EDU-ARCTIC2
LEARNING TOOL-KIT

INVASIVE SPECIES

Do you know what happens when an exotic species comes to a new place, where it does not belong? Can the planet be completely invaded by exotic species? What exactly is an exotic species?

You can always navigate back to this main menu. Look for the menu symbol.

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pst. click to go directly to a step

Step 1 Introduction

Step 2 Understand

Step 3 Explore

Step 4 Reflect

Step 5 Wrap-up

Step 1 of 5: Introduction

INVASIVE SPECIES

LEARNING GOALS

Pst!

After using this tool-kit, the goal is that the student

- knows what an ecological niche is
- grasps the main differences between native species and exotic species
- has an idea of factors that make an exotic species likely to become invasive
- understands why it is important to study species invasions

WHY IS THIS IMPORTANT?

Invasive species disrupt the established niche system of the ecosystem

This is a serious threat to sustainability of ecosystem functioning, which includes human well-being as everything we do depends in some way on functional ecosystems

In this educational tool-kit,
you will learn how invasive species can impact environments, other species, and even the whole global bioeconomy.

We will also look at why with climate change, we expect the number of invasive species to grow.

You will learn the difference of

RE-INTRODUCED
(NOT INVASIVE)

EXOTIC AND
INVASIVE

RE-INTRODUCED
BUT INVASIVE (!)

