Institute of Geophysics
Polish Academy of Sciences

EDU-ARCTIC2.EU

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NORWEGIAN INSTITUTE OF BIOECONOMY RESEARCH

NATURE, WILDLIFE AND SUSTAINABILITY IN CLIMATE CHANGE

Educational tool kits

Target group: pupils 13-19 years of age (or continued education for teachers)
Pedagogy: flipped classroom, interactive learning, 5-steps model

Language version

Iceland Liechtenstein Norway grants

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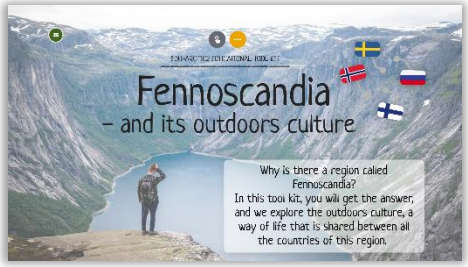
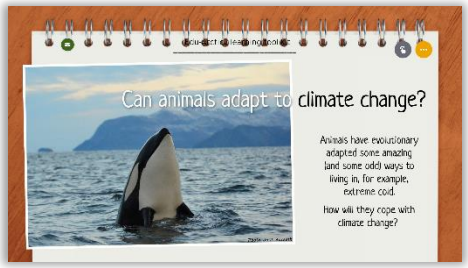
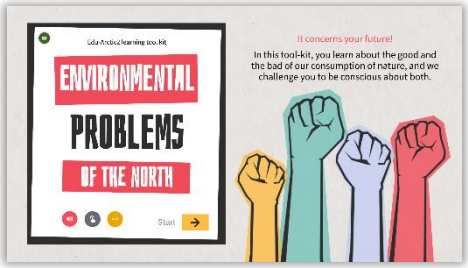
Click a tool kit to see its contents

All packages can easily be integrated on your choice of digital school platform. If you do not already have one, go to https://edu-arctic2.eu to sign up and obtain access to the packages in the Graasp platform, which allows you to add your own materials and to track your students' progress. There you find even more packages.







Project office: Księcia Janusza 64, 01-452, Warsaw, Poland edu-arctic2.eu **edukacja@igf.edu.pl**

EDU-ARCTIC 2: from polar research to scientific passion – innovative nature education in Poland, Norway and Iceland receives a grant of ca. 245 000 EUR received from Iceland, Liechtenstein and Norway under EEA funds. The purpose of the EDU-ARCTIC 2 project is to: enhance the knowledge about nature, geography, natural resources, political specificities concerning polar regions and increase awareness of environmental issues and climate change, increase of interest in pursuing STEM education and careers due to enhancement of knowledge about scientific research, and their place in the modern world, familiarizing young people with scientific career opportunities; introduce innovative tools by way of an e-learning portal and effective methods of teaching science in schools

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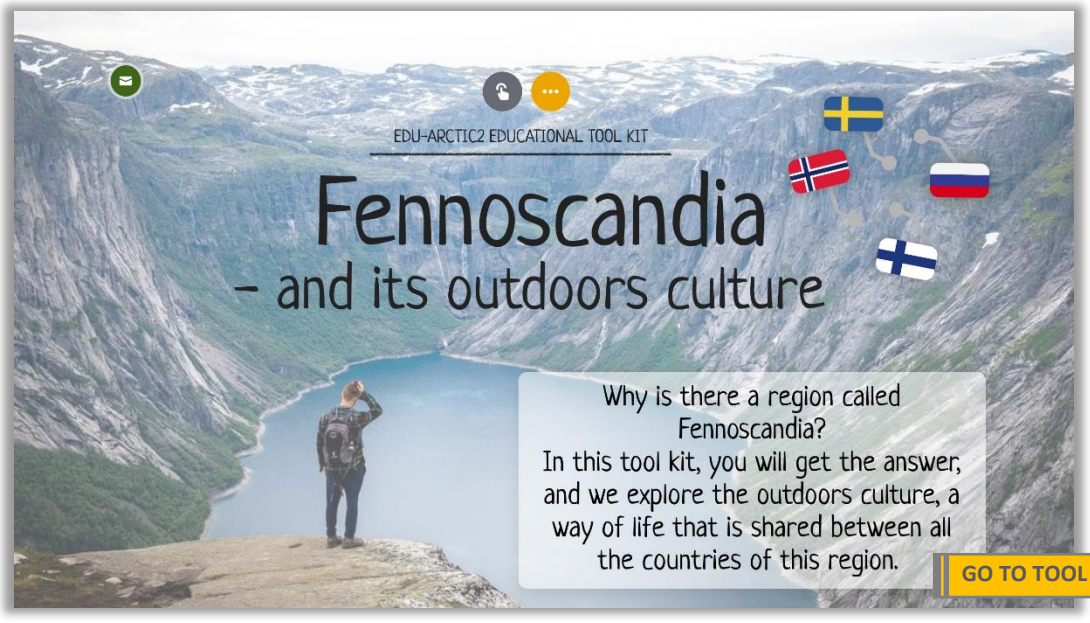
BACK TO MENU

Teachers' Guidelines

Fennoscandia - and its outdoors culture



In this educational tool kit, your pupils will learn about why and where there is a region called Fennoscandia. We explore cultures for the outdoors that are shared between all the countries of the region. In role play, pupils will explore how one, by learning about another's culture, one can more easily accept it even when one does not like it.

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60d33bd7f934aa0dd88188a1

Age Range: 13-19 years

Didactical Hours: 2-4 school hours + students working on their own 4+ hours (you can pick modules, see time per module on the next page)

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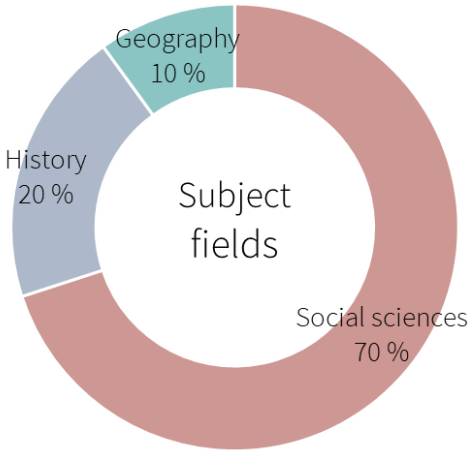
How does the package relate to STEAM education? This is an interdisciplinary tool kit, combining geography, history and social sciences, with emphasize on the latter.



Keywords: cultures, weather, languages, skiing, outdoors, hunting, Sami culture, Norway, Sweden, Finland

Learning objectives:

After finishing the tool kit, the goal is that the student

- knows where Fennoscandia is, and why we have a name for this region
- understands the long tradition for the outdoors culture found in all of Fennoscandia
- understands that we can accept someone else's culture even if we do not like it

Guidelines for teaching:

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

Click  *then the stack of papers* 

(or insert page number if you already know it, and want to be quick)

Didactic 30 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few partly interactive slides. Eagerness to learn is stimulated

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with a quiz. The introduction slides can preferably be presented by the teacher in class, while the next step (2) can preferably be used as individual pupil work.

Individual 60-90 minutes

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube.

