


## **Biology**

# **Invasive Species: Feral peril**



Sometimes when plants or animals move into a new area they take over. Getting rid of these pests is costly and difficult, and trying to solve the problem often makes it worse. New research into feral cats underlines the importance of understanding the complex web of life before we take action.

In this lesson you will investigate the following:

- What is an invasive species?
- How do invasive species affect the ecosystems they invade?
- How can we solve the problem without causing more harm?
- What is biological control and does it work?

So sink your teeth into the lesson!



This is a print version of an interactive online lesson.

To sign up for the real thing or for curriculum details about the lesson go to <http://www.cosmosforschools.com>

# Introduction: Invasive Species



**When a cat is curled up, purring, in your lap on a cold evening, it doesn't seem much like a vicious killer.** But even the cuddliest of cats will hunt down birds, rodents and other critters if given half the chance. It's their natural instinct as predators.

Most cats these days are a long way from their original homeland in northern Africa and southern Europe. As humans have spread around the globe, we've taken them along for the ride.

We've taken lots of other animals and plants too: cows, pigs and crops for food, trees for our gardens, and even snakes, fish, spiders, insects and worms. Other species hitch a ride without us knowing, hidden in our ships or aeroplanes as stowaways.

Sometimes when a species is released into a new environment it goes viral. It might have plenty to eat – and none of the natural predators that used to eat it. This winning combination leads to a population explosion. For example, the number of wild, or feral, cats in Australia is now between 10 and 20 million! Each one is a skilled hunter that kills native birds and mammals every night. Combined with other human impacts such as the clearing of forests, this helps to push some native species to extinction.

Many ways of dealing with this problem have been tried: hunting, poisoning and even introducing new predators to catch and eat the intruders. But new research reminds us that solutions need to take into account the whole web of life in the affected areas.

Read or listen to the full *Cosmos Magazine* article [here](#).





## Question 1

**Relocate:** Imagine that you're a penguin. You and your family are stowaways on a ship leaving Antarctica but you have no idea where it's going. In which of these regions would you have the best chance of surviving and thriving, and why?

- The Sahara Desert
- The Amazon rainforest
- The Australian outback
- An island off the coast of Alaska
- The Himalayan mountains

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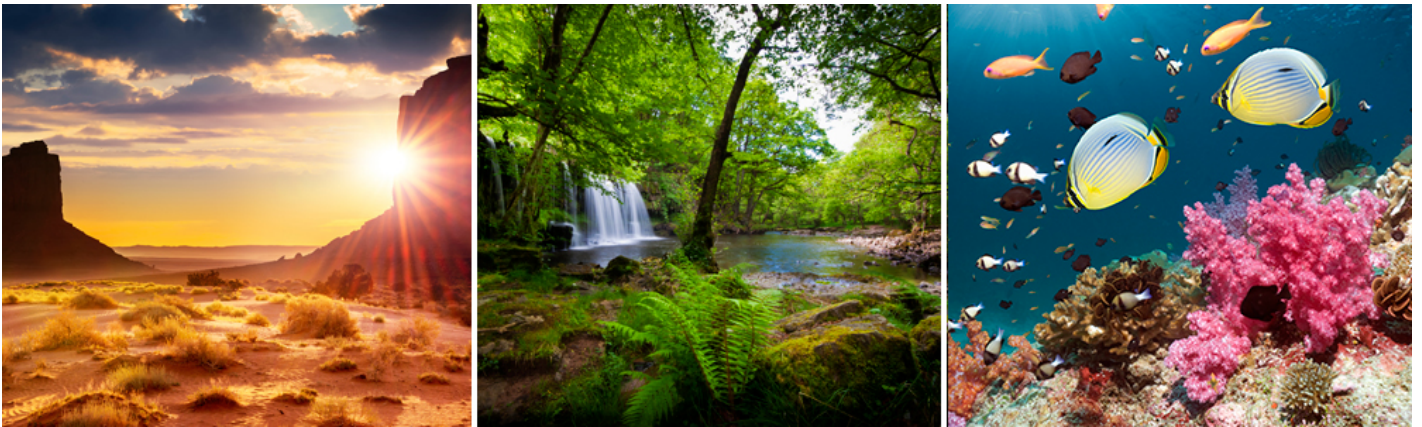
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# Gather: Invasive Species



The environments on Earth are extremely diverse and each species is adapted to do well in only some of them.

