

Science for Saving Species

Research findings factsheet

Project 4.4: Identifying and managing refuges from threats



National Environmental Science Programme

Threats to Australia's imperilled species and implications for a national response

An inventory of threats

Our review focused on the 1,533 freshwater and terrestrial invertebrate, vertebrate and plant species listed as Vulnerable, Endangered or Critically Endangered under Australia's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

We identified the threats to each species through the Australian Government's Species Profiles and Threats (SPRAT) Database and IUCN threat categories used to assess Red Listed species. SPRAT and IUCN threat categories are broadly comparable and draw on similar data. Threat categories are described in table 1.



Invasive species include plant diseases like myrtle rust. Photo: Forest and Kim Starr CC BY 3.0 Wikimedia Commons

A unique country with much to lose

Australia occupies a unique position in global biodiversity. Although accounting for only 5% of the world's landmass, it supports 12.5% of all vertebrate species, and almost 8% of all known plant, animal and fungi species. The great majority are found nowhere else on earth: more than 85% of Australia's plants, mammals, reptiles and amphibians are endemic. This makes Australia one of 17 'megadiverse' nations and, with the US, one of only two that are also economically wealthy. However, since European occupation, Australia has had an extremely poor record for the dramatic decline and in some cases extinction of many of this continent's unique species.

Ninety extinctions are recognised under Australia's *Environment Protection and Biodiversity*

Conservation Act 1999 – 36 plants, 27 mammals, 22 birds, four frogs and one earth worm. The actual number is higher, as many known extinctions are yet to be listed, and the rate of extinction is unabated, with at least three in the past decade. Currently, 1,533 freshwater and terrestrial invertebrate, vertebrate and plant species and subspecies are listed as Vulnerable, Endangered and Critically Endangered under the Act. It is estimated that without significant action, at least 17 of these are likely to be lost in the next 20 years.

Australia's distinctiveness lies not only in its biodiversity but in the extent and mixture of threats to the survival of these species, which we have found are very different to the most prevalent threats impacting threatened species worldwide.

Table 1: Threat categories used in the analysis and their description.

IUCN Red List threat category	Abbreviated threat category	Description
Residential and commercial development	Urban development	Threats from human settlements or other non-agricultural land uses with a substantial footprint
Agriculture and aquaculture	Agriculture	Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture, mariculture and aquaculture
Energy production and mining	Energy production	Threats from production of non-biological resources.
Transportation and service corridors	Transportation	Threats from long narrow transport corridors and the vehicles that use them.
Biological resource use	Overharvesting	Threats from consumptive use of 'wild' biological resources including both deliberate and unintentional harvesting effects; also persecution or control of specific species.
Human intrusion and disturbance	Human disturbance	Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources.
Natural system modifications	Ecosystem modifications	Threats from actions that convert or degrade habitat in service of 'managing' natural or seminatural systems, often to improve human welfare. For example, fire and fire suppression; dams and water use.
Invasive and other problematic species, genes and diseases	Invasive species	Threats from non-native and native plants, animals, pathogens/microbes, or genetic material that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance.
Pollution	Pollution	Threats from introduction of exotic and/or excess materials or energy from point and non-point sources.
Geological events	Geological events	Threats from catastrophic geological events.
Climate change and severe weather	Climate change	Threats from long-term climatic changes that may be linked to global warming and other severe climatic/weather events that are outside of the natural range of variation or potentially can wipe out vulnerable species habitat.



Irrigated agriculture,
Kununurra WA.
Photo: Jaana Dielenberg

Research findings

Which types of threats are most prevalent?

We found that the threat impacting the most Australian threatened species is invasive species. Invasive species affect 82% of all threatened species (1,257 species). In close second place is ecosystem modifications, chiefly fire and hydrology, which affects 74% of all threatened species (1,136 species). Impacts due to agricultural activity was third-ranked, affecting 57% of all threatened species (873 species).

We found that the ranking of these three most serious threats was largely consistent across each broad taxonomic group (plants, invertebrates and vertebrates) and the degree of risk to species (Critically Endangered, Endangered or Vulnerable).