Didactic 45-90 minutes, individual 30-60 minutes

Step 3 (Explore) The roleplay group exercise is carried out at two different days, with individual homework in between. There are step-by-step instructions, and no equipment is needed. The exercise explores opinions and feelings in a relational setting, so teachers should be mentally prepared for to give a bit of diplomatic guiding and emotional support.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is pedagogically very important. We recommend reflecting as individual homework, with subsequent discussion in class. We also advise that the pupils can choose the communication form they prefer on their hand-ins. Pupils may also present their work in front of the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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BACK TO MENU

Teachers' Guidelines

Climate & change in the north

Heavier rainstorms, more landslides, the winds howling more often, a longer summer… The good or bad of a warming climate! In this educational tool kit, your pupils will learn about northern climates, and possibly even sense it. Not the least, they will learn about climate changes in the north, which are not quite the same as in the south.

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60d5553a00ac720dd823d904

Age Range: 13-19 years

Didactical Hours: 3-5 school hours + students working on their own 2+ hours (you can pick modules, see time allocation per module on the next page)

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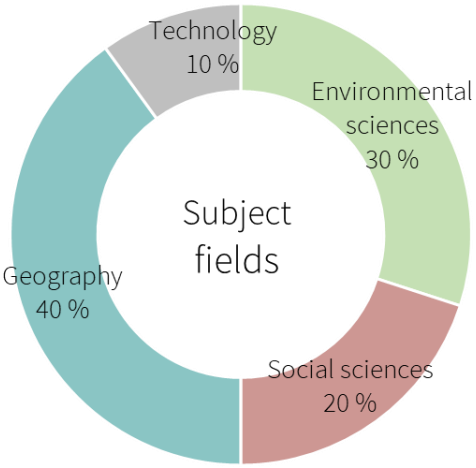
How does the package relate to STEAM education? This is an interdisciplinary tool kit, combining geography, natural science, history and sociology.



Learning objectives:

After finishing the tool kit, the goal is that the student

- understands the difference between weather, climate and climate change
- knows a lot about how climate change affects the north
- can evaluate scientific merit in the climate debate

Terms to learn

Weather = what you see out of your window right now, whether it is rainy or blue sky, what the temperature is, how windy it is and so on.

Climate = the most typical view of the weather you have seen outside your window over a long period. Typically meteorologists use three decades.

Continental = in relation to climate, continental means inland (as opposed to coastal). Continental areas typically are drier and colder than coastal areas.

Coastal = in relation to climate, coastal means near the ocean (as opposed to inland). Coastal areas typically are wetter and warmer than inland areas.

Inland = in relation to climate, inland means the same as continental (as opposed to coastal). Inland areas typically are drier and colder than coastal areas.

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Arctic = in relation to climate, arctic means the polar climate zone in the northern hemisphere (while in the south the polar is called antarctic). It is the northernmost climate zone. Often its border is referred to be at 76 degrees north, but this varies by, for example, altitude (how far above sea-level you are).

Sub-arctic = in relation to climate, sub-arctic means areas just south of the true arctic. The transition from sub-arctic to arctic is gradual, sometimes a bit south of the arctic circle (76 degrees north), often quite far north of that circle. The difference between the arctic and sub-arctic is mainly that the arctic is even colder than the sub-arctic.

Start of growing season = its definition varies between countries. One quite common way to define it, is the first day of the year when daily temperature has been above 5 degrees Celsius for 5 days in a row. In practice, it means the time when plants starts growing again after winter.

Permafrost = larger areas where the ground stays frozen year-round. Only the topmost layer of it normally melts when the temperature is above freezing. Permafrost occurs in the very north towards the arctic climate zone, or in rarer occasions, high up in the mountains. The most talked about permafrost type is the peat land areas (peat is old organic material), but permafrost can also be in areas with mostly rocks and very little organic material. One major effect of climate change is that permafrost is melting.

Tree-line = the height above sea level where tall trees no longer grow because of cold. It marks the change from forest (taiga or mountain forests) to the tundra. This varies between parts of the world. In Fennoscandia, for example, it lies at about 700-800 m.a.s.l. in the south and gradually lower as you go north. One major effect of climate change is that the tree-line expands northwards and upwards.

Normal weather = the typical weather for a certain time window, such as daily, monthly or annual, measured in many years (often 30 years is used), for which average values (or sometimes median) are calculated. The average is considered the normal weather. Various weather parameters are measured, such as temperature, precipitation (= rain- or snowfall), cloudiness, humidity, snow cover and wind.

Extreme weather = there are two different ways we consider a weather to be extreme: 1) by its strength, If it is above or below the normal range typically occurring. For example, the most powerful of winds or the driest of summers. 2) when it occurs at times or places it normally does not. For example, a snow storm in southern Portugal or start of growing season in May in Siberia.

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Greenhouse effect = the Earth with its atmosphere is like a greenhouse. Short wavelength radiation from the sun that is not stopped by the ozone-layer, travels easily through the rest of the atmosphere towards the Earth. When it hits a surface or an object, its wavelength become longer and it emits some of its energy, before it is reflected back through the atmosphere. This is why your skin is getting warmer the longer we stay in the sun. The short length UV-radiation is converted into long waved IR-radiation. The longer wave radiation cannot so easily move through the greenhouse gases in the atmosphere. Thereby much of it gets trapped and keeps emitting energy that warms the air temperature. Without the greenhouse effect, Earth would not be livable. However, there is now more greenhouse gases in the atmosphere than for as long as we have recorded it, so more of the outbound radiation is stopped than has been the normal. The most common greenhouse gases are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and fluorinated gases like hydrofluorocarbons.

Guidelines for teaching:

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

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Didactic 30 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are explained as simply as possible. The introduction slides can preferably be presented by the teacher in class, while the next step (2) as individual pupil work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45-90 minutes, individual 30-60 minutes

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Step 3 (Explore) This is two-fold. First there is a quiz (kind of escape room), which the pupils work on individually. Then there is an in-class/homework exercise. The tool kit presents only part of the instructions, as some should only be known by the teacher (there is a twist in the exercise!). Here are the more detailed instructions for the teacher:

1) Ask the class to move into three groups:

- those who are confident that current climate change is largely human-caused
- those who are confident that current climate change is NOT human-caused
- those who are in doubt.

Then ask the group of doubters to take a stand and go to either of the other two groups, even though they may feel uncertain. We suggest this way of doing it, so that nobody is forced to

take a stand immediately without signaling "formally" that they are in doubt.

2) Let each group have some time to discuss by themselves their views and formulate a list in the form of short statements about the TWO most important reasons behind their view. They should not use literature of any kind at this stage, only their minds. Since the groups may be quite large, the students may have to vote to reach agreement which are the two most important. Or figure out another way to agree. This is a training in democracy too.

3) As individual homework, you tell the students to prepare 3 pieces of evidence FOR each of the two reasons. Advise them that these should be scientific studies. You collect their evidence and print them on small pieces of paper. Only one of each, but make sure you keep them apart (which of the two groups they belong to).

Pst. Because science is difficult to read for most teenagers, they are bound to bring back evidence that is not science. You can use the evidence they come up with, to teach the class about source diligence, which is a huge and important topic that you may wish to set aside a separate school hour for.