## Why worry about invasive species?

Every plant and animal species prefers to live in certain **habitats** – for example, rainforests, grasslands, deserts or shallow seas – where they can find enough food, water and sunlight to survive.

An **ecosystem** is a collection of habitats in which living things and non-living nature interact in a balanced way. Humans have negative impacts on ecosystems in a wide range of ways – by clearing forests, building cities, damming rivers and changing the climate, for example.

But introducing a new species can damage an ecosystem in very deep ways that are difficult to fix.





### Question 1

**Define:** According to the video, what makes an introduced species **invasive**?


### Question 2

**Evaluate:** Earthworms are an invasive species in North America because they till the soil and improve our ability to grow crops.

- ☐ True
- ☐ False

### Question 3

**Recall:** Features that are likely to make an introduced animal species *invasive* include (select all that apply):

- ☐ Being tasty to eat
- ☐ Reproducing very slowly
- ☐ Having a voracious appetite, eating anything in their path
- ☐ Being poisonous
- ☐ Lacking natural predators

### Question 4

**Outline:** The video describes how yellow crazy ants were introduced from South East Asia to Australia and attacked a wide range of native species, including many that are endangered.

Outline the impact of these ants on the forest ecosystem of Christmas Island and how this change came about.




Red crabs on Christmas Island.



Three examples of invasive species in the US: a boa constrictor (left), kudzu engulfing a shed (centre) and a flock of European starlings (right).



### Question 5

**Complete:** Describe how each of these invasive species were introduced to the US.

*Note: The boa constrictor invaded the Everglades, a swamp ecosystem in the state of Florida. The brown tree snake invaded Guam, a small island in the western Pacific Ocean that is a US territory.*

