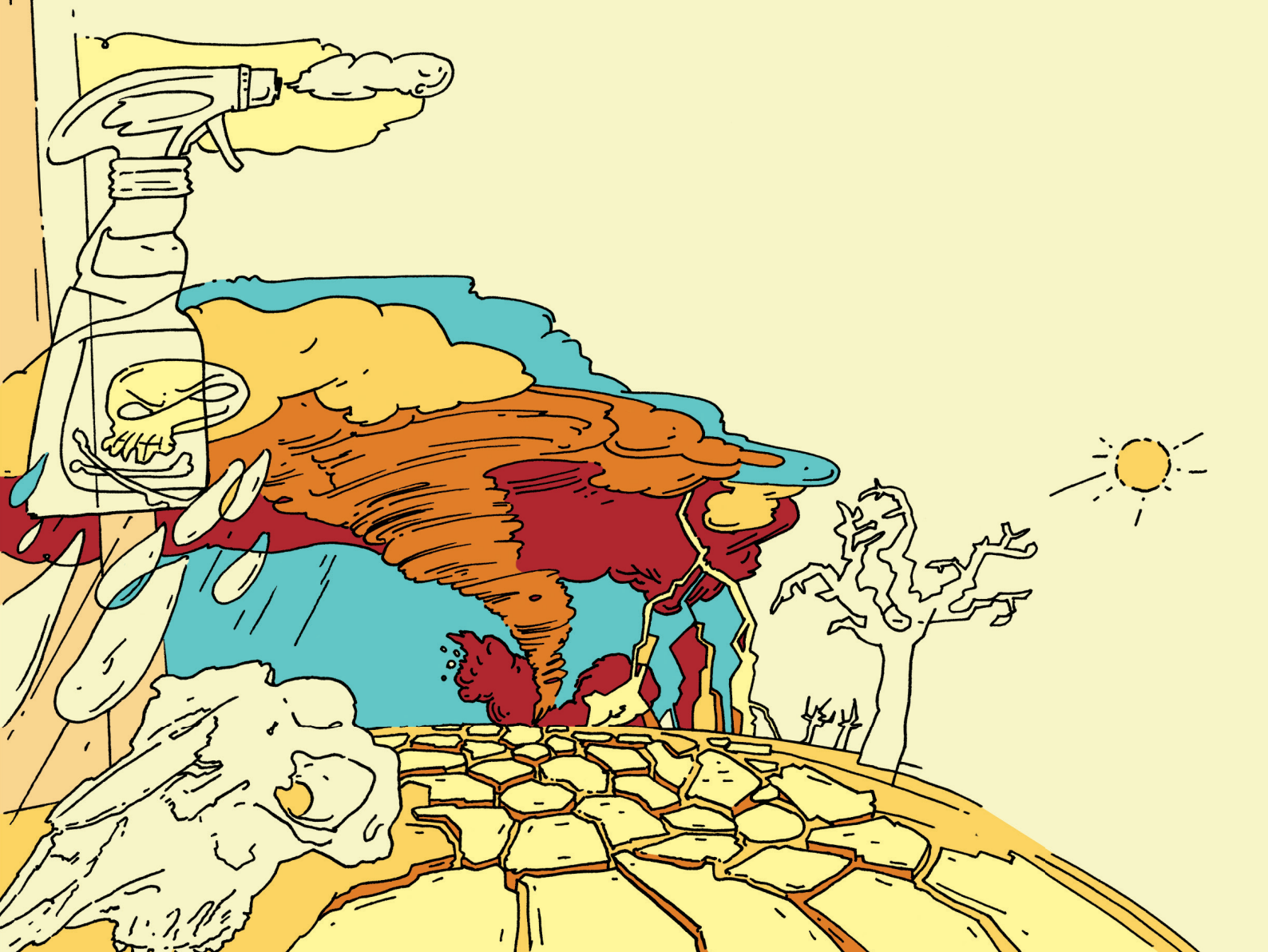


HOW CLIMATE CHANGE AFFECTS ECOSYSTEMS



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

At the Intergovernmental Panel on Climate Change (IPCC), scientists have pointed out that global warming of 1.5 °C will have serious and even irreversible consequences for the environment and society as a whole including significant impacts on biodiversity. The more we disrupt the climate, the greater the risks to society, the environment, and the delicate balance of ecosystems that support countless species of plants and animals.

INDICATOR: Selected species as bioindicators of climate change.

