**Islands &**

**Invasive Species**

Teacher Guide

Coastcare Victoria School Kit

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| Volunteering For Threatened Flora  Teacher Guide |

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Acknowledgements

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Coastcare Victoria would like to acknowledge all our video presenters and individuals who reviewed or assisted with the creation of the Coastcare Victoria School Kit.

Author

Coastcare Victoria and Ecolinc Science and Technology Innovations Centre.

Photo credit

Parks Victoria (David Paul/ Museum Victoria). <https://www.parks.vic.gov.au/news/2021/06/07/23/30/protecting-shorebirds-on-important-islands>.

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| DELWP Pupangarli Marnmarnepu ArtworkAcknowledgment  We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.  We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond. |
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Module Overview

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| --- | --- | --- | --- |
| **Activity** | **Time** | **Difficulty** | **Topic & Skills** |
| 1: Quiz | 5 min Video  15 min Quiz | **Simple** | Islands and invasive species – Gabo Island.   * Listening comprehension. |
| 2: My Favourite Place | 30 min | **Simple** | Space, place and nature.   * Reflective writing. |
| 3: Mirror Bush Identification | 30 min | **Simple** | Observable traits for identification.   * Observation and description. |
| 4: Mirror Bush Weed Map | ~30-60 min  &  30 min | **Moderate**: Multiple step activity using external resources. Outdoors. | Species identification and map drawing.   * Species identification, data collection, data visualisation on a map, and map creation. |
| Investigation 1: What Makes a Species Invasive? | 60 min | **Complex**: Using external resources. Independent learning. | Life history traits, and species invasiveness.   * Research and information gathering. |
| Investigation 2: Island Ecosystems | 30-60 min | **Complex**: Multi-step instructions. Independent problem solving. | Ecosystem traits, species distribution, and biogeography.   * Problem solving, and visualising written instructions. |

# Curriculum links

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| --- | --- | --- | --- |
| Year 5 and 6 Curriculum Area | C/ Code | Content Description | Elaboration/ Link to this lesson/ Learning intentions |
| Geography/ Geographical Concepts and Skills/ Data and information | VCGGC089 | Represent the location of places and other types of geographical data and information in different forms including diagrams, field sketches and large-scale and small-scale maps that conform to cartographic conventions of border, scale, legend, title, north point and source; using digital and spatial technologies as appropriate | Add the essential elements to a map |
| Science/ Science Understanding/ Biological Sciences | VCSSU075 | The growth and survival of living things are affected by the physical conditions of their environment | Observe traits of Mirror Bush  Learn about the life history traits of invasive species  Investigate island ecosystems and how the life history traits of a species will determine its distribution |
| Science/ Science Inquiry Skills/ Recording and processing | VCSIS085 | Construct and use a range of representations, including tables and graphs, to record, represent and describe observations, patterns or relationships in date | Record data on iNaturalist  Visualise data on a map |
| Science/ Science Inquiry Skills/ Analysing and evaluating | VCSIS086 | Compare date with predictions and use as evidence in developing explanations | Refer to data collected on iNaturalist to explain life history traits of Mirror Bush |
| Science/ Science Inquiry Skills/ Communicating | VCSIS088 | Communicate ideas and processes using evidence to develop explanations of events and phenomena and to identify simple cause-and-effect relationships | Create a labelled diagram of a weed species |

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| Year 7 and 8 Curriculum Area | C/ Code | Content Description | Elaboration/ Link to this lesson/ Learning intentions |
| Science/ Science Inquiry Skills/ Communicating | VCSIS113 | Communicate ideas, findings and solutions to problems including identifying impacts and limitations of conclusions and using appropriate scientific language and representations | Use the iNaturalist app to access observation data and make own observations |
| Geography/ Geographical Knowledge/ Landforms and landscapes | VCGGK116 | Different types of landscapes and their distinctive landforms | Identify different types of landscapes, such as coastal and mountain |

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| --- | --- | --- |
| Cross Curriculum Priorities | Content Description | Elaboration/ Link to this lesson/ Learning intentions |
| Sustainability > Futures | Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments. | Demonstrate the benefits of weed removal |
| Sustainability > Futures | Promoting reflective thinking processes in young people and empower them to design action that will lead to more equitable and sustainable future. | Demonstrate how people are connected to places and how this empowers them to feel a sense of personal ownership and responsibility, which creates stewardship |
| Sustainability > Futures | Sustainable futures result from actions designed to preserve and/or restore the quality and uniqueness of environments. | Demonstrate the work people do to improve a natural space |

## Key Themes

Biogeography, stewardship and connection to place, observable traits and species identification, cartography and mapping, life history traits, invasive species, and species distribution.

