51, Wanneroo, WA 6849, and Alexander Baynes, Western Australian Museum, Francis St, Perth WA 6000.

After agreeing on a list of 305 species of native terrestrial mammals and 26 species of exotic mammals, a status was allocated to each species for each of the 85 IBRA regions in Australia in which it occurred at European settlement. The main codes used were as follows:

P Persists in >50% of former range within Region;

D Declined in Region: a decline 50-90% of former range within Region;

SD Severe Decline: extant within Region but declined by >90% of former range within Region (range equates to 'extent of occurrence', not 'area of occupancy' (IUCN 2000));

EX Extinct in Region: when there is no reasonable doubt that the last individual has died.

We also recorded species that had naturally extended their

range since settlement and species that had been translocated into regions where they did not naturally occur or where they had become extinct or had seriously declined. Once the data from each State and the Northern Territory were combined we generated maps for each species using GIS software showing presence/absence in each IBRA Region plus status. This was followed by interaction with the State coordinators to ensure maximum consistency in status allocation across jurisdictions.

The data were then analysed and compared with attributes of the mammals and the IBRA Regions.

Selected Results

- ◆ The analyses confirm that Australia's terrestrial mammal fauna is particularly susceptible to declines and extinction. Twenty-two species of mammals are extinct in Australia (excluding External Territories), with eight other species remaining only on continental islands. A further two, possibly three, species have become extinct on Christmas Island (Indian Ocean), an Australian External Territory: *Rattus macleari*, *R. nativitatis* and possibly the shrew *Crocidura attenuata*.
- ◆ Of the 305 indigenous species recognised for this study, 258 (85%) are endemic to Australia. The remaining 47 species also occur in New Guinea and/or nearby islands. Thirty of the species shared between Australia and islands to its north are bats. Taxonomic research, particularly among bats, may change these figures.
- ◆ Nine species have been successfully translocated into 12 Regions. Many additional translocations have taken place in recent years but have not been established long enough to meet our definition, which required establishment for > 10 years.
- ◆ Some of the 26 exotic species are very widespread, with *Felis catus* (Feral Cat) occurring in all 85 regions, *Mus domesticus* (House Mouse) occurring in 76 regions, and *Vulpes vulpes* (European Red Fox) occurring in 60 regions. Others are highly restricted,

eg, *Funambulus pennantii* (Five-striped Palm Squirrel) occurs only in the Perth Metropolitan area near Perth Zoo. It previously occurred in Sydney suburbs near Taronga Park Zoo. *Rattus exulans* (Polynesian Rat) (two regions) has been recorded only on islands of Australia's northern coastline, while *Mus-tela putorius* (Polecat; domesticated individuals are known as Ferrets) have established in four regions. Polynesian Rats and Polecats are considered by us to be at high risk of increasing their range to the detriment of the indigenous fauna.

◆ Map 1 displays the relative richness of Australia's regional mammal faunas as best we can re-construct them from a combination of modern, historical and recent sub-fossil specimens. The 85 data values were normally distributed. The mesic regions of north and eastern Australia had the richest faunas, while the poorest were in the cool temperate regions of Tasmania, the southwestern tip of Western Australia and some remote and sparsely-settled regions. For this last group, only localised mammal surveys have been undertaken (Gulf Plains, Desert Uplands and Mulga Lands of Queensland and Yalgoo of Western Australia, in particular).

◆ Some species have contracted from more than 90% of the regions that they originally occupied in Australia. Map 2 shows how many such species occur in each region, thereby indicating regions whose faunas have been susceptible to changes: the arid and semi-arid regions of Northern Territory, South and Western Australia, particularly the desert and cereal crop regions. The species that have declined most are hare- and nail-tailed wallabies, potoroids (rat kangaroos), numbat, bandicoots

and large rodents (*Notomys*, *Leporillus*, large *Pseudomys* and *Zygomys*). All such species had ranges centred on the continent's arid and semi-arid zone. In general, bats and small mammals (< 35 g mean adult body weight (MABW)) show little range contraction. High range contractions among species from Australia's medium to high rainfall regions were confined to *Conilurus albipes*, *Macropus greyi*, *Potorous platyops* and the Basalt Plains Mouse, all of which had geographic ranges confined to regions that are now intensively settled or virtually cleared. *Thylacinus cynocephalus* may be a special case, as it was a relatively large obvious animal that became extinct in Tasmania, an island where it was selectively hunted.

