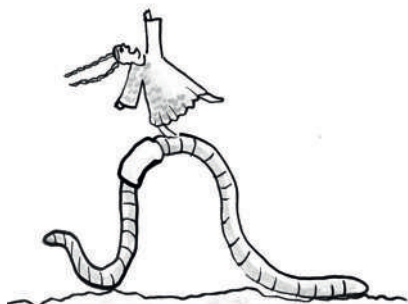




## WITH CHILDREN AGAINST DROUGHT



## LIFE IN BALANCE


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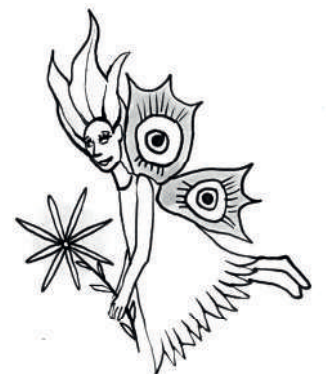
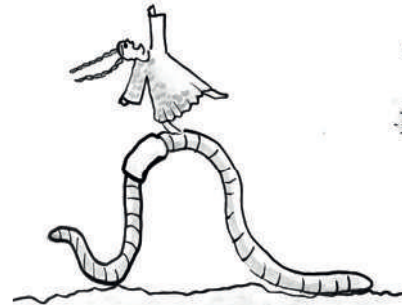
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“The theory will remain plain theory unless we take action.”

(John Amos Comenius)

“Let him who would move the world, first move himself.”

(Socrates)



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The world and the climate are changing. This is a fact that no one doubts anymore. Nor is there any doubt about the role humans play in causing the climate to change. Only recently did we, as a society, allow ourselves to accept this reality. However, we believed that the changes already started wouldn't show until decades later, that they would be a problem of our children and the solution would be dealt with by someone else, not us.

But it is all coming down way faster than we thought. We are experiencing the changes first-hand in real time. The average temperature on Earth has increased significantly since the Industrial Revolution. Nineteen of the twenty hottest years on record have occurred since 2000.<sup>1, 2</sup> From our ancestors' weather proverbs and folk sayings, we know that they were able to predict the weather in the near future, but today, the climate that has surrounded us for hundreds of years, is becoming unpredictable and sometimes changes from day to day. Major changes are taking place in nature that affect life on the entire planet.

And we, people, still believe that someone will come and miraculously solve the changes that have been set in motion. We keep forgetting, however, that the changes are not just about nature, they concern and affect us all. We all live on the same planet and are an integral part of it. There is no "man" and "nature", there is only "man in nature". The entire globe is one ecosystem in which everything is connected to everything, and any disruption of the system causes it to lose its balance. Fortunately, it works the other way around too. Each and every one of the nature-friendly measures we adopt, however small it may be, triggers restoration processes.

There are many ways to participate in landscape restoration. It is simply untrue that an individual is powerless against climate change. In our project, we focus on one piece of the puzzle – manifestations of drought, floods, and landscape care. In the future, the landscape will be exposed to more frequent and stronger extreme weather conditions (intensive rainfall, long droughts, unexpected weather events, etc.). We need to be prepared for these extremes and, above all, learn to prevent their consequences – floods, drying water sources, damage to the landscape and property, crop failure, etc.

The main idea of the With Children Against Drought methodology is inspired by the Living Landscape model of Živá voda association, one of the main goals of which is to return water to the landscape (especially through revitalisation of streams, floodplains and wetlands), and the methodology was created in co-operation between the Educational and Cultural Center Broumov and the Prameny Primary School.

The target group of this methodology are first grade primary school pupils, i.e. children from approximately 6 to 11 years of age.

Children at this age take the problems they see around them seriously and genuinely want to be part of the solution. One of the main goals is to build and strengthen their relationship with nature. Unfortunately, science education in schools is still mostly informative. It's a world of heavy textbooks isolated from the real world. Most schools still believe that taking children out for walks in the nature is a waste of time. But where could we teach about nature better and more accurately than in the nature itself? What is the best place to learn about landscape if not the landscape? Isn't it best to see what the loss of equilibrium means directly at the places it affects? How better can we help nature than by putting our own hands to work? **It's time to change the way we think.**

Any "knowledge" remains a theory if it doesn't become part of the lifestyle and thinking of every individual. Children build a positive relationship with the landscape around them primarily through experience linked to specific tasks and activities. The moment a child personally participates in the creation of a forest pool, plants a tree or helps to regulate the flow of a stream, he/she builds a personal relationship with the surrounding landscape, the animals and plants. The landscape around them virtually becomes their own garden. This creates a feeling and awareness in children that the care for nature and landscape is not somebody else's job they cannot influence by their actions, but that it is also their responsibility to personally nurture and care for it. There is a sense of pride in this for the children: "I helped create this. This is here because of me." They feel responsible for the state of the landscape around them and want to keep it in good condition.



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## How to work with the methodology

The methodology is divided into six chapters. The chapter Climate Change focuses on understanding climate change and the underlying context. The chapters Water and Me, Forest, Soil, and Water in the Landscape are aimed at exploring the individual areas described by their titles. The chapter Landscape and I guides us as we try to understand the landscape around us, learn how to orient in it, recognize what is right, which human actions disturb the balance in the landscape and what we can do about it. We bring you a guide to finding the places that need to be restored, proposing a solution and presenting this proposal to people who can do something to make it happen. We can even make some changes ourselves. There is no need to follow the exact order of the chapters; activities can be chosen according to the situation, the current possibilities and needs, the age of the children, the teacher's intention, etc. However, it is recommended to include experiential and exploratory activities first and progress from the simpler to the more complex ones.

In each chapter, you will find a brief description of the activity, a well-arranged list of activities, their goal, description and space for reflection. Supporting activities are highlighted in colour.

There are print-ready attachments below each activity. The work sheets can be found at the end of the methodology. Individual thematic chapters are distinguished by colour.

We recommend that activities be incorporated throughout the school year, preferably in the form of regular project days. You can also systematically incorporate activities into individual subjects to keep the topic of water in the landscape alive in the classroom. The methodology is rich in topics and activities, so there is the possibility to spread them over several years. Alternatively, it is possible to work with it in an after-school science club.

Activity No. 9 "Landscape survey" from the chapter Landscape and I is central to the whole project and takes place throughout the project's duration, i.e. on every walk. The "New forest" activity is also a long-term activity.

Many of the games and experiments are inspired by activities from forest preschools and schools, eco-centres, etc. The number following the name of the game or activity refers to those sources of inspirations. Many of the activities can be adapted and developed further. It is recommended to include sensory activities repeatedly.

The activities included in the methodology span all areas of education, develop many key competences and lead the pupils towards active citizenship.

Let's take the first step together to bring our living conditions and life itself back into balance.

We wish for each of you to establish a deep connection with nature, attain a comprehensive understanding of natural principles in the landscape, undergo immersive learning experience in individual games and experiments, meet with inventiveness in finding solutions to return water to the landscape and derive joy in their implementation.

Your team of methodologists

### Sources:

News European Parliament: EU measures against climate change [online]. [cited on 28 July 2022] Available from <<https://www.europarl.europa.eu/news/en/headlines/society/20180703STO07129/eu-measures-against-climate-change>>. Fakta o klimatu: Vývoj světové teplotní anomálie [online]. [cited on 28 July 2022] Available from <<https://faktaoklimatu.cz/infografiky/teplotni-anomalie>>.



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"...gentleness is stronger than severity, water is stronger than rock, love is stronger than force."

(Herman Hesse)





Water is a precious liquid, drinking water especially. We have enough of it for now, but things are changing rapidly with poor care of the land and soil and with climate change. Our goal in this chapter is to introduce activities closer to the topic of drinking water to what is most precious and important to us – our own body. We also want to highlight the connection to everyday life and also touch upon the broader context in order to develop and deepen global empathy. In this chapter, you will find activities that deal with our relationship to water through the perception of our body. Alienation from the body leads to alienation from nature. Conversely, deeper awareness of the body creates a more sensitive and considerate relationship towards nature. We introduce activities that lead to realisation that without healthy quality water in nature, we humans cannot be healthy either. Water makes up a large part of our body and food, and that is why we must protect it and take care of it. Everything is connected and it is not only our life that is entirely dependent on it.

Activity name	Activity type (e.g. experiment, video sample, artwork)	Activity information (relevant to what the activity is about: e.g. summary or topic)	Duration (min)	Environment	Page
1 A drop in the palm	sensory activity	initial motivation	15 min	indoor/outdoor	8
2 Liquid body	physical activity/body perception	initial motivation, forming a relationship	30 min	indoor/outdoor	8
3 Fresh × dried	scale	introduction	15 min	indoor/outdoor	9
4 Valuable drinking water	physical activity	co-operation, practical experience – understanding the amounts of drinking water	20 min	indoor	11
5 How much of human body is water	experiment (also suitable for lower primary grades)	research, calculating the percentage of water in the body	60 min	indoor/outdoor	12
6 Access to water	work with work sheet	familiarisation with the issues globally	60 min	indoor	14
7 Dance of water	physical activity/body perception	feeling the water, forming a relationship	30 min	indoor/outdoor	16
8 We drink what we pour into the water	dice game	contextual thinking	45 min	indoor	17
9 Two friends	story/work with text	final activity – responsibility/ethics	25 min	indoor	19





## 1 A drop in the palm<sup>7</sup>

**TARGET:** Pupils develop a relationship to nature through sensory perception, sensitivity to and awareness of nature.

**TIME:** 15 min

**AIDS:** Bowl/glass with water

**PROCEDURE:** All pupils sit comfortably in a circle. The teacher asks the pupils to calm down and remain silent for a few minutes with their eyes closed. Then the teacher asks each pupil to hold out his/her hand. He/she slowly walks around the circle and puts a drop of water into each pupil's palm. The teacher then encourages the class to focus on the feeling in their hand and on the structure, shape, temperature, weight of the drop etc. After a moment, he/she asks the students to open their eyes and share what they noticed. Give the pupils space to share what they felt and what they assumed was in their hand before they found out. Variations: it is possible to start with different natural materials and use a drop at the end.

## 2 Liquid body

Physical activity to introduce the experiment

**TARGET:** Students will experience the connection with water in landscape/nature through the perception of their own body.

**TIME:** 30 min

**AIDS:** 2 balloons, water

**PROCEDURE:** The teacher fills a balloon with some water and inflates it. He/she shows the balloon to the pupils and asks what the balloon evokes, what it reminds them of, what it might represent. The pupils give their suggestions and the teacher adds (if it is not mentioned) that the balloon could represent a body wrapped in skin with fluid inside. A discussion may follow about the permeability of the skin and about body fluids. The teacher then invites the pupils to start moving. They imagine themselves/their body as a balloon or another container with water. The teacher moves the balloon and the pupils imitate the movement, they repeat the movement a few times, focusing on the perception in the body. The conception of water in the body based on the balloon will help them. The teacher shows the movements, e.g.

- rolling water from one side to the other – pupils move from side to side, playing with their centre of gravity
- jiggling/shaking water – pupils jump, only a little at first, then more dynamically
- swirling water – students spin in different ways
- walking with water

The pupils are given the space to invent and demonstrate any other movement of water in their bodies, but also in nature.

**REFLECTION:** Possible questions: *What have you experienced? What did you like? Can we live without water? What is the relationship between water in the body and water in the environment, how can water quality affect my health? (use simpler formulation for younger pupils).*







### 3 Fresh × dried

**TARGET:** Pupils become aware of the water content of food, sensory cognition.

**TIME:** 15 min.

**AIDS:** Larger room/adjusted classroom, labels with food names (depending on the number of pupils about 4–5 pcs of each food).

**PROCEDURE:** The teacher lets the pupils draw slips of papers with food items on them. Several pupils will always have the same picture. Pupils look for friends with the same type of food, e.g. eggs, and work together in groups. Their task is to agree on how much water each food contains and to create a scale accordingly.

The teacher explains that 0 means that the food contains no water, and 100 means that the food is mostly water. Pupils then choose numbers between 0 and 100. The more water, the higher the number. The groups/foods then stand in the line from the driest to the juiciest. Finally, the teacher reads/write on the board how much water individual foods contain and the scale is corrected.

Information for teachers – list:

Water content in food (g/100g):

Potato crisps	2	Biscuits	5
Bread	40	Banana	74
Egg	74	Apple	84
Cucumber	96		

**VARIATION:** food tasting in the classroom – sensory game (stimulation of taste). Each group will be given the food to taste it and better experience the amount of water it contains. They can also offer it to others to taste.

**DISCUSSION:** Which foods are better for our body, with more water content or less water? How much water is needed to produce food? An estimate.





POTATO CRISPS	BISCUITS	BREAD	BANANA
EGG	APPLE	CUCUMBER	BANANA
POTATO CRISPS	BISCUITS	BREAD	BANANA
EGG	APPLE	CUCUMBER	BANANA
POTATO CRISPS	BISCUITS	BREAD	EGG
EGG	APPLE	CUCUMBER	APPLE
POTATO CRISPS	BISCUITS	BREAD	CUCUMBER



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## 4 Valuable drinking water<sup>3</sup>

Suitable introductory activity to supplement the experiment in activity 5 or activity 6 Access to water (for grade 3–5).

**TARGET:** Students will experience and learn how little drinking water there is on Earth.

**TIME:** 20 min

**AIDS:** A4 paper with a drawing of a drop/wave representing fresh water for each pupil (the pupils can draw it themselves).

**PROCEDURE:** The teacher places all papers on the ground/floor/carpet (number of papers = number of pupils). He/she comments that *the papers represent all the water on planet Earth*. The pupils' task is to stand on the papers so that neither their feet nor any other part of their body touches the floor. Each has 1 paper. Then the teacher says that a *certain amount of fresh water is locked in icebergs* and removes 4 pieces of paper. The task for the students remains the same all the time, they must stand on the paper, they must not touch the ground outside the paper with any part of their body. They are trying to cooperate. After the statement is said, they must move and regroup so that everyone is standing on a different paper. The teacher can first say statements without taking away any of the papers – water supplies. This is so that students can get to grips with the rules. The teacher continues in a similar manner. He/she removes more papers and provides a statement that justifies it: *water consumption is rising because there are more people on the planet*. He/she gradually removes more and more papers (water). The justifications may be the following:

*Climate change*

*Some of the water is chemically polluted.*

*Precipitation is decreasing, rainfall is low, surface water levels are falling.*

*A great drought has come, the level of groundwater (amount of water in wells) is dropping.*

*Forests are shrinking not only in our country but all over the world, there is less and less water.*

*The soil is compacted, it does not have the ability to soak and retain water – the rain waters just flow over it and away.*

*The industry needs to produce more, so it consumes more water.*

The teacher can comment on what happens when more papers are removed. It's getting harder for the pupils to find a paper to stand on. It is technically possible for a class to fit to 3 pieces of A4 papers if they can agree and work together. You may or may not reach this stage. However, it is interesting to watch and guess the relationships among classmates and their ability to co-operate even in at the beginning of this activity.

In the end, the pupils and the teacher sit in a circle and talk about how the game simulates reality of the world's actual drinking water supplies. They learn that **fresh water makes up only 3%**, of which only 1% is useful for humans. **Drinking water amount to 0.3% only.** We can also use the activity to summarise the knowledge gained so far.

**POSSIBLE ADDITIONAL QUESTIONS FOR DISCUSSION:** *Where can water be found, in what form? What challenges are we going to face in the future? Have you observed any reduction in the water available in your life/family? How can we help? How can we reduce our water consumption? What could be a reason for adding, rather than removing, more papers?*

**REFLECTION:** *How did they like the co-operation in the activity? How did they feel? What strategy did they choose to succeed? What would they do differently next time?* During the activity when the papers (water) are being removed, many emotions may arise among the pupils. In that case, give them space, let them express their feelings, listen to them.



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## 5 How much of human body is water

**TARGET:** Pupils will understand why water is important for our health, they will understand the connection between the water contained in their bodies and the water they consume.

**TIME:** 90 min. (alternativně námět na projektový den)

**EVOCATIVE ACTIVITY:** As part of the experiment: The teacher shows (passes around) a grape and a dried raisin, a plum and a dried plum, an apple and a dried apple (depending on what is available and the season) and asks: "What do these things have in common? How do they differ?"

**AIDS:** Personal scale, old plastic bottles (about 20 pcs), water, empty container for the bottles: a large bucket, barrel, basket, etc., Record work sheet.

**AIDS:** Na začátku aktivity osloví pedagog třídu s tzv. badatelskou otázkou.

**RESEARCH QUESTION:** *How many kilograms of water does your body contain?* The pupils develop a hypothesis, formulate their opinion.

**PROCEDURE:** The pupils, with the teacher's help, create a research question. It could read as follows: Does the human body contain water? How much water does my body contain? They'll try to estimate the number of kilograms. This is followed by an experiment. Selected pupils from class (2–4) weigh themselves and record their weight in the table. The teacher will help the pupils to calculate the water content by multiplying the pupils' weight by 0.7 (about 70% of the body weight is fluid). The teacher can work with decimal numbers or fractions  $\frac{7}{10}$ . They put down the resulting weight, e.g. 23 kg, in the work sheet (rounding the decimals to whole numbers) and then calculate the number of bottles corresponding to the water content of their bodies. For demonstration, the pupils fill the bottles with water so that their resulting weight equals 70% of the pupils' average body weight. That is the proportion of water in their bodies.

After the calculation, the pupils return to their hypothesis and compare their speculation with the results. If the hypothesis is not confirmed, the teacher assures the pupils that it is okay. It does not mean they failed, because research is not a competition. A discussion follows.

**TIP/WARNING:** After the activity, do not pour the water out of the plastic bottles, save it for watering the flowers in the classroom/corridor.

### Questions for discussion:

*What surprised you in the research/calculation?*

*Do you think there's a lot or little water in your body?*

*Where in the human body is the water present? In what form and what is it used for?*

*Can a person live without water? What happens when you stop receiving water?*

*How does our health relate to the quality of the water we drink and the amount of water in the landscape?*

*How does a person excrete water?*

*What fluids do you drink every day? What kind of water do you drink?*

*Which foods contain a lot of water?*



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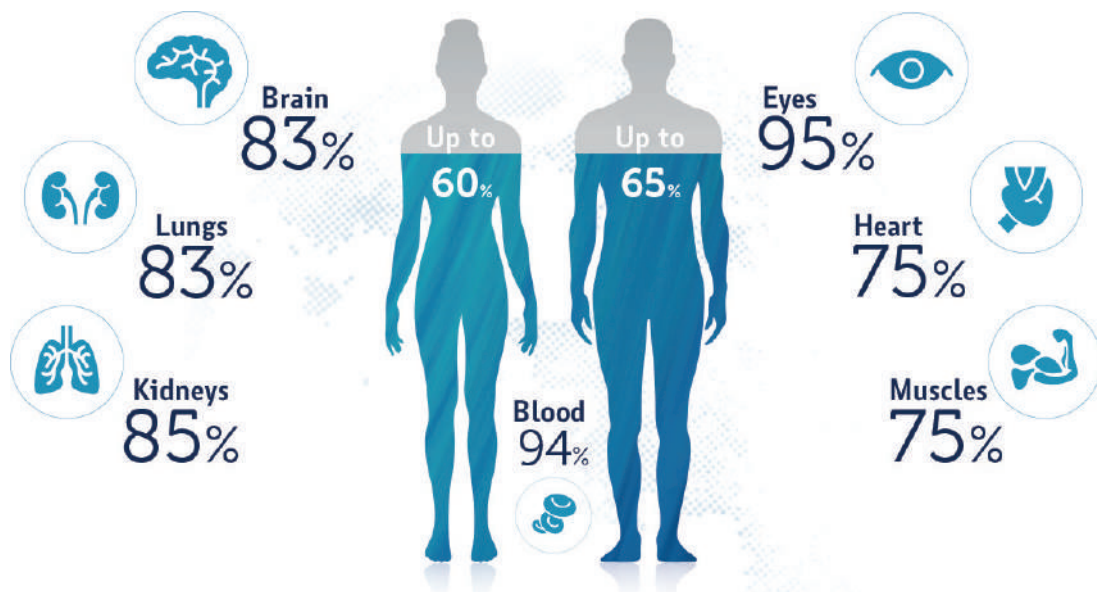


**REFLECTION:** How did you like the tasks? How and why could something change in your relation to water after this experiment? What do we do with the used drinking water?

**WATER IN OUR BODY**

We humans are a bit like walking water vessels. Most of the water in our body is in the blood (83%). So, you would wring several litres of water out of an adult. Men have a little more water in them than women. Water is the basic building block of all our cells. It aids the course of many chemical processes in the human body. It serves to regulate body temperature, moistens mucous membranes, and distributes oxygen, dissolved minerals, vitamins and nutrients throughout the body. At the same time, it washes away and discharges waste substances.

It lubricates the joints and serves as a shock absorber. The water in your head is where your brain rests. Very much like a baby in its mother's belly. A person can survive without water for a few days at most.



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## 6 Access to water

**TARGET:** The pupils will learn that drinking water is not taken for granted in many countries of the world. They think about the topic, evaluate and creatively solve problems. Development of teamwork skills. Development of global empathy.

**TIME:** 60 min

**POMŮCKY:** Nakopírované PL *Kolik vody potřebuješ* dle počtu skupin, lístečky s krajinami dle počtu žáků, vystřižené lístečky se spotřebou vody, tabulka denních činností, mapa světa.

**AIDS:** Copied *How much water you need* work sheets according to the number of groups, cards with landscapes according to the number of pupils, cut out labels with water consumption, table of daily activities, world map.

**PROCEDURE:** Pupils model everyday life with regard to the amount of drinking water they have at their disposal depending on where on Earth they live. They show their countries of origin on the map of the world. They try to put themselves in the situation of people in different countries of the world in relation to the consumption of drinking/clean water. Their task is to work in groups (the teacher can group them into families) and agree and decide on how to use and consume the given amount of drinking water. They try to adapt their needs to the amount of water they have at their disposal. They discuss what they need and what they have. They look for the best solution for all of them.

Pupils split into groups of 3-4 – they draw a card with the region/country + continent where they were born; that is where their home is and where they live for the purpose of this activity. The card will also specify the following information – a number with litres of drinking/clean water per day available to people in the given region, e.g. Czech Republic 90 litres. Each group receives a set of laminated cards with activities and water consumption. After the group has discussed together what they need water for, they place the water consumption cards on the *How much water you need* work sheet. Gradually, they make more decisions and fill their “container” (work sheet) with the water they have available.

**Note:** At the beginning, the teacher should specify that pupils who come from African countries must travel long distances to get water, so they will have an extra task, e.g. push-ups (or a different exercise the teacher chooses), to simulate the need to carry the water.

### Regions and daily water consumption

Czech Republic	90 l
Cambodia (Southeast Asia)	20 l
Bangladesh (South Asia)	50 l
Mozambique (Eastern Africa)	10 l
France	150 l

Examples of water consumption in other countries (pupils can guess): USA 300 l/day...



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### Table of daily activities: (for teachers only, no need to cut out)

Activity	Water consumption per day per person [l]
Hand washing	4
Drinks	3
Cooking/preparing food/washing food	8
Bath	150
Short shower 5 min	20
Long shower 15 min	50
Flushing toilet (on average 6 flushes × 6 l)	36
Watering of flowers at home + others	5
Washing dishes	8
Laundry/cleaning	15
Drinking for animals	
Watering the garden/crops	150
Washing the car/bike	200

### Other activities:

#### Watering the garden/lawn

Filling a swimming pool	3 000 l
Dripping faucet	25-50 l
Leaky toilet tank	150 – 1000 l/day

Sources of statistical data:

[www.elektrina.cz](http://www.elektrina.cz)

[www.scvk.cz](http://www.scvk.cz)

[www.nazemi.cz](http://www.nazemi.cz)

**FINAL REFLECTION AND DISCUSSION:** Where we are born is a lottery, we are the lucky ones but nobody really gets to choose. We can be grateful for where we live, the others have not chosen it for themselves.

**POSSIBLE QUESTIONS FOR DISCUSSION:** How did you manage your drinking water supplies? What arguments did you consider when making the decisions? What was the difference between real life and the task? How did the pupils living in countries with little drinking water feel? What can we learn from this exercise for our daily use of drinking water? Is there anything else related to the topic you would like to discuss? What could we as a class do for children (people) from regions with more difficult conditions to help them? How did you like working together? What did you experience when you became a resident of another country for a while? Do you think we will always have as much water (90 l/day) here in the Czech Republic? How did you feel making the decisions? Was it hard/easy to get along in the group? Have you come across any interesting topics? Leave room for emotions as well.



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## WATER SCARCITY

Lack of drinking water is one of the biggest problems facing children around the world. One in three people in the world do not have access to safe drinking water and 4.2 billion people (more than half) lack access to sanitation. The bodies of the world's youngest children are particularly vulnerable to the lack of safe water. In poor countries, where traditional water sources are drying up rapidly and water is scarce for livestock and crops, children's lives are not counted in days or hours, but in litres of clean drinking water. The situation is particularly critical in areas of armed conflict and natural disasters where vital water resources are damaged or even destroyed. Contaminated water claims 20 times more children's lives each year than wars. The drinking water problem is also closely linked to children's education. Every day, girls and women in developing countries spend long hours walking to fetch water, missing out on the opportunity to be in school.

### Further interesting information on water scarcity can be found at:

<https://www.unesco.org/en/articles/imminent-risk-global-water-crisis-warns-un-world-water-development-report-2023>

## 7 Dance of water

**TARGET:** Pupils will develop a relationship to water through awareness of their own bodies and through creative expression.

**TIME:** 30 min (depending on the number of songs)

**AIDS:** Music, audio player/PC/speakers, scarves, space for dancing (or outdoor environment by the water).

**AIDS:** Pupils first become present in the body, they, for example, become aware of how they stand, they can stomp their feet or stretch as they need, and relax the muscles. They then visualise various forms of water (rain, river, sea, waterfall, etc.) and tune into the quality of water in their bodies. At first without music, they try to make movements that express the water in their visualisation. If they are outside near a water element (river, stream...), they try to adjust to the flow/motion of the water nearby. The teacher gives the pupils space to find their own water-like movements (waves, soft movements, rotations...) and then repeats examples of the various water forms and encourages pupils to go on. There are many kinds of movements the pupils can try from swaying and soft movements to expressions imitating falling raindrops, etc. It depends on their creative expression only, which is never incorrect. It is possible to use suitable music to underline the atmosphere, see the tips below. At the end, the pupils stand in a circle and show their movements to others and mirror the movements of their classmates. Finally, the pupils can thank the water in their body for keeping them healthy. If the activity takes place outside, they thank the water at the site.

**TIPS FOR CONDUCTING THE ACTIVITY:** There is no wrong movement, every movement is correct. We express ourselves through movement all the time, it is the language of our body. Free movement is not a dance formation that is supposed to look a certain way. We move and dance without judging ourselves and others. If we have the opportunity, we can use scarves to dance. They are very popular as they stir the energy and encourage both children and adults to expand their locomotor range and experience.