17 000+

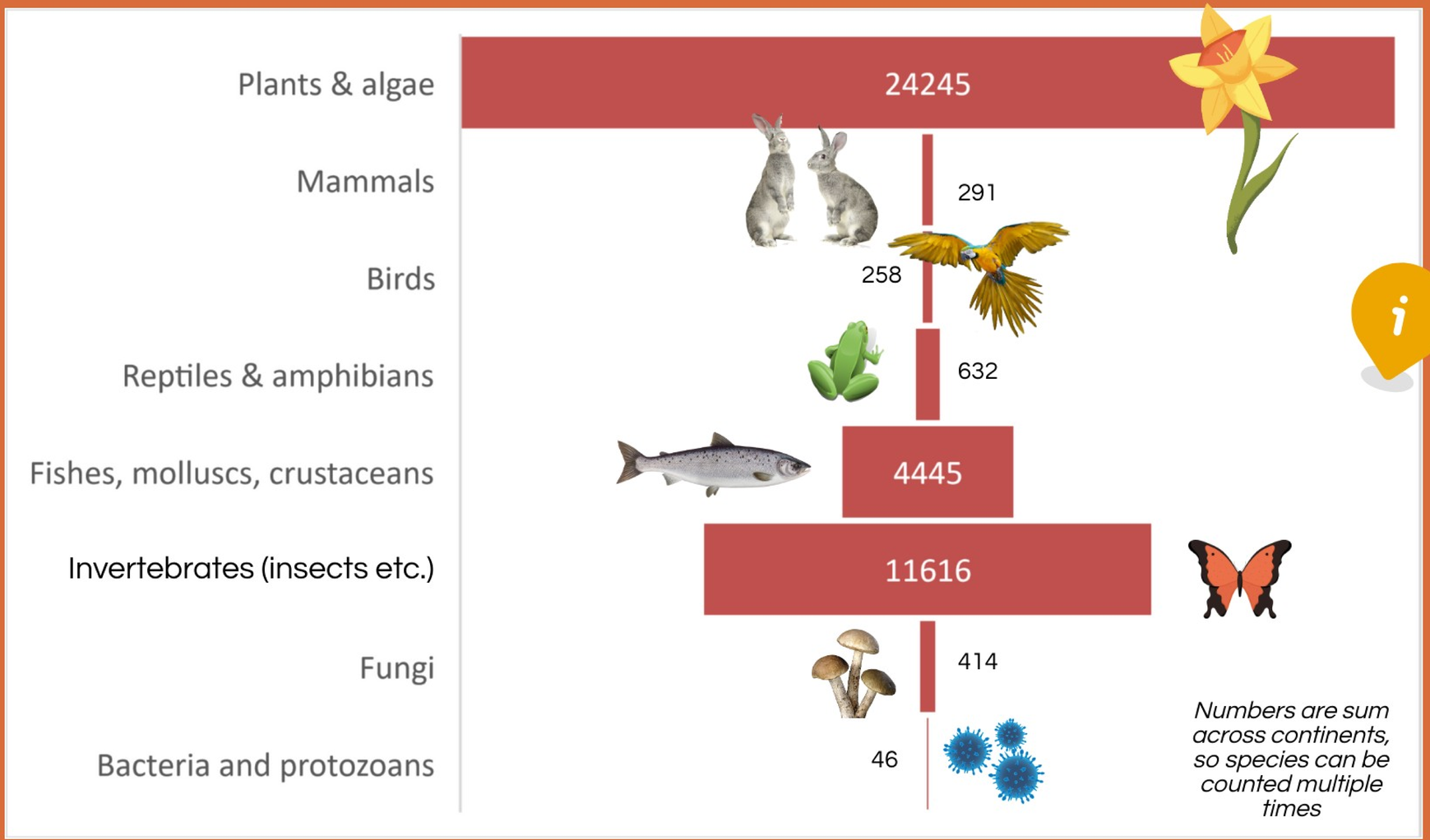
invasive species

And these are only the ones that scientists have recorded. Vast areas of the world have not yet been sampled.

Fun fact:
the first invasive species was recorded in the year 1503!

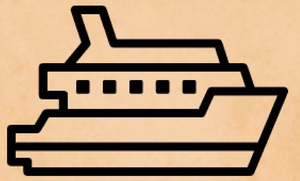
Plants

are the most numerous of the invasive species



invasive species will of course not take over the planet.
This is not science fiction.

BUT INVASIVE SPECIES CONQUER MORE AND MORE AREAS!



Because humans travel a lot more,
and ship more and more goods across the world

And because there are climate changes going on

TERMS TO LEARN

Tap words to learn their meaning!

exotic

ecological niche

reintroduced

species distribution

native

invasive

niche competition

hybridization

control of exotic species

Click for text version

HAVE YOU GRASPED THE TERMS TO LEARN?

Check it here

Step 2 of 5: Understand

INVASIVE SPECIES

BACKGROUND THEORY

For millions of years, evolution has shaped our ecosystems. Darwin called it "the survival of the fittest"

BACKGROUND THEORY

Evolution created ecological niches.
The thing is, there can be ONLY one species per niche.
Ecosystems have over time established
which species occupies which niches.

Don't remember
what niche is?
Look it up

Niches can change if one of two things happens:

MAJOR, SUDDEN DISTURBANCES

like earthquakes, wildfires, human bulldozing or hurricanes

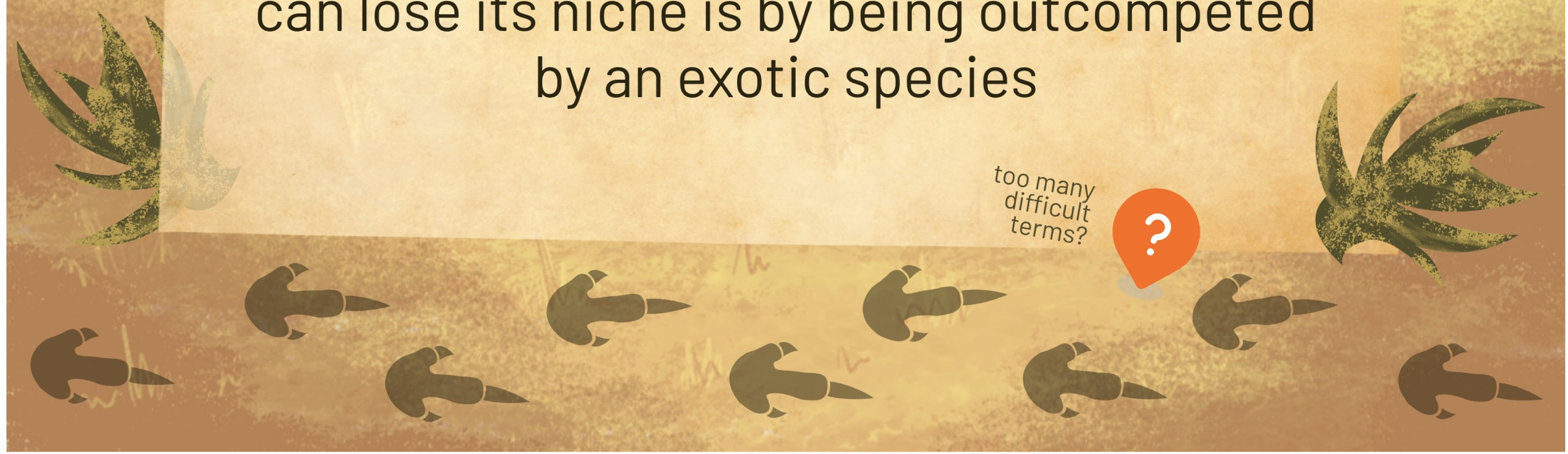
VS

SMALL, SLOW CHANGES

mainly climate change,
but species can also slowly engineer the environment

BACKGROUND THEORY

Unless niches are changed,
the only way a native species
can lose its niche is by being outcompeted
by an exotic species



FROM EXOTIC TO INVASIVE

The easiest way to start understanding species invasion likely is to see some examples.

Let's look at examples!

SOME OF THE MOST NUMEROUS INVASIVE SPECIES IN NORTHERN EUROPE

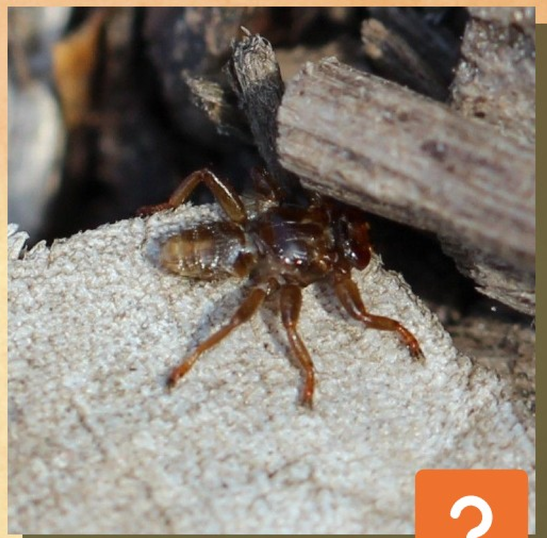
KING CRABS

Because of warming sea and release by humans for fisheries

LUPINS & RUGOSA ROSE

Because of human deliberate planting

interested in science? read this



DEER KED

Because of warming climate and human-caused high deer densities

PROGRESJONSMETER

50%

YOU HAVE NOW COMPLETED THIS MUCH
OF THE INTERACTIVE ROOM

WHY (WHEN) SPECIES BECOME INVASIVE

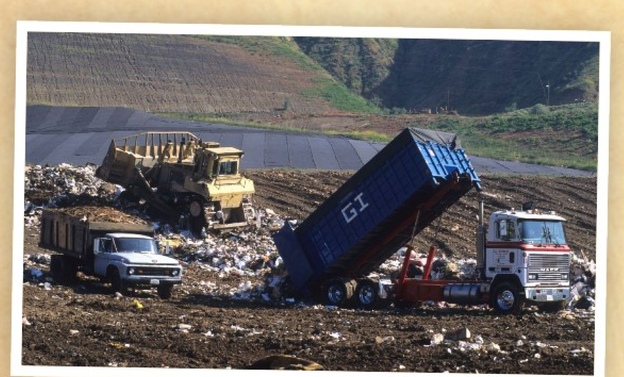
When an exotic species arrives in a new area, it tends to either die very soon or it becomes invasive.