## Learning intentions

Students will:

* Understand how their personal ethics influence their connection to place and how people care for places.
* Develop skills in species identification.
* Interact with iNaturalist, a citizen science resource which provides Artificial Intelligence (AI) assisted species identifications.
* Learn that maps are more than a picture of the ground; they are made for specific purposes by following a set of guidelines.
* Study life history traits, particularly how a species may be more or less invasive in an ecosystem.
* Understand that island ecosystems have traits which make them globally unique.
* Explore how interaction between species traits and ecosystem traits determine the distribution of all life on earth.

## Success Criteria

Students are able to:

* Quantify a place which is important to them.
* Successfully identify Mirror Bush from its observable traits.
* Follow mapping guidelines to create an accurate map.
* Recognise life history traits mentioned in research material.
* Describe a new species based on life history traits.
* Research and record geographical terms.
* Draw the distribution of a species in an ecosystem based on life history and ecosystem traits.

## Background

**Restoring Gabo Island**

Twice a year, volunteers from the Friends of Mallacoota make a boat trip out to Gabo Island - located off the coast of Far East Gippsland - to rid the island of weeds. The volunteers work for a week to remove the highly invasive Mirror Bush from the rocky slopes, allowing native flora to return. The long-term goal to completely eradicate introduced plant species from the island.

This module is focused on Geography. Geography is a science which encompasses the whole world, such as natural and man-made places, and populations of all living things, including humans.

The module begins by exploring the concept of ‘place’, and what makes different places special to different people. Also, how people care for places that they are connected to through stewardship.

Species identification is a necessary skill for observing organisms and studying their distribution in the world. All living things have a set of observable traits, such as size, colour and shape. When these traits are considered in combination, they build up into a set of characteristics which describe a species and set it apart from all other species. iNaturalist is a citizen science program which facilitates species identification through ‘community experts’ and Artificial Intelligence (AI) image recognition. iNaturalist also creates global maps of species records. This allows for the collection and display of large amounts of high-quality data so that communities and scientists can study that data.

The purpose of a map is to simplify and represent complex spatial information. Maps provide a means to understand the physical and cultural features of a region. Maps collate geographical data, such as landforms and cities, also boundaries like national parks and countries. Due to the large amount of information compression, maps have specific design elements which they use to translate the real world into a visual representation.

In the same way that individual organisms are categorised by their traits, groupings such as invasive and non-invasive species, and even ecosystems, are also categorised using traits. Understanding these categories allows scientists to predict how organisms will interact with their environment. For example, a weed or invasive species being dominant in their habitat due to having more competitive traits. The interaction between species traits and ecosystem traits are part of what determines a species’ geographical distribution (where a species can and cannot live).

## Resources

* Video: Islands & Invasive Species
* Presentation Slides: Islands & Invasive Species
* Teacher Guide: Islands & Invasive Species
* Answers: Islands & Invasive Species
* Worksheets: Islands & Invasive Species
  + Quiz
  + My Favourite Place
  + Mirror Bush Identification
  + Mirror Bush Weed Map
  + Investigation 1: What Makes a Species Invasive?
  + Investigation 2: Island Ecosystems
  + Islands and Invasive Species Review Questions
* Islands and Invasive Species Glossary

## Extra links

* [iNaturalist home page](https://www.inaturalist.org)
* [Coastcare School Kit Mirror Bush Map project page](https://www.inaturalist.org/projects/coast-care-school-kit-mirror-bush-map)
* [National Geographic lesson for Year 7/8 on essential elements of a map](https://education.nationalgeographic.org/resource/map/)
* [Short video on recursive islands/lakes by Geomargin on Youtube](https://www.youtube.com/watch?v=YaBy5fLUsCc)

# Module

## Activity 1: Quiz

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| --- | --- | --- | --- |
| **Topic** | **Time** | **Difficulty** | **Skills** |
| Islands and invasive species – Gabo Island | 5 min Video  15 min Quiz | Simple | Listening comprehension |

After watching the video complete the quiz.

*\*Completed quiz (and all answers) are available in the accompanying answer booklet.*

## Activity 2: My Favourite Place

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| **Topic** | **Time** | **Difficulty** | **Skills** |
| Space, place and nature | 30 min | Simple | Reflective writing |

**Visiting and volunteering are great ways to build your connection to a place. People spending time to care for a place they love, like we have seen on Gabo Island, is called stewardship. Hands on involvement helps to build a deeper connection to a place and empowers people to feel a sense of personal ownership and responsibility. These feelings are both elements of stewardship which might motivate you to improve, promote or protect a place that you care about. Keep in mind, two people might be motivated to protect the same place for completely different reasons.**

In this activity students will read quotes from the Friends of Gabo Island video, about why they love volunteering on the island. Students will gain an understanding of the different motivations by re-writing them in their own words. Students will then explore their own motivations by ranking the quotes from most to least important, according to them. Have students compare responses with a peer or explore the similarities and differences in your class motivations. Remembering that different motivations for the same outcome are equal.