**TIPS FOR MUSIC:** Flow (René Aubry), Vltava (Smetana), River flows in you (Yiruma), Voda voděnka (Svěrák, Uhlíř), also suitable is any piano music or natural sounds of water.



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## 8 We drink what we pour into the water – everything is connected

The game is inspired by Story Cubes.

**TARGET:** To encourage and develop pupils' contextual and creative thinking.

**TIME:** 45 min

**AIDS:** Template to be cut out and glued into the shape of a cube/die.

**PROCEDURE:** Pupils cut out and glue the printed templates (4 types). The pupils split into groups of four. Each group member rolls the die once. Each group thinks of several sentences (3 is enough) explaining how the words rolled by the group members are related to each other, how they are interconnected and how they influence each other.

**EXAMPLE:** *crop, flood, chemical, frog.*

**SENTENCES:** *A heavy downpour came and caused a flood and destroyed the crops. A stream of water washed the chemicals from the field into the nearest creek/well. Chemicals can endanger aquatic animals such as frogs and others. Water from wells will no longer be drinkable.*

Variation for the 1st and 2nd grade: use only two or three words. These will inspire the sentences which must be meaningful.

### WORDS TO PUT ON THE DICE:

Jeans — Tomato — Bathtub — Soil — Field — Forest — Pool — Pond — Brain — Medicines — Fertilisers —  
Outhouse (latrine) — Earthworm — Frog — Crop — Roof — Parking — Beef — Meat — Toilet — Paper —  
Chemicals — Floods — Tractor — Washing machine

**EXAMPLE:** *The frog lives in the pool. The tractor carries fertilisers to the field.*

(The teacher can choose any other words; there is also an empty template available).



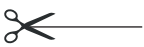
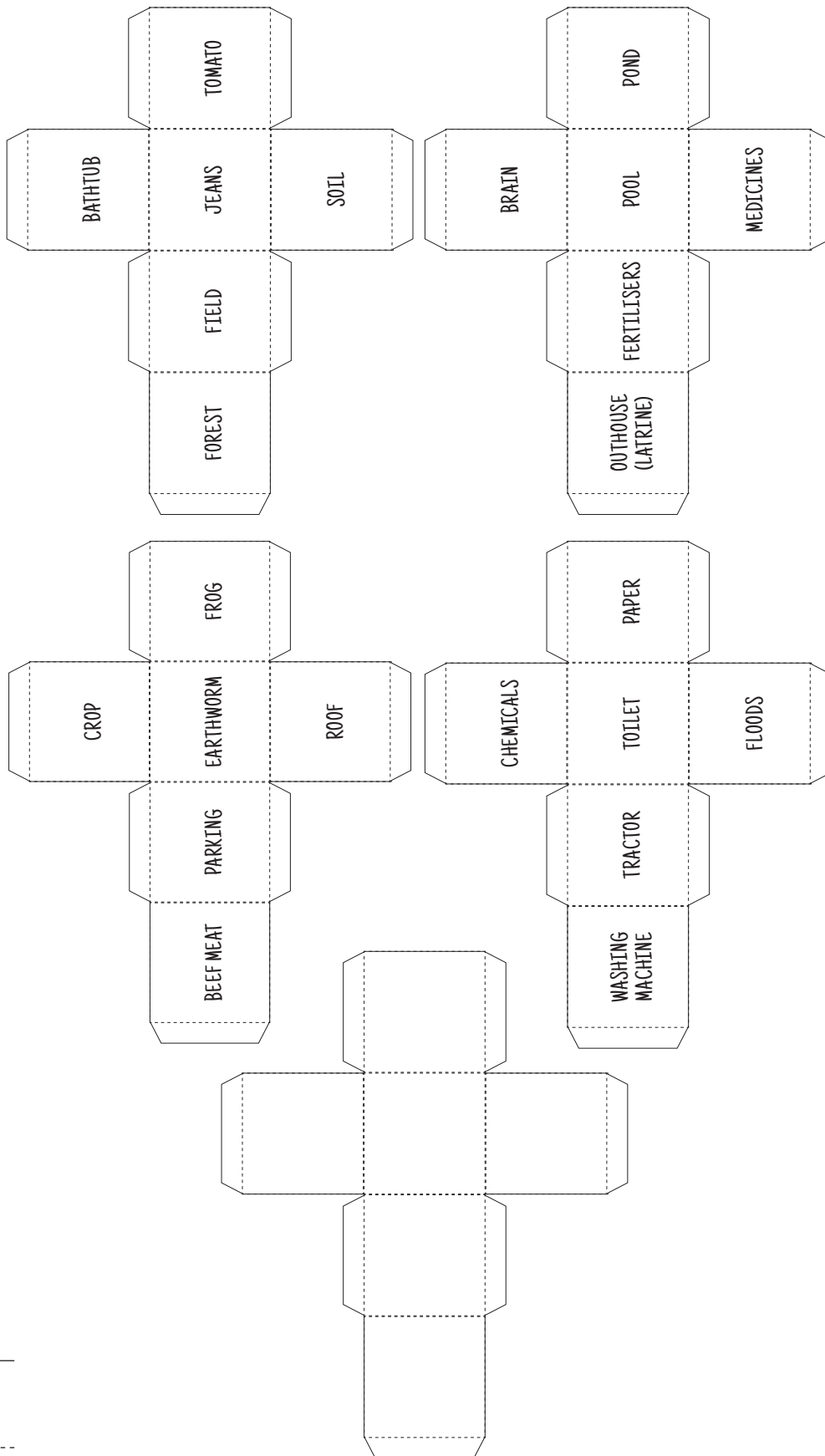
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cut it



fold over



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## 9 The story of two friends<sup>6</sup>

**TARGET:** Developing global empathy, developing awareness about the issue of having enough drinking water to survive.

**TIME:** 25 min

**AIDS:** Printed story<sup>7</sup>.

**AIDS:** The teacher (or a selected pupil) reads the story of two friends, Jammil and Khalil. Pupils sit down comfortably and listen to the short story. After the story has been read, they think about how it relates to the topic of access to and availability of water around the world. You can start the discussion based on the sentences below:

*How did you like the story?*

*What lessons can we learn from it?*

*How do you understand the ending of the story?*

### MORE SUGGESTIONS FOR WORKING WITH THE TEXT:

**Which of the following sentences does NOT fit the meaning of the story:**

*The sacrifice we make for others today will always pay off in the future.*

*If you lie down with dogs, you will get up with fleas.*

*If we are modest and tighten our belts, there will be enough for everyone.*

*First come, first served.*

*No one is useless in this world who lightens the burdens of another. (Charles Dickens)*

*It is your concern when the wall next door is on fire. (Horatius)*

**FINAL REFLECTION:** Try to think of a situation where you have helped a friend without being asked to do so. Would you help someone you don't know without expecting anything in return? Try to think of how we here in the Czech Republic can help children or people in general to have better access to drinking water.



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**ATTACHMENT:** Story

Two faithful friends, Jammil and Khalil, were wandering together through the desert. Each was carrying one leather bag with water. They had just enough water for the two of them to survive.

One night, Jammil woke up and was alarmed by what he saw. One of the bags had broken and all the water had soaked into the sand. His thoughts started spinning frantically.

"If we share the water we have left, we will both die of thirst. If only one of us drank, he would sentence the other to death and would never find peace again for the rest of his life. The guilt would be unbearable! I can never accept such a sacrifice from Khalil, and he will never accept mine. What a hopeless situation! I see no solution at all.

He considered all of the few possibilities. Then he got up and stuffed his blankets with sand to make it look like a lying body. Then he walked away aimlessly out into the deep darkness.

"I have to buy some time and get as far away as possible. I know Khalil will cry for me, but this will save his life. Why should we both die when one of us can survive? The second bag of water will be enough for him.

He was walking for a long time when he heard sand squealing under someone's steps. It was Khalil, walking through the bottomless darkness, muttering quietly:

"Hopeless... what a hopeless situation...

Dear Jammil... at least he is still sleeping deeply and unworried. He would have never accepted my sacrifice. When he wakes up, he will cry for me, I know, but his life will be saved. With the remaining water, he will be able to cross the desert.

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“There are storms, torrents of water, floods. There are trees withered to the last sap... How hard it must be — to be good as rain, which is distributed without disaster to other people's lives — and disappears.”

(Jana Moravcová)



In the last few years, almost every year has been slightly warmer than the previous one, despite the declining solar activity of the current solar cycle 25. The climate is changing and so is the weather we are used to. Part of the preparation for unexpected, extreme weather events is revitalising the naturally healthy landscape. In the case of water, in particular, this means restoration of the absorbing capacity of the landscape, i.e. its ability to capture water, which can be used by people and animals, to grow forests, wild plants and crops.

In principle, this concerns restoration of the entire area of the landscape, where a great deal of minor modifications, such as creation of small water absorbing features, restoration of wetlands and pools, meandering rivers and care for agricultural and forest land, must be carried out.

Many of today's problems with water are caused not only by technical adaptations of streams, climate change and landscape conditions, but also by our relationship to water and to water quality and availability which we take for granted. Wherever we look in the contemporary cultural landscape, we see traces of human activity. Humans have been interfering in the Earth's surface since ancient times.

Our landscape used to be characterised by a high diversity of water elements – wet meadows, soaked spruce forests, drying puddles, "black" forest ponds (peat bogs), small, even miniature, as well as vast wetlands, goose and carp ponds, mill and blacksmith's ponds, water gullies, mill races, etc.<sup>2</sup>

In the last century, most of these water elements were altered, often even systematically destroyed.

This diverse natural quilt began to break down already in the 18<sup>th</sup> century. All that for the sake of seizing more land. At the end of the 19<sup>th</sup> century, the regulation of watercourses became popular, and 1950 marked the start of a large homogenisation of landscape and intensification of production. This led to draining the water out of the landscape entirely, to reduced retention capacity of landscape and to disruption of the hydrological cycle.

We have ahead of us a long and costly road to restore our landscape. It is in the power of individuals to implement small measures – construct pools, ponds, small barrages and other elements that do not require permission of authorities. However small these may be, they are extremely important because they are the individual drops that together make up the entire ocean. And each of these drops can become a home to many animals whose existence is not pleasing but helps maintain the stability of the entire ecosystem. Let's remember that *"we can understand, direct and cooperate with water only if we perceive it as a living being."*<sup>3</sup>



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	Activity name	Activity type (e.g. experiment, video sample, artwork)	Activity information (relevant to what the activity is about: e.g. summary or topic)	Duration (min)	Environment (outdoor/ indoor activity)	Page
1	<b>Where is the water hiding?</b>	research, work with work sheet	motivation	30 min	outdoor	24
2	<b>Everything is alive</b>	song	music education	15 min	indoor	25
3	<b>Healthy landscape</b>	art, work with work sheet	healthy × unhealthy landscape, from spring to sea	45 min	indoor	26
4	<b>Landscape full of water</b>	art	new terms: wetland, spring, lake, etc.	90 min	indoor	27
5	<b>Where do snowmen go?</b>	text comprehension, story	water cycle, motivation	15–20 min	indoor	31
6	<b>The water cycle as a theatre scene</b>	movement, theatre	water cycle, cooperation	45 min	indoor/outdoor	31
7	<b>Wetlands</b>	PowerPoint presentation, working with work sheet	what is a wetland, function of wetlands	45 min	indoor	45
8	<b>Water retention in wetlands</b>	short experiment	function of wetlands: water retention	10 min	indoor	51
9	<b>Pools everywhere</b>	short educational video	motivation	15 min	indoor	52
10	<b>Meanders</b>	physical activity	introduction to the concept of meanders	15 min	outdoor	52
11	<b>And again it waves – meanders</b>	work with work sheet	flow length comparison	10 min	indoor/outdoor	57
12	<b>Floods – detectives' search</b>	simulation game	causes of floods	70 min	indoor/outdoor	58
13	<b>Homework for researchers</b>	research	landscape features	70–120 min	outdoor	62
14	<b>Bingo</b>	asking questions, cooperation	homework evaluation	30 min	indoor	64
15	<b>Memory game</b>	cooperation, burning energy	repetition	45 min	outdoor	64
16	<b>Camera</b>	perception of the landscape	calming down, perception of the aesthetic aspect of the landscape	15 min	outdoor	78
17	<b>The story of the river</b>	imagination	calming down, perception of the aquatic ecosystem	25 min	indoor/outdoor	79
18	<b>Closing ritual</b>	conclusion of the chapter	expressing thanks to the landscape and landscape features	45 min	indoor/outdoor	80



## 1 Kde se skrývá voda?

**TARGET:** Children will learn that water is part of nature, that it is found in plants and on the surface of things, in soil, etc. The activity should motivate children to explore water in nature.

**TIME:** 30 min

**AIDS:** work sheet, pencils

### PROCEDURE:

1. The teacher and the pupils go for a walk in the nearby nature. Preferably in the morning when there is dew. The teacher asks the pupils where they think they can find water in nature. Pupils tell their guesses. The teacher praises them and tells them that water may be present even in places where we would not expect it or would not even think it possible. Let's explore.
2. The teacher hands out work sheets which the pupils use to write down what they are studying and what they find. They can even draw their discoveries. The teacher motivates pupils to examine everything they discover in nature, motivates them to work independently or in groups. The first column in the work sheet is completed by the pupils themselves. They take a stone in their hands and find that it is dry and that there is no water in it. Or they see it is wet on the surface, but there is no water coming out of it. They find a moss, and when they squeeze it, they see water flowing out of it. They notice that the water on the leaves looks like little pearls and that a spiderweb is full of tiny drops. They find dead wood, bark. They dig up the soil under grass and find it moist when they have it in their hands. They can also check the soil in the field, the soil near a stream, etc. In the Water YES box, they describe or draw their findings and observations.
3. Sharing: Once the pupils have completed the research part, they come together and share with others what they have found.
4. Summary: Water can be found even where it is not visible at first sight. It is retained by the soil and plants, it sticks to leaves and spiderwebs. It is more likely to be found near watercourses or ponds, wetlands and also in shady places (woods, groves, etc.)

**REFLECTION:** The teacher talks to the pupils about their research. *Was it hard to find water in the country? How different would our research be if we came here at noon when it is hot outside? Did anything surprise you?*

**TIP:** This activity can be easily expanded by the use of the Water in living organisms work sheet from the Water Magic 1 (*Vodní čarování 1*) by Blanka Ponížilová, which gives children a chance to realise how much water is contained in the bodies of animals and humans. It is also useful to follow up with the activity How much of human body is water from the chapter Water and Me.



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## 2 Everything is alive

**TARGET:** Through music, pupils tune in to nature and to being a part of nature.

**TIME:** 15 min

**AIDS:** Gila Antara: Mother I feel You, <https://www.youtube.com/watch?v=hq6afMjZMH8>  
Sam Garrett and Mollie Mendoza: Mama, <https://www.youtube.com/watch?v=HvLNje4aC6c>  
I Am The Earth, <https://songlibrary.net/I-Am-The-Earth/>

**PROCEDURE:** The teacher listens to the song with the children. They can learn the whole song, or just the chorus. They talk about the meaning of the different parts of the song.

## 3 Water in the landscape<sup>4</sup>

**TARGET:** Children will learn to understand concepts related to the topic of water in the landscape. They realise that the landscape can be healthy or damaged.

**TIME:** 45 min

**AIDS:** work sheets, pencils, crayons, the poem Samá voda (translated as All is Water)

**PROCEDURE:** Children will read the poem Samá voda (All is Water)<sup>5</sup> (and work with the work sheet) together and talk about its meaning. Then they look at the picture on the work sheet.

*All is Water*

*At first, just a tiny droplet,  
growing to a little brooklet,  
then the brook meets another  
and merges with its larger brother,  
joining waters flowing from all sides,  
look, the drop became an ocean wide.*

(J. Brukner)

The teacher first asks the pupils if they like the landscape in the picture. Why do they like it or why don't they? With the help of the teacher, pupils assign terms to letters in the picture of the landscape. The words will form the following phrase: Healthy landscape. But the phrase is in Czech, pupils can try translate into English. Pupils draw their favourite place outside into one of the frames. Or if they have ever been to a pond, a river or a wetland.

**REFLECTION:** The teacher then asks the children *why the answer to the puzzle reads "healthy landscape"? Can a landscape be healthy or unhealthy (damaged)? What does unhealthy landscape look like? And what about healthy landscape?*



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Possible answers:

**Healthy landscape:**

*It's diverse and colourful. There are fields, meadows, forests, groves, pools, alleys, ponds etc.*

*Many different animals live there because there are plenty of different shelters, trees, food, etc.*

*There are different plants growing there – different kinds of trees, flowers, plants that like moist environment and plants that like dry environment, etc.*

*There's plenty of water.*

**Unhealthy landscape:**

*There are no trees.*

*It's dry.*

*There are few plants and few animals.*

*It is plain and featureless.*

**TIP:** With young children, the teacher can dramatize and memorize the poem.

## 4 Landscape full of water

**TARGET:** The children will deepen their knowledge of concepts related to water in the landscape and express themselves through an art activity.

**TIME:** 90 min

**TERMS:** wetland, stream, river, spring, well, pool, dew, fog, ice, snow, rain, pond

**AIDS:** A quarter of A2 – format paper or wrapping paper, A4 paper cut in quarters, water colours or crayons, scissors, glue, names of different bodies of water on A4 papers, photos of bodies of water, descriptions of the bodies of water – see below, flipchart (whiteboard)

**PROCEDURE:**

1. Brainstorming. The teacher invites the children to say anything that comes to their minds as answers to the question "Where can we find water in the Czech countryside"? The teacher writes all the answers on the board.
2. Together they go over words that some of the children may not know. The teacher also adds other terms that have not been said and shows them pictures (photos) of these bodies of water – see *Terms* above.
3. The teacher motivates the pupils: "Now we're going to create a landscape full of water." The teacher then places A4 paper sheets with the terms (or pictures, photographs) printed on them around the classroom and invites the children to stand next to a body of water they would like to draw and about which they would like to learn more. He/she motivates the children to spread out among all the different bodies of water. But if this does not happen, he/she does not reassign them to other pictures and leaves the choice up to them.
4. Each child will be given brief information about the chosen body of water (for example: *wetlands are places in the landscape often holding a lot of water, various water-loving plants grow there and a wide variety of animals live there – butterflies, dragonflies, frogs...*) – see appendix. The child then gets a quarter of A4 paper with a pre-drawn drop into which they draw the selected body of water that we can see in the landscape.
5. Once the children have painted their pictures, they cut out the drop and glue all their drops together on a large A2 paper to create a landscape full of water – see Fig.



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6. If any body of water is missing in the picture because none of the children chose it, a drop with this body of water can be created by the teacher.
7. Pupils can also add different forms of water in the landscape – rain, dew, fog, snow on the mountains, etc.
8. Together with the children, or on his/her own, the teacher draws the main features of the landscape to complete the picture of a wholesome landscape. Add a photograph of the completed picture here.



**REFLECTION:** *How did you like painting the drop with the body of water? Are you happy about your work?*

Feeling thermometer: Children can position themselves around the classroom according to how they feel: on the one side "YES" – I am maximally happy about my work; on the other side "NO" – I am not happy at all; and the space in between means "somewhat happy" or "somewhat unhappy". The teacher then asks the children why they feel happy or unhappy. What could they do differently next time to be happy<sup>6</sup>?



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## ATTACHMENT 1:

1. **Wetlands** – places in the landscape that often hold water. Plants that like water grow here, and a wide variety of animals (butterflies, dragonflies, frogs, ...) live here. It is an area of marshes, peat bogs, etc.
2. **Thin** – a depression in the ground filled with water. Even if it dries out for part of the year, it is home to many animals or helps to hold back or slow down heavy rains.
3. **Pond** – a body of water created by man. It is used to raise fish and waterfowl.
4. **River** – a larger body of water.
5. **Stream** – a watercourse, usually smaller and shorter than a river.
6. **Confluence** – a place where two watercourses come together.
7. **Spring, well** – a place where underground water flows naturally to the surface, above ground.
8. **Floodplain forest** – a waterlogged forest near a river. Many species of animals and plants live here.



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## 5 Where do snowmen go<sup>7</sup>

**TARGET:** Children will understand parts of the water cycle with the help of a fairy tale. They practice reading comprehension.

**TIME:** 15–20 min

**AIDS:** a text with the fairy tale for each child, seven pictures (see the attachment)

**PROCEDURE:** Children and the teacher read the fairy tale together. While they read the story, children assign pictures to the text (snowman in the garden, snowman melts, evaporates into clouds, cloud in the sky, rain falls on the burning roof and meadow, dew on grass leaves, snowflakes falling down, new snowman). If the teacher works with children who are not yet able to read or are still learning, he/she will read the story for them. The children have only the pictures in front of them and arrange them in a line according to the storyline.

When the story is over, the teacher asks the children what the story was about (possible answers: about the snowman, about the change of seasons, about water...).

The children then arrange the pictures they matched to the text in a circle. In circle because the events in the pictures are repeated over and over again. This cycle is called the WATER CYCLE, because snow, cloud, rain and dew are all forms of water.

**REFLECTION:** The teacher asks the pupils what they liked about the story. *Did they feel joy, regret? Did they learn anything new?*

**TIP:** You can actually build a snowman outside first and take a photo. And when the snow has melted, go back to the spot and search for the snowman and follow up with the story *Where Snowmen Disappear*.

## 6 The water cycle as a theatre scene

**TARGET:** Children will understand the water cycle in nature.

**TIME:** 45 min

**AIDS:** Pictures that can be put on a string to hang around the neck – one for each pupil, text of the water cycle for the teacher, picture of the water cycle in nature  
Pictures: sun, cloud, water drop, tree, soil, sea

**PROCEDURE:** Children are split into two groups. One is the audience and the other are the actors. Later, they'll switch.

### PREPARING FOR THE THEATRE SCENE:

The pupils divide the roles. The best option is for each pupil to choose the role they want. However, all roles need to be represented on the stage.

One pupil gets a picture of the sun, so he/she represents the sun.

Some pupils have pictures of clouds.

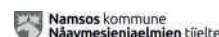


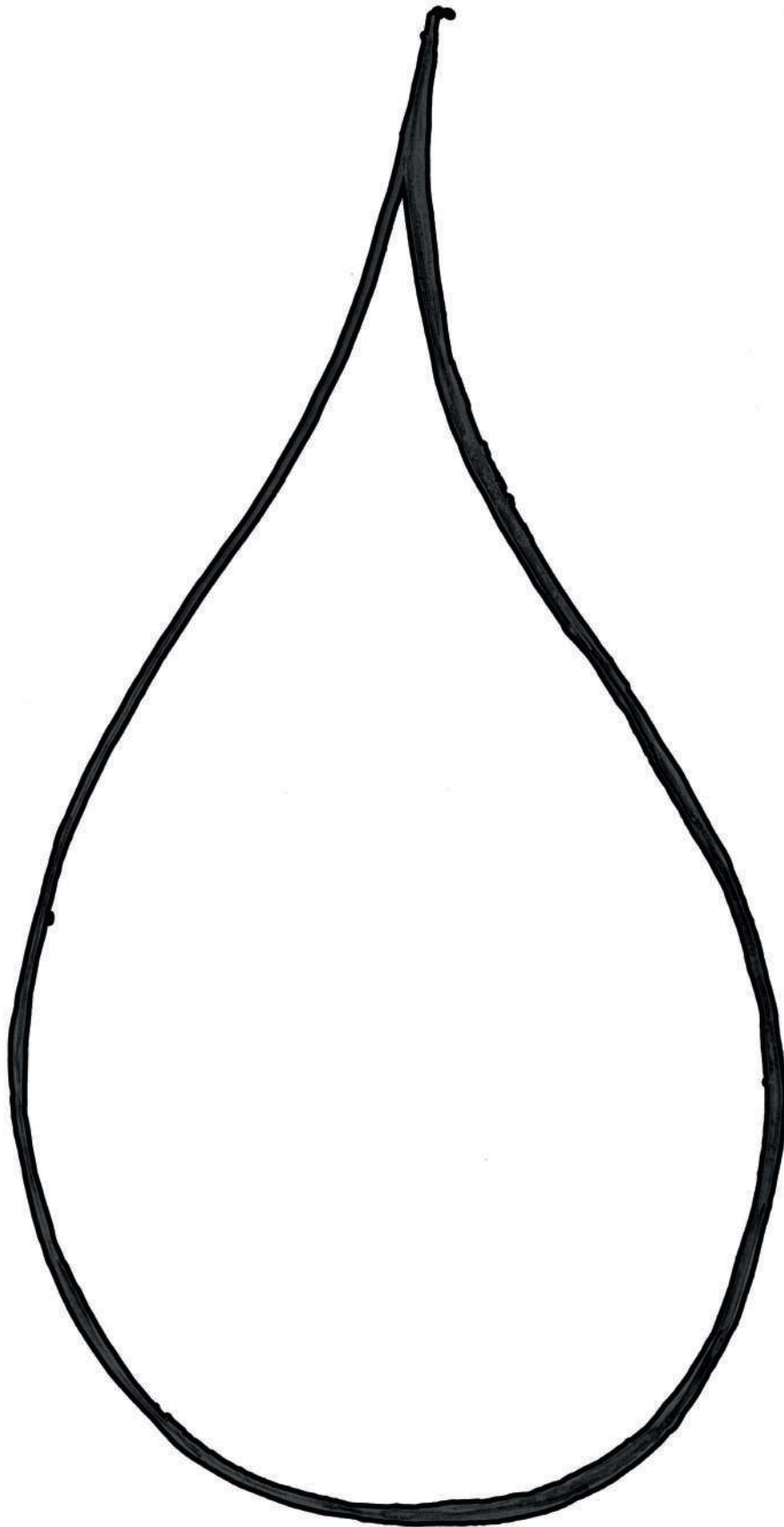
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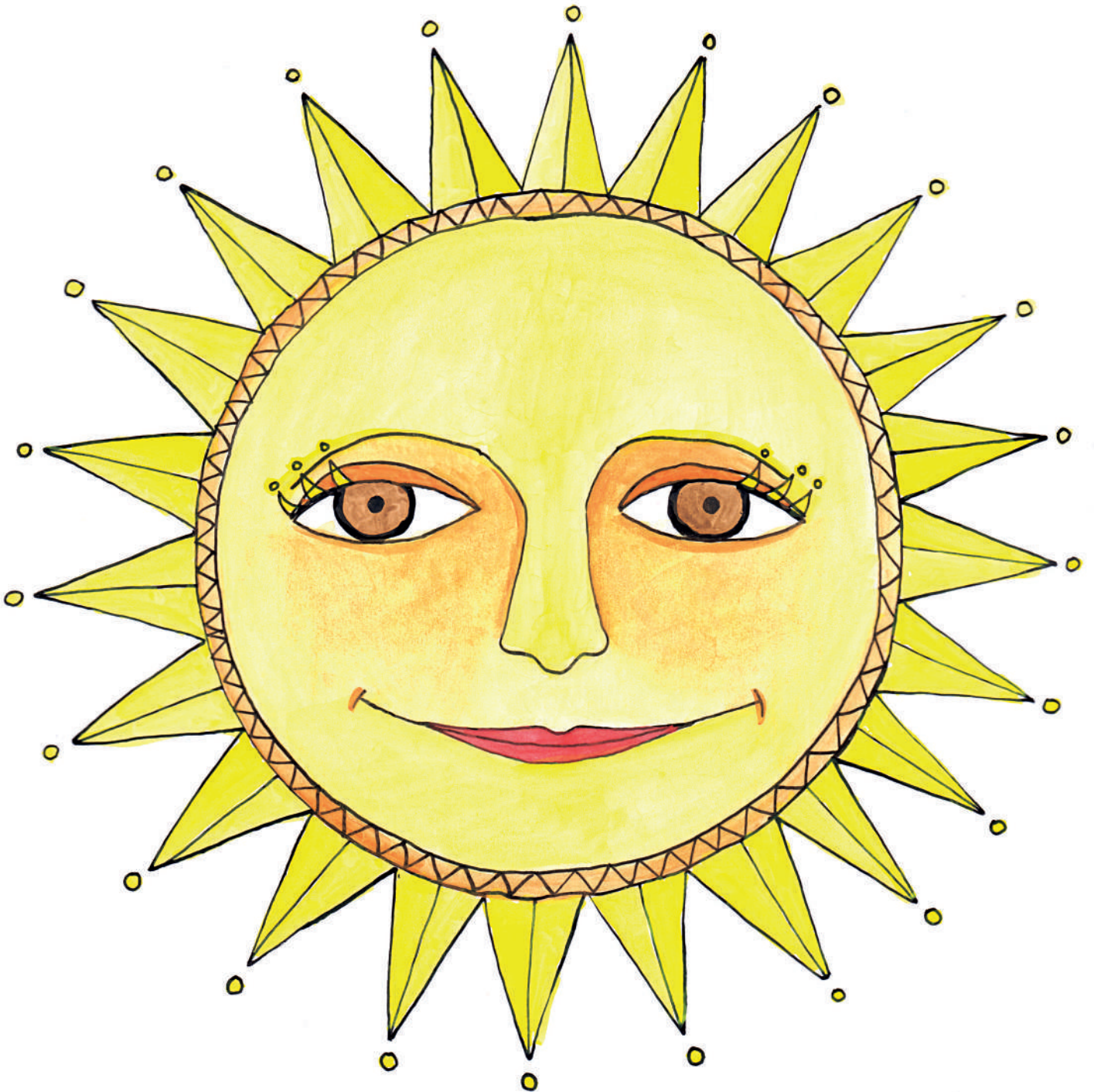
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## THE SUN

You are the Sun. At the beginning of the story, you come to the scene and hold the card of the sun in your hand. When it is cloudy, a cloud comes in front of you, but you stay in your place. When you shine above the sea, you go to the children who represent the sea and hold a picture of the sun in your hand again.



