



National Environmental
Research Program

NORTHERN AUSTRALIA *hub*

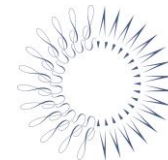
Change and loss at the frontier: the past, present and future of biodiversity in remote Australia



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EIANZ Conference: *Living on the edge*
Hobart 30 October 2014



THE
PEW
CHARITABLE TRUSTS



Drawn in water by B. Townsend

"Hunk"

Male & Female

From a drawing by J. B. Robinson 1845

Engraved by J. T. Bowen, Philad.

Continental context

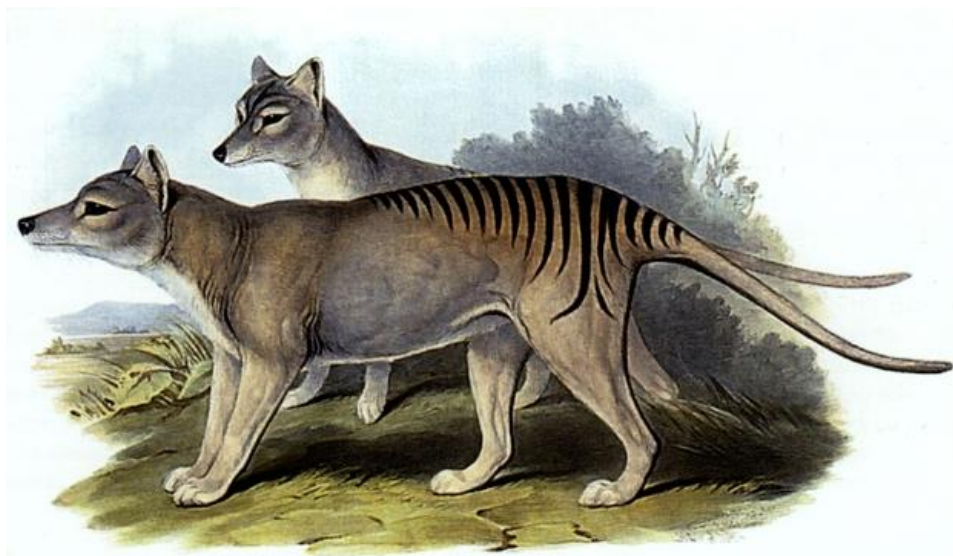


- European colonisation of **north America** from the 16th century
 - Loss of traditional Indigenous management;
 - Much clearing, and introduction of new plants and animals;
 - Intensive hunting of very many species;
 - Human population increase to >350 million (USA+Canada)
 - **Extinction of one land mammal species (the highly localised Sea Mink)**

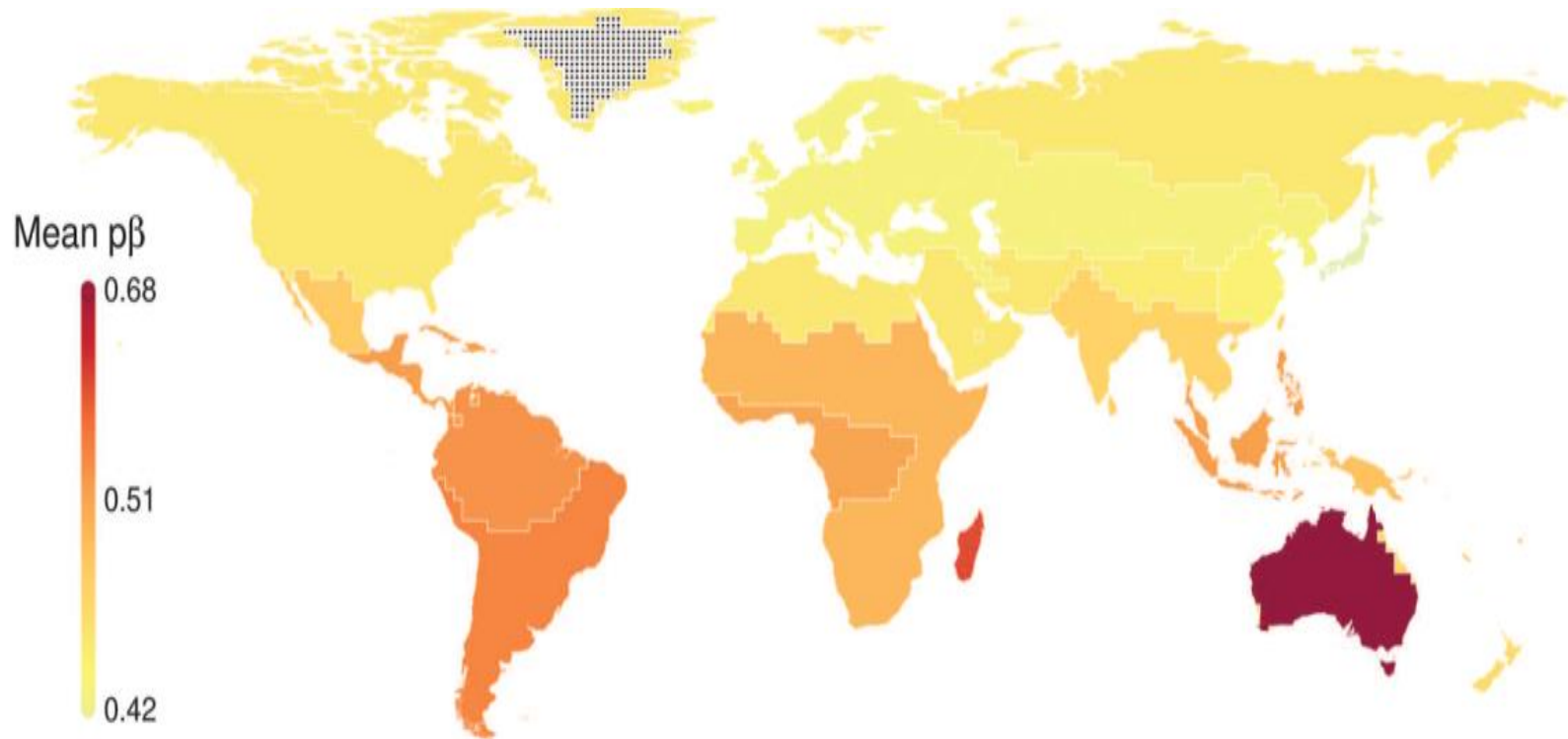
Continental context



- European colonisation of **Australia** from late 18th century
 - Much loss of traditional Indigenous management;
 - Some clearing, and introduction of new plants and animals;
 - Some hunting of a few species;
 - Human population increase to c. 24 million
 - **Extinction of 30 land mammal species**



