TEACHING GREEN

Ideas for student research projects

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BIOPROFILES TEACHING GREEN

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Learning through Landscapes

Vita 21 eco-consulting

Consiglio Nazionale delle Ricerche
Istituto per la BioEconomia

STROM ŽIVOTA

UNIVERZITA KONŠTANTÍNA FILOZOFA V NITRE

INAK

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ABOUT THE PROJECT

BIOPROFILES

We believe in the power of change and that the best gift we can give to future generations, the most valuable legacy we can leave behind us is a world of educated and environmentally conscious people equipped with the sustainable attitude which is so sorely lacking in today's society.

Environmental education in Slovakia, and also in other European countries, doesn`t comply with its elementary mission and it`s more symbolical or theoretical than practical or real (Zborník, 2018). Teachers in secondary schools should implement environmental education into daily education of general subjects, though they might be missing relevant skills, knowledge or, more often, motivation for environmental education. Therefore there is an **urgent need** for the appropriate training programme and teaching materials for teachers in practice aimed at practical environmental education and its implementation into schools, to strengthen their skills and competences and to gain the knowledge about environmental issues.

The answer to this need is the ERASMUS + project "BIOPROFILES - Implementation of practical environmental education in schools". The project involves 6 partners active in the area of environmental education from 4 countries, Slovakia (INAK, Strom zivota, Constantine the Philosopher University), Italy (CNR-IBE), Spain (VITA XXI) and United Kingdom (Learning through Landscapes).

It focuses on the development of innovative materials for practical environmental education for the target group of teachers and students aged 10 - 15 years, leading them towards increased interest in local communities' life.

The project aims at:

- Supporting the professional development of teachers and their skills in active use and implementation of environmental topics into teaching.
- Providing teachers of primary and secondary schools with innovative teaching materials, while integrating the practical environmental concept into the teaching process.
- Delivering high-quality teaching and adopt a new student-centred method of research-based learning.
- Increasing the environmental awareness of teachers and students through monitoring of the local environment.

To reach these overall project goals there are 4 main project outcomes developed within the project lifetime:

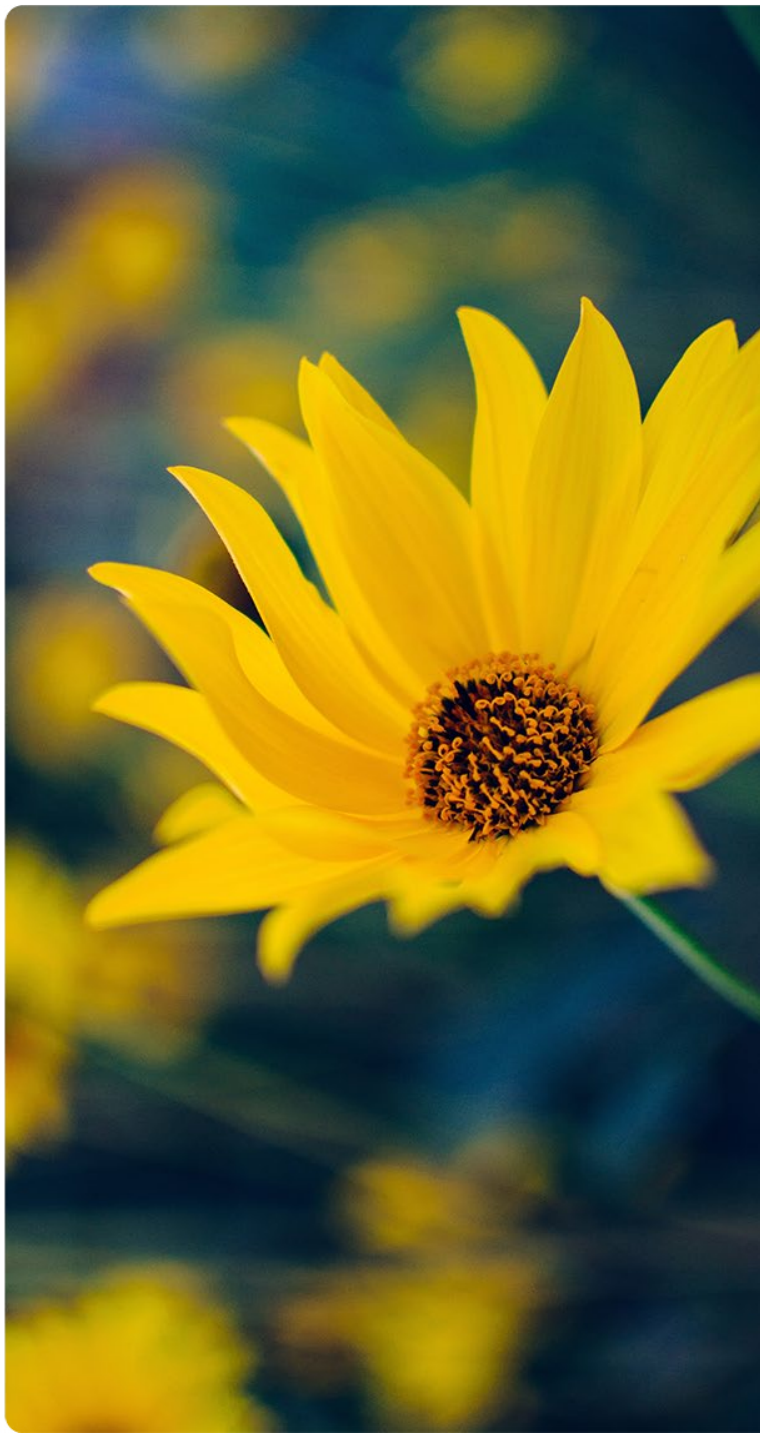
- TRAINING PROGRAMME as ENVIRONMENTAL MINIMUM for teachers,
- HANDBOOK for practical environmental education,
- INDICATORS BOOK for research of pupils,
- COLLECTION OF BIOPROFILES research results, which all together provides complex teaching and learning materials to support practical environmental education in schools.

If you are looking for:

- Reliable teaching materials to support your environmental education,
- Inspiration to provide practical real-life activities rather than formal and theoretical environmental education,
- Ready-to-use materials for research-based learning, supporting critical thinking of students in the environmental context,
- Possibility to attend a training programme for teachers in practice to gain skills and knowledge required for effective and practical environmental education,
- Materials to increase the environmental awareness of your students through monitoring of local environment and motivating them to become active citizens,

project BIOPROFILES and its outcomes are just for you.

teachinggreen.eu.



PARTNERS

Learning through Landscapes, United Kingdom

Learning through Landscapes is based in the UK but work worldwide. Learning through Landscapes vision is a society where the benefits of regular time outdoors are valued and appreciated, and outdoor learning, play and connection with nature is recognised as a fundamental part of education, at every stage, for every child and young person. Learning through Landscapes aim to enable children to connect with nature, be more active, and be more engaged with their learning.

For this project Learning through Landscapes has coordinated Collection of Bioprofiles, research-based activities of students in the UK and contributed to the handbook and training.

www.ltl.org.uk

VITA XXI, Spain

VITA XXI is a micro consulting firm focused on education for sustainability, training, learning outside the classroom and environmental issues. VITA XXI started in 2005 working for a Spanish Regional Government, coordinating the Volunteer Environmental programme in Natura 2000 sites in Murcia Region. 5 different environmental action projects were established from marine habitats, passing through dunes, salt works, Peri-urban green areas to Mediterranean forests. After 8 years, those actions projects were transformed in civil society organizations which are now partners of the participatory management plan on each protected area. Accompanying this process was a highly valuable experience for VITA XXI. This allowed VITA XXI to work together on volunteering, participation and association initiatives, including collaborating in writing a participation regional law, thank one of its freelance professional international networks. Additionally, VITA XXI collaborates with Hippocampus Association since 2008 in a citizen science project to protect seahorses in el Mar and also in a circular economy project.

Since 2007, VITA XXI has been working on European projects participating in a large network of EU organizations, mainly developing educational materials and Online Open educational resources for environmental education in several environmental fields.

VITA XXI is also involved in solar energy as a local photovoltaic producer, sending 5Kw a year of green energy to the grid and promoting the use of alternative energy locally. VITA XXI has also participated in several initiatives like DIF (Disruptive Innovation Festival), and use educational materials to promote the circular economy, cradle to cradle, biomimicry on international cooperation projects in EU and Latin America.

Recently, VITA XXI is collaborating with Wastewater Planet to promote water treatment solutions at the family, community, and sector, urban or rural scale using a Percolation- Oxygenic Treatment (POT) technology. Finally, VITA XXI has been appointed as Murcia Branch of the SINER Network, for working on Industrial symbiosis (Circular economy in Action) to promote synergies between public, private partnerships to optimise natural resources use with a virtual platform and supporting community environmental training.

VITA XXI believes in project-based learning and learning by doing outdoors on daily basis with the support of technological and digital media, respecting local wisdom and fostering better life for all.

For this project, the VITA XXI has contributed to the handbook and training and has coordinated research-based activities of students in Spain.

www.vitaxxi.com

CNR-IBE, Italy

The Institute of Bioeconomy (CNR-IBE) of the National Research Council of Italy researches the following main thematic areas: Primary production and biodiversity; Wood technology and derivatives; Utilizations, agroforestry mechanization and woody biomass; Climate, meteorology and oceanography; Biotechnology, bioenergy, process and product technologies; Sustainable use of natural resources and ecosystem services.

CNR-IBE has a strong interdisciplinary and excellent value and numerous human and project resources. CNR-IBE is also deeply involved in science dissemination at the local, regional, national and international level for more than 20 years. In this period, CNR-IBE developed and applied teaching units and activities targeting teachers and students (10-18 years old) based on innovative learning methodologies, such as Inquiry-Based Learning, Intergenerational Learning, Learning in Natural.

Environment, and innovative tools like Location-Based Games, e-quiz, geographic information systems.

For this project, the CNR-IBE has contributed to the handbook and training and has coordinated research-based activities of students in Italy.

www.ibe.cnr.it/en

Consiglio Nazionale
delle Ricerche
Istituto per la BioEconomia

Strom života, Slovakia

Strom života (Tree of Life) is an educational non-profit organization focusing on environmental and outdoor education, inquiry-based learning, active lifestyle, and youth and children's personal development. Activities of Strom života are based on more than 40 years of continual programming in all regions of Slovak republic. We collaborate with various partners, such as various experts, non-profit organizations, governmental and municipal institutions, schools and universities, business partners and foreign organizations.

