



ACTIVITY 5

The Galapagos megaherbivore and seed dispersal

This activity begins by exploring the terms native, endemic, introduced and invasive species and goes on to investigate how the diet of giant tortoises or 'megaherbivores' help to disperse seeds of these plants during their migrations.

LEARNING TARGETS

Understand the different terms used to describe whether or not species are native.
Explore and identify different plant species in reference to the above.
Explain how tortoises disperse seeds and its impact on the environment.

WORDS TO REMEMBER

herbivore, megaherbivore, ecosystem engineer, native, endemic, introduced and invasive species, seed dispersal, migration, selective feeding, trampling, observation

WHAT YOU NEED Part 1

- Let's talk question prompt
- Native, endemic, introduced or invasive prompt
- Invasive species in Galapagos text *optional read*
- Plant species picture cards
- Climatic zones (natural habitats) of a Galapagos island image
- ID guides or books/internet for plant identification

ACTIVITY DESCRIPTION

This activity is split into 2 sections:

Part 1 begins with introducing different terms to describe the origin of the various species in Galapagos: endemic, native, endemic, introduced and invasive. It goes on to explore different plant species that inhabit different zones and encourages students to explore their area to identify different species.

Part 2 explores the diet of tortoises and how they help to disperse seeds during their migrations, and how this may impact on the environment.

Let's talk

Use the [question prompt](#) to classify animal diets and tortoises as **herbivores**. Read on to explain why they are referred to as **megaherbivores**.

Moving on

Q: What do tortoises eat? What do you think their favourite foods to forage (selective feeding) on may be? Suggest they eat a variety of plants with at least 64 different species in their diet on Santa Cruz; eating stems, leaves and fruits.



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Tortoises eat a variety of plant species, which include **native, endemic, introduced** or **invasive** species.

Look at the [Native, endemic, introduced or invasive prompt](#) to encourage students to identify and understand the difference between these terms.

Prompt students to think of ways invasive species can have a negative impact on native and endemic species. Share ideas and scribe them on a board or large sheet of paper together if desired.

** Invasives can out-compete endemic and native species for natural resources such as food, space, breeding sites and shelter.*

** They can introduce and spread new diseases.*

** New predators can have a devastating impact on species that have evolved in the absence of predators.*

** They can breed with similar species and create **hybrids**.*

** They can have an economic impact on agriculture, fisheries and forestry; and also affect human health.*

Read the [Invasive species in Galapagos](#) text together if desired for extra information.

Keep going

Use the [Plant species picture cards](#) of some native (including endemic) and introduced (including invasive) species share them with students. Ask them to read their card information to others – name, native (endemic or not) introduced (invasive or not) and where it may be found.

Look at the [climatic zones of a Galapagos island](#) image to ensure students know where these areas are on the island.

An extra to put learning into context in their local area (Educator will need to be aware of some plant species) 'Spot the species' plant hunt: Go on a 'spot the species' walk around the local area if possible. Do they recognise any plant species? I wonder which may be native or endemic? Take a photo or sketch the plant and use reference material in the classroom to find out.

Let's talk: What do I like to eat?

Different animals have different diets and foods they prefer to eat. Can you match the following terms to the correct description? Work with a partner to discuss what you think and draw a line to match them.