Phylogenetic distinctiveness



Holt *et al.* (2013) *Science* **339**, 74-78

Australian mammals: many extinct, many threatened

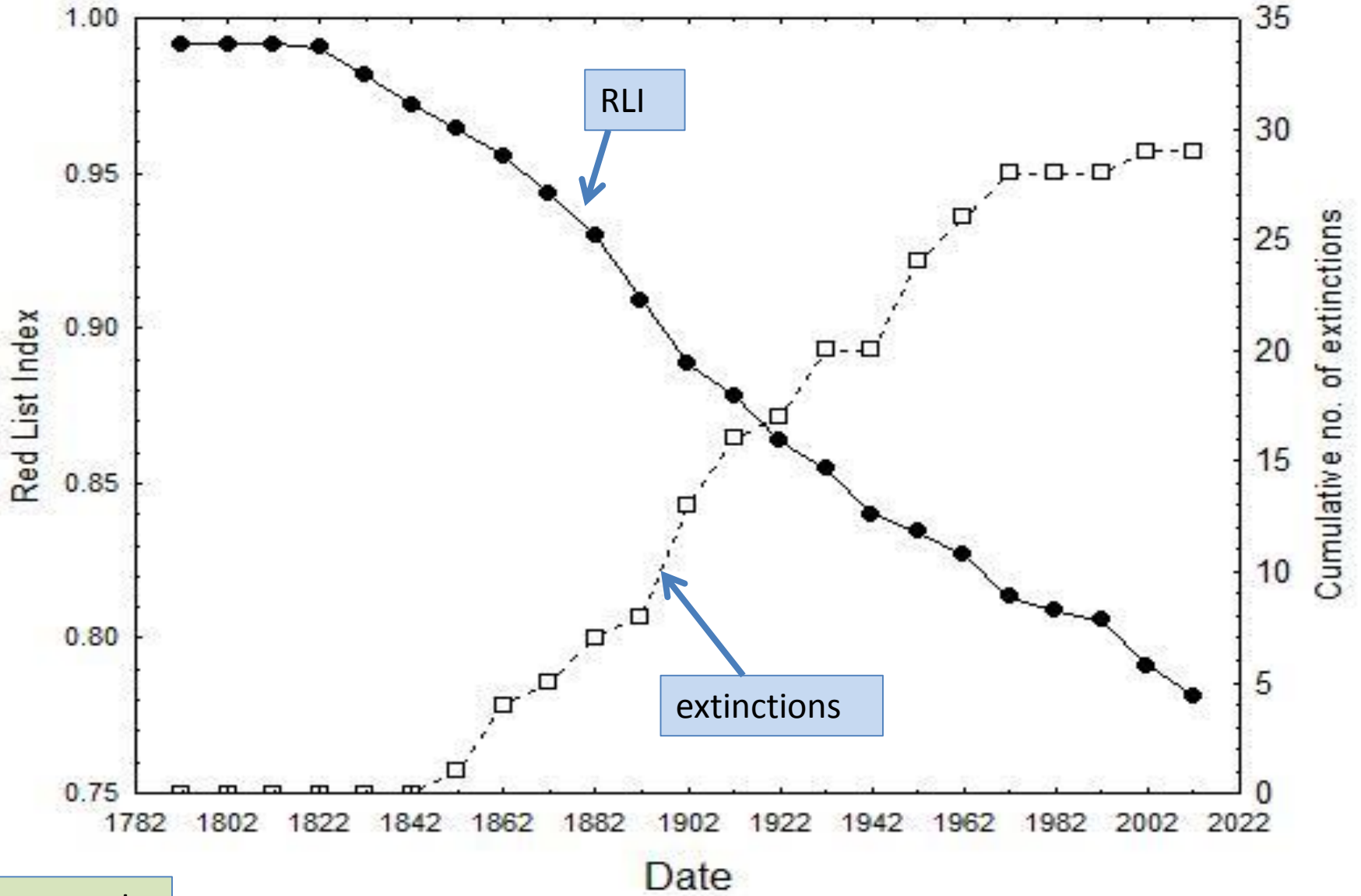
The action plan for
AUSTRALIAN
MAMMALS 2012



Of 272 endemic terrestrial
species at 1788:

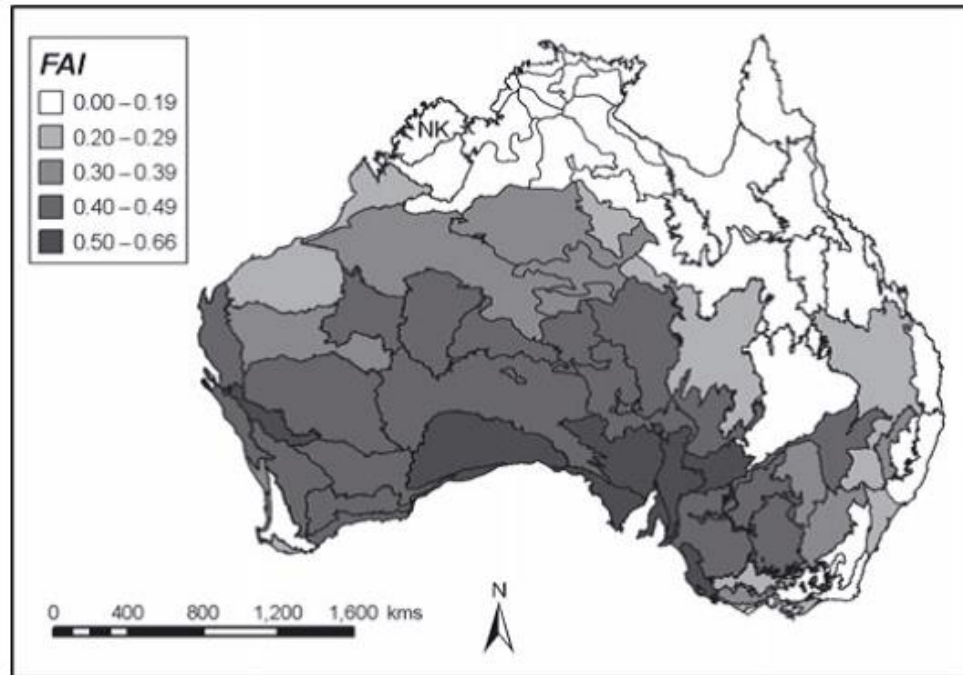
- 30 now extinct;
 - 53 threatened;
 - 42 Near Threatened
- Most taxa still declining

paradise



graveyard

The geography of Australian mammal loss



apologies, Tasmanians

McKenzie *et al.* (2007). *J. Biogeog.* **34**, 597-611.