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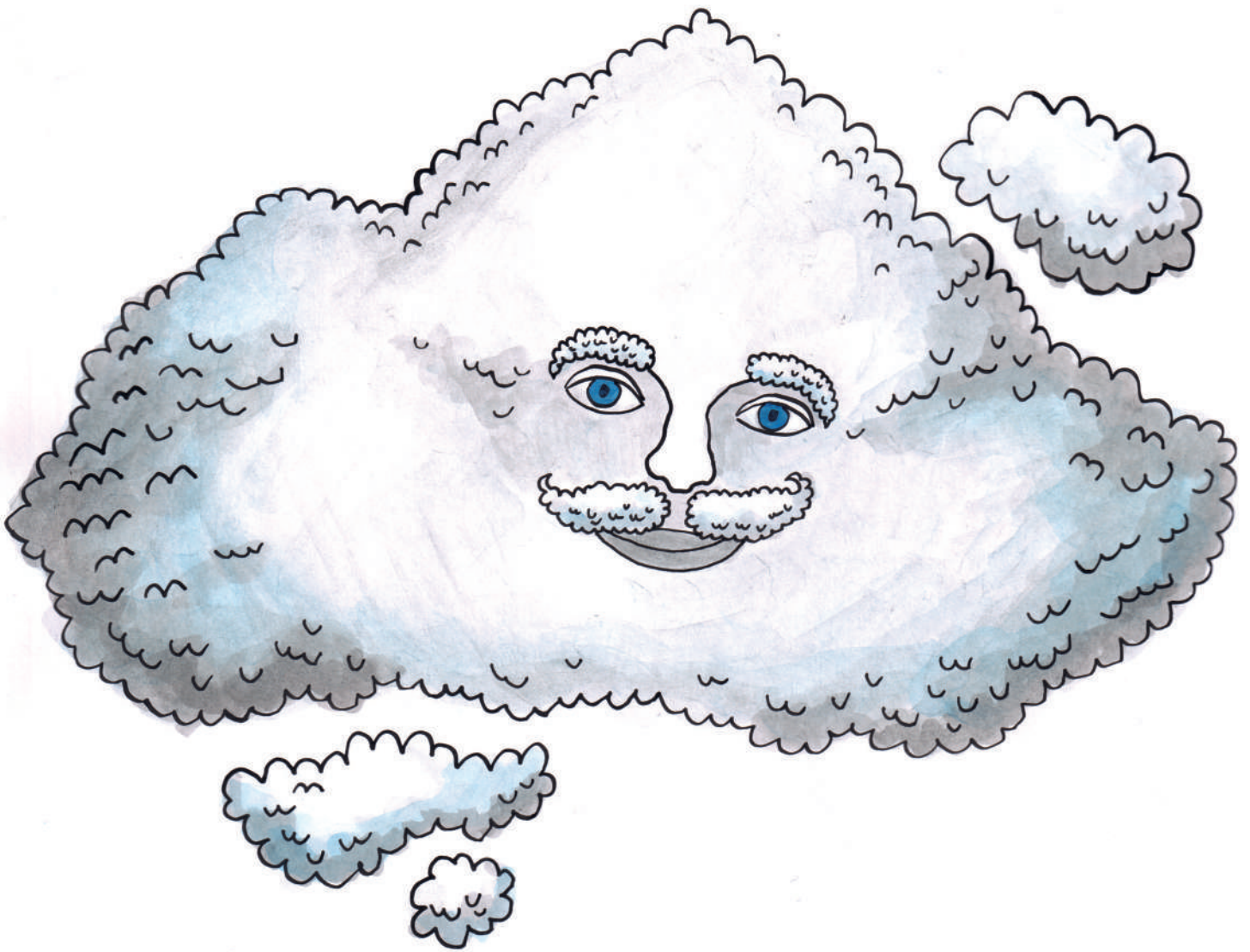
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## THE CLOUDS

When it gets cloudy, you come on stage and stand in front of the Sun. You're holding a picture of the cloud in your hands. You're still standing there waiting for your time to come. Once the narrator says that the heat from the sea evaporates the water and forms clouds, you move closer to the children who represent the sea. The wind moves the clouds over land, you return to your original place.



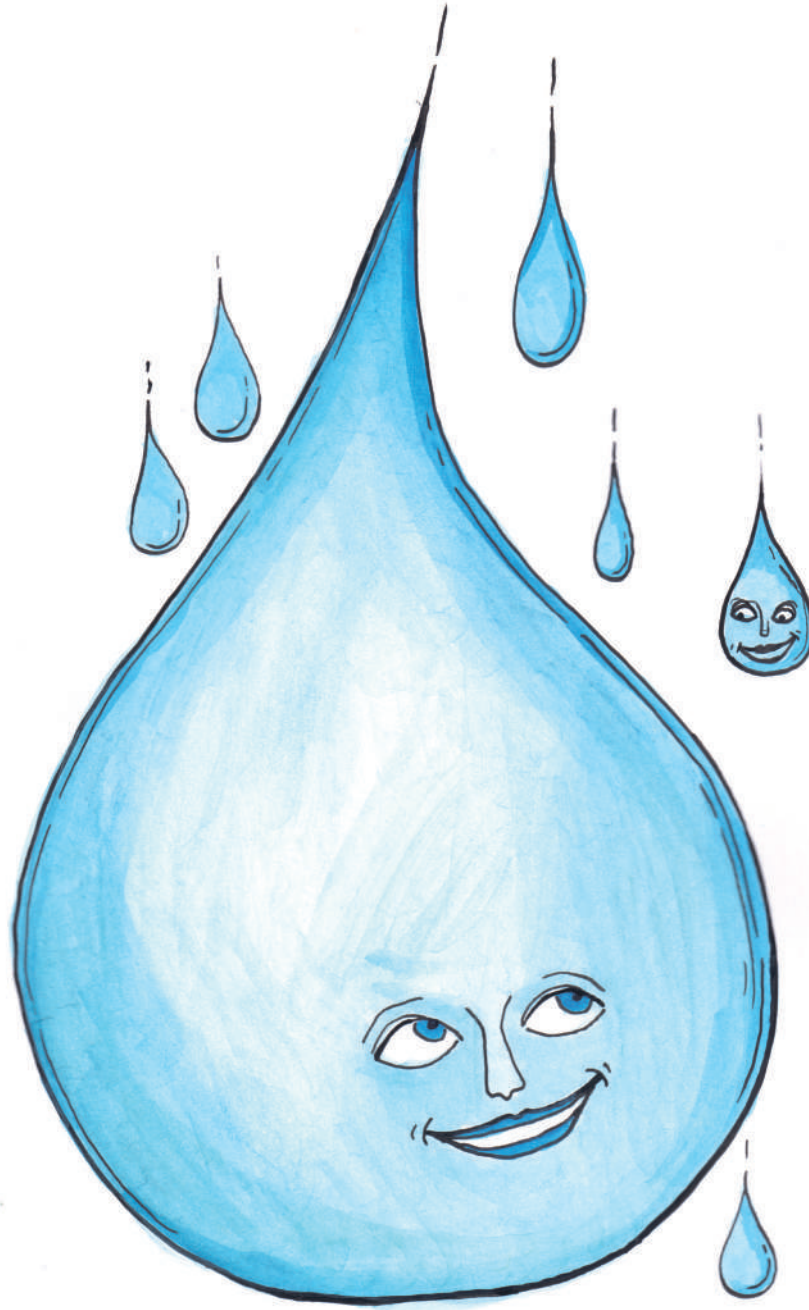
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## DROP OF WATER

When it rains, you come on the scene and do slow squats, which looks like drops falling to the ground. You tap your palm with two fingers to imitate the sound of rain. Then you stop to listen what the narrator says next.



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## THE TREE

Trees are on the scene from the very beginning. Your hands are raised like branches of a tree. When the wind starts to blow, your hands move like branches in the wind. When you draw water from the roots into the leaves, you bend forward and indicate that you are drawing water from the soles of your feet gradually to the tips of your fingers. You're making a sound of sucking water.



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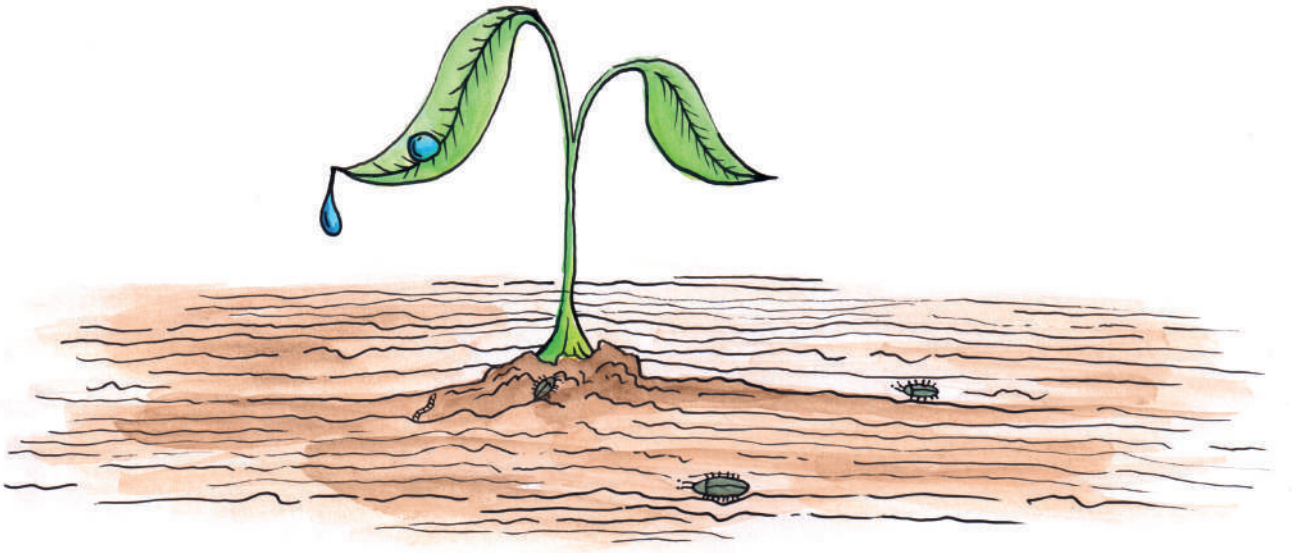
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## THE SOIL

Soil is on the scene from the very beginning. As the rain falls on the ground, you move your hands. Stretch your arms to the side and then bring them together to your chest and make water sucking sounds with your mouth.



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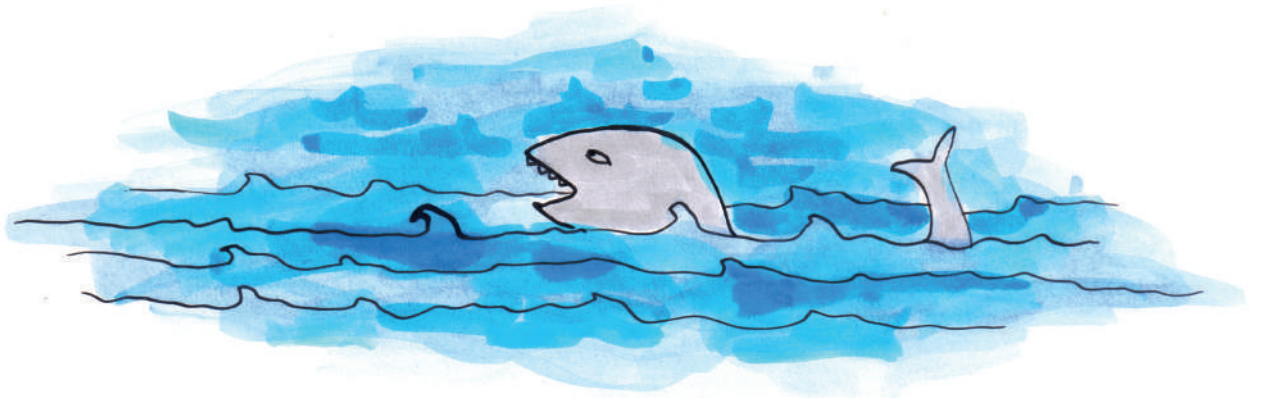
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## THE SEA

The sea is on the scene from the very beginning. Children can demonstrate with their bodies or hands how the sea waves.



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Three pupils will have pictures of a drop of water.

Some pupils have pictures of the sea that they put on their necks and their movements represent sea waves.

Three pupils stand around and represent trees, they hang pictures of a tree on their necks and represent trees with their postures.

Three pupils represent the land (soil), they hang pictures of the soil on their necks. They can also hold a bowl of soil in their hands.

**THE PLOT:** The teacher is a narrator, children are actors.

The teacher first tells the story of the water cycle without acting. Before the beginning of the story, the teacher invites the pupils to focus on their roles, to imagine in their mind how they will play their roles.

The teacher tells the story again, and now the children are acting their roles. It can help the pupils to read their role and what to do in advance on their cards. However, this is not a condition (see the advice for the teacher). With young children, at the first reading of the story, we talk about who plays what role, young children don't read the text on the other side of the picture.

**THE STORY:**

*"The sun is shining on the earth (the sun enters the scene), it is not very hot, the sun is warm and all the flowers and trees are warming up (the trees are already on the scene). The wind gently blows and plays with the branches of the trees (the trees gently sway with their hands above their heads).*

*Suddenly the clouds came and the wind rose (the clouds stand in front of the sun). It's raining. The drops fall and clap, drip, drip, drip. (Children representing drops squat and clap their palms together).*

*The rain is also falling on the trees. The trees, after a warm day, are thirsty and soak water with their roots and lead it into their leaves. (The trees soak up the water by standing, bowing and moving to indicate how they suck water from the feet up, gradually distribute it to the ends of the fingers above their head).*

*The rain is also falling on the soil, which likes to absorb the water so that it can provide moisture for the plants and animals that make their homes there. (Children representing soil demonstrate a movement: arms outstretched to the side, they pull their hands together towards their chest and make a sucking sound). Part of the water evaporates from the soil, and part of it flows gradually into groundwater, streams and by rivers to the sea. (children representing the sea wave their arms as waves.) The sun shines on the sea (the sun reappears on the scene and shines above the sea). Water is evaporated from the sea with heat and clouds are formed (drops go from sea to cloud). The cloud is getting bigger and the wind pushes it over the mainland. What happens to it next?"*

Let's not forget the applause at the end of the show.

The children change roles and act out the story again.

**REFLECTION:** The teacher asks the pupils: *How satisfied were you with your role? How was your acting? Was it easy/difficult to fit in with friends, other actors? What would you change next time? So where does water come from? Where does it disappear?* The correct answer: Water doesn't go anywhere, it keeps going round and round in the world.

**ADVICE FOR THE TEACHER:** You can think of other roles for the children to act, e.g. the wind can be represented. You can also give the children freedom in the representation of the plot, in the movements and in the performance. It's more beneficial if they figure out how to play their role themselves. The text on the other side of the picture is mainly for those who do not know what to do with their role, they do not have enough imagination at that moment.



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### SMALL AND LARGE WATER CYCLE

Some of the water that falls from the atmosphere to the Earth's surface soaks into the ground, later evaporates from the ground, then condenses, and then falls to the ground again and soaks in. This cycle of water over the landscape is called the small water cycle. In addition to rain, it can also take the form of snow, frost, mist, dew. The bottom line is that the more times the water on the ground "turns" like this into the sea, the more efficient the small water cycle is. The small water cycle therefore necessarily requires the possibility of retaining water on land. Forests, wetlands, river and stream floodplains, peat bogs, natural and artificial water reservoirs, and the land itself are all used for this purpose. The large water cycle involves, very simply, the evaporation of water in the oceans, the transport of water by air to land, the falling of water as precipitation (rain, snow) on the land surface and the outflow of water through watercourses back to the sea. The major impact on the large water cycle is the airflow around the Earth.

## 7 Wetlands<sup>8</sup>

**TARGET:** Pupils are able to distinguish between terrestrial and wetland habitats. They know the functions of wetlands, they know that organisms adapted to water and the flooded wetlands.

**TIME:** 45 min

**AIDS:** presentation Wetlands, presentation comments, work sheets, hidden small pictures related to wetlands, sponge, sprinkler (plastic bottle)

**PROCEDURE:** During the presentation\*, between the individual slides, children complete the work sheets. A discussion follows, the teacher invites the children to think and reflect (see comments on the presentation).

\*Link to presentation:

<https://docs.google.com/presentation/d/1RONzKokdBUZO7oFWbQVFJaNUqF8uUz-c/edit?pli=1#slide=id.p1>



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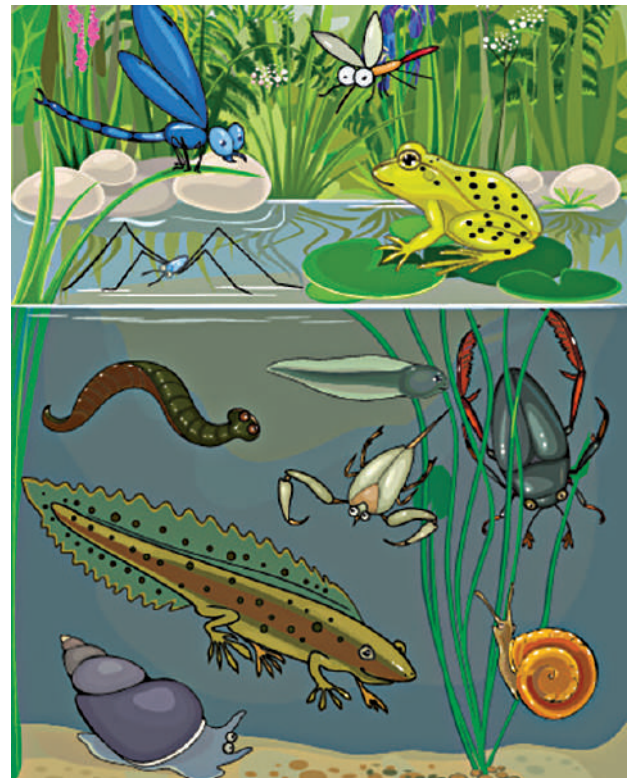
**Water retention in the landscape:** creating ground-water reserves



**Impact on local climate:** air conditioning by evapo-transpiration (**cooling** by evaporation of water by soil and plants)



Necessary for some plant and animal species: **source of biodiversity**



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**Flood protection:** wet soils absorb rainwater well, ponds, floodplains, wet meadows can hold more water than terrestrial habitats



**Surface water purification:** retention of nutrients (nitrogen, phosphorus, calcium, magnesium, potassium) and heavy metals



**Recreational opportunities:** walking, water sports, relaxation, sport fishing



**Fish production**



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**COMMENTARY ON THE WETLANDS PRESENTATION:**

The text is more extensive than students should know, rather it is intended for you, the educator, to better understand the topic. During the presentation, it is a good idea to let the students work independently to come to an idea of what the term wetland actually means. Another important purpose of the presentation is to highlight the function of wetlands – why we are concerned with them at all and why we are concerned that they are declining globally.

**IMAGE 2****Terrestrial habitats**

In order for students to understand the term wetland, it is useful for them to first make their own comparison between terrestrial and wetland habitats. The first slide therefore introduces terrestrial habitats – spruce forest, meadow, field. Let the children look at the pictures and suggest other similar habitats (field, meadow, spruce forest) and try to characterise them. You can use the worksheet Wetlands. On the left half of the board, write the terms the children can think of in relation to these habitats (sun, drought, grass, heat, butterflies, plants...)

**IMAGE 3****Wetland habitats**

Now do the same for wetland habitats (again, possibly with another worksheet). In the picture you see a pond, a floodplain forest, a bog. This time, write the students' ideas on the right side of the board (wetland, frogs, fish, water lily, fog...) Part of the evaluation should include a discussion of the fact that, for example, mosquitoes are introduced to wetlands because they are tied to it by their developmental stages, crops cannot tolerate root flooding, etc.

The educator can ask if there is any wetland habitat around the school or residence.

When you click and the question, "How are they different?" you and the children can come up with their own characteristic of a wetland.

Information:

- flooded or waterlogged for most of the year, usually permanently waterlogged
- wetlands are not only natural, they can also be man-made
- water can be standing or flowing, fresh, salt (or brackish)
- peat bogs, fens, estuaries, bays, ponds, pools, lakes, rivers, reservoirs, marine and coastal ecosystems with a depth of up to 15 m (depth at low tide does not exceed 6 m).

**IMAGE 4****How to identify a wetland?**

There are a number of definitions, it is not necessary to insist on their literal wording and burden pupils with them. It is enough to make them aware of how wetlands differ from terrestrial habitats.

The term 'wetland' is defined in different ways. Perhaps one of the simplest definitions is: "A wetland is a seasonally or permanently shallowly flooded or waterlogged area where conditions are created for the development of plants adapted to living in water" (Patrick Denny, 1995).

The definition most often encountered comes from the Ramsar Convention (1971) for the protection of wetlands: "Wetlands are areas of marsh, bog, fen, and areas covered by water, natural or artificial, permanent or temporary, with standing or flowing water, fresh, brackish or salt."



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It is important to focus on the processes that take place in wetlands. The following processes are characteristic for wetlands:

- The soil is flooded with water for most of the year, so respiration usually takes place without the presence of oxygen (anaerobic).
- Plants tolerate flooding of their roots – adaptation to lack of oxygen, plant tissues bring air to the roots (aerenchyma), plants have an adapted metabolism, they are less sensitive to the products of anaerobic processes in the soil.
- Animals adapted to life in water – this is the shape of the body allowing efficient movement in water, protection of the body surface, again adapted to respiration under water, etc.
- Very slow decomposition of plant and animal body remains – organic matter accumulates – e.g. the well-known process of peat bogging.

### IMAGE 5-12

#### What is a wetland?

A wetland can be seen as a transition between terrestrial and aquatic environments. The following list of wetland habitats is not exhaustive; the point is to give children an idea of what can be included:

- **Peatlands and bogs:** Peat bogs are where plant debris accumulates and is not completely decomposed (due to lack of oxygen and lack of available nutrients).
- **Wet meadows:** These are often found near watercourses where they form natural floodplains. Wet meadow vegetation tolerates root inundation well. With regular mowing, wet meadows can host rare plant and animal species.
- **Floodplain forests:** often occur in the floodplains of rivers and streams. Many have declined due to regulation of watercourses and drying of floodplains. They allow large amounts of water to spill during times of heavy rain and snowmelt.

Ask the children: *which trees can withstand flooding and which ones die in a flood?* (alders, willows can withstand flooding; most fruit trees cannot)

- **Floodplains:** These are flat areas adjacent to a watercourse on one side and bounded by higher ground on the other side. They form natural floodplains along watercourses. They allow large water spills during times of heavy rain and snowmelt.
- **Pond and stream shorelines:** the riparian zone is called littoral and is an important refuge for waterfowl, as well as amphibians and reptiles.
- **Ponds:** This is an artificial, man-made habitat. Ponds are artificial, artificially created wetlands that are replacing natural wetlands that are disappearing from the landscape. They are used for fish farming.

### BEFORE IMAGE 13

Before image 13, the teacher asks the children to look for hidden pictures, photographs (small, e.g. 5 × 4 cm) related to wetlands. There will be pictures that should guide the children to define some of the functions of wetlands. Together they will write the functions on the board.

### IMAGE 13

#### The meaning of wetlands

This slide is only an introduction to the other slides and should only outline the main meanings of wetlands. We will return to some of these in the following slides and explain them more thoroughly.

- **Water retention in the landscape:** the creation of groundwater reserves
- **Influence on the local climate:** conditioning by evapotranspiration (evaporation of water by soil and plants)
- **Necessary for certain species of plants and animals:** source of biodiversity (species diversity)
- **Flood protection:** wet soil absorbs rainwater well, ponds, floodplains, wet meadows can hold more water than terrestrial habitats



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- **Surface water purification:** retention of nutrients (nitrogen, phosphorus, calcium, magnesium, potassium) and heavy metals
- **Recreational opportunities:** walking, water sports, relaxation, sport fishing
- **Fish production:** and in the case of the sea, other animals

**IMAGE 14****Water retention**

The teacher demonstrates water retention using a sponge on the board. The sponge represents a wetland. It is slightly damp. He calls on a student who uses a dropper or bottle to simulate rain falling on the sponge (wetland). The sponge sucks up the water, it doesn't let it go anywhere else. Even if the rain stops, the sponge still holds water. What happens to it next? When the sun comes out, it can gradually evaporate. Or gradually the water seeps into the surroundings (the educator gently squeezes the sponge), but it never empties quickly.