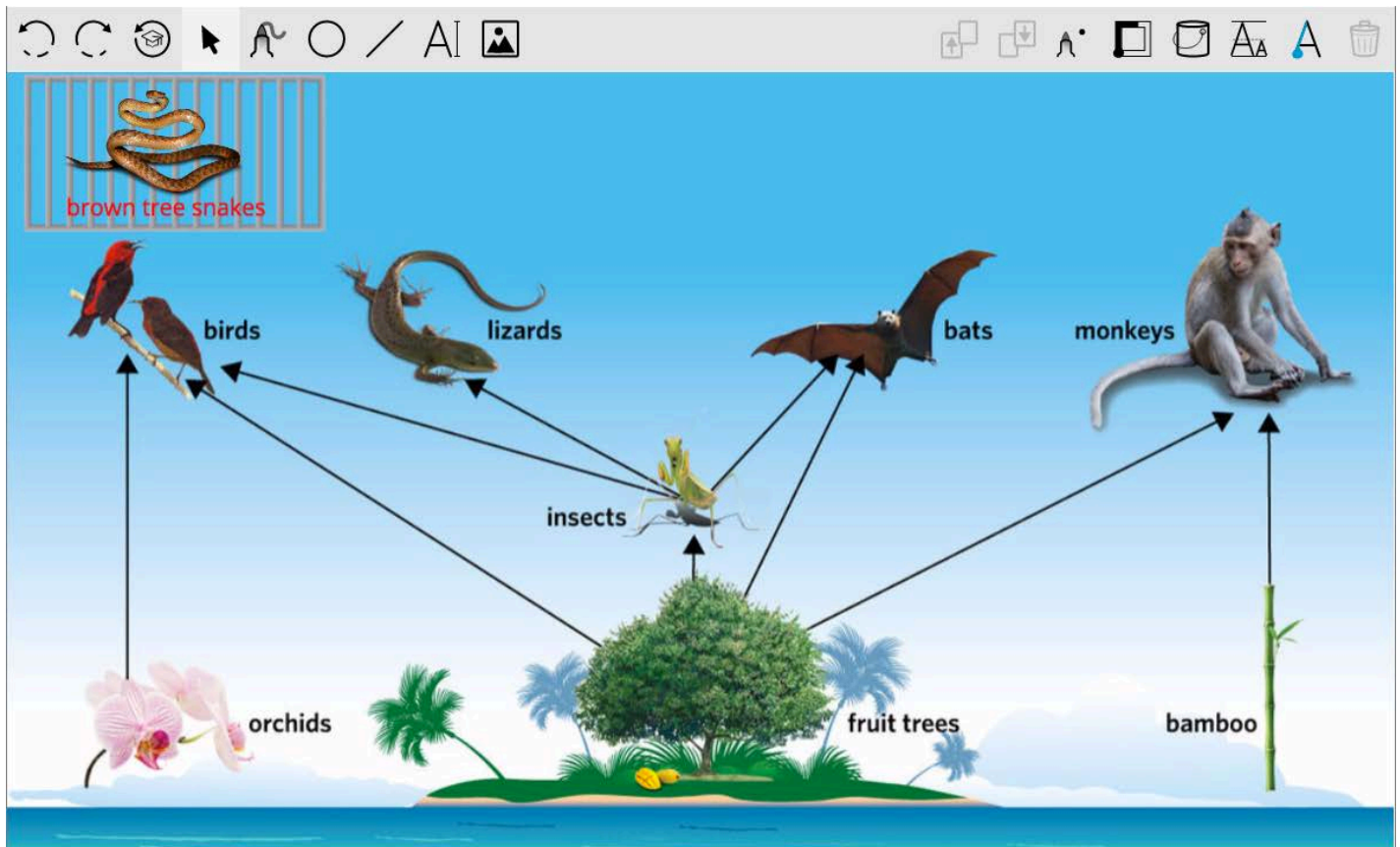
Species	Native habitat	How it was introduced to the US
European starling	Europe	
Boa constrictor	Central and South America	
Kudzu	Japan	
Brown tree snake	Northern Australia, South East Asia	

## Question 6

**Modify:** The image below shows a simplified food web for Guam's rainforest ecosystem *before* the introduction of brown tree snakes.

Modify the image to show the food web *after* the invasion:

1. Drag and drop the brown tree snake to release it from its cage as well as the label to identify what it is.
2. Draw **red** arrows to show how brown tree snakes relate to their new food web, given that:
  - They prey on all of the vertebrates shown in the web except monkeys.
  - They are **top predators**, meaning that they have no natural predators themselves.



## Question 7

**Classify: Primary consumers** are animals that eat plants, though they might also eat other things. According to the above food web, which of the following are primary consumers?

- ☐ orchids
- ☐ birds
- ☐ lizards
- ☐ bats

## Question 8

**Analyze:** According to the new food web you've created, which species do brown tree snakes compete with for food?

- ☐ monkeys
- ☐ birds
- ☐ none
- ☐ lizards



### Question 9

**Recall:** List the negative effects of the invasion of brown tree snakes on Guam, according to the video. Be sure to mention the impact of the snakes on the island's **biodiversity** – that is, the variety of different species living there.

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#### *Did you know?*

A flow-on effect of the brown tree snake invasion on Guam was an explosion of the spider population. The snakes' voracious appetite for birds, lizards and bats removed many of the spiders' natural predators from the food web.

The rainforests of Guam are now so thick with spider webs that you can't walk through them without carrying a stick to clear a path!



### Question 10

**Analyze:** Are *you* a member of an invasive species? The first video claimed that humans don't qualify as an invasive species because we don't present an ecological threat to ourselves. Do you agree? Why or why not?

