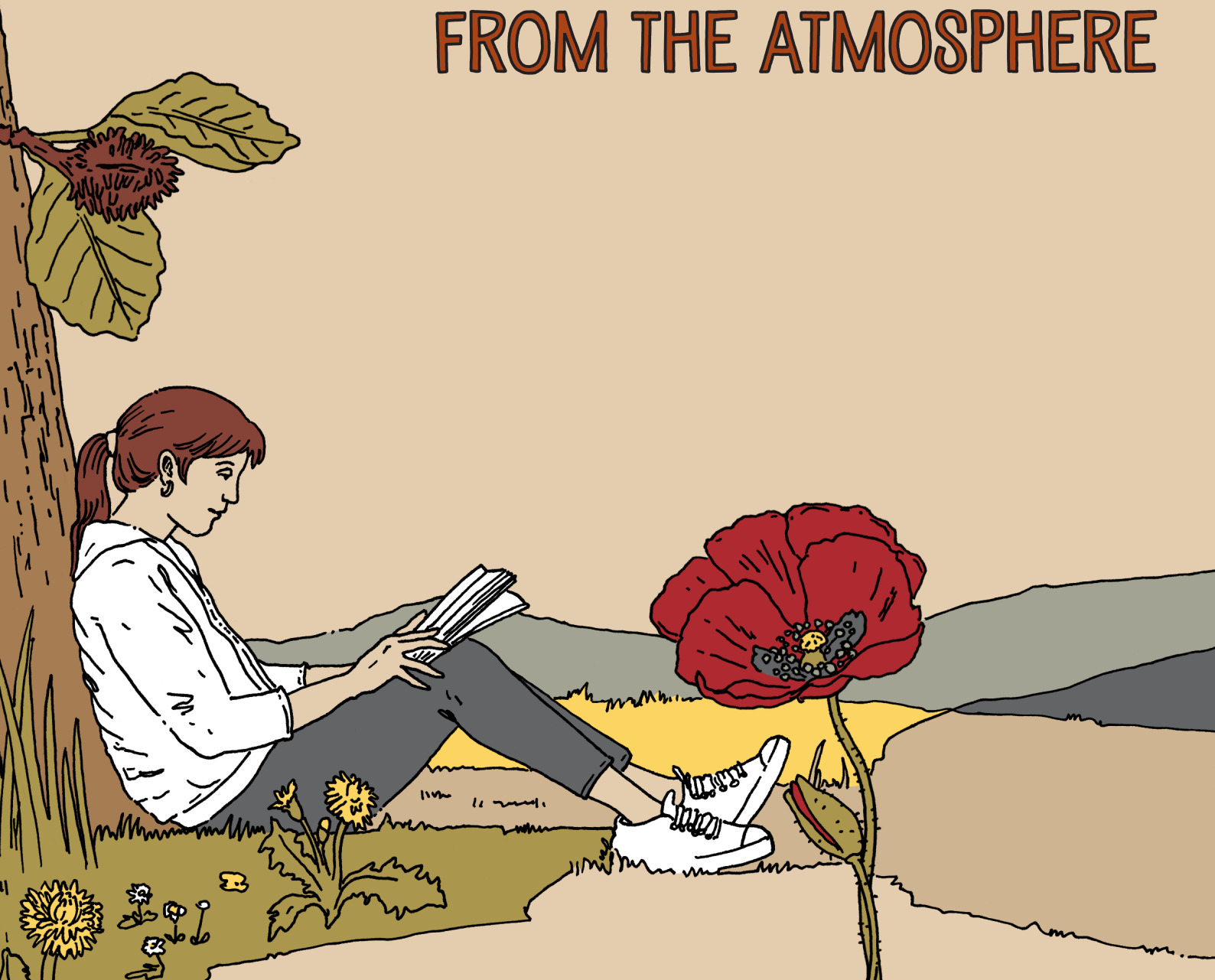
# HOW FORESTS CONTRIBUTE TO CAPTURING CARBON DIOXIDE FROM THE ATMOSPHERE



# INTRODUCTION

This indicator book was created as part of the Teaching Green project and should support teachers of students aged 10 – 16 years who are implementing education about climate change.

The educational process is divided into 4 steps. The first step is the creation of a group of students who will implement the project activities. In the introductory part, students fill out also an questionnaire about their attitudes link to the indicator mentioned below. The second step is theoretical preparation. You can use online learning models or your own resources. The third step consists of practical monitoring of the indicator (at least twice). The result of the monitoring is a presentation prepared by the students containing findings from the practical part. In the final fourth part, students fill out the attitudes questionnaire again and the changes in their character qualities are evaluated.

