

Environmental science in Australia

IAN LOWE

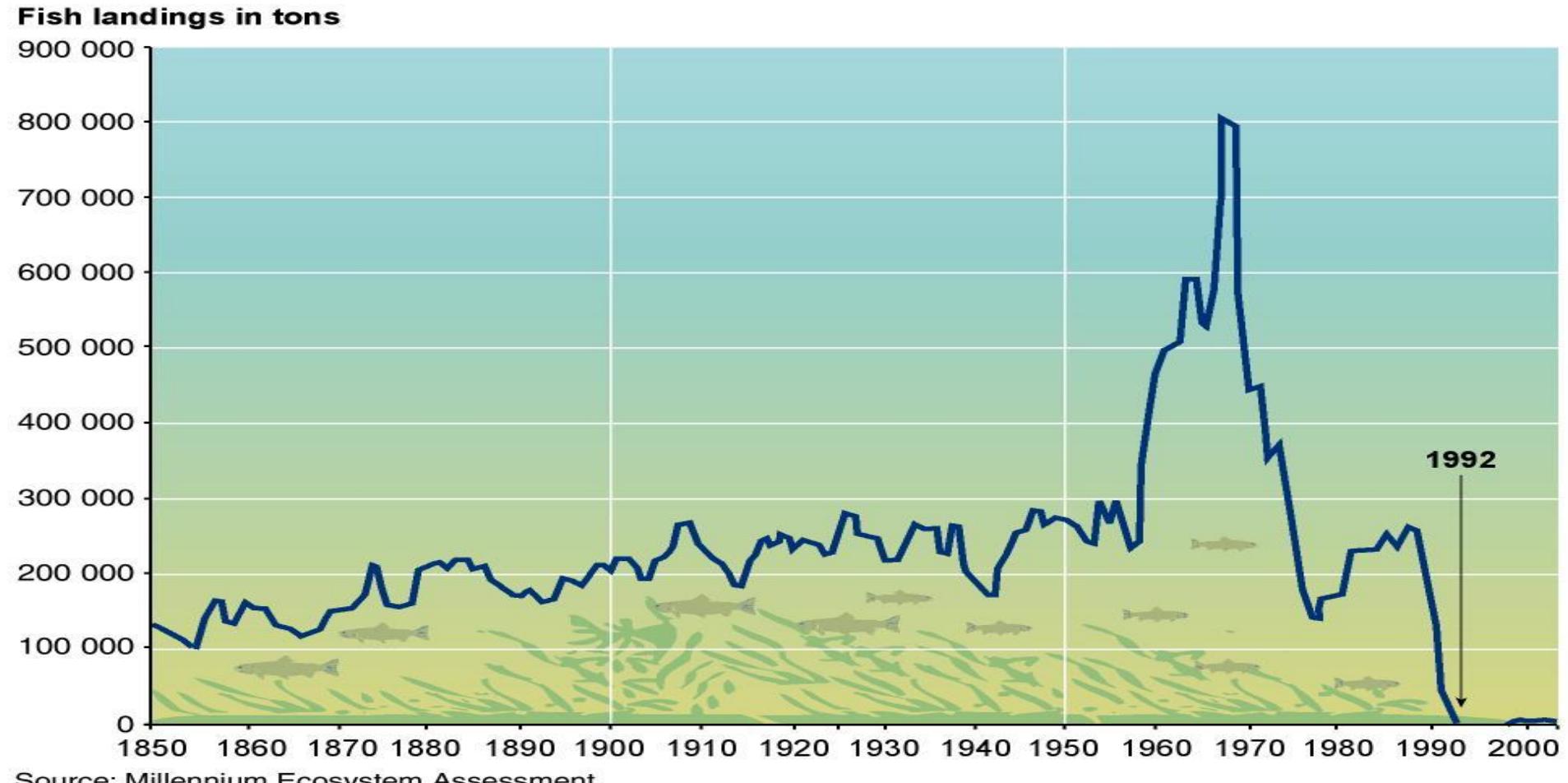
Overview

- ▶ Global trends
- ▶ Local issues
- ▶ Priorities

GEO5 Summary

- ▶ “current observed changes to the Earth systems are unprecedented in human history”
- ▶ “several critical global, regional or local thresholds are close or have been exceeded...abrupt and possibly irreversible changes to the life support functions of the planet are likely to occur”