For a more detailed experiment on soil absorption, see the Forest chapter.

**SLIDE 15****Water retention**

If the natural channel of a watercourse is preserved, there is a natural floodplain between its meanders, where water can spill over, for example, during spring thaw or heavy rainfall. The floodplain contains plant species that can tolerate flooding and can use the excess water and nutrients dissolved in the water. Willows, oaks and ash trees tolerate long-term flooding well. Birch and alder are less tolerant.

Note: During the 2002 floods, for example, the flow of the Lužnice River was flattened and the peak wave was delayed by about 60 hours (Bouček 2003). The water spilled into the Třeboň Basin – it was retained both in the natural floodplain of the Lužnice River and in the outlets of the ponds. When the wetlands are drained, we get very fertile soil – temporarily. In the air, organic matter decomposes more quickly and carbon dioxide is released into the air. The decomposed (mineralised) nutrients dissolve in the water and, if not used by the plants, are washed into surface waters. A concomitant effect of the mineralisation of organic matter in the soil is subsidence and the risk of backwatering.

The floodplain reduces the flow of water both by spillage and evaporation – spilling into the floodplain increases the surface area on which evaporation takes place several times. During spillage, water is both retained in the overland space of the floodplain and percolates into the soil. The slowing down of the flow in a natural channel is also due to meandering – the water has to take a longer route along the same stretch. The natural channel is shallow and rough, resulting in turbulence (which also has a positive effect on oxygenation). Regulated streams are deep and divert water quickly away to the lower part of the stream. This increases the risk of flooding.

**IMAGE 16**

Wetlands are able to purify water – solid particles settle to the bottom, nutrients are used by wetland plants, which accumulate on the bottom after dying and are difficult to decompose in the aquatic environment. This ability is also used in the construction of artificial wetlands, not to mention root-type sewage treatment plants.

**TIP:** This activity can be worked with at several levels depending on the age or knowledge of the children. You don't have to start with it in Year 1, but you can and don't have to wait until Year 5. After reading the entire activity, choose the method and level of activity or combination of activities that best suits your group of children.

We work with pictures (photos from the appendix of activity 16) and either the children and the teacher will just talk about them, name them correctly and assign the right descriptions to each photo (floodplain forest, floodplain, pond,

pond, etc.) or they can be kept in the classroom, in the corridor and the teacher can work with the activity as a mystery: "Some strange pictures were found in the school. No one knows what they belong to or who they belong to. Only the janitor says that someone was at school last night, but before he could find out who it was, no one was there. It's up to us to find out where and what the pictures are and who was here last night." The children then search for the pictures and take them to the designated place, after which they talk about them. Alternatively, 'science or research teams' can be formed to search (they can think of a name for their team, identify a leader for the expedition, design their emblem, their flag, etc.). Once they have found the images and scraps of text, all the teams should get together and work collaboratively to find out what is in the images and put together a story. The children should therefore find among the pictures and on the scraps of paper words like: save, Earth, It is necessary..., important pictures, LIVE H<sub>2</sub>O – the name of the expedition.

If children can already write, they can write the names of the habitats on sticky notes and attach them to the pictures. In individual teams they can also draw the habitats (pond, floodplain forest, pond...).

The children continue to look for what the landscape in the pictures has in common. All the pictures show water. The children will probably figure out at this point that the mysterious expedition probably wanted to save the Earth by keeping water in the landscape (the children will probably say it differently – they wanted water to stay on the Earth so that water would not disappear, so that water would return to the landscape).

Later (Years 3, 4 and 5) they will continue their search and find more fragments of the mysterious expedition (words and sentences from Worksheet 7 Wetlands). The teacher can say, "More leaves have been found, they are much smaller, we probably didn't notice them before." Based on these words (clues), children can try to think of one word that relates to the clues and the pictures. It is the single word WETLAND.

Worksheets could be used to reinforce whether we are looking in the right direction. On the basis of this knowledge, sitters will try to create a mind map – the expedition probably worked on creating wetlands = map Wetlands – what belongs to them + what is their meaning (use photos and descriptions found). And there may be a discussion about how they probably wanted to do it. The mystery remains why they disappeared, what happened. We can only guess. But it is strange that it happened in our school. Maybe we're the ones who can carry on their plan...

At the end or the next time we talk about this topic, we can remind ourselves of everything we know, not only with the map we have created, but also with a clear presentation that should serve only to repeat and remind ourselves of the most important findings.

## 8 Water retention in wetlands

**TARGET:** Pupils will understand one of the important functions of wetlands – water retention.

**TIME:** 10 min

**AIDS:** two containers with water, dry cloth, moistened cloth

**PROCEDURE:** It may be hard to understand that wet soil can hold more water in the rain than dried. You will find many similar examples all around you.

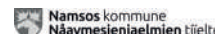


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The teacher pours two similar puddles of water on the floor or on a plastic mat. He/she invites two children to wipe the water with a cloth. One child has a cloth completely dry, the other moist, well wrung out. The experiment should show that it is harder to wipe off the water with the dry cloth. On the other hand, the moist and well wrung out cloth absorbed the water much faster.

The teacher then asks the children: *Is our experiment in any way related to the topic of wetlands or landscape?* The children try to come up with answers.

In heavy rain, a dry field or a meadow with hardened soil will react in the same way as the dry cloth. The rain does not soak into the soil, so the water will flow away quickly. Wetlands, although they are moist, are not completely saturated (full of water), in the rain they can quickly absorb more water. Another similar example is very common. Have you ever forgotten to water flowers. When the soil in the flower pot is very dry and hardened, it is easy for you to pour too much water so that it overflows, although the soil remains dry. Water soaks more slowly than in a flower pot with moist soil.

**TIP:** Try the experiment first to see how your substance reacts.

## 9 Pools everywhere

**TARGET:** Pupils will understand why it is good to return wetlands and pools to nature again, they are motivated to protect nature.

**TIME:** 15 min

**AIDS:** Data projector for short video projection.

**PROCEDURE:** The teacher shows the pupils a short video.

<https://edu.ceskatelevize.cz/video/11118-tune-pro-zaby?vsrc=vyhledavani&vsrcid=mok%C5%99ady>

The teacher then asks them: *What do you think about the video? Did you like it? Why? Why not? Why is it good to build pools in the landscape?* Pupils will probably say the answers they heard in the video: animals who live near water like these pools. However, the teacher can return to the topic of wetlands discussed earlier and can put together all the functions of wetlands with children.

## 10 Meandry

**TARGET:** Pupils will learn about the concepts of straightened and natural streams and meanders. They will realise that the shape of the river bed affects the velocity of water flow and that the balanced flow affects the drying of the landscape.

**TIME:** 15 min

**TERMS:** Natural and straightened streams



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**AIDS:** Chairs or stones, or pupils themselves, two maps of the same territory – one modern, the other from an earlier era, where you can see the original meandering flow (see attachment or the teacher will find maps of the school's surroundings at <https://ags.cuzk.cz/geoprohlizec/>).

**ACTIVITY VENUE:** Gymnasium, outside on a meadow, or even a field, forest road, in the most ideal case near the water-course.

### PROCEDURE:

1. The teacher will prepare two tracks that have a start and end in the same place. However, one is direct, the other has bends – delineated by chairs, stones, or the pupils themselves.
2. Children are divided into two groups of the same size. Both groups get ready at the starting line. The teacher introduces the activity: "Children, imagine that you are drops in a little stream. You will now make your way through the river bed and we'll see how fast you flow in the different streams."
3. After the start, pupils from both teams set off to run. One team runs along the straight route, the other through bends and corners (meandering). Once a pupil reaches the finish line, he/she raises his/her hand and the next pupil from the team starts to run. Once all the pupils finish the race, we will swap the teams and repeat the activity.

**REFLECTION:** *How did you like the running?* The teacher will discuss with the pupils that it was clear from the beginning that the team that runs along the straight course will win because it had no obstacles on the way. It was not a competition, but an experiment. The teacher reminds them what he/she said to them at the beginning: they were drops in a stream, one stream was straight and the other had many bends.

*In which of the two streams does water flow faster? (In a straightened river bed, water flows faster and runs away quickly from the landscape. In the natural river bed, where there are bends, the so-called meanders, the water flows more slowly, because the bends slow it down and the water stays longer in the landscape. That's very good for the landscape. It stays fresh for much longer and provides moisture to surrounding plants, animals, soil and air.)*

*What is more natural for a river or a stream? If it flows in a straight line or if it bends and forms meanders?*

**TIP:** You can extend the activity with an experiment: place two equal length cable protectors at an angle so that a ball can roll from one end to the other. The educator and the children twist the other protector as if it were a meandering flow. He drops the ball at the beginning of the protectors and measures with a stopwatch how long it takes the ball to reach the end.



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## REGULATION OF WATER COURSES

Watercourse regulation means, for example, raising and strengthening river banks by means of concrete barriers, construction of flood barriers and dams, strengthening the streams, deepening the river beds, and also changing the water courses – i.e. the creation of a new water bed of a watercourse – flat, concrete. This is due to efforts to prevent floods and to protect soil fertility. The rivers used to be more shallow, and they regularly overflowed their banks in the spring, thus supplying water to the surrounding area. Floods were important because nutrients flowing from mountainous areas settled in the lowlands. Floods are, therefore, a natural and naturally desired phenomenon. People have prevented flooding to protect their homes and fields. The original meanders of the rivers were often filled in and the river beds were straightened. For this reason, the water in the stream flows faster and does not “communicate” with the surrounding landscape. One could say that we are deliberately getting rid of the water. The total length of watercourses in the Czech Republic has been reduced by a third due to water regulation; some rivers were even shortened by two-thirds. Naturally meandering streams lined with floodplains have been converted into straightened channels surrounded by barrages to prevent overflow. In 1918, a third of rivers and streams were regulated and there were 17 dams in the Czech Republic. Currently, more than 90 % of domestic streams are regulated and there are around 180 dams. Yet this massive change in the water regime, driven by people, does not prevent current droughts or floods, it does not help hold water in the landscape, nor does it protect agricultural production. Straightened river beds cause major problems in torrential floods, when in a very short time the water level can rise by a few meters and sweep away everything that stands in its way.

## WHAT TO DO ABOUT IT?

The solution to regulating watercourses is to revitalise them – to bring them back to life. Various types of revitalisation can also be carried out in a technically modified stream bed. There is room for complete revitalisation, especially for smaller watercourses, which have often been regulated without any justification. In such a case, it is possible to implement measures to such an extent that the stream is returned to its natural character. Greater promotion of revitalisation is mainly hindered by the property ownership issues concerning land around rivers, where there is not enough land for the necessary measures.<sup>8</sup>

Another solution is to leave the area to spontaneous renaturation – to let the existing concrete fortifications crumble, let roots and vegetation grow there, let the water find its way out of the modified channels on its own and not to interfere with its processes, if possible, by more modifications.

**REFLECTION:** *We already know what meanders are. We know that water flows slower in them, that it turns and travels longer in the landscape. We know that people in the past often straightened meandering streams and rivers. Why?*

*Watercourses originally meandered across the landscape. In the last century, most streams have been straightened and regulated. This has had many consequences for water clarity and for plants and animals. Straightening has also greatly increased the risk of flooding. Why did people straighten rivers in the past?*

*Answer: they wanted more farmable land, they didn't want tractors and other heavy machinery to be ploughing through. Our agriculture is based on the cultivation of steppe plants (corn, maize, etc.) that do not tolerate waterlogging. In order for farmers to grow these crops, there must be adequate drought. To do this, they needed to get water away from the waterlogged soils around rivers and valleys – and they did this by straightening streams and reclaiming land. They also straightened the rivers to make them navigable for timber, and some later for ships. They built weirs on the regulated river to raise the water level (create a dam), which also usually allowed part of the flow to be taken out of the main river channel and into the embankment. They serve to harness the run-off water for power generation (watermill, water sawmill, hydroelectric power station, etc.).*



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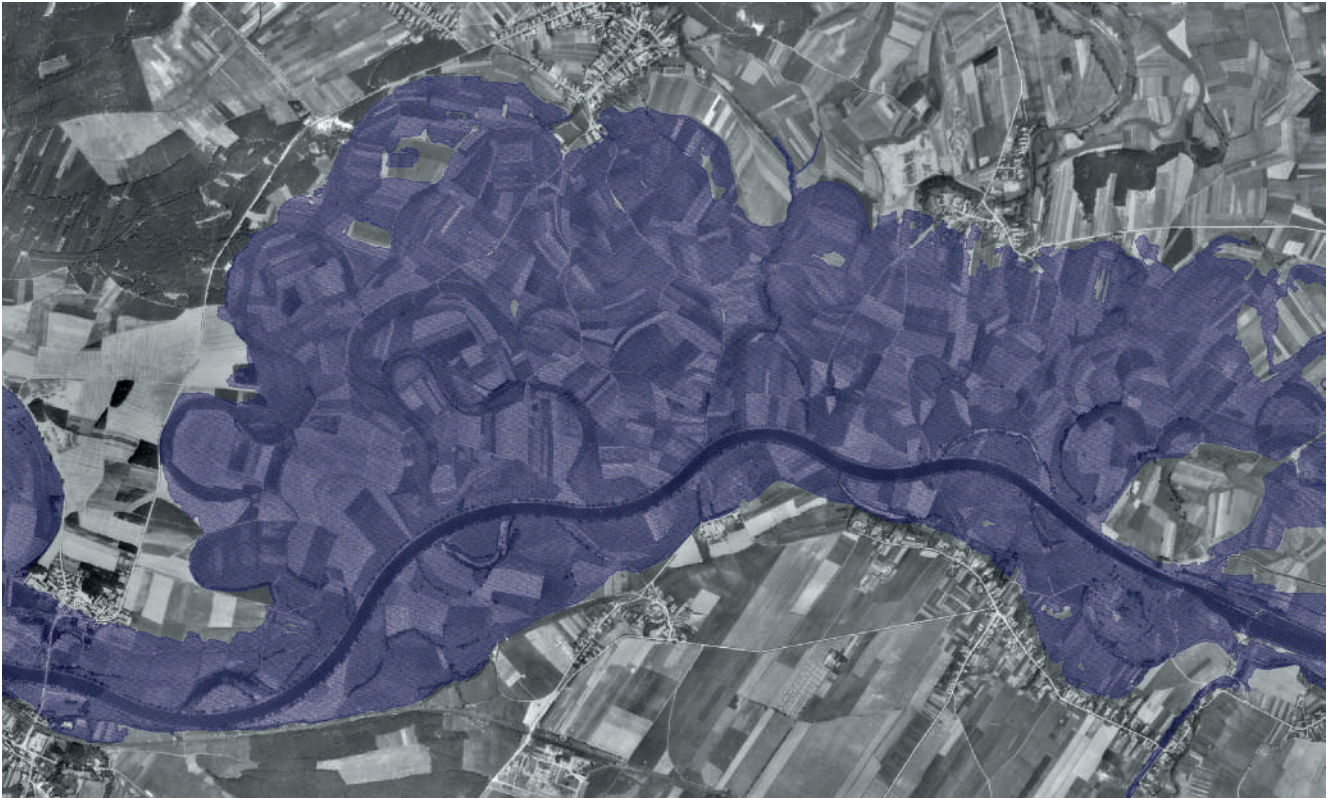
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Elbe at Pardubice – the colour-coded area shows the area of river movement at Q100



Drawing of the riverbed during the second military mapping



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The riverbed today. The original meanders are visible on the map.



The riverbed today – orthophoto image. In the northern part, the aquifer part of the original riverbed is visible.



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## 11 And again it waves – meanders<sup>8</sup>

**TARGET:** On the basis of an experiment, the children will understand how water behaves in a meandering channel and how it behaves in a straightened channel. They try to think about the experiment for themselves.

**TIME:** 90 min

**AIDS:** Spade, gardening trowels, gutter, stopwatch, watering can, measuring cup, cubes (houses, cars, etc.), pencils, work sheet

### PROCEDURE:

#### Provedení pokusů:

**Experiment A and B:** The teacher takes the children to a slope where he/she knows it will be possible to do the experiment. A good place is near a water source. The teacher invites the pupils to think of an experiment where they could actually use water to verify that water flows more slowly in a meandering channel. The teacher can help the children by showing them the tools and equipment they need for the experiment.

**Experiment C:** The pupils try to think of another experiment – how to check if the same amount of water always reaches the end of the track in different channels. In this experiment, they also try to establish a hypothesis first. In which channel will the volume of water flowing to the end be the smallest and in which the biggest?

#### What the experiment might look like:

1. The teacher and the pupils dig a straight channel on a slight slope, then a second straight channel, where they place a gutter or they can line it with plastic sheeting, and a meandering channel (with at least 3 bends).
2. Above the channels, they plough and loosen a piece of soil (water erosion)
3. Underneath, they dig holes into which cups with a specific volume are inserted.

#### Execution of the experiments:

- A. Does the same volume of water flow into the bowl as is poured in? The pupils measure the volume of water that has reached the cups placed under the channels. Did the same volume of water reach all the cups? The outcome of the experiment should be as follows:
- a. The straight channel with the gutter (foil) placed inside it – the largest volume of water. Water does not get absorbed.
  - b. The straight channel – slightly smaller volume of water flows into the cup than is poured in, the water partially soaked into the ground.
  - c. The meandering channel – the smallest volume of water reached the cup. The water moves the slowest in this channel and more water is absorbed. This helps to keep water in the landscape.
- B. **Flow speed.** Two pupils stand at the beginning of the channels and pour water into them from two watering cans filled with the same amount of water. We recommend that both pupils agree on the speed of the water pouring in advance. Pupils with stopwatches keep track of how long it takes for the water to flow through the two channels. Other pupils mark the times in their work sheets. They track how fast a certain volume of water flows through a straight channel, straight channel with the gutter, and the meandering channel.
- C. **Force of flow, torrential rain.** Place cars, dolls, etc. at the end of the channels. Water is quickly poured into the channels (torrential rain) and the pupils observe what it does to objects at the mouth of the channel. Will the water



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slow down in any of the channels? Where did it flow quickly? What happens to the objects? It is a flood simulation. Water will flow with the greatest force in the straight channel with the gutter (foil), just as it does in straightened and paved, concrete river beds. The slowest flow should be seen in the meandering channel. Some of the pupils can record the whole experiment on a video, which they can later watch in the classroom and see what happened at the mouth of the individual channels.

**ADVICE FOR THE TEACHER:** It is better to repeat all experiments several times. The experiment can also be done in a simplified manner in the classroom by using large plates and lots of modelling clay, with the children creating the shape of the channels from the clay. In this option you should limit the experiment to a meandering and straight channel (water soaking cannot be demonstrated on the modelling clay, only flow velocity). The plates are preferably placed in a slope with an inclination of 30°. The top side of a school desk can also be used instead of the plates.

**REFLECTION:** The teacher stands in a circle with the children and asks questions. Children who answer YES always take a step forward, those who say NO take step backwards. Before every question, all children return to the circle. The teacher always tries to give those who have felt a problem during the experiments the space to express themselves and to get to the bottom of the problem. They try to find a solution together to make the pupil more satisfied next time. The teacher can also point out that the children in the class have different talents. Some have better imagination, some are more precise, others have skilled hands. The strength of a group is that it can use the strengths of each individual member and bring them together. No one in the class is useless, they just may not have found their talent yet.

*Did you manage to carry out the experiment? Was it easy for you, or hard?*

*Did you enjoy preparing the experiment?*

*Is there anything that surprised you about the experiments?*

*How did you feel when the cubes collapsed in the torrential rain simulation and the water knocked them down?*

*Could something like that happen in reality?... the teacher can talk to the children about floods.*

## 12 Floods – detectives' search<sup>10</sup>

**TARGET:** Pupils will learn to distinguish between the causes and the consequences of floods.

**TIME:** 70 min

**AIDS:** a picture of a damaged landscape with missing landscape features, text about children experiencing a flood (the same number of copies as the number of children in the class), pictures of floods in the Czech Republic, pictures of the narrating characters with bubbles containing the characters' statements, pictures on the causes of floods (built-up floodplain forest x floodplain forest, straight stream x meandering stream, ploughing along the slope line x along the contour line, land development and placing drainage tubes, spruce monoculture x mixed forest, flood barrier), work sheets

**PROCEDURE:** The teacher gives each pupil a text about Peter and Clare. They will read it aloud together. The teacher asks the pupils: *How do you feel about the story? How did the children in the story feel? Can you imagine if something similar happened to you? Do you think that a similar story could take place in the Czech Republic?* The teacher shows photographs from floods in the Czech Republic. They can also find flooded places on the map of the Czech Republic. They can find pictures of floods from their country and show on the map.



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The teacher picks up at the end of the story where the children in the story ask the question: "why did all this have to happen?" The teacher motivates the pupils to search with Petřík and Klárka and help them determine the cause of the flood.

### The story of the flood:

*Peter and Clare are siblings. They live in the small town of Kostohůrky near the Děrůvka stream, where they often go to play. They are currently enjoying the summer break. They have returned from a holiday by the sea and are spending time at home and in the surrounding area. They play by the river, wading barefoot through the water and playing with boats built from leaves and twigs. They're looking under rocks looking for bugs. They're having a great time. But suddenly the sky clouds over and they hear a thunder. It's getting dark. Let's go home! There's a storm coming. Bang, thunder and lightning. The kids run home as fast as they can. They're all wet. But they're safe at home.*

*Or are they? It's pouring outside. One can't see a thing, water is pouring from the sky everywhere. "Now that's what I call a torrential storm," Peter says to himself. Within an hour, the level of the Děrůvka river rises. The water is pouring out of the banks so fast that no one has had time to react. Only when Clare takes her wet clothes to the laundry room, she is surprised to find water everywhere, up to her ankles. "What are we going to do?" she asks herself. Parents are at work. Only Peter and his grandmother are at home, but she is not walking well. "I have to call my mom and save my grandmother," Clare thinks. She's running to her grandma for the phone. Grandma, meanwhile, has climbed up on the table because the chairs and armchairs are in the water. Clare can't get to the phone. Grandma's terrified.*

*Where's Peter? "Peter!" shouts grandma. But Peter doesn't answer. They're worried about him. Then Clare sees him outside at the doghouse. He went to rescue their dog ALex, who would probably drown without his help. Now they are both sitting in the doghouse with water and mud all around them, they can't get away. "What's going to happen to them?"*

*Someone's pounding on the door. It's the firefighters who came to rescue them. Phew. They take them all to the fire truck and drive them to a city where there's no danger of flooding. They're saved.*

*But what awaits them when they return home? ... Broken things, mud and water everywhere.*

*Peter and Clare want to know why this had to happen. Why did the water spill over the banks and flood their house and the houses of their neighbours?*

*The pupils are searching for the causes. They'll split up into groups. The groups are given a picture, a plan of the damaged landscape around the village of Kostohůrky with bad landscape features: a straightened stream without wetlands and pools, a ploughed floodplain, large fields ploughed along the slope line, the outlet of drainage system, spruce monoculture, a built-up floodplain...*

*And they become detectives. There are several stations in the classroom with pictures of the characters and their statements. The children try to identify the causes of the flood. There are six causes in total. They always write down the cause of the flood in the work sheet. They mark the causes of floods in the landscape plan, or draw a second picture in the same way to show what a healthy landscape should look like.*

*A joint discussion on the causes follows. The teacher will help the children to fill in and draw the missing good landscape features in the plan and correct or mark the bad ones.*



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*"Come on, I think the problem is that the state didn't give us the money to build flood barriers, we would have just built a concrete wall on the riverbank. And there would be no flood. Besides, I think the forest is not what it used to be. There are only spruce forests around the village – and I've heard that they can't hold water all that well."*

**John Davies**  
Mayor

*"First of all: the river has shallow banks which should be reinforced. Surely the channel should be dredged and deepened."*

**Andrew McDrive**  
Businessman

*"When I was a kid, I remember there was a floodplain forest where the supermarket and parking lot are. And when the spring floods came, it always spilled there and didn't ruin anything for anybody. And on those fields above the town, used for farming these days, there used to be a deciduous forest and a lot of dead trees. I think they used to hold the water, that's why I have mud in my cellar every time it rains."*

**Eve Williams**  
Pensioner

*"Look, the guys in the neighbouring village told me that I should change the way I plough my fields and sow, and that I should not use heavy machinery. They say there's no more ploughing!"*

**Nicolas Smith**  
Farmer

*"In school we were taught that the landscape should be diverse. For example, if you have fields and by them, for example, alleys, balks, wetlands. It stops the excess water. Well, look at us here, we have huge fields. Maybe there's something to it"*

**Jane Taylor**  
Student

*"There's a huge pipe sticking out of the ground just around the corner, I can almost fit inside it. And sometimes water comes running out of it. And there's a similar pipe on the edge of the village and water flows from it too. Maybe it has something to do with the floods."*

**David Brown**  
A pupil at the local school

*"I don't like the wetland here, it's always wet, you can't walk there with dry feet, tractors can't drive through. Such places should not be in the landscape, because then they cause a flood."*

**Erica Evans**  
Postmistress

### JUSTIFICATION FOR CORRECT ANSWERS:

***"Besides, I think the forest is not what it used to be. There are only spruce forests around the village – and I've heard that they can't hold water all that well."*** (John Davies)

Justification for the correct answer: Single-species spruce forests do not absorb water as much as mixed forests. Spruces

have shallow roots, which is why they cannot bind as much water as trees with deeper roots. Deciduous and mixed forests also have a shrub and herb layer, which also retains and subsequently evaporates a lot of water. The spruce forest is barren, nothing much grows in it.

***“When I was a kid, I remember there was a floodplain forest where the supermarket and parking lot are. And when the spring floods came, it always spilled there and didn’t ruin anything for anybody. And on those fields above the town, used for farming these days, there used to be a deciduous forest and a lot of dead trees. I think they held the water, that’s why I have mud in my cellar every time it rains.”*** (Eve Williams)

Justification for the correct answer: Floodplain forests and other wetlands act as a sponge in the landscape, water from the river can pour into them, and they are able to hold it in large quantities. By clearing floodplains and floodplain forests and building over them, the landscape loses its ability to absorb water and thus protect settlements from flooding.

***“Look, the guys in the neighbouring village told me that I should change the way I plough my fields and sow, and that I should not use heavy machinery. They say there’s no more ploughing!”*** (Nicolas Smith)

Justification for the correct answer: Ploughing should always be done along the contour lines so that water cannot run away quickly from the hill through the furrows. There are already progressive farmers who do not have to plough the land and still grow crops in the field. This protects the soil and increases its ability to absorb and retain water. The frequent driving of large tractors over the field hardens the soil and the water cannot soak in, it drains quickly and runs off from the field. The soil then behaves like concrete when it rains.