Some invade faster than others.

WHAT MAKES IT MORE LIKELY TO BECOME INVASIVE?

1

The ecosystem is largely disturbed by human activity



2

The species is small and easily transported by humans

3

The species is tolerant to varying living conditions

WHAT MAKES IT MORE LIKELY TO BECOME INVASIVE?

4

The species has no natural enemies in the new area

5

The species is able to eat lots of different food

6

The species is a fast breeder

?

WHY ARE INVASIVE SPECIES A CONCERN?

Watch this video and you will see why

WHY ARE INVASIVE SPECIES A CONCERN?

Invasive species disrupt the established niche system of the ecosystem

This is a serious threat to sustainability of ecosystem functioning, which includes human well-being as <u>everything we do depends on functional ecosystems</u> in some way

The northern areas are particularly vulnerable if invaded by exotic species.

Because of the harsh polar environment, the native species are living at the extreme.

Even a small change in their environment can shift the odds from living to dying, such as having to compete for food with a new species or being chased by a new predator.

Like the very invasive king crabs you saw in a previous video

Now, consider what you just learnt in the context of climate change.

The king crab larvae cannot molt in waters that are colder than about 0.5 degrees celsius. It is likely expanding so rapidly in the polar oceans (the coldest oceans on Earth!) due to global warming.

SOLUTIONS

The challenge is two-fold:

1) One must learn how stop new species invasions

+

2) Clean up previous ones.

A special part of the challenge is that we sometimes do not agree if a species is exotic or native!

But if we do agree, new technology gives hope for solutions to the control of exotic species!

Step 3 of 5: Explore

INVASIVE SPECIES

THANKS

FOR FOLLOWING US THIS FAR

Invasive species may not be the coolest of topics, but it is so important that we are all aware of the problem.

Now we send you on a research expedition!

Step 4 of 5: Reflect

INVASIVE SPECIES

1) Is it okay to use captive animals to reintroduce into the wild a native species that has become extinct?

Why or why not?

Does it matter if humans caused the extinction?

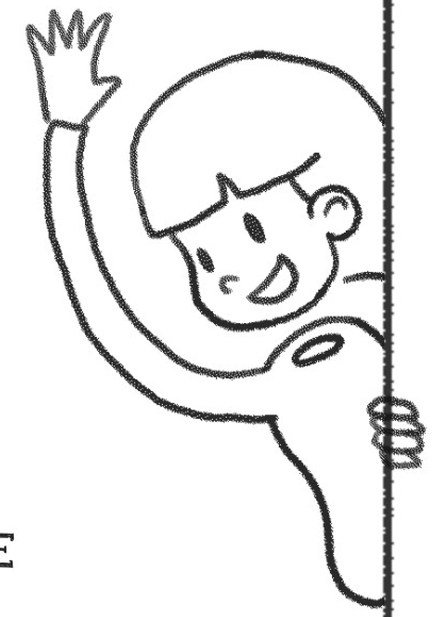
2) Are all means to eradicate an exotic species acceptable?

Which are or which are not?