An example: non-linear change

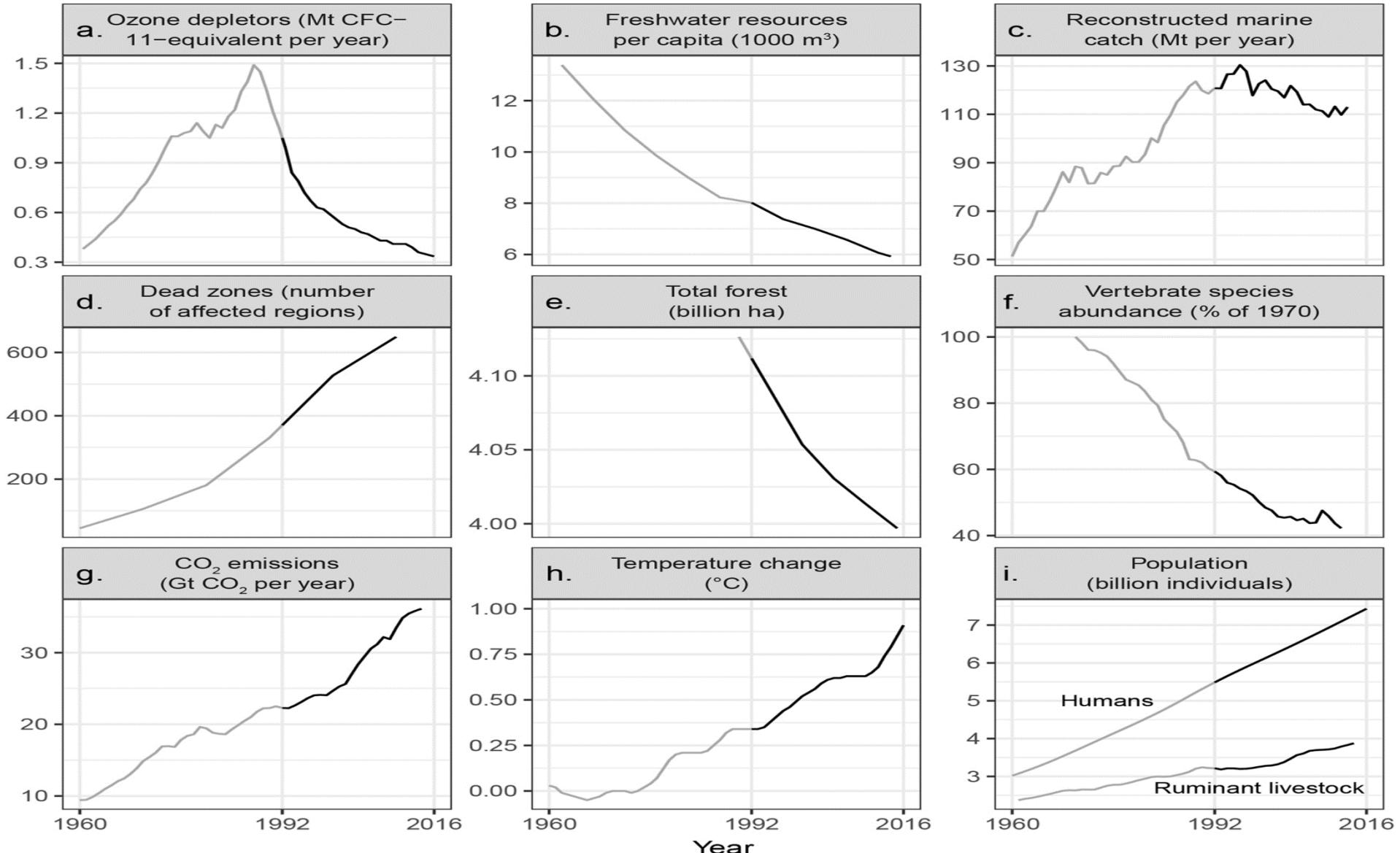


World Scientists' Warning to Humanity: A Second Notice

William J. Ripple, Christopher Wolf, Thomas M. Newsome, Mauro GalettiMo, hammed Alamgir, Eileen Crist, Mahmoud I. Mahmoud, William F. Laurance + 15,364 scientist signatories from 184 countries

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“Since 1992, with the exception