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# Process: Invasive Species

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Three ways of dealing with the problem of invasive species: hunting of foxes (left), using trained dogs' keen sense of smell to detect smuggled animals and plants (centre) and using helicopters to spray or drop poisons (right).

## How to fight an invasion



**Vote:** Is parachuting poisoned mice into Guam a good way of tackling the problem of the invasive brown tree snake?

⊘ This poll is currently closed, so you can't vote

Yes, send in the mice!

No, we should look for other options.

The parachuting mice method relies on the discovery that acetaminophen – also known as paracetamol – selectively poisons brown tree snakes without presenting too much risk to native animals or the wider ecosystem.

A similar trick has been used to try to **eradicate** – that is, get rid of – yellow crazy ants on Christmas Island. The poison in this case is the insecticide fipronil. This is dropped over the island by helicopter in pellets, which the ants carry back to their gigantic colonies.

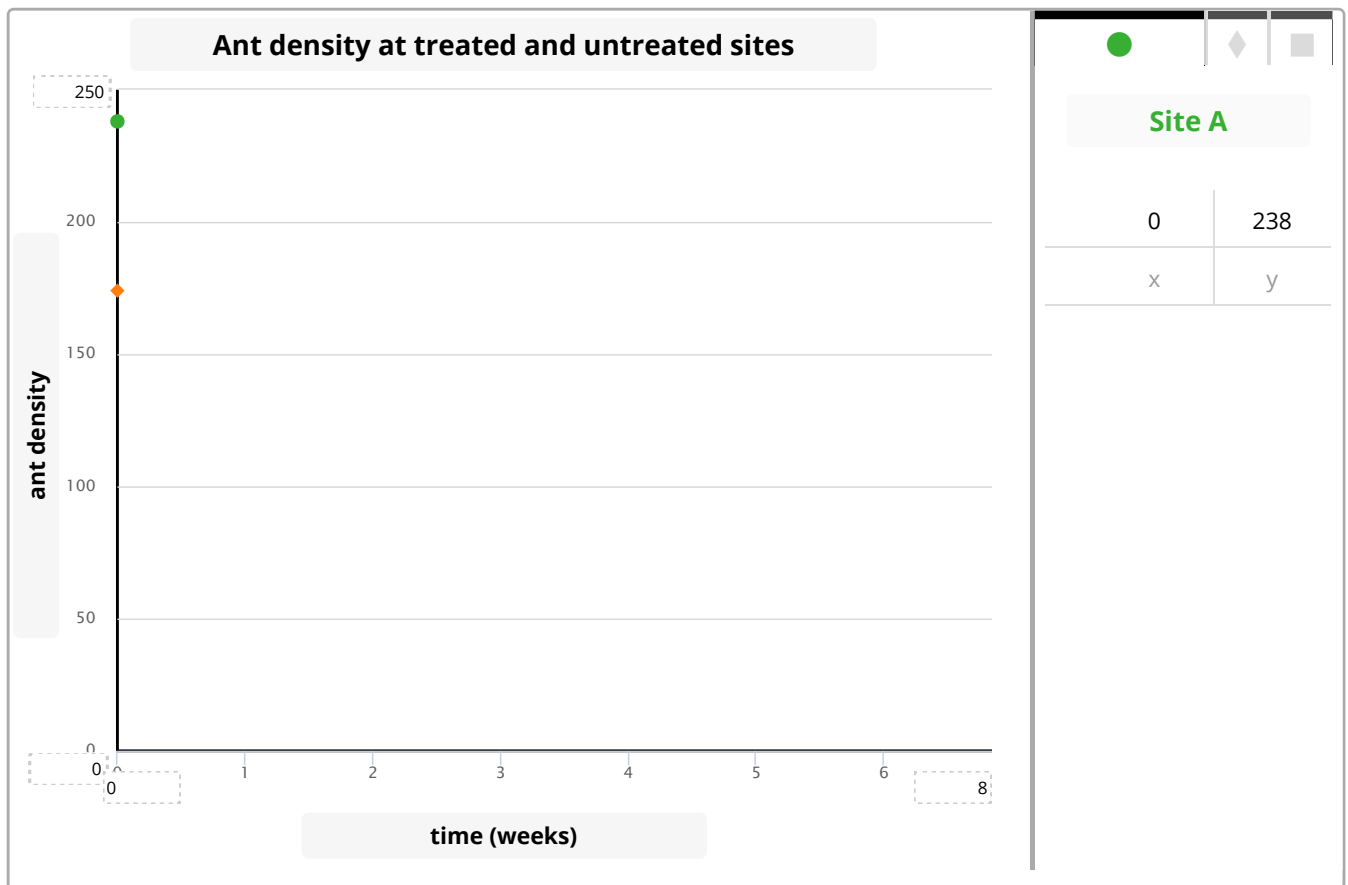
The table below shows the observed ant densities over 8 weeks for two infested sites: one treated with fipronil and one left untreated. Ant density is measured by counting how many ants crawl over a piece of card of a standard size in a set period of time.