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

Due to climate change, the biotic and abiotic properties of the environment are changing. Changing conditions often mean that species have to adapt, leave, or migrate to find the appropriate conditions. Climate change is therefore mostly affecting the sensitive species of plants and animals, such as **endemics**. These organisms are indigenous – are tied to specific conditions and environment. Climate change may change the environmental conditions of their natural habitats, which may mean their extinction, or they may be displaced by stronger expansive species.

? Questions for students

- **Why are some species threatened more than others? What can threaten them?**
- **Do you think that you also have an influence on species becoming endangered?**
- **How could you help or protect them?**



Before we start searching for endangered species in various databases, try to think about what you think is the most endangered or most protected species in your country or in your region.



RESOURCES FOR FURTHER STUDING:

• MODULE 1

• MODULE X



- Websites and freely available mobile applications informing about the state of protected species of plants and animals in the region in the village) as well as about the causes of their threat.



For example:

• **Biomonitoring**

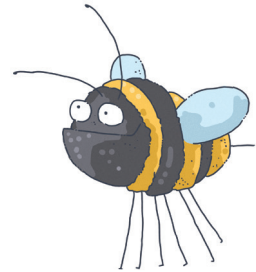
• **website of Natura2000**

• **natura2000 databases**



• **IUCN Red List of Threatened Species**

• **Free and open access to biodiversity data**



NECESSARY TOOLS:

Identification keys, plant and animal atlases, etc.



PRACTICAL PART

Aim of activity

Recognition and protection of biodiversity of the region.

Pupils should get acquainted with protected species of a region, find out what causes biggest threats, identify the connection between threats and changing climate and find possible measures to protect them.

Orientation or Engagement

Introduction to the issue (theoretical part)

1. Identify rare species of plants and animals that live in the area and the degree in which they are endangered
2. Find out the reason of the threat - habitat loss, pollution, overfishing/hunting, endangerment by non-native species
3. Select up to three species that you think will be most affected by climate change. They can be directly or indirectly affected (e.g., change in the quality of individual components of the environment and the subsequent impact on the organism)

? Questions for students



- **Have you noticed which factors have the greatest impact on biodiversity loss?**
- **What role do the ongoing climate changes play in this?**
- **How do humans contribute to this?**
- **What is your contribution, your lifestyle and your activities to the change?**
- **How much does the problem of biodiversity loss affect your region?**



Use those questions to guide the discussion towards mindfulness and resilience. You can add your own to pique pupils' interests.

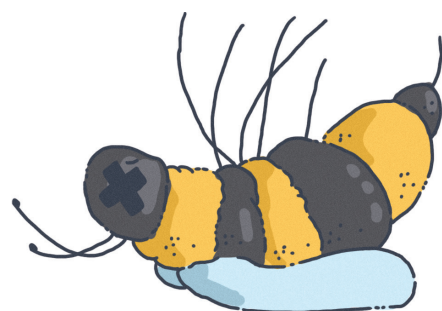
Conceptualization

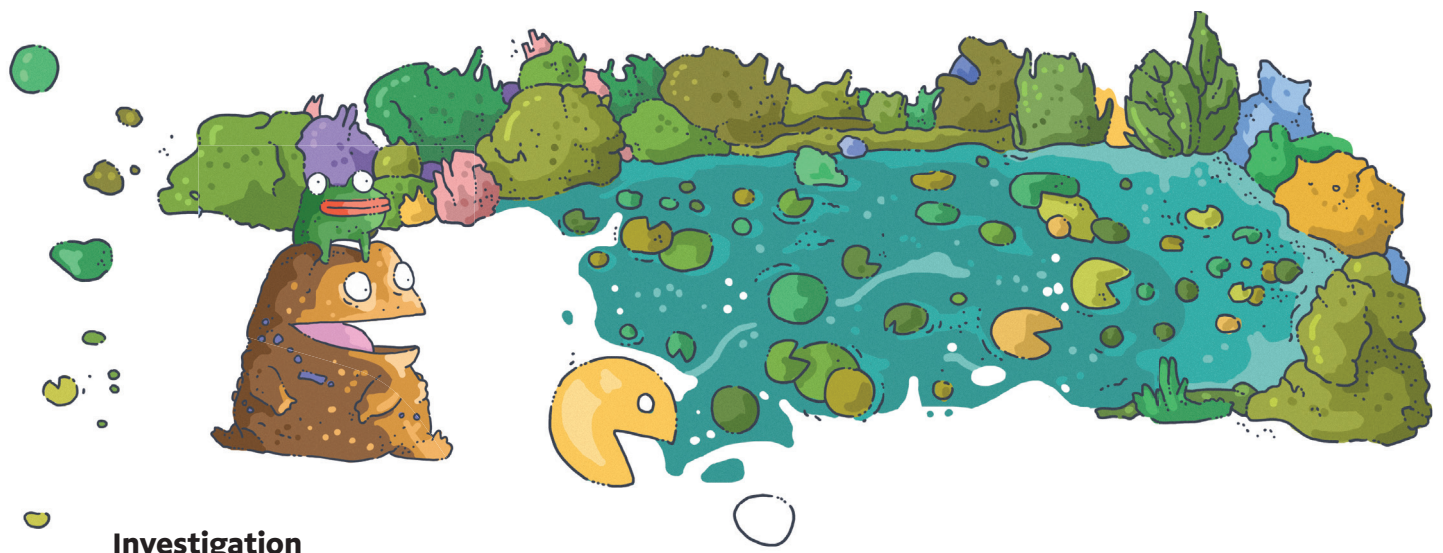
Discussion on the topic, understanding the issue, questions and answers.