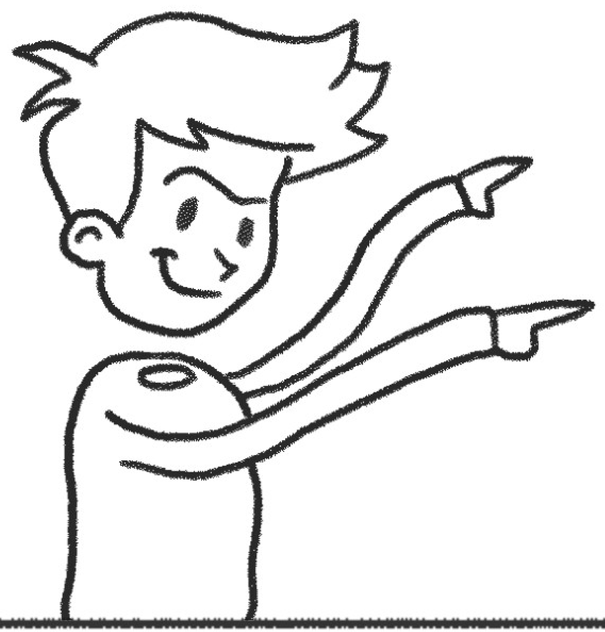
Step 5 of 5: Wrap-up

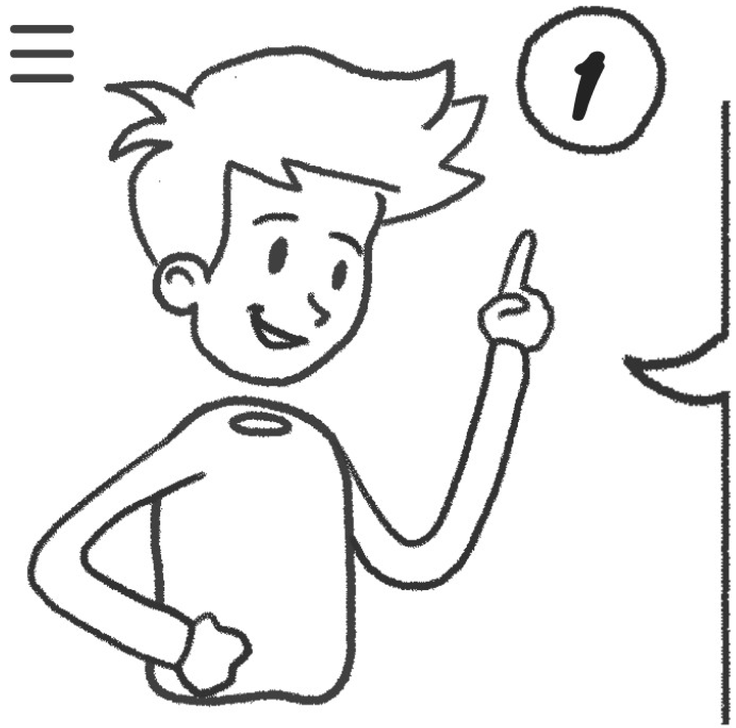
INVASIVE SPECIES

REMEMBER THE LEARNING GOALS?



- KNOWS WHAT AN ECOLOGICAL NICHE IS
- GRASPS THE MAIN DIFFERENCES BETWEEN NATIVE SPECIES AND EXOTIC SPECIES
- HAS AN IDEA OF FACTORS THAT MAKE AN EXOTIC SPECIES LIKELY TO BECOME INVASIVE
- UNDERSTANDS WHY IT IS IMPORTANT TO STUDY SPECIES INVASIONS





KNOWS WHAT ECOLOGICAL NICHE IS

All creatures need certain elements to live, such as food, light, shelter from weather and so on.

An ecological niche is any combination of these factors that makes a livable space for a species.

