Didactic and methodological notes on the part „Invasive Species“

Invasive species have a significant impact on **biodiversity** and can exert strong **selection pressure** on native species occupying similar ecological niches if they **are more competitive.**

The immigration of foreign species is not a new phenomenon and was intensified by the modern times‘ **discovery voyages**. In some cases, foreign species were deliberately imported, for example, to increase the food spectrum (potato, tomato) or to enrich gardens. Thus, many plants that we consider native were originally also neophytes, e.g. the tulip.

Most **neobiota** are ecologically **unproblematic** and in part enrich the native flora and fauna. A smaller proportion, however, can lead to serious disruption of the ecosystem and up to the **displacement of native species**, in which case they are referred to as invasive species.

The learners should get to know this **delimitation** and familiarize themselves with concise neobiota using various media. The lesson unit contains materials such as texts and profiles and there are numerous references to further sources such as picture galleries and videos, so that it is possible to divide the work and differentiate the performance. The texts also have different levels of difficulty.

The students should also be able to recognize that the immigration of alien species has increased significantly in recent decades, and they should be able to name globalization as a cause with its international flow of goods and worldwide tourism. They should also understand the economic dimension of invasive species and the need to combat them.

As a further cause of the increase of invasive species, learners should also be able to identify climate change, which acts as a significant accelerator. Here, there is also a link to the teaching units on birds and insects.

Causes and global consequences of global warming are covered in a separate unit.

The health dimension is also playing an increasing role. Doctors expect diseases to spread more and more in our latitudes that we previously only knew as tropical diseases, but which are already appearing here in isolated cases, such as West Nile fever.

The materials contain optional language didactic suggestions in the tasks, which should enable multilingual treatment in the classroom.

Author: Brigitte Suchaneck, 2021

Subject area III
Threat constellations and solutions
Invasive Species 1

Invasive Species

1. Find out more using text 1 and 2 and the video: HLNUG 2019 about invasive species. Define them and distinguish them from neobiota. Give two examples of each.

2. In English, use the info text to describe the risks to competing species, entire ecosystems and humans. Include the video (HLNUG 2019), the lecture by Jörg Oehlmann (Oehlmann 2020) or the following link (Quarks 2019).

Text 1

Animal species that were taken by humans to areas outside their native country after 1492, i.e. the discovery of America by Columbus, and live there in the wild for a long period of time are called **Neozoa** by scientists . If it concerns plants one speaks of **Neophyten**. The generic term for both is **Neobiota**.

Besides wild herbs, typical representatives of the neophytes are many garden plants. Neophytes can spread by leaps and bounds if they find favorable conditions. At present, they have already become a problem in some regions, and their spread should be prevented if possible, as they may displace native vegetation.

On a global scale, invasive species represent one of the greatest threats to biodiversity. In the European Union (EU) alone, experts estimate the number of so-called alien species (neobiota) at about 12,000, of which about 10 to 15 percent are considered problematic (invasive). These invasive species (IAS) have a significant negative impact on biodiversity, for example when they displace native species from their habitat.

A well-known example are American crayfish, which have introduced a fungal infection ("crayfish plague") that almost led to the extinction of the European noble crayfish. Other species can also cause significant economic damage, such as the Pacific oyster in mussel beds in the Wadden Sea. Or they pose a health hazard to humans, such as the giant hogweed native to the Caucasus or the North American mugwort ambrosia, whose pollen is dangerous to allergy sufferers.

Neobiota

Invasive Species

Source: (NABU e.V. o.J.b)

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Neobiota

Species that became native to us after 1492.

Invasive Species

Species that threaten biodiversity by being more competitive than and therefore displacing native species and by replacing native species through hybridization.

Source: (NABU e.V. o.J.b)

Author: Brigitte Suchaneck, 2021

Invasive Species

Text 2

Infobox: How invasive species displace native ones

Invasive species contribute to the reduction of native species' diversity in several ways. First, species compete with each other for limited resources such as food and habitat. Since invasive species are often more competitive, for example, they grow faster, it often leads to the displacement of native species.

However, mating of native and related invasive species (hybridization) is also problematic, especially if the newly added population grows faster than the native one. By altering the gene pool, this can sooner or later also lead to the displacement of the native species.

Another problem is the introduction of yet unknown diseases for which the immune systems of native species are not prepared.

Overall, invasive species can even change entire ecosystems.