# CLIMATE CHANGE IMPACT

Forests are an integral part of the landscape and perform several functions in it. In regards to climate change, non-productive functions of forests include ecological and environmental functions: soil protection, water management and climate function, health, cultural, educational, recreational, nature protection and water protection function. With diminishing forests all these functions are dissapearing, creating a large impact on unexpected weather conditions.

INDICATOR: Forest as a carbon sink.

**Project activities support development of 6 essential character qualities:**

 **mindfulness**

 **curiosity**

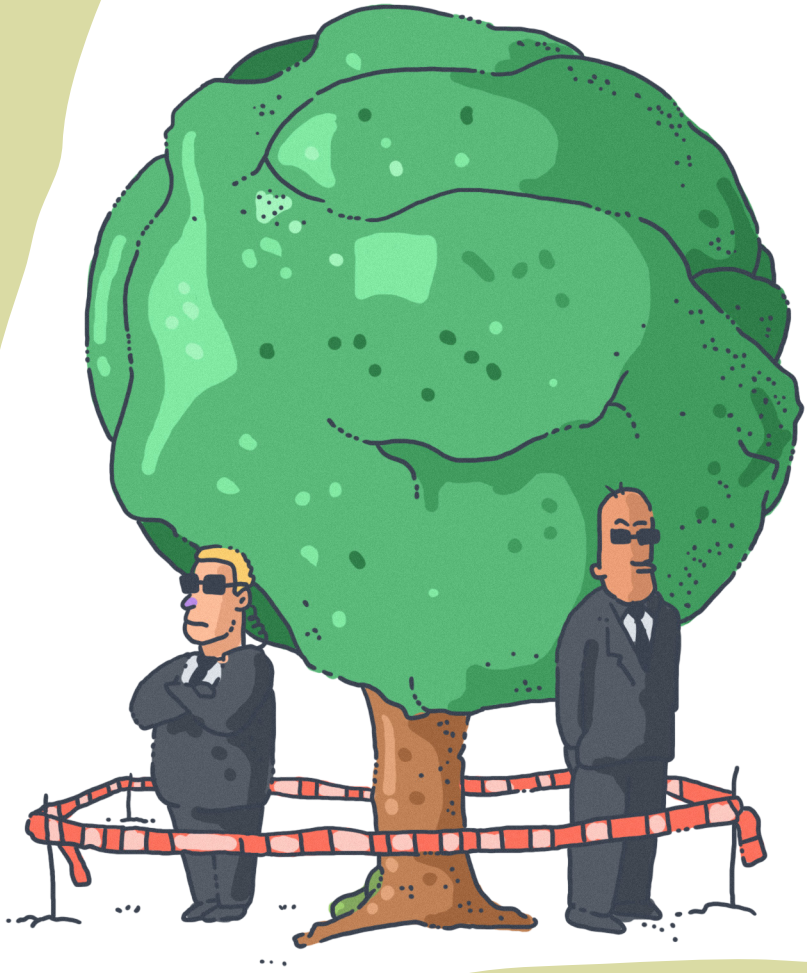
 **courage**

 **leadership**

 **resilience**

 **ethics**

You can find these icons next to the exercises.



**Mindfulness**
*wisdom, self-awareness, observation, insight*
"The awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experiences moment by moment."