Our programs are implemented through these main activities:

- Publishing children's and youth magazines
- Year-round programs for schools, families and broad public in an online Academy
- Various educational activities (expert training, workshops, field trips, seminars and conferences)
- Volunteering programs for children, youth and adults

For this project, Strom života has coordinated the development of Indicators book, contributed to the training and handbook and has coordinated research- based activities of students in Slovakia.

www.stromzivota.sk

STROM ŽIVOTA

Department of Ecology and Environmental Science, Faculty of Natural Science, Constantine the Philosopher University in Nitra, Slovakia

Department of Ecology and Environmental Science, FNS CPU in Nitra is focused on pregradual training of teachers of ecology, environmental science and environmental education from its foundation in 1994. Training of teachers is realized via the study program Teacher training studies in academic subjects in combination with ecology in two study levels: bachelor and master degree. The department has also an accredited bachelor's, master and doctoral degree in the single-subject study program Applied Environmental Studies. In a research area, DEES contributes to the development and application of new methods in the fields of ecology and environmental sciences.

Scientific research is focused mainly on landscape and land-use changes, evaluation of agricultural and urbanized landscape, biodiversity, ecosystem functions and services, remote sensing of Earth and environmental education. Research activities are realized especially through participation in national and international projects and international cooperation.
For this project, Constantine the Philosopher University proposed training programme and its content, organized training along with other partners and contributed to the handbook.

www.kee.fpv.ukf.sk

INAK, Slovakia

INAK is an NGO that tries to do things DIFFERENTLY/"INaK", if possible, „Innovatively and Creatively". „INaK" was established in 2014, as the team of people experienced in the field of using innovative approaches, activating methods and ICTs in education, with the experience of development of didactic materials, running of educational training, as well as the other activities from the field of innovative education. Through our activities, we aim to support the implementation of environmental education and outdoor learning into daily practice.

We focus on the use of innovative approaches, using creative methods in the educational process and whilst working with a variety of target groups – children, youth and adults. Our projects enhance lifelong learning and help to develop learners´ key competences. We try to implement our ideas and bring them into practice through local, national and international projects, usually in strong partnership with a variety of institutions.

INAK, SK initiated this partnership based on the results of needs analysis carried out in spring 2018 and an online survey carried out in March 2017 with 356 teachers and students expressed their interest in the project focused on practical environmental education and research-based activities, as well as based on positive previous experience with similar educational projects.

For this project, INAK has coordinated the partnership and project management and also coordinated this handbook.

www.trochuinak.sk

DON'T BE AFRAID OF RESEARCH

When you use term research, many may be worried about trying such a thing. Yet research is just exploring and discovering previously unrecognized facts on the basis of their analysis. It doesn't sound that complicated, does it?

Every research is a bit like building a house - first a project of the house is designed and only then construction is started according to it. With research it is similar. When implementing ideas for a student research project, you may have already noticed that the procedure or methodology of individual research projects is similar. In our handbook, we have compiled ideas for research projects using the DITOR methodology, which is one of the heuristic methods and is recommended for the development of creative thinking and for solving problems. Let's take a closer look at this method.

The authors of this heuristic method are the Slovak pedagogical psychologists Miron Zelina and Milota Zelinová (1990) and its name is derived from the initial letters of the steps in creative problem solving:

D - Define the problem!
I - Get informed!
T – Try to define solutions!
O – Out single solution by scoring them!
R - Realize particular solution!

The method is based on the sequential implementation of five consecutive steps:

- **Define the problem!** - Definition of a problem or several problems on a certain topic, defining the goal to be achieved.
- **Get informed!** - Gathering information on the problem, working with information, consulting experts,
- **Try to define solutions!** - Analysis of the collected information in order to creatively solve the problem,
- **Out single solution by scoring them!** – Selection of best solutions from the list of proposed ones, considering their impact, feasibility, implementation costs, etc.
- **Realize particular solution!** - Implement the proposed according to a well-thoughtout plan.

The method can be used to solve any problem or research that you would like to do with students. In our case, we have replaced the "define the problem" step with the term "introduction". We divided the "inform yourself" step into partial parts - self-study on the topic and the actual data collection. Based on the analysis of data, students then propose solutions, evaluate their relevance and feasibility, and in the last step implement their proposal. If you want to learn how to work with the DITOR method, try any student research project from this guide.


BIOPROFILES

Water retention ability of the landscape

Introduction

The landscape has a natural ability to retain water. We call it retention ability. Landscape elements such as forests, meadows, fields, waterbodies, parks, houses and roads, and others, greatly influence this ability. Each element "manages" water differently. Therefore, it depends on how they are deployed in the landscape, in what amount, or how big an area of the land they cover. The rainwater is absorbed differently by a forest than by a concrete road. Reducing the retention ability of the landscape may not only be directly related to climate change, but primarily to man-made landscaping. Recent findings show that intense and impetuous human interventions to the landscape are raising the risk and the frequency of floods and desiccation as well.

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available information on the water retention ability of the landscape. Also focus on the following questions:

- Do different surfaces have different permeability?
- How much water can one adult tree retain?
- What problems are large paved areas causing in cities?
- Where does rainwater flow from your school or residence?
- What is the importance of green areas in urban areas?
- How many green areas / elements are near your school or residence?
- Do you collect rainwater in the school yard?

Recommended resources

Source 1:
Natural water retention measures

Source 2:
Natural Water Retention Measures Platform

Verify the occurrence of a problem in your area with your own research

Goal

Students can identify different types of surfaces due to their permeability. They can calculate the approximate retention ability of chosen landscape. Students are aware of the difference between natural and artificial surfaces and understand the importance of water retention in the landscape.

Tools & Materials

- online maps with satellite imagery (e.g. Google maps)
- size area calculation tool (e.g. Google maps)
- a meteorological portal containing information on average daily rainfall
- a table for calculating the proportion of the landscape element in chosen territory
- recording card
- a board / flipchart / tablet or similar
- calculator
- camera / mobile to record activity

Implementation

At the beginning, choose the territory whose retention ability you want to calculate (e.g. school area, part of community / city). Print the satellite image of the selected area and draw a square grid across it. Be sure you write down the map scale. Go to the terrain with the satellite image and assign a surface type to each square. Think about which areas retain water and from which it quickly flows away. Also note for each square whether it is sloping or flat. In the class then use online maps to calculate the size of the area in square meters. Then, on the meteorological portal, find out the daily rainfall for that area during any rainy day. Alternatively, you can replace the daily rainfall with an average annual total. Precipitation data is usually given in millimetres be sure to convert it to litres per square meters (1 mm = 1 l / 1 m^2). If you have both data available, use the table for calculating the proportion of the landscape element in the chosen territory and recording card to calculate the water retention ability of the landscape.

Mapping process

First, identify the coverage of selected elements in the landscape:

- forests, parks
- meadows, lawn
- arable lands
- slack surface waters
- running surface waters
- hard surfaces

Look at each square of a square grid. Assign which part of the given square occupies the selected landscape element (whole, ½, ¾, ...). For forests, green fields and arable lands, identify the type of terrain (sloping or flat). Count the parts of selected elements and determine their coverage in the monitored area.

Transfer the calculated coverage to the recording card. Fill in the sum of precipitation and calculate other indicators according to the formula.

Analysis of results and proposal of solution

Interpret the calculated retention ability of your territory. Which surfaces prevailed? What is the ratio of retained and drained water? How could you use the amount of water that drained from the hard surfaces? Do you think that some measures can be taken to increase the amount of water retained? Try to think about solutions together. Write them down and choose the ones you can action.

Implementation of the solution and evaluation

Did you implement the selected solution? If so, what result did you get? Did your school, family or community help with implementation of the solution? How did they react to your initiative? Do you think there is a better / more effective solution to increase the retention ability of the landscape?

How would you evaluate your feelings after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Table for calculating the coverage of selected elements in the landscape					
Total land area (m^2): TA	1000	**The number of squares in the square grid: TNofS**	100	**Size of area in 1 square (m^2): S = TA / TNofS**	10
The number of squares covered by the landscape element NofS		**Calculation of covered size (X) X = NofS x S**		**Coverage share (C) C = X / TA**	
flat - forests, parks	30	300		0,30	
sloping - forests, parks	2	20		0,02	
flat - meadows, lawn...	10	100		0,10	
sloping - meadows, lawn...	3	30		0,03	
flat – arable lands	10	100		0,10	
sloping – arable lands	0	0		0,00	
slack surface waters	10	100		0,10	
running surface waters	5	50		0,05	
hard surfaces (houses, roads...)	30	300		0,30	

Recording card					
Class	9				
School	Elisabeth's Elementary school				
City	London				
Water retention ability of the landscape					
Total land area (m^2): TA	1000	**Rainfall (l/m^2/ rainy day): R**	10	**Volume of rainfall (liters): VR = TA x R**	10 000
Coverage share (C)		**Terrain coefficient (TC)**	**Recalculated share Y = C x TC**	**Retained rainwater RR = VR x Y (liters)**	**Drained rainwater (1) DR = VR x Y (2) DR = VR x C x (1-TC) (liters)**
flat - forests, parks	0,30	1	0,30	3000	X
sloping - forests, parks	0,02	0,9	0,018	180	(2) 20
flat - meadows, lawn...	0,10	0,9	0,09	900	X
sloping - meadows, lawn...	0,03	0,8	0,024	240	(2) 60
flat – arable lands	0,10	0,9	0,09	900	X
sloping – arable lands	0	0,7	0	0	(2) 0
slack surface waters	0,10	1	0,10	1000	X
running surface waters	0,05	1	0,05	X	(1) 500
hard surfaces (houses, roads...)	0,30	1	0,30	X	(1) 3000
Overall	1,00		**Total (Σ):**	6220	3580
Retention ability (%) Σ RR / VR * 100	**62,20 %**				

Recording card – Water retention ability of the landscape

Table for calculating the coverage of selected elements in the landscape					
Total land area (m^2): TA		**The number of squares in the square grid: TNofS**		**Size of area in 1 square (m^2): S = TA / TNofS**	
The number of squares covered by the landscape element NofS		**Calculation of covered size (X) X = NofS x S**		**Coverage share (C) C = X / TA**	
flat - forests, parks					
sloping - forests, parks					
flat - meadows, lawn...					
sloping - meadows, lawn...					
flat – arable lands					
sloping – arable lands					
slack surface waters					
running surface waters					
hard surfaces (houses, roads...)					

Recording card					
Class					
School					
City					
Water retention ability of the landscape					
Total land area (m^2): TA		**Rainfall (l/m^2/ rainy day): R**		**Volume of rainfall (liters): VR = TA x R**	
Coverage share (C)		**Terrain coefficient (TC)**	**Recalculated share Y = C x TC**	**Retained rainwater RR = VR x Y (liters)**	**Drained rainwater (1) DR = VR x Y (2) DR = VR x C x (1-TC) (liters)**
flat - forests, parks		1			X
sloping - forests, parks		0,9			(2)
flat - meadows, lawn...		0,9			X
sloping - meadows, lawn...		0,8			(2)
flat – arable lands		0,9			X
sloping – arable lands		0,7			(2)
slack surface waters		1			X
running surface waters		1		X	(1)
hard surfaces (houses, roads...)		1		X	(1)
Overall		**Total (Σ):**			
Retention ability (%) Σ RR / VR * 100					

Water saving

Introduction

If we watch the consumption of drinking water on a water-gauge for a few days, we usually realise how much we waste. Our connection with water begins with turning the tap and ending with the drain, without realising the connection to the water and what happens to it after use. Problems with drinking water shortage are not only for developing countries, but also in Europe we can see changes in the water cycle. The riverbeds dry out, the groundwater level decreases, the rainfall activity is usually irregular and extreme. This evidence alerts us to the emerging problem. Scientists say climate change will affect up to half of groundwater resources in the next 100 years. It is therefore important that we protect drinking water sources and use water sensibly and deliberately.