I am a herbivore

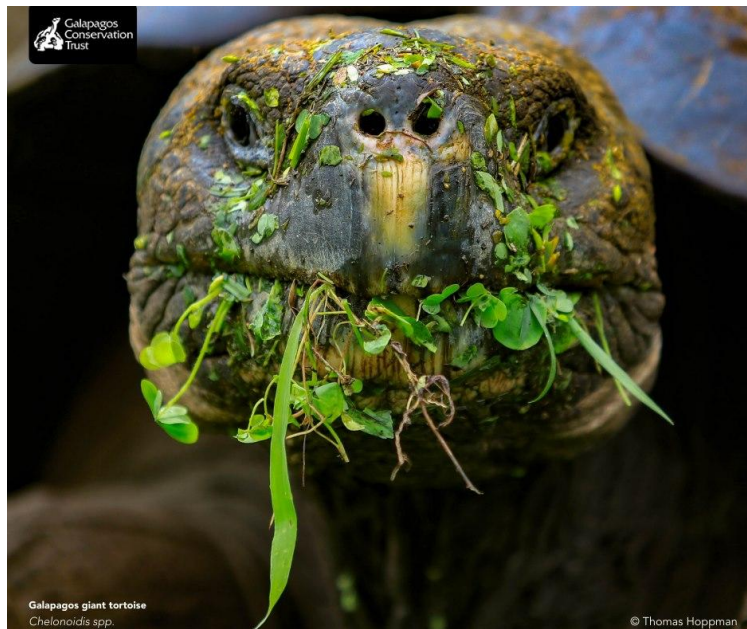
I eat other animals

I am an omnivore

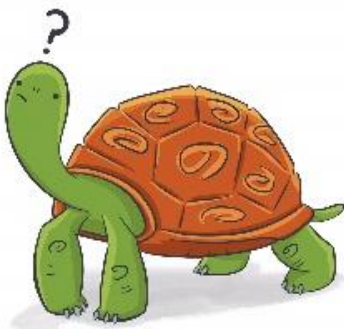
I only eat plants

I am a carnivore

I eat plants and other animals



What is a giant tortoise classified as?



Did you know that Galapagos giant tortoises are **Megaherbivores**! Yes, that's right! That means they are large herbivores and can weigh over 300kg, or about the weight of 10 children! On Galapagos they are the chief herbivores!

Native, endemic introduced or invasive?

Plant and animal species that you find in Galapagos can be grouped into either native, endemic, introduced or invasive species.

Read the descriptions below and match the type of species with the correct description. Chat with a learning partner and then share your ideas.

Endemic species

A species which does not occur naturally in the environment and poses a threat to native wildlife, agricultural production or human health.

Introduced species

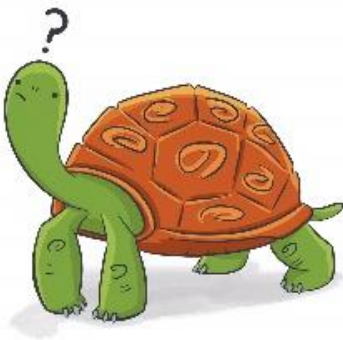
A species which lives and thrives in a particular area or ecosystem naturally and not as a result of human activity.

Invasive species

A species which does not occur naturally in an area but is now present because it has been accidentally or deliberately brought in by people.

Native species

A species that is found in a particular area or place and nowhere else.



Did you know that...?

Endemism often occurs on remote islands like the Galapagos. There are many endemic species here including the giant tortoises that are even endemic to individual islands or volcanoes.

Now that you know more about these groups of species, with your learning partner, jot down 2 or more ways in which you think **invasive species** have a **negative impact** on **endemic** and **native species** of Galapagos.

Share your ideas.

Invasive species in Galapagos

Invasive species interrupt and damage the balance of flora and/or fauna within a local ecosystem. They usually have the ability to grow and reproduce quickly, causing harm to the environment in many different ways. There are many invasive species in existence across the globe, introduced both deliberately and accidentally.

Since the Galapagos Islands were first discovered in 1535, a large number of species have been introduced by humans. Many of these were introduced before we knew about the impact they would have on the natural ecosystem.

Some were deliberately brought to the Islands for agriculture or because they were attractive to look at. Pigs, goats and chickens were brought to provide food; species such as domestic cats and dogs were brought to have as pets, and ornamental plants were introduced to create gardens. Other species were introduced accidentally including rats and various insects, and even smaller bacteria and microbes. The marine environment also has invasive species, such as some sea squirts and *Caulerpa* seaweed. Today there are estimated to be almost 1,500 introduced species in the Galapagos Islands.