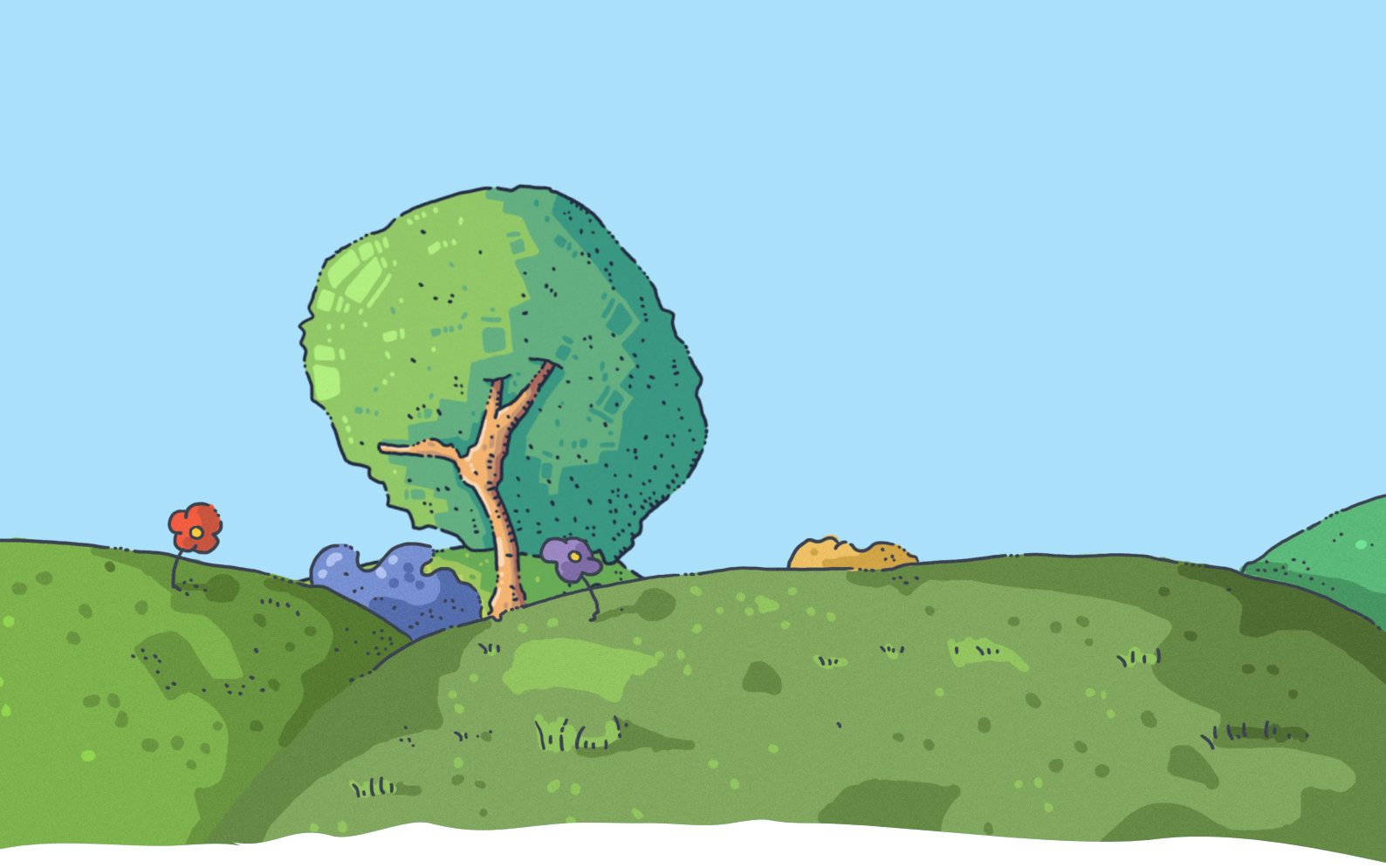
**Curiosity**
*open-mindedness, exploration, passion, initiative, enthusiasm*
"The essential desire for information, the drive to resolve uncertainty."

**Courage**
*bravery, determination, confidence, risk taking*
"The ability to act despite fear or uncertainty, in risky situations or when we are feeling vulnerable."

**Leadership**
*responsibility, accountability, dependability, reliability, selflessness*
"The relational and ethical process of people attempting to accomplish positive change."

**Resilience**
*perseverance, grit, tenacity, resourcefulness, self-discipline*
"The ability or set of qualities that allow one to overcome obstacles."

**Ethics**
*benevolence, humaneness, integrity, respect, justice, fairness*
"The moral principles that govern a person's behavior or the conducting of an activity."



# THEORETICAL PART

**Introduction to students**

Forests are an integral part of the landscape and perform several functions in it.

The **production function** is its ability to create wood. The **non-productive functions** of forests include ecological and environmental functions: soil protection, water management and climate function, health, cultural, educational, recreational, nature protection and water protection function. In present, we are also using the term ***ecosystem services***, defined as the benefits that people derive from forest ecosystems.

Forests of EU countries have been affected in recent years by extreme weather events, not only floods, heavy torrential rains, extreme winds, but also extreme droughts and temperatures which were followed by wildfires and calamities.

Every year from 2011-2015 about 20 million hectares of forest was cut down. Since 2016, an average of 28 million hectares have been cut down every year. That's one football field of forest lost every single second around the clock. A study published in the journal Nature Geoscience analysed 27,000 annual rings out of 147 oaks. As a result of this research, the drought and heat that plagues Europe after 2014 is the worst since the Roman Empire. In addition, areas suitable for afforestation are declining every year due to the climate. The **common denominator** of all natural disasters is **man** and his activities, especially growing built-up areas.

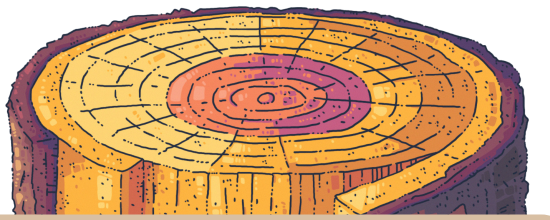
Open a discussion with the students in your class and find out what they know about the importance of the forest not only for humans, but for all living organisms.