Student worksheet provocation: “Think of a place which makes you feel the same way that the Coastcare volunteers feel about Gabo Island. It might be your backyard, favourite park, beach or national park. It does not have to be a natural place. People also feel connected to their home, school, neighbourhood, or places like the museum. Connection to a place makes people feel good about being there and responsible for protecting and improving their favourite place.”

Next, students can answer the Activity 2 questions about their favourite place.

## Activity 3: Mirror Bush Identification

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| **Topic** | **Time** | **Difficulty** | **Skills** |
| Observable traits for identification | 30 min | Simple | Observation and description |

**Every living thing has a list of traits which define them and set them apart from their closest relatives. One trait may not be enough for an accurate *species* identification. For example, most plants have green leaves. A set of observable traits which define a species are known as a *phenotype*, essentially, what a species looks like. Learning a list can seem daunting, but the brain very quickly learns to recognise the whole (*phenotype*), instead of each part. Your students already know how to recognise many plants from their unique combination of traits, such as a Christmas tree, palm tree and gumtree.**

**iNaturalist has become a popular tool because it has two types of support for identifying species. Users can upload photographs and AI image recognition will offer initial species identification (ID) based on similar images and location. This is followed up by certified users who use their expertise to confirm the AI species ID.**

\**You can prime your students on the concept of observable traits using the cats and dogs table in the slide deck* [Slide 5]*.*

In this activity students will view the Mirror Bush Identification slide in the slide deck [Slide 6] (or you can provide real foliage for them to study) and use their observations about the plant to answer the Activity 3 questions on their worksheet. Once they have written their own description of the traits which identify Mirror Bush, compare their answers to the official weed ID slides [Slides 7,8,9].

Now that your students know how to identify Mirror Bush, consider testing their skills by contributing to the Coastcare School Kit Mirror Bush Map on iNaturalist.

[<https://www.inaturalist.org/projects/coast-care-school-kit-mirror-bush-map>].

* 1. Download the iNaturalist app, (it’s free) and make an account.
  2. Go to the ‘Coastcare School Kit Mirror Bush Map’ project page, click on ‘Join this Project’ in the top right-hand corner, and follow the steps as prompted.
  3. Once you are a project member, anytime you ‘Add an Observation’ that is Mirror Bush (*Coprosma repens*) within Australia, that observation will automatically be added to the project.
  4. Take a class walk around the block or along the foreshore and add your observations of Mirror Bush to iNaturalist using your device (iPad/smart phone and camera). [Slides 10, 11] The app has AI image recognition which will help you confirm your plant ID.
  5. Once your observations are uploaded, your class can see their data on the Mirror Bush Map (desktop version is best).

## Activity 4: Mirror Bush Weed Map

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| **Topic** | **Time** | **Difficulty** | **Skills** |
| Species Identification  Map drawing | ~30 - 60 min  30 min | Moderate: Multiple step activity using external resources. Outdoors. | Species identification, data collection, data visualisation on a map, and map creation |

**A map is more than just a picture of the ground. A map is a symbolic representation of the Earth, designed to present information in a simplified way. Mapmakers, called cartographers, create different maps for different needs. When you’re on holiday you need a small local map which shows footpaths to the beach. City planners, for example, decide where to put hospitals and parks using maps of housing density and population.**

**We can turn a picture into a map using DOGSTAILS: this is an acronym to remind us of all the essential information that a map must include to be truly accurate and useful.**

Date – The map was made tells us if it is current or maybe out of date.

Orientation – North point diagram tells you which way is North.

Grid – A global (longitude/latitude) or local (A/1) grid system to assist finding places on the map.

Scale – A scale bar converting distance on the map into distance on the ground. \*The grid is often scaled to be used for measurement where one grid square on the map = 1km on the ground.

Title – Indicating what the map is and is not designed for.

Author – Who made the map can influence its accuracy.

Index – A list of locations shown on the map, and the grid reference used to find them.

Legend – A list of icons used on the map and what they mean in real life (bridge, gate, school).

Sources – The data that the map is based on influences its accuracy.

In this activity, your students will take a picture of the Earth and transform it into a technically accurate map.