Learn about the problem

Use the internet, (scientific / popular) literature or in collaboration with experts to find available information on water consumption and its waste. Also focus on the following questions:

- What sources of drinking water do we have and where are they located?
- Does our country have sufficient supplies of drinking water?
- How many litres of water does an average household use?
- What are the options for saving water at home?
- What technologies / devices can you use for this purpose?

Recommended resources

Source 1:
The Problems of water stress

Source 2:
WWF #ProtectWater

Source 3:
Close up — Water in the city

Verify the occurrence of a problem in your area with your own research

Goal

Students can calculate how much water they consume in the home. They are aware of the value and importance of drinking water and that its availability and quality are not a matter of course. Students know how to save water in the home.

Tools & Materials

- recording card
- calculator
- board / flipchart / tablet or similar
- camera / mobile to record activity

Implementation

Before starting the measurement, check whether your household has a separate water-gauge (for hot and cold water). If you do not have a water-gauge, choose another building with access to a water-gauge (e.g. apartment building, school) so you can take the measurement. In this case, remember to divide the measured consumption by the number of people connected to that connection. Prepare a table in which

you will transmit the water consumption values for each student before and after the austerity measures are implemented.

Measurement

Within one week, record how much water your household consumes. Measure the values every day at the same time to avoid distorting the results for each day. Measure the values at the end of the week and recalculate how much water you use per year. Then calculate what the annual water consumption is in your class. You can recalculate the result e.g. the number of Olympic pools. Finally, calculate the average water consumption for your class.

Analysis of results and proposal of solution

What values did you manage to measure? Compare your results to your class average and national average. Is your consumption bigger or smaller? Discuss how you could reduce the amount of water used in your home. Which solutions are unpretentious and which in turn require higher investment? Record your suggestions and choose the ones you can implement. After implementing the solutions, repeat the water consumption measurement

Implementation of the solution and evaluation

Have you noticed water savings during repeated measurements? If so, what amount have you saved? How did the environment react to your efforts? How much water has been saved by an individual and how much by the class? Have you also identified other water-saving solutions? Can you implement them in practice?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording card							
Name	John Doe						
Class	9						
School	Elisabeth's Elementary school						
City	London						
Number of household members	2						
Day and Date **Time:** 17:00		**Water-gauge reading (m^3)**		**Water consumption (m^3)**		**Total water consumed (m^3)**	**Total water consumed per household member (m^3)**
		Hot Water	**Cold Water**	**Hot Water**	**Cold Water**		
0.	3. 5. 2019	50	100	x	x	x	x
1.	4. 5. 2019	50,20	100,42	0,20	0,42	0,62	0,31
2.	5. 5. 2019	50,35	100,67	0,15	0,25	0,4	0,2
3.	6. 5. 2019	50,40	100,99	0,05	0,32	0,37	0,185
4.	7. 5. 2019	50,55	101,40	0,15	0,41	0,56	0,28
5.	8. 5. 2019	50,71	101,78	0,16	0,38	0,54	0,27
6.	9. 5. 2019	50,83	102,01	0,12	0,23	0,35	0,175
7.	10. 5. 2019	50,93	102,15	0,10	0,14	0,24	0,12
Total per week				**0,93**	**2,15**	**3,08**	**1,54**
Total per year				**0,93*52=48,36**	**2,15*52=111,80**	**160,16**	**80,08**

Recording card - Water saving

Recording card							
Name							
Class							
School							
City							
Number of household members							
Day and Date Time:		**Water-gauge reading (m^3)**		**Water consumption (m^3)**		**Total water consumed (m^3)**	**Total water consumed per household member (m^3)**
		Hot Water	**Cold Water**	**Hot Water**	**Cold Water**		
0.				x	x	x	x
1.							
2.							
3.							
4.							
5.							
6.							
7.							
Total per week							
Total per year							

Mapping of ecosystem services

Introduction

The ecosystem is a multipurpose, coherent part of nature. Examples are forest, pasture, meadow, lake, wetland, pond, field, and part of the river flow with surrounding vegetation. The size of ecosystems is not specified, so an ecosystem may be a small forest, or spacious rainforest as well. Ecosystems give us various benefits in the form of goods and services, such as food, water, wood, air purification, soil formation and pollination. However, human activity alters the ability of ecosystems to provide us with such services. In the past, the importance of ecosystems has often been ignored. Mostly, they were considered as public property and thus not sufficiently appreciated. Currently we are witnessing the loss of some of the services and their replacement with costly alternatives. An example is a forest that formed clouds and rainfall. When we cut down the forest, the soil began to dry out and we had to invest in irrigation equipment. A better way is to understand the economic value of ecosystem goods and services and to invest more in ecosystems, which will also save our resources in the long term.

Learn about the problem

Use the internet, (scientific / popular) literature or in collaboration with experts to find available information on ecosystem services. Also focus on the following questions:

- What ecosystems are in your area?
- What services these ecosystems provide?
- Do you think that you also use some of these ecosystem services?
- Which ecosystems are endangered in your country/region? Explain why and localise them on the map.
- Do you think that humanity uses ecosystems sustainably?

Recommended resources

Source 1:
A beginner's guide
to ecosystem services

Source 2:
Ecosystem services

Source 3:
Fragmentation of natural
and semi-natural areas

Verify the occurrence of a problem in your area with your own research

Goal

Students can identify ecosystems in their surroundings and interpret the concept of ecosystem services. At the same time, they can name and assign basic services and goods that we get from ecosystems. Students are aware of the need for sustainable use of natural resources.

Tools & Materials

- online maps (e.g. Google maps) or territory map
- recording card
- a list of ecosystem services (link is in recording card)
- mobile phone (with internet connection) or GPS device
- a board / flipchart / tablet or similar
- camera / mobile to record activity

Implementation

Use the online maps to explore the allocated territory and try to identify the ecosystems that are located there (park, meadow, field, creek, pond, etc.). Choose the ecosystems you visit. Adjust the number of choosen ecosystems to the number of people involved and the time you can devote to this activity. Alternatively, assign the individual ecosystems to particular members of your group. Then print the map of the selected territory. Printed maps should be large enough to allow you to navigate and record the necessary information (e.g. ecosystem boundaries, taking notes).

Mapping process

Take the printed territory map, recording card, list of ecosystem services, mobile phone with internet access or GPS device and camera to the field. Visit selected ecosystems and write down the necessary information on the recording card. We recommend that you mark the ecosystem boundary in the map and enter the selected code (e.g. M1 as meadow #1) inside it to distinguish ecosystems from each other. Also make photo documentation in the field to support the information recorded. Include current positive and negative human interventions that affect the number and sustainability of ecosystem services (column “Notes”).

Analysis of results and proposal of solution

What types of ecosystems and ecosystem services have you identified? Which ecosystems were the largest? Which ecosystems are most at risk and why? Can you propose measures to help protect ecosystems or promote sustainability of services provided? Are there ways to increase the number of ecosystems, or to increase the number of services provided? Write down your ideas and select the ones you can implement.

Implementation of the solution and evaluation

Did you implement the selected solution? If so, what result did you get? Did you, your school, family or community help with implementation of the solution? How did they react to your initiative? Have you managed to increase the number of ecosystems or ecosystem services provided, or to support the sustainability of those existing? Do you think there is a better / more effective solution for the problem?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording Card	
Class	8.A
School	Leonardo´s Elementary School
City	Florence
Monitoring period	25.-26.06.2019

Ecosystem services								
Ecosystem	**Code**	**Picture**	**Location**	**Provisioning Services**	**Regulating Services**	**Habitat or supporting services**	**Cultural services**	**Notes**
greenwood	F1	ID_0001, ID_0002	N 48° 10’ 47.0” E 17° 06’ 04.0”	wood, water, medicinal herbs	water retention, temperature control, soil protection	soil formation, oxygen production	recreation, relax	timber harvesting planned

Ecosystem services (source)

Recording Card – Ecosystem services

Recording Card	
Class	
School	
City	
Monitoring period	

Ecosystem services								
Ecosystem	**Code**	**Picture**	**Location**	**Provisioning Services**	**Regulating Services**	**Habitat or supporting services**	**Cultural services**	**Notes**

Ecosystem services (source)

Mapping of invasive plant species

Introduction

Invasive alien species are non-native species whose introduction and / or spread outside their natural past or present ranges pose a threat to biodiversity. Invasive alien species occur in all major groups including animals, plants, fungi and micro-organisms, and are considered as one of the most important reasons for biodiversity loss worldwide (after direct habitat loss or destruction).

About 10,000 alien species have been registered in Europe. Some were imported as ornamental or melliferous plants, which began to spread from parks and gardens to the surrounding area and occupy new areas. They are characterised by high reproductive capacity and resistance to pests. Many of these species currently form in lush vegetation, most often along waterways, roads, railways, abandoned areas, but also in native plant communities.

Invasive species can cause great damage to native species by competing with them for food, eating them, spreading diseases, causing genetic changes through inter-breeding with them and disrupting various aspects of the food web and the physical environment. Their removal is very problematic and requires systematic interventions.

Learn about the problem

Use the internet, (scientific / popular) literature or in collaboration with experts to find available information about invasive plant species. Also focus on the following questions:

- What negative impacts do invasive plants have on local habitats or human health?
- What is the difference between the original and the alien species?
- What are potentially invasive plants?
- What invasive plant species occur in your area?
- How to properly remove invasive plants?

Recommended resources

Source 1:
Actual and potential future alien plant invasion hotspots under two emissions scenarios

Source 2:
Invasive alien species: a growing problem for environment and health

Source 3:
100 of the Worst

Source 4:
European Alien Species Information Network - EASIN

Verify the occurrence of a problem in your area with your own research

Goal

Students can identify the negative impacts of invasive plants on local habitats, know how to remove invasive plants, and identify measures to prevent invasive plants from spreading.

Tools & Materials

- online maps (e.g. Google maps)
- map of territory or GPS device
- field guide for identifying invasive plant species (characteristic, photograph) or a mobile plant determination application (e.g. Plantnet)
- recording card
- camera / mobile to record activity

Implementation

If you do not have information about the occurrence of invasive plant species in your area, explore the area through online maps (e.g. Google maps) and select their possible sites. Adjust the size of the area in which you will map invasive plant species to the number of people involved and the time you can devote to this activity. Mark the boundaries of the selected territory on the map and divide it into smaller sections that you assign to pairs or groups. Before you start mapping, find your region's invasive list of plants on the internet. Add the list to the record card. During the mapping, make photo documentation for possible species control or additional determination.