## DID YOU KNOW?

*Every year from 2011-2015 about 20 million hectares of forest was cut down.*

*Since 2016, an average of 28 million hectares have been cut down every year. That's one football field of forest lost every single second around the clock.*

*To print a Sunday edition of the New York Times requires 75,000 trees!*



*Try an activity with your pupils where you use different images of forest in the contrast to a polluted city.*

## ? Questions for students

- **When you say forest... what do you imagine?**
- **When was the last time you visited the forest?**
- **How do you feel in the forest when you visit it?**
- **What role does the forest play for human society and for biota?**
- **With which activities of man and human society do we threaten forests?**
- **How does forest cover your country compare to other European countries and how has it changed in the last 20 years, or in the length of your life?**

# RESOURCES FOR FURTHER STUDING:

- MODULE 1

- **Articles** on Ecotree website
- **Articles** on World resource institute
- **Articles** on World economic forum
- **Articles** on Nature.com
- **Article** on Hakai magazine

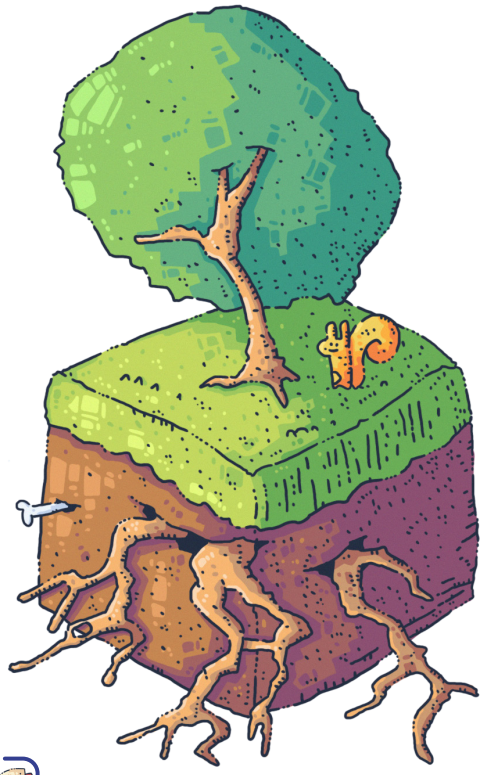
- MODULE X

## NECESSARY TOOLS:

Access to internet, mobile phone, tablet or laptop, calculator, writing tools (pen, pencil), paper, plasticine (possibly gypsum), wax pencils, mirror with dimensions 10 x 15cm

**Available calculators to calculate carbon footprint:**

# PRACTICAL PART



### Aim of activity

Understanding the functions of the forest and especially its climatic function. Determining the size of the forest, or the number of trees planted to eliminate our carbon footprint and highlighting green adaptation measures for climate change.

### Orientation or Engagement

There's increasing recognition of how nature can help tackle the climate crisis. From protecting standing forests to planting new trees, forests offer significant climate mitigation benefits. Now, new research shows that **letting forests regrow** on their own could be a secret weapon to fighting climate change.
Use these questions to guide the discussion towards mindfulness and resilience.

*Let students use available online calculators to calculate their carbon footprint in kg $CO_2$ per year. They can calculate the carbon footprint of a class or family and compare them with each other.*

### ? Questions for students

- **How many trees do you think you would have to plant to balance your carbon footprint or the carbon footprint of our community (or school)?**
- **For how many people with the same carbon footprint as yours, is a given forest (or park) sufficient?**
- **For how many people with a Slovak or European average, a given forest will suffice?**
- **Human demands are constantly increasing, increasing our carbon footprint worldwide. Do you think that the forest cover of individual countries increases accordingly?**
- **What carbon footprint should the inhabitants of the village have to be covered with the trees in the area of interest? Is it real?**

### Conceptualization

The results of their carbon footprint can be compared with the national or European average (SK = 5888 and EU = 8608 kg $CO_2$ per year). Pupils can also compare themselves with individual countries of the world. Students calculate how many trees are needed to balance $CO_2$ consumption if we know that one typical average adult tree can absorb on average approximately 22 kg of carbon dioxide in one year. However, this figure is only achieved when the tree is **fully grown** – saplings will absorb significantly less than this.
Students can also calculate the estimated age of a tree using a simple formula. Over a lifetime of 100 years, one tree could absorb around a tonne of $CO_2$. As trees grow, they pull and store carbon from the atmosphere, helping to lower the high greenhouse gas concentrations driving climate change.

