



AUSTRALIAN  
EARTH  
SCIENCE  
EDUCATION

# Impact of Introduced Species

## Economics and Extinctions

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# Overview

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Overview of the types and effects of introduced species

For more information see Australia's Silent Invaders by the Australian Academy of Science: <https://www.science.org.au/curious/earth-environment/invasive-species>

## Introduced vs invasive species

- Brought to Australia by humans deliberately or accidentally
- **Introduced** may not be harmful
- **Invasive** species damage the environment, economy or health



Introduced wheat (Bluemoose 2005, Creative Commons)



Invasive boneseed  
(B Dupont 2016,  
Creative Commons)

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Any species brought to Australia by humans is an introduced species. The introduction may be deliberate (e.g. rabbits) or accidental (e.g. alligator weed). Not all introduced species are a problem. Many remain controlled for agriculture, gardening or pets.

Invasive species are those which escape cultivation and spread, damaging native and human ecosystems. These include vertebrate pests such as rabbits, invertebrates such as yellow crazy ant, plants such as fireweed, fungus such as *Phytophthora* and marine species such as the Northern Pacific seastar.

## 10 most unwanted (affecting threatened native species)

1. Rabbit
2. Phytophthora plant fungus
3. Feral pig
4. Feral cat
5. Feral goat
6. Red fox
7. Lantana
8. Blackberry
9. Black rat
10. Feral cattle



Rabbits imperil 321 threatened species in Australia (CSIRO Science Image 2004, Creative Commons)

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Research by the Threatened Species Recovery Hub (2019) identified Australia's top 10 most damaging species based on the number of Australian species they affect.

See: <https://www.nespthreatenedspecies.edu.au/news-and-media/media-releases/australia-s-10-worst-invasive-species-study>

An economic analysis would produce a different ranking, with weeds featuring more prominently because of their affect on agriculture

## Impacts of introduced species

- Grazing degrades natural habitats
- Hard hooves compact soil
- Competition
- Kill native animals and livestock
- Introduce parasites and diseases
- Weeds may favour invasive animals
- Affect water quality
- Reduce crop yields



*Mimosa* clogs tropical waterways, choking out native vegetation and destroying fish, turtle, crocodile and waterbird habitats (J Tann 2011, Creative Commons)

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- Intensive and/or selective grazing degrades habitats. For example, rabbits eat every part of the plant – even the roots. This causes erosion, as well as loss of vegetation.
- Hooved animals compact the soil, making it difficult for vegetation to grow and water to infiltrate. This increases erosion and decreases vegetation.
- Competition takes many forms. Rabbits can take over the burrows of bandicoots, as well as competing with other herbivores for food. Invasive plants compete for food and light. Predators compete for prey.
- Cats and foxes are responsible for billions of native animal deaths every year. Foxes and pigs kill lambs and sheep as well as domestic fowl (chickens, ducks). Plague minnows eat the eggs and tadpoles of native frogs.
- Phytophthora root rot was introduced on plants brought to Australia. It now affects thousands of native Australian plant species.
- Many introduced plants rapidly invade disturbed sites and provide shelter for introduced species such as rabbits and foxes (e.g. Bitou bush).
- Species may affect water quality by stirring up sediments (buffalo, carp), causing erosion (rabbits, hooved animals) or choking waterways (mimosa, alligator weed, etc).
- Weeds compete with agricultural crops for light and soil nutrients, causing decreases in crop yields. Pigs, goats and other grazers eat crops.

# Economic Impact

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The economic impact is difficult to calculate.

Two valid sources are:

Hoffman BD, Broadhurst LM (2016). The economic cost of managing invasive species in Australia. *Neobiota* **31**:1-18 <https://doi.org/10.3897/neobiota.31.6960>

NSW DPI (2018). NSW Invasive Species Plan 2018-2021.

[https://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0003/807753/InvasiveSpeciesPlan2018.pdf](https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/807753/InvasiveSpeciesPlan2018.pdf)



It is very hard to quantify the cost of invasive species. The 2011-2012 estimate is the best available (as of 4/1/2021) and the authors say it is an underestimate. The cost represents approximately 1% of GDP.

For example, rye grass alone costs cereal farmers \$93 million/year.  
(<https://theconversation.com/invasive-species-are-australias-number-one-extinction-threat-116809>)

Pest animals cost the NSW economy over \$170 million/year and weeds cost the NSW agricultural sector approximately 1.8 billion/year. The cost to aquaculture is unknown, but thought to be substantial.

See:

Combined costs from: Hoffman BD, Broadhurst LM (2016). The economic cost of managing invasive species in Australia. *Neobiota* **31**:1-18

<https://doi.org/10.3897/neobiota.31.6960>

NSW figures from: NSW DPI (2018). NSW Invasive Species Plan 2018-2021.