Mapping process

Take the determination keys / field guide, a mobile phone with a plant identification application installed, a recording card, a territory map or a GPS device, and camera to the terrain. Scroll through the selected area and record the recognised plant invasive species in the recording card and map, respectively GPS devices. Make photo documentation and assign a photo code to the photo card so that the photo can be clearly matched to the listing in the recording card. Assign a score to each species based on its presence by underlining the corresponding score from 0 to 3 in the table. In addition, assign a score to the attitude of the owner and the municipality regarding the presence of alien species on the monitored area, highlighting the corresponding scores. After completing the mapping of the individual parts of the territory, elaborate the final evaluation. After completing mapping of individual parts of the territory, process the final evaluation. Try to establish a hierarchy of invasive species according to frequency of their occurrence in your area.

Analysis of results and proposal of solution

Have you identified invasive plant species in your area? If so, what kind of prevalence? What is the likely cause of their occurrence? Is it possible to prevent them from spreading? What solutions would you use to remove them? What other measures could you take? Write down your ideas and select the ones you can implement.

Implementation of the solution and evaluation

Have you managed to remove some of the invasive plant species in your area? Was the method chosen effective or do you know about a more appropriate method? Did you inform your community or the landlord about your findings? How did they react? What do you think would be an acceptable total score for your area?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording Card						
Class	8.A					
School	Leonardo´s Elementary School					
Municipality	Florence					
Monitoring period	25.-26.06.2019					
1. Invasive Plants:	**Photo**	**Location**	**We have not seen the incidence**	**Occurs only in small groups up to 100 m² in total**	**Occurs in small groups up to 1000 m² in total m²**	**Generates continuous surfaces totaling over 1000 m²**
genus Fallopia	ID_0001, ID_0002	N 48° 10' 47.0" E 17° 06' 04.0"	0	1	2	**3**
genus Solidago			**0**	1	2	3
Helianthus tuberosus			**0**	1	2	3
genus Impatiens			**0**	1	2	3
Aillanthus altissima			**0**	1	2	3
Heracleum mantegazzianum			**0**	1	2	3
2. Owners or users of land with invasive plant species:	They are well known and are trying to make measures to remove these species as thoroughly and regularly as possible.					0
	They are known and partly take measures to remove these species.					1
	They are known but do not take any action to remove these species.					**2**
	They are not known, no measures are taken to remove them.					5
3. Does the municipality implement measures to remove invasive species in cooperation with landowners or land users?	Significantly.					0
	Partially.					1
	Just a few.					**2**
	Not at all.					3
					Total score:	**7**

Recording card - Occurrence of invasive plants in our area

Recording Card						
Class						
School						
Municipality						
Monitoring period						
1. Invasive Plants: (rows should be added as needed)	**Photo**	**Location**	**We have not seen the incidence**	**Occurs only in small groups up to 100 m² in total**	**Occurs in small groups up to 1000 m² in total m²**	**Generates continuous surfaces totaling over 1000 m²**
			0	1	2	3
			0	1	2	3
			0	1	2	3
			0	1	2	3
			0	1	2	3
			0	1	2	3
2. Owners or users of land with invasive plant species:	They are well known and are trying to make measures to remove these species as thoroughly and regularly as possible.					0
	They are known and partly take measures to remove these species.					1
	They are known but do not take any action to remove these species.					2
	They are not known, no measures are taken to remove them.					5
3. Does the municipality implement measures to remove invasive species in cooperation with landowners or land users?	Significantly.					0
	Partially.					1
	Just a few.					2
	Not at all.					3
					Total score:	

Getting out into our heritage

Introduction

Europe has a wealth of natural and cultural heritage. Heritage involves two main factors: a sense of belonging and a sense of time. Natural heritage is taken in the broadest sense and covers not only the wildlife and habitat of particular areas whether protected or not, but also the geological features and landscape / scenery.

Cultural heritage encompasses any cultural expression transmitted from the past and inherited by present day society. The material cultural heritage is everything we can touch. These are castles and their ruins, chateaux and manor houses, churches, chapels, monasteries, various monuments of folk architecture, important urban and rural settlements, technical monuments such as old mills, mining works, old factories. It also includes sculptures, art objects, paintings, costumes, and various objects of utility art as well as archaeological sites and findings, historical parks, alleys and rare sites.

In addition to material cultural heritage, we also have heritage that has been preserved only in writings, records, memory, or human awareness. Such a cultural heritage is intangible. These include various customs and traditions, songs, dances, folk literature, and also various scientific and literary works.

Learn about the problem

Use the internet, (scientific / popular) literature or in collaboration with experts to find available information about natural and culture heritage. Also focus on the following questions:

- What is the concept of monument care?
- What forms of territorial protection exist in your country?
- What does the world cultural and natural heritage mean?
- What role does cultural and natural heritage play in tourism?
- Which natural or cultural monuments are located in your area?
- What is a SWOT analysis?

Recommended resources

Source 1:
Links between natural and cultural heritage

Source 2:
World heritage

Source 3:
What is a SWOT analysis, and how to do it right

Verify the occurrence of a problem in your area with your own research

Goal

Students know the natural sites and cultural monuments that are in your surroundings. They understand the importance of protecting cultural and natural monuments; they can evaluate the status of the selected monument and propose solutions that will increase the interest of domestic residents, but also domestic and foreign tourists.

Tools & Materials

- online maps with cultural and natural monuments (e.g. Google maps)

- notepad / dictaphone
- recording card
- board / flipchart / tablet or similar
- camera / mobile to record activity

Implementation

Find the cultural and natural monuments in your area using the online maps. Choose one or more sights that you will visit. Arrange a meeting with the monument manager and prepare the questions you want to ask them in advance. At the same time, study as much information as possible about the site from the available sources.

Mapping process

As part of the interview with the site manager, check out the history of the object / location, its significance, what is the current status of the object / location (what is retained and what is irreversibly lost), how it is currently being used, what are the plans for the object / location for the future, whether it is private, state, or combined. Also note what part of the building / location is open to the public. When it comes to construction, be interested in the period from which it comes, what materials were used to build it, and what parts it consists of. Learn about the threats that can put the object / location at risk. Finally, visually assess the current status of the object / location (well-maintained or damage). Record your answers in a notebook or on a dictaphone (if you have permission from the person you are interviewing). Process the information obtained to the recording card.

In the recording card assess these **key factors**:

- **significance** – the importance of the object / locality (cultural or natural heritage) on the regional level
- **distinctiveness** – this refers to everything that make the object / locality unique
- **current state** – current maintenance status or damage rate
- **accessibility** – availability, opening hours, entrance fee, toilets, wheelchair accessibility
- **responsibility of property owner** – interest of the landlord in the conservation of the natural or cultural heritage
- **sustainability** – the risk level of losing the cultural and natural heritage in the near future
- **services and civic amenities nearby** – how these services support the local tourism
- **awareness** – stance of local inhabitants to the particular cultural or natural monument
- **seasonality** –accessibility of the monument / locality throughout the year

Use this evaluation scale to assess the key factors:

1. excellent, exceptional
2. good, significant
3. highly satisfactory, very interesting
4. satisfactory, interesting
5. basic, neutral
6. unsatisfactory, uninteresting
7. highly unsatisfactory, very uninteresting
8. bad, very insignificant
9. critical, absolutely without interest

Finally, attach a map of the area monitored to the recording card indicating the object or location you assessed.

Analysis of results and proposal of solution

Interpret the information from the recording card. Are positive or negative aspects prevailing? Are the identified threats significant? Could we lose the monument in the near future? How can you change people's behaviour and attitudes to natural and cultural heritage? How should a particular object / location be used to increase the interest of residents and tourists in the local cultural and natural heritage, while respecting the conditions of conservation or territorial protection? Write down your suggestions. Think about whether your solutions are feasible. Is there one that you can action?

Implementation of the solution and evaluation

How did you implement the selected solution? If so, what result did you get? Did you, your school, family or community help with the implementation of the solution? How did they react to your initiative and how do they perceive the protection of cultural and nature heritage? What did you learn?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

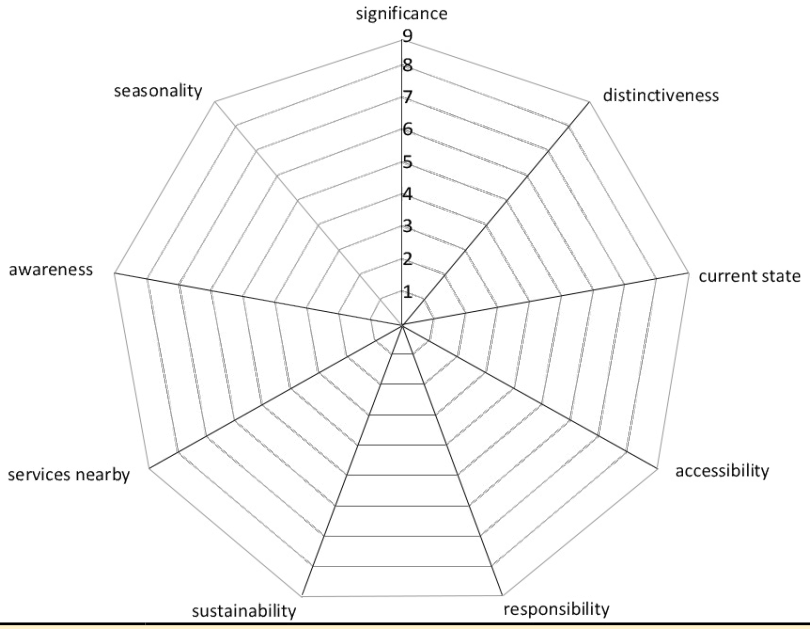
Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Recording card – Getting out into our heritage

Recording Card	
Class	
School	
Municipality	
Name of the object / locality	
Monitoring period	

Brief history of the object / locality

Key factors assessment



Current status / SWOT analysis

Positives / Strengths:	Negatives / Weaknesses (internal):
Opportunities:	Threats (external):

Suggestions for improvement

Other notes or insights

Mandatory annex: map of the monitored area indicating the object or location you assessed

Emotional map of public place

Introduction

Both the subjective and the objective factors influence the perception of the quality of a particular urban or rural environment. These include the human personality, expectations and interests, lifestyle, perception of aesthetics, but also his economic or health situation. The objective factors include the distribution of landmarks and its relevance, the availability and quality of greenery, cleanliness and safety, functioning public transport, cycling possibilities, peaceful sites or dilapidated spaces, and the availability of space for sports, entertainment, relaxation and culture. It is the quality of the public space that gives the place its life and decides whether or not we will stay in that place or avoid it.