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Plant species picture cards

Opuntia (Prickly pear cactus)
Opuntia species

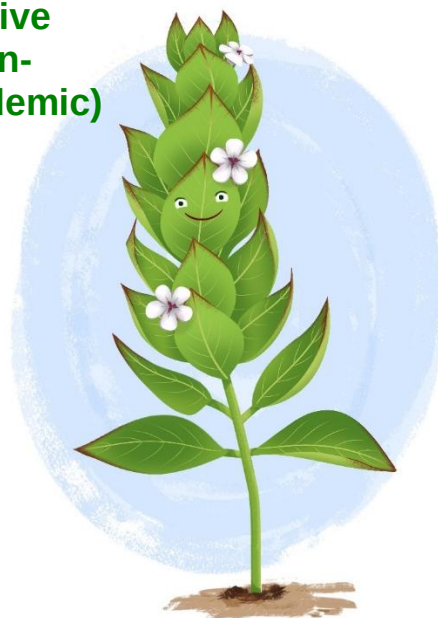
Native
(endemic)



 Habitat: **dry zone**

Camaroncillo (Browne's blechum)
Blechum pyramidatum

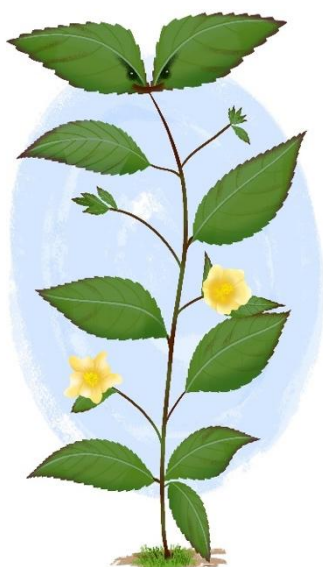
Native
(non-
endemic)



 Habitat: **humid and transition zones**

Escobilla (Arrowleaf sida)
Sida rhombifolia

Introduced
(invasive)



 Habitat : **humid and transition zones**

Calcha (Small-leaf spiderwort)
Tradescantia fluminensis

Introduced
(invasive)