of stabilizing the stratospheric ozone layer, humanity has failed to make sufficient progress in generally solving these foreseen environmental challenges, and alarmingly, most of them are getting far worse.”



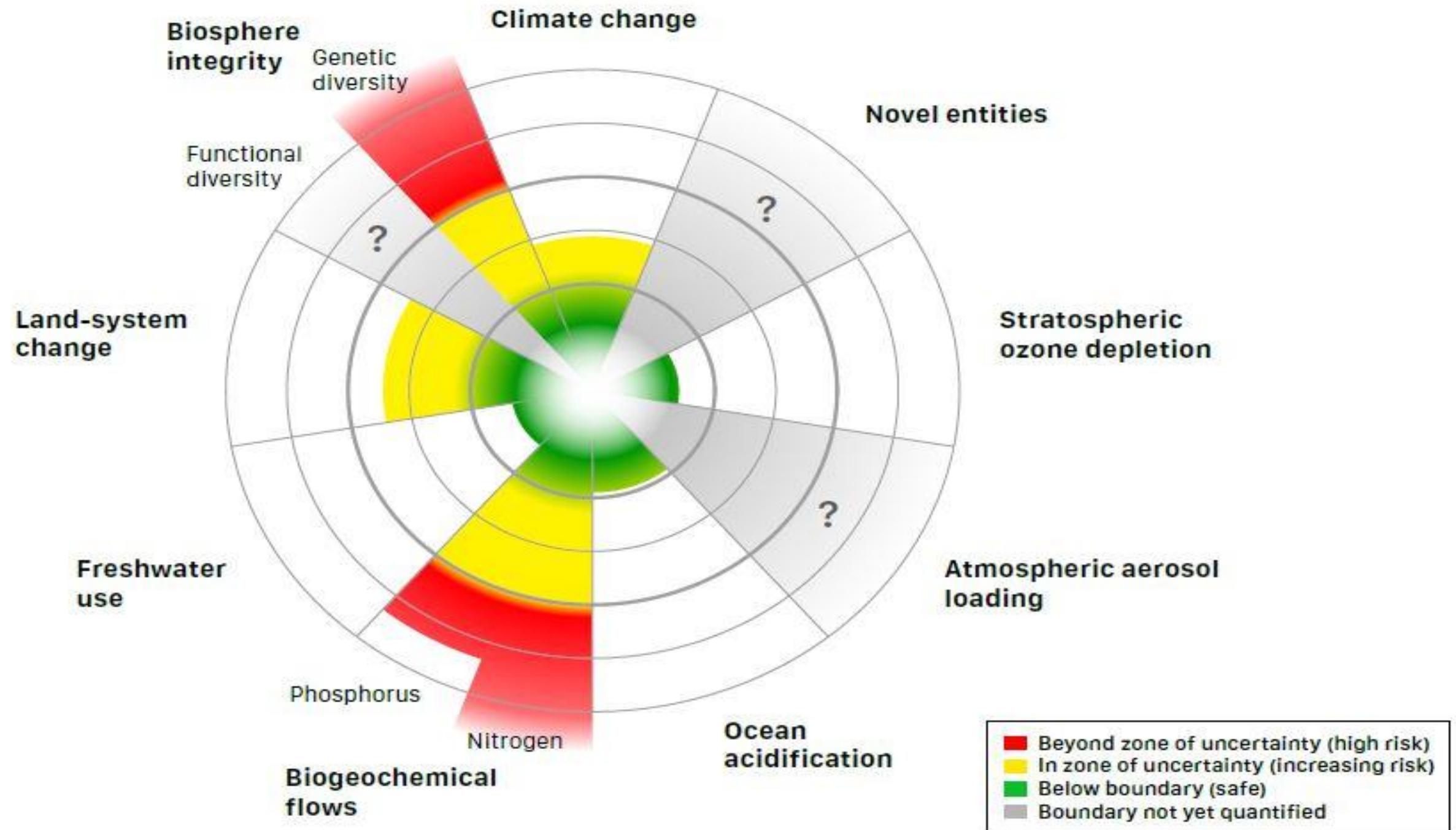
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“Especially troubling is the current trajectory of potentially catastrophic climate change...”