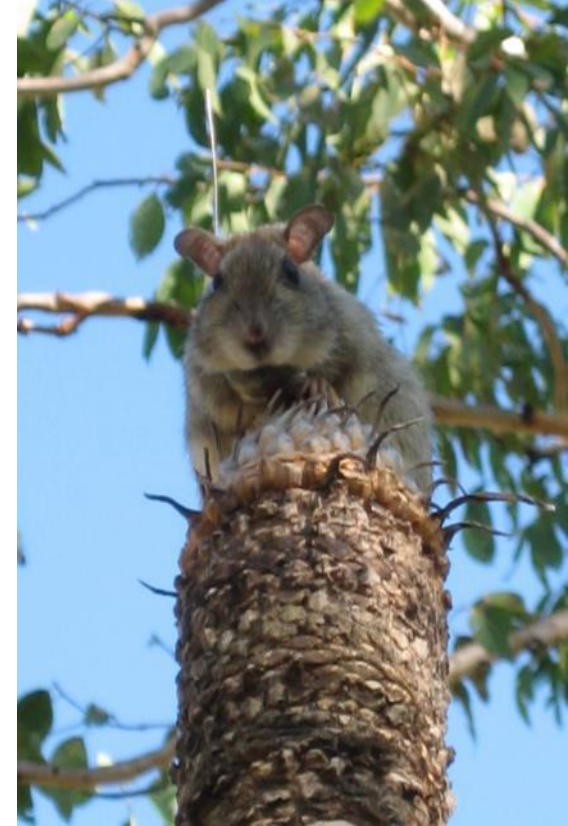


Conilurus penicillatus

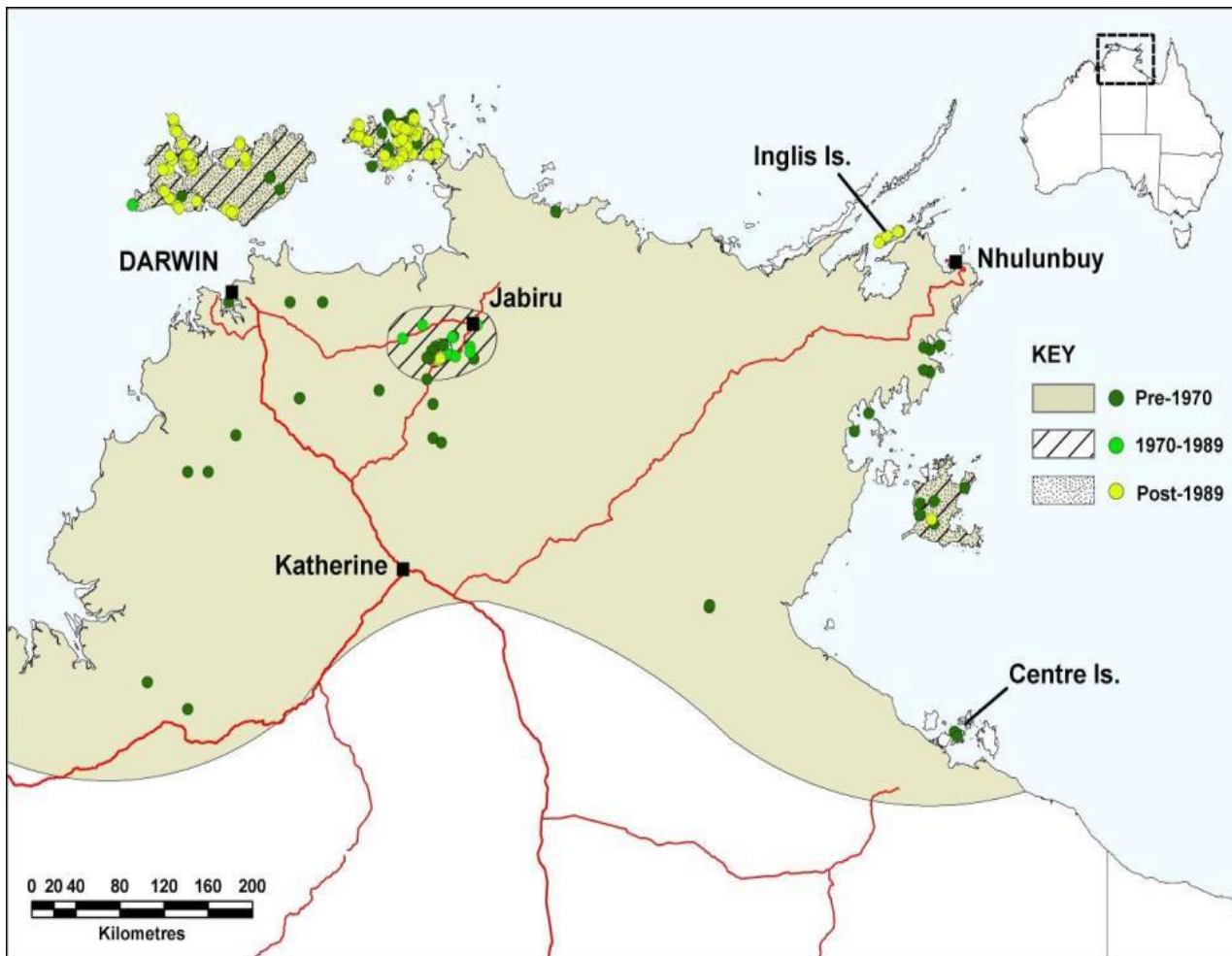


Conilurus albipes





Decline of Brush-tailed Rabbit-rat



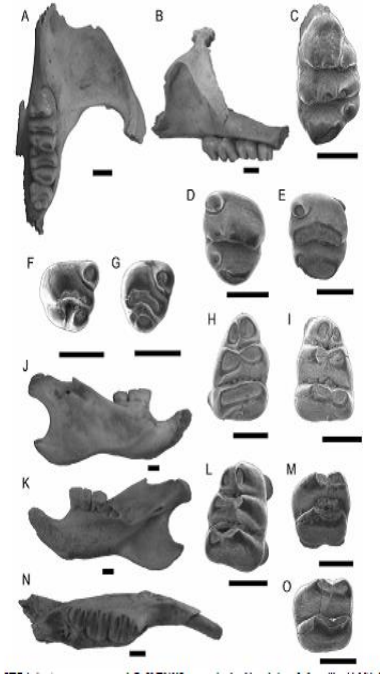


Conilurus penicillatus



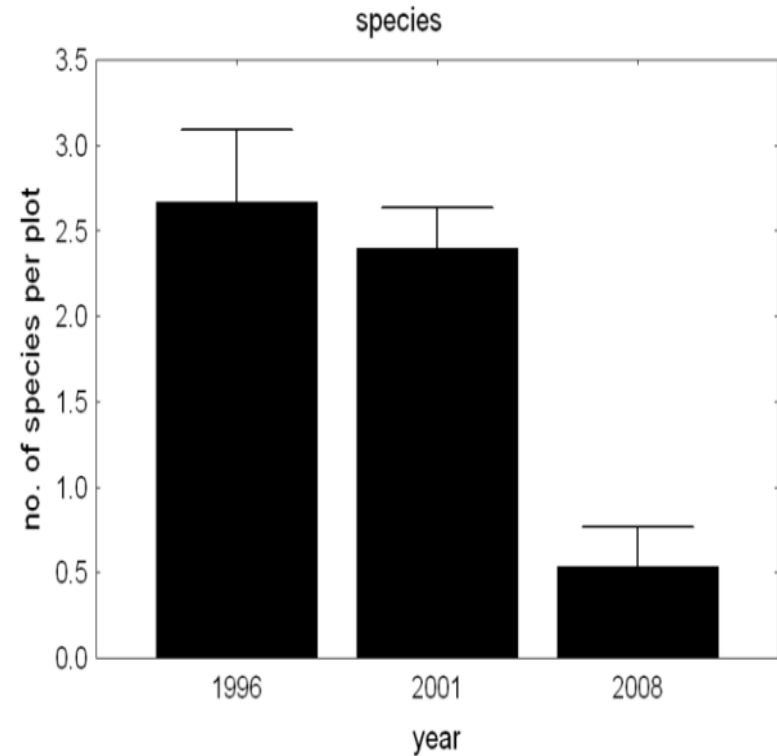
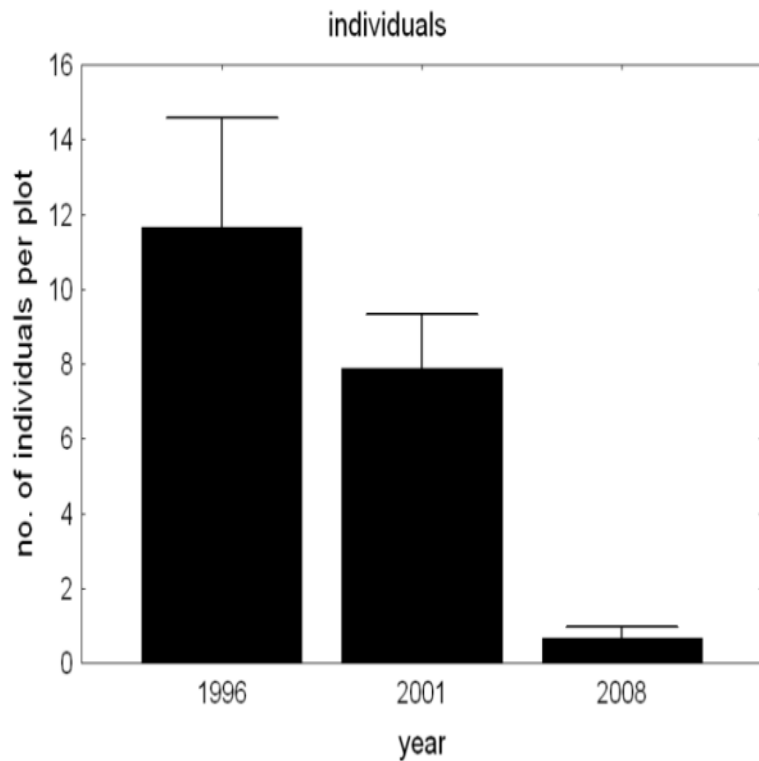
Conilurus albipes





Cramb & Hocknull (2010) *Zootaxa* 2634, 41-56.

Kakadu NP mammal monitoring results, 1996-2008



Possum invasion

The introduced species has a population of 70 million in New Zealand, outnumbering humans almost twenty-fold

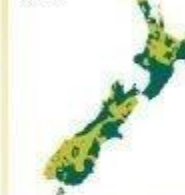
The invasion

- ▶ Introduced from Australia 1830s, to establish a fur industry
- ▶ By the 1930s many batches of possums let free
- ▶ Damage to environment recognised by the 1950s
- ▶ 1951 government puts a bounty on animals
- ▶ By 1963 had spread to 84% of country

1930



1950



1974



2000



The possum fur fetches around \$82 a kilo

The damage

Pressure on native species as population thrives with no natural predators

Spread disease: bovine tuberculosis

Damage crops, orchards, eat pasture

Kill or stunt growth of trees by damaging bark, breaking upper branches

Alter habitat of native species

Prey on native birds, insects

Sources: Landcare Research/Hawkes Bay regional council

AFP

Population trends of Common Brushtail Possum in Kakadu:

1989-99: 94% decline.