◆ 'New endemism'. We identified regions that still have a relatively large number of declined species (Map 3). The regions with extant populations of the greatest variety of new endemics (>5 species) are Carnarvon Basin, Avon Wheatbelt, Jarrah Forest and Esperance Plains in Western Australia, Stony Plains in South Australia, and Channel Country, which straddles the South Australia – Queensland border. Ignoring translocations, some 'new endemic' species rely entirely on a single region for their persistence. These are:

1. Carnarvon Basin (Western Australia): *Lagostrophus fasciatus*, *Lagorchestes hirsutus*, *Bettongia lesueur*, *Perameles bougainville* and *Pseudomys fieldi* (Barrow, Bernier and Dorre Islands);

2. Jarrah Forest (Western Australia): *Potorous gilbertii* and *Myrmecobius fasciatus*,

3. The Gulf Coastal Plain (Northern Territory): *Pseudan-techinus mimulus* (Pellew Islands);

4. MacDonnell Ranges (Northern Territory): *Zygomys pedunculatus*,

5. Eyre-Yorke Block (South Australia): *Leporillus conditor* (Franklin Island).

6. Brigalow Belt North (Queensland): *Lasiorhinus krefftii* and *Onychogalea fraenata*

7. Wet Tropics (Queensland): *Bettongia tropica*.

◆ We calculated a Faunal Attrition Index (FAI) for each region. A very high value means most species are extinct or have declined in the Region. FAI was used as a basis for comparing status of regional mammal faunas and relating the level of decline/extinction to regional attributes (changes to regional environments since European settlement and average annual rainfall as an approximate surrogate of 'productivity'). Map 4 shows the pattern of FAI for Australia as a whole. It resembles rainfall patterns; the drier the region the greater its mammal attrition. One visible modifier of the pattern is that the cereal-growing regions show higher-than-expected attrition indices.

◆ We compared the FAI with the rainfall and 'environmental stress' (the Continental Landscape Stress Class devised by Gethin Morgan for the 'Landscape Health Project') of each region and attributes of the region's mammals: the proportion of Critical Weight Range (CWR) species and the proportion of species able to fly (ie, bats), as these factors have been previously shown to be significant modifiers of mammal decline. This was done by forward step-wise, fixed non-linear regression analysis.

◆ Thus rainfall, 'environmental stress', CWR and ability to fly accounted for 81% of the variation in the data. Variation in rainfall explained 48% of the accounted-for variation in the pattern; while body weight and the ability to fly together explained 37%. Individual variation in regional environmental stress explained only 15% of the accounted-for variation.

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CONCLUSIONS

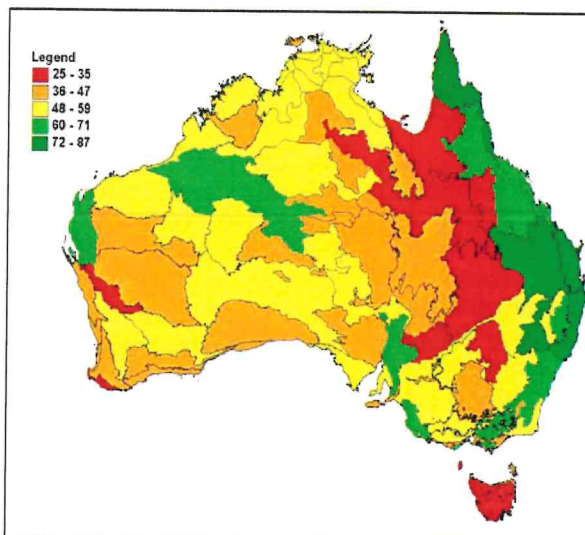
Two major conclusions emerge from this study:

1. There has been a massive contraction in the geographical ranges and species composition of Australia's indigenous mammal fauna. This is unparalleled in any other component of Australia's biodiversity, or anywhere else in the world; one third of the world's extinct mammals since 1600 AD are Australian.
2. Available evidence suggests that the wave of mammal extinctions in Australia is continuing. John Woinarski and co-workers have documented recent massive declines in abundance of a variety of mammal species in the mesic regions of the Northern Territory. Equivalent changes have been observed in the North Kimberley where all ground-dwelling CWR mammal records during the last two decades have come from the northwestern fringe of the region, less than 20 km from its coast. Over the last 30 years this region has suffered massive changes in vegetation composition and structure due to increased fire frequency and the recent arrival of large exotic herbivores that have now penetrated to the coast. If this change is not halted and reversed, we expect that some of the region's mammals will become extinct, while others will persist only on islands. The 'top end' of the Northern Territory and the North Kimberley have been considered to be refugia for a range of mammal species—this belief

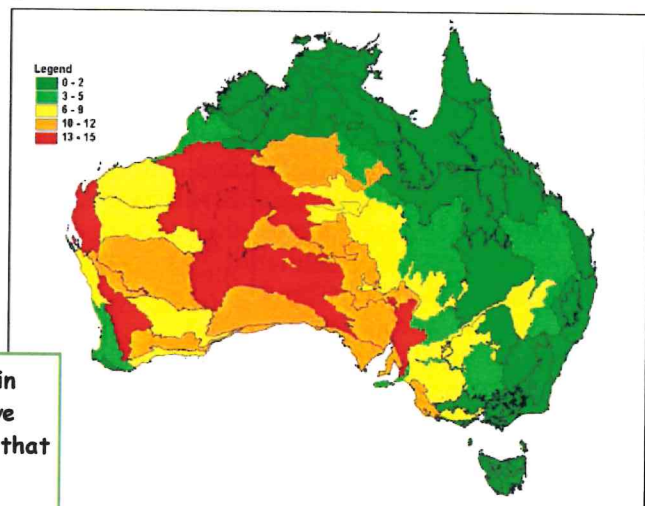
appears to be false. Similar recent declines are evident elsewhere in Australia, for example *Myrmecobius fasciatus* and *Dasyurus geoffroii* have disappeared from the Avon Wheatbelt during the last 25 years.

While mammal decline is being addressed in some parts of Australia through detailed species and fauna recovery programs, many areas and many species are not the subject of effective recovery programs. Unless Australia provides more resources to mammal conservation and unless the nation is willing to address the continuing massive changes to mammal habitat, species will continue to be lost.