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available information on active citizenship and participatory methods. Also focus on the following questions:

- What does the term public place mean?
- What participatory methods does your government use and how they motivate citizens to participate actively?
- How did the public participate in the last major investment in public space?
- What kind of public space beautification initiatives do you have in your area?
- Why is it important to be an active citizen?

Recommended resources

Source 1:
Urban systems

Source 2:
Towards a more urban world

Source 3:
Active citizenship and participation (pdf)

Verify the occurrence of a problem in your area with your own research

Goal

Students can argue about the quality of life in urban or rural environments. They can identify beautifying or corrective actions to improve the quality of public space.

Tools & Materials

- territory map for each group member
- green, blue, brown, orange and red marker for each group member
- notepad
- a board / flipchart / tablet or similar
- camera / mobile to record activity

Implementation

At the beginning, choose the territory you will be mapping. Start with a smaller area first and only when you master creating of an emotional map, can you expand the mapped area. If you do not have a map for each member of the group, print it from the map website (e.g. Google maps). Discuss the progress of the activity beforehand. In order to create a really good emotional map, you must also notice the details in the field. For example, if there is enough green space in a given area, or whether a part of the cycle path is not dangerous in a particular place, whether the particular public transport stop is destroyed or whether the curb is too high and thus problematic for handicapped citizens.

Mapping process

Take the printed map of the territory to the terrain (each member of the group has its own), markers (green, blue, brown, orange and red), mobile phone or camera and notepad. In the first part of the mapping, each individual (or pair) creates his / her own map - by colouring the printed map. Remember that you only spot each public place. For example, if one is a building, one dot is enough for the entire building.

The meaning of colours is as follows:

- green: here I feel good and safe, I like it, there's nothing to disturb me or require a more fundamental repair
- blue: At this point, I feel good and safe, but something requires correction or repair
- brown: I feel neutral, I have no positive or negative emotions on this place
- orange: I am not happy here because it is dangerous, neglected or dilapidated, or I have a different reason for it
- red: I feel uncomfortable at this point and I would prefer to avoid it because I am afraid of it, there is nothing I am interested in, or I have a different, serious reason for it

Be sure to take pictures while mapping, especially if you gave them a non-green colour. In the second part of the activity, as a group, meet and try to create a common emotional map of the same territory. Discuss why you assigned a particular colour to a particular location and find a compromise.

Analysis of results and proposal of solution

Did you manage to create a common emotional map? Which places were most discussed and why? What colour prevails on your sensation map? Can you identify entire zones that require higher attention and a more fundamental change? Can you say you are proud of your town / city? Is there anything you miss here? Choose a particular public place that you have marked with blue, orange, or red and try to suggest a change. Write down your suggestions. Think about whether your solutions are feasible. Is there one that you can action among them?

Implementation of the solution and evaluation

Did you implement the selected solution? If so, how did you get the result? Did you approach the school, family or community in your effort to implement the solution? How did they react to your initiative? What would you do differently next time?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Measuring the acidity of rain

Introduction

Rainwater is formed by the condensation of water vapour in the atmosphere. Initially it's like distilled water - neutral and it's pH value is 7. On the way to the ground the rain is polluted by the absorption of other substances (especially CO_2) and becomes slightly acidic. Regular rainwater has a pH factor in the range of 5.6 - 6.2. If rainwater absorbs more pollutants, especially sulphates and nitrates, due to polluted air, and it's pH drops below 5.6, we would refer to this as acid rain. Acid rain damages facades, cultural monuments and soil, causes the death of fish in lakes and significantly harms trees. Acid rain often occurs a long way from air pollution, because wind can easily carry sulphur and nitrogen oxides long distances

Learn about the problem

Use the internet, (scientific / popular) literature or in collaboration with experts to find available information on the causes of acid rain. Also focus on the following questions:

- What pH value does rain usually have in your area?
- Did acid rains occur in your area?
- Is there a specific season?
- Can you identify damage caused by acid rain on cultural monuments or on the health of a nearby forest?
- Can you identify air polluters in your area?

Recommended resources

Source 1:
Acid rain, explained

Source 2:
Air pollution still harming Europe's ecosystem

Source 3:
Acid Rain: Causes, Effects and Solutions

Verify the occurrence of a problem in your area with your own research

Goal

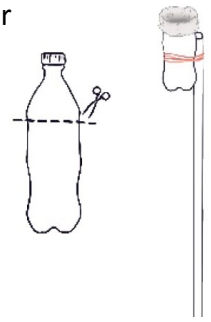
Students can analyse the pH of a rain sample, learn the negative effects of acid rain, and understand the relationship between wind direction and acidity of rain.

Tools & Materials

- wooden or metal rod (180 – 200 cm)
- collection container / collector (cut 2 a litre plastic bottle with a diameter of about 10 cm)
- two rubber bands
- new plastic bags for collecting rainwater (one for each day) and clean rubber gloves
- litmus papers or digital pH meter
- measuring cylinder
- place for the monitoring station
- recording card
- calculator
- web page with meteorological data or mobile phone application
- camera / mobile to record activity

Implementation

Based on your climate, choose a monitoring period in which you can expect rainfall. Then, choose the number of days you would like to measure the acidity of the rain (at least 5 in order to get a good results). Find a suitable location for the station in the school grounds (a suitable distance away from buildings, trees, and where it cannot be tampered with, to prevent the sample being contaminated or the station being damaged). Insert a rod into the ground, the rod should stand approximately 150 cm above the surface. Under the supervision of an adult, cut off the top of the plastic bottle. Fasten the bottom of the bottle to the rod with the rubber bands. The top of the container needs to be slightly higher than the end of the rod. Place a new plastic bag into the bottle on the first monitoring day. Insert the bag as follows: put on clean rubber gloves and insert a clean rain bag into the bottle.



Measurement

Collect rainwater in the monitoring station during the selected period. Each day (e.g. in the morning) change the plastic bag and write all the necessary data onto the recording card. When you are taking measurements, follow these steps:

- Check the station (mainly its stability).
- In the absence of rainwater in the collector (less than the teaspoon), do not take any measurements.
- If you have enough rainwater, put rubber gloves on and insert the litmus paper or the digital PH meter sensor into the collected rainwater. Write the measured pH on the record card.
- Record the type of precipitation (snow, ice, rain) and assign the appropriate value of ratio.
- Check for rainwater pollution (bird droppings, dust, insects, parts of plants and other impurities) which can potentially affect the measured data and assign the appropriate value of ratio.
- Multiply measured pH value with ratios.
- Pour the collected rainwater from the bag into the measuring cylinder. Record the amount of rainfall (ml) onto the card.
- Replace the plastic bag with a new one, without touching the inside with your fingers.
- Use the weather portal or application to determine the wind direction.

After the monitoring period, calculate the arithmetic mean of the non-zero pH values and analyse the data obtained.

Analysis of results and proposal of solution

What is the average pH value of the rain during the monitoring period? What do you think is the cause of the potential acidity? Can you identify the link between the wind direction, the source of air pollution and the results of the rainwater analysis? Suggest solutions that may help lower the acidity. Write down your suggestions.

Implementation of the solution and evaluation

Did you manage to implement any of the suggestions? Were they successful? What would you do differently next time?

How would you evaluate your feelings after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording card							
Class	9						
School	Elisabeth's Elementary school						
City	London						
Is there a source of local air pollution within a radius of 10 km from the monitoring station? If so, please specify:						~~yes~~	**no**
Date and time	**Wind direction**	**Amount of precipitation (ml)**	**Measured pH**	**Ratio for the type of precipitation snow, ice = 1,1 rain = 1**	**Ratio for bird droppings: yes = 1,2 no = 1**	**Ratio for dust, insects: yes = 1,1 no = 1**	**Calculated pH (multiplied by ratios)**
				Apply ratios only if measured pH is different than 5.6 – 6.5			
3.6.2019 / 8:00	S	0	0	-	-	-	0
4.6.2019 / 8:00	S	0	0	-	-	-	0
5.6.2019 / 8:10	SW	0	0	-	-	-	0
6.6.2019 / 8:00	SW	52	5,7	-	-	-	5,7
7.6.2019 / 8:05	W	70	5,2	1	1	1,1	5,72
10.6.2019 / 8:00	W	120	6,1	-	-	-	6,1
11.6.2019 / 8:00	W	65	5,9	-	-	-	5,9
12.6.2019 / 8:00	W	60	5,4	1	1	1,1	5,94
13.6.2019 / 8:00	W	40	4,9	1	1,2	1	5,88
14.6.2019 / 8:00	W	0	0	-	-	-	0
Arithmetic average of calculated non-zero pH							5,87

Recording card: The acidity of rain

Recording card							
Class							
School							
City							
Is there a source of local air pollution within a radius of 10 km from the monitoring station? If so, please specify:						yes	no
Date and time	**Wind direction**	**Amount of precipitation (ml)**	**Measured pH**	**Ratio for the type of precipitation snow, ice = 1,1 rain = 1**	**Ratio for bird droppings: yes = 1,2 no = 1**	**Ratio for dust, insects: yes = 1,1 no = 1**	**Calculated pH (multiplied by ratios)**
				Apply ratios only if measured pH is different than 5.6 – 6.5			
						Arithmetic average of calculated non-zero pH	

Greenhouse Gas Production (CO_2)

Introduction

Carbon dioxide (CO_2)) is a colourless, non-combustible, atmospheric gas. It is produced by people, animals and plants in the process of breathing. The problem arises in its overproduction, especially when burning fossil fuels such as coal, oil and natural gas. A significant share of fossil fuel combustion is represented by means of transport, such as aircraft, cars, trucks, boats or buses. Over the past decades, we have produced such a large amount of CO_2 that its volume has created an invisible layer that retains heat in the atmosphere, causing global warming. This process is also called the greenhouse effect. As a result, climate change is becoming an increasing problem, so it is the time to act.

Learn about the problem

Use the internet, (scientific / popular) literature or in collaboration with experts to find available information on CO_2 production using different modes of transport. Also focus on the following questions:

- What causes increased CO_2 in the atmosphere?
- What are the main sources of CO_2 production in your country / region / city?
- What percent of your country's emissions are generated by transport?
- What is the traffic density in your city / municipality?
- What are the alternative transport fuels and are they being used locally?
- Which European cities support the use of bicycles? What about your city?
- How many kilometres of bike paths are in your city / town?

Recommended resources

Source 1:
CO_2 emissions from transport

Source 2:
Greenhouse gas emissions from transport

Source 3:
A European strategy for low-emission mobility

Source 4:
Range of life-cycle CO_2 emissions for different vehicle and fuel types

Source 5:
Transport and public health

Source 6:
Green choices: policymakers, investors and consumers

Verify the occurrence of a problem in your area with your own research

Goal

Students can calculate the amount of CO_2 emissions they produce from travelling to and from school. Students are aware of the impact of increased CO_2 in the atmosphere and are considering ways to reduce production to help achieve higher air quality.