***“In school we were taught that the landscape should be diverse. For example, if you have fields and by them, for example, alleys, balks, wetlands. It stops the excess water. Well, look at us here, we have huge fields. Maybe there’s something to it.”*** (Jane Taylor)

Justification for the correct answer: Landscape features such as balks, trees and alleys slow down water and help it soak into the deeper layers of the soil. In smaller fields, water cannot run downhill as quickly because it is prevented from doing so by “obstructions” (landscape features).

***I can still remember my grandfather telling me that the river used to bend a lot. But I don’t know if it had any effect when they straightened it out back then.”*** (Jane Taylor)

Justification for the correct answer: Water flows faster in a straight channel than in a meandering channel. The meandering natural stream is not as deep, so the water can spill in fields and meadows where it can gradually seep away without threatening the village.

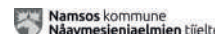
***“There’s a huge pipe sticking out of the ground just around the corner, I can almost fit inside it. And sometimes water comes running out of it. And there’s a similar pipe on the edge of the village and water flows from it too. Maybe it has something to do with the floods.”*** (David Brown)

Justification for the correct answer: Drainage pipes speed up water runoff from the landscape. The teacher can play for children a short video concerning drainage pipes: <https://edu.ceskatelevize.cz/video/7523-mokradly-a-jejich-vyznam>



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**JUSTIFICATION FOR INCORRECT ANSWERS:**

***“Come on, I think the problem is that the state didn’t give us the money to build flood barriers, we would have just built a concrete wall on the riverbank. And there would be no flood.”*** (John Davies)

**Why is this not a correct statement:** This is not the real cause of the floods. Building flood barriers is one of the measures people take to protect themselves from floods. But it won’t reduce the amount of water or slow it down. Moreover, it is not always a reliable solution. It may happen that one day it rains so much water that even the big concrete wall overflows. It is not possible to endlessly build bigger and bigger walls. Flood barriers address the consequences but not the causes of flooding.

***“First of all: the river has shallow banks which should be reinforced. Surely the channel should be dredged and deepened.”*** (Andrew McDrive)

**Why is this not a correct statement:** This is not the real cause of the floods. The regulation and strengthening of watercourses, as well as reinforcement of riverbeds, leads to the drainage of water from the landscape, which then does not absorb water naturally. It quickly drains water from the landscape. A reinforced riverbed does not allow for the water to seep into the soil. Water flows faster in a straight channel than in a meandering channel. A dug-in channel does not allow for the water to spill into the surrounding floodplains in time, the water accumulates and causes floods in populated areas. Such channel draws water from the surrounding area, thereby drying it out and impairing the soil’s ability to retain water. Regulation of streams can help in small floods, but makes the effects of larger floods worse. If the natural channel of the watercourse is preserved, there is a natural floodplain (alluvium) between its meanders, where water can spill over, for example, during the spring melting season or during heavy rainfall.

***“But the worst thing is that after the floods more and more of my crops are dying. Just take a look around! So you see, I’m not going to get anything out of that wheat.”*** (Nicolas Smith)

This is not the cause of the floods. Dying crops do not cause flooding. On the contrary, the floods cause crops to die.

***“I don’t like the wetland here, it’s always wet, you can’t walk there with dry feet, tractors can’t drive through. Such places should not be in the landscape, because then they cause a flood.”*** (Erica Evans)

On the contrary, wetlands and water retention areas contribute to slowing the water flowing from the landscape, absorbing it like a sponge and then slowly releasing it.

**REFLECTION:** The teacher can ask the following questions and the children can answer. Or they can all have pictures of the sun, a cloud with rain, cloudy sky, and partly cloudy sky and always show the picture according to their feelings in respect of the given question.

*How was your detective investigation? Did you find it easy/difficult to identify the correct causes of the floods? How did you find working with the plan, the map of the city and the surroundings? Did you work well together in the group? Would you do anything differently next time to make you feel more comfortable as a detective?*

**ATTACHMENT:** pictures of characters with statement bubbles



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## 13 Homework for researchers

A similar activity can be found in the Landscape and Me chapter -Exploring the Landscape Together. Choose the format that suits you and your pupils best.

**TARGET:** Pupils get to know the surrounding landscape, recognise landscape features and water-related features (even those not beneficial for the landscape).

**TIME:** 70–120 min

**AIDS:** work sheet for each pupil, overview of the landscape features

### PROCEDURE:

The teacher asks the pupils questions:

*What do you think about the situation in our surrounding area, do we have a healthy landscape? Or are there elements that should not be in a healthy and resilient landscape? Your research homework will be to explore your surrounding area and see if you can find the features in the landscape listed in the table below. If you can't find a specific feature, try asking your parents, relatives and search like detectives. You can also take photos of the places you discover and send them to my email address: .....@.....*

In the work sheet, children fill in only the first three columns. The other two are filled in at school during a group activity.

**REFLECTION:** *Did you do the task alone or with your parents, siblings, friends? Did you find the task difficult/easy? What interesting things did you find?*

Feature	Found/not found	Where it is located	What you like/dislike about it	Name of the pupil who found the feature	What he/she liked/disliked about it
Wetland/marsh					
Grove					
Meandering stream/river					
Alley, treeline					
A large field without greenery					
Drainage trench, pipe					
Pond					
Pool					
Straightened stream					







wetland



pool



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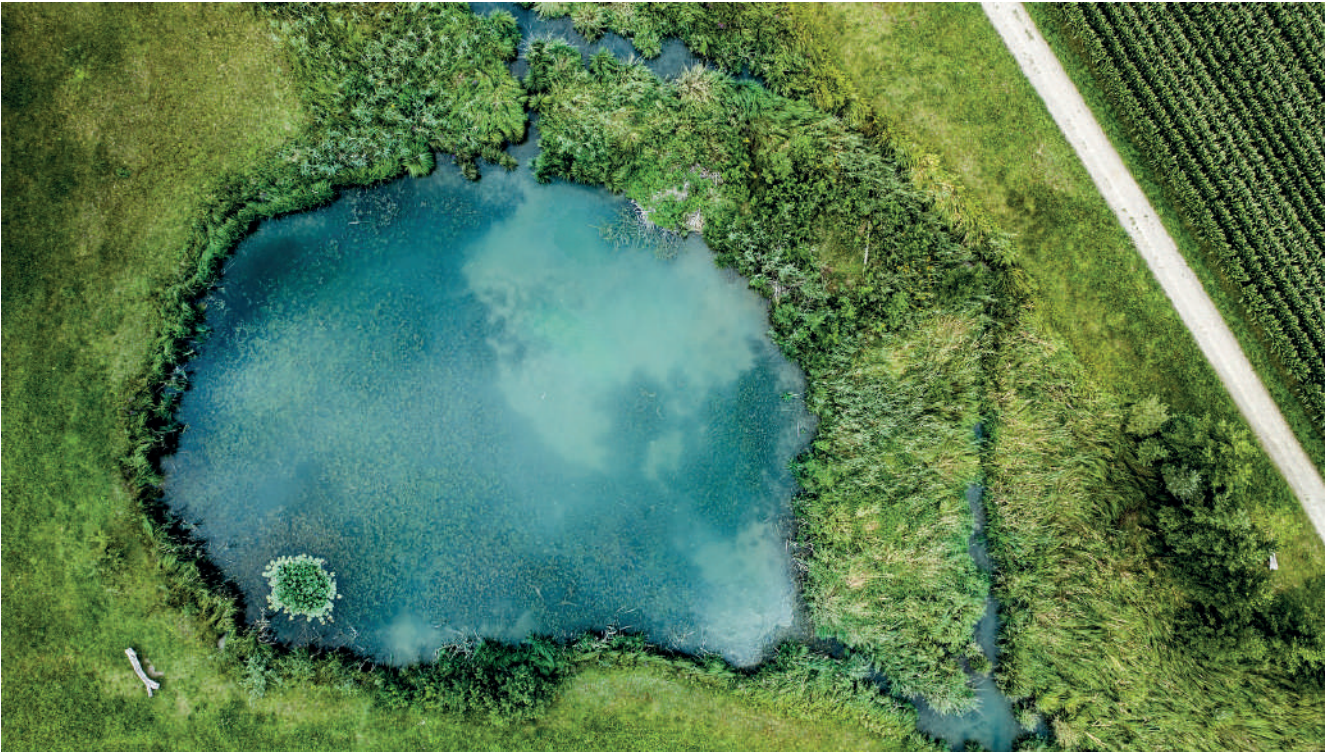
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lake



river



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mountain stream



confluence



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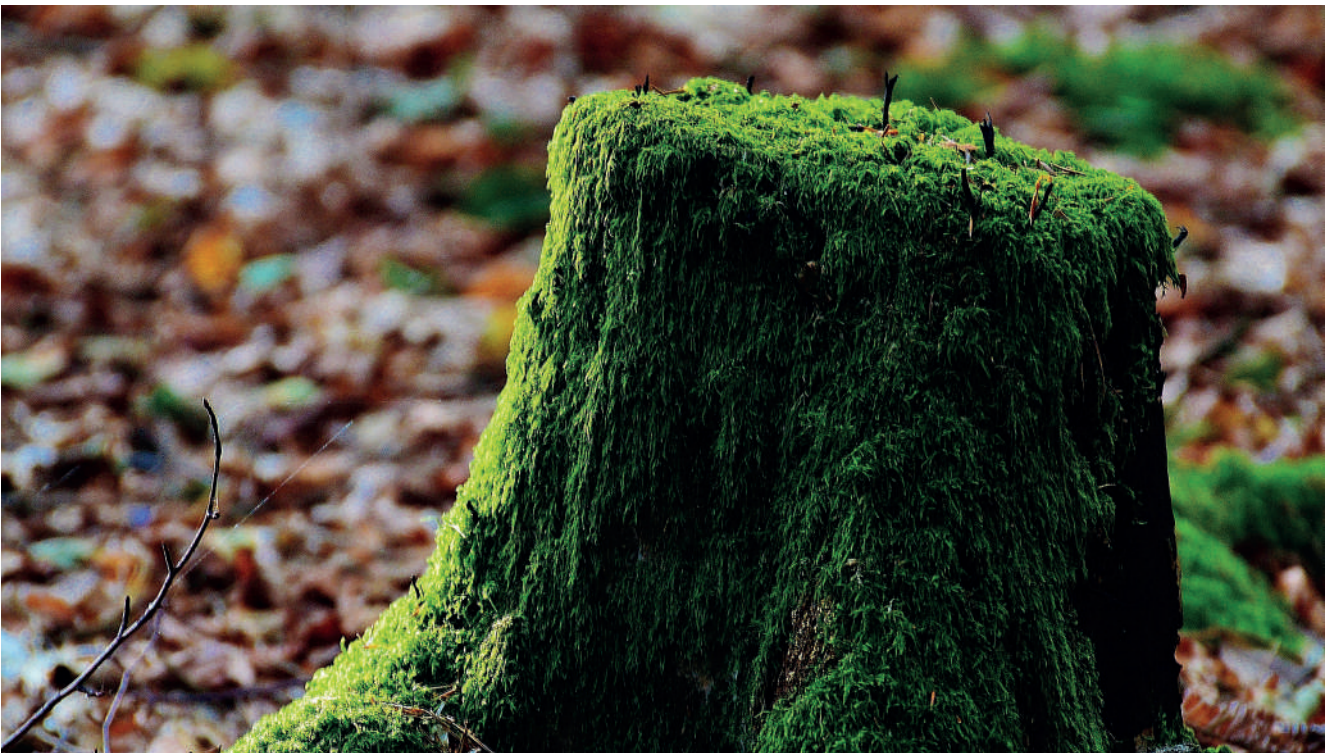
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deciduous forest, dead wood



stump



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mushrooms on a tree stump



spring, well



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floodplain forest



pond



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the meander of the stream



boundaries between fields



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two pools



waterlogged meadow, meadow



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bog



solitary tree



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alley



straightened flow



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a city built in a river floodplain



spraying a corn field



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hopper



newt



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buttercup



cattail



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## 14 Bingo

A follow-up activity to the previous Homework for Researchers.

**TARGET:** Pupils will practice asking questions and working with others. They repeat the landscape features and get to know their surroundings better.

**TIME:** 30 min

**AIDS:** Completed work sheets from the previous activity, pencils.

**PROCEDURE:** The teacher invites the pupils to find someone who has found a wetland, meander, alley, etc. and ask the classmate where they found the feature and what they liked or disliked about it. For each answer, pupils look for a different classmate. Whoever has all the boxes filled in sits down so that it is evident that they have completed the task. Pupils sit in a circle or at their desks and the teacher invites them to share what they found out. Who managed to find a classmate for all the boxes? The teacher then reads the features from the table one by one and asks who remembers an interesting answer from a classmate.

**REFLECTION:** After discussing the answers from the bingo game, the teacher asks the pupils one more time if they want to share what they found out while doing their homework, what they discovered, and what has not been mentioned yet that would be worth mentioning.

*Did they complete the task alone or with parents, siblings, friends?*

*Did they find the task difficult/easy?*

## 15 Matching game<sup>6</sup> (3<sup>rd</sup> to 5<sup>th</sup> grade)

**TARGET:** The game serves as an energizing activity, to burn energy, to induce cooperation and also to review the topics already discussed.

**TIME:** 45 min

**AIDS:** 24 pairs of picture cards (photos of the landscape features)

**PROCEDURE:** The teacher prepares cards – 24 pairs of cards – photos of the landscape features. In the best-case scenario, the teacher can take pictures of the places around the town where the school is located. Or he/she can use prepared photographs from the attachment. The cards are placed face down in a varied terrain. Pupils are divided into teams of 5–8 people (preferably 3 teams). Each team has a base – a house – on the edge of the defined area. The teams should not be too close so that they do not disturb each other during the game and hear every word the other team says. The goal of the team is to collect as many pairs of the matching cards as possible.

Students run out of the house (they can all run out at once, depending on their strategy). They can only see one card per run. When a pupil is sure that he/she remembers the card, he/she turns the card back face down and returns it to its original place. The pupil then runs back to the house. The pupil can tell the team what he/she saw in the picture and



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where the card is located only once he/she is in the house. It is not permitted to write down, photograph or otherwise record any information. Any communication outside the house is not allowed.

Once the team is sure that they know of a pair of identical pictures, they report to the game leader that they are running for a pair of the picture cards. A different player goes for each card. Pupils must not show the cards to each other while going to the game leader. They show them to the leader who checks that they form a pair. If YES, the cards are returned to the players and their team scores a point. Otherwise, both players must return the cards to their original place without showing them to each other. During this time, students from the same team cannot bring in another card to the game leader.

**REFLECTION:** Express in a single word how you feel after the game.

Write down how you progressed and collaborated during the game.

*What would you change next time?*

On the fingers of one hand, show how much you followed the rules (1 finger – absolutely NOT, 5 fingers – absolutely YES)

*Why did you follow the rules? Why not?*

*How did you feel when the rules were (not) followed?*

*Do you know of any examples of cases where rules are (not) followed in your area?*

## 16 Camera<sup>11</sup>

**TARGET:** Pupils calm down and focus their attention on nature, tuning in to the perception of natural beauty.

**TIME:** 15 min

**AIDS:** None

**PROCEDURE:** The teacher invites the children to walk around the surroundings and choose natural objects (plant, stone, branch, leaf, rock...) that interests them. They are then split into pairs. One closes the eyes, the other is the one who leads the "blind" to the natural object he/she has chosen before. It should be pointed out that the pupil who can see takes full responsibility for the one who is blindfolded. He/she handles him gently, using a touch on the shoulder to gently guide his classmate. The activity is silent. After squeezing the shoulder, the blindfolded pupil can open his eyes. The "guide" steps back three steps and lets his classmate observe the object in silence. Before the activity, the teacher explains that the blindfolded person, after opening his/her eyes, silently observes the place/thing to which his friend has led him. He can quietly ask the natural object if it wants to tell him something, how it is doing, if it is happy or if something is bothering it, or just watch and try to feel as the object.

Allow 1–2 minutes for silent observation (depending on concentration, age, etc.).

Then the pairs switch and the activity is repeated.

**REFLEXE, SDÍLENÍ:** The teacher invites the pupils to return quietly and form a circle and share their feelings. Those who could see say why they chose the specific natural object, what made it interesting to them. Those who were blindfolded can communicate their feelings about how they felt when their classmates led them and later when they "could take a photograph" of the nature.

**ACTIVITY EXTENSION:** Memorize the most interesting photo and try to draw it – either immediately or at school. The photos can be made into an exhibition.



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## 17 The River Story

**TARGET:** Pupils learn about the aquatic ecosystem. The activity strengthens the sense of belonging to the aquatic habitat, develops the pupil's imagination.

**TIME:** 25 min

**AIDS:** The story of the little river – text

**PROCEDURE:** The teacher asks the pupils to find a place where they feel comfortable. So that they can hear the teacher well and do not disturb each other. The children lie on their backs and close their eyes. The teacher will explain that he/she will tell them a story and they will imagine it. No one speaks during the story.

**THE RIVER:** *Close your eyes. Together, we will be transported to a time when there were no humans on Earth. However, the Earth already looked like it does now. There were already forests and meadows growing, water flowing in streams and rivers. The weather was also similar. When we breathe together for three times, we will be transported to a time before mankind. (They breathe in and breath out together three times). Let's take a look around. We see deep forests, the landscape is full of wildlife. We listen and hear birds singing, a fox calls to us from the forest. Everything is in harmony and calmly flowing. From the very beginning of all existence on Earth, water has been sustaining life. Water feeds plants, trees, and quenches animals' thirst. Life on the planet thrives on water. We are walking through nature, something glitters in the distance. You're intrigued and you go closer to check it out. You stand on the bank of a beautiful living river. That river is magnificent. You like how clean it is, how fast it flows. You think you'd like to explore it. A drop splashed on your cheek. It cools you down nicely. Taking off your shoes and closing your eyes, you slowly step into the river, into the magical river that gives you the opportunity to become a fish for a while. You feel yourself shrinking, you gradually grow fins and you find yourself completely submerged in the water, you see that you can swim fast and even breathe underwater. What do you look like? Are you a big fish or a small fish? What kind of fins do you have? Do you swim slow or fast? You take a look at your new body and test what it can do now.*

*You are swimming upstream. You feel the water caressing your body and its gentle coolness on your skin. You like being in the river. There are rocks and various coves. Shallow waters in creek turn into deeper pools where you can hide. There's plenty of food everywhere. You feel happy and carefree. The river twists and turns, meanders, and you enjoy going through the bends. Often you will jump above the surface out of sheer joy of life. Hop! You're enjoying diving back in the water again. You can even jump over rocks out of the water and back in. You enjoy it so much that you can spend hours doing it.*

*This is how you live here generation after generation, you are born and you pass away. Time goes by. But one day something strange and unexpected starts to happen. You can hear the ground shaking, the water's surface vibrating. You try to jump above the surface, but you can't see anything. This has been going on for 7 days. You are beginning to feel insecure. Then an iron giant machine starts dropping dirt and rocks into your river and all your favourite spots are filled in. Fortunately, the water is diverted elsewhere and you flow with it. But where is it taking you? You are frantically flapping your fins to keep up, because you know that without water you would be lost. Sometimes you will find yourself on dry land, but there is always a wave that comes and takes you with it. The water won't leave you alone. You belong to the water and it belongs to you. You're out of breath, but you made it. You are back in the stream and you have plenty of water. You're resting. You catch your breath.*



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*You swim to look for a new home. The river has no bends, it is as straight as a ruler. There are no rocks and small stones. And where is that broken branch where you always played hide and seek with the other fish? Ugh, you must be flapping your fins all the time now, the water's flowing a lot faster than it used to. There's nowhere to hide, the river is flat, the same everywhere, and there's less food. The days are passing, you feel hungry and miserable. You're hoping that everything will turn out for the best.*

*Your wish has been granted. After many years of surviving like this, the iron machine has arrived again. It's smaller this time, it doesn't make such tremors. Around the river there are strange animals that walk on two limbs and don't even use the other two limbs they have for walking. Instead, they're either holding tools or catching fish, your friends. You got caught too, but you feel like they're helping you. You're not afraid. They carry you in a purple container, there's not much water, but say to yourself, I can do it. They're helping me. The moment finally arrives. The iron machine is done with its work, it has restored the original river bed, now the water is flowing again and you are being released back into your home. You're beaming with joy. It's back to the way it used to be. Pools, meanders, hiding places. You're home. After all these years, you're back. You jump over the rocks with joy, do somersaults in the air and fall into the water again. You are happy. And it will remain so forever.*

*It's time to come back to the present moment. You're slowly coming ashore. You have legs, you have arms, you are human. You are lying (sitting) on the ground near a river (stream, classroom, etc.). Take three breaths together and open your eyes after the third breath. One, two, three (breathing together). We open our eyes, stretch first our arms, then our legs, we can yawn.*

The teacher slowly allows the children to sit down, wake up. There is no need to hurry.

Autor: Šárka Vávrová

**REFLECTION:** The teacher invites the pupils to share their experience and feelings. *What part of the story spoke to them the most, what did they feel? Did they feel safe? Or were they uncomfortable with the imaged ideas? What exactly happened in the story? Could that have really happened?* Together they find out that this is indeed how it happened in history. It's a story about straightening rivers and streams. About filling of original river beds. *What was the iron machine? (excavator) Children will be reminded of the river meanders, how they function and what they are good for. Who was the animal with two limbs?*

## 18 Closing ritual

**TARGET:** Children celebrate the end of the great Water in the Landscape chapter. They will strengthen their positive relationship with nature.

**TIME:** 45 min

**AIDS:** Things that hold water in nature (children should bring them themselves)

**PROCEDURE:** The teacher tells the children in advance that the following day/in the next class they would be celebrating the end of the chapter concerning the water in the landscape. To celebrate, children need to bring to school one thing from nature that helps retain water in the landscape, or paint that thing. *"Think back to our research assignment, when we were looking for all the places where we can find water."* If the children look like they will not be able to cope



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with the homework, the teacher will give them a list of things they can bring: moss, soil (compost), rotting wood, fallen leaves, pictures of raindrops, ponds, trees in the landscape, etc.

Before the celebration begins, they sit in a circle and put all the objects in the middle of the circle. The teacher begins to thank the water in the landscape for giving us life, for giving life to the plants, for providing drinking water to the animals and for maintaining a suitable climate for all life. The teacher then sends any object (e.g., a bowl of water) and invites the students to express how they feel about the water in the landscape, or say their thanks or their wishes. The pupil that holds the object is speaking. The others are listening. When the object finishes the round and goes back to the teacher, the speaking part of the ritual is completed and together they sing the song they have learned, *Živa je živá*.

**REFLECTION:** The teacher will repeat to the pupils what they have experienced and what activities they have participated in on the topic of Water in the Landscape. They can think back at what they liked, what they did well or failed to do. And they try to evaluate the whole topic, they can formulate the main idea that they take away from the chapter.



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“We are looking for a way to understand nature as a living organism, in which we do not have to be mere visitors, but we get to be those who breathe with it and appreciate it.”<sup>1</sup>

(Alena Svačinková)



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Forests cover about a third of the Earth's land surface, and provide habitats for up to half of all living organisms. When we realise how extensive and varied the forest environment is, then it is obvious why it arouses such a great interest in people. Humans use forests as a source of warmth, food or medicine, for recreation, but also for scientific purposes. Forests shape the landscape, they produce oxygen, trap dust particles, prevent increased water runoff and washing of soil, resist strong winds and generally stabilise the climate. In meeting human needs, it is therefore essential to be constantly mindful of the importance and vulnerability of forests.

Forests contribute significantly to retaining water in the landscape and positively influence water runoff conditions. A proportion of rainfall or snowfall is caught on the leaves of trees and shrubs, on the surface of herbs, grasses and mosses. The presence of dead wood also increases the water retention area. The technical term for this unique forest feature is interception. The water then evaporates from the surface of the plant organs and saturates the air with the typical forest scent.

The remaining portion of the precipitation falls on the soil surface, soaks into the soil and is directly used by the plants. Unlike in pastures, areas with sparse vegetation or agricultural fields, in forests, the water does not evaporate from the soil surface due to the high air humidity.

Water retention by forest vegetation, which then releases water slowly, is a natural process of forests with abundant living and dead plant matter. Therefore, a forest that is intensively managed by humans (e.g. spruce monocultures) and the plant communities do not form a sufficient canopy, retains rainfall and snowfall only for a short time and water runoff is significantly faster. This leads not only to an insufficient water supply for plant and animal growth and development, but also to an increase in water erosion and more frequent floods in areas populated by humans.<sup>2</sup>

That is why we should take care of the landscape and forests around us. Let us work together to create a diverse and species-rich landscape, or ask farmers and forest and land managers to create or maintain such landscapes. It's in the interest of all of us.

If you want to make the activities described in this chapter more interesting for the pupils, especially for younger pupils, you can present the activities not in the role of a teacher, but as a forest elf, fairy, little forest gnome, etc... Create a costume or a specific piece of clothing (hat, coat, sweater, dress, skirt...) decorated with natural materials (hat with leaves stuck on it, headband made of ferns, coat with a fern in the lapel...); such costume will magically turn a teacher into a magical forest creature.

The forest-related activities are divided into 3 sections – games (activating, attention-focusing, sensory experience) (activities 1–9), indoor science experiments (activities 10–10.7) and outdoor science experiments (activities 10.8–13). Games (activities 1–9) can serve as an introduction before the experiments that are more research-oriented and require the pupils to be more focused. For some games, it is directly stated in the introduction before which experiment they should be played. The last game (The Air Spoilers and Air Purifiers) can be found right next to experiment 11.2, to which it is directly linked. Otherwise, choose games and experiments as you see fit in your teaching at the given time, taking into account the age and abilities of your pupils.





