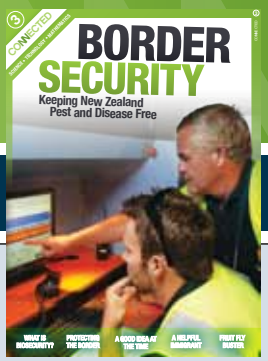
What Is Biosecurity?

by Andrew and Anna Dickson

CONNECTED 3
SCIENCE • TECHNOLOGY • MATHEMATICS



Overview

This article introduces the concept of biosecurity and explains how, as a group of isolated islands, New Zealand developed a unique range of ecosystems. The arrival of plants or animals from other countries could be disastrous for our environment. Therefore, our borders are constantly monitored by biosecurity agencies to protect our environment, agriculture, and our health.

Curriculum context

SCIENCE

LIVING WORLD

Ecology

Achievement objective

L3 and 4: Students will explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

Key idea

- In order to thrive, every living thing has particular requirements in terms of water, light, temperature, and other environmental factors.

Learning goal (to be shared with your students)

In this activity, we are learning:

- to define what is meant by the term ecosystem and explain how easily it can become unbalanced.

Evolution

Achievement objective

L3 and 4: Students will explore how the groups of living things we have in the world have changed over long periods of time and appreciate that some living things in New Zealand are quite different from living things in other areas of the world.

Key idea

- Plants and animals have evolved uniquely because of New Zealand's geological history. Many of our animals lived for millions of years without any natural predators. They adapted to this ecosystem and shed defence mechanisms such as flight.

Learning goal (to be shared with your students)

In this activity, we are learning:

- to describe the features of a habitat
- to explain how changes to a habitat can require animals and plants to adapt
- to identify a dominant plant growth and insect type within an area and describe the habitat supporting that life form.

Nature of science

Achievement objective

L3 and L4: Students will identify ways in which scientists work together and provide evidence to support their ideas.

Key idea

- Scientists develop and debate new ideas.

Learning goals (to be shared with your students)

In this activity, we are learning:

- to consider alternatives and use evidence to justify our explanations.

MATHEMATICS AND STATISTICS

NUMBER AND ALGEBRA

Number strategies and knowledge

Achievement objectives

L3. Students will use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.

L4. Students will apply simple linear proportions, including ordering fractions.

Key idea

- It's often difficult to understand what large numbers signify, so it can be useful to interpret them graphically or compare them to another known quantity.

Learning goals (to be shared with your students)

In this activity, we are learning:

- how to represent chronological events on a timeline
- how to compare large numbers using percentages.

GEOMETRY AND MEASUREMENT

Measurement

Achievement objectives

L4: Students will use appropriate scales, devices, and metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time.

L3 and L4: Students will convert between metric units, using whole numbers and commonly used decimals.

Key idea

- Working out how things happen in the real world can be difficult. However, if we use appropriate mathematical tools, we can model a situation and then make predictions.

Learning goal (to be shared with your students)

In this activity, we are learning:

- how to simply model and graphically represent the way infections spread or organisms grow.

ENGLISH

READING

Ideas

Achievement objectives

L3: Students will show a developing understanding of ideas within, across, and beyond texts.

L4: Students will show an increasing understanding of ideas within, across, and beyond texts.

Indicators

- L3: Makes meaning of increasingly complex texts by identifying main and subsidiary ideas in them.
- L4: Makes meaning of increasingly complex texts by identifying and understanding main and subsidiary ideas and the links between them.

Language features

Achievement objectives

L3: Students will show a developing understanding of how language features are used for effect within and across texts.

L4: Students will show an increasing understanding of how language features are used for effect within and across texts.

Indicators

- L3: Identifies oral, written, and visual language features used in texts and recognises their effects.
- L4: Identifies oral, written, and visual language features used and recognises and describes their effects.
- L3 and L4: Uses an increasing vocabulary to make meaning.

The Literacy Learning Progressions

The relevant knowledge skills and attitudes for students at this level are described in the The Literacy Learning Progressions.

Suggestions for providing literacy support for the key ideas

The following strategies will support students to engage with the ideas and information as they use the text for particular curriculum purposes.