4) Now, back in class after homework, ask the students to go into their groups again. Hand them their evidence, BUT switch the groups! So that group 1 (confident that climate change is largely human caused) get the evidence from group 2 (confident it is not human caused).

5) Let the groups look up the evidence, discuss and dissect it and see if they can find proof against it. You are now turning the table of evidence.

6) Open for class reflections about who has the balance of proof when it comes to climate change. Are there more for or against that it is human caused? In your class, and among all

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evidence out there? What if there were equally much evidence for both? How should society handle it? How does it matter whether climate change is human caused?

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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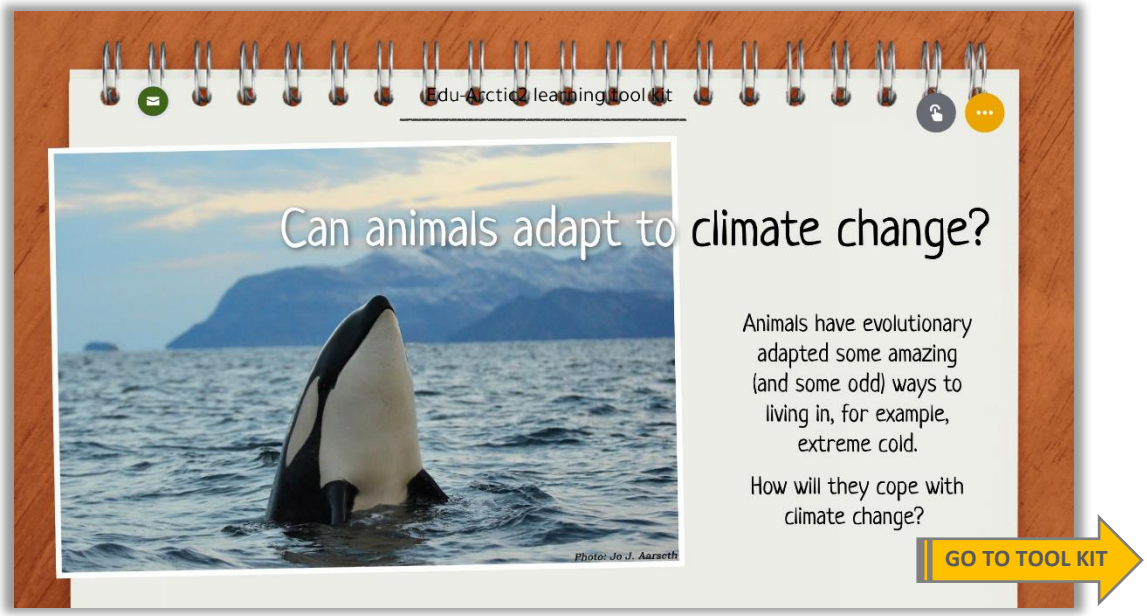
Teachers' Guidelines

Can animals adapt to climate change?



In this educational tool kit, your pupils will learn about the amazing and sometimes odd ways animals have adapted to living, especially in polar extreme environments. This is part 1 of a series of three tool kits on the topic. Part 1 gives an introduction and explains principles of evolutionary adaptations in view of climate change. Part 2 is about animals in the taiga, while part 3 is about animals on the tundra.

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

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Age Range: 13-19 years

Didactical Hours: 2-4 school hours + students working on their own 5+ hours (you can pick modules, see time allocation per module on the next page)

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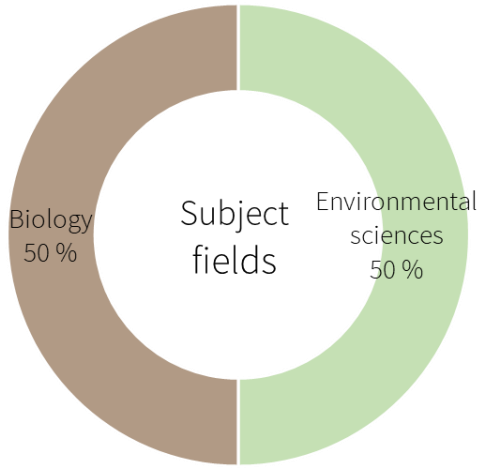
How does the package relate to STEAM education? This tool kit is specialized for biology classes, but there is also interdisciplinary content about climate change, involving environmental science.



Learning objectives

After finishing the tool kit, the goal is that the student

- understands why it is important to study animal evolution
- knows that evolution takes a long time (several generations)
- can reflect on how animals can or cannot adapt to climate change

Terms to learn

Physiology = how the organs of living beings are arranged in their bodies, and how these work to keep the being alive and well through changes occurring in the environment in which they live.

Physiological adaptations = how evolution has shaped the physiology of a given species. While one talks about the physiology of individuals, one talks about physiological adaptations mainly regarding a species. All individuals of a species within an area has more or less the same physiological adaptations. These are largely genetically determined, which means that the individual was born with them.

Behavioural adaptations = these are also shaped by evolution, largely genetically determined and similarly so for all individuals of a species within the same area. However, each individual can adjust their behaviour more than they can adjust their physiology. All these small

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individual adjustments in behaviour and physiology ultimately leads to the species' adaptations through natural selection and hence, to evolution.

Generalist = a species that is adapted to eat a variety of food types, and to live in a wider range of environments. Generalists therefore are more adaptable than specialists.

Specialist = a species that is adapted to eat a narrow diet, and to live in a quite specific environment. Specialists thrive the most with few and small changes in their environment.

Guidelines for teaching

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

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Didactic 30 minutes, individual 15 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are explained as simply as possible and learning eager is facilitated with a quiz. The slides can preferably be presented by the teacher in class, while the next step (2) as individual work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45 minutes

Step 3 (Explore) is an in-class experiments about inner and skin temperature. There are step-by-step instructions, and no advanced equipment is needed, only tools that everybody has access to. There is a printable one-page sheet with the instructions in -brief, in case it is not possible having tablets available for the pupils while working.

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Individual 60+ minutes (didactic 45+ minutes)

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Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

EDU-ARCTIC 2: from polar research to scientific passion – innovative nature education in Poland, Norway and Iceland receives a grant of ca. 245 000 EUR received from Iceland, Liechtenstein and Norway under EEA funds. The purpose of the EDU-ARCTIC 2 project is to: enhance the knowledge about nature, geography, natural resources, political specificities concerning polar regions and increase awareness of environmental issues and climate change, increase of interest in pursuing STEM education and careers due to enhancement of knowledge about scientific research, and their place in the modern world, familiarizing young people with scientific career opportunities; introduce innovative tools by way of an e-learning portal and effective methods of teaching science in schools