Activity name	Activity type (e.g. experiment, video sample, artwork)	Activity information (relevant to what the activity is about: e.g. summary or topic)	Duration (min)	Environment (outdoor/indoor activity)	Page
1 <b>Photographic memory</b>	sensory, physical activity	motivation/ connecting to nature	30 min	outdoor	93
2 <b>My tree</b>	sensory activity	motivation/ connecting to nature	25 min	outdoor	94
3 <b>Forest — what comes to mind?</b>	introduction to the more technical part	introduction to the topic	45 min	indoor/ outdoor	94
4 <b>Intuition Game</b>	sensory activity	connect to oneself and to friends	20–30 min	outdoor	100
5 <b>Connecting to the tree</b>	sensory activity	motivation/connection with nature	15 min	outdoor	100
6 <b>Blind caterpillar</b>	sensory activity	motivation/ connecting to nature	30 min	outdoor	101
7 <b>Listening to the forest sounds — making musical instruments, forest concert</b>	sensory activity	motivation/connection to oneself, friends and nature	40 min	outdoor	102
8 <b>Web of life (biodiversity)</b>	perception of interconnectedness	experience, perception of relationships in nature	30 min	outdoor/ indoor	103
9 <b>My life as a tree</b>	experiential activity	connection to the forest	30 min	outdoor	104
10 <b>Where does water come from in a forest?</b>	motivation, introduction to the more technical part	working with a short video, finding answers to questions	15 min	indoor	106
10.1 <b>Where nutrients flow</b>	experiment, work with work sheet	research activity	5 min preparation + 2 h colouring + 20 min reflection	indoor	107
10.2 <b>How plants return water to the landscape</b>	experiment, work with work sheet	research activity	60 min	indoor and outdoor	108
10.3 <b>How green plants and trees produce oxygen</b>	experiment, work with work sheet	introduction to the concept of photosynthesis, research activity	introduction and preparation – 15 min, implementation 15–30 min (?)	indoor	111
10.4 <b>Protective soil cover</b>	experiment, work with work sheet	research activity	30 min	indoor	112
10.5 <b>Absorption Experiment I</b>	experiment, work with work sheet	research activity	40 min	indoor	113





10.6	<b>Absorption Experiment II</b>	experiment, work with work sheet	research activity	60 min	indoor	115
10.7	<b>Absorption Experiment III + soil life</b>	experiment, work with work sheet	research activity	60 min	outdoor	116
10.8	<b>Forest air conditioning</b>	experiment, work with work sheet	research activity	120 min	outdoor	117
11	<b>Forest air and water purification</b>	initial activity	questions and the search for answers	10 min	outdoor	118
11.1	<b>Water filter</b>	experiment, work with work sheet	research activity	45 min	outdoor	119
11.2	<b>Air filter experiment (school surroundings, forest)</b>	initial game, experiment, work with work sheet	initial physical activity (game), research activity	initial game – 15 min, research activity duration depending on the distance of the sites	indoor, outdoor	120
12	<b>Bark beetle</b>	artistic activity, storytelling	introduction to the topic of the bark beetle calamity	60 min	outdoor	122
13	<b>New forest</b>	creation of an "outdoor laboratory"	forest care, long-term observation of natural processes	long-term project	outdoor	124

## 1 Photographic memory<sup>3</sup>

This game can be used as an initial motivational activity before the absorption experiment. In such a case, the game should be modified as described in the introduction of the experiment (Activity 10.7).

**TARGET:** Activation of pupils, exercising memory, concentration, connecting with nature.

**TIME:** 30 min

**AIDS:** 2 scarves (one single-colour), a small bag for everyone



**PROCEDURE:** Before the game starts, the teacher collects 5–10 natural objects in the location where the game will take place (a pine cone, a piece of bark, a stick, moss...). The teacher then spreads them out on the single-coloured scarf (or a stump, for example) and cover the natural objects with the other scarf. He/she calls the children to position themselves around the scarf and asks them to turn into photographers. In a moment, they will be shown a forest "artwork", which they will "photograph" and then look for its parts in the forest. Then the teacher uncovers the "artwork" for 30 seconds and the children try to remember its parts. After covering the artwork, each photographer goes out into the surrounding area to find the parts he or she has memorized. They each collect the objects they found to their bags. 10–20 minutes later, the teacher calls the children back. Each photographer then lays out their little treasures in front of them and one by one the teacher pulls the objects out from under the scarf. He/she asks the pupils if they have found anything similar. You can stop and talk about each object. You can talk about its uniqueness and what it can be used for. After the game, if the pupils feel like it, they can try to find the natural objects they did not find.



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## 2 My tree<sup>3</sup>

**TARGET:** Activation of pupils, focus, connecting with nature, cooperation, awakening the senses.

**TIME:** 25 min

**AIDS:** Blindfolds (scarves)

**PROCEDURE:** A varied deciduous forest comprising of a mixture of different species, or a park or woodland, is most suitable for the game. Pupils are divided into pairs. One of the pair is blindfolded so he/she can't see. His/her friend becomes his/her eyes. The other pupil from the pair chooses a nearby tree (the teacher determines in advance the area in which the children should move). The teacher then gives a sound signal (e.g. taps two wood sticks against themselves). Pupils who can see lead their classmates to the trees in the area. Each blindfolded pupil is brought to "his/her" tree and goes to get acquainted with it. He/she touches its bark, smells it, finds out the size of the trunk, the shape of the roots, the taste of the tree, the soil under the tree... whatever comes to mind. The friend can help him and guide him with questions: "Is the bark of your tree rough, smooth or bumpy?", "Do you feel that the tree is alive?", "Where do its roots lead?", "Can you reach any branches?", "What is the shape of the leaves?", "Does it grow straight or crooked?" etc. Upon expiration of the set 5-minute deadline, the blindfolded pupils are taken back to the starting point. After untying the blindfolds, the pupils try to find "their" tree. If the pupil cannot find the tree, his/her friend can help by giving clues "freezing/cold/getting warmer/burning".

**TIP FOR TEACHERS:** At the beginning of the activity, it should be emphasized that the pupil who can see is absolutely responsible for his/her friend. He/she must lead him/her very carefully, pointing out any unevenness of the terrain, branches, dangers, etc.

**REFLECTION:** At the end of the game, encourage children to share their experiences. *What helped them find the tree? What was the most difficult and why? What helped them most to be sure that they found their tree (bark, smell, soil...)? What was the first thing they noticed when they found the tree? What was their first feeling when they found the tree? You can also focus on questions about trust, blindness: How did you feel about being blind? Was it hard to rely on your friend? How did you feel as a guide?*

## 3 Forest – what comes to mind? (forest functions)



**TARGET:** Introduction to the forest functions.

**TIME:** 45 min

**AIDS:** Small object from the forest, canvas bag, cards showing the forest functions, piece of white cloth/big white paper, flipchart/blackboard, crayons

**PROCEDURE:** Pupils sit/stand in a circle and close their eyes. The teacher tells the children that he will send a small object from the forest around the circle in a bag. Everyone touches it quietly and sends it to a classmate. After the first round, the teacher hides the object behind his/her back, invites the pupils to stay quiet and keep the answers to themselves. He/she asks whoever thinks they recognized what the object was to raise their hand. He/she then shows the object. He/she then





invites the pupils to proceed to other tasks. In the first round, anyone currently holding the object says 1 word about the forest that comes to their mind and then sends the object to a neighbour. In the second round, the pupils tell what they like in/about the forest. In the third round, they say why they think the forest is important. The teacher has printed cards with pictures showing the forest functions (the other side has the function written on it) and some free cards. When the function is mentioned, the image is placed in the middle of the circle between the pupils on white paper/piece of white cloth. If the pupils think of a forest function that is on any of the pictures, it is written on a blank card and a volunteer may draw a picture that comes to his/her mind on the other side. You can also record the answers on a flipchart/blackboard. Below is a list of some forest functions. The pupils surely won't be able to list all of them, they won't know some of them yet, but it doesn't matter. After the third round, the teacher asks all students if they can think of a forest function that has not been mentioned yet. He/she can then guide the pupils by asking appropriate questions such as "where do you think the water drains faster – in a field or in the forest? Why is that?" "Where will it be more pleasant to be on a hot summer day? Why?" "Where will you feel more protected when the wind comes – in a meadow or in the forest? Why?"

If the activity takes place indoors and if the teacher has the technology available, he/she can show the pupils a short video about the forest functions (trees):

<https://edu.ceskatelevize.cz/video/7521-stromy-a-jejich-prinos-pro-krajinu?vsrc=vyhledavani&vsrclid=zadr%C5%BEO-v%C3%A1n%C3%AD+vody+v+krajin%C4%9B>

After watching the video, the teacher asks if anyone found a function of the forest (trees) in the video that has not been mentioned yet.

List of some forest functions<sup>4</sup>:

1. Trees produce oxygen – one mature tree can release up to several thousand litres of oxygen per day. That's enough for 20 people to breathe for a day.
2. Forests significantly capture rainfall and gradually release the accumulated water. This reduces the effects of flooding from heavy rains and spring snowmelt.
3. Forests purify water and thus protect drinking water sources.
4. During heavy rainfall, trees catch droplets with their branches and leaves, slowing their journey to the surface of the ground and preventing soil runoff (water erosion) – a large forest can reduce flood runoff by up to half compared to an unforested area.
5. Evaporation of water from the above-ground part of the trees releases the capacity to absorb further precipitation.
6. The roots of the trees strengthen the soil and thus protect it against being washed away – water erosion.
7. The forest is an effective dust filter – wind speeds in the forest decreases by more than half compared to the open landscape, so that dust particles can settle on trees and be washed to the ground by rain.
8. The forest provides shade, in summer evaporating water lowers the air temperature by several degrees Celsius.
9. It provides shelter for wildlife.
10. Each tree is in itself a habitat for other organisms, e.g. symbiotic fungi, soil microorganisms, insects, small vertebrates, etc.
11. The forest is a popular place for relaxation and recreation.
12. The forest has an aesthetic and landscape-forming function.
13. The forest is a source of knowledge of the processes taking place in nature and an object of scientific research.
14. The forest is a source of wood for people, which they use in many areas.
15. People like to pick mushrooms and berries in the forest.

**TIP FOR TEACHERS:** We recommend that teachers print the list of forest functions to take with them.



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Pictures of the individual functions:



3.



4.



1.



2.



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11.



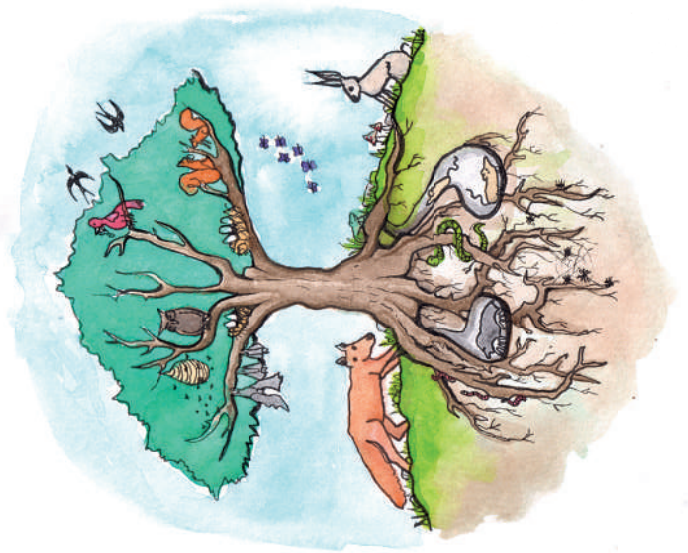
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9.



10.



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15.



16.



13.



14.

**REFLECTION:** Did you learn about any forest function that you had not known before? Which one? Would you like to know more about any forest function?



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## 4 Intuition Game<sup>5</sup>

**TARGET:** Calming, focus, mindfulness, internalisation, deeper experience in nature.

**TIME:** 20–30 min (depending on the number of pupils)

**AIDS:** Blindfold (scarf)

**PROCEDURE:** All animals in the forest have very well-developed senses – including the “sixth” sense – intuition. They ensure the survival of themselves and their offspring, whom they care for at an early age.

We also have intuition – an inner feeling that tells us that someone is watching us from afar or that something is about to happen.

A well-attuned group – calm, receptive and relaxed – is needed for the game. If the group is not in a good mood, it is better not to play this game. It is good if the teacher has experience in meditation or yoga. Warm spring and summer days are suitable for the game, as the children stay relaxed even during prolonged periods of sitting down.

Pupils sit comfortably in a circle. The teacher will invite the children to share their experiences with intuition. Whether they have experienced it themselves or have seen it in a dog, for example. The teacher then explains that the game is only meaningful if everyone can keep completely quiet and assures the pupils that everyone who wants to will take turns in the game. He/she then guides the children to inner quieting and awareness of themselves and their surroundings. The teacher asks the pupils to close their eyes and guides them to notice their bodies – for example, by observing their breathing and becoming aware of the different parts of their body. This phase may take several minutes.

When the group is calm and focused, everyone can open their eyes. The teacher closes eyes and turns in a circle and after 3 turns, without looking, points with his hand to pupils that would go inside the circle and close his/her eyes. He/she then chooses a second pupil. The player inside the circle must not know and see which classmate has been selected, nor where he/she sits in the circle (he/she can be blindfolded with a scarf). The other pupils close their eyes, lower their heads and try to stay quiet and focus on the stillness, themselves, or nature. The second selected pupil then begins to look at his classmate in the middle of the circle with a positive attitude, mentally greeting him, calling him by name, waving at him... When the player in the middle thinks that he/she feels a gaze on him/her from somewhere, he/she points in that direction. He/she does not have to point exactly at the second student, but sometimes it happens. Even an approximate direction is a success. The pupils then take turns guessing. Before each round, the giggles, excitement and chatter need to calm down. Without stillness and silence, the game will not work.

**REFLECTION:** After all the pupils who wanted to play take their turns, a discussion in the circle follows. *How did it feel to sit in the middle? What led the students to point in a certain direction? Did anyone get chills? How did it feel? What was it like to call on the student in the middle? What was it like just sitting there quietly? Has anyone noticed the sounds of the forest, the smell, the silence...?*

The activity can serve as a link to activity 6.



## 5 Connecting to the tree<sup>6</sup>

People often feel physically and mentally unwell or tired. One way to replenish the missing energy can be contact with trees. In many cultures, trees are attributed with deep spiritual significance, healing powers and wisdom. In our society, where we have been disconnected from the wisdom of nature for a long time and are trying to reconnect again, “dendrotherapy” was created. Dendrotherapy considers trees to be sources of healing energy, which can be drawn by direct touch or by being near a tree. Try to connect with the trees as well.

**TARGET:** Connecting to nature, calming down, awakening sensitivity.

**TIME:** 15 min

**AIDS:** optional crayons/art supplies, papers, drawing pads

**PROCEDURE:** Choose any healthy tree that you feel comfortable around. Let your intuition guide you. Approach the tree slowly. At the beginning, just gently touch the tree. If it lets you, you can hug it or lean against its trunk. Invite the pupils to engage in a mental conversation with the tree. They can just say hello and tell it why they are here, but they can also ask it for help, for listening, for advice, for energy... They can also ask the tree how it feels, how it lives here, what it remembers... Try to breathe deeply and feel the energy of the tree. Relax and feel how you feel near the tree. Stay connected to the tree as long as it is comfortable for you and the tree and before leaving the tree, don't forget to say thank you and goodbye. You can then sit near the tree and paint it. Children can even name their tree.

**REFLECTION:** Sit in a circle and discuss, what was it like to be around the tree. *Has anyone been able to talk to their tree? What did the tree tell you? How do the children feel after the activity?*

## 6 Blind caterpillar<sup>7</sup>

**TARGET:** Focus, mindfulness, deeper experience in nature, collaboration.

**TIME:** 30 min

**AIDS:** blindfolds (scarves)

**PROCEDURE:** At an interesting place in the forest, divide the pupils into groups of up to six. They all put on the blindfolds, and each group stands in a line with the pupils grabbing the person in front of them by the shoulders. Only the first in the group – the head of the caterpillar – is not blindfolded. The teacher tells the children that the caterpillar wanders slowly through the landscape and stops if it feels like it. The rest of the caterpillar's body can relax their hands at that moment and feel what is around them. After hearing a signal (clap), the pupils forming the body reconnect and the caterpillar moves on.

At the teacher's signal, the caterpillars quietly disperse and lead the others to interesting places (passing the thickets, the moss cushion, piles of rocks, etc.). The head stops at these interesting places and lets the rest of the caterpillar touch everything for a while. After 15 minutes, the teacher stops the caterpillars' journey, the caterpillars stop, the pupils take off their blindfolds and try to find the same way back to the starting point.





**REFLECTION:** In the finish, caterpillars can communicate impressions in their groups, or within the entire class sitting in a circle.

*Did the pupils recognize what they were touching? What was it like to be led by a classmate? Did they have to align their stride so they didn't trip over each other? Was it hard to stay quiet and not laugh? Did everyone manage it? What did they feel most intensely while wandering around (the need to tune in to others, stops, finding the way back...)? What was it like for the heads to lead the rest of the caterpillars?*

**NOTE:** If you have a very lively group of children, it is better for each group to be accompanied by one adult, who will help the group to maintain calm and focus.

## 7 Listening to the forest sounds — forest concert<sup>5</sup>

As evidenced by the results of the monitoring of common bird species, in our country, the farmland bird species are declining at the highest rate. Since 1982, the number of these species decreased by about a third. The main reasons for the decline of farmland birds include changes in agricultural management methods and in the overall approach to the landscape, especially the drainage of wetland sites in the last century or socialist land consolidation. The start of increased use of chemistry and rapid mechanisation also contributed to the decline of the number of bird species.<sup>8</sup>

It has been scientifically proven (e.g. in the prestigious scientific journal *Nature Communications*) that contact and connection with nature helps maintain physical and mental health. Sound is essential in contact with nature. As its quality declines, so does the interconnectedness between humans and nature. This can be a major problem in the deepening global ecological crisis — with decreasing connectivity with nature, there is also a reduction in pro-environmental behaviour and an increasing degradation of the environment. In spring, take the pupils out into nature, into the woods, and listen to the birds singing. Tell them also that the variety and intensity of birdsong is diminishing and it is possible that one day birdsong will die out completely. In our country, we can support birds and their species diversity by planting groves, species-rich forests, by protecting birds of prey, etc.

The following activity can be freely linked to previous games — Intuition Game / Blind Caterpillar.

**TARGET:** Quieting, enhancing perception, concentration, focus, connection with nature, cooperation.

**TIME:** 40 min



**PROCEDURE:** The teacher asks the pupils to close their eyes for a moment. They begin to observe their breath again. They can count while breathing in and while breathing out to see their natural breathing rhythm. Then the teacher shifts their focus to sound. *Can anyone hear the blood flowing in their body? Can you hear your stomach growling? Your heart beating? Anything else? Do they feel the rhythm? If they can't hear anything, what other sounds are disturbing them? What do they hear around them?* There will be a moment of silence for listening.

After a while, the teacher invites them to open their eyes and share what they have heard, felt, perceived. *Did anyone hear birds? Leaves rustling in the branches? Wind?* Inside the forest we can listen to the wonderful forest concert if we are receptive.

Pupils can join in the music of the forest after the forest concert with their own musical instrument or even create their own forest orchestra. Everyone will find their own musical instrument – two sticks as percussion woodblocks, a forest





drum: a piece of log + a drumstick from a smaller branch, 2 leaves or branches to rustle against each other, stones for tapping... imagination is boundless. Give the pupils 5 minutes to find their own musical instrument and try it out. Gather the pupils in a circle and have each one introduce his or her instrument. Then divide the circle into 3 parts forming a gap between each part. Then invite the pupils to start the concert all at once. The result will be noise and chaos.

End the chaos and the teacher-conductor will call on the "orchestra" to work: "Now only the right side plays, the left side joins in, everyone goes quiet and the centre joins in..." The conductor variously mutes, amplifies, stops, joins the sections.

**REFLECTION:** After the concert is over, discuss how the concert was perceived. *Which concert did the pupils like? Did the conductor's leadership succeed in turning the chaos and noise into a likable concert? How satisfied are the pupils with the final composition? Would they play it in public? What attracted them during the concert?*

## 8 Web of life (biodiversity)<sup>3</sup>

### BIODIVERSITY

Biodiversity refers to the diversity of living organisms on Earth, which includes both species diversity and ecosystem diversity. Human activity is causing degradation of ecosystems and the environment, threatening populations of many species and depleting irreplaceable natural resources, all of which means a significant reduction in biodiversity on a global scale. It is estimated that biodiversity loss is currently 100 to 1,000 times faster than if it were caused by natural processes alone. Moreover, the pressure on ecosystems is increasing with the growing demand for agricultural land, food, etc.<sup>9</sup>

The loss of biodiversity affects the life of the entire human society, as ecosystems with a higher level of biodiversity provide food, medicine, irreplaceable clean water, contribute to protection against floods or increased erosion, and provide good conditions for health, quality of life and recreation. If the deterioration of ecosystems due to human activity continues, this will inevitably lead to a gradual loss of the ecosystem services, which are essential for humans.<sup>10</sup>

**TARGET:** Awakening the sense of belonging, ecology – understanding the concept of ecosystem, cooperation, developing empathy, concentration.

**TIME:** 30 min

**AIDS:** Wool ball, optional: large paper, blank drawing papers, glue, crayons, marker

**PROCEDURE:** The pupils and the teacher form a circle. The teacher then asks the children if they have heard the term ecosystem? *What do they imagine when they hear that word?* The teacher asks them to guess. He/she listens to the pupils and then adds the correct answers/summarises them.

*Ecosystem is formed by every living organism (plants, animals, fungi, bacteria...) and non-living object (stones, air, water, weather, sunlight...) in a certain area that interact with each other. A forest, for example, is a very complex system, with a plethora of individual components that make up the system.*



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The teacher holds the ball and says that he/she is a buzzard. He asks what does a buzzard eat? The pupil who answers first, saying that it eats for example fieldmice, is thrown the ball. He/she hooks the string behind his/her index finger (without actually tying it around the whole finger). He/she then asks another question – what does a fieldmouse need to live? Whoever answers anything related to the fieldmouse (*burrow, water, warmth...*) is the next one to grab the ball and hook the string behind his/her index finger. And this person also thinks of another question related to the previous answers (e.g. where does it drink water from?). The ball thus travels among the pupils until everyone is entangled in the web of life – the ecosystem.

After the whole ecosystem has been linked into a web, the teacher says that one of the links in the ecosystem was destroyed (e.g. a tree has been cut down by lumberjacks, *water* has dried up in a dry hot summer, etc.). The pupil representing this tree/water drops the string. Anyone who feels the loose string is somehow affected by the loss and also lets go of the string. This is repeated until the loss of one member is felt by everyone in the ecosystem.

We are all in the same boat, any harm or disruption to one part of the ecosystem will affect the whole ecosystem and therefore all of us. This also applies to “pests” and “weeds”. Nettles, for example, are food and home for the larvae of the peacock butterfly. The peacock butterfly is a beautiful butterfly that pollinates a large number of flowers and is itself food for many birds, such as tits.

The teacher can then ask the pupils to draw (or write) on a paper who they were representing in the ecosystem. Cut the pictures out and glue them on one large piece of paper and connect the individual pictures with links. Then add any other animals, plants, and inanimate objects that you can think of in relation to the forest.

**REFLECTION:** *How did the members of the ecosystem feel? Who is affected by the loss of someone/something in the ecosystem or its collapse? Why? Who hasn't been affected? Why? What do the pupils feel after the game? What can be done to promote sustainable ecosystems? Do such links work elsewhere outside the forest?*

## 9 My life as a tree<sup>1</sup>

**TARGET:** Connecting with nature, understanding the importance of species and age diversity of the forest, developing empathy and imagination.

**TIME:** 30 min

**AIDS:** Optional auxiliary text for the teacher

**PROCEDURE:** For this game it is good to find an area where the forest is cleared and where it is fully grown, ideally with shrub or undergrowth – the game will be played on the border between these areas.

The teacher asks everyone to find a place they like. Pupils can stand on a stump, among grown trees, hide in the undergrowth, etc. Of course, they should still be able to hear the teacher's narration well (the teacher can write the narration in advance and keep it on hand during the narration):

Every child is now a seed of a tree. The children are squatting down and representing the seed. The seed is in the soil, where it is quietly sleeping. Spring comes and the seed starts to feel the sun. The water wakes it up. And the seed is coming above ground. First just one petal peeks out, then another. The tree begins to grow stronger and taller.... The



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teacher begins to talk about the journey of the seed and its subsequent growth. Along with the narrative, the pupils – the trees – begin to grow as well. They stretch up to the sky, stretching their branches. They let the energy of nature flow through them.

Strong winds will come. The teacher blows and the trees bend and rustle. There's a big storm coming, a downpour and everyone and everything is wet. But the trees stand firm. Then it's quiet again. It's a hot summer day and the sun is shining brightly and the trees are also very hot, they need water, they are very thirsty. After a while the rain comes and all the trees can finally drink. For some the water lasts a long time, for others just a shorter moment. A herd of deer arrives and enjoys eating the shoots of trees – the teacher walks among the trees and tastes their branches. He/she does not notice those that are hidden in the undergrowth and leaves them alone, or he/she tastes only the branches hiding the pupil.

**REFLECTION:** The teacher calls the pupils into a circle and asks *how they felt at their spots during the storm and strong winds? Were they protected, or did the wind shake them wildly? Why was it? Did it break off someone's branch, or a tip? Did it uproot any tree? And what about the time when the heat came? Who felt well and who was sweating and thirsty? Whose water lasted longer? Which part of the forest holds more water – inside the forest or in the clearing? Who was afraid of the deer? Was it like a game of hide-and-peek? Did the trees survive, or did any of the children get uprooted by the wind? Did any trees die or wither due to the bark beetle attack?* The teacher tries to show the children a suitable area for the growth of new trees with the right questions.

### A TREE SEED

A tree seed, which thrives in a particular habitat, will take hold and grow in soil with sufficient moisture and nutrients. Each tree species has different life requirements and each also performs different functions. For example, the Norway spruce is a hardy tree that can survive in poor quality soils and can cope with relatively harsh climates. On the other hand, the roots of European beech trees reach much deeper for nutrients and it requires more nutrients than the spruce.

When the spring sun awakens the seeds, soon the soil under the protection of the shelterwood looks as if sprinkled with tiny seedlings. The shelterwood produces new saplings, but also protects them like a coat from direct sun, frost, and other adverse effects. Such a microclimate can also partially replace forest cover of dying standing trees. Small trees need to grow as quickly as possible and not succumb to the pressure of fast-growing grasses, brambles or ferns that would restrict their light and water supply. The forest weeds and the animals that like to graze and eat the tops of young trees will naturally reduce the number of future healthy and sturdy trees. A compact forest cover is then made up only of healthy and strong trees, chosen by nature to provide shelter, food and oxygen for the forest's inhabitants for the rest of their lives.<sup>2</sup>





## Where does water come from in a forest?

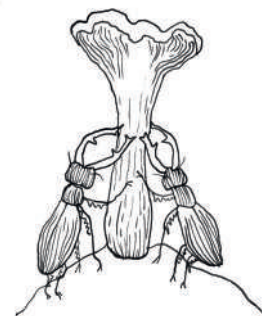
**TARGET:** Probuzení zájmu, úvod do odbornější části.

**TIME:** 15 min

**AIDS:** Work sheet, crayons

**PROCEDURE:** The teacher can introduce the activities related to water retention in the forest with an educational video<sup>11</sup>:

<https://edu.ceskatelevize.cz/video/5754-funkce-lesa-zadrzovani-vody?vsrc=kolekce&vsrclid=co-umi-les> (2:29 min)



After watching the video, the teacher can ask the children the following questions:

*What was the video about?*

*Did you know anything of what was said in the video?*

*Did you learn something you didn't know?*

*What did you find interesting about the video?*

*Did anything surprise you?*

*Would anyone like to know more or in more detail about where the water is held in the forest?*

(If not, the teacher can rephrase the question at the end of the lesson/day as part of the reflection – see below).