2001-08: 86% further decline



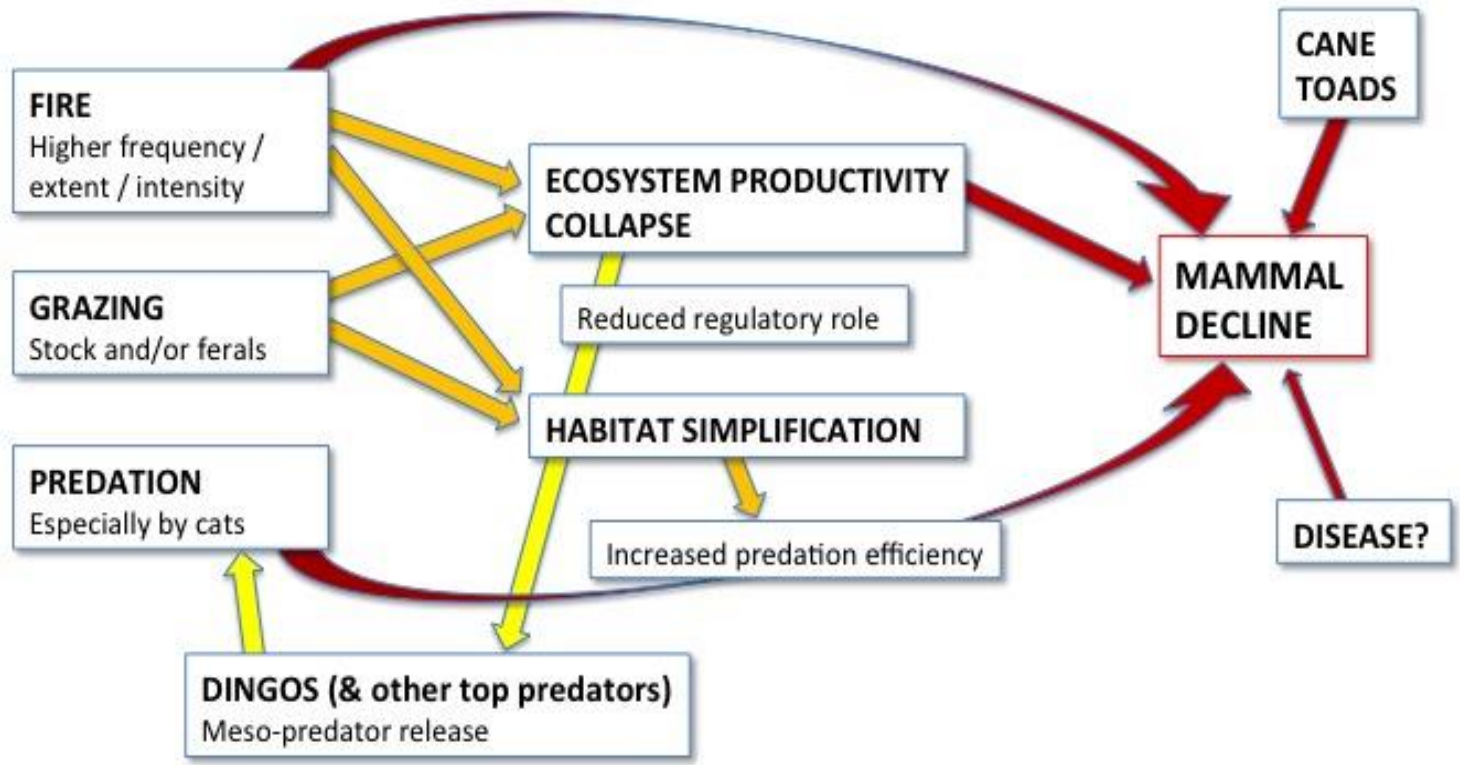
Results from highly localised monitoring programs have been complemented and corroborated by reviews of broader-scale Indigenous knowledge

Ziembicki *et al.* (2013) *Biol. Cons.* **157**, 78-92.

Largely unrecognised, the mammal fauna in remote Australia is disappearing

- Counter-intuitive;
- Contrasts with the general world trend for biodiversity decline to be most evident in regions with:
 - high human population density,
 - clearing and
 - environmental modification;
- Largely unappreciated by most Australians
- Most Australian mammal species are small, shy, nocturnal

It is, of course, not straightforward



... the complex equilibrium which governs long established floras and faunas is drastically disturbed or even demolished altogether ... much evidence of the past history of life of the country slips suddenly into obscurity ...

The old Australia is passing. The environment which moulded the most remarkable fauna in the world is beset on all sides by influences which are reducing it to a medley of semi-artificial environments, in which the original plan is lost and the final outcome of which no man may predict.



Hedley Finlayson (1935)
The Red Centre

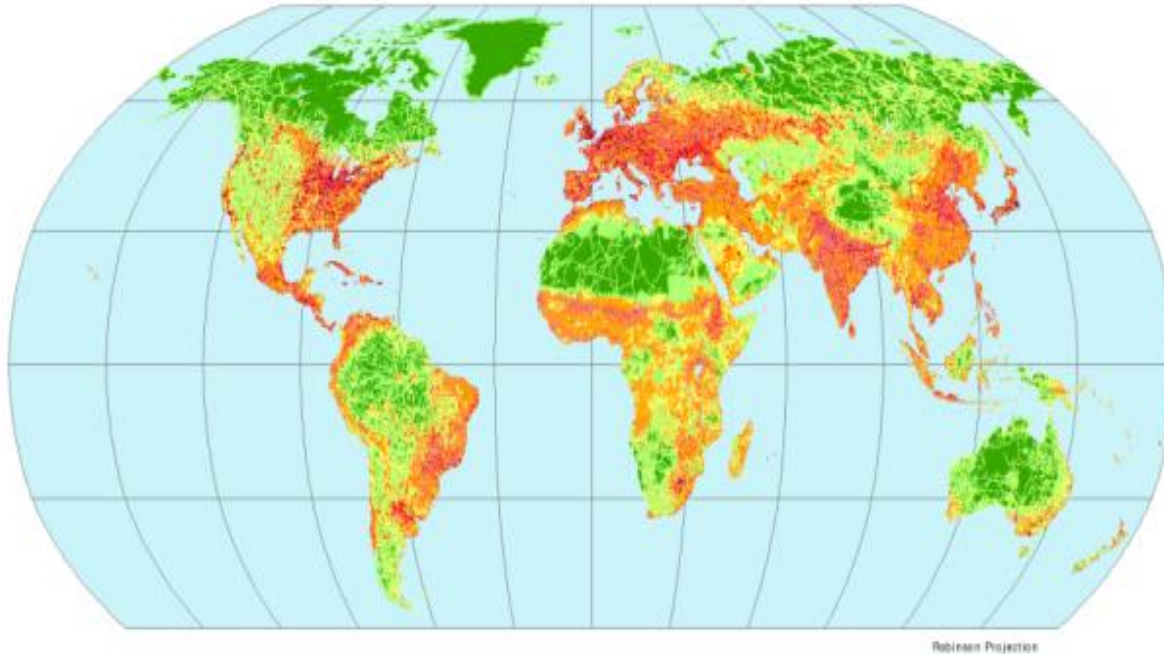


The Modern Outback

Nature, people and the future of remote Australia

'Last of the wild' analysis

[CIESIN, Wildlife Conservation Society: Sanderson *et al.* (2002)]

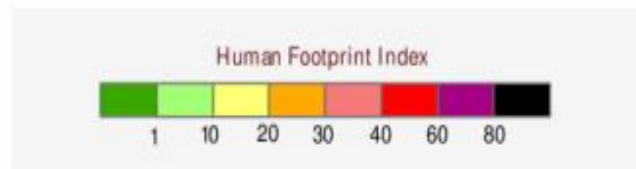


The Human Footprint Index

The Human Footprint Index (HF) expresses as a percentage the relative human influence in each terrestrial biome. HF values range from 0 to 100. A value of zero represents the least influenced - the "most wild" part of the biome with value of 100 representing the most influenced (least wild) part of the biome.



Copyright 2006, The Trustees of Columbia University, in the City of New York, School Center for International Earth Science Information Network (CIESIN), Columbia University, and Wildlife Conservation Society, the Bronx Zoo, New York. The Last of the Wild Data set Available at <http://www.wildofthewild.columbia.edu/wildofwild>



Publication Date: 03-07-04

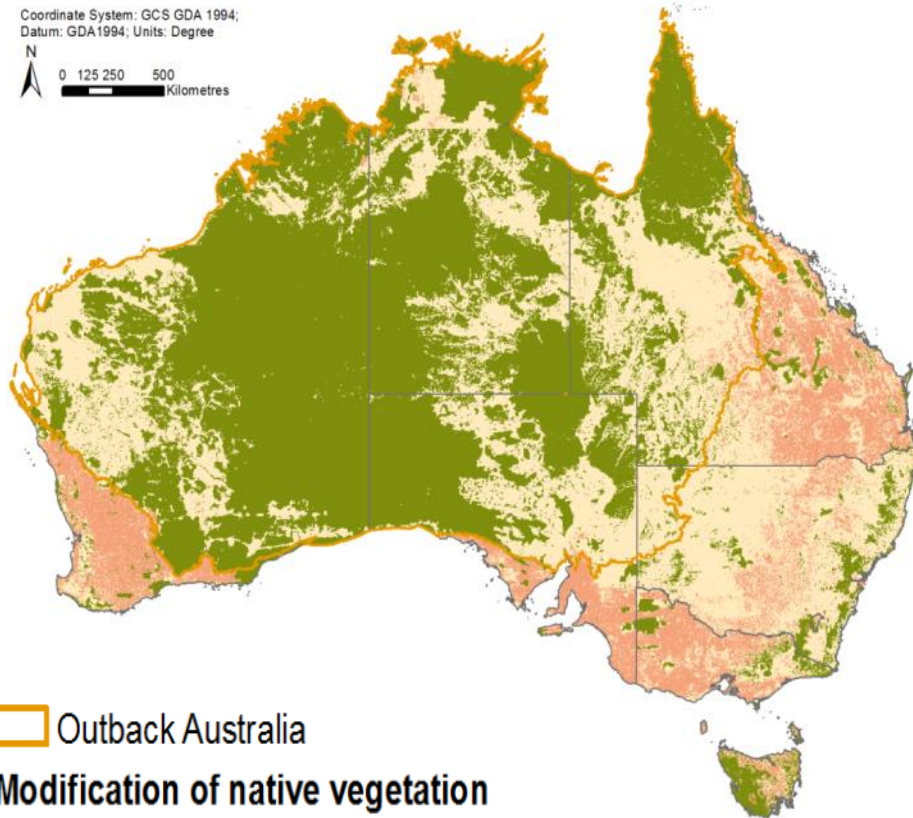


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Coordinate System: GCS GDA 1994;
Datum: GDA1994; Units: Degree