**Not all trees are equally performant.**

The absorption capacity of carbon varies considerably from tree to tree, even for the same species. The ability of a tree to store carbon depends on its species and age, as their weight varies. Another factor that changes is the rate of growth. Other factors to consider include weather conditions and soil type. Softwood tends to grow much faster than most hardwoods, so it can absorb more $CO_2$. But because they live shorter, they ultimately store less $CO_2$ during their lifetime. Some trees grow faster than others and therefore absorb $CO_2$ faster like eucalyptus. In contrast, other tree species grow more slowly but also live longer and therefore absorb more $CO_2$ in the long run, such as oak or beech.

**Investigation**

Now students are ready to calculate their carbon footprint in kg $CO_2$ per year. After calculating their carbon footprint in kg $CO_2$ per year should be to find out whether students have enough trees in the evaluated area or not enough. If enough trees have been found in the area, it is necessary to think about their preservation, or students could calculate how long the state will be sufficient in the area in connection with increasing carbon footprint (e.g. population growth, vehicles, human activities etc.).

Otherwise, if students find that there is an insufficient or low number of trees in the assessed area, the result should be not only their design, but also the actual implementation of supplementing the missing number of trees in the area. However, this part should be consulted with the relevant municipal or city authorities (due to the occurrence of e.g. *engineering networks* – water supply and sewerage, gas pipeline, optical cables, or in terms of zoning plan etc.) or contact the forest authorities and forest managers and to find out the procedures and methods of planting trees and the reasons for their cultivation. Students should search for ideas to reduce the carbon footprint according to the research plan determined by the group (focus on family, school, community). It is possible to use various websites providing suggestions for reducing the carbon footprint in households, transport, etc.

## HOW TO ROUGHLY ESTIMATE THE AGE OF A TREE?

*We estimate the approximate age of the tree by measuring the circumference of the tree trunk at a height of 1.3 m above the ground (breast height) with a measuring tape. We divide the measured data of the circumference of the tree in centimetres by the number 2.5. Example: If we measured the circumference of a tree trunk at a height of 1.3 m above the ground, 154 cm, 154/2.5=61.6. We estimate the age of the tree to be approximately 62 years.*

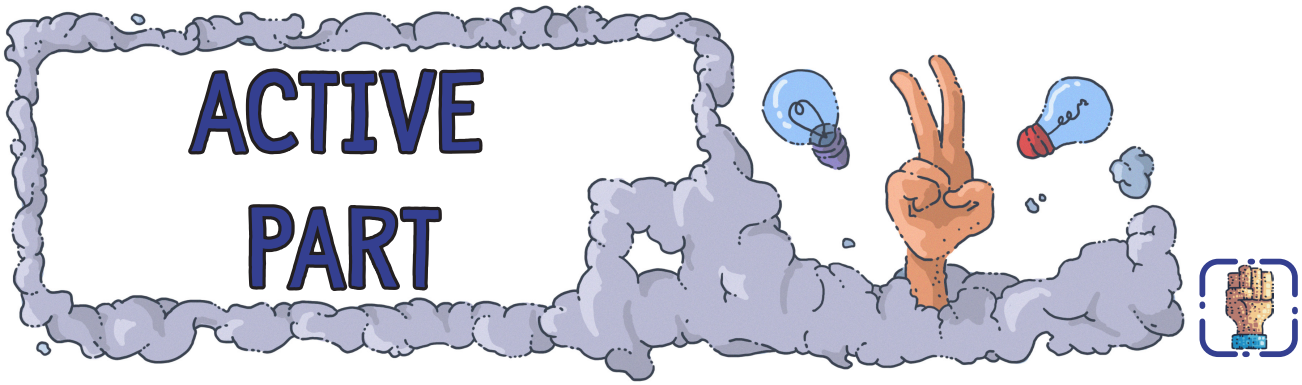
**Conclusion**

Every student calculates their own carbon footprint and carbon footprint of their family in kg CO2 per year. Next students can summarise and compare results between each other in a class.

The results of the emitted CO2 emissions can also be converted to the number of trees needed to absorb the amount of CO2 every student produced in 1 year. Students' results can be compared with results found on the internet on local, national and European level.

**? Questions for students**

- **How carbon footprint in kg CO2 per year you produced as individuals and as a group?**
- **Which of the students has the highest and who has the lowest carbon footprint in kg CO2 per year?**
- **What specifically can I, as a citizen, producer, and consumer, do to reduce the carbon footprint?**
- **Are there enough trees in the area to absorb our carbon footprint (student, class, school, family, community, etc.)?**




Let the students prepare and create an informative **board or presentation** about the forest or park around the school about their results within the project.