The *Connected* series includes a range of texts that provide opportunities for students to locate, evaluate, inergrate, and synthesise information and ideas.

It is expected that students will read across the range of texts in this *Connected* to develop their literacy skills and their understanding of the topic.

Text characteristics

- Contains some non-continuous text
- Abstract ideas – particularly biosecurity and biodiversity
- Technical and subject-specific vocabulary related to the topic – usually supported by text and visual features
- A variety of sentence structures, some with several clauses
- Subheadings, photographs, a text box, and a map to support the text.

1. FINDING THE MAIN IDEAS

This article discusses two complex concepts, biosecurity and biodiversity. The introduction and the text box on page 3 provide students with background information that will support them as they learn about biosecurity.

The main ideas in the text include:

- New Zealand has laws to protect and preserve its unique environment from diseases and pests.
- Separation from other land masses resulted in its unique pest-free environment.
- Our horticultural and agricultural industries are important for New Zealand's economy.
- Foot-and-mouth disease would have a serious impact on the economy.
- New Zealand could be at risk from diseases that affect people.
- We have a top-class biosecurity system.

MODEL the process of thinking aloud to show how to scan the headings, photographs, and map in order to gain an overview of the text.

The title is a question, so I know that the text will contain information that tells me what biosecurity is. I need to evaluate the information as I read to see if it is related to the title question. I notice that information about biodiversity is introduced early in the article, so that's a clue that it's an important idea. What questions can you ask as you read to evaluate whether the information is related to the title question?

Before reading, **ASK QUESTIONS** to help the students find key words in the headings and paragraphs in order to build their understanding of the main ideas and information.

What theme comes through in the headings and visual information?

What key phrases and information provide more information in relation to the headings?

What picture are you building of biosecurity issues in New Zealand?

2. DEALING WITH UNFAMILIAR VOCABULARY

IDENTIFY any challenging vocabulary. Preview the text by asking the students to:

- identify the information provided by the photos, map, and text box
- brainstorm the topic
- match words and definitions related to the topic.

EXPLAIN how the students can use their prior knowledge about their understandings of biodiversity and biosecurity.

What have you read or seen on TV that might help you work out what these words mean and the difference between them?

To work out the meanings of "biosecurity" and "biodiversity", use your knowledge of the prefix "bio". What does "bio" add to your understanding of "security" and "diversity"? As you read, look for the connections between biodiversity and biosecurity.

MODEL for the students how reading on and using context clues can help them work out the meaning of unfamiliar vocabulary.

3. USING THE MAP TO MAKE INFERENCES

Tell the students that maps and charts often provide more detailed information in non-fiction texts.

Do a **THINK-ALOUD** to explain how the map on page 4 provides precise information about the extent of didymo in the South Island.

The text provides information about when didymo was first discovered. It then states that it has spread to many rivers in the South Island. I can see from the map exactly where it has spread. This has surprised me. I can combine this information with the facts to get a better understanding about the spread of didymo.

ASK QUESTIONS to support the students to use the map and integrate information as they read.

Why is only the South Island shown on the map?

What can we conclude about didymo from the red dots and blue squares?

What can we infer about the problems of containing didymo? How does the map help us infer this?

What do we need to do next time we see a map in a non-fiction text?

Exploring the science

The following activities and suggestions are designed as a guide for supporting students to develop scientific understandings as they explore how living things adapt to environmental changes.

Key ideas

- In order to thrive, every living thing has particular requirements in terms of water, light, temperature, and other environmental factors.
- Plants and animals have evolved uniquely because of New Zealand's geological history. Many of our animals lived for millions of years without any natural predators. They adapted to this ecosystem and shed defence mechanisms such as flight.
- Scientists develop and debate new ideas.