Weeks after treatment of Site A	0	1	2	3	4	5	6	7	8
Ant density at Site A (treated)	238	41	15	12	14	10	8	7	5
Ant density at Site B (untreated)	174	122	136	98	164	199	178	145	151



### Question 1

**Plot:** Plot the ant density data in the graph below, using **green circles** for Site A and **orange diamonds** for Site B. The first two values, for the ant densities at the two sites just before treatment of Site A, are provided for you.



### Question 2

**Compare:** Describe and compare the two lines in your graph.

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### Question 3

**Evaluate:** Was the treatment effective? Do you think it will fix the yellow crazy ant problem at Site A in the long term? Why or why not?

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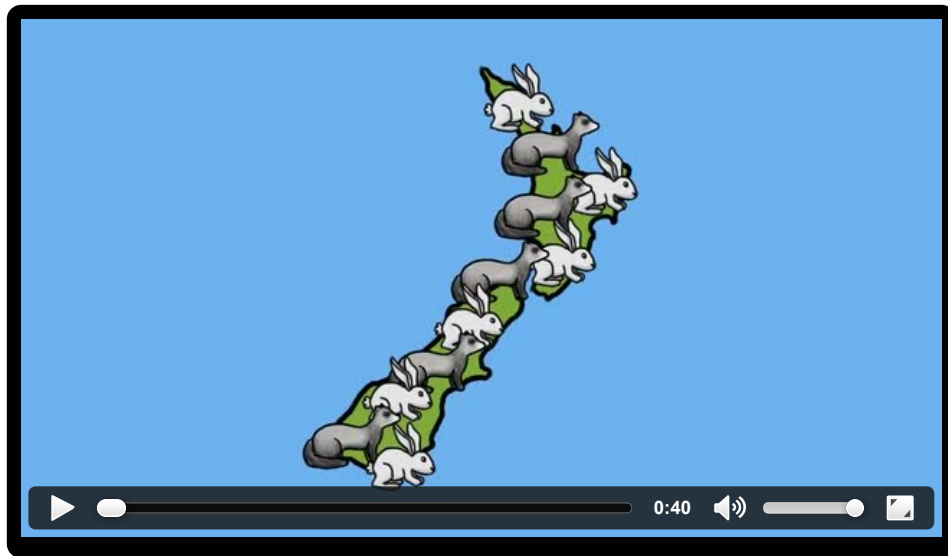
## Question 4

**Explain:** Explain why scientists also collect data at a "control" site that is left untreated rather than just measuring the change in ant density at treated sites.




Another way of dealing with an invasive species is to introduce a new species to catch and eat it. The nursery rhyme about the old lady who swallowed a fly takes this idea to an extreme!