Students should have the most engaging way to characterise results to classmates in the classroom. If it is possible, make the presentation in school or public and invite local authorities.

The most effective completion of the activity is the planting of trees in the school area, or near the place of residence and care for them. Students can observe selected trees for longer, for example, they can adopt a specific tree and take care of it (during the school year or even longer). The teacher can assign tasks related to the adoption of the tree, which students solve with the relevant authorities:

1. **Find out** everything about your tree – its species, environmental requirements, approximate age (planting date), current problems (pollution, diseases, etc.).
2. **Describe** what function the tree plays (ornamental, productive, increases biodiversity, aesthetics, shadow, etc.).
3. **Watch,** take **care** of it and **protect** it for the next year (or longer).
4. **Document and share** points of interest and photos.

**RESOURCES**

*https://iep.sk/Kalkulacka.*

*https://eplca.jrc.ec.europa.eu/ConsumerFootprint.html.*

*https://www.theworldcounts.com/challenges/forests-and-deserts/rate-of-deforestation.*

*Website with information on forest cover of individual countries of the world and their regions:*

*https://www.globalforestwatch.org/dashboards/.*

*Free available mobile application: Forest Watcher at:*

*https://forestwatcher.globalforestwatch.org/.*

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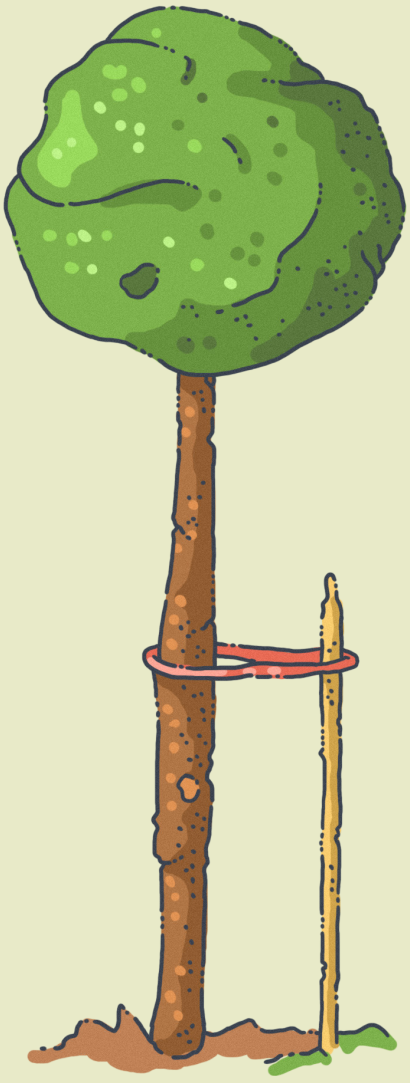
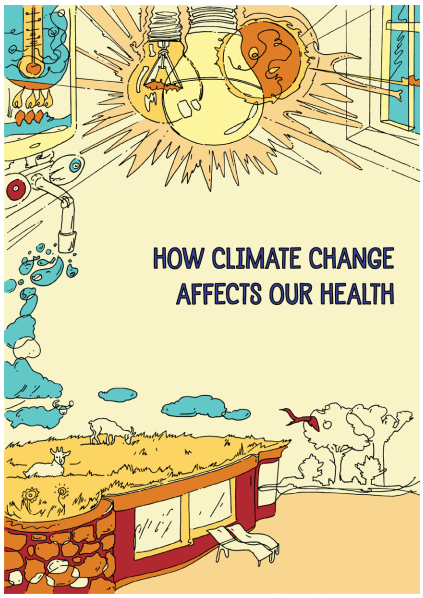
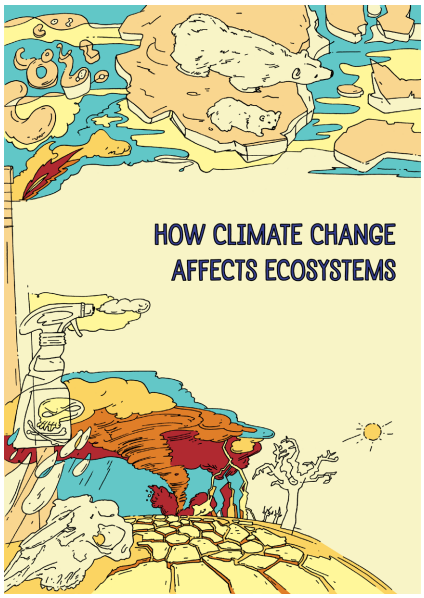
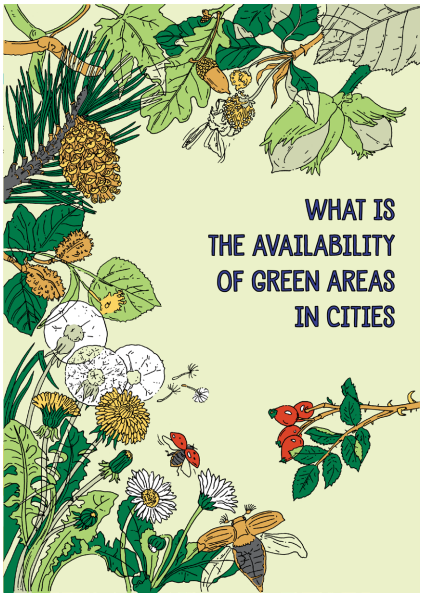
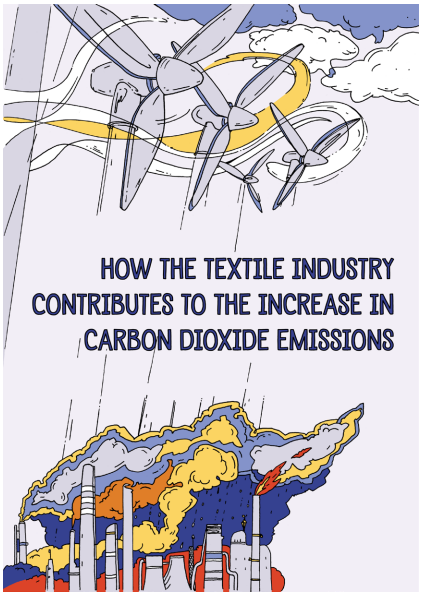