Begin by reading "What Is Biosecurity?". Have a discussion about continental drift. On a geological map, show how New Zealand separated from Australia and Antarctica. You could show the students a video on the early geological history of New Zealand. A good example is at:

- www1.teachertube.com/viewVideo.php?title=Geological_History_of_New_Zealand&video_id=115501

Evolutionary factors that affected the development of plant and animal life in New Zealand were:

- isolation – after breaking away from Gondwana, New Zealand became isolated and developed its own unique ecosystem
- alpine development – many New Zealand plants and animals evolved in the South Island after the Southern Alps developed and created new climates and habitats
- ice ages, which caused sea levels to drop hugely. At times, the North and South Islands were joined and forests retreated.

Activity 1: *What is an ecosystem?*

Explore the term "ecosystem" with the students. Introduce a scenario that has only a few living things. For example, a field with grass growing on it; a simple insect eats the grass; a rodent then eats the insect.

This scenario might seem harmonious, but what if it doesn't rain and the grass doesn't grow? Or what might happen if birds arrive and eat the same insects as the rodents? Or if the land rose and created a steep slope, then the soil was washed away leaving bare rock?

Guide the students to the understanding that an ecosystem is a community of living things, such as plants and animals, as well as the landscape and the climate, which interact and are interdependent.

Think about the ecosystem in New Zealand a million years ago. How many flesh eaters were there then? So what happened to the ecosystem when predators such as cats arrived?

Activity 2: *Exploring a habitat*

During this activity, it's important that students organise and record their findings and thoughts in order to identify patterns in the behaviour or characteristics of living things. You could discuss the way Charles Darwin recorded his observations and questions in diaries and notebooks during his research into evolution and ecology.

Before beginning the activity, make sure that the students understand what a habitat is – a place where an organism lives. Most plants and animals are only able to survive in places where they are suited to the conditions. For example, earthworms live in damp soil and have delicate, moist skin. Organisms living in drier habitats, such as beetles, have thick, hard shells to keep their skin from drying out.

Divide the class into small groups. Give each group:

- string
- a metre stick or measuring tape
- a magnifying glass
- a trowel or stick
- paper
- a pencil.

Identify different areas around the school, such as a constantly sunny patch, shady patch, damp place, and dry place. Assign an area to each group. Have the students do the following:

- Use the string to mark out a 1 metre by 1 metre square in their area.
- Use the magnifying glass to examine the ground. Write down everything they see, for example, grasses, loose dirt, leaves, weeds, insects.
- What is the dominant plant, for example, moss or grass? How much of the area does the plant cover, for example, a quarter, half, almost all?
- How many insects or animals are there?
- Dig carefully into the soil with the trowel or stick. Notice the layers in the soil. Describe the soil, for example, wet, dry, sandy, rocky, and/or clay-like. List everything they find in the soil from earthworms to rocks.

Ask each group to report their findings to the class. Highlight the similarities and differences between each habitat. Ask questions such as:

What insects and other animals are living in the wet soil?

What plants are living in the shady area?

Activity 3: *Why and how do organisms multiply? What endangers this process?*

In this activity, the students will grow some simple organisms. The survival of any community depends on the habitat.

Equipment needed:

- Petri dishes or shallow jars with lids
- agar powder (available from health shops or online)
- insulation tape.

Before the activity, prepare an agar solution and put it in the Petri dishes or the jars. Leave it to set overnight. Allow the students to infect the agar by touching it, placing a hair on it, or licking a finger and wiping their saliva across it. Seal the Petri dishes or jars with the insulation tape and leave them in a warm place for several days.

Observe the bacteria (don't open or unseal the dishes or jars) and record their growth using sketches. Estimate the increase in bacteria every day. Do the bacteria keep growing?

Discuss the features of the habitat that cause the bacteria to grow. What limitations does the habitat have? Discuss how a change in such features as food supply, air, temperature, water, light, terrain, and threats such as predators may affect an organism and its growth.

Repeat this experiment but place the Petri dishes or jars in different habitats. How does this affect the growth of the bacteria?

MINISTRY OF EDUCATION RESOURCES

- *Connected* 3 2006, "The Secret Life of Estuaries"
- *Connected* 1 2007, "A Trip to Nīkau Cave"
- *Connected* 2 2007, "The Good, the Bad, and the Ugly"; "The Invasion"
- *Connected* 2 2009, "The Magic of Science"; "Double, Double, Toilet Trouble!"; "Dead Pigs with Maggots, Please!"