	Total (1533)	Invertebrates (48)	Plants (1212)	Vertebrates (272)	Amphibians (29)	Birds (84)	Fish (34)	Mammals (74)	Reptiles (51)	Critically Endangered (178)	Endangered (646)	Vulnerable (709)
Invasive species	82%	79.2%	79.5%	94.1%	100%	95.2%	97.1%	97.3%	82.4%	80.9%	86.5%	78.1%
Ecosystem modifications	74.1%	79.2%	75.7%	66.5%	65.5%	72.6%	79.4%	62.2%	54.9%	64.6%	79.1%	71.9%
Agricultural activity	56.9%	72.9%	53.5%	69.9%	69%	82.1%	47.1%	73%	60.8%	51.1%	60.2%	55.4%
Human disturbance	38.4%	20.8%	40.3%	33.1%	51.7%	35.7%	38.2%	27%	23.5%	34.8%	43%	35%
Climate change	34.8%	45.8%	32.1%	44.9%	44.8%	56%	55.9%	37.8%	29.4%	43.3%	36.2%	31.3%
Transportation	30.3%	14.6%	34%	16.9%	41.4%	16.7%	2.9%	17.6%	11.8%	27.5%	34.4%	27.4%
Overexploitation	27.4%	50%	24.6%	36%	48.3%	40.5%	52.9%	28.4%	21.6%	25.8%	26.3%	28.8%
Urban development	22.2%	31.2%	21.4%	24.6%	24.1%	26.2%	29.4%	14.9%	33.3%	23.6%	22.6%	21.6%
Energy production	18.9%	10.4%	18.2%	23.5%	10.3%	20.2%	47.1%	16.2%	31.4%	19.7%	20.4%	17.2%
Pollution	17.8%	25%	16.2%	23.9%	44.8%	19%	61.8%	6.8%	19.6%	15.7%	21.8%	14.7%
Geological Events	1%		1.3%							0.6%	0.6%	1.6%

Table 2: The prevalence of threats to Australian threatened species across broad taxonomic groups, vertebrate taxonomic groups and extinction risk categories. Cells are shaded from red to blue based on the percentage of species in a group affected. Red is most species in the group affected. Blue is few species in the group affected.

Our most problematic invasive species

In total, 267 invasive species are listed as impacting listed threatened species: 207 plants, 57 animals and three pathogens. This includes 230 non-native species (187 plants, 41 animals and two pathogens) and 37 problematic native species (20 animals, 16 plants and one pathogen).

Of all invasive species, rabbits top the list for impacting the most threatened species, 322 in total, or 21%, of all threatened Australian species. Rabbits destroy plants and can stop them regenerating by eating the seedlings, they compete with native grazing animals for food and even boost the number of predators like cats and foxes.

Phytophthora cinnamomi, a plant root disease, is in second place, affecting 236 threatened plants, and can cause dieback of a wide variety of plants, shrubs and trees.

Three other species also threaten over 100 threatened species each – these are feral pigs (149), feral cats (123) and feral goats (116).

Figure 1 (below) shows the number of EPBC Act-listed species affected by the ten most threatening invasive species.

Problematic native species are listed as threats for one-fifth of threatened species. Grazing pressure from kangaroos and wallabies is a threat to 152 threatened plants and five threatened animal species.

Their abundance in some regions is partly due to the control and exclusion of dingoes, the proliferation of reliable sources of water and the greater extent and reliability of palatable feed grasses.

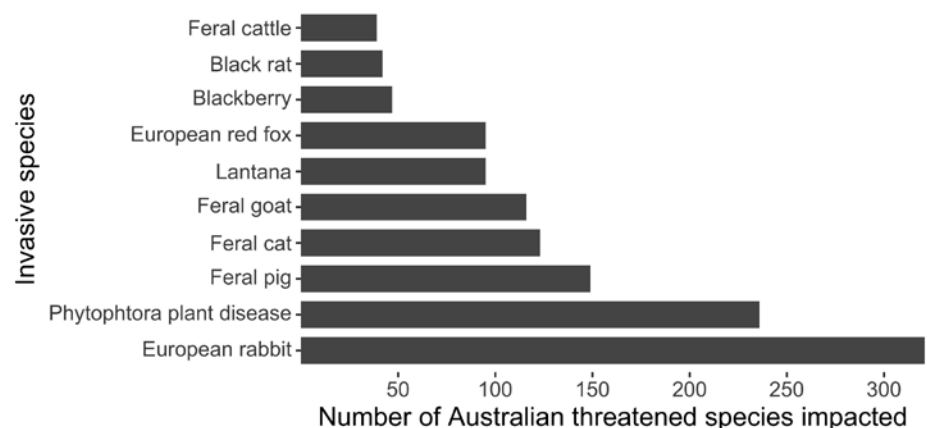


Figure 1: The 10 invasive species that impact the greatest number of EPBC-listed threatened species and subspecies.