You can find more info here: Quarks 2019

Risks from invasive species

Author: Brigitte Suchaneck, 2021

Subject area III
Threat constellations and solutions
Invasive Species 2

Invasive Species

Text 2

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Risks from invasive species

- Competition for habitat and food can lead to the displacement of native species (e.g. Japanese knotweed).
- Alteration of the gene pool can reduce genetic diversity (biodiversity)
- Entire ecosystems can change when individual species fall prey to the new predator (raccoon) or habitat quality is altered (black locust)
- Introduction of new diseases

Author: Brigitte Suchaneck, 2021

Text 2

This is why introduced species threaten diversity

"Raccoons, crayfish, ladybugs - there are more than 2000 introduced species in Germany. They do not help other animals and plants. On the contrary, they are a major cause of species extinction worldwide."

May 16, 2019

Competition for habitat and food

Not all animals and plants manage to survive in their new home - for example, because they cannot cope with the climate. But some species manage to gain a permanent foothold.
Often, neozoa, introduced animal species, and neophytes, introduced plant species, have a negative impact on their new environment. A competition for habitat and food begins, in which usually only one can win. Claws or sharp teeth are not needed for this. The Japanese knotweed, for example, a very fast-growing, green and herbaceous plant, is spreading so much along some riverbanks that other plants no longer stand a chance.

The gene pool is changing

If native and alien species like each other too much, this can also have disadvantages. If they mate, this leads to a gradual genetic change of the species. If the population of the native species is significantly smaller than that of the introduced species, the long-term consequence can be that the native species is "replaced" by the alien species. Instead of more diversity due to an additional hybrid species, genetic diversity is reduced in that case. Additionally, it becomes critical when the native species is already threatened in its habitat. An example of this process is the black-headed ruddy duck and the white-headed ruddy duck. The black-headed ruddy duck is originally from North America. In Europe, their representatives encountered white-headed ruddy ducks and stole their females by acting aggressively.

Entire ecosystems are changing

In some cases, the appetite of the introduced species is also a problem. For example, the raccoon, which actually comes from North America, has taken a great liking to the European food supply. Its menu includes bird eggs, breeding birds and amphibians.

It can be particularly dangerous when introduced species bring foreign diseases and parasites with them, against which native species have not yet developed protection. American crayfish, for example, transmit crayfish plague. For native crayfish species, the disease is fatal.

Over time, invasive species can change entire ecosystems. The black locust, a green deciduous tree originally from North America, grows on semi-arid grasslands, where it enriches the soil with nitrogen. This attracts plants that like nitrogen-rich soil. Other species disappear and with them some of the insects that depend on them.

Source: Quarks 2019

Risks from invasive species

Author: Brigitte Suchaneck, 2021

Subject area III
Threat constellations and solutions
Invasive Species 3

This is why introduced species threaten diversity

1. **Using Figures 1 and 2, describe and explain the development of neobiota and invasive species. Also include the information from the videos and the texts.**

2. In English, describe and discuss ways to control invasive species (Text 3).

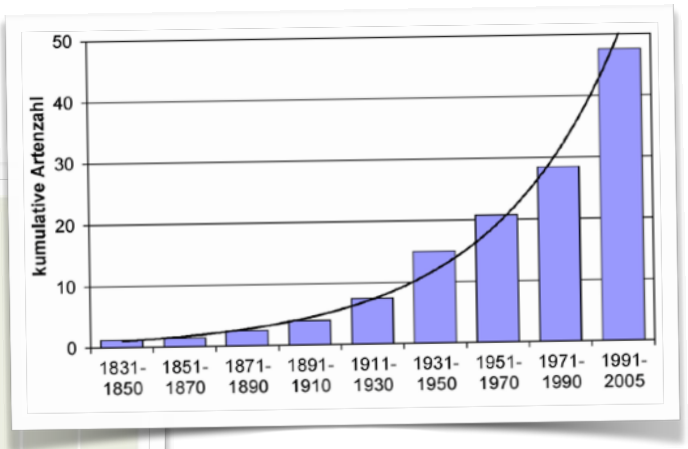

Fig. 1: Baur & Schmidtlin 2007 (in LANUV NRW o.J.)