## Biological control



As described in the video, **biological control** is the attempt to deal with an invasive species by introducing *another* species to the same area, such as the introduction of ferrets to New Zealand to deal with the rabbit invasion. There are two main ways that one introduced species can control the population of another one:

- by *preying* on it, or
- by *competing* with it for food and other resources.

To be successful, we need to understand not just the eating habits of both species but the entire food web they are embedded in. Otherwise, the new species might do even greater harm without solving the problem, just as the ferrets wreaked havoc in New Zealand by eating native birds rather than rabbits.

## Question 5

**Explain:** The kakapos mentioned in the video are one of New Zealand's flightless bird species. As they evolved, they gradually lost the ability to fly because they had no natural predators to escape from – before humans arrived with their cats, dogs, ferrets and other predators. After that the kakapo population plummeted from hundreds of thousands to about 100!

Propose an explanation for why the introduced ferrets preyed on the native kakapos and failed to control the invasive rabbits.



### Did you know?

Given the difficulty of getting rid of an invasive species once it's been introduced, a lot of effort is now directed at preventing invasions in the first place. One way of doing this is through strict customs controls at airports and ports, which might involve the use of trained dogs to sniff out animals or plants stashed in luggage.

The many bizarre cases of animal smuggling include this three-month old tiger cub discovered alongside a stuffed toy in a suitcase at Bangkok airport.

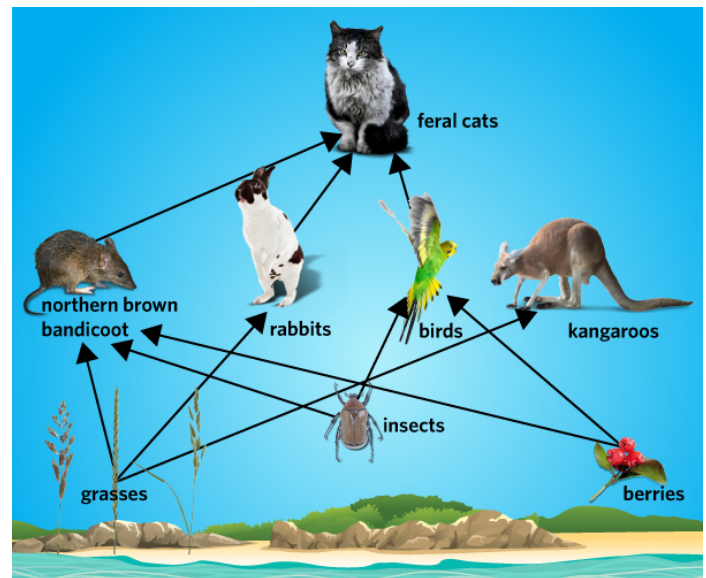
## Cosmos Student: Invasive species specialist

The local council of an island in northern Australia is trying to decide how to save the northern brown bandicoot, a small native marsupial that is threatened with extinction.

The island has been overrun by rabbits that compete with the bandicoots for food and destroy their habitat. To make matters worse, feral cats were introduced decades ago to control the rabbits but now feast on the bandicoots and native birds as well. A simplified food web for the island is shown on the right.

You've been asked to consider three options for saving the bandicoots and to decide which has the best chance of success:

1. Eradicating the rabbits by spraying poison gas into their burrows.
2. Eradicating the feral cats by laying poison pellets that specifically target them.
3. Introducing dingoes to prey on both the rabbits and the feral cats.







### Question 6

**Predict:** If you choose Option 1 and wipe out the island's rabbits the bandicoots' food supply and habitat will improve. But what negative effects might follow on from the removal of the rabbits?

*Hint: What will the feral cats eat?*

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### Question 7

**Infer:** If you choose Option 2 and remove the bandicoots' only predator then surely this will help them survive. But can you think of any negative side-effects of this course of action?