The teacher hands out the work sheets “Water retention in the forest” and lets the children complete the first two tasks. Together, they discuss the answers circled by the children – first in blue, then in green. Finally, the teacher asks the pupils to circle in red the pictures where they are not likely to find water in the forest.

The teacher then asks the pupils a question:

*Do trees need to “drink”? Can a tree live without water?*

*What does it need water for?*

Talk with the pupils about what they think of the questions (older pupils can write down their ideas) and come back to the answers later after completing the experiments on vascular bundles, photosynthesis, evapotranspiration and gluing faces (activities 10.1–10.4). Adjust the complexity of the tasks to the age, sensitivity and mood of the children.

The following activities should help the pupils find the answers:

- distributes water with nutrients from the soil to the leaves through tubes in the trunk
- produces sugar to feed on from water and sunlight in the leaves
- evaporation of water cools it down
- uses water to make a resin to defend itself against pests
- ... (add more?)

**TIP FOR TEACHERS:** A controversial point in the worksheets is rocks, where some rocks (rocks) can hold water inside, while others cannot (e.g. some types of sandstone are porous, so they can hold water, while granite or diorite rocks do not hold any water). Let the children discuss which elements contain water and which do not contain water. Nothing will be circled in red except rocks, so we find that water is found almost everywhere.





# 10.1 Where nutrients flow (colouring the vascular bundles)<sup>12</sup>

Every life form is dependent on energy supplies. Plants need nutrients and water to grow, which they draw from the soil via their roots. The transfer of nutrients from the roots to the leaves is ensured by vascular tissue that runs through the bast between the wood and the bark.<sup>2</sup>

**TARGET:** Understanding water transport inside leaves.

**TIME:** Preparation 5 min + 2 h colouring (speed depends on temperature and humidity, leaf blade size, airflow. If colouring takes too much time, let the experiment run overnight) + 20 min for the reflection and completing the work sheet.

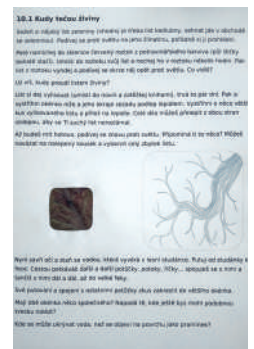
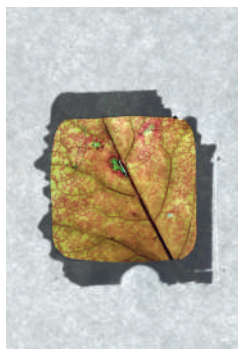
**AIDS:** Various leaves/flowers with white petals (kohlrabi, lettuce, celery, marguerite, daisy...), razor blade, raspberry red food colouring, spoon, water, several glasses, magnifying glass, work sheet

**PROCEDURE:** The teacher may instruct the pupils to bring one of the aforementioned leaves/fresh flowers or provide the plant material himself/herself.

Fill a few glasses with cold water and stir in a teaspoon of food colouring (to make the solution deep red). Put the leaves and flowers in the glasses and let them stand at room temperature until they are dyed. The experiment can take tens of minutes to several hours. Meanwhile, you can perform the following experiment with vascular bundles.

After dying, cut the petioles with a razor blade. The dyed vascular bundles through which the water and dye flowed will be visible on the section. Examine the leaves against the light; you can also examine them with a magnifying glass.

The vascular bundles form several thick "tubes" in the petiole, which gradually branch into thinner "tubes" in the blade. These supply water and nutrients to all the cells of the leaf. The food dye solution travels through the woody part of the vascular bundles. Draw the leaves with the dyed vascular bundles in the worksheets. You can also press the sheets and glue them to your picture when dry (the dry leaf can be cut into smaller parts so that each pupil can have a piece of the leaf). If you want the vascular bundles in the worksheets to be more visible, cut a small window (smaller than your piece of paper) in the work sheet, cover the edges of the window with glue and glue the pressed piece of your leaf. Then look through the paper against the light.





**REFLECTION:** Let the students formulate their own answers to the questions of how, by what and from where the plant distributes water.

## 10.2 Birch bubble blower (experiment with vascular bundles)<sup>13</sup>

**TARGET:** Understanding evapotranspiration (evaporation and condensation of water by plants).

**TIME:** 60 min.

**AIDS:** Cooker, small pot with glass lid, water, 3x plastic bag with no holes, 3x string, measuring cylinder, permanent marker (ozkoušet, zda vydrží var)

**PROCEDURE:** At the beginning, the teacher will play a video to introduce pupils to the water cycle:  
[https://www.youtube.com/watch?v=Zm\\_lqw4ui2M](https://www.youtube.com/watch?v=Zm_lqw4ui2M)

After watching the video, the teacher can refer to the video and the previous activity and ask the students what happens to the water when it flows through the trunk/stem into the leaves? Have you heard that trees have "mouths" (stomata), just like us humans? The teacher can prepare and show an enlarged photograph of the stomata (see teacher's aids). Like us, the plant breathes through its "mouth", exchanging gases with its surroundings and exhaling water.

The teacher asks the pupils: Do you think that the plant leaves can exhale water and that this water can liquefy again? Can you imagine what such evaporation and condensation of water looks like? The teacher invites the children to investigate – he/she divides the pupils into detective groups of 5 and asks them to try to think of an experiment to prove:

### (a) evaporation

The teacher prepares the aids for the pupils: pot, permanent marker, cooker, water. The pupils work in groups for 10 min to think about and draw their experiment designs on the work sheet. The groups will then present their proposals. You may be pleasantly surprised by the pupils' wit and ideas. Encourage them and tell them that every proposal is appreciated and good. It may not lead directly to the goal, but it may reveal something different, new, revelatory... This is how science works.

If any of the proposals corresponds to the following procedure, feel free to follow it. If not, try to guide the pupils to the correct procedure with appropriate questions, for example:

### WATER FLOWING

Water forms networks in a similar way everywhere. In the leaf, as well as in the soil or in the river network. It combines from droplets into tiny capillaries, into larger and larger trickles, into streams, rivulets, rivers...

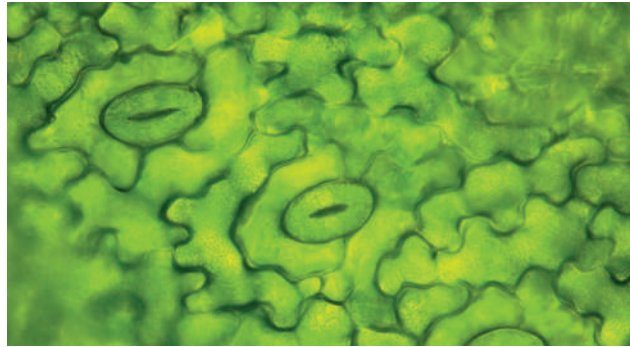
Through the leaf it flows in turn through the thick petiole in thinner and thinner veins to the edge of the leaf, where it evaporates as water vapour.

And what about in the soil? Individual droplets are absorbed into the soil, some of which evaporate, others travel deep, deep into the soil (tens to hundreds of metres). At first they are droplets, then they merge into capillaries, into trickles, then into underground streams and rivers, until they reach deeply buried underground lakes. The water is crystal clear. Humans often draw water from these lakes for their own use. Let's appreciate it, it doesn't have to be there all the time. It is in danger of being polluted by humans and drying up.





Source: www.istockphoto.com



Place a smaller pot of water on the cooker. Before heating, mark with the permanent marker the water level. Then bring the water to the boil and let it evaporate for 6 min (to be tested) in an uncovered pot. After the cooker has been switched off and the level has stabilised, check how much the water level has dropped. You can see how much water has evaporated from the pot in 6 minutes by refilling the water to the original mark using a measuring cylinder. This proved that water can **evaporate and "escape" from the pot.**

#### b) condensation (liquefaction) of water vapour

During the 6 minutes of boiling water, the teacher prompts the pupils to consider *how the escaping steam from the pot could be captured and liquefied again?* He adds a glass lid among the aids for the pupils. Pupils have 5 minutes to think about and draw the experiment in their work sheets. Each group then presents its proposal again.

**PROCEDURE:** When the pot is covered with the lid, water will condense on the lid. This is condensation. Water vapour condenses into liquid water on contact with a cold object.

You can check whether the whole process works for plants outdoors. On a sunny day (the sun in nature serves as our cooker – it provides energy, warms), enclose a few leafed branches in a plastic bag (add photo) for 24 hours. The water that evaporates through the vents in the leaves during the day condenses back to a liquid state at night (when it cools down). If there was no plastic bag around the twig, the water would condense in the surroundings, for example as dew. In the work sheet, circle what water vapour can turn into in summer (rain, hail, dew, fog) and what it can turn into in winter when it freezes (snow, frost, hail, fog). In the work sheet, pupils can draw their favourite tree and use arrows to show where and how the tree transports water.



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the beginning of the experiment



after 24 hours



result of the experiment



**SMALL WATER CYCLE**

Some of the water that falls on the landscape soaks into the soil. This water then feeds into the springs of streams and rivers and the water flows away. However, the vast majority of rainwater does not run off the landscape. Either directly or through plants, it evaporates back into the atmosphere, where it precipitates into either clouds, dew or rainwater and remains in the surrounding landscape from where it evaporated. That is the **small water cycle**.

A small water cycle produces mild rainfall. These are less intense, but more frequent. But we've disrupted it, and this type of rainfall is becoming scarce. It hardly ever rains over cities and farmland because the heated dry air doesn't let rain clouds in. The water from the clouds therefore falls on the mountain slopes causing local floods. And then every once in a while, a large frontal system comes from the sea causing a big shower. The dry landscape is unable to cope with such large surges of water.<sup>15</sup>

The role of vegetation in the distribution of solar radiation and the water cycle in the landscape is also referred to as the "air-conditioning effect" of vegetation in the landscape. In a landscape supplied with water and covered with vegetation, a substantial part of the sun's radiation (up to 80%) is used for water evaporation. The difference in the distribution of solar energy on a drained area and in vegetation well supplied with water on a sunny day is enormous. A mature tree with a crown radius of 4m evaporates about 200 litres of water on a clear sunny day. It also uses a large amount of solar energy for evaporation. Therefore, this energy is not released as heat we could feel. Trees (and vegetation as such) cool themselves and their surroundings in this way. Moreover, this is double-acting air-conditioning effect – cooling the landscape by evaporation and warming it by condensation (especially at night), which contributes to balancing temperature gradients in the landscape. Heating through condensation is of great importance for farmers, fruit-growers, winegrowers, etc., during sudden spring frosts.<sup>14</sup>

**REFLECTION:** *How did you like the investigative detective work? Did you enjoy coming up with new ideas? Did anyone find the research challenging, did they find it hard to imagine something new and unknown?*

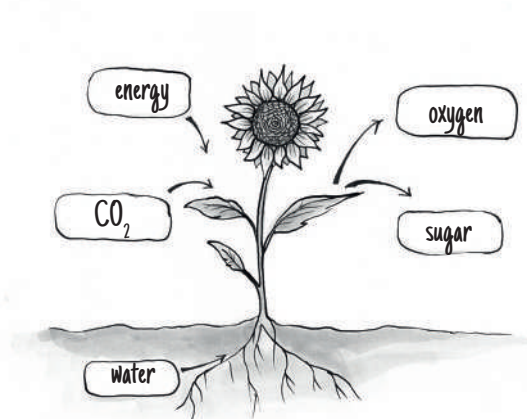
Peoples' talents differ. Someone is a good scientist, researcher, another is an excellent painter, graphic designer, mathematician... Value each member of the group, because everyone contributes with something different and together you can form a great whole!





## 10.3 How green plants and trees produce oxygen (photosynthesis)<sup>16</sup>

Apart from transpiration, plants mainly need a source of energy for their growth. The main energy source is the sun. The plant uses sunlight to produce energy-rich sugars from the carbon dioxide and water it takes in. At the stage when the plant receives the sunlight energy, the water is decomposed and oxygen is released. Oxygen is then used by other organisms to breathe. During this biochemical process called photosynthesis, carbon dioxide is turned into the sugars that the plant accumulates in its body. Plants therefore provide a rich source of food for mammals, birds and insects. Dead plants and animals decompose and the nutrients depleted from their bodies are returned to the soil<sup>2</sup> where they are used again as food for soil organisms.



**TARGET:** Understanding the concept of photosynthesis and its importance

**TIME:** Introduction and preparation 15 min, experiment duration: 15–30 min (?) (depending on external conditions)

**AIDS:** Mirror, transparent bowl of water, larger green leaf (freshly picked), magnifying glass, baking soda, spoon

**PROCEDURE:** The teacher introduces the experiment with a few questions to discuss with the pupils:  
We already know that trees and green plants “breathe” and that they “exhale” water.

1. *Do we humans exhale water too? What happens when you breathe outdoors in the winter or on a cold morning? (water vapour is coming from our mouths)*
2. *And what happens when you breathe on a mirror? (the mirror gets wet, because water condenses on its surface). Try it out. So it is not only the trees that breathe out water, but also us humans.*
3. *Are we exhaling something other than water? (carbon dioxide – pupils can be reminded that this is the same gas that was discussed during the climate change discussion)*
4. *What would happen if someone locked us in a small airtight room? Could we stay there for long? (No, we would use all the oxygen by breathing and suffocate).*
5. *Where does the oxygen in the air come from?*
6. *Have any of the pupils heard the term “photosynthesis”? Anyone have any idea what that word means?*

Add 1 teaspoon of baking soda (a source of carbon dioxide) to the water and stir. Place a larger fresh green leaf on the surface of the water with the underside facing the water (nákres nebo fotka experimentu). Place the bowl with the leaf near a light source – either a window or a table lamp. With an intense light source, small bubbles should form on the







underside of the leaf after 10 minutes. The bubbles are visible to the naked eye, you can use a magnifying glass to see them better. (Try the experiment without baking soda - opinions vary on effectiveness.)

The experiment can be repeated with boiled water that is free of carbon dioxide. In this water, bubbles should not form on the underside of the leaf. You can then add the baking soda solution again to restart the formation of oxygen bubbles.



If you want to show the students that only green plants produce oxygen, you can do the experiment in a second bowl with an organism that does not contain chlorophyll (green dye) – an onion, a mushroom, the root of a plant, etc.

### STOMATES

Plants breathe with their leaves and all their green parts. On the underside of the leaves, they have breathing holes visible under a microscope, which can open and close like our mouths. They are not called mouths like ours, they are called stomata. The tree transports water from the soil through its roots and trunk and it then reacts with sunlight and carbon dioxide in the leaves. This reaction produces sugar and oxygen. The tree needs sugar, as we do, for food. We need oxygen to breathe.

**REFLECTION:** *Can any of the pupils describe in their own words what happens when green plants breathe? What substances are involved in photosynthesis, where they come from and where they go to? Why is photosynthesis essential to life on Earth?*

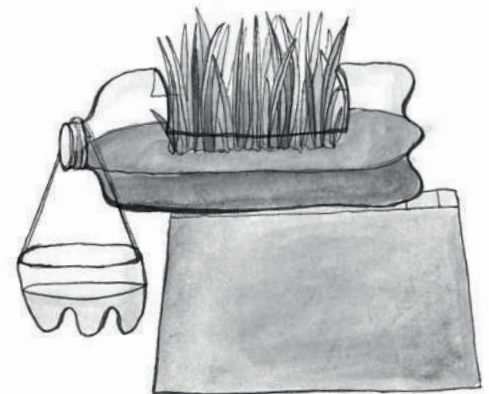


## Protective soil cover<sup>17</sup>

The experiment can be carried out both indoors (activity 10.5) and outdoors (activity 11.1). Choose the option that is more suitable for you at the time. A similar, related experiment can be found in the chapter concerning soil (Soil erosion experiment).

**TARGET:** Getting an idea of how soil cover (plants, trees, moss, fallen leaves...) protects the soil from erosion and helps clear water.

**TIME:** 30 min





**AIDS:** 4 plastic bottles, knife, scissors, string, some soil, leaf litter (layer of fallen leaves under the trees including deeper decaying layer), moss, water, glass/jug, dropper.

**PROCEDURE:** Cut off part of the wall of the 2 bottles. Lay the bottles with cut-out sides flat and fill them with soil below the level of the neck (so that the soil does not block the drain hole). Place the bottles on the edge of a table so that the necks protrude over the edge and secure the bottles at the sides so that they do not roll. Place some soil in the first bottle, add a layer of leaf litter and place moss on top (remember to leave the drain hole clear). Leave only the soil in the second bottle – this bottle represents bare soil, such as a ploughed field, soil in a cornfield, etc. Cut off the bottoms of the remaining bottles to use as containers to catch the water. Make 2 holes at the top edge of the container through which you thread a string that will be used to hang the container on the neck of the bottle with the soil (see picture). *When you have everything ready, try to guess with the children what kind of water will flow out of the two bottles when you pour a glass of water on the soil in each of them? Try to note the shade and intensity of the colour. Make a note in the work sheet in the caterpillar's header. Then you can start the experiment. Slowly pour an equal amount of water onto both substrates and observe the colour of the water flowing out. Is the colour of the water coming out of both bottles the same?*

The plants that grow in the soil protect it from erosion. This means that they prevent it from being degraded and carried away by water and wind. They also help keep the water clean. The denser the plant cover, the more the soil is protected.

Some plants and fungi can also clean chemicals from water and soil. This is used for example in root waste water treatment plants. In nature, reeds, cattail or mushrooms can function in a similar way.

**REFLECTION:** *Did the colour of the water differ in the experiments? Why? Is it important to have plants and trees growing on the soil? What happens in heavy rain or strong winds to the soil in a field that has been freshly ploughed or where corn is growing?*

### HOW PLANTS AND TREES PROTECT THE SOIL

With heavy rain, the soil quickly turns into muddy slurry, which the water carries to the nearest stream. How much soil is carried away depends on whether the soil is exposed (e.g. on a field after ploughing or harvesting) or whether grass, shrubs or trees are growing on it. Raindrops pick up a lot of speed as they fall to the ground and can be very hard. With every drop that hits the soil, a little bit of soil is ejected into the air. With all the drops of a heavy rainfall, it makes a very large amount of soil. If the soils is covered with grass, it is partially protected. If there are trees on the soil, it is even better. Before hitting the ground the drops hit the leaves and branches of the trees and break and shatter, after that they slowly drop and run down. In the forest, fallen and decaying leaves/needles or moss also cover and protect the soil. In such an environment, water soaks in slowly and the soil stays in place.

## 10.5 Absorption Experiment I

*Did you know that the amount of water retained depends on the age of the forest and its composition? For example, a 300-year-old fir tree weighing 200 kg can hold up to another 200 kg of water!*<sup>18</sup>

Healthy forests and wetlands are extremely important. They can hold huge amounts of water and gradually release it back to the surrounding landscape. This is how they keep the climate balanced and how they draw clean groundwater into the bedrock, from which humans then obtain drinking water.



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**TARGET:** Understanding the importance of water absorption in the process of water retention and gradual release, the importance of water in natural processes.

**TIME:** 40 min

**AIDS:** Blackboard sponge, measuring cup, measuring cylinder, tray, stopwatch, paper napkins, 3 chocolates (or other rewards)

**PROCEDURE:** The teacher festively invites the pupils to participate in a guessing contest. He/she prepares 3 prizes for the winners (chocolates that can be divided into cubes are suitable).

The teacher introduces the pupils to the experiment: the teacher or one of the pupils pours a known volume of water (e.g. 2l) into a measuring container. The teacher asks for a pupils' guesses of how much water the sponge can absorb. *Will it absorb half of the water in the container? More, less? How long will it take for the sponge to release the excess water?* Pupils write down their guesses in their work sheets. Another student takes the sponge and dips it into the water. He/she lets it fully soak. When the sponge is removed from the water, another student starts the stopwatch and tracks the time it takes for the sponge to release the excess water. The tracking can be stopped when the water from the sponge is slowly dripping off. Then the student puts the sponge on the tray.

Record everyone's guesses on the board. While including the guessing portion of the experiment take into account the age and ability of the pupils.

*How long did it take for the water to flow out of the sponge?*

*How much water did the sponge hold?*

Counting results can be used as a mathematical challenge. Ask the children how to find out *how much water has soaked into the sponge?* (Measure the remaining water in the container by measuring cylinders and subtract the result from the initial volume.)

Compare the pupils' guesses. You can give 2 rewards (for guessing the time and the volume of water in the sponge) to the pupils with the closest guesses (older pupils), or divide them among the pupils so that everyone gets a share of the chocolate. Those with the closest guesses can have a bigger piece, the others a smaller one, or even just a tiny piece depending on the results (younger pupils).

You can then continue to work with the work sheet. Pupils can try to guess what objects can act as our sponge in the forest? Pupils circle their guesses in the work sheets (forest soil, moss, fungi, dead decaying wood).

Pupils can also try to think of an answer to the following question. The teacher writes the answers on the board, at the end he/she selects the correct answers with the pupils, and tries to guide the children to the missing ones with appropriate questions. Older pupils can write the answers in their work sheets.

*Why is the ability to soak up large amounts of water in the forest important?* (source of water for plants and animals, protection against drought and flooding during heavy rains and snowmelt, slowing runoff during heavy rains / flash floods, water is part of the natural cycles...).

You can then leave the sponge in the classroom to dry and check every day to see if all the water has evaporated from the





sponge – you can put a paper or a napkin on it and press it down to see if it gets wet. *How many days did it take for the sponge to dry out completely?*

When the experiment is completed, record the time in the work sheet, and the teacher will distribute the last reward to pupils with the best guesses. You can use the evaluation and distribution of the prize as a festive ceremony to start the next day's activities.

**REFLECTION:** Reflection can be done after all experiments related to absorption have been completed. If you are only doing some of the experiments, see the questions for reflection at the end of Chapter 10.8.

## 10.6 Absorption Experiment II<sup>13</sup>

**NOTE:** You can do the activity in class. If this is the case, go to the woods beforehand to get a handful of peat moss, weigh it down and let it dry.

If you are starting the Absorption experiment II outdoors, you can work your way up to the experiment through the introductory motivational game "Photographic Memory". Collect a piece of wet moss, a piece of wet decaying wood, a piece of wet forest soil, a mushroom? and other natural objects for the "photography".

After the introductory game, you can single out the above-mentioned natural water-holding objects and ask the pupils *what they have in common?* The teacher can guide the pupils to the correct answer (they hold a lot of water) by responding to the pupils' answers by saying "freezin/cold/getting warmer/burning", or by asking questions (*What does touching these natural objects feel like? Would you sit on them in the forest?*), or by recalling the indoor activity Absorption Experiment I during which the children circled the natural objects in the work sheet.

The teacher will ask the students another question to think about. He/she will listen to the answers and help the pupils to choose the right one or try to guide them with appropriate questions.

*Why is it that moss and loose soil retain a lot of water? How are they similar to the sponge?* (they are porous and function similarly to a sponge)

Let's see if the moss really behaves like the sponge we use to clean our board.

**TARGET:** Understanding the importance of the water absorption by healthy soil and by certain natural objects in the process of retention and gradual release of water.

**TIME:** 60 min

**AIDS:** A handful of dried peat moss, a bowl of water, a kitchen digital scale (check the range and accuracy of the scale beforehand, the range should be between x to xxx g.)

**PROCEDURE:** Find a handful of peat moss in the woods. Weigh it after plucking to get an idea of how much water it held in its natural conditions. At the end of the day, bring it to your classroom and let it dry completely. Weigh it (it may weigh around 10 g) and then proceed with the pupils in class and place the weighed dry peat moss in a bowl of water and allow it to soak fully (test how long it can take). Weigh your sample again.





How much water did the peat moss hold (it can absorb up to 16 times more water than it weighs)?  
 How much would each pupil weigh if it could hold the same amount of water as the peat moss?  
 How much water did the peat moss hold when collected in the forest? How much more water could it hold at any given time if it rained?

Record the weights, calculations and drawing of the moss and peat moss plant in the work sheet.

## 10.7 Absorption Experiment III + soil life<sup>19</sup>

**TIP:** You will encounter a similar experiment in the chapter concerning Soil and Agriculture. Include this activity if it makes sense to you in your teaching. It is interesting to see the difference between agricultural and forest land. Forest land is also likely to have richer soil life.

**TARGET:** Understanding the importance of the water absorption by healthy soil and by certain natural objects in the process of retention and gradual release of water.

**TIME:** 60 min

**AIDS:** Spade, tape measure, paper napkin, work sheet, writing pads, crayons, glue, trays, magnifying glasses, a key for identification of soil organism\*

**PROCEDURE:** Try to find an old thick dead log in the forest, preferably rotten and with completely soft wood. *What happens when you push your fingers into it?* (water should appear) Repeat the experiment with moss as well. Find moss in the forest and put a paper napkin on it. *What happens when you put your hand on it?* (it gets wet).

Healthy forest soil functions the same way. Go to a deciduous or mixed forest where there is more tree litter on the ground and the soil life should therefore be richer. You can ask the pupils to first draw in the work sheet what they think the soil looks like about 0.5 m below the ground (show them on a tape measure how deep this is). *Is the soil the same everywhere? What colours can it have? Is it stiff, loose, sticky,...? Does anything live inside it?*

Then take a spade and dig 2 holes to a depth of about 0.5 m (see photo – taken from the Internet, I will try to take my own photo in spring) – one in a place where there are traces of heavy machinery (e.g. after logging) or on a forest path, the other one in an undisturbed forest soil nearby. *What do the soils from both holes look like? What makes them different?* Pupils can first coat the 2<sup>nd</sup> column (soil compacted by heavy machinery) in their work sheets with glue and scoop some soil from each layer of the sample and glue it into the work sheet according to reality. They will similarly glue soil to the 3<sup>rd</sup> column (uncompacted soil).

*When finished, the teacher asks the students if they think the soil profiles are any different from each other? Which one seems more suitable for living organisms? Why? Did the pupils find any animals?*

(Healthy soil is usually brown and loose, with lots of holes in it that take in water and air, allowing organisms to live in it. These organisms are constantly loosening the soil by their activity – creating new tunnels and chambers of different sizes, mixing and fertilizing it. In contrast, the damaged soil is grey, compacted, hard and more or less lifeless from the depth of about 20 cm. Heavy machinery compresses the soil and closes the pores. There is therefore nothing for soil organisms to breathe or drink and the soil is impenetrable to them).





Crumble the soil from both holes from a depth of about 25–35 cm (ozkoušet různé hloubky i zda experiment bude fungovat) into trays and wait for a while. After a while, the healthy soil should start to “move” – the tiny and larger soil organisms present should start to move again after a moment of shock, looking for a way to burrow back into the soil. You can also use a magnifying glass for observation. Record in the work sheet the number of organisms (species) you find. *In which soil is life more diverse?* Using the key\*, try to identify some of the organisms and record 1 in the work sheet.