“we have unleashed a mass extinction event, the sixth in roughly 540 million years... many current life forms could be annihilated or at least committed to extinction by the end of this century.”



Living Planet Report 2014

- ▶ Survey of populations of 10,000 species:
mammals, birds, amphibians, fish and reptiles
- ▶ Populations down by > 50 % since 1970

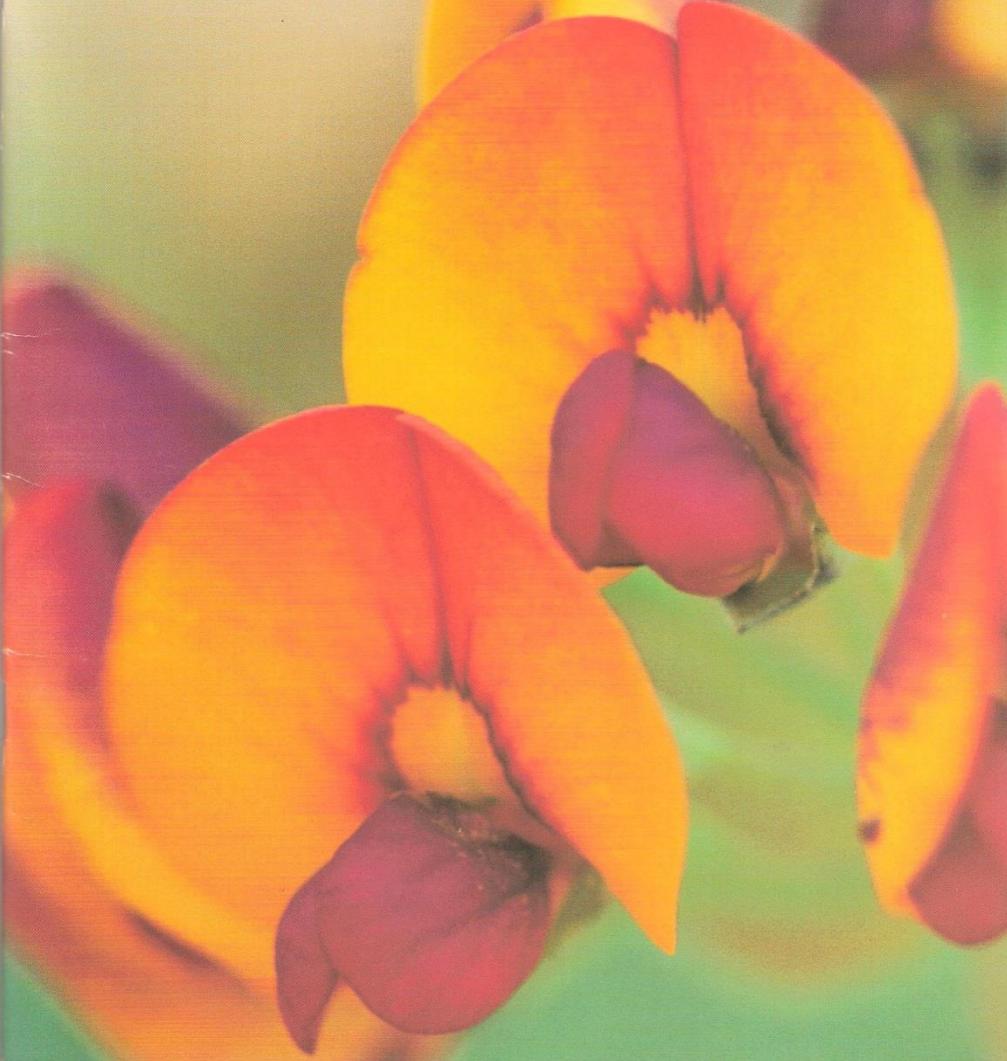
Causes of loss

- ▶ Destruction of habitat
- ▶ Introduced species
- ▶ Chemical pollution
- ▶ Climate change

CoAG 1992

- ▶ National Strategy for Ecologically Sustainable Development
- ▶ “a path of economic progress that does not impair the welfare of future generations”
- ▶ “equity within and between generations”
- ▶ “recognition of the global dimension”
- ▶ “protection of biological diversity and the maintenance of ecological processes and systems”

- State of the
Environment
Australia
1996 Executive Summary



The conclusion

- ▶ “Australia has some very serious environmental problems. If we are to achieve our goal of ecological sustainability, these problems need to be dealt with immediately.
- ▶ “The problems are the cumulative consequences of population growth and distribution, lifestyles, technologies and demands on natural resources”

The five big problems

- ▶ Loss of our unique biodiversity
- ▶ Pressures on the coastal zone
- ▶ State of most inland rivers
- ▶ Degradation of rural land
- ▶ Greenhouse gas emissions

Lack of knowledge

- ▶ 1996 report said we just don't know what is out there
- ▶ 2018 ten-year plan, Academy of Science & NZ Royal Society
- ▶ Only about 30 % of estimated 600,000 species named, described
- ▶ “it will take around 400 years” at current rate
- ▶ Attenborough: “Our taxonomic capacity is not adequate for the magnitude of the task... at the very time that many species are under greatest threat, funding and other resources allocated to the task of discovering, naming and documenting nature are declining”

2016 SoE Report