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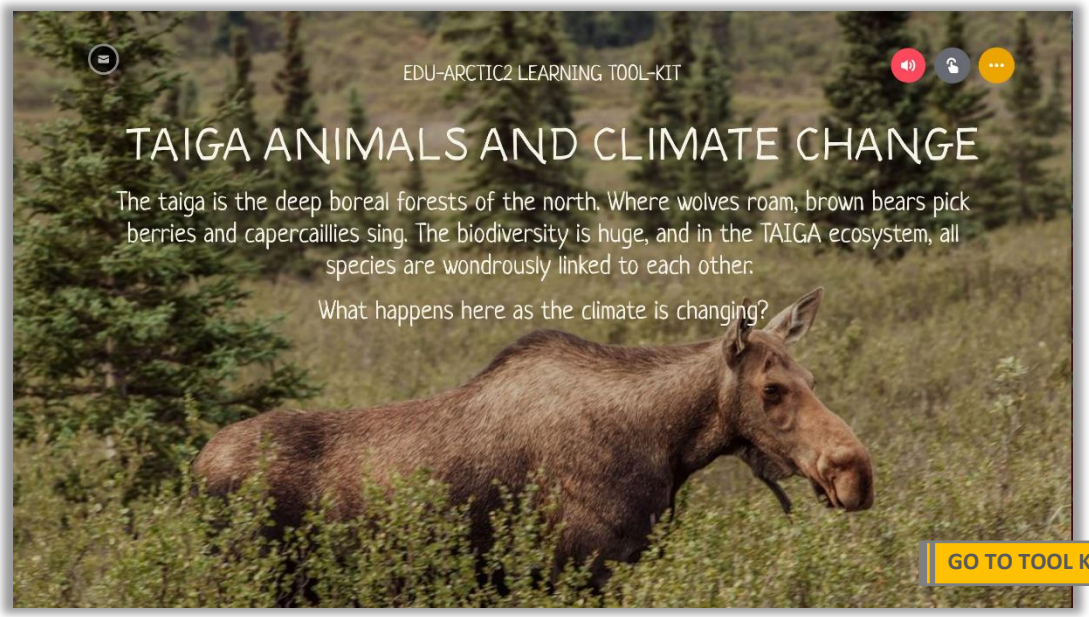
Teachers' Guidelines

Taiga animals and climate change



The taiga is the deep boreal forests of the north. Where the wolves roam, brown bears pick berries, and capercaillies sing. The biodiversity is huge, and in the taiga ecosystem, all the species are wondrously linked to each other. What happens here when the climate is changing?We advice you first do part 1 (Animal adaptability to climate change).

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60d5cf6483b8480ded4e082e

Age Range: 13-19 years

Didactical Hours: 3-6 school hours + students working on their own 5+ hours (you can pick modules, see time allocation per module on the next page)

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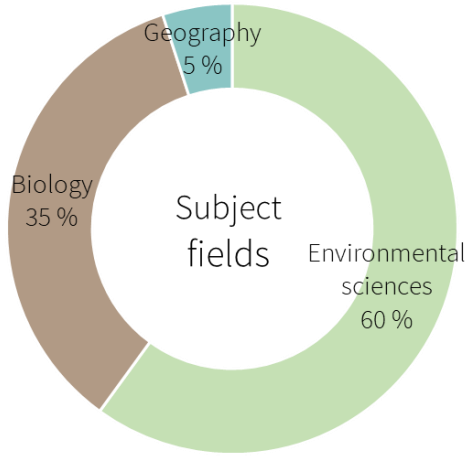
How does the package relate to STEAM education? This tool kit is specialized for biology (ecology) and environmental science. It is also suitable to use in other subjects when these are addressing climate change.



Learning objectives

After finishing the tool kit, the goal is that the student

- knows what and where is taiga
- understands ongoing climate change in the taiga
- can outline possible effects of climate change on taiga animals
- grasps how effects on one species cascade on many others

Terms to learn

A keystone species = a species that has large effects on other organisms within the same ecosystem. Keystone species are for example large predators such as wolves or sea otters, which regulate the numbers of their prey. Keystone species also include so called “engineers” such as beavers or elephants, which can alter the environment physically.

Cascade effects = are the domino effects that happen because everything in any ecosystem is linked and affect each other. In the taiga, for example, if wolves get a disease and nearly dies out, the deer populations are likely to become so numerous they will destroy their own food plants. Then the deer will also start to die… and the trees can grow back. Maybe, in the meantime, new wolves move into the area and again keep the deer in check… until a new disturbance of some kind makes everything crash again.

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Boreal = the word stems from the Latin borealis and the Greek boréas, which means 'northern', 'the far north' or 'northern winds'. It is a term mainly used in science (ecology), where it refers to a vegetational climate zone. This zone is dominated by forests, mainly conifer trees with deciduous trees only mixed in between.

Canopy = the topmost part of trees growing close together. The tree crowns form a layer of leaves and needles, which partly shade the ground from light and partly stop rain and snow. The crown of a tree is the part where it branches out from the stem or trunk.

Field layer = is the layer of small plants and bushes growing at the bottom of the forest floor. In the taiga boreal forest, its height typically range from a few cm to half a metre. It is also called forest floor vegetation.

Conifers = tree species that carry green "leaves" all year round. The leaves are termed needles instead of leaves. Note that there are a few conifer species that do shed their needles in winter (in Europe one example is the larch).

Deciduous = the trees which shed their leaves in autumn, and grow new leaves in spring, as opposed to conifer trees.

Heat stress = occurs when a species over time must endure a warmer environment than it is evolutionary adapted to. You likely knew this term, but did you know that plants can experience heat stress too?

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

Click  *then the stack of papers* 

(or insert page number if you already know it, and want to be quick)

Didactic 30 minutes, individual 15 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are

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explained as simply as possible and learning eager is facilitated with a quiz. The slides can preferably be presented by the teacher in class, while the next step (2) as individual work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Individual 30 minutes (didactics 30 minutes)

Step 3 (Explore) is a quiz to explore solo. We advice that you have a brief Q&A session in-class, as some of the questions concerns attitudes rather than strict facts.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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Teachers' Guidelines

Tundra animals and climate change

Will the toughness of tundra animals be their benefit or their bane in a changing climate? The tundra is a harsh and brutally cold place in winter, with almost no plants to eat. Only the toughest of creatures survive here. In this tool kit, we explore how climate change affects the tundra and its animals. We advice that pupils first do part 1 (animal adaptability).

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60dd651e83b8480ded4e58a0

Age Range: 13-19 years

Didactical Hours: 3-4 school hours + students working on their own 5+ hours (you can pick modules, see time allocation per module on the next page)

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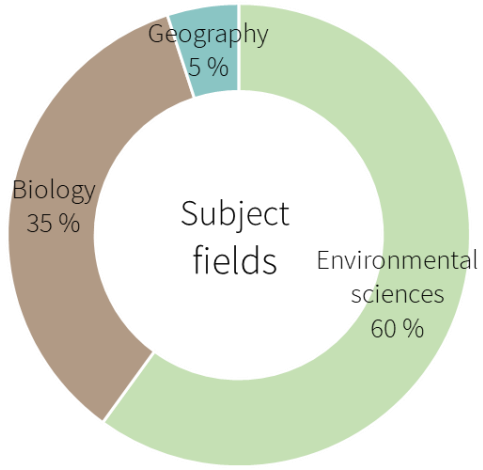
How does the package relate to STEAM education? This tool kit is specialized for biology (ecology) and environmental science. It is also suitable to use in other subject fields addressing climate change.