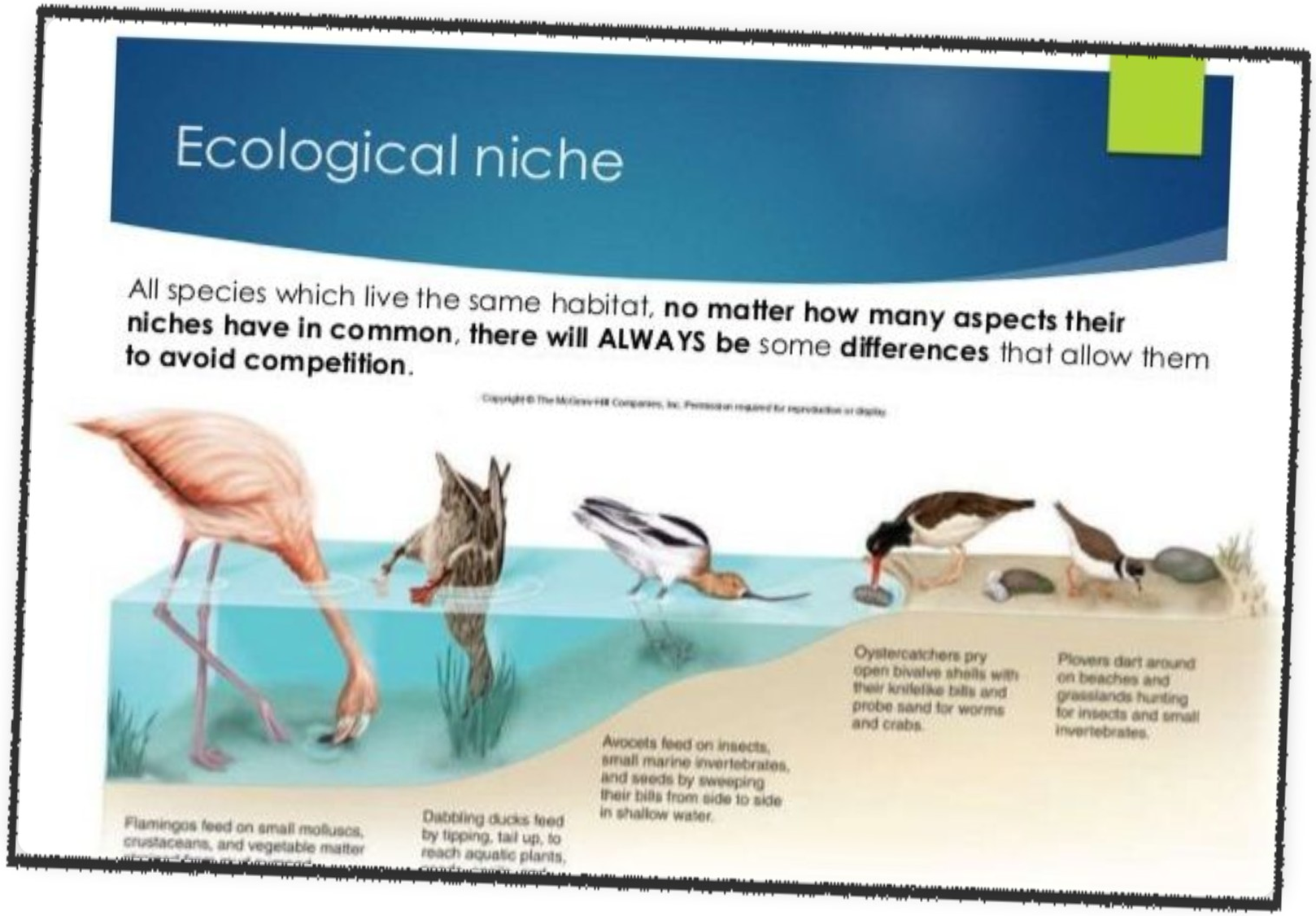
Any one species has its own niche, but at the same time is part of different niches for many other species. The relations conserve the niches.

However, external factors in the environment can disrupt and change the niches. Such as climate change or the introduction of a new species.

Apart from great nature forces like earthquakes it is nearly only the human species who has the capacity to start the chains of events that can permanently disrupt niches in established ecosystems.

STILL DON'T QUITE UNDERSTAND THE NICHE CONCEPT?