- There are areas where the condition of the environment is poor and/or deteriorating. These include the more populated coastal areas and some of the growth areas within urban environments, where human pressure is greatest (particularly in south-eastern Australia); and the extensive land-use zone of Australia, where grazing is considered a major threat to biodiversity.

The driving forces

- The main pressures facing the Australian environment today are the same as in 2011: climate change, land – use change, habitat fragmentation and degradation, and invasive species...interactions between these and other pressures are resulting in cumulative impacts.

Changing pressures

- ▶ “some individual pressures on the environment have decreased since 2011, such as those associated with air quality, poor agricultural practices, commercial fishing, and oil and gas exploration and production in Australia’s marine environment.
- ▶ “**other pressures have increased** — for example, those associated with coal mining and the coal-seam gas industry, habitat fragmentation and degradation, invasive species, litter...

Climate change

- ▶ “Climate change is an increasingly important and pervasive pressure on all aspects of the Australian environment. It is altering the structure and function of natural ecosystems, and affecting heritage, economic activity and human wellbeing... the impacts of climate change are increasing, and some of these impacts may be irreversible.”

Biodiversity

- ▶ “Australia’s biodiversity is continuing to decline... new approaches are needed to prevent accelerating decline in many species.
- ▶ “A legacy of extensive land clearing and the current clearing policies in some jurisdictions continue to cause loss of biodiversity (including the loss and fragmentation of native vegetation). These factors also impact on soils, waterways and coastal regions.
- ▶ “Invasive species have a major impact... threatening biodiversity by... reducing overall species abundance and diversity. **They represent one of the more potent, persistent and widespread threats to the environment.**”