Learning objectives

After finishing the tool kit, the goal is that the student

- knows what and where is tundra
- understands ongoing climate change in the tundra
- can outline possible effects of climate change on tundra animals
- grasps how tundra animals are worse off than taiga animals in the changing climate

Terms to learn

A keystone species = a species that has large effects on other organisms in the ecosystem. If this species goes extinct in the area, many of the ecosystem functions are likely to be messed up. A keystone species on the tundra is, for example, the reindeer/caribou. They are main prey for wolves and wolverines (at times also for eagles), and they are themselves large-scale engineers of the vegetation (eating it, trampling it and fertilizing it).

Population cycle = when the population numbers fluctuate between a high and a low at regular intervals. Such cycles normally involve two or more species, who are strongly linked, for example, in a predator-prey relationship. In ecology, there are some very famous population cycles, such as the lynx and the hare in the taiga. Which for decades, and probably centuries, have fluctuated in a cycle with tops and bottoms every 10 years. Another one is lemming and fox on the tundra.

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Scavenger = is an animal that lives off meat from animals that are already dead. Scavengers typically also kill animals themselves, but they have specialized in utilizing the carcasses of animals that often are much bigger than the scavenger could kill by itself. On the tundra, the decaying of meat goes slow because of the cold, so a large carcass can be good food for a scavenger for months.

Snow crust = is a strong layer in the snow which makes it harder for plant-eaters to dig through to their food, but at the same time, it makes the snow more likely to bear the weight of some animals. It is formed either by strong winds, which compacts the snow, or by large fluctuations in temperature, which transforms the snow into ice. One major effect of climate change is that icy crusts form more often, and even at times it did not use to do so.

Tree-line = the height above sea level where tall trees no longer grow because of cold. It marks the change from the taiga (boreal forest) to the tundra. This varies between parts of the world. In Fennoscandia, for example, it lies at about 700-800 m.a.s.l. in the south and gradually lower as you go north. One major effect of climate change is that the tree-line expands northwards and upwards.

Permafrost = larger areas where the ground stays frozen year-round. Only the topmost part of it normally melts when temperatures are above freezing. Permafrost occurs in the very north towards the arctic climate zone, or in rarer occasions, high up in the mountains. The most talked about permafrost type is the peat land areas (peat is old organic material), but permafrost can also be in areas with mostly rocks and very little organic material. One major effect of climate change is that permafrost is melting.

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

Click  *then the stack of papers*  *(or insert page number if you already know it, and want to be quick)*

Didactic 30 minutes, individual 15 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are

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explained as simply as possible and learning eager is facilitated with a quiz. The slides can preferably be presented by the teacher in class, while the next step (2) as individual work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45-90 minutes, individual 30-60 minutes

Step 3 (Explore) is two-fold. First there is an exercise to explore solo (quiz, kind of escape room), and then an exercise about source diligence, which can be carried out as group work, either in-class or partly as home-work. It is important that the teacher has solid experience in being source diligent, and that the pupils' work eventually is explored in class under the guidance of the teacher.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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Teachers' Guidelines

Too many or too few wild animals?

When humans decided to conquer the world, we took on the responsibility to manage most wildlife. This is not an easy task. Ecosystems are so complex. People have so differing opinions. In this tool kit, you'll learn about wildlife management! About the easy theory and the struggling practice. And, what may happen if we give wildlife "back to nature".

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60db107300ac720dd82414db

Age Range: 13-19 years

Didactical Hours: 1-3 school hours didactical, 5+ hours student self-schooling (you can pick modules, see time allocation per activity on the next page)

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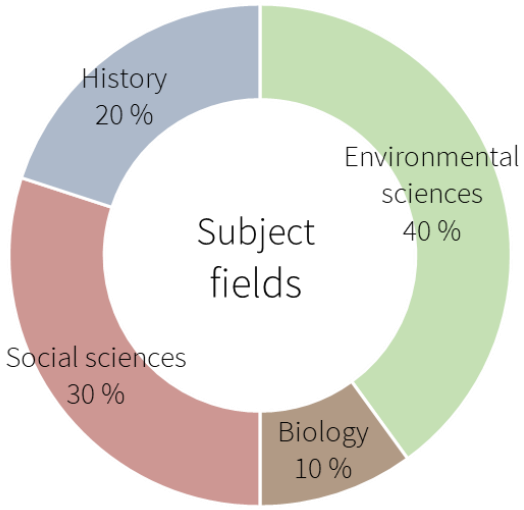
How does the package relate to STEAM education? This is an interdisciplinary tool kit combining environmental science and social science (ethics, philosophy, sustainability) and a bit of history.



Learning objectives

After finishing the tool kit, the goal is that the student

- knows a bit about the history of wildlife management
- understands when and why wild animals must be managed
- has insights to the many opinions about how wildlife should be managed
- is aware of one's own strong influence on what happens to wild animals

Terms to learn

Wildlife management = is the human facilitation for or manipulation of wildlife populations so that its individuals stay healthy, and the number of them stays within an area's carrying capacity. This is mainly carried out by regulating the number of individuals, for example by prohibiting or allowing hunting of the species in question. It may also include restricting the access by humans to an area, to minimize disturbance. Sometimes relocation of certain individuals is also necessary. Wildlife management must struggle to balance the requirements of the animals and the many opinions and wishes that people have about wildlife.

Wildlife monitoring = keeping account of how many individuals there are in a wildlife population. Two main types: Monitoring over time (change in numbers from year to year), or over space (where are the animals). Increasingly, it also involves monitoring the health of the animals.

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Wildlife conflict = When the wishes of humans clash with the needs of wild animals. It may involve single and specific individuals, or whole animal populations.

Animal relocation = Deliberate physical transport by humans of a wild animal, which is either in danger or is considered a nuisance to humans where it currently is, OR the animal is moved to another population of the species that has become too few in numbers.

Carrying capacity = The density of animals that can live healthy in an area, without destroying the habitat, so that similar densities of animals can live there in the same way for infinite time.

Population bottleneck = When a population is drastically reduced in numbers. It not only looses many of its individuals, but with them, it also looses much of its genetic variation. Any population needs genetic variation (diversity) to stay the most healthy and fit for the future, especially when their environment is changing.

Wildlife harvesting = Harvesting of wildlife is another term for killing wild animals (or plants). In the context of wildlife management, animals are harvested to avoid that their population become too numerous. The term was established many years ago, and reflects that often these killed animals provide humans with food.

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

Click  *then the stack of papers* 

(or insert page number if you already know it, and want to be quick)

Didactic 30 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are explained as simply as possible. The introduction slides can preferably be presented by the teacher in class, while the next step (2) as individual pupil work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room

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with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45 minutes, individual 60+ minutes

Step 3 (Explore) is two-fold. First there is an exercise to explore solo (quiz, kind of escape room), and then an exercise about ethics around species eradication versus conservation, which preferably is carried out in-class in smaller group, but also finalized with an individual hand-in.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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Teachers' Guidelines

Wildlife technology

Technology has given humans a major upper-hand on other animal species. Here you will learn about ways in which humans use technology to monitor and manage wildlife, and we explore ethical dilemmas. For example, is it okay to catch and operate on wild animals?

Do we want to know all the secrets of nature?