[https://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0003/807753/InvasiveSpeciesPlan2018.pdf](https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/807753/InvasiveSpeciesPlan2018.pdf)

## What is the cost breakdown?

- Control of species
- Lost productivity
- Damage to land?



Man standing by a field infested with prickly pear, circa 1935 (History Trust of South Australia, public domain)

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Although many people focus on the cost of controlling invasive species, economic loss is the greatest cost. This is 2 – 10 times greater than the expenditure on management. Most economic loss is due to crop losses.

The cost of damage to land is unknown. Farmers may change crops or stock due to damage by introduced species. Sometimes areas are rendered unusable due to damage such as extensive erosion. Invasive animals also damage infrastructure such as fences and roads. During the prickly pear plague (1920s), many farmers were unable to access their land due to dense growth of cactus.

Information from:

Hoffman BD, Broadhurst LM (2016). The economic cost of managing invasive species in Australia. *Neobiota* **31**:1-18 <https://doi.org/10.3897/neobiota.31.6960>

## Australia's costliest control program – fire ants

- \$300 million by 2013
- \$411 million by 2029



Fire ants [ausearthed.com.au](http://ausearthed.com.au)  
(S Bauer 2004, public domain)



Although introduced vertebrates are the greatest threat to native species, invertebrates have the highest expenditure for eradication and pest control. Eradication of fire ants is Australia's most expensive campaign with a cost of \$300 million by 2013 and a \$411.4 million. 10 year plan launched in 2019.

Although eradication is expensive, this expenditure is justified by known costs of fire ants overseas. In the US state of Texas alone, fire ants cost US\$1.2 billion/year and there have been more than 85 deaths from stings.

Information from:

Australian Interstate Quarantine (2019) Ten year fire ant eradication plan.  
<https://www.interstatequarantine.org.au/ten-year-fire-ant-eradication-plan/>

Hoffman BD, Broadhurst LM (2016). The economic cost of managing invasive species in Australia. *Neobiota* **31**:1-18 <https://doi.org/10.3897/neobiota.31.6960>

## What if we didn't control fire ants?

Projected yearly costs of infestation:

- \$7 million road damage
- \$508 million electrical and telecommunication damage
- \$114 million medical
- \$224 million damage to golf courses
- \$308 million to cattle industry



Fire ant stings – more than 250 in <10 seconds (D Wojcik, public domain)

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The photo shows the leg of an unwary scientist who knelt on a collapsed fire ant mound. He was stung over 250 times on one leg in less than 10 seconds. The ants bite to hold on and then sting repeatedly with a stinger on their abdomen, injecting an alkaloid venom. Each ant can sting several times.

Projections from the invasive species council provide frightening estimates of the **yearly** cost of unchecked fire ants in Australia:

- \$7 million damage to roads (undermined by digging)
- \$508 million damage to electrical and telecommunication equipment
- \$114 million medical costs
- \$224 million damage to golf courses
- \$308 million to cattle industry (equipment, injury, death)

Information from:

Invasive Species Council (n.d.). Projected impacts of fire ants in Australia.

<https://invasives.org.au/wp-content/uploads/2017/05/Projected-impacts-of-fire-ants-in-Australia-V1-2.pdf>

# Decline of Native Species

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Hundreds of native species are threatened by invaders. The threat is compounded by human effects such as habitat loss and climate change.

Information in this section is from:

Kearney SG, et al. The threats to Australia's imperilled species and implications for a national conservation response.

[https://www.nespthreatenedspecies.edu.au/media/qile4abf/kearney-et-al-2018\\_the-threats-to-aus-species\\_postprint.pdf](https://www.nespthreatenedspecies.edu.au/media/qile4abf/kearney-et-al-2018_the-threats-to-aus-species_postprint.pdf)

Sheppard A, Broadhurst L (2019). Invasive species are Australia's number-one extinction threat. <https://theconversation.com/invasive-species-are-australias-number-one-extinction-threat-116809>

## Effect on threatened species

- 1 257 threatened species are affected by invasive pests
- **Rabbits** (321 sp)
  - destroy plants
  - cause erosion
  - outcompete grazers
  - boost the number of cats and foxes



Rabbits imperil 321 threatened species in Australia (CSIRO Science Image 2004, Creative Commons)

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The rabbit is by far the most damaging introduced species because of its digging habit and voracious appetite for any type of plant material. It eats seedlings, preventing recruitment of new trees. Large rabbit numbers encourage the breeding of cats and foxes, thus increasing the number of predators which also feed on native species.