Tools & Materials

- online maps (e.g. Google maps) or GPS device to measure distance
- recording card
- map to mark individual student routes (additional)
- a board / flipchart / tablet or similar
- calculator
- camera / mobile to record activity

Implementation

At the beginning, set a monitoring period (e.g. week / month). The chosen period should represent the students' travel habits to the maximum extent. Alternatively, implement the monitoring repeatedly in different seasons. You can compare the results of individual monitored periods with each other and propose such solutions that are suitable for a particular season of the year, or weather.

Measurement

Each student records the route to and from the school on a daily basis and the method of transport used. If you are transferring to another method of transport during your journey to / from school, write down the place where this is happening.

Use the map or GPS device to find out the length of the route for each of the methods of transport you used on your day's route to / from school.

Based on the length of the route and the method of transport used, calculate the amount of emissions you produced on that day.

At the end of the monitored period calculate the average daily production and compare it to the average daily production of the entire group. You can also convert the CO_2 produced to the number of trees needed to process your CO_2 volume at different times (1 day, 1 month, 1 year).

Analysis of results and proposal of solution

How many kilograms of CO_2 did you produce as individuals and as a class? How do you perceive this quantity? Together, discuss how you could reduce CO_2 emissions while travelling to / from school. Write down your suggestions. Think about whether your solutions are feasible. Is there a solution that could be applied by each group member?

Implementation of the solution and evaluation

Try to implement the selected design and then repeat the monitoring. Have you managed to improve your results in repeated monitoring? How did the environment react to your solutions? Are there other solutions that you could apply? Do you have advice on how to convince others to reduce their CO_2 production?

How would you evaluate your feelings after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording card												
Name	John Doe			**Class**			9.B					
School	Victoria's Elementary School			**City**			London					
Date		**Day 1**		**Day 2**		**Day 3**		**Day 4**		**Day 5**		**Total production of CO_2 [g]**
Mean of Transport		**to school**	**from school**	**to school**	**from school**	**to school**	**from school**	**to school**	**from school**	**to school**	**from school**	
foot or bicycle	Length of route in km (L)	2		2				2	2	2		
	CO_2 production in g = L * **0 g/km**	0		0				0	0	0		**0**
tram or trolleybus	Length of route in km (L)	3						3	3	3		
	CO_2 production in g = L * **42 g/km**	126						126	126	126		**504**
electric car	Length of route in km (L)											
	CO_2 production in g = L * **43 g/km**											
minibus	Length of route in km (L)											
	CO_2 production in g = L * **55 g/km**											
diesel train	Length of route in km (L)											
	CO_2 production in g = L * **60 g/km**											
electric train or metro	Length of route in km (L)	11		11				11	11	11		
	CO_2 production in g = L * **65 g/km**	715		715				715	715	715		**3575**
bus	Length of route in km (L)			3								
	CO_2 production in g = L * **69 g/km**			207								**207**
moped	Length of route in km (L)											
	CO_2 production in g = L * **73 g/km**											
hybrid car	Length of route in km (L)											
	CO_2 production in g = L * **84 g/km**											
motorcycle	Length of route in km (L)											
	CO_2 production in g = L * **94 g/km**											
small car	Length of route in km (L)											
	CO_2 production in g = L * **110 g/km**											
medium car	Length of route in km (L)		18		18	18						
	CO_2 production in g = L * **133 g/km**		2394		2394	2394						**7182**
big car	Length of route in km (L)						18				18	
	CO_2 production in g = L * **183 g/km**						3294				3294	**6588**
Source	**Total production of CO_2 [g]**	**841**	**2394**	**922**	**2394**	**2394**	**3294**	**841**	**841**	**841**	**3294**	**18 056**

Recording Card - Greenhouse Gas Production (CO_2)

Recording card												
Name				**Class**								
School				**City**								
Date		**Day 1**		**Day 2**		**Day 3**		**Day 4**		**Day 5**		**Total production of CO_2 [g]**
Mean of Transport		**to school**	**from school**	**to school**	**from school**	**to school**	**from school**	**to school**	**from school**	**to school**	**from school**	
foot or bicycle	Length of route in km (L)											
	CO_2 production in g = L * **0 g/km**											
tram or trolleybus	Length of route in km (L)											
	CO_2 production in g = L * **42 g/km**											
electric car	Length of route in km (L)											
	CO_2 production in g = L * **43 g/km**											
minibus	Length of route in km (L)											
	CO_2 production in g = L * **55 g/km**											
diesel train	Length of route in km (L)											
	CO_2 production in g = L * **60 g/km**											
electric train or metro	Length of route in km (L)											
	CO_2 production in g = L * **65 g/km**											
bus	Length of route in km (L)											
	CO_2 production in g = L * **69 g/km**											
moped	Length of route in km (L)											
	CO_2 production in g = L * **73 g/km**											
hybrid car	Length of route in km (L)											
	CO_2 production in g = L * **84 g/km**											
motorcycle	Length of route in km (L)											
	CO_2 production in g = L * **94 g/km**											
small car	Length of route in km (L)											
	CO_2 production in g = L * **110 g/km**											
medium car	Length of route in km (L)											
	CO_2 production in g = L * **133 g/km**											
big car	Length of route in km (L)											
	CO_2 production in g = L * **183 g/km**											
Source	**Total production of CO_2 [g]**											

Ecological footprint

Introduction

Every day we use natural resources to secure our standard of living. Whether it is living in a house, eating, travelling, or leisure activities, almost all of our activities are linked to the consumption of natural resources. Some are non-renewable (such as fossil fuels) and after exhausting them we will have to find an alternative. Other resources are renewable (e.g. biomass or wood) and can be restored after a certain time. And there are resources whose amounts do not change on the planet, but their quality does (e.g. water). Increasing population and living standards are causing an increasingly rapid depletion of resources and affecting the natural balance and ecological resilience. However, this cannot work forever because our planet also has limits, therefore it is necessary to meet the needs of all people and participate actively to reverse current situation to be more sustainable. A good example of how to find out our consumption of resources is by calculating the Ecological Footprint. Do you think that if everyone lives like you, the planet will have enough resources for everyone?

Learn about the problem

Use internet, (scientific / popular) literature, or in collaboration with experts find available information on ecological footprint and sustainable development. Focus on the following questions:

- What information is needed to calculate the ecological footprint?
- What is the size of the national ecological footprint?
- Do you know what Earth Overshoot Day is?
- What does sustainable development mean? What are its principles? Are you implementing these principles in your daily life?

Recommended resources

Source 1: Ecological footprint

Source 2: Ecological Footprint of Countries: Deficit or Reserve?

Source 3: World Overshoot Day

Source 4: Ecological footprint

Source 5: Energy in Europe: State of play

Source 6: Climate change and investments

Verify the occurrence of a problem in your area with your own research

Goal

Students using the selected online calculator can calculate the size of their ecological footprint representing the demand of land / sea / lakes for a certain human community in a year, or the amount of CO_2 produced

per year according to their lifestyle. Based on the calculated value, students are aware of the impact of their behaviour on the planet. Students can identify their strengths and weaknesses in the area of natural resource consumption and can change their behaviour towards a more sustainable life-style by focusing on energy consumption, water usage, consumption patterns and waste production.

- Tools & Materials
- online ecological footprint calculator:

Henkel

Carbonfootprint

WWF

- a board / flipchart / tablet or similar
- recording card
- calculator
- camera / mobile to record activity

Implementation

Before starting an ecological footprint calculator, discuss questions that occur in the selected area or topic (food, home, travel, leisure, etc.). If students are unable to answer all the questions, look for missing information on the internet or give them a time to prepare answers with their parents. Then answer the questions in the selected online calculator. Write down your results in the record card. Then calculate the average footprint of the whole class.

Analysis of results and proposal of solution

What results have you achieved? Together, discuss the size of the ecological footprint of each student and class. Is your footprint larger or smaller than the world / national average? Is your consumption sustainable? What are the strengths and weaknesses of how you live from a sustainable point of view? How could you reduce your environmental footprint? Write your ideas on the board or flipchart. Pick some solutions as individuals or make a commitment as a team.

Implementation of the solution and evaluation

Did you implement some solutions? Have you respected the commitments you made? If so, how has your ecological footprint changed? How did your friend or family react? Are there other ways how to reduce your environmental footprint? Would you be able to calculate the environmental footprint of your school and propose solutions to reduce it? After some time, you can repeat the ecological footprint calculation.

How did you feel after implementing the selected solution?

Frustrated	Disappointed	Rather Negative	Neutral	Rather Positive	Satisfied	Enthusiastic
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording card					
Class	9				
School	Elisabeth's Elementary school				
City	London				
Name and surname	**Amount of CO_2 [t/year]**	**Number of trees needed to store CO_2 [trees/year]**	**Strengths of my life-style**	**Weaknesses of my life-style**	**My commitments**
John Doe	3,6	288	Housing (economical appliances)	Nutrition (meat), Travelling (diesel car, flights)	Restrict meat consumption, use public transport more often
Lucia Smith	2,0	160	Nutrition (vegan)	Housing (electricity consumption)	Save electricity and restrict playing video games
Carol Bright	2,8	224	Holiday (local trips)	Travelling (diesel car)	Use public transport more often
Anthony Bridge	3,9	312	Housing (eco-friendly)	Holiday (flights, hotels)	Restrict luxury holidays
Alan W. Bean	2,9	232	Eating in restaurants (occasionally)	Housing (water consumption	Reduce water consumption
Samantha Fox	3,1	248	Travelling (no car)	Nutrition (exotic food)	Buy local food
Total	**18,3**	**1464**			
Average	**3,05**	**244**			

Recording card – Ecological footprint

Recording card					
Class					
School					
City					
Name	**Amount of CO_2 [t/year]**	**Number of trees needed to store CO_2 [trees/year]**	**Strengths of my life-style**	**Weaknesses of my life-style**	**My commitments**
Total					
Average					

Power consumption in STAND-BY mode

Introduction

An average household uses many electrical appliances, for example a fridge, a washing machine, a microwave, a kettle, a computer, a modem, a television and others. All these devices consume a certain amount of electricity, depending on their energy class. But what happens when we are not at home, e.g. at school, work, or on vacation, and devices stay in stand-by mode? If we do not switch them off completely their consumption will decrease, but they will still consume a small amount of electricity constantly. Taking into account millions of appliances in stand-by mode around the world, this is an unnecessary waste of our natural resources that are used to produce that electricity.

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available information on wasting electricity with appliances that are in stand-by mode. Also focus on the following questions:

- What is a STAND-BY mode?
- What are the sources for creating electricity in your country?
- What percent is renewable energy and how much is non-renewable?
- How many households are registered in your country?
- What is the average household electricity consumption in your country?
- What is the cost of 1 kWh of electricity in your household?