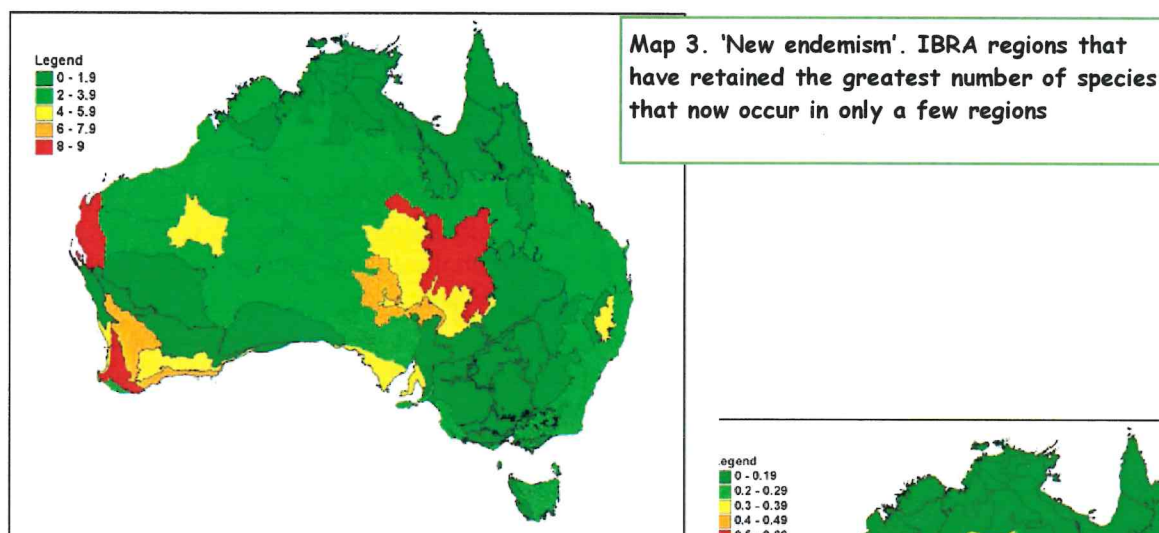
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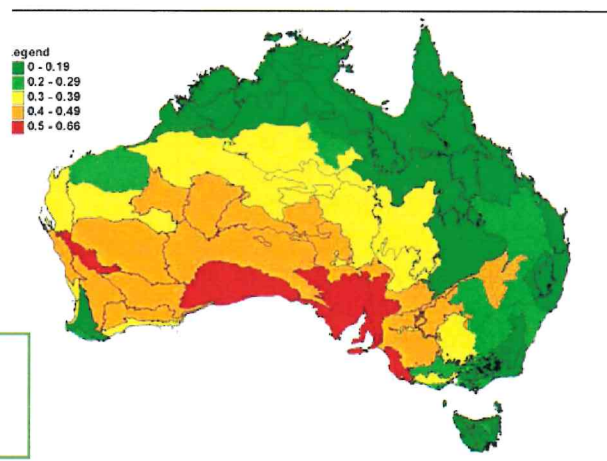
Map 1. Species richness of the original mammal fauna in each IBRA region



Map 2. 'Range contraction'. Number of species in the original fauna of each IBRA region that have contracted from more than 90% of the regions that they originally occupied in Australia



Map 4. 'Faunal Attrition'. The pan-Australian pattern of attrition in Australia's regional mammal faunas (regional FAI values)



Translocations of threatened fauna and flora ~ Jill Pryde

Since our last issue of *WATSNU*, four new translocations and four extensions of previously approved translocation proposals have been endorsed by the Department. The following provides details of the translocations.

Species	Translocation	Proponent/s
<i>Symonanthus bancroftii</i> Bailey's <i>Symonanthus</i>	From seedlings raised at Botanic Gardens and Parks Authority to two reserves	Greg Durell and Andrew Brown (the Department), Dr Kingsley Dixon (Botanic Gardens & Parks Authority) and Daley Walker, (Bruce Rock Land Care District Committee)
Shark Bay Mouse, <i>Pseudomys fieldi</i>	Captive bred animals from Perth Zoo to Faure Island (Shark Bay WA)	Andre Schmitz on behalf of the Australian Wildlife Conservancy
Burrowing Bettong, <i>Bettongia lesueur</i>	Heirisson Prong to Faure Island	Andre Schmitz on behalf of the Australian Wildlife Conservancy
Norseman pea, <i>Daviesia microcarpa</i>	From seed sourced from populations around Norseman and Southern Cross and introduced to sites located nearby in a water catchment reserve	Leonie Monks, Sarah Barrett, Klaus Tiedemann (the Department)
<i>Brachysema papilio</i> , <i>Darwinia</i> sp. Williamson,	Extension to Translocation Proposals approved in 2001	Leonie Monks (the Department)
<i>Grevillea maccutcheonii</i>	Extension to Translocation Proposal approved in 2000	Leonie Monks (the Department)
<i>Grevillea calliantha</i>	Extension of translocations approved 1998 and 1999	Leonie Monks (the Department)