 Habitat: **humid and transition zones**

Maracuyá (Passion fruit)
Passiflora edulis

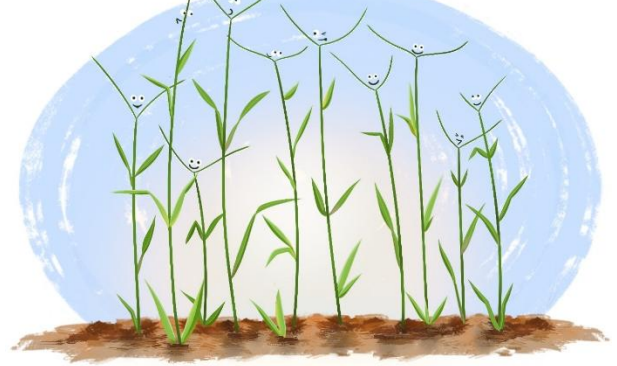
**Introduced
(Invasive)**



Habitat: humid zone

Pasto de burro (Buffalo grass)
Paspalum conjugatum

**Native
(non-endemic)**



Habitat: humid zone

Manzanillo (Poison apple)
Hippomane mancinella

**Native
(non-endemic)**



Habitat: transition, dry and coastal
zones

Guayabillo (Endemic guava)
Psidium galapageium

**Native
(endemic)**



Habitat: humid and transition
zones

Guayaba (Introduced guava)
Psidium guajava

**Introduced
(invasive)**



Habitat: humid zone

Mora (Hill raspberry)
Rubus niveus

**Introduced
(invasive)**



Habitat: humid zone

Pasto (East-Indian crabgrass)
Digitaria setigera

**Introduced
(non-invasive)**



eFlora of India



Habitat: humid zone

Cola de Gato (False Elephant foot)
Pseudelephantopus spiralis

**Introduced
(non-Invasive)**



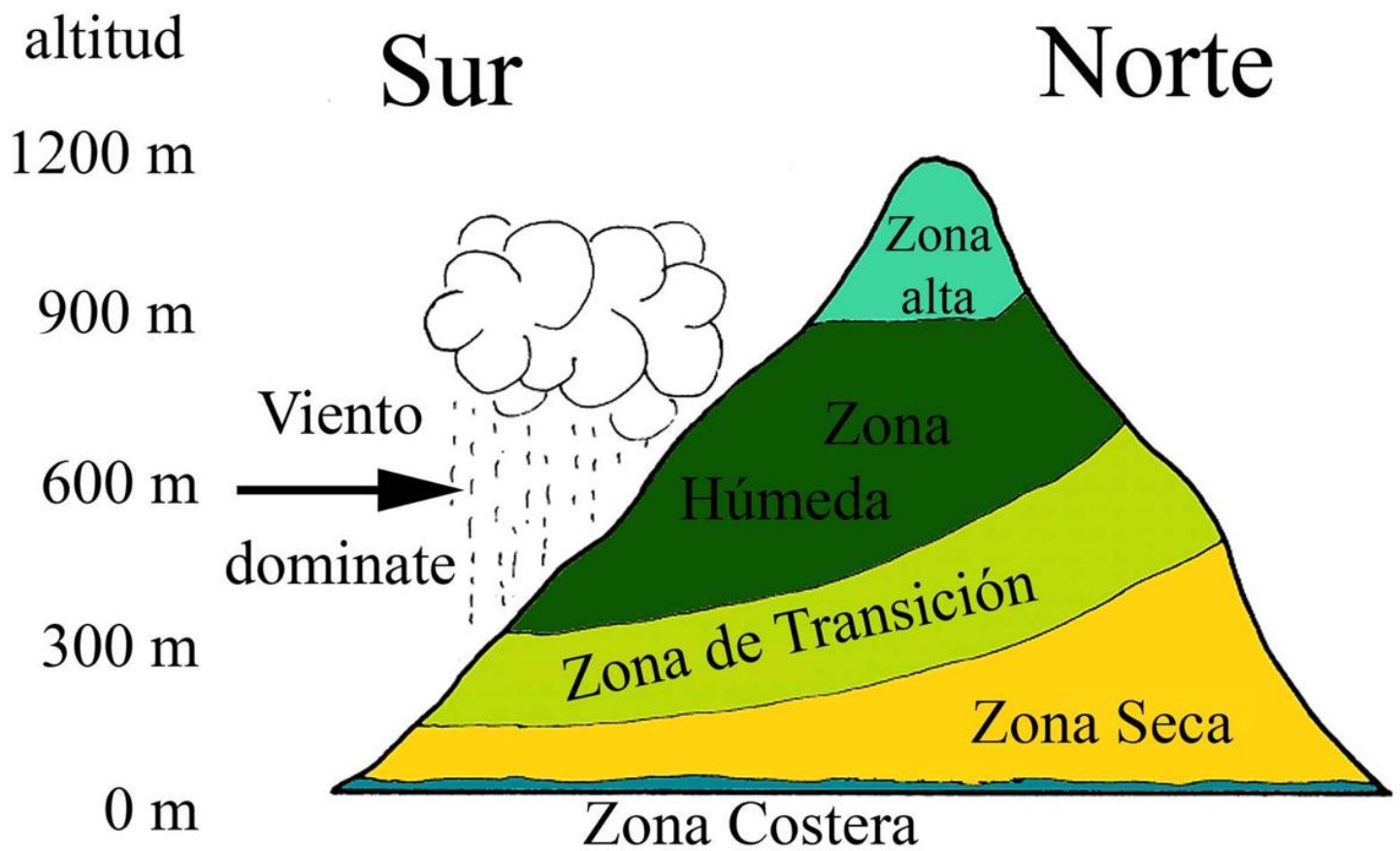
Michael Hogan -iNaturalist



Habitat: humid zone

Climatic zones or natural habitats of a Galapagos island

The image below shows the climatic zones or natural habitats of a Galapagos island according to elevation.



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WHAT YOU NEED Part 2

- 'Super seed dispersers' cards
- Sobrevivencia boardgame: instructions, tarjetas de tortuga, tarjetas de acción, board, dice, counters.

Let's talk



Review what students have remembered from Session 3 about migration.

Q: Why do giant tortoises migrate?

Q: Where do they go to and from? Relate to Santa Cruz where appropriate.

Q: When do they migrate?

Moving on

Q: Ask students what they think '**seed dispersal**' or the term dispersal means.

Seed dispersal is the movement or transport of seeds away from the parent plant. Some seeds are transported by wind, some glide or spin through the air, some float, others may get attached to fur or feathers of animals.

Q: Tortoises can disperse seeds: How do they do this? - Share ideas.

To further describe the idea of giant tortoises being great seed dispersers during their migrations, and to share some interesting facts, use the '**Super seed dispersers**' cards for students to read to others.