Recommended resources

Source 1:
Preventing energy loss

Source 2:
Household energy consumption

Source 3:
Energy efficiency benefits us all

Verify the occurrence of a problem in your area with your own research

Goal

Students know what a STAND-BY mode is. They can calculate how much electricity the appliances consume in their household switched in this mode. Students realise that this is a waste of electricity and by changing their behaviour they can save natural resources and family budgets.

Tools & Materials

- recording card
- list of devices in stand-by mode and their consumption in stand-by / off mode (Table no. 1)
- a board / flipchart / tablet or similar
- calculator
- camera / mobile to record activity

Implementation

Before starting the measurement, ask your parents what price you pay in the household for 1 kWh of electricity. You will use this value to calculate the cost of energy consumed. Your parents can also help you to write down all the electrical appliances you have in your household and keep them plugged in stand-by or off mode.

When calculating, be careful to use the same units of measurement.

Measurement

When completing the recording card, assign the average electricity consumption of each appliance using Table no. 1 and write down the number of each appliance that you have in your household. Then consider how many hours of the day this appliance is on STAND-BY / OFF mode. By using the formula in the recording card, calculate how much electricity your appliances spend is per year and how much money you pay unnecessarily for consumed energy. Finally, count the values of the entire class together and also calculate the average electricity consumption for your class, compare this against your household.
Based on the number of households in your country, calculate how much electricity would be unnecessary consume if all residents behaved in the same way as your class. Just multiple the average electricity consumption of your class and the number of households registered in your country.

Analysis of results and proposal of solution

What values have you calculated within your household and for the class? Why can't we disconnect all household appliances from the mains? Were you surprised by the amount of money or kWh that your appliances consume in 1 year even though they are not being used? What could you buy with this saved money? What solutions would you propose? Discuss ways to avoid unnecessary electricity consumption. Write down your suggestions and select the ones you can implement.

Implementation of the solution and evaluation

Did you manage to implement the selected solutions? What is the estimated electricity saved (in kWh and € / £)? What was the opinion of family members on your efforts? Were they willing to cooperate? Do you think there are other ways to save electricity? If so, what are they? Can you share your results with other students and implement some solutions at your school (e.g. computer laboratory)?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Table no. 1: Average electricity consumption of selected appliances

Appliance (OFF/STANDBY mode)	Average power consumption kWh	Appliance (OFF/STANDBY mode)	Average power consumption kWh
Air Conditioner, room/wall	0,0009	Set-top Box, satellite	0,01566
Charger, mobile phone	0,00026	Speakers, computer	0,00179
Clock, radio (ON)	0,00201	Stereo, portable	0,00166
Computer Display, CRT	0,01214	Television, CRT	0,00306
Computer Display, LCD	0,00138	Television, rear projection	0,00697
Computer, desktop	0,02113	Timer, irrigation	0,00284
Computer, notebook	0,01577	Tuner, AM/FM	0,00112
Fax, laser	0,00642	Amplifier	0,00027
Modem, DSL	0,00137	Audio Minisystem	0,00832
Modem, cable	0,00385	CD Player	0,00504
Multi-function Device, inkjet	0,00526	Caller ID Unit	0,00127
Multi-function Device, laser	0,00312	Coffee Maker	0,00114
Night Light, interior	0,00022	Copier	0,00149
Phone, cordless (handset)	0,00281	DVD Recorder	0,00075
Phone, cordless (no handset)	0,00158	DVD Player	0,00155
Phone, cordless with answering machine (handset)	0,004	DVD/VCR	0,00504
Phone, cordless with answering machine (no handset)	0,00282	Game Console	0,02334
Printer, inkjet	0,00126	Garage Door Opener	0,00448
Printer, laser	0,00158	Microwave Ovens	0,00308
Scanner, flatbed	0,00248	Musical Instruments	0,00282
Security Systems, home	0,0027	Receiver (audio)	0,00292
Set-top Box, DVR	0,03668	Telephone Answering Device	0,00225
Set-top Box, digital cable with DVR	0,04346	Television/VCR	0,00515
Set-top Box, digital cable	0,01783	Turntable (audio)	0,0002
Set-top Box, satellite with DVR	0,0278	VCR	0,00468

Source

Example

Recording card					
Name	John Doe				
Class	8.A				
School	Leonardo´s Elementary School				
City	Florence				
Appliance	**Average power consumption (APC)**	**Number of hours in stand-by/off mode (H)**	**Number of appliances (N)**	**Power consumption per year (PC)**	**Price for electricity**
	-	-	-	(APC*H*N*365 = PC)	[PC*(price/kWh)] = P)
	kWh	H	number	kWh	€ / £
Game Console	0,02334	22	1	187,42	12,44
Computer, notebook	0,01577	20	1	115,12	7,64
Television/VCR	0,00515	19	1	35,72	2,37
Summary		**61**	**3**	**338,26**	**22,46**

Recording card - Power consumption in STAND-BY / OFF mode

Recording card					
Name					
Class					
School					
City					
Appliance	**Average power consumption (APC)**	**Number of hours in stand-by/off mode (H)**	**Number of appliances (N)**	**Power consumption per year (PC)**	**Price for electricity**
	-	-	-	(APC*H*N*365 = PC)	[PC*(price/kWh)] = P)
	kWh	h	number	kWh	€ / £
Summary					

There is an alternative

Introduction

We are currently living in a consumer society, and the lives of most of us are affected by constant consumption. Under the influence of tempting ads, we buy many products, even if we don't need them. Disposable items have become a common part of our lives. Plastic cups, cutlery, plastic bags, pastry gloves, PET bottles and many other items are used only once and then thrown into the trash immediately. Waste accumulation is an increasing environmental problem for mankind, mostly because the amount of the waste and its dangerous characteristics and costly disposal methods. So, let's start with reasonable consumption as aware customers. Do you think that excessive waste production also applies to you or your class?

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available information about ZERO WASTE. Also focus on the following questions:

- What types of disposable products you use most often?
- What are they made of?
- What do you do with them if you no longer need them?
- What are the options for reducing waste production?
- What are the alternatives to disposable goods?

Recommended resources

Source 1:
Going ZeroWaste

Source 2:
Waste

Source 3:
Recycling of municipal waste

Verify the occurrence of a problem in your area with your own research

Goal

Students can identify the disposable goods they use in school and are aware of the problem of excessive waste generation. Students know which types of disposable goods can be replaced with ecological alternatives to help reduce waste.

Tools & Materials

- recording cards
- a board / flipchart / tablet or similar
- camera / mobile to record activity

Implementation

At the beginning, choose the period during which you will record waste production (e.g. a week). Then agree on which categories of waste to monitor (e.g. PET bottles, paper napkins, plastic bags, plastic beverage cups, sweets packaging, etc.). You determine the number of categories yourself. The list of categories put on a prominent place in the class. The role of each of you will be to record the amount of waste you produce. When writing, be honest and write down the waste you throw away not only in the classroom, but also in other school premises (e.g. school yard, dining room).

Measurement

Every day write down what you have thrown into the trash. At the end of the week, calculate how many pieces of waste you have produced within each category. Multiply this result by the number of weeks spent at school in the current school year. This will give you an approximate amount of waste generated during school time.

Analysis of results and proposal of solution

How do you feel about the amount of waste you produce? Discuss how you could reduce this amount. Are there alternatives to commonly used packaging materials? If so, can you use them? Record your ideas on a board or flipchart. You can create a board with your ideas.

Implementation of the solution and evaluation

Did you put into practise some solutions you have chosen? If so, what are your results? What amount (pieces, kilograms) of waste have you saved? How did your friends and family react to your efforts? Are there other solutions that you can implement? How would you inspire others to join your initiative? Expand this activity to school and record results.

How would you evaluate your feelings after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Example

Recording card			
Name	John Doe		
Class	9		
School	Elisabeth's Elementary school		
City	London		
Day and date		**Categories of waste produced**	**Amount**
1.	3. 5. 2019	Plastic bottle	1
1.	3. 5. 2019	Plastic cup	2
2.	4. 5. 2019	Plastic bottle	1
2.	4. 5. 2019	Plastic bags	2
2.	4. 5. 2019	Paper napkins	4
3.	5. 5. 2019	Plastic cutlery	1
4.	6. 5. 2019	Plastic plate	1
5.	7. 5. 2019	Plastic food container (polystyrene)	1
5.	7. 5. 2019	Plastic bottle	3

Categories of waste produced	Weekly summary	School year summary
Plastic bottle	5	175
Plastic straw	0	0
Plastic cup	2	70
Plastic cutlery	1	35
Plastic plate	1	35
Plastic bags	2	70
Paper napkins	4	140
Plastic food container (polystyrene)	1	35
Total amount	**16**	**560**

Recording card – There is an alternative

Recording card			
name			
class			
school			
city			
Day and date		Categories of waste produced	Amount

Categories of waste produced	Weekly summary	School year summary
Total amount		

Mapping of illegal dumping

Introduction

Landfills are divided into legal (with strict rules and standards applied) and illegal (black, wild dumps). Black landfills are a serious environmental problem and are occurring in almost every community despite awareness, waste separation and recycling technologies, and collection yards. Black landfills are created in nature or in the streets of the city from loose waste. Besides the aesthetic point of view, illegal landfills have a negative impact on plants and animals in its vicinity, threatening water, soil and air quality, as well as human health. Despite penalties for illegal dumping and various voluntary initiatives, their number has not declined.

Learn about the problem

Use internet, (scientific / popular) literature, or in collaboration with experts find available information on illegal dumping. Also focus on the following questions:

- How would you define illegal dumping?
- What are the causes of illegal dumping?
- Where do such landfills mostly occur?
- What type of waste most often occurs on illegal landfills?
- What is their impact on the environment?
- What is your city doing to remove illegal landfills?

Recommended resources

Source 1:
TrashOut

Source 2:
The waste trade – legal and illegal

Source 3:
How can waste policy contribute to a resource-efficient economy?

Verify the occurrence of a problem in your area with your own research

Goal

Students know what illegal landfills are and can identify them. Using the app they can map their occurrence in their neighbourhood. Pupils are aware of the risks associated with the occurrence of illegal landfills and can report illegal landfill to responsible persons / authorities.

Tools & Materials

- online maps (e.g. Google maps) or territory map
- mobile phone (with internet connection) or camera
- TrashOut application or similar
- mobile application for tracking path
- board / flipchart / tablet or similar

Implementation

Choose a territory where you will map illegal landfills (e.g. neighbourhood of school, city district, village). Adjust the size of the territory to the number of people involved and the time you can spend on mapping. Mark the boundaries of the selected territory on the map and divide it into smaller sections that you assign

to pairs or groups of pupils. Before starting the mapping, mark the TrashOut dump already reported in the printed map. Subsequently, you can use the photos taken during the mapping process to create a presentation or a dashboard.