0 125 250 500
Kilometres





Australian perspective – vegetation transformation

 Outback Australia

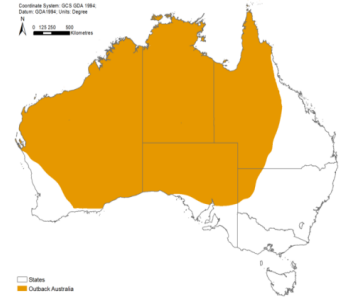
Modification of native vegetation

 Modified

 Native or intact

 Replaced

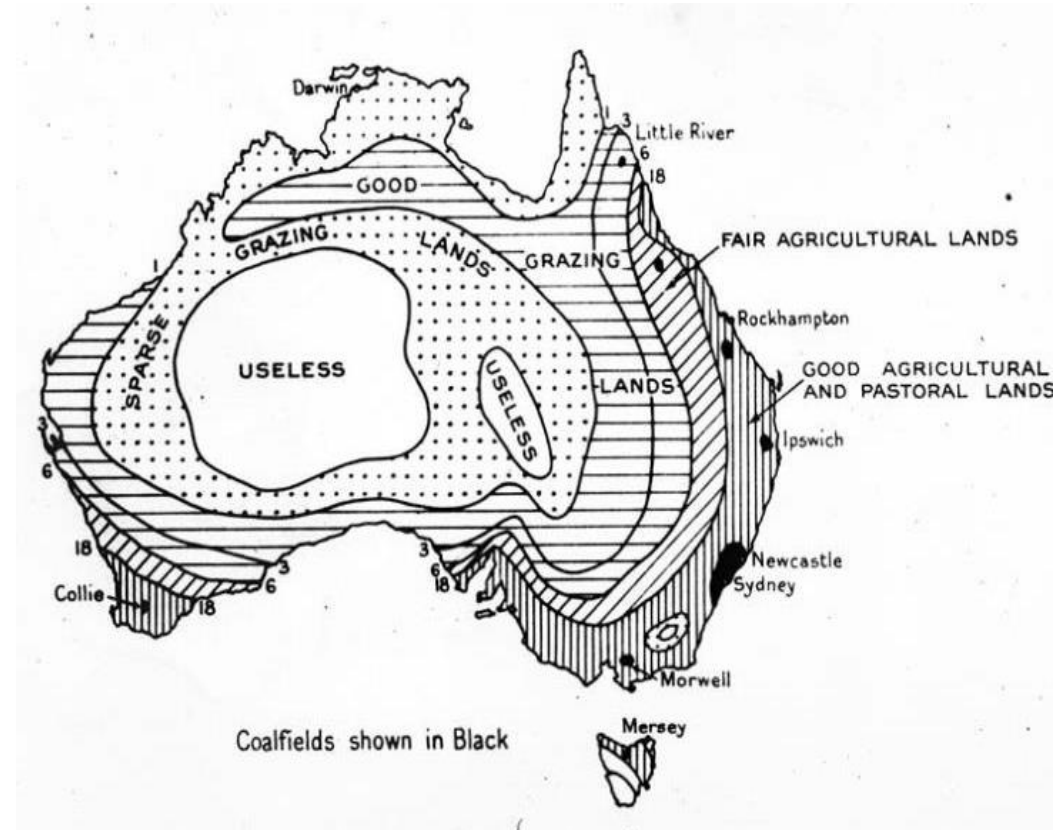
Defining the Outback



- Area: 5.6 million km² (73% of Australia)
- Very largely natural condition (little transformed);
- Very few people
 - 800,000 (c. 4% of Australia)
- density in Outback: 0.14 person/km²
cf. world average: 50 person/km²
- Remote from major population centres

Our (mis)conception of Outback nature

- A land empty of people and their influence,
- a land to be neglected ...



HABITABILITY MAP OF AUSTRALIA

After T. Griffith Taylor in "Limits of Land Settlement"

It is instead a land shaped by people; and
with multiple values



Our (mis)conception of Outback nature

A set of discrete
spectacular sites ...





Our (mis)conception of Outback nature

... counter-pointed with the unexceptional, humdrum, the boring bush



But the icons are
embedded in,
connected with, and
rely upon their less
spectacular surrounds:

it is a vast natural
interconnected
landscape

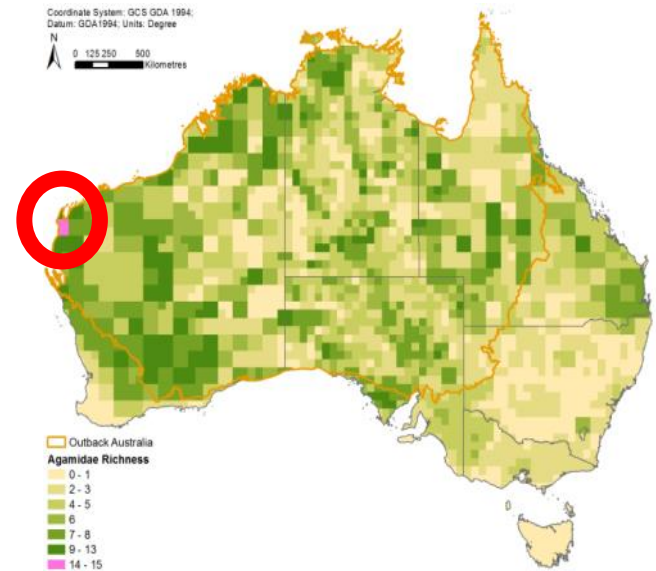
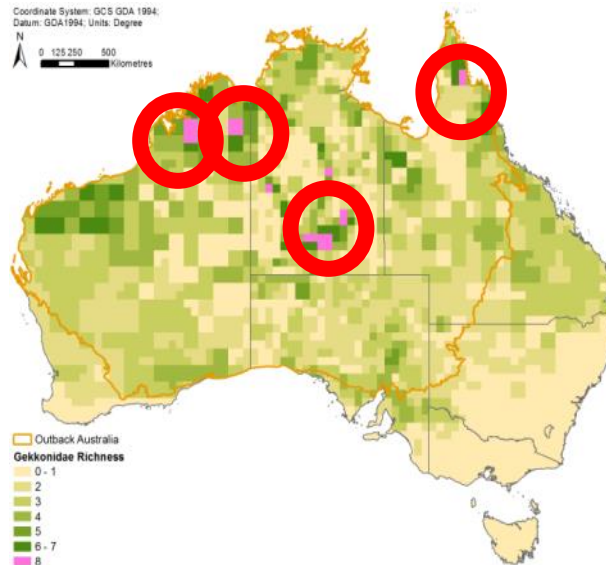
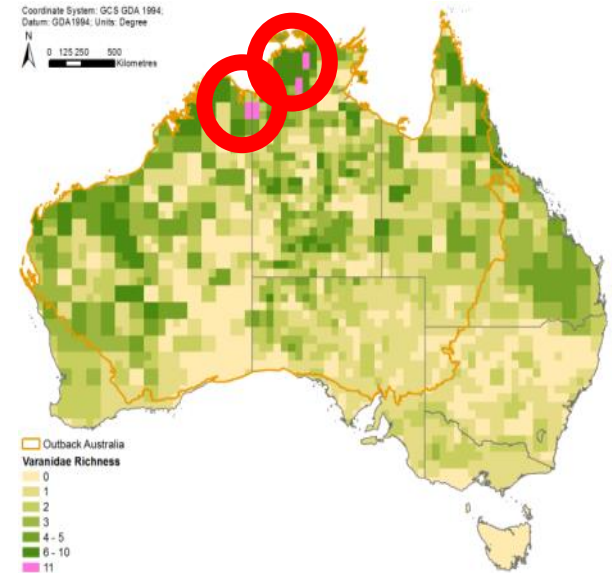
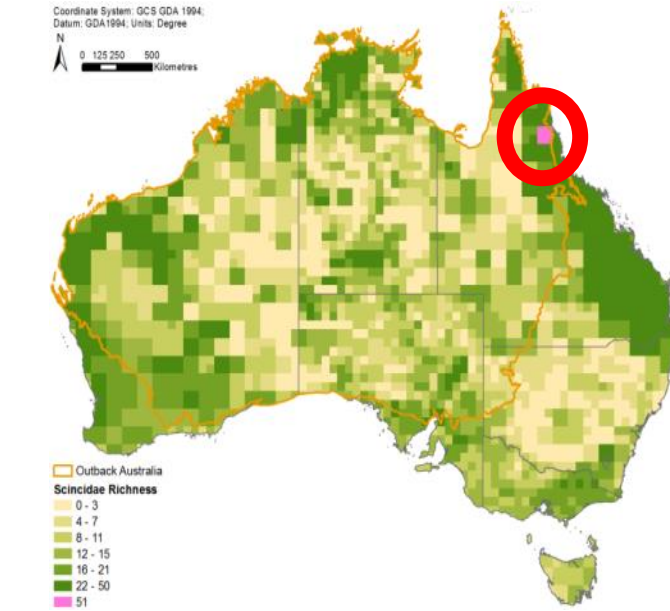