Habitat lost due to timber
harvesting in NSW.
Photo: Harley Kingston
CC BY-NC 2.0



Ecosystem modification

Ecosystem modification, which includes changed fire and water regimes, is listed as a threat for almost three-quarters of threatened species (74% or 1,136 species).

Numerous Australian species have evolved with particular fire regimes. However, since European occupation, many areas have experienced dramatic changes in fire regime, ranging from reductions in the incidence of fire to increases in its frequency, extent and intensity. Many native plant species require fire to germinate and are in decline as a consequence of reductions in fire frequency (e.g., the orange dryandra, known only in the Wandoo National Park in Western Australia).

Across Australia, hydrological regimes have changed substantially through the construction of dams and weirs, drawing down of aquifers, draining of swamps, and salinity.

This has severely impacted biodiversity, particularly freshwater species and those occurring in agricultural landscapes.

Agriculture

Agricultural activities, which includes cropping, timber plantation and livestock production, threaten 57% (873 species) of Australian threatened species. It is a particularly prevalent threat for vertebrate and invertebrate species, threatening 70% and 73% of species respectively (Table 2).

Many agricultural activities result in the bulldozing of native vegetation and replacement with a monoculture of non-native plant species. This removal of native vegetation renders these areas obsolete for all but a handful of native species.

Agricultural activities are the dominant land use in Australia, with livestock grazing occupying 54% of the continent and threatening 621 taxa.

Other agricultural activities such as cropping and horticulture dominate the southwest and southeast of the country.

Our other threats

Human disturbance through recreational, military and other outdoor activities threatens 588 species and subspecies. The impacts of climate change and severe weather threaten 533 Australian species, although this number is likely conservative, as such impacts are only listed when the evidence is for direct impacts, plus the interactions between climate changes and other threats (especially fire, water use and agriculture) are unlikely to be captured in the SPRAT databases.

The remaining threats categories also impact large numbers of threatened species: transport corridors and infrastructure (465); overexploitation (hunting, fishing, collection, logging) (420); urban development (341); energy production (289); and pollution (225).

Australian vs global trends

Given Australia's geographic isolation and long history of fire, it is likely that the most serious threats to Australian biodiversity interact with threatened species in unique ways. We compared the threats to species globally with those affecting species in Australia using data provided in a recent threat assessment of 5,296 IUCN Red List Threatened and Near Threatened terrestrial and freshwater species.

For these species, the most common threats globally were agriculture (affecting 74%), overexploitation (71%) and urban development (34%). Contrasting with Australia's top three threats (invasive species 82%, system modification 74% and agriculture 57%) highlights that Australia is distinct not only in its particular biodiversity but