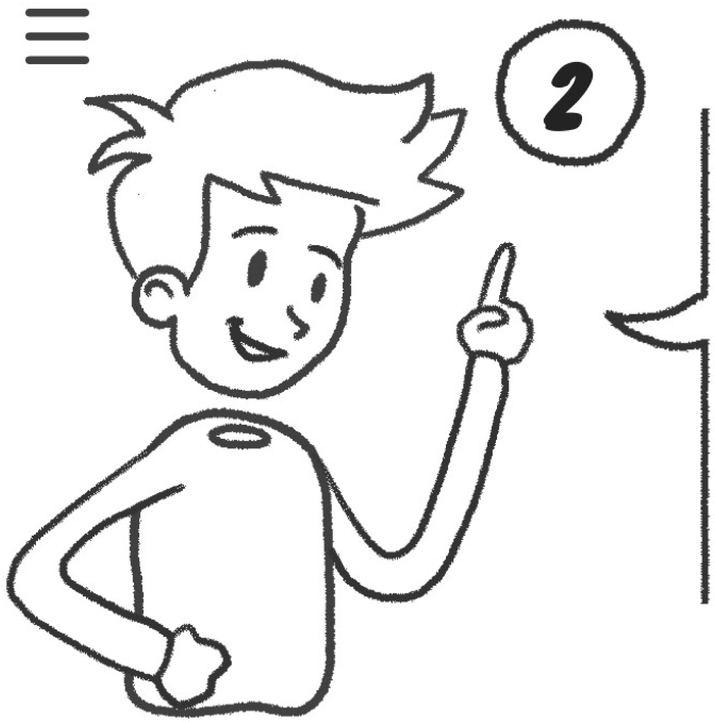
Click for a mini-lesson!



By evolution, a species can live only in one ecological niche with its specific combination of living conditions.

Relations between species <u>conserve</u> the combinations of niche types that exist in any given ecosystem.

But external factors can <u>disrupt</u> the niches, such as climate change, human bulldozing or introduction of new species.



DIFFERENCES BETWEEN NATIVE SPECIES AND EXOTIC SPECIES

An exotic species arrives in an area where it did not live before, by the means of human transport. The transport can be deliberate or accidental.

A native species is one that came to the area without the help of human transport.

Remember that for a species to be truly exotic, it has not been native in the new area at any time in history. And for a species to be truly native, its ancestors must also have been native to the area they lived in.