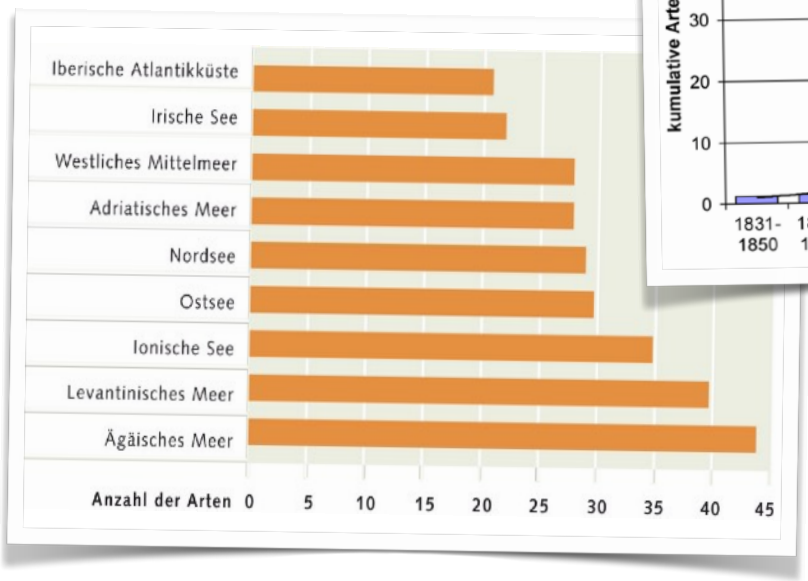

Fig. 2: Maribus gGmbH 2010: 112

Task 1

Author: Brigitte Suchaneck, 2021

Subject area III
Threat constellations and solutions
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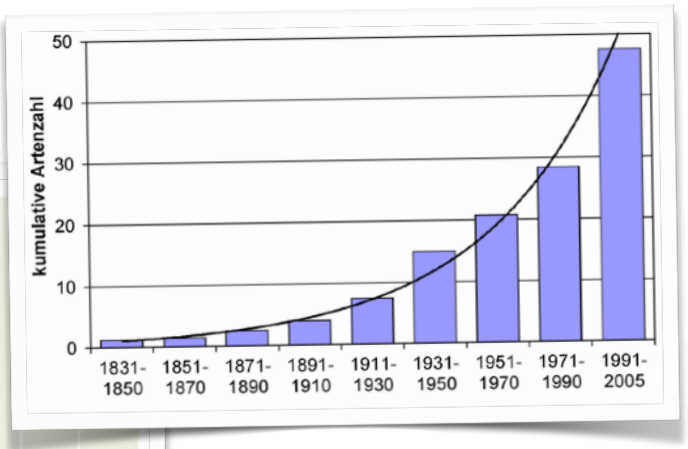

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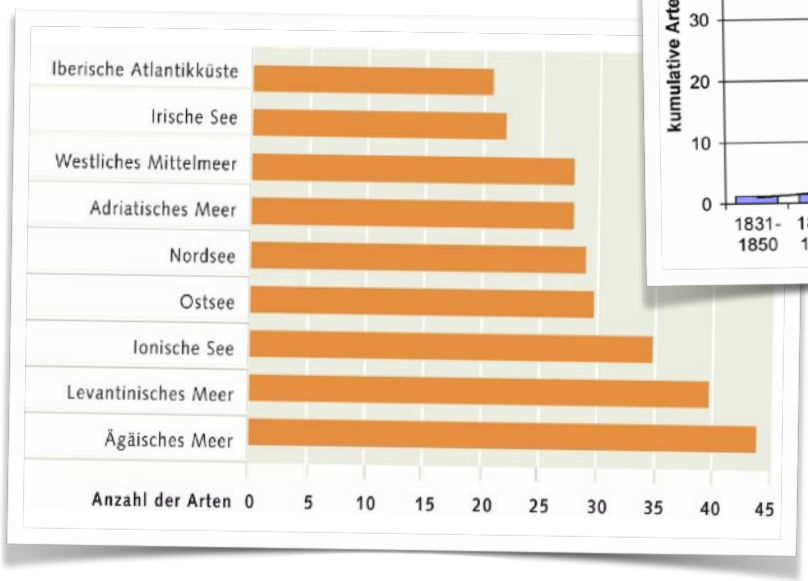

Fig. 2: Maribus gGmbH 2010: 112

Task 1

During the 19th century, few new species in the Rhine, initially slow, but steadily increased, overall exponential, acceleration in the last period.

The number of problematic neobiota species is also increasing in the seas and oceans. The proportion is particularly high in the southeastern Mediterranean Sea, but these species also account for 30% of the North Sea and Baltic Sea.

Author: Brigitte Suchaneck, 2021

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Text 3

Species Strategies for dealing with invasive species

The Convention on Biological Diversity internationally recommends that regulations on invasive species should be based on a three-stage approach: In line with the precautionary principle, the introduction of further species should primarily be prevented, new invasive species should be detected in time by an early warning system, and their establishment and spread - as long as this is still feasible and financially viable - should be prevented by immediate measures. If this is not possible or if the invasive species has been with us for a long time and is widespread, its effects are to be mitigated depending on the individual case.