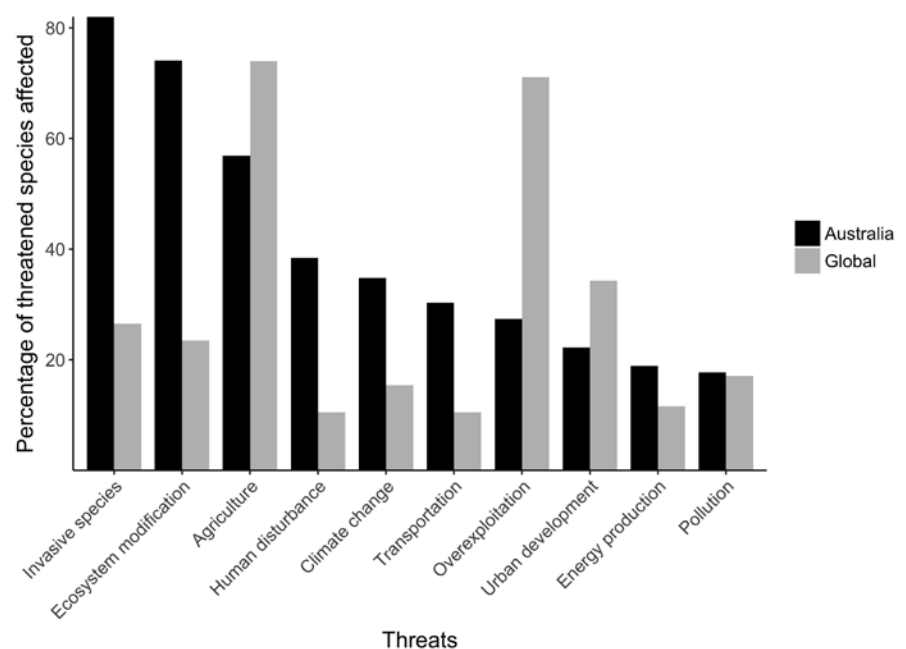
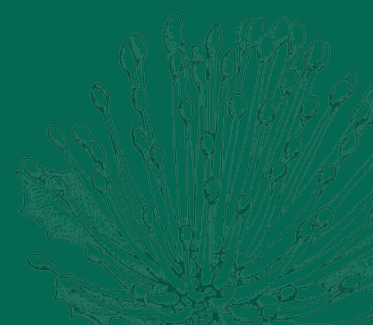


Figure 2: The percentage of Australian ($n = 1,533$) and global threatened species ($n = 5,296$) threatened by each threat category.



Rabbits are the invasive species that impacts the most threatened species.
Photo: Hugh McGregor / Arid Recovery



also in the extent and mixture of processes that threaten the survival of these species.

These differences in the ranking of threats may be due in part to the fact that in Australia, human population density is comparatively low and geographically biased to the country's south-east and coastal areas. Additionally, while deforestation and intensive land-uses have impacted much of south-western and eastern Australia, vast areas of the continent have experienced low levels of development and are considered to be largely intact. These factors indicate that despite the poor record

of declines and extinctions in Australia, the country has the potential to curtail future losses and conserve its remaining species, if it can act urgently to coordinate responses.

Australia's long separation from other continents and the subsequent evolution of its plants and animals in isolation has likely had a considerable influence on the susceptibility of these species to the impacts of invasive species. Australia is the only continent apart from Antarctica, for example, where the animals evolved without predation by cats. In addition, the resulting predator-naivety and susceptibility interacts with the

climate-driven boom–bust ecological cycles that characterise much of the continent.

The threats posed by changed fire regimes since European occupation of the continent have been complex, with ecosystems that evolved with no fire now experiencing devastating fires (e.g., high-altitude Tasmanian forests), ecosystems that evolved with fire now experiencing very little of it (e.g., grasslands and woodlands near urban areas) and areas evolving to a particular fire regime experiencing new regimes that do not meet the ecological needs of their species (e.g., Sydney bushland).

Implications and recommendations

The unique variety and combination of threats facing Australian threatened species calls for a comprehensive and coordinated approach to managing their impacts. Despite the efforts of many government agencies, NGOs, communities and individuals at local, regional and national scales, and despite the nation's protected area network and the protections afforded under the EPBC Act, Australia has been unable to reverse or prevent further decline in all but a small minority of threatened species. The general trend for threatened species is continuing decline.

The status quo will be insufficient to address the crisis facing Australia's threatened species across the continent.

We have five recommendations for addressing declines in Australian threatened species.

1. Adequate resources for implementing recovery actions
2. Effective policy support for response mechanisms and management
3. Identifying and filling knowledge gaps in understanding the distributions of species and threats, and the severity and interactions of their impacts
4. Understanding how threatening processes (e.g., land clearing, pollution) are impacting species, so that effective response mechanisms can be designed
5. Coordinating information and resources to help policy-makers

and local land managers enable species recovery, including the ongoing collection and sharing of information to guide effective management.

While some progress has been made in response to the most prevalent threats of invasive species, ecosystem modifications (particularly changed fire regimes) and agriculture, they have not been enough, and while essential, protected areas alone will not effectively combat the impacts of these threats in isolation or combination. If Australia is to conserve its globally significant biodiversity a well-planned response supported by adequate funding and legislation is urgently needed.

Further Information

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