Threatened Species Recovery Hub

- ▶ April 2018 paper in journal *Pacific Conservation Biology*
- ▶ Australia has lost 30 mammal species and 29 birds since 1788
- ▶ “highest mammal extinction rate in the world”
- ▶ Seventeen unique Australian birds and mammals likely to disappear within twenty years
- ▶ Birds most at risk are located in south-east Australia
- ▶ Mammals most at risk in regions of more recent development, e.g. Top End

Species

% chance extinction within 20 yrs

► King Island brown thornbill	94
► Orange-bellied parrot	87
► King Island scrub-tit	83
► Western ground parrot	75
► Houtman Abrolhos painted button-quail	71
► Plains wanderer	64
► Regent honey-eater	57
► Grey-range thick-billed grass-wren	53
► Herald petrel	52
► Black-eared miner	47

Species

% chance extinction within 20 yrs

► Central rock-rat	65
► Northern hopping mouse	48
► Carpentarian rock-rat	44
► Christmas Island flying fox	41
► Black-footed tree-rat	39
► Gilbert's potoroo	36
► Leadbeter's possum	29
► Nabarlek (Top End)	29
► Brush-tailed phascogale (Kimberley)	25

Water quality

- ▶ “Since 2011, there have been noticeable local improvements in water quality in the Murray – Darling Basin. **In more populated regions, inland water quality is in moderate to very poor condition. In most regions, the condition of Australia’s groundwater is poor.**”

S.R. Morton et al, The Big Ecological Questions Inhibiting Effective Environmental Management in Australia, *Austral. Ecology* 34, 1-9 (2009)

- ▶ “Increasingly, managers and policy-makers will be called on to use the present state of scientific knowledge to supply reasonable inferences for action based on imperfect knowledge.”
- ▶ “enough information already available to develop effective policy and management to address several significant ecological issues.”
- ▶ “participatory research, co-production of knowledge (including Indigenous knowledge) and adaptive management are central”

Areas of continuing research

- ▶ Alteration of natural habitats
- ▶ Invasive species
- ▶ Altered fire regimes
- ▶ Water extraction

Alteration of habitats

- ▶ Sustainable harvesting rates in changing climates
- ▶ Preserving and extending connectivity
- ▶ Moderating off-site impacts of intensive agriculture
- ▶ Chemical and biological control of invasive species

Fire regimes

- ▶ Using scientific and Indigenous knowledge
- ▶ Tensions between protection of human life and property, and management for ecological purposes ?
- ▶ Quantifying impacts of fire regimes on biodiversity and ecosystem function, allowing better management

Water extraction and use

- ▶ Loss of species & ecosystem services from watercourses, wetlands & groundwater-dependent ecosystems
- ▶ Likely climate change accelerating impacts
- ▶ Over-exploitation [and pollution?] of groundwater
- ▶ Reconciling environmental flows to ensure resilience of rivers, wetlands and estuaries with human demands
- ▶ Need for more effective use of extracted water

Over – arching issues

- ▶ Inadequate long-term monitoring and data collection
- ▶ Insufficient resources for management and restoration
- ▶ Inadequate understanding of cumulative impacts
- ▶ Ecological integrity regarded as less important than economic production

So priorities ?

- ▶ Putting pressure on **all** levels of government to develop and implement responsible policies
- ▶ Addressing the **driving forces** of environmental decline
- ▶ Treating the most urgent symptoms of decline

Driving forces of biodiversity loss

- ▶ Habitat loss
- ▶ Habitat fragmentation
- ▶ Invasive species
- ▶ “human litter”, especially plastics
- ▶ [Climate change]