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60d7577f00ac720dd823edf1

Age Range: 13-19 years

Didactical Hours: 3-5 school hours didactical, x hours student self-schooling (you can pick modules, see time allocation per activity on the next page)

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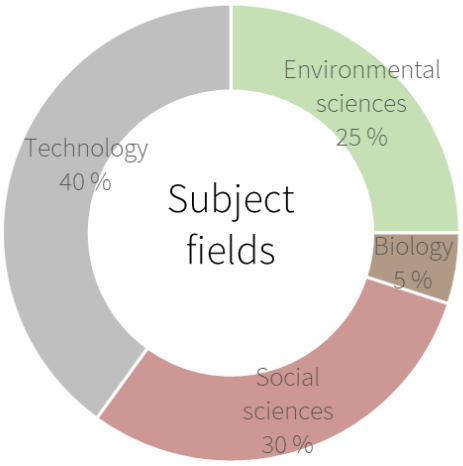
How does the package relate to STEAM education? This is an interdisciplinary tool kit combining a bit of technology, with focus on ethics and wildlife management.



Learning objectives

After finishing the tool kit, the goal is that the student

- understands WHY wildlife technologies are important
- knows that technology is just a tool, not the whole solution to save species
- can reflect on ethical dilemmas around wildlife technologies

Terms to learn

Wildlife monitoring = the regular count or estimation of how many individuals there are in a wildlife population. This number is of importance for wildlife management, as a basis for decision-making, for example if conservation measures are required when the numbers are too low, or to set a hunting quota when numbers are too high.

GPS collaring = the attachment of a GPS sender on a wild animal. For larger animals, this is typically a neck collar. On birds, it is a foot collar or a unit glued to their feathers. For animals living in sea (fish, seals and so on), it is typically a unit glued to their skin. The process is highly stressful to the animals, and there are regulations and permissions required for doing it.

Sedation = when larger animals that are captured and handled by humans for wildlife studies, they normally must be sedated to be safely handled. The typical method is to dart them with a gun from a safe distance, such as from a helicopter. The process is highly stressful to the animals, and there are regulations and permissions required for doing it.

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Non-lethal trapping = the capture of an animal for the purpose of not killing it, but to make measurement of it or collect samples from it. The process is nevertheless highly stressful to the animals, and there are regulations and permissions required for doing it.

Catch-and-release = the capture of animals mainly for the purpose of counting them, but in some cases, one uses this term synonymous with non-lethal trapping. Then it typically also involves taking samples, measuring or weighing.

Collecting samples = can involve feces (scats, stools, poop), hairs, antlers, bones, body tissue (blood, skin or organs), or in the case of plants; leaves, buds, flowers, bark, roots etc. The collection of samples can be done lethally (killing the animal or plant) or non-lethally, and invasive (handling the animal) or non-invasive (collecting hairs or scats that have been left naturally by the animals along their path).

Wildlife camera = the placement of automated and camouflaged cameras in nature, with the aim to capture footage of which animals are there. Wildlife is also studied with the use of cameras on drones, but these are actively operated and not camouflaged. The placement of cameras in nature imposes strongly on human personal freedom and protection, and the regulation of it is in ongoing debate and regulation.

DNA monitoring = the regular collection of DNA from wild animals to 1) identify new individuals, or 2) measure the genetic variation in the population. All populations need genetic variation. If it drops too low, the population is much less equipped to handle changes in its environment. or 3) keeping an eye on the animals' diet. Yes, one can use DNA from their stomachs or poop to see what they have been eating.

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

Click  *then the stack of papers* 

(or insert page number if you already know it, and want to be quick)

Didactic 30 minutes

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Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are explained as simply as possible. The introduction slides can preferably be presented by the teacher in class, while the next step (2) as individual pupil work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic involves a lot of ethical concerns, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45 minutes, individual 60+ minutes

Step 3 (Explore) is an escape room to explore solo (with a small mathematical challenge too, as maths are always involved in developing new wildlife technology). The student gets an explanatory response on their answer, so there should not be much need for in-class work.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a few slides to be presented in-class or the pupils can work on their own.

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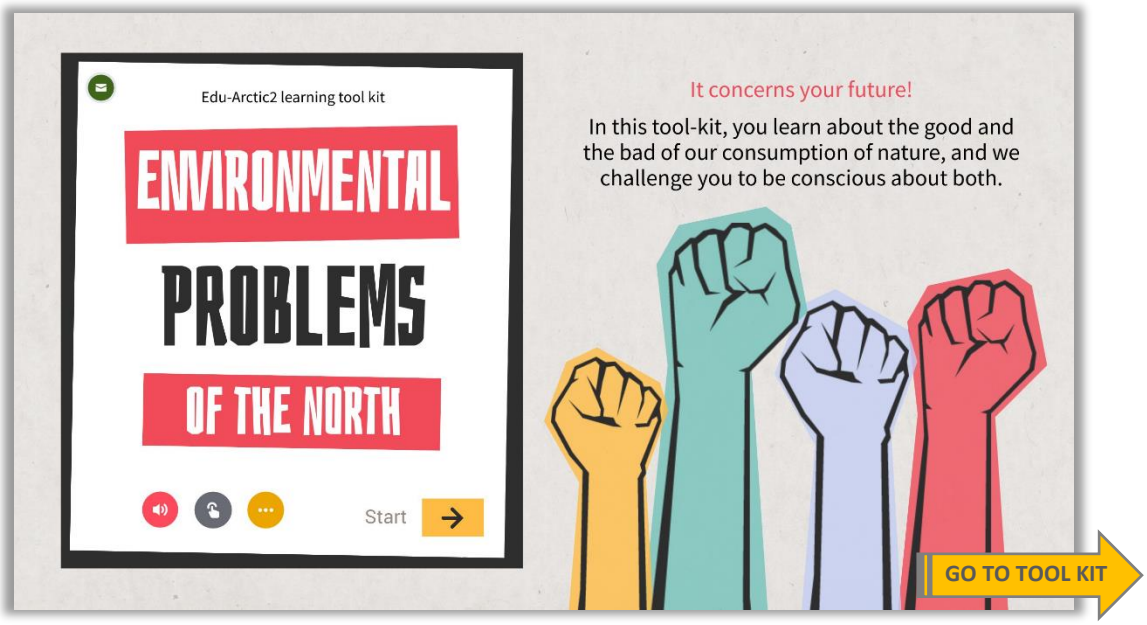
Teachers' Guidelines

Environmental problems of the north



Even in the most pristine of northern Europe, we have lost almost all the long stretches of intact natural lands. We build and travel all over the place. The environmental problems it creates are unsustainable. In this tool kit, the students learn about the good and the bad of our consumption of nature, and are challenged to be conscious about both.

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60d9b030533a900de690f599

Age Range: 13-19 years

Didactical Hours: 1-3 school hours didactical, 5+ hours student self-schooling (you can pick modules, see time allocation per activity on the next page)

Project office: Księcia Janusza 64, 01-452, Warsaw, Poland edu-arctic2.eu edukacja@igf.edu.pl
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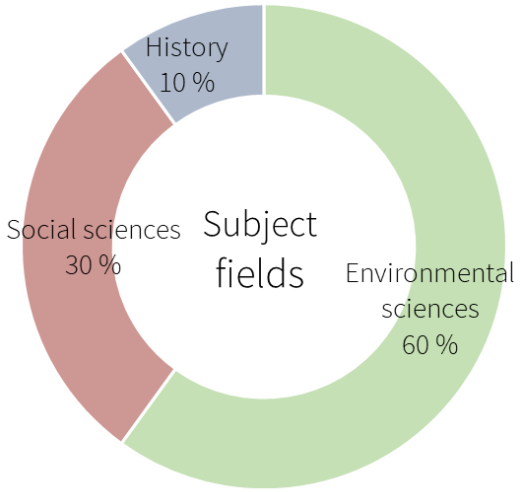
How does the package relate to STEAM education? This is an interdisciplinary tool kit combining environmental science and social science (ethics, philosophy, sustainability) and a bit of history.