## Effect on threatened species

- **Phytophthora** (236 sp)
  - Destroys plant roots
  - Affects more than 2000 native plants



Phytophthora root rot  
(S Nelson 2011, public domain)

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Phytophthora is a soil fungus that destroys the roots of plants. It has damaged fragile endemic ecosystems in WA, Victoria, NSW and Tasmania. Phytophthora affects 236 threatened and 2000 other native plant species.

## Effect on threatened species

- **Feral pigs (149 sp)**
  - destroy crops
  - degrade wetlands
  - damage fences
  - kill livestock
  - spread weeds
  - carry diseases



Feral pig (CSIRO Science Image 2004, Creative Commons)

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Feral pigs affect 149 threatened species by eating them and damaging the environment. They destroy vast areas of crops, wetlands and floodplains in northern Australia. In southern areas they damage fences, eat crops, and kill livestock (esp lambs and poultry). They spread weeds in their faeces and on their coats, as well as carrying diseases that can affect humans and other animals. They even dig up and eat sea turtle eggs and hatchlings.

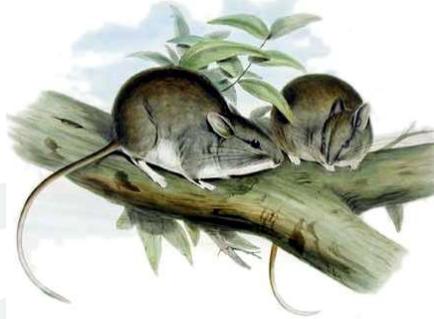
Leptospirosis is of great concern because there is a risk to hunters, dogs and cattle. It is widespread in feral pigs and is the most common zoonosis in the world.

For more information on leptospirosis in pigs, see;  
<https://www.ckn.org.au/content/feral-pig-hunters-and-farmers-are-risk-re-emerging-communicable-disease>

## Extinctions

- Cats and foxes caused the extinction of 22 native mammals
- Birds on Norfolk Island were driven extinct by rats and cats

Lesser stick nest rat is extinct due to cats and foxes (J Gould 1863, public domain)



Norfolk Island thrushes are extinct due to cats and rats (J Gould, public domain)

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Many extinctions are due to a variety of factors including habitat loss, hunting and changed fire regimes. However, introduced predators can be blamed for a number of recent extinctions, including the lesser stick nest rat and Norfolk Island Thrush.

For more information:

Dutson G (2010). The ghost birds of Norfolk Island. Australian Geographic.  
<https://www.australiangeographic.com.au/topics/wildlife/2010/12/the-ghost-birds-of-norfolk-island/>

## Threatened by invasive species

- Purple wood wattle
- Purple copper butterfly
- White-chested white-eye
- Multiple species in the Eastern Stirling Range Montane Heath Community (WA)
- Greater stick-nest rat



White-chested white-eye is threatened by cats and rats (J Gould, public domain)



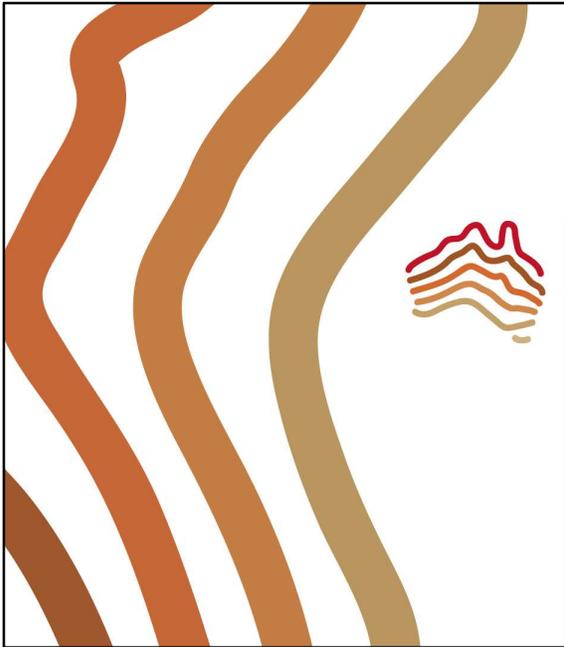
Greater stick-nest rat is threatened by cats and foxes (XiscoNL, Creative Commons)

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### Examples of the impact of invasive species:

- Purple wood wattle is classified as Vulnerable due to grazing from rabbits. Rabbits eat seedlings, so new plants are not recruited.
- The purple copper butterfly is threatened by pigs, goats and invasive plants (blackberry, scotch broom) that cause degradation of habitat
- The white-chested white-eye of Norfolk Island is on the verge of extinction due to rats and cats.
- Many endemic species in the Eastern Stirling Range Montane Heath Community in WA are threatened with extinction due to Phytophthora.
- The greater stick-nest rat only survives in fenced reserves and cat/fox free islands. (The other species in the genus is extinct.)



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