Mapping process

Use the map to review the allocated territory and try to estimate the locations of possible dumps. Plan a route to check for previously reported landfills while checking for new tracks. Take the printed territory map and mobile phone with Internet access and TrashOut installed to the field. Gradually navigate the entire route and record illegal dumps into the application and printed map. If you find a new illegal dump, follow the instructions in the app (add a photo, enter the landfill size, waste type, landfill availability, location and additional information). After completing mapping of individual parts of the territory, process a map of the entire territory indicating all the illegal landfills you have discovered.

Analysis of results and proposal of solution

Did you find illegal waste dumps around you? What kind of waste prevailed on them? Where did they occur most often? What is the likely cause of their occurrence? Do you think there is a way to prevent the emergence of these landfills? What solutions would you use to remove them? Write down your ideas and select the ones you can implement.

Implementation of the solution and evaluation

Did you manage to implement the selected solution? If so, how did you get the result? Did you inform the community / landlord about illegal landfills? How did your friends and family react to your activities? Have you encountered understanding or vice versa? Have you managed to remove any of the waste dumps? Do you think there is a better / more effective solution for the problem?

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
Help others to join us.

Real availability of public open areas

Introduction

Many scientific studies have shown that greenery has a major impact on the quality of life of urban residents. Greenery provides the human with so-called ecosystem services whose value can be measured and financially valued. The ecosystem services that green spaces provide us include air cooling during hot days, cleaning of air, reducing noise, increasing the mental and physical well-being of the population, beautifying of urban spaces with a variety of structures, shapes or colours, and providing living space for different animals or plants. As well as the presence of green areas in cities, their effective management ensuring the functioning of the ecosystems, is important as well.

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available information on importance of greenery in public spaces. Also focus on the following questions:

- What is the proportion of green areas in the urban area of your city?
- Which of these areas are open to the public?
- Are public green spaces located so that they are in a suitable walking distance for any inhabitant?
- Who is maintaining the public greenery?
- How does your city deal with substitute planting?

Recommended resources

Source 1:
'People-first' for greener, liveable cities

Source 2:
Better planning and methods needed to restore nature

Source 3:
How to make cities 'green'

Verify the occurrence of a problem in your area with your own research

Goal

Students can name the benefits of green spaces and know the recommended availability of public green areas. They can determine the area of the selected green space and calculate its availability from a set starting point.

Tools & Materials

- online maps with area size calculation function (e.g. Google maps)
- GPS device with the possibility to record the distance walked
- recording card
- a board / flipchart / tablet or similar
- camera / mobile to record activity

Implementation

When we use the term public green areas we are referring to public parks, gardens, private green areas open to the public and cemeteries, school yards, sports fields or playgrounds where there is plenty of greenery. According to the recommendations of the European Union, public green areas from 0,5 to 2 hectares should be available within 300 meters (about 5 minutes walk) and public green areas over 2 hectares up to 800 meters.

Before starting the measurement, agree on starting points from which you will measure the availability of public green areas. It can be your place of residence or any place within the residential area. Then use online maps or walk around and identify the public green areas around the specified starting point. Insert individual green areas into the recording card - specify their name (or street). Fill separate recording card for each starting point.

Measurement

Use the "measure distance" function within the Google Maps to determine the area of the identified green areas. Right-click on the map to launch the feature and then click to create space boundaries. Transfer the result to hectares and write them to the record card. Determine the type of public green space (park, garden, private area, school yard, cemetery, sports field, playground) and the required availability (up to 300 meters or up to 800 meters). For areas smaller than 0.5 hectares, just write "unmonitored" and do not work with them further.

In the second step it is necessary to verify the real availability of public green areas larger than 0.5 hectares. Using a GPS device (such as a mobile phone with a distance tracking application downloaded), measure the distance from the starting point to the border of public green area. Measure while walking. If you have a fence in your path, include this route as well. As a result, you will calculate the amount of green space available.

Finally, find out who is maintaining the space and optically evaluate the state of greenery (excellent, good, satisfactory, poor, bad).

Analysis of results and proposal of solution

Has there been at least one public green space available within 300 metres with size 0.5 - 2 hectares and up to 800 metres with size over 2 hectares from the chosen starting point? How would you improve the availability of green spaces? Do existing green areas require better care? What didn't you like in a specific green space? How would you suggest improving a particular public green space? Write down your ideas and select the ones you can implement.

Implementation of the solution and evaluation

Did you implement the selected solution? If so, what result did you get? Did your school, family or community help with the implementation of the solution? How did they react to your initiative? Have you managed to increase the availability of green spaces? Do you think there is a better / more effective solution for the problem?

How would you evaluate your feelings after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

Record and share photos on social networks with #mybioprofile during the activity.
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Example

Recording Card						
Class	8.A					
Schol	Leonardo´s Elementary School					
City	Florence					
Starting point	2nd Yellow street					
Monitoring period	25.-26.06.2019					
Name of public area (or street)	**Area (ha)**	**Type of green public area**	**Required availability[1] (m)**	**Real availability (m)**	**Evaluation of greenery**	**Responsible for maintenance**
park Main street	0,4	park	unmonitored			
school yard Green street	0,3	school yard	unmonitored			
park Hills	3	park	up to 800 m	1245	good	municipality

[1] – Use only these 3 types:
unmonitored – for areas smaller than 0.5 hectares
up to 300 m – for areas between 0.5 to 2 hectares
up to 800 m – for areas over 2 hectares

Recording Card - Real availability of public open areas

Recording Card						
Class						
Schol						
City						
Starting point						
Monitoring period						
Name of public area (or street)	**Area (ha)**	**Type of green public area**	**Required availability [1] (m)**	**Real availability (m)**	**Evaluation of greenery**	**Responsible for maintenance**

Population exposure to noise

Introduction

We get about 11% of the information from the outside world through our hearing. Therefore, it is important that we save our hearing and avoid harmful noise. We consider noise to be any undesirable, unpleasant, disturbing or harmful sound to a person. This can be dangerous in the long run from as low as about 70 dB. The increasing traffic intensity on the road, coupled with the increasing urbanisation of cities in recent decades, has also changed the perception and attitude of man to noise, which is increasingly affecting the quality of life and health of the exposed population.

Learn about the problem

Use the internet, (scientific / popular) literature, or in collaboration with experts to find available noise information and its permitted standards for each type of space. Also focus on the following questions:

- What sources of noise exist?
- Which sources of noise are predominate near your home / school?
- Are there any sounds during your sleep?
- What impact does noise have on human health?

Recommended resources

Source 1:
How much noise is too much noise?

Source 2:
What is noise pollution?

Source 3:
Transport and ecosystems

Verify the occurrence of a problem in your area with your own research

Goal

Using the noise measurement application, students can measure noise intensity. Students are aware of the impact of noise on their health and know how to protect themselves from it.

Tools & Materials

- mobile phone (with internet connection)
- noise measurement application:
  - Decibel X: dB, dBA Noise Meter (iOS)
  - Decibel X - Noise Detector (Android)
- camera
- map
- a table showing the effects of noise on humans
- recording card

Implementation

At the beginning, choose the territory (e.g. school premises) and the specific places where you will measure the noise intensity (e.g. in front of the school entrance, in the relaxation zone, etc.). These locations may be both indoor and outdoor. Mark the selected locations on the map. Attach a recording card to the map where you will write the measured values. Repeat the measurements at all selected locations in the morning

and at the same time in the afternoon (e.g. 8:00 and 13:00). Use the mobile app to measure noise intensity and during measurement don't make any sounds that may affect the results. You can add different sounds from your school environment to your measurements (e.g. school bell, school radio, etc.)

Measurement

Measure the intensity of the noise using the mobile application at selected locations and at the selected time. Enter the data you have recorded in the prepared recording card. Try to identify the source of noise (e.g. traffic, mower, noisy conversation) and record it. Compare the measured data with the permissible noise values. Based on Tables 1 and 2, evaluate how recorded noise affects human health.

Table no. 1: Outdoor human health impact:

Value	Recording card	Effect
0 – 30 dB	**1**	Satisfactory
31 – 50 dB	**2**	Satisfactory with some disturbances
51 – 65 dB	**3**	Negative impact on long-term exposure
66 – 90 dB	**4**	Unsatisfactory
91 or more dB	**5**	Damaging

Table no. 2: Indoor human health impact:

Value	Recording card	Effect
0 – 30 dB	**1**	Satisfactory
31 – 40 dB	**2**	Satisfactory with some disturbances
41 – 65 dB	**3**	Negative impact on long-term exposure
66 – 90 dB	**4**	Unsatisfactory
91 or more dB	**5**	Damaging

Analysis of results and proposal of solution

What values did you manage to measure? Have the noise levels exceeded the permitted limits in some locations? Which places were the noisiest and the quietest? What was it caused by? How could noise in problematic places be reduced or eliminated? Record your solution suggestions and select the ones you can implement.

Implementation of the solution and evaluation

Did you manage to implement some solutions? If so, did you get better results with repeated measurements? How do you rate selected solutions? How did the environment react to your efforts? Are there other solutions that you could apply? If so, implement them and repeat the measurement.

How did you feel after implementing the selected solution?

Frustrated	**Disappointed**	**Rather Negative**	**Neutral**	**Rather Positive**	**Satisfied**	**Enthusiastic**
○	○	○	○	○	○	○

Publicity

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Table no. 3: Sources of noise and their intensity

Sound Source	**Sound intensity (dB)**
fizzing grass, nightlife in the countryside	10
whisper, ticking the clock	20
urban noise at night	40
human speech, TV in the home	60
croaking frogs	65
busy street	70
shouting, vacuum cleaner, noise in the railway tunnel	80
cock crowing	85
motor vehicle	90
disco, crying baby	110
rock concert	120
gun shot	150
firecrackers, start of a jet aircraft	170

Example

Recording Card					
Name	John Doe				
Class	9				
School	Elisabeth's Elementary school				
City	London				
Date and time	**Location**	**Outdoor / Indoor**	**Noise source**	**Measured noise value in dB**	**Effect on human health**
05.05.2019 08:00	dressing room	indoor	human speech	63	3
05.05.2019 08:00	entrance to school	outdoor	transportation	72	4
05.05.2019 08:00	school yard	outdoor	distant street	28	1
05.05.2019 08:00	dining room	indoor	human speech	46	3
05.05.2019 13:00	dressing room	indoor	human speech	62	3
05.05.2019 13:00	entrance to school	outdoor	transportation	49	2
05.05.2019 13:00	school yard	outdoor	distant street	68	4
05.05.2019 13:00	dining room	indoor	human speech	72	4

Recording card - Population exposure to noise

Recording Card					
Class					
School					
City					
Class					
Date and time	**Location**	**Outdoor / Indoor**	**Noise source**	**Measured noise value in dB**	**Effect on human health**

BIOPROFILES

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