The output should be the increased interest in determining the state of biodiversity threat in the region

1. Ask students to search for the most endangered and protected species of plants and animals in groups using the internet or a mobile phone application.
2. Then, analyze the causes of their threat: **direct** (overfishing, excessive hunting or harvesting, destruction of habitats), **indirect** (pollution of environmental components, invasion and its impact on e.g. food resources)
3. On the basis of the analysis of information about these species, find the ones that are the most sensitive to the ongoing climate change according to the students, ie. those most affected by a 1.5 °C increase in temperature.
4. Present the findings of student groups to classmates.

Think about the responsibility for the state of the environment and the impact of our daily activities on the individual components of the environment.





Investigation

I. Simulation of the impact of climate change (temperature increase of 1.5 °C) on selected species.

The beginning of the simulation will be climate change and at the end of it the students will choose a protected species. The changing influences of abiotic and biotic environmental

factors with possible positive and negative effects on the selected species will be in the process of change.

II. The application <https://ncase.me/loopy> can be used for the simulation:

Procedure for setting up the application:

1. Delete the introductory preview (click on the items you want to delete with the mouse)
2. Select the icon for creating individual project items
3. To add items, you need to draw a circle with the mouse
4. The drawn circle automatically changes to the new item
5. Set colors, fill and description items
6. In the same way (by drawing a line between items) we create relationships between items

7. Relationships represent the effect of one item on another, which can be harmless (–) and positive (+)

8. The properties of individual items can be changed using the mouse

9. Text descriptions can also be added to the display

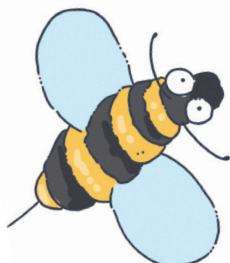
10. Finally, it is possible to start the presentation



Use QR code to see a picture guide.

III. Searching for solutions:

Research possibilities of protection of selected species, proposals for improving their situation, informing stakeholders and the general public.



Conclusion

Summarise and present the results – model as well as proposals of measures, presentation of results.

Ask yourselves and **think**:

- **What exactly can I, as a citizen, producer and consumer, do?**

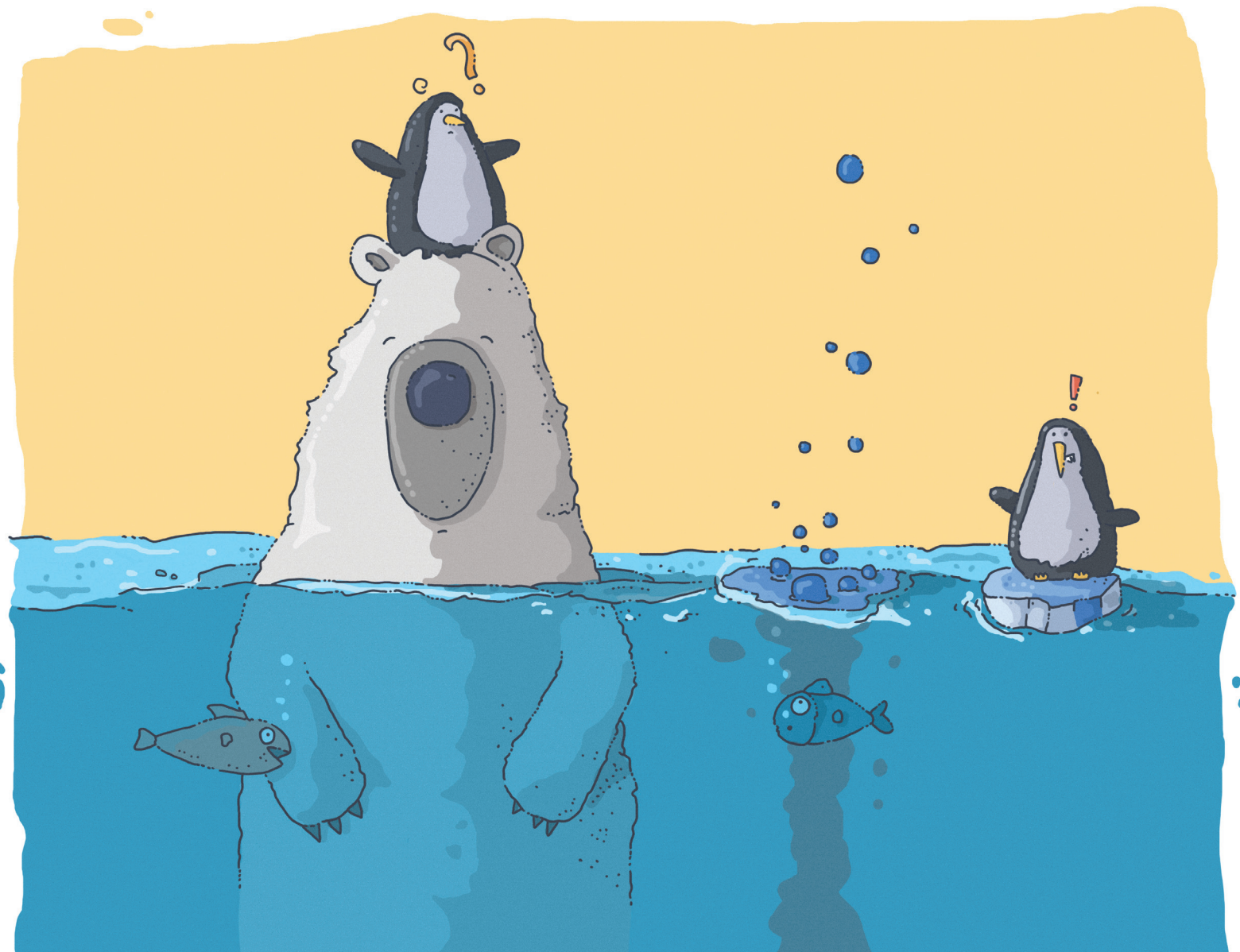
Alternatives:

- Students can carry out an inquiry-based activity aimed at finding out the real presence or absence of selected species and factors that affect them (e.g. climate and competing species) directly in the environment where the species occurs.
- In addition to the current state, students can also focus on the analysis of historical data and compare the available historical data on the occurrence of selected species and factors with the current state. It could be useful for testing the correctness of their model and for citizen science purposes.
- Comparison of results and topics of the indicator at the regional level with the national or EU level.

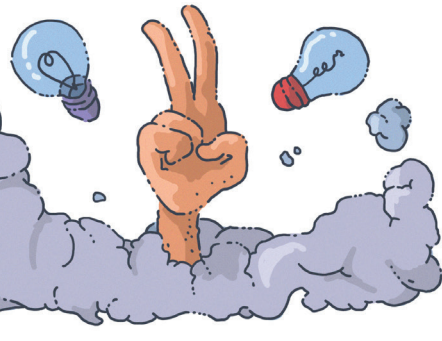


? Questions for students

- **How have the living conditions of the selected species changed?**
- **How have the threats affecting the existence of the selected species changed?**
- **How does the selected species live in our conditions compared to other places in our country and abroad?**
- **What will be the greatest threat to the selected species in the future?**



ACTIVE PART



Design and implement ideas to support biodiversity directly on the school campus:

- to support biodiversity, it is possible to plant a tree or create insect houses and thus support pollinators and other useful insects
- to support the diversity of songbirds, it is possible to make birdhouses or feeders
- if interested, it is possible to help biodiversity with other slightly more demanding activities: support the planting of flower meadows in place of current lawns, create raised beds and grow your own medicinal herbs or healthy vegetables, establish rain and vertical gardens, green roofs, water bodies, etc.)