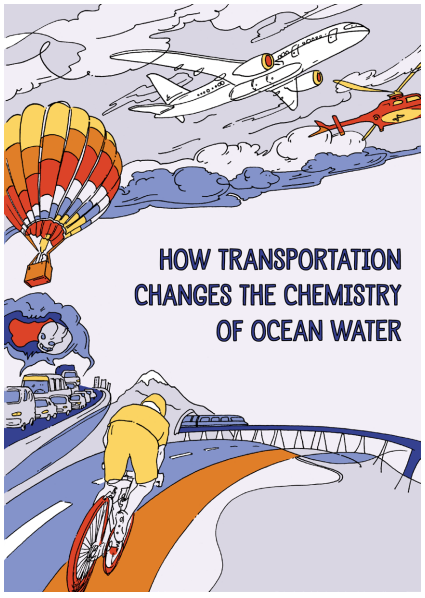
# OTHER INDICATOR´S BOOKS YOU MAY LIKE CAN BE FOUND ON: TEACHINGGREEN.EU

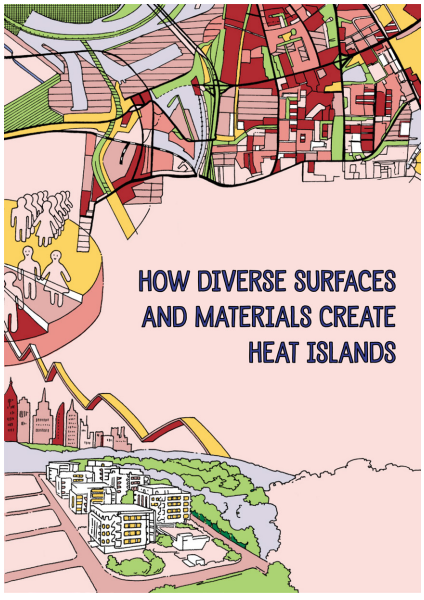


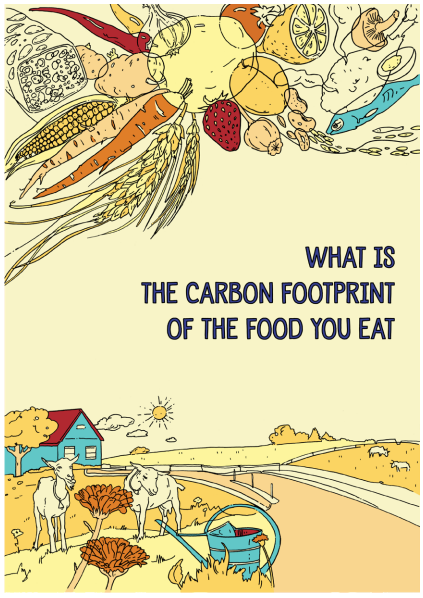