Ecological processes, connectivity and conservation

- Many different centres of endemism, often with very narrowly localised species
- Many refuge areas, often widely scattered across the landscape
- It is an intricately patterned landscape



Species richness of Australian reptile families



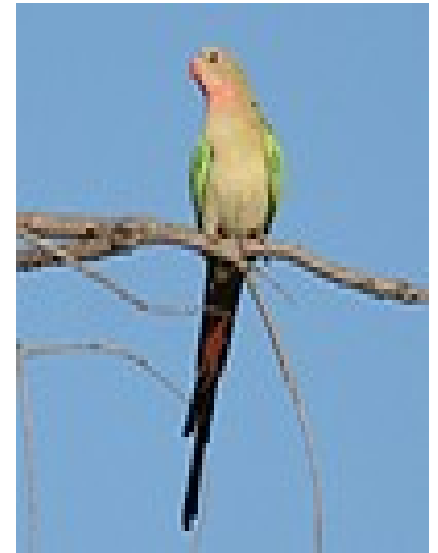
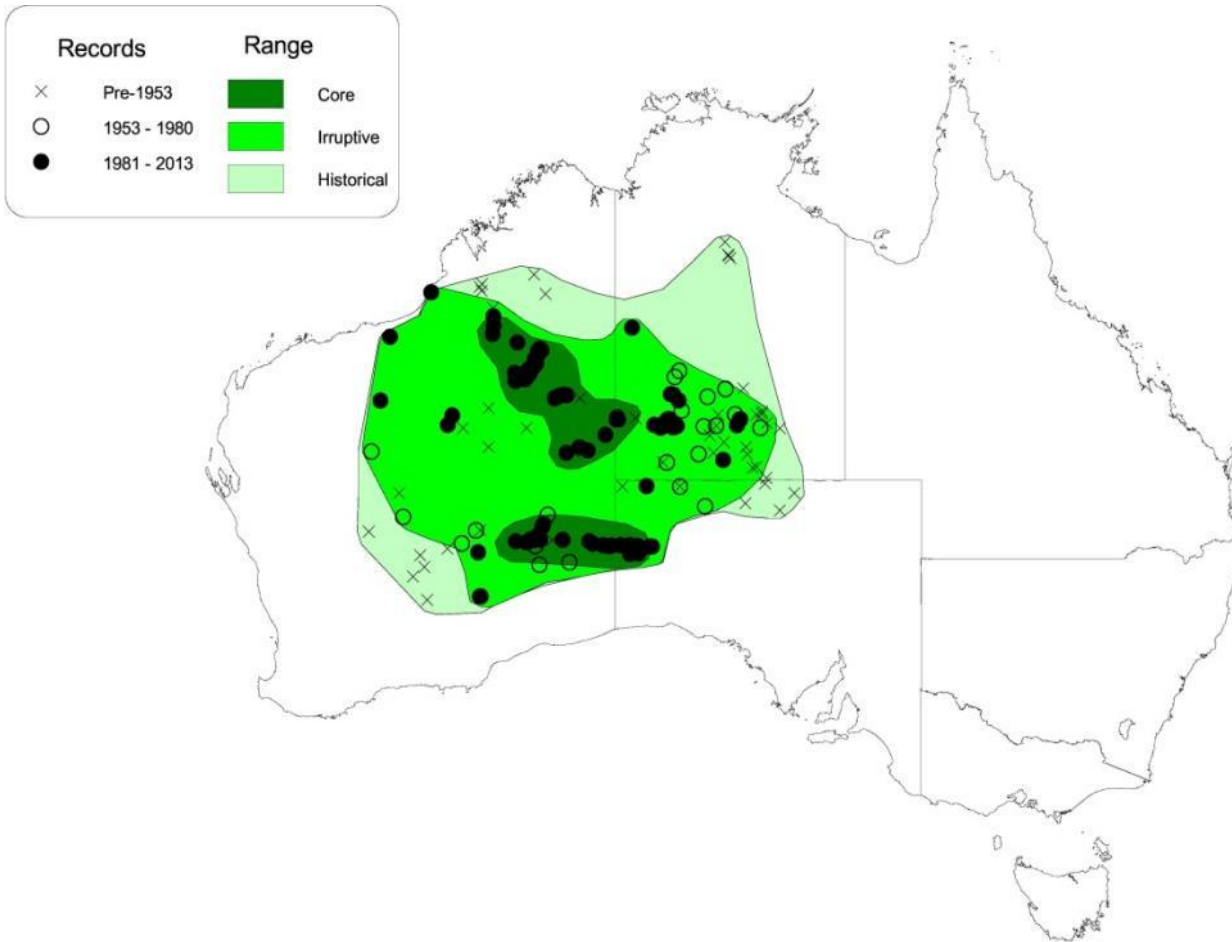
Source: ANHAT

Ecological processes, connectivity and conservation

- Very diverse patterns of movement;
 - varying in spatial and temporal scales
 - regular or irregular;
 - directional or chaotic
- Very broad-scale ecological processes



Shifting distributions: Princess Parrot



Pavey *et al.* (2014).
Emu **114**, 106-115

Connectivity

- Songlines; dreaming paths; dot paintings;
- All places are deeply inter-connected
 - there is a maze, a criss-crossing, of meaningful linkages between places, and between places and people



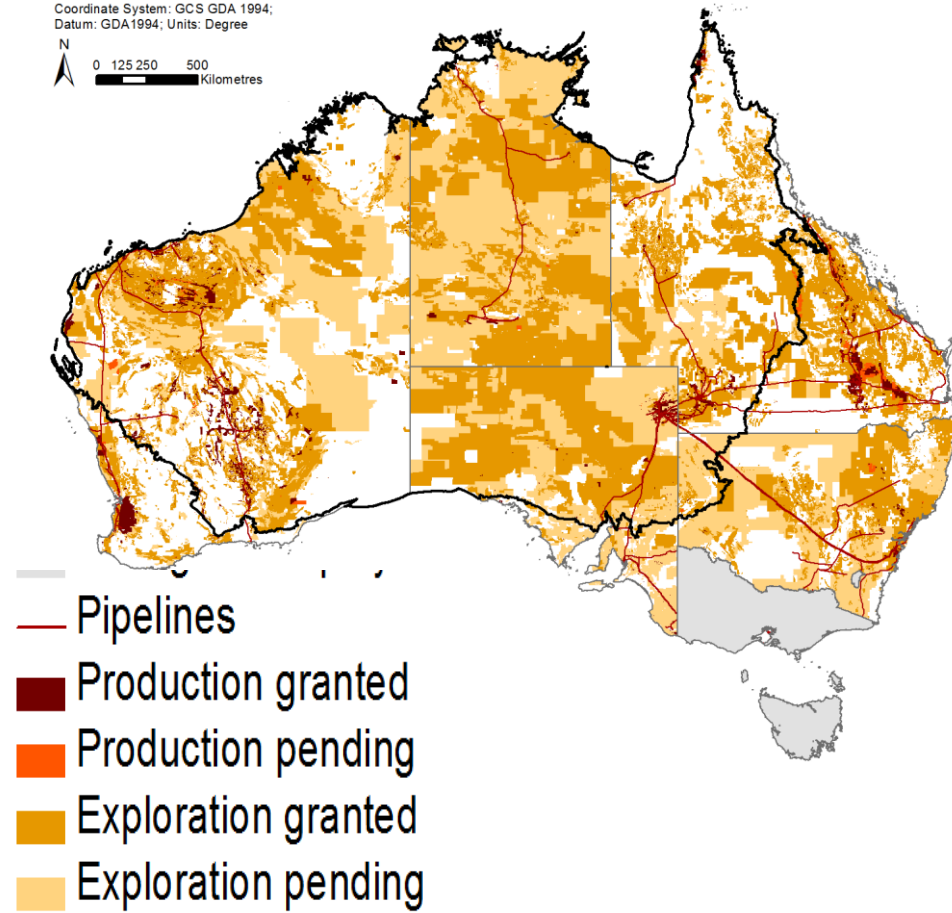
Outback nature is interconnected; but so are its threats