Devise an **educational purpose** – an information board, a video document, an article on the web, a radio report, an information stand in the city, etc.

? Questions for students

- **What is the relationship between biodiversity, climate change and human activities?**
- **How can we help increase the level of local and global biodiversity?**
- **Which of our daily activities can have an impact on local and global biodiversity?**



RESOURCES

Reinman, S.L. (2012), „Intergovernmental Panel on Climate Change (IPCC)“, *Reference Reviews*, Vol. 26 No. 2, pp. 41-42.

Available at:

<<https://doi.org/10.1108/09504121211205250>>

Loopy at: <https://ncase.me/loopy/>

HOW CLIMATE CHANGE AFFECTS ECOSYSTEMS

Text: Imrich Jakab

Illustrations: Tomáš Cíger, Katka Slaninková

Graphic Design: Andrea Plulíková

Publisher: Strom života (Trer of Life), Jelenia 7, 811 05 Bratislava, Slovakia

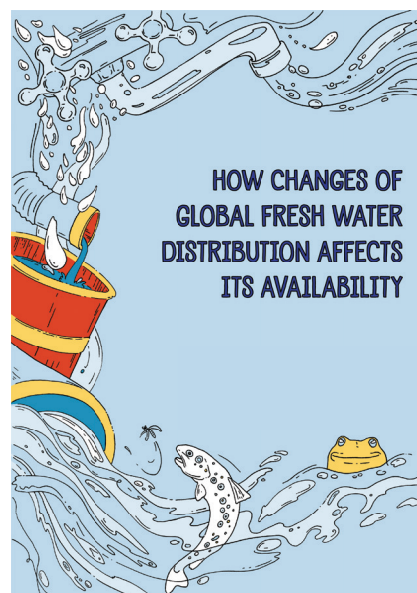
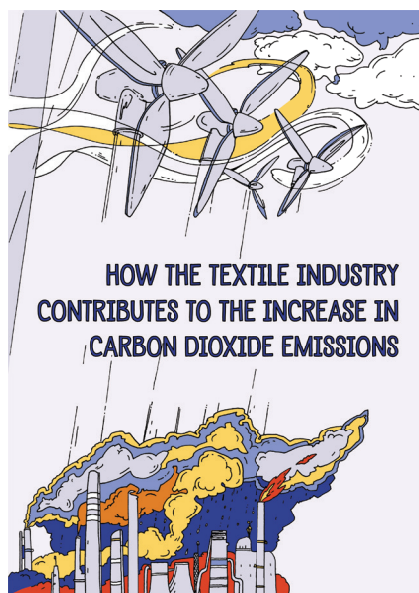
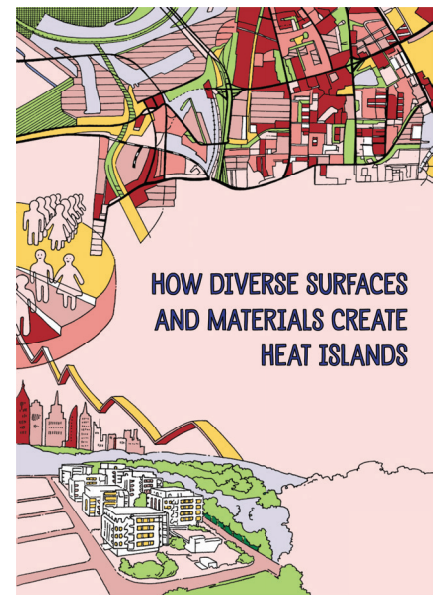