1. Teach your class about each of the essential map elements using the DOGSTAILS acronym; either by:
   1. Using the ‘Spot the Difference’ slide [Slide 12], and Activity 4 on the worksheet.
   2. EXTENSION: Have your students read a short description of each map element in this National Geographic lesson <https://education.nationalgeographic.org/resource/map/>
2. Print out a screen shot of your region of the Mirror Bush Map from the iNaturalist project page. Give one to each student to draw the missing map elements onto.

## Investigation 1: What Makes a Species Invasive?

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| --- | --- | --- | --- |
| **Topic** | **Time** | **Difficulty** | **Skills** |
| Life history traits, and species invasiveness | 60 min | Complex: Using external resources. Independent learning. | Research and information gathering |

**Life history traits is what makes a species invasive.**

**A species' life history is the pattern of life cycle processes, including growth, development, reproduction, and death. Some life history traits include the age or size of a plant when it can reproduce, how many flowers, fruits and seeds it produces, how long the plant can live for, and the kind of stressors that the plant can tolerate without dying.**

**Mirror Bush is native to New Zealand where it has adapted to grow along harsh, rocky coast. It is well suited to Australia’s coasts, and it grows here like a weed. Mirror Bush is an invasive species in Australia.**

Introduce your class to invasive and non-invasive life history traits in the slide deck [Slide 13, 14], and the background information below.

Reproduction & Growth Rate

Plants and animals which grow quickly and have a fast (high) reproduction rate will fill the landscape and outcompete ones which grow and reproduce slowly.

Examples:

* Fast: Rabbits produce many kits in a litter, and can have 7-8 litters a year, starting when they are four months old.
* Slow: Humans can produce about one baby a year.

Damage

Some organisms are weak, delicate and easy to damage. If they get damaged, they do not grow and reproduce. Whereas other organisms are the opposite and can even benefit from damage.

Examples:

* Strong: Some lizards can regrow their tail and spiders can regrow legs if they are pulled off by a predator. Starfish and cacti can regrow a whole new body/plant from pieces that are cut off! They spread and reproduce when they are cut up (an elephant definitely cannot do that).
* Weak: Many trees can grow new leaves if a herbivore eats some, but cannot regrow if their trunk is cut down.

Food & Habitat

The more abundant your food and habitat is, the more abundant an organism can become. Either you eat one thing that is very abundant, like grass, or eat many different things so you always have options available.

Examples:

* Many: Pigeons can eat plants, grains and meat from the wild or from human food scraps in cities. Oscar the Grouch eats garbage and lives in garbage, meaning he can live everywhere! In addition, organisms which can tolerate a wide range of temperature or soil conditions, have more places that they can grow.
* Few: Swift Parrots only drink nectar from specific flowering gum trees and are limited by the number of food trees. While the Cookie Monster only eats cookies, he could only live near bakeries or supermarkets.

**Research life history traits**

Your students will find information on the life history traits of Mirror Bush on the iNaturalist Coastcare Mirror Bush Map project page [Slide 15].

* Direct them to read the observations notes made by user ‘MirrorBushMaster’ to help them complete Table 1 on their worksheet.
  + *You can break the class into research groups or break the observations into sub-groups (Tasmania and Warrnambool) to reduce the task size*.
* Confirm student answers using the slide deck^ [Slides 16-20].

**Create a new weed species**

Students flip a coin to determine High or Low weediness for each of the five life history traits in Table 2 on their worksheet.

*^As you share each of the five answer slides showing Mirror Bush life history traits* [Slide 16-20]*, students can flip a coin to select their weediness (High/Low) in Table 2 on their worksheet.*

Students then create a description (a character profile) of their new species. Drawings, maps or narrative writing may help.

*\*Students can test their species’ invasiveness by looking at the island worksheet from Investigation 2 and drawing how wide their weed will spread into the different habitats on the Island. This can also be done at the end of Investigation 2.*

## Investigation 2: Island Ecosystems

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| --- | --- | --- | --- |
| **Topic** | **Time** | **Difficulty** | **Skills** |
| Ecosystem traits, species distribution, and biogeography | 30-60 min | Complex: Multi-step instructions. Independent problem solving. | Problem solving, and visualising written instructions |

**Islands are small pieces of land (smaller than continents) which are surrounded by water. The largest island, Greenland, is three times smaller than the smallest continent, Australia. Being small and isolated are two traits of islands which also influence the plants and animals which live there. The smaller an island is, the more difficult it is for plants and animals to live there, so only the strongest will survive.**

Referring to the picture of Gabo Island in the slide deck [Slide 21] (or live on Google Maps), explain the following geographical traits of islands to your class.