- Many threats are pervasive, disrespectful of tenure or political borders;
- Many threats are deeply ingrained and will be effectively managed (if at all) only by efforts that are:
 - long-term;
 - large-scale;
 - collaborative
- Even large reserves are losing or have lost substantial parts of their biodiversity



Coordinate System: GCS GDA 1994;
Datum: GDA1994; Units: Degree



Conservation approach

'it seems likely that it will be necessary to have wildlife reserves of not less than 200 hectares each at several locations in each of the major vegetation associations'.

Hallsworth *et al.* (1976).

Principles of a balanced land-use policy for Australia. (CSIRO)

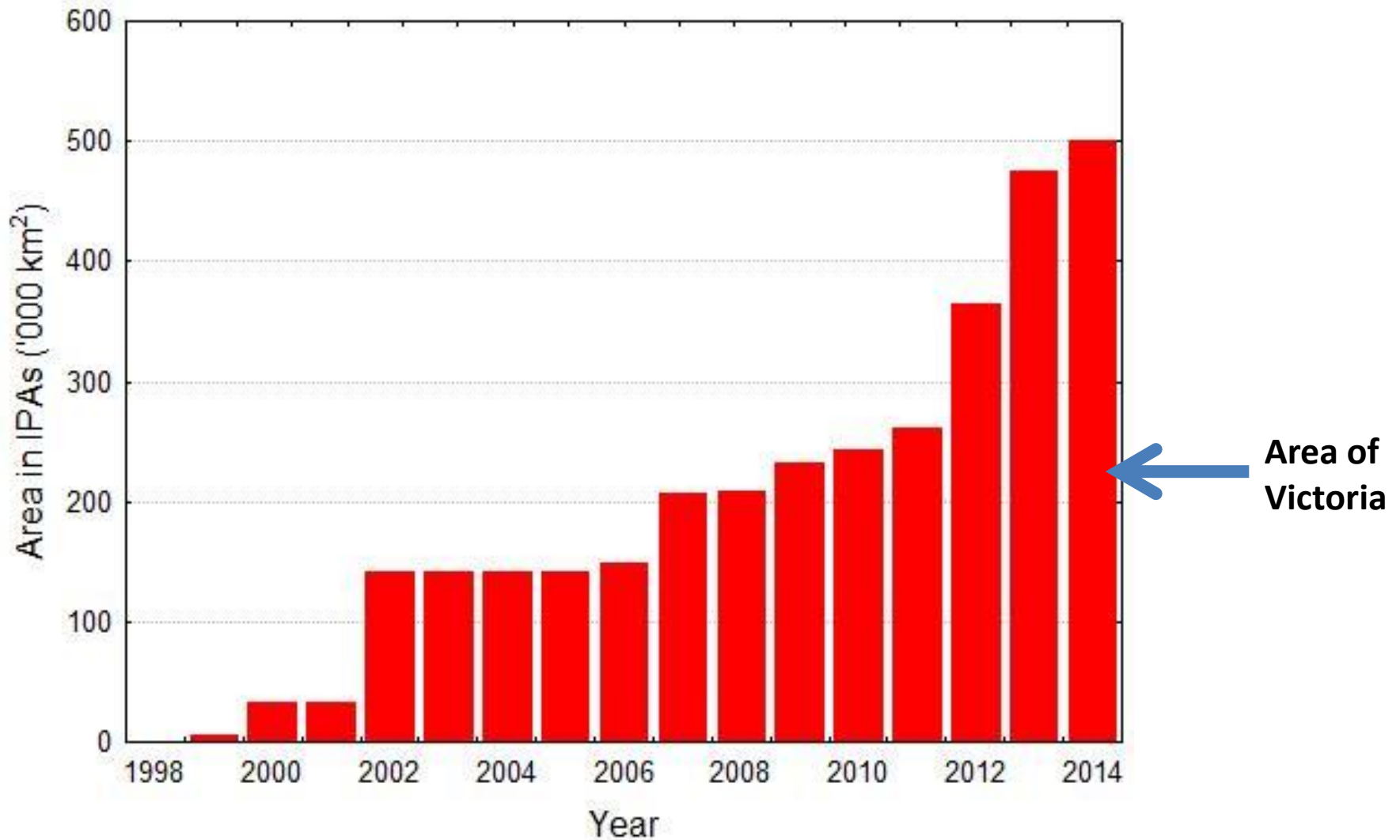
Changing approaches to conservation

- Policy approaches:
 - 1988 Brundtland report (*Our common future ...*) 10%
- Evidence-based approaches
 - 2007: Canadian Boreal Initiative – protection of ‘in the range of half’