FURTHER RESOURCES

- www.aboutdarwin.com/
- http://sci.waikato.ac.nz/evolution/NZevidence.shtml#
- www.sciencenewzealand.org/biosecurity
- www.nzonscreen.com/title/moas-ark-1990/series

Exploring the mathematics

This article refers to large numbers. For such numbers to have meaning, students need to compare them with something they understand. The article also discusses the spread of colonies or infections. This results in some intriguing mathematics known as exponential growth.

Key ideas

- It's often difficult to understand what large numbers signify, so it can be useful to interpret them graphically or compare them to another known quantity.
- Working out how things happen in the real world can be difficult. However, if we use appropriate mathematical tools, we can model a situation and then make predictions.

MATHEMATICAL IDEAS AND LANGUAGE

- Vocabulary (cost, predict, spread)
- Units (centimetres, metres)
- Common fractions (one-quarter, one half, three-quarters)

FOCUS QUESTIONS

- What percentage of rivers in an area in the South Island are infected with didymo? You will find this information on the following website:
  www.didymosamplesdb.org.nz
  Username: didymo
  Password: didymosamples1
  Search using the "Sites" tab and choose an area.
- The government spends $300 million every year on biosecurity. Why does it spend so much?
- How much money does agriculture earn for New Zealand every year? What percentage of the total earnings of the country is this?
  See: www.fedfarm.org.nz/about_us/farmingfacts

ACTIVITIES

Activity 1: *How old is old?*

The article states that New Zealand finally seperated from other land masses around 83 million years ago. How can you help your students gain an appreciation of what this means?

You could do the following activity, or you could discuss the difficulties of doing it because of its immense scale.

Create a timeline by joining sheets of flip chart paper. Choose a scale, for example, 10 centimetres to represent 1 million years. For this you will need $10 \times 83 = 830$ cm = 8.3 metres of paper!

Research as many species as possible to find out how long ago they evolved. Plot them on the timeline. Other events such as eruptions of Mount Ruapehu could be recorded too.

The interesting part will be when you try to plot modern events, such as humans inhabiting New Zealand. If an estimate of 1000 years is used, how far back from the end point of the line should this event be marked?

$$\frac{1000 \text{ years}}{83\,000\,000 \text{ years}} = \frac{1}{83\,000}$$

Wow! We are looking for this fraction of 10 cm! The human eye wouldn't be able to distinguish it from the end point that represents today!

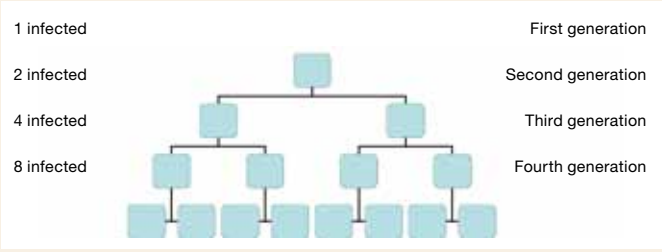
Activity 2: *How fast does infection spread?*

The article explains the rapid spread of the H1N1 virus and foot-and-mouth disease. Discuss what happens when a student catches flu in winter. Approximately how long does it take for another student to become sick? If sick students return to school instead of staying home, what risk does this pose?

The spread of infection can be modelled by playing tag.

- Begin with one "infected" person in the class.
- When the infected person has tagged two other students, he or she sits down.
- The newly infected students must tag two other students and sit down when they have done this.
- How long does it take before the whole class is seated?

Play the game again, but this time, have the infected students tag three people before sitting down. Does it take longer or less time for the whole class to become infected? Use a tree structure to represent the "generations" of the infection where each infected person infects two others:



Discuss the following questions:

- How many people would be infected in the fifth generation?
- How many people would be infected in the tenth generation?
- What would be the total number of infected people after five generations of infection?
- Why is a measure such as quarantine a good way to prevent the spread of a disease?
- What would the structure look like if every infected person infected three other people?

FURTHER RESOURCES

- www.nctm.org/resources/content.aspx?id=8496
- www.teach-nology.com/web_tools/materials/timelines/