Small islands:

* Are exposed to a lot of salt from the ocean. Too much salt can poison plants and animals.
* Have very sandy or rocky soil which has less nutrients and holds less water for plants to grow.

Without good water and soil less trees can grow, offering less shade, therefore only very sun and wind tolerant plants will grow. This means that any plant or animal which can live on an island is very hardy, can tolerate very difficult conditions, and are also very difficult to kill/remove. For example, invasive animals like rats and rabbits, and plants like Mirror Bush.

However, an Island is protected from re-invasion. Like a castle, an island has a moat made of sea water. The water prevents most plants and animals from ever reaching the island. So, if volunteers and researchers can work hard and remove an invasive species completely, it is highly likely the island will remain free from the invader forever.

**Island Similes**

There are other ecosystems on Earth, which are isolated like islands, although isolated in different ways. Students use a search engine to help them complete the Island Similes table on their worksheet.

Just for fun: Use Google Maps to visit Yathkyed Lake, on the Inuit lands of Nunavut, Canada. Where you can zoom in on an island, which has a lake, which has an island, which has a lake. *These are called recursive islands and lakes.* [Watch this short, informative video on recursive islands by Geomargin](https://www.youtube.com/watch?v=YaBy5fLUsCc) on YouTube.

**Species Distribution Mapping**

**The combination of a species’ life history traits and ecosystem traits determine where a species can live, and its distribution (also called its range).**

Test your students’ understanding of life history traits and island ecosystems using the species distribution map slides [Slides 22-30].

1. On the student worksheet, there is a blank map for each student to draw the species distributions onto. The answer booklet includes a map with all of the distributions illustrated.
2. Make sure your students understand the different habitats on the island and how they will impact habitation. For example, beaches are exposed to sun and salt, and they will be hotter and drier than the forest, which is shaded by trees.
3. Introduce the imaginary species to the island using the slide deck [Slides 23-28]. Read out the species life history traits. These should inform the students where to draw the outline of the species range on the island map. Confirm their answers using the slide deck.
4. **Extension**: Blue range - this is a forest and mountain habitat [Slide 29]. Students can create a species which would occupy the blue range illustrated. It will prefer shaded forests and cool mountain temperatures and will avoid the exposure to the ocean and high temperatures of the coast.
5. **Extension**: Students can experiment with introducing their weed species from Investigation 1 to the Island. Is your weed species successful? Is it invasive?

## Review Questions

Students answer the Islands and Invasive Species Review Questions on their worksheet.

## Glossary

**AI image recognition**: Technology that identifies and classifies objects or organisms in images using artificial intelligence algorithms.

**Habitat**:The natural environment where a particular species lives and thrives, characterized by specific geographical and biological features.

**Herbivore**: An animal which only feeds on plants.

**Invasive**: An organism in a context where it is highly competitive in an ecosystem and is able to establish and outcompete native organisms.

**Litter**: In this context, a group of baby rabbits all born together, ‘a litter of rabbit kits’.

**Longitude/latitude**: Geographic coordinates used to specify locations on the Earth's surface. Latitude measures distance north or south of the equator, while longitude measures distance east or west of the Prime Meridian.

**Nectar**: A sweet liquid food for animals, created by flowers on plants.

**Non-invasive**: An organism which is not highly competitive in an ecosystem and is less likely to establish or compete with native organisms.

**Outcompeting**: All organisms in an ecosystem compete for limited resources. A highly competitive organism is one which can monopolise more resources and outcompete other organisms.

**Phenotype**: The typical physical appearance of a species which is the combination of their observable physical traits.

**Recursive Island/ Lake**: When an island has a lake on it with an island within, or the reverse.

**Region**: In geography, a region refers to an area on the Earth's surface that is defined by certain characteristics, such as physical features, climate, vegetation, human activities, cultural traits, or administrative boundaries. Regions can vary in size and scale and are often studied to understand spatial patterns and relationships within and between areas.

**Reproduction**: In biology, reproduction is the process by which organisms produce offspring, and create the next generation.

**Species**: The basic unit of classification which sorts plants and animals into groupings based on similarities. Each species is a group of individuals able to breed among themselves, but not breed with the organisms of another species.

**Species distribution**: The geographical area or range where a particular species can be found in nature.

**Stewardship:** Is the responsible management and care of resources, often with a focus on sustainability and long-term preservation.

**Trait**: Observable features of an organism which can be used to tell one species apart from the next.

**Weed**: A plant with life history traits which allow it to grow out of control, or outcompete other local plants.