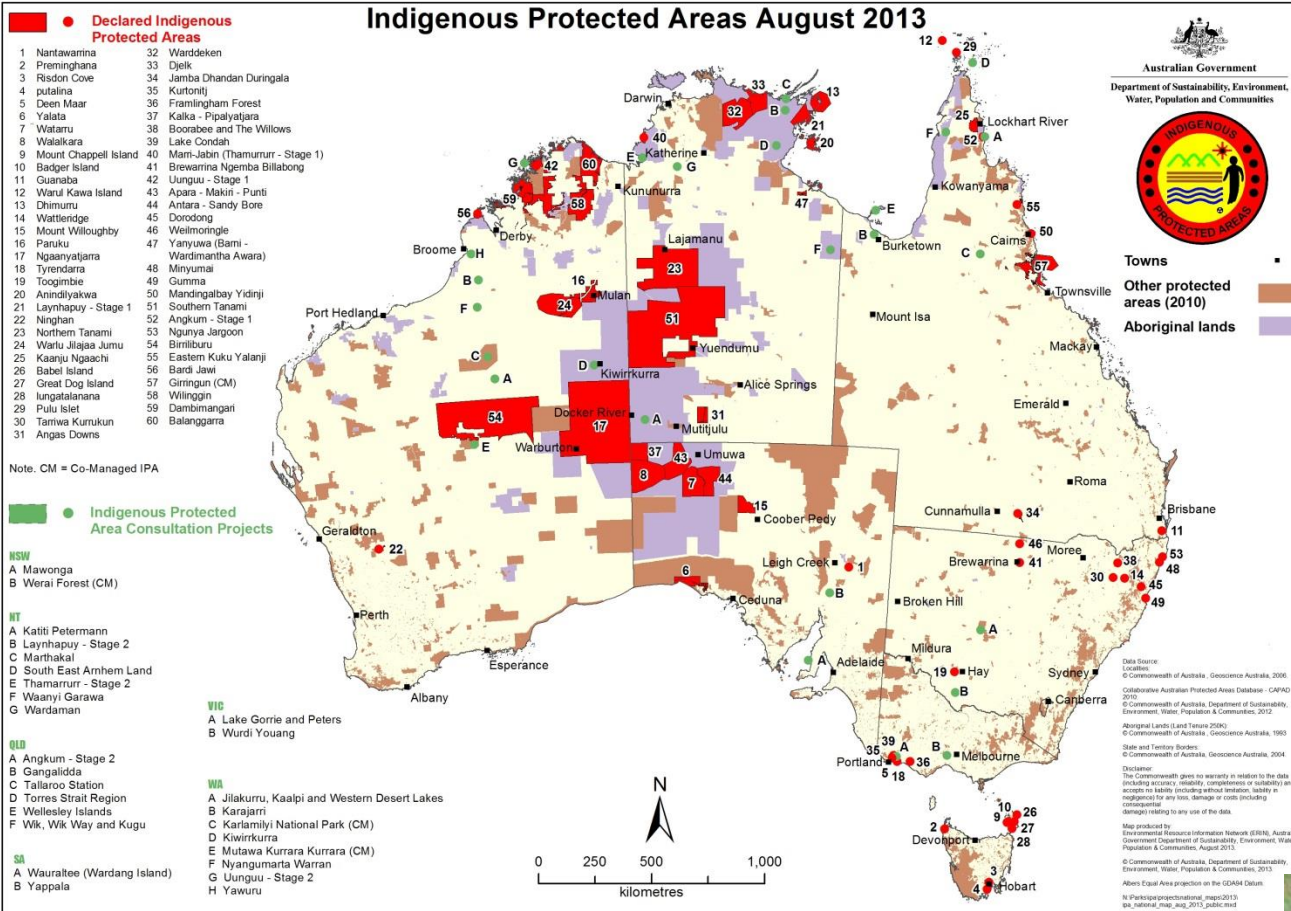
Changing approaches to conservation

Characteristic	Status 2-3 decades ago	Current status
Primary purposes of the reserve system	iconic tourism sites; sampling of major environments; threatened species	... & maintenance of ecological processes; linkages across large landscapes
Responsible management authority	government conservation agencies	... & Indigenous groups, conservation NGOs, with some contributions from pastoralists and mining companies
Parks in context	conservation will be achieved with a discrete system of reserves	linked reserves are a focus for intensive land management, complemented by extensive and coordinated threat management across entire landscapes

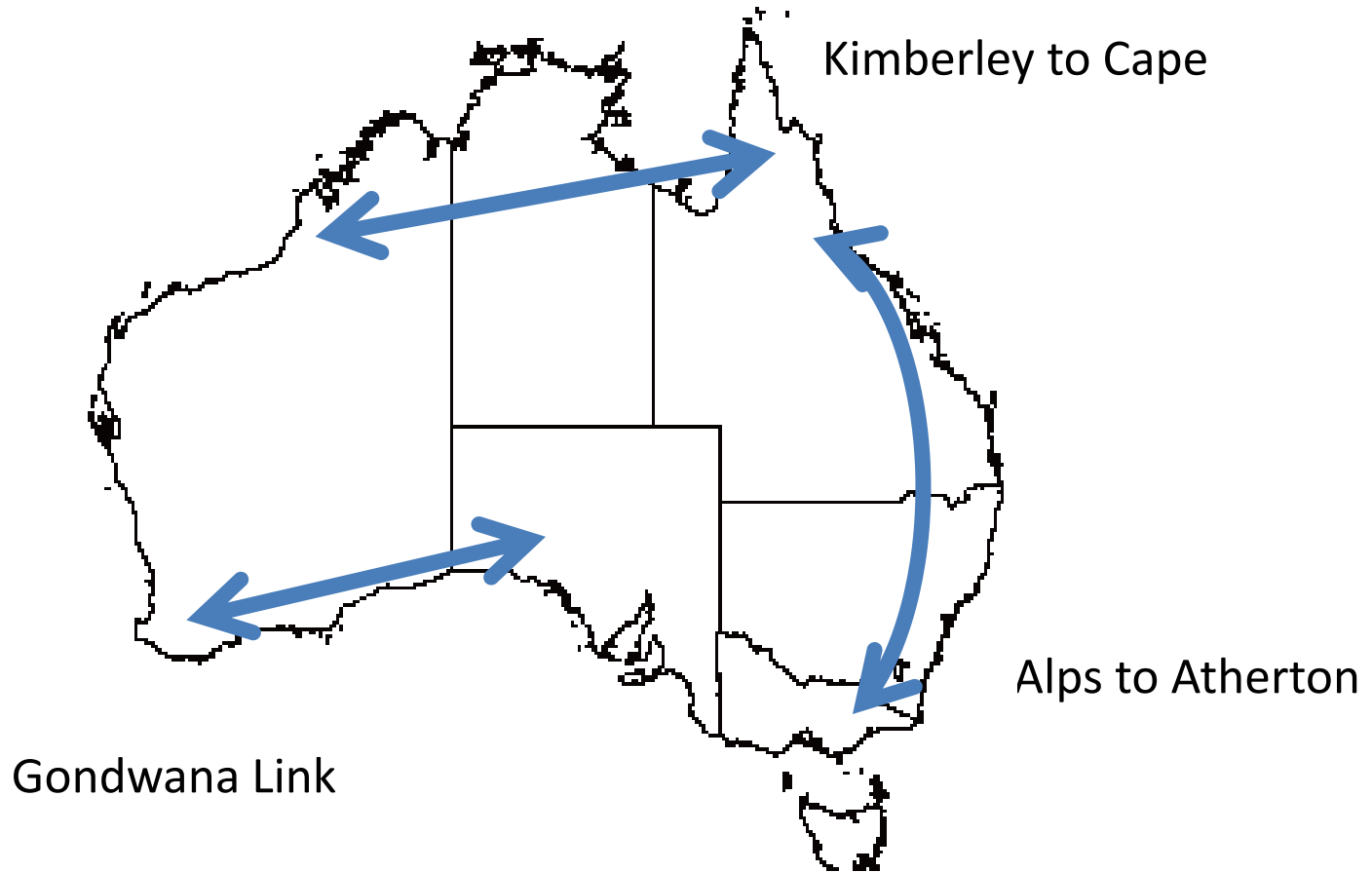
Increase in extent of Indigenous Protected Areas



Indigenous Protected Areas August 2013



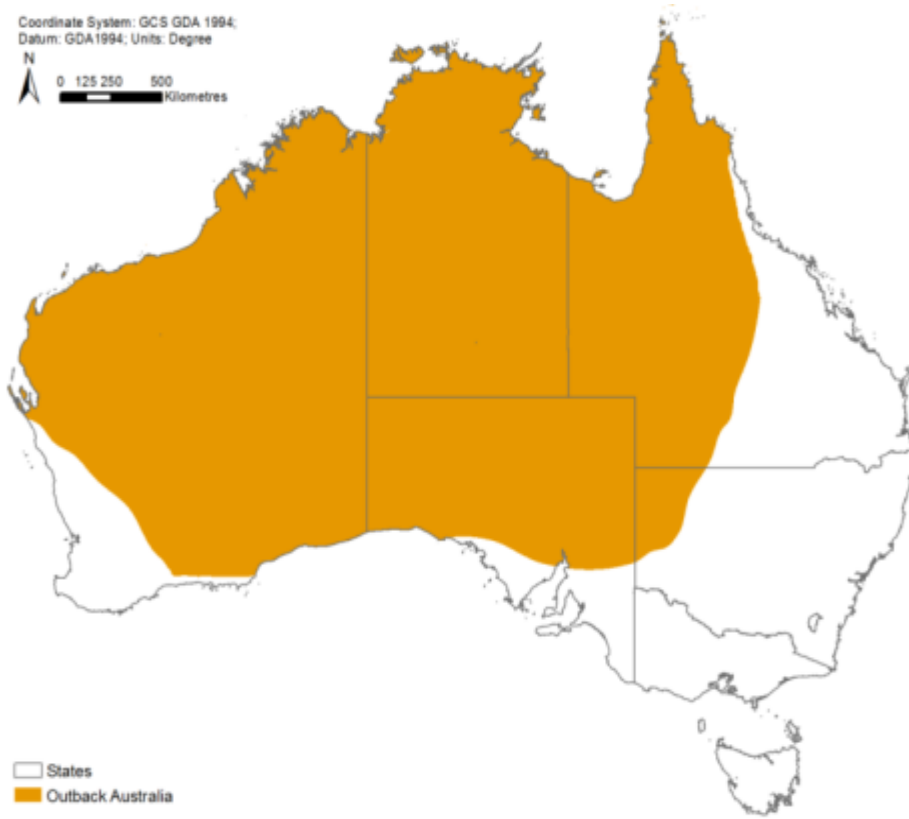
Consideration of connectivity



Coordinate System: GCS GDA 1994;
Datum: GDA 1994; Units: Degree

N

0 125 250 500
Kilometres



States

Outback Australia

Many benefits

Most of Outback enterprise depends upon the condition of nature and the maintenance of ecological processes

- Indigenous livelihoods
- Tourism
- Pastoralism
- Mining
- Carbon farming



The fate of the Outback affects us all

Ecological, social and economic dysfunction in the Outback will diminish the nation.

The Outback offers a meeting-place, an opportunity to reset our notion of the country and our fit to it.





Thanks

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