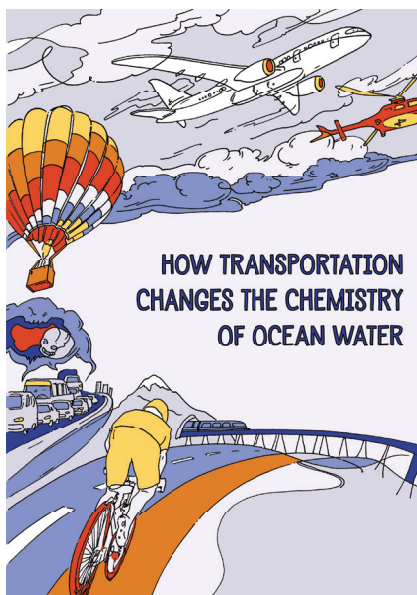
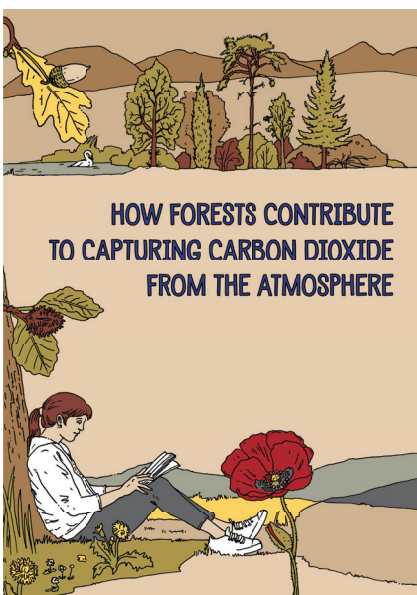
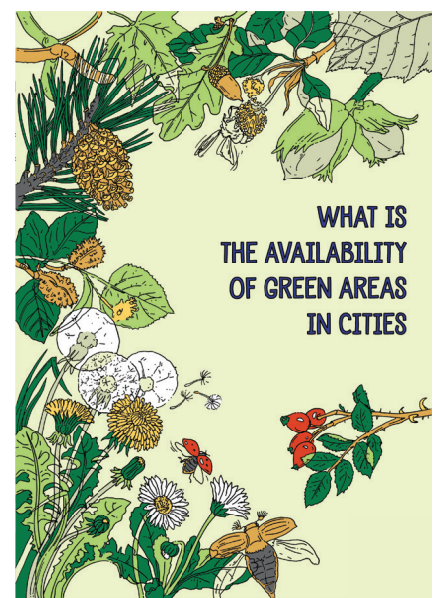
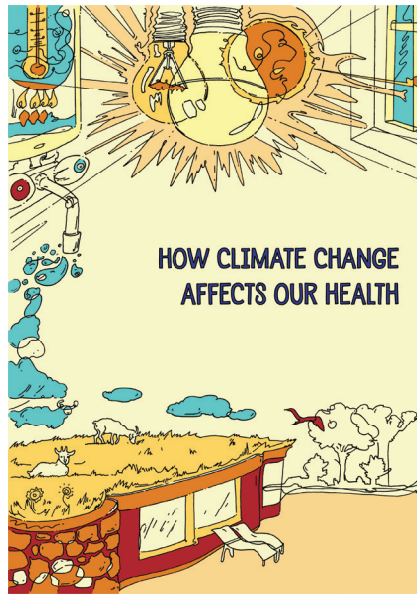
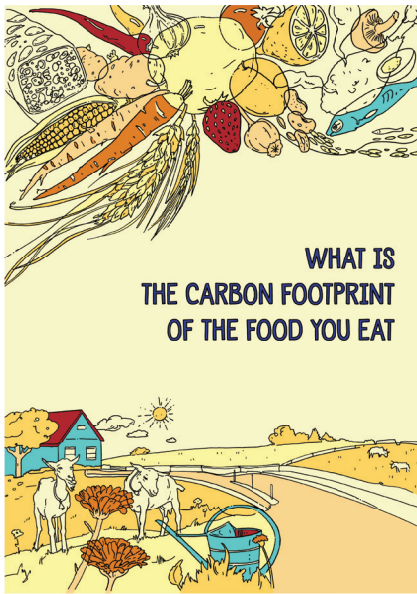
12 pages • Format: A4

Year of publication: 2023, 1st edition • ISBN 9788082920058

Creation of this book was funded by the European Union – NextGenerationEU. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Commission. Neither the European Union nor the European Commission can be held responsible for them.



**OTHER INDICATOR'S BOOKS YOU MAY LIKE CAN BE FOUND ON:
TEACHINGGREEN.EU**





STRM ŽIVOTA

CARDET

Vita21
eco-consulting



UNIVERZITA
KONŠTANTÍNA
FILOZOFA
V NITRE

National Research Council of Italy
Institute of BioEconomy
Department of Biology, Agriculture and Food Science



Co-funded by
the European Union

TEACHING
GREEN

TEACHING GREEN - From Climate Change Education
and Awareness to Citizen Science Action

Contract Number: 2021-1-SK01-KA220-SCH-000032754

teachinggreen.eu



9 788082 920058