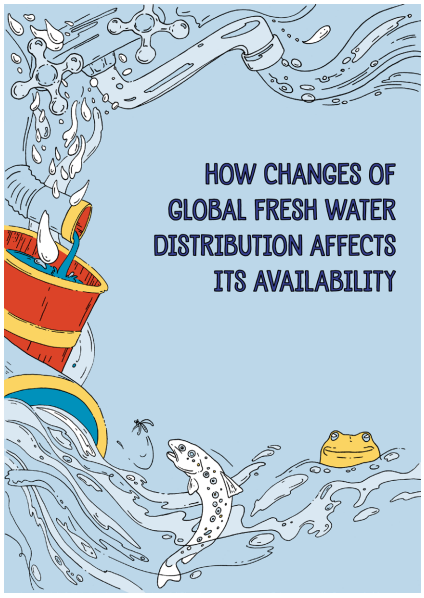



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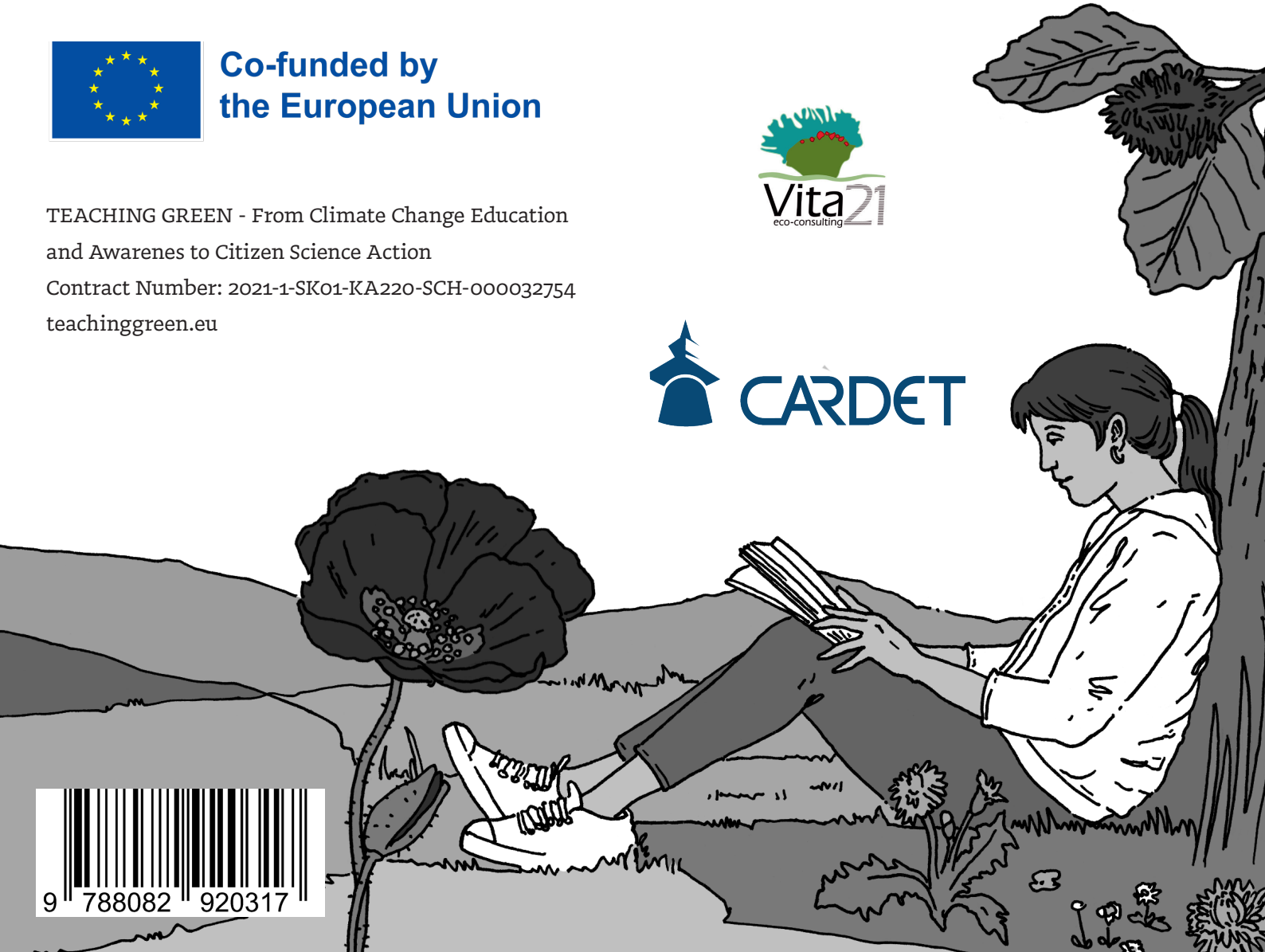

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