Some of the cards have questions that they can read out to discuss and encourage them to think of the implications of the fact given. Share ideas and lead and extend the discussion where necessary.

You may want to cut them out and chosen students to read them in number order to 'work through' facts logically.

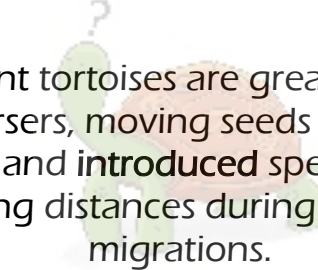
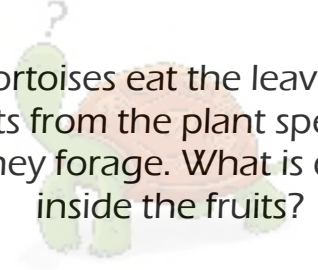
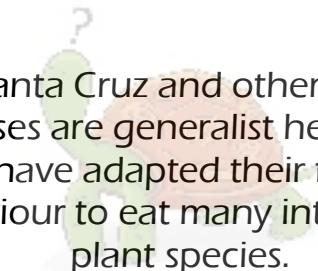
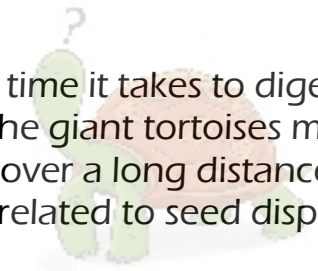
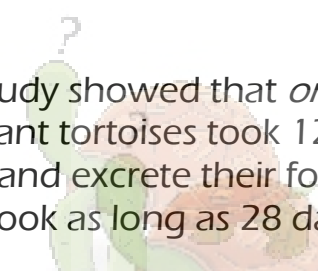
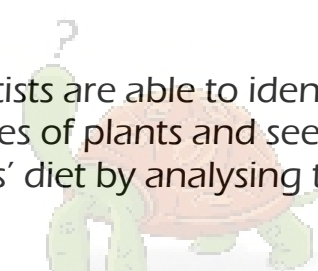
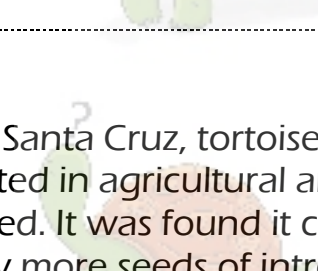
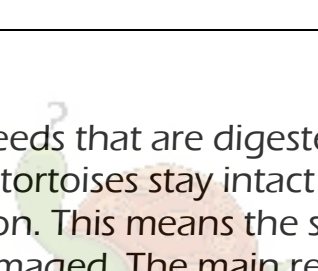
Extra blank cards have been provided for students to find out their own facts from research or for the educator to change the activity and write extra statements that are not true. Students then have to decide whether the statement read is true or false.

Keep going

To continue to explore the relationship between plant species and the Galapagos giant tortoises and how a balanced ecosystem can be maintained, play the game '**Sobrevivencia**.'

Super seed dispersers

Look and read through the following facts together about giant tortoises and seed dispersal.

1.  Giant tortoises are great seed dispersers, moving seeds of many native and introduced species over long distances during their migrations.	2.  Giant tortoises eat the leaves, stems or fruits from the plant species on which they forage. What is contained inside the fruits?
3.  On Santa Cruz and other islands, tortoises are generalist herbivores and have adapted their feeding behaviour to eat many introduced plant species.	4.  In the time it takes to digest their food, the giant tortoises may have moved over a long distance. How is this related to seed dispersal?
5.  One study showed that <i>on average</i> the giant tortoises took 12 days to digest and excrete their food. Some took as long as 28 days!	6.  Scientists are able to identify the species of plants and seeds in a tortoises' diet by analysing their poo!
7.  On Santa Cruz, tortoise dung collected in agricultural areas was analysed. It was found it contained many more seeds of introduced species than of native ones. What impact do you think this may have?	8.  Many seeds that are digested by the giant tortoises stay intact during digestion. This means the seeds are not damaged. The main reason for this is their lack of teeth!

You can use these spare cards to find out your own facts about the diet or other interesting things about the Galapagos giant tortoise.