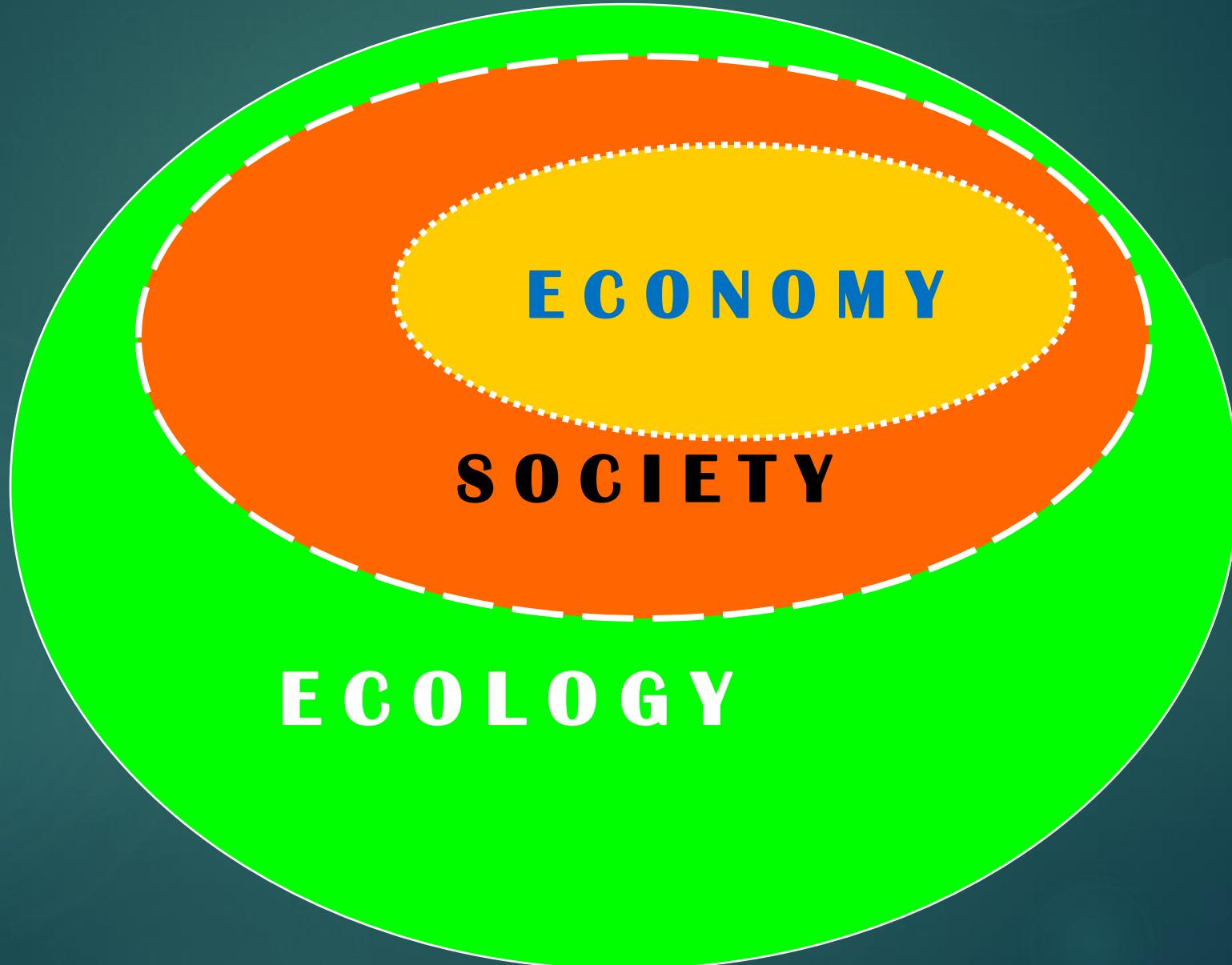
A systems approach

- ▶ Protect remaining habitat
- ▶ Improve connectivity
- ▶ Remove invasive species
- ▶ Monitor changes over time
- ▶ Be prepared to adapt

The overall approach

- ▶ Making reasonable inferences from existing knowledge
- ▶ Implementing action plans
- ▶ Adaptive management based on responses

The overall picture



Conclusion

- ▶ Despite CoAG 1992, no overall vision or national policy
- ▶ In its absence, environmental decline continues
- ▶ Biodiversity decline most critical problem
- ▶ Addressing **driving forces** should be a priority
- ▶ Learning by doing, adaptive management