An exotic species came to the area by the means of human transport

A native species came there on its own, from a place where it was also native

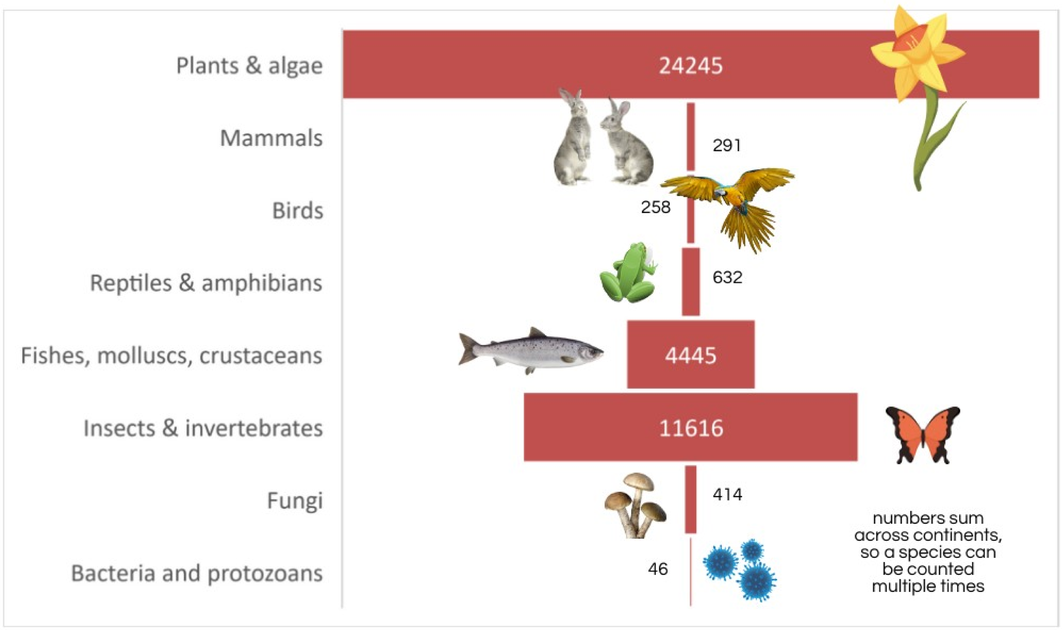
3

FACTORS MAKING A SPECIES LIKELY TO BECOME EXOTIC AND INVASIVE

- The ecosystem is largely disturbed by human activity, so that the niche system is disrupted
- The exotic species is small and easily transported by humans, especially if it is a blind-passenger
- The species is tolerant to varying living conditions
- The species is able to eat lots of different food
- The species has no natural enemies in the new area
- The species is a fast breeder

MORE THAN 17 000 SPECIES ARE RECORDED AS INVASIVE

the most numerous in North America, Europe and Oceania (that is, the richest countries of the world, which have the most human transport)



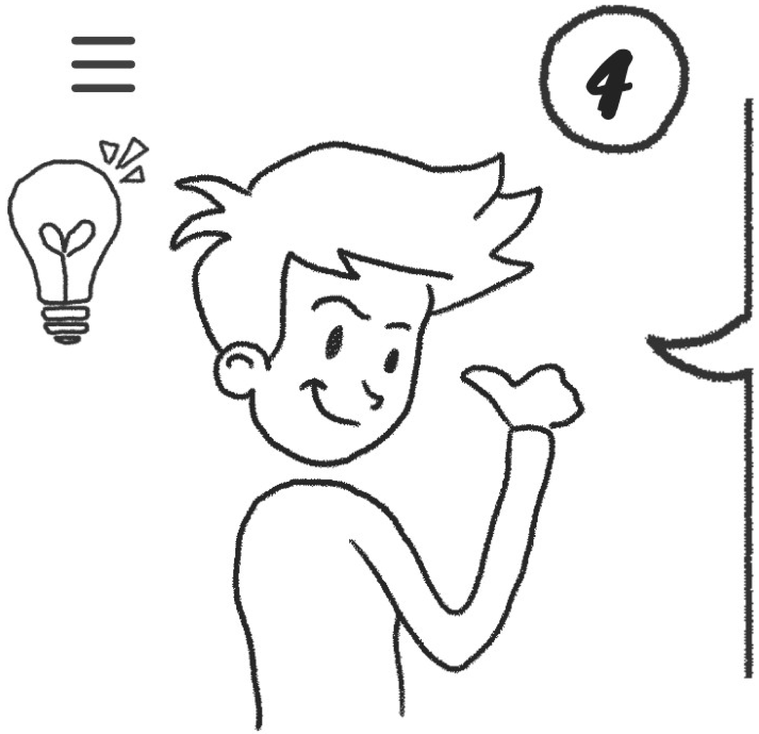
PLANTS ARE THE MOST NUMEROUS

(PARTLY BECAUSE THEY ARE EASIER TO DETECT)

Human action is responsible for almost all species invasions, either deliberately or accidentally.

The most invasive species are small, can live under various conditions, and are fast breeders.

An exotic species becoming invasive multiplies fast as it has no enemies who have yet learnt how to catch and eat it.



WHY IT IS IMPORTANT TO STUDY SPECIES INVASIONS

Invasive species disrupt the established niche system of the ecosystem.

This is a serious threat to sustainability of ecosystem functioning, which includes human well-being as everything we do depends on functional ecosystems in some way.

One must learn how to stop new species invasions + clean up previous ones. In some cases this is tricky, and sometimes we do not agree if a species is an invasive exotic one or really a native one.

But there are solutions! The most promising ones use technology, rather than chemical or biological controls, which have their own dangers.

END OF TOOL KIT

We hope you have been inspired to study more!