*Hint: What else did the feral cats eat?*

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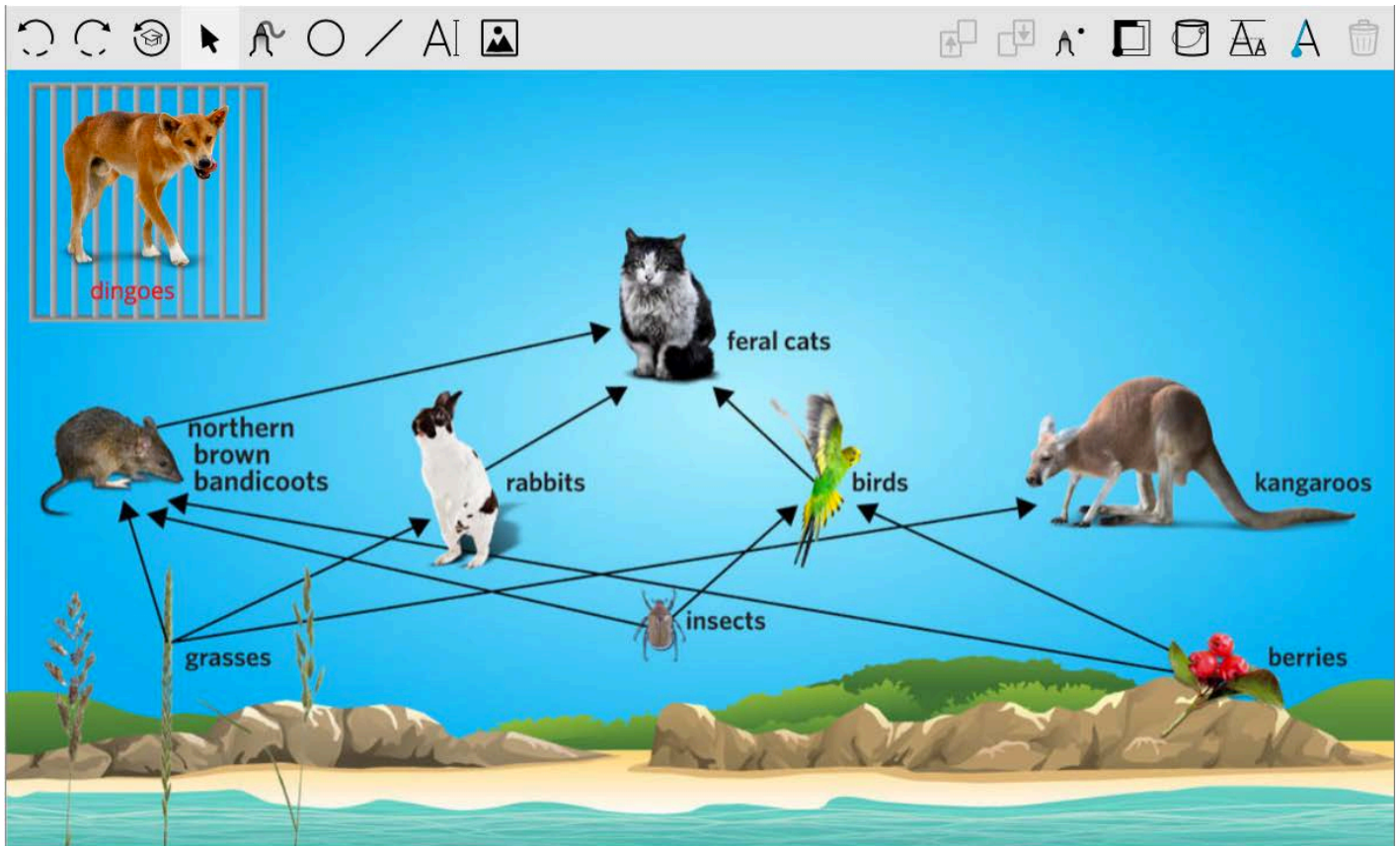
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## Question 8

**Draw:** Dingoes are top predators that will prey on cats and rabbits and they will also eat kangaroos. Modify the food web below as follows:

1. Drag and drop the dingo out of the cage area as well as the label.
2. Show how dingoes relate to the island's food web by drawing appropriate arrows in red.