About ten percent of the established neobiota threaten biodiversity in Germany and are therefore identified as "invasive". In addition, there is also a larger number of invasive species among the impermanently occurring neobiota whose complete elimination still appears possible.

(BfN o.J.)

Task 2

Author: Brigitte Suchaneck, 2021

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Task 2

Three-step principle: Prevent introduction of invasive species. Early control to prevent establishment. Mitigation of impact in case of strong spread and establishment. Only early control is truly promising, late response often impossible or very costly.

Author: Brigitte Suchaneck, 2021

Subject area III
Threat constellations and solutions
Invasive Species 4

Describe in each case how the invasive species came to be introduced, **what threat** it poses to other **organisms** and whether or what options exist for **control**

Choose an appropriate form of presentation - see T 1 and T 2 for instructions.

Source: Ochsenfrosch

"The North American bullfrog (Rana catesbeiana) was widely offered for sale in garden centers in the 1980s and 90s. As a result, it was released in Europe in various places, either intentionally or through carelessness.
In Germany, four locations are known so far. At two sites (Celle and Stuttgart) it was successfully eliminated. Near Bonn, it was located in a water body bounded by a fence, which prevented its spread. The occurrence in the northern Upper Rhine Plain is distributed over several, partly larger water bodies

Due to its body size, the adult bullfrog (Rana catesbeiana) cannot be confused with any native frog species. The slightly larger females reach a head-torso length of about 20 cm and a hind leg length of about 25 cm. Characteristic are the, almost like a second pair of eyes acting, drum skins, which for the males are almost twice as large as the eyes. Equally striking is the fold of skin that extends from the posterior edge of the eye around the eardrum to the forelegs. Bullfrogs prefer to eat other amphibians in addition to insects, spiders, fish, crustaceans, small mammals, and small birds. Due to its negative impact on biodiversity, the bullfrog is considered an invasive species throughout the EU."

(Dreher & Aufmkolk 2020)

Group work: You decide on an animal or plant species and your working and presentation language.

You can choose two different languages. However, the presentation should be in English or German.

"The raccoon known to us (Procyon lotor) belongs to the small bears. Its original range extends over North and Central America. The species came to Germany at the beginning of the 20th century through fur breeders. The raccoon was even actively released at the Edersee in northern Hesse. The fact that the raccoon was under protection until 1954 helped the species to spread in Germany. Today, the focus of its range within Germany is in the tri-border area of Hesse, North Rhine-Westphalia and Lower Saxony.

Raccoons are generalists, making few demands on the nature of their diet and able to adapt quickly to changing circumstances. This explains their success in colonizing new habitats. As cultural followers, they even populate our cities and also like to feed on food scraps in garbage cans. However, there is increasing evidence of negative impacts of the raccoon on biodiversity, so much that the raccoon is considered an invasive species throughout the EU. For example, in Brandenburg, the raccoon has specialized in digging up eggs of the European pond turtle, which is strictly protected in Germany as an FFH IV species and threatened with extinction according to the German Red List."

(NABU e.V. o.J.a)

Source: Waschbär

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Subject area III
Threat constellations and solutions
Invasive Species 4

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Source: Der Mink

The **Mink** originates from North America and was originally a domestic animal. It feeds mainly on small mammals, crustaceans and frogs and lives along bodies of water. It is still relatively rare, but its population is increasing rapidly. (ntv 2020)

Source: Der Maderhund

The **Raccon Dog** (also called **Tanuki**) is an immigrant from **East Asia**, where it escaped from fur farms. It occurs mainly in northeastern Germany and in Schleswig-Holstein. So far it does not seem to have caused **any major damage**, so it is rather a **neozoon**. (NABU Schleswig-Holstein 2016)

More information about invasive (animal) species can be found here and here

Author: Brigitte Suchaneck, 2021

B

Steckbrief

Tierart

Herkunft

Gefährdungspotential

Bekämpfungsmöglichkeiten

More information about invasive (animal) species can be found here and here

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Subject area III
Threat constellations and solutions
Invasive Species 5

Invasive plant species

Use the link to interactively learn about invasive plant species.

You can find another overview here.

Describe the impact of a species on the ecosystem and, if applicable, on human health. You may choose the language yourself.

Plant species:

Source: Wildpflanze/ Neophyten

Name invasive mosquito species and explain their threat to humans. Use one of the links. For more information, visit One Health concept.

Again, you are free to choose the language, although it is recommended to choose a different language than in the previous task to improve your general language skills.

Source: Das Indische Springkraut

Author: Brigitte Suchaneck, 2021

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