Learning objectives

After finishing the tool kit, the goal is that the student

- grasps that when we encroach on nature, it always adds to these problems
- knows which activities add to which environmental problems
- knows that we can solve all environmental problems, as long enough people want to do it!
- can outline a research experiment with hypotheses set-up

Terms to learn

Ecosystem functioning = the thousands of interactions going on in an ecosystem: between the living beings (animals, plants, fungi etc.) and between the living beings and the abiotic factors (soil, water, space etc.). Because all functions are linked in an ecosystem, any change in one part ripples consequences throughout all other parts.

Biodiversity = the plethora of variation in nature. Diversity is on many levels, it is not just the number of species. There is also variation within the species, where genetic variation is especially important. We also talk about diversity between ecosystems. Apart from all the benefits humans receive from biodiversity (food, medicine, raw materials etc.), nature needs diversity to be able to cope with environmental changes.

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Landscape fragmentation = human encroachment on (until then) intact stretches of natural lands, with our roads, settlement, wind turbines etc. While humans are a natural part of nature, just like any other species, our technological abilities have given us complete dominance in the ecosystems. There are two main effects of our fragmentation: it takes away habitats for other species, and it splits it into pieces and erect physical barriers between them.

Wildlife barrier = a physical or mental barrier to the natural movement of wildlife (mainly animals, but also plants can be stopped by barriers), which comes as a consequence of human activity, for example roads, settlement, wind turbines etc.

Habitat = an area that holds all the ingredients one species need for living and thriving. So there is specific habitats for specific species. Animals often use different habitats at different times of the year.

Pollutants = comes in many forms, not just the toxic chemicals that would be labelled with a dead skull on its bottle. There are physical pollutants, like the infamous plastic, which breaks into micro- and even nano-sized particles (plastic is also a chemical pollutant). And there are noise- and light pollutants, which you maybe have not thought of before.

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

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Didactic 30 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are explained as simply as possible. The introduction slides can preferably be presented by the teacher in class, while the next step (2) as individual pupil work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way

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to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45 minutes, individual 60+ minutes

Step 3 (Explore) is two-fold. First there is an exercise to explore solo (quiz, kind of escape room), and then an exercise about hypothesis and designing an experiment about an environmental issue. This must be carried out in pairs or small groups, and preferably also finalized with a hand-in. Because hypotheses theory is tricky, we advise that the teacher spend some didactical time on this too.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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Teachers' Guidelines

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? In this learning package, we look at how invasive species are a growing problem and how they can affect the environment, other species and even the entire global bioeconomy.

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

Here is a direct link to the tool kit, in case you want to embed it in your own choice of digital school platform: https://view.genial.ly/60dc1255533a900de6911434

Age Range: 13-19 years

Didactical Hours: 1-3 school hours didactical, 2+ hours student self-schooling (you can pick modules, see time allocation per activity on the next page)

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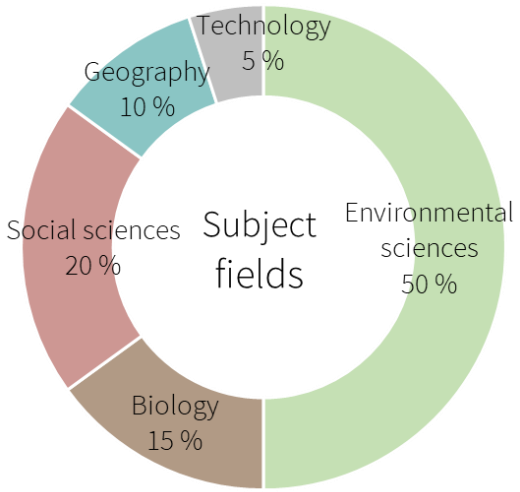
How does the package relate to STEAM education? This is an interdisciplinary tool kit combining a wide range of subject fields.



Learning objectives

After finishing the 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

Terms to learn

Ecological niche = all creatures need certain elements to live, such as food, air, light, temperature, conspecifics to mate with, shelter from weather, stones to crack open their food, wind to blow away insects, and so on. In ecology, a niche is any combination of these factors that makes a liveable space for one species. Any one species has its own niche, but at the same time is part of different niches for many other species.

Exotic (or introduced) species = an exotic species is a species that arrives in a new area where it did not live before, by the means of human transport. The transport can be deliberately or accidentally done by humans. For a species to be truly exotic, it has not been native in this new area at any time in history.

Native (or indigenous) species = a native species is one that came to an area without the help of human transport. For a species to be truly native, its ancestors must also have been native

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to the area they lived in. If a species is introduced by humans in for example Poland, but moves on its own feet into Germany where it has never been native, the species will not become native in Germany.

Species distribution = the geographical space that a species normally occupies. Its distribution can expand by natural dispersal (keeping it as a native species), or by human transport (making in into an exotic or reintroduced species).

Reintroduced species = is the human deliberate release of a species from one area to another area where it was once native, but has since become extinct.

Invasive species = if an exotic species becomes very numerous in the new area, we start to talk about the species being invasive. Also native species can become invasive, but this is rare and almost always caused by humans having made extreme changes to the environment.

Niche competition = this happens if more than one species tries to occupy the same niche. It typically occurs when exotic species invade new areas. Because only one species can occupy a niche over time***, the most competitive species will "win" the niche, while the other one will have to evolutionary adapt and start occupying another niche (or become extinct!).
****why? because if more than one species could occupy a niche, evolution by natural selection would over time make them into the same species (pst. if you understood this, you have really grasped what natural selection is ;).*

Hybridization = occurs when two species or two species subtypes that are quite similar mate and produce offspring. The offspring is called a hybrid. The most frequent occurrences in the wild are between wild (native) and escaped domestic individuals of the once same species. Hybrid individuals often have survival benefits because of their new and more varied gene pool. Because the hybrid is still very similar to the native species, it can occupy the exact same niche as the native. The native may then become extinct, if the more competitive hybrid wins the niche competition.

Control of exotic species = the application of technological and/or chemical tools by humans in order to either kill, sterilize or relocate an exotic species from an area.

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section

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Didactic 30 minutes, individual 15 minutes

Step 1 (Introduction) presents the learning goals. A short intro to topic builds up the overall understanding, presented on a few slides of text and illustrations. Terms to learn are explained as simply as possible and learning eager is facilitated with a quiz. The slides can preferably be presented by the teacher in class, while the next step (2) as individual work.

Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Individual 60+ minutes

Step 3 (Explore) is an exercise to explore solo (escape room). The pupil is guided if they answer right or wrong, and there should be not much need to go through this in class.

Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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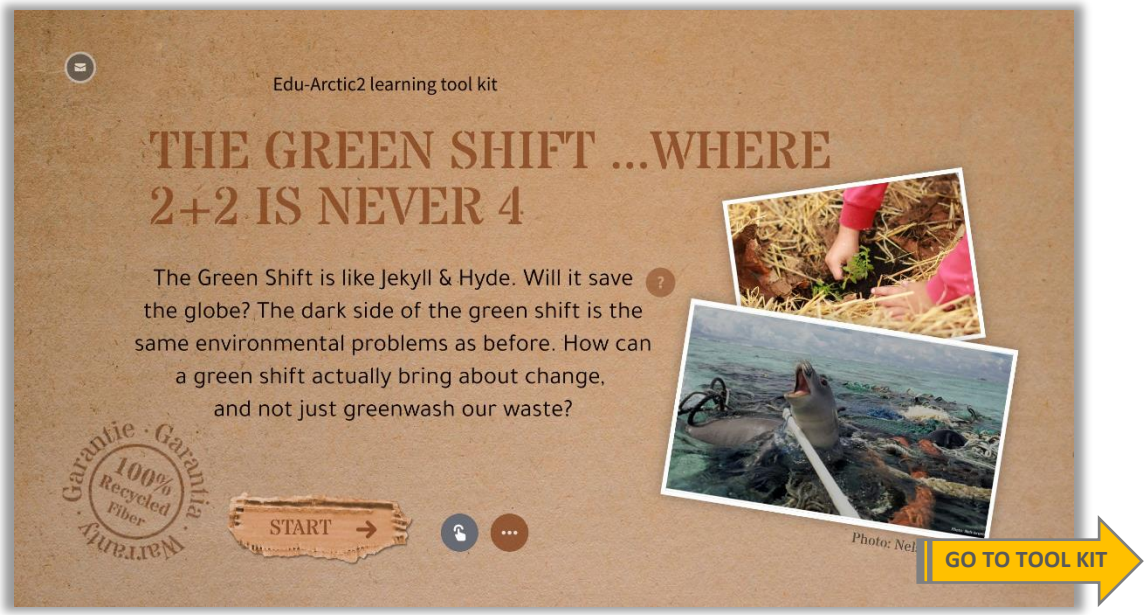
Teachers' Guidelines

The Green Shift, where 2+2 is never 4



The Green Shift is like Jekyll & Hyde. Will it save the planet, or is it just greenwashing? In this tool kit, we try to get a practical grasp on this vague buzz-word. You will learn why 2+2 is never 4 in the green shift. The shadow side of it is still the same environmental issues as before. We reflect upon how the green shift indeed can be used to make changes, and not just greenwash our dirt.

Practical information about the package:

This tool kit is designed to be used in a flipped classroom setting. It follows an interactive pedagogy in 5 steps: introduce, understand, explore, reflect, wrap-up. It is meant to be used online, although there are options to download or print parts, especially modules that are to be used in-class, so that the teacher has these available even without internet.

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Age Range: 13-19 years (best for 15+ years)

Didactical Hours: 1-3 school hours didactical, 5+ hours student self-schooling (you can pick modules, see time allocation per activity on the next page)

Project office: Księcia Janusza 64, 01-452, Warsaw, Poland edu-arctic2.eu **edukacja@igf.edu.pl**

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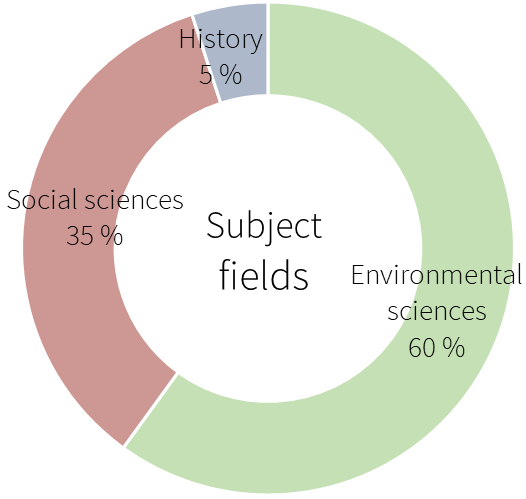
How does the package relate to STEAM education? This is an interdisciplinary tool kit combining environmental science and social science (ethics, philosophy and a bit of history and economy).



Learning objectives

After finishing the tool kit, the goal is that the student

- can explain The Green Shift, why our aims for it are far from being realized
- is aware of how The Green Shift is used to greenwash environmental issues
- can suggest how The Green Shift can indeed be used to lessen human impact on Earth

Terms to learn

Sustainable = If what we do is to be sustainable, it must not reduce the opportunities for future generations to do the same as us.

Circular use of resources = means to not extract new natural resources from nature, but recycling those we have already extracted.

Natural resources = Raw materials that we find in nature, which humans want to harvest and transform with our technology into for example housing, roads, tools, clothing, food or chemicals. Examples are oil, timber, minerals, pasture, animals and medicinal plants. Virtually everything we have of material goods has at least one natural resource in it.

Double-edged sword = When doing one thing that we consider good, inevitably follows by something not good happening too. So we get into a dilemma, weighing pros and cons.

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Environmental problem = Anything that is not sustainable. In almost all cases, it is something humans do, or have done in the past, in order to obtain benefits for ourselves. An environmental problem leads to changes in nature or the atmosphere around the Earth, which makes the ecosystems no longer functioning as before.

Greenwashing = When someone presents something to be more environmentally/eco-friendly than it is, for example, by only highlighting the environmentally friendly aspects of it. Greenwashing can be done by commercial companies, private persons and not least, politicians and authorities!

Guidelines for teachers

All the modules can easily be presented by the teacher on a large screen in front of the class, or the pupils can work individually or in groups on their own, also at home (modules are largely self-explanatory). Most of the modules have content with audio, so pupil headsets are recommended. You share with your pupils the link to the full tool kit, and tell them which section of pages to look at. For example, you tell them to do step 2 (understand) as individual work. You easily navigate the pages by right-clicking the three dots in the lower right corner:

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Didactic 30 minutes

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Individual 60+ minutes (didactics 45+ minutes)

Step 2 (Understand) are facts and engaging photos and videos put into an interactive room with small curiosity-stimulating bits and pieces along the way, where the pupils click their way to learning. Content embedded from internet are scrutinized by scientists for scientific merit and lack of false news, but advice your pupils that this does not hold if they follow further links, e.g. on YouTube. Because the topic is rather complex and not clear-cut, we advise that the teachers also present some of the material in class, for Q&A engagement.

Didactic 45+ minutes, individual 30+ minutes

Step 3 (Explore) This is two-fold. First there is an escape room (a bit advanced, so some pupils may need technical guidance), which the pupils work on individually. Then there is an in-class exercise about dialogue (ethical agreement or disagreement), based on the escape room.

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Individual 60+ minutes (didactic 45+ minutes)

Step 4 (Reflect) This is a pedagogically important step. We advise that the pupils can choose the communication form they prefer on their hand-ins. It can be used as a solely individual exercise, or as we recommend a combination where pupils also present their work for the class, as being able to communicate for an audience is such an important skill in work-life.

Didactic 45 minutes (or individual)

Step 5 (Wrap-up) is a slideshow to be presented in-class or the pupils can work on their own.

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