## Question 9

**Conclude:** Based on your analysis of the food web and the changes you've predicted, decide which of the three options you will recommend to the local council. Note that although dingoes are not currently found on the island they are native to Australia. As natural predators of kangaroos, they help to keep the kangaroo population under control.

You can present your findings using only the text tool or construct a table, sketchpad diagram or mind map to compare the three options before making a decision.

*Note: If you have time you might like to consider combining some of the options to solve the problem.*

# Apply: Invasive Species



## Project: Investigate a case study

One of the reasons that invasive species pose such a difficult problem is that ecosystems involve incredibly complex interactions. This makes the effects of introducing a new species – or *removing* an invasive species – highly unpredictable unless we can understand the whole system.

When faced with complex problems like this, scientists often examine **case studies**. These are particular examples that are investigated in great depth with the hope of understanding the general problem better.



### Question 1

**Investigate:** Choose one of the following invasive species for your case study:

- The rabbit in Australia or New Zealand
- The Nile perch in Lake Victoria (East Africa)
- The European starling in the United States
- The American mink in the United Kingdom
- The cane toad in Australia

Carry out research to gather evidence of the impact of your chosen species on its new ecosystem and the attempts that have been made to control it. Use the project space to present your case study using both text and images, as well as graphs, tables, videos, maps or any other useful resources you find. Be sure to include the following:

1. A short description of your chosen species, including its appearance, diet and natural habitats. Include at least one image or video of the species and the habitat it lives in.
2. A summary of the effects it has had on its new ecosystem, including the plants and animals it feeds on as well as the habitat more generally. *Hint: If possible, include a food web.*
3. A summary of how people have tried to control or eradicate the species and how successful these attempts have been.
4. An argument for what you think the best solution to the problem is: hunting, trapping, poisoning, biological control or some combination of methods.



Some useful websites to get you started:

<http://www.issg.org/database/welcome/>

<http://www.environment.gov.au/biodiversity/invasive-species/feral-animals-australia>

<http://www.doc.govt.nz/nature/pests-and-threats/animal-pests/animal-pests-a-z/>

<http://www.invasivespeciesinfo.gov/index.shtml>

# Career: Invasive Species



Brought to you by Edith Cowan University

**Last year Tim Doherty found himself wandering across the arid red landscape of northwestern Australia.** Along the way, he made sure to set up a lot of traps. He was out to capture northern quolls, small mammals that live in crevices in the rocks. They are endangered because of a number of invasive species, including feral cats, foxes and cane toads.

Tim is a researcher at the Wildlife Ecology Lab at Edith Cowan University in Western Australia, where he was born and raised. He studies how native animals deal with disturbances in their habitats. Sometimes he reads and writes reports at work, but every spring and autumn he gets to work in the outback. He uses pitfall trapping to catch birds, mammals and reptiles so that he can study them.

Fires have a huge impact on native animals. Tim explores which animals are threatened the most by fires and which animals prefer fire-affected habitats. For example, feral cats are drawn to freshly burnt areas because their prey are easier to spot and hunt down there.

Tim never really thought he would end up studying wildlife. Because he enjoyed biology and geography at school, he decided to major in Environmental Science at university. During his second year there, he realized how much he liked wildlife conservation.

When he isn't busy catching critters in the bush, Tim loves gardening, camping, bush walks and going to the football.



## Question 1

**Reflect:** As you've seen in this lesson, a scientific understanding of living things and ecosystems is necessary for saving endangered species from extinction.

Imagine that you're a wildlife conservationist who is trying to save an endangered species. What scientific information would you need? How important do you think it would be to go out and observe animals and plants in their natural habitats, as Tim Doherty does?




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