You may not find soil life. If this happens, talk with the pupils about the reasons why this may be the case (severe drought, excessive moisture after heavy rainfall, soil contamination,...).

\* e.g. Key to identifying soil invertebrates. Rezekvítek, 2021.

Miko, L.: Život v půdě. Příručka pro začínající půdní biology. Lipka, 2019.

**REFLECTION:** After the absorption experiments, you can ask the pupils:

*Do they realize why high water absorption of healthy soil and some natural objects is important?*

*What role does the water absorption of these objects play in droughts and floods?*

*How does healthy soil behave and what are its properties? And what about soli compacted by heavy machinery?*

### PART OF THE LIVING FOREST

Many people might think that dry standing trees or fallen tree trunks – as well as dry branches – have no place in the forest. Where space is given for the natural development of the forest, the opposite is true. Many forest inhabitants find food and a shelter in dead or dying wood. It is therefore an essential part and foundation of a living forest. Decayed trees mean a big economic loss for the owners of production forests. However, where the forest is left with at least some dead wood, the forest is given a chance of natural restoration. Dead wood is part of the constant cycle of natural substances. It is home to fungi, mosses, as well as ants, beetles and many other animals. They all contribute to the slow decomposition of wood into humus. Humus-enriched soil provides the trees with abundant nutrition and retains more water.<sup>2</sup>



Source: www.istockphoto.com





## 10.8 Forest air conditioning<sup>13</sup>

**TARGET:** Awareness of the different temperatures in forest and treeless areas, the importance of trees in cooling the landscape on hot days.

**TIME:** 120 min

**AIDS:** Outdoor thermometers (preferably digital thermometers), work sheets, pencil, scissors, glue

**PROCEDURE:** Take the pupils into the woods on a hot day. Divide the pupils into groups and give each group 1 thermometer. Experience for yourself and use thermometers to measure temperature differences in different locations: in the city outside green areas, in the urban green areas, in a field, in a meadow, in a forest. In the forest, measure the temperature at the edge of the forest and deeper in the forest. You can also test the surface temperature with your bare feet.

Beforehand, the teacher asks the pupils *where they think it will be coldest and warmest?* Pupils record their guesses in their work sheets using cut-out pictures.

In the forest, the teacher asks what happens to us in the summer when it's hot, *when we go to the sauna or when we're running around chasing each other? (we sweat) Does anyone have any idea why this is so? (a moist coating forms on the skin to cool us)* *Where do children like to spend time in nature in the summer heat? (by the water, in the forest) Why? (They can cool in water. At the same time, evaporation of water cools the air near water and in the forest. That's why the temperature is lower there).*

*What temperature differences did the students measure? Why is this so? ("Forest air conditioning" works in such a way that trees, instead of sweating, exhale water with their leaves. This humidifies the surrounding air and the temperature in the forest drops by several degrees).*

According to the pupils, which of the measured environments can hold the most water and therefore evaporate the most water? (The forest, that's why it's the coldest on hot days).

*How can cities be helped to be less hot in summer? (green grass roofs, green facades made of climbing plants, water features – fountains, ponds, planting trees where possible, preserving parks, etc...)*

**REFLECTION:** *Where were the pupils most comfortable on a hot (warm) day? Was anyone surprised by the difference between the temperatures at the measured locations?*

**NOTE:** Work sheets for this activity should be printed one-sided.

### FOREST AIR CONDITIONING

There's a dampness in the forest air. In air-conditioned rooms or cars, on the other hand, the air is often dry. The forest "exhales" water vapour through transpiration during the process of photosynthesis. This not only cools the environment, but is also the basis for rain – it rains more often in forests. Photosynthesis is an essential process for plants to produce sugars from carbon dioxide and water using the sun's energy, which they store and use for growth. The trees also produce oxygen during the photosynthesis process and use some of the sun's energy to convert water into water vapour. This energy would otherwise be used to heat the soil surface.<sup>20</sup>





## 11 Forest air and water purification

**TARGET:** Introduce children to the principles of how a forest cleans water and air.

**TIME:** 10 min

**AIDS:** prepared questions

**PROCEDURE:** The teacher asks the children if *anyone has seen polluted water or air? What polluted the water or the air? Where does the pollution in the air and water come from? Does the pollution bother anyone, anything? Who, why? Has anyone heard of a forest cleaning the air or water? How would that work?*

### NATURAL WATER TREATMENT PLANT

Trees need some of the water that falls during rain for themselves. They absorb it through their roots so that they can drink. The rest of the water very slowly seeps deeper into the soil. Deep means sometimes fifty and sometimes hundreds of metres. At such depths, water gathers to form large rivers and lakes. Many years pass before water gets there. If there is dirt in the rainwater, such as animal faeces or soot, it will be trapped in the soil or rock below. Deep down, the water is so pure that it is safe to drink.<sup>13</sup>

## 11.1 Water filter<sup>13</sup>

**NOTE:** A similar experiment can be done indoors (Activity 10.5). It demonstrates the essential function of plant cover in protecting soil from erosion and the ability of plants to purify water.

**TARGET:** Getting an idea of how water purification works in the forest, demonstrating plant cover as a protective shield against erosion.

**TIME:** 45 min

**AIDS:** Bucket with holes in the bottom (what diameter? – check), watering can, water, bucket, 3 jars, stones, soil, forest litter (decaying leaves) and moss, dropper.

**PROCEDURE:** First, place some stones and soil alternately in a bucket with holes (approx. 0.5 cm? – test). Land in a field looks similar. Prepare some muddy water in a watering can (at least 3 litres? – test) – mix the water with some soil. After mixing, pour some of this water into the jar 1. Then pour the water from the watering can into the “field filter” and watch the water coming out. Catch some of this water in the jar 2.

For the second experiment, pile rocks, soil and leaves alternately into the bucket – dig deep even for decaying leaves, and place a cushion of moss on top. Again, pour the muddy water into the “forest filter”. Catch the water coming out of the bucket in the jar 3.

Stir and then compare all jars. *Which is the cleanest and which is the muddy?* From both.







Draw both experiments in your work sheets. What you are left with in the windows are fine soil particles that have been washed out of the soil by water during the experiment.

**REFLECTION:** *Lišila se barva vody v obou experimentech? Proč? Je důležité, aby na půdě rostly rostliny a stromy? Jak dochází v lese k čištění vody? Co se děje při prudkém dešti nebo silném větru s půdou na poli, které je čerstvě zorané, nebo kde roste např. kukuřice?*

### LANDSLIDES

A dense web of roots strengthens the soil on the mountain slopes. The mosses, horsetails and ferns accumulate rainwater, which can then slowly seep into the ground. In areas where mountain forests are damaged or even dead, huge masses of soil and debris slide into the valleys during rain and snowmelt, creating the dreaded landslides. Such masses of mud can overwhelm entire villages and threaten the lives of their inhabitants.<sup>21</sup>

## 11.2 Air filter experiment<sup>22</sup>

### Opening game The Air Spoilers and Air Purifiers:

**TARGET:** Activation of pupils

**TIME:** 15 min

**AIDS:** Various papers – scratch paper, crepe paper, old drawings, newspapers..., scissors, toilet paper rolls, rubber bands, inflatable balloons, old nylon tights, hole punchers, straws, hair dryers, sweeping brooms, dustpans and brushes, garbage bag

Tell the children in advance that you are going to play the game of Air Spoilers. We all have a rascal in us that likes to make a mess sometimes! Now that's our Air Spoiler. For its spree, make blow guns with children, make "factory chimneys", car exhausts, home chimneys, strong winds carrying sand from the Sahara to us... Children can make a blow gun out of straws — from a small piece of paper they make a small ball, stuff it into one end of straws and blow into a straw — the ball will fly out. Factory chimneys and house chimneys can be made from toilet paper rolls – a piece of tights is attached to one end of the roll with a rubber band. Fill the inside of the chimney with tiny pieces of paper. Then they turn on the hairdryer and start blowing sharp air from below with the hairdryer – the mess from the chimney can fly out into the world. They can also use a toilet paper roll to make a car exhaust or a volcano – this time stretch an inflatable balloon over the bottom end (cut off the narrow part so it can be stretched over the roll). Fill it again with small papers and shoot either horizontally (car exhaust) or upwards (volcano). They can simulate a strong wind by filling the lying roll with confetti from the hole puncher and then blowing strongly into the roll.

Enjoy uncontrolled spree with children and make a serious mess. Tell the pupils that they have 7 minutes — including the production of their polluting object for their task — to make the mess in the world. After 7 minutes, a gong (sound signal) sounds and the Air Spoilers magically turn into Air Purifiers. The task of Air Purifiers is to save the world after the Air Spoilers' spree. They have 3 minutes to clear the world of the flying dust. The teacher hands out "weapons" to the pupils — brooms, cloths (to wipe dust from windowsills, cabinets, etc.), brush and dustpan – and shows them a "black hole" (the garbage bag) that is supposed to swallow all the flying dust. The gong sounds and the teacher tracks 3 minutes to clean up.



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After the gong sounds again, the pupils sit in a circle in the classroom.

The teacher starts asking the students *how they enjoyed the Air Spoilers' spree? Who was more into being an Air Spoiler and who enjoyed more being an Air Purifier? And does anyone think the air can be "dirty"? Did anyone see dirty air? What can make it dirty?* (Dust and ash from domestic heating plants and thermal power stations, flying dust from fossil fuel transport. §In strong winds, soil particles, dust, etc., also enter the air and can travel thousands of kilometres in the air before falling back to earth). *Is this dirt dangerous in any way?* (respiratory problems, poor visibility, premature deaths from health problems, transfer of hazardous substances into the environment)

The teacher can show photos or videos of places where bad smog situations occur.



(illustration photo from the internet)

The teacher suggests that the pupils test whether this is not just an invention and whether some dust particles are flying and settling in their surroundings. *Does anyone have any idea how to verify this?* (e.g. in winter with snow – the flying dust is clearly visible as a grey coating on the snow. Such snow can also be scooped up, left in a glass to melt and the melted water then placed in a petri dish or beaker on white paper. The sediment on the bottom comes from flying dust.) *Where could the amount of dust be the highest and where the lowest?*

Think of 4 locations with the pupils that would interest you for verification of the hypothesis – where the pollution could be the largest and where the smallest. Locations should be: inside the city/village (e.g. near a busy intersection, factory, etc.), urban green area (park), forest at a greater distance from the city/village, you can add your classroom just for comparison. Draw the sites in your work sheets according to your own estimation from least polluted to most polluted (each pupil may have a different order). Evaluate the orders after the experiment and discuss *what is causing the pollution at the site and what/who is cleaning up the pollution at the site?* Record the results in your work sheets.

**TARGET:** Verification of the presence of airborne dust and its concentrations at different locations (depending on the intensity of dust sources and the presence of greenery), understanding the role of green plants in air purification.

**TIME:** Part 1: 10 min introduction + preparation, then depending on the distance of the selected locations.  
Part 2: sample collection (can be done by the teacher or as part of another outdoor activity) + 10 min for evaluation

**AIDS:** 4 large jar lids, white cream, marker



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**PROCEDURE:** Mark the lids on the outside with letters A–D with the marker and apply a layer of white cream about 5 mm thick on each lid. Place the lids at the selected locations (write down which letter indicates which location). Try to hide the lid a little to avoid having it taken away by someone. You can place more of them on the site just to be sure. At each site, take a deep breath and feel how comfortable the air is in that location. Does it smell well? Does it stink? Is it nice? Does it sting? Leave the lids out for a few days. Then bring them back to the classroom and compare their colour. The lid(s) can be placed in the forest by the teacher or by any of the pupils (again, place more than one lid to be sure) who live near the forest. Take photos on your phone. *At which location did the cream trap the most dust? Where does the pollution come from?*

**REFLECTION:** *Did the colour of the cream differ from one site to another? Have you tracked down the sources of pollution and the heroes who clean the air? Did the air smell/stink anywhere? Where did you find it good/bad to breath the air?*



## Bark beetle

**TARGET:** Introducing pupils to the bark beetle calamity, searching for historical and climatic connections, exonerating the “bark beetle” from the blame for the current calamity.

**TIME:** 60 min

**AID:** Insect observation container

Source: www.istockphoto.com (brouk)



If you have a spruce forest in your vicinity, go on an excursion to it, if not, skip the activity.

With the current “bark beetle calamity”, there is a good chance you will find spruce trees infested with bark beetles. Usually, bark beetles attack especially sick, old and weak trees. In forest monocultures, however, it can easily overpopulate and kill all trees in the forest, because spruces in our country have been weakened by long droughts. Mixed healthy forests can resist bark beetles.

The teacher invites pupils in the spruce forest to try to *find spruces that struggle with bark beetles and spruces that succumb to the bark beetle*. In the first case, they can notice that the trunk is dotted with resin drops or find small “sawdust” piles at the tree’s heel. The tree still has needles, but its colour is slowly changing compared to healthy spruces. When students find such a tree, they can mark it for others by gluing natural materials to the trunk to make a face (pebbles, pine cones, grass, bark...). Spruces that have succumbed to bark beetles can be identified by peeling bark on the trunk and a decayed crown.



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Under the remaining bark, they may find a tiny little bug – a bark beetle. If a pupil manages to find it, place it in the observation container with a magnifying glass. If you can't find it, at least explore its corridors. After some time, gather the other pupils and talk to them about what they know about bark beetles. *Has anyone seen it before? Have they heard anyone talking about bark beetle lately? In what context? Do the students know which tree is being attacked by bark beetle? And why has this little bug been causing so many problems in recent years? Has anyone heard the term "bark beetle calamity"? And what could be the cause of this calamity?*

Take a tour to see all the trees marked with "faces" and finally the teacher can tell the children a story from the history of the Czech forest... (text can be printed and taken to the forest as an aid).

*...In the early times (in the 11th century) there were similar forests in the territory of the Czech Republic as today, there were only fewer of them. However, they were very different from today's forests in their composition, with more deciduous trees. At that time, people did not know any plastics, paper packaging, nails and screws ... They only discovered how to process metal - blacksmithing began to develop in our country around that time. And to forge iron, huge amounts of charcoal were needed. This was obtained by burning wood. A large number of trees were cut down for this purpose. And the forests were rapidly diminishing. Forests began to disappear even more widely when people discovered the glassmaking industry. It too needed many trees for the furnaces where the glass was melted. In addition, people began to convert forests into grazing land for cattle.*

*In the 14th and 15th centuries, there were very few forests left. People worried about running out of the sources of wood so they started planting new trees in addition to continuing logging. Actually, they started planting a lot of trees. The kind of trees that suited them best at the time – fast growing and straight. Do you know which kind of trees we are talking about? Even today these are the most prevalent tree species in our country. Originally, however, these trees grew in completely different places than today. High in the mountains, in cold conditions where it rains and snows a lot and where they had plenty of water. (spruces)*

*People started planting them everywhere – even in lowlands and places where water is sparse. They planted "spruce fields" in the landscape alongside the grain fields. Today we call them spruce monocultures. In a spruce forest, almost nothing but spruce grows. No bushes, no grass.*

*At that time, people did not realise that the spruce forests, where all the trees were the same age, were threatened by several dangers:*

*"Acid Rain". The dirt that got into the air from the burning of coal in homes and power plants created a very acidic rain that burned the needles of the spruce trees and they died in large numbers. Measures against this danger have improved a lot today. But thanks to the burning of coal and oil (fuel for cars, planes, etc.) the whole planet has started to warm up noticeably and the rains have changed – the rainfall is less frequent but heavier and the water is not able to soak in adequately. Moreover, the winds often blow stronger. And the think about spruces is that they are a lot like polar bears. Try moving them to Africa... They'll die there. It's too warm for them and there is not enough water. And so the spruces in our country are dying again. They now have little moisture for drinking and for making resin. They use resin to defend themselves against pests (mainly bark beetles). When a bark beetle burrows into a healthy spruce tree, the spruce drowns it in the resin. However, a weakened tree, e.g. by a long drought, has little resin and nothing to drown the bark beetle in. Lots of other bark beetles come to the feast and eat the bast under the bark (they create corridors) and the spruce dries out. Once they finish one tree, they immediately fly to feast on its neighbour. And the spruces can't play hide and seek with the beetles, the bark beetle can see them wherever they look. Spruce trees are growing pretty much everywhere. If the spruces were growing individually, hidden among other trees, the bark beetle would have a very difficult time finding*





them. Maybe it would have found them, but either the spruce would have had enough moisture from the neighbouring deciduous trees to resist the bark beetle attack, or it would die, but the forest as a whole would remain alive because there are other tree species that are not attacked by bark beetles.

Today, thanks to previous experience and long-term observation of old primary forests (forests not managed by humans), we know that we need to grow more diverse, in terms of tree species and age, and drought-resistant forests.

On the contrary, in small areas, early death of forest cover can have a positive effect. It opens up and offers space for new seedlings of different tree species. This helps keep the forests more diverse in terms of species, age and space and thus more stable.

**REFLECTION:** Is it easy to identify the “culprit” of the bark beetle calamity? What needs to be done differently to prevent recurring bark beetle calamity (and other plant-affecting calamity)? What problems do forest and forest land face due to the bark beetle calamity? (denuded land exposed to sunlight and weather conditions, soil compaction and the formation of erosion furrows caused by the movement of heavy machinery,...)?

### BARK BEETLE (SPRUCE BARK BEETLE)

What threatens the life of trees? Snow and wind, frost or damage by animals are the most common reasons for forest to die. Windfalls can trigger an overgrowth of bark beetles or other insects, which can then secondarily cause forest decay as early as in its middle age. The premature decay of the forest cover, in the case of smaller areas, opens up space for a new generation of tree species. As a result, forest maintains a diverse structure in terms of species, age and space.<sup>23</sup>

## 13 New Forest<sup>23</sup>

“You’re never too small to make a difference.”  
(Greta Thunberg)

If you do this activity, we recommend watching the classic short animated film *The Man Who Planted Trees* (30 min) with your pupils beforehand.

### CONTEMPORARY FOREST

Forests as we know them today have very little in common with the original natural forests. Most of them consist purely of spruce or pine trees planted in dense rows to maximize timber yield. Such forests are called monocultures because they consist of only one plant species. The natural forest of our latitude is the mixed forest of deciduous and coniferous trees. The most common deciduous trees in such forest include oaks, beeches, ash, maples, birch and elms, while pine and fir are the typical conifers. In the past, fir, spruce and pine trees grew from the foothills to the mountains. Fir trees used to be relatively common in our forests, but due to air pollution and cutting for construction timber, they have completely disappeared in many places.<sup>21</sup> Climate change is changing the landscape, and in our area, the forests are a clear example of its effects. The time has come to look at the forest not just as a source of wood, but above all as an important element that influences the climate and microclimate, affects the water cycle in nature, captures carbon and promotes biodiversity.





**TARGET:** Awakening and establishing a deep relationship with the forest and the surrounding area, watching the development of the forest in real time, activating pupils and citizens.

**TIME:** Long-term project

**PROCEDURE:** The New Forest activity is a long-term project that requires enthusiastic and committed teachers, quite a lot of effort and a lot of time. However, its value and importance cannot be overestimated. By planting a new forest and caring for it, pupils gain a connection to the area, to individual trees, see the results of their work, gain personal experience with real life, work, cooperation, craft, etc. Moreover, it is a powerful tool in the fight against environmental angst, which today affects not only adults but also youth and children.

By planting your own school forest, you will create a school forest laboratory that can be used with all grades throughout the year. You can also invite parents, former alumni, friends of the school, etc. to plant and care for the school forest. In this way, the activity can be the spark igniting interest in people and leading them to civic activism.

You can use the school forest laboratory for a number of long-term experiments – measuring the growth of individual tree species, monitoring the development of different sites (you can plant trees in one part of the forest, leave other part of the forest to spontaneous succession, fence part of the forest, leave other part without fencing...), measuring various chemical and physical parameters, etc. When planning the planting you will get to know the different trees, their characteristics and habitat requirements, you will also have to deal with the topic of a warming climate. Invite various experts who can tell you a lot about the forest and give you advice.

The entire activity can be a great joyful game for teachers and pupils. To avoid feeling lost at the beginning and to avoid many initial mistakes, visit the website [www.skolniles.cz](http://www.skolniles.cz) or get your hands on the publication *Školní les*. Both come from the school facility for special-interest education Chaloupky, o.p.s., which was the first to plant school forests.

To inspire and motivate teachers and pupils to start their own school forest, we also recommend watching the short animated film *The Man Who Planted Trees* (30 min) or reading the book of the same name.



## Final reflection

Reflection is always recommended after completing the activities. At the very end of the chapter FOREST, take more general look back with the pupils. Remind the pupils of all the activities you have done together.

With younger pupils, you can do this in a form of discussion – ask them questions and let the children answer in turn:

- 1) Which games and experiments did you enjoy the most?
- 2) What have you learned new?
- 3) What didn't you like at all?
- 4) What you did well?
- 5) What didn't go well / what would you like to try again?

For older students, hand out green and red papers labelled "WE ENJOYED / WORKED WELL", and "DID NOT ENJOY / NEEDS IMPROVEMENT" respectively, and let them write their impressions. You can also read them the guidance questions above.



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KAMPAŇ PRO ČISTOU VODU VE ŠKOLÁCH

**PRAMĚNY**  
ZÁKLADNÍ ŠKOLA

Namsos kommune  
Nåvmesjenjaelmien tjetle



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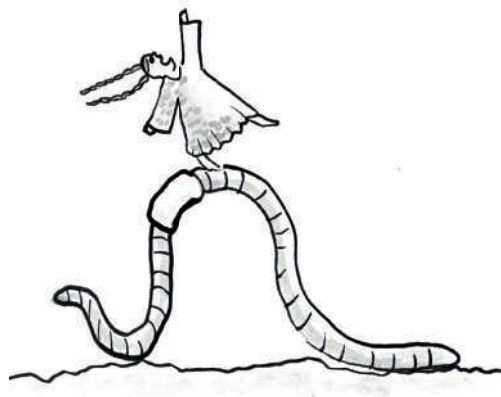


“As the soil, so the bread.”

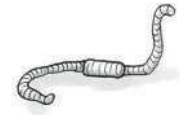
(Czech proverb)

“The nation that destroys its soil destroys itself.”

(F. D. Roosevelt)







Adam was the first man who walked on Earth. His name means “a person who is connected to the soil”. As Adam’s descendants, we too have been fundamentally connected to the soil since the beginning of human kind. Soil is indispensable for life on Earth and for humans. It is literally our greatest asset.

If we observe it closely, we can see that it is an incredibly magical, complex, adventurous and vulnerable world full of life. If you can get a glimpse of it with the children, even the “ugliest minibeast” will become fascinating and will enchant us. They are the ones who **work tirelessly and incessantly** to produce fertile soil.<sup>1</sup> The soil that gives us our **food**. The soil that provides **support and nourishment** for plants and trees. The soil that **binds organic carbon**, helping to maintain climate balance. The soil that **holds** precious **water**. The **richer the life in the soil**, the **better it holds water**.<sup>2</sup> To give you an idea – healthy agricultural land in the Czech Republic could hold as much water as 41-times the volume of the Lipno reservoir.<sup>3</sup>

**Soil is formed** by the slow process of **erosion of rocks caused by water, wind and chemical substances, changing temperatures and the interaction of microorganisms, plants and animals**. One cm of soil takes **hundreds of years** to form.<sup>4</sup>

Soil is a treasure that we should guard like an apple of one’s eye. In the Czech Republic, however, **21 million tonnes of topsoil**, the most fertile part of soil, disappear every year due to poor farming and increasing weather extremes. That is as if we took more than 1.5 million full trucks of fertile soil away from the fields. It will take hundreds of years to rebuild.<sup>5</sup> The amount of soil is also reduced due to erosion by wind and water. It is being damaged by compaction caused by heavy machinery, loss of organic matter, loss or excess of nutrients, pH decline, pollution and loss of biodiversity. Soil degradation also impacts water quality, air quality, human health and food availability and quality.

Healthy soil works like a sponge. It absorbs rainwater and releases it gradually according to the needs of plants and organisms that live in and on it. All organisms need water to live. Healthy soil contains organisms that create a **constantly balanced soil structure** that ensures rapid water absorption and retention. As water flows through the soil, it is also **filtered and purified**. Cleaning occurs both mechanically and through **soil microorganisms**. They take up water, including dissolved substances that enter the soil with water and air. Microorganisms can break down and process most of these substances. Without these organisms, the filtering function of the soil would not work. In addition, they also ensure decomposition of dead biomass, nutrient cycling and help plant growth. In healthy soil, every square metre is home to trillions of bacteria and microorganisms, billions of metres of fungal filaments and millions of tiny animals. That is hundreds of grams to several kilograms of soil organisms.<sup>1</sup>

In soil used for farming, soil microorganisms need to be cared for. A **positive relationship with the land** needs to be restored. Progressive approaches to agriculture do not see land as a means of production. It is about growing healthy soil that provides us with crops. This approach does not imply a reduction in profitability, it is just a different approach to management that promotes equilibrium. Farmers are injecting **more organic matter** into the soil – in the form of manure, compost, plant residues from harvest, green manure that serves as food for organisms. The use of **pesticides and operation of heavy machinery on soil should also be significantly reduced**. Chemical sprays not only kill the target group of organisms, but also kill life in the soil. Heavy machinery compacts the soil and impairs soil permeability to water and gas exchange. Disturbed soil stability increases the risk of water and wind erosion, which further worsens the loss of soil organic matter.<sup>6</sup>

**Restoration of bosks, groves, solitary trees, alleys, etc.** also helps the soil greatly. They allow more small animals and predators to enter the landscape and move soil microorganisms long distances on their bodies. They restore soil life and increase biodiversity. In addition, the bosks and groves form a natural barrier in the landscape, protecting the soil from wind and water erosion. We will talk more about this in the chapter Water in the Landscape.



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Activity name	Activity type (e.g. experiment, video sample, artwork)	Activity information (relevant to what the activity is about: e.g. summary or topic)	Duration (min)	Environment (outdoor/ indoor activity)	Page
1 What comes to mind?	chat	motivation	7 min	indoor/outdoor	130
2 What is the land for?	working with information	cognitive	20–25 min	indoor	130
3 Apple Earth	demonstration experiment	motivation	15 min	indoor/outdoor	133
4 The Secret Code	adventurous search	motivation for erosion experiments, story	45 min	outdoor	133
5 Erosion experiment I – compacted vs healthy soil	experiment, work with work sheet	research activity	20 + 25 min	outdoor	135
6 Permeability	motion	verification of an experiment	20 min	outdoor	137
7 Erosion experiment II	experiment, work with work sheet	research activity	20 + 20 min	outdoor	138
8 Erosion experiment III – along the slope line vs along the contour line	experiment, work with work sheet	research activity	15 + 20 min	outdoor	139
9 Who does the soil belong to	video	revision (erosion) and new topics (organic matter)	18 min	indoor	140
10 The soil is home	imagination	emotional experience	25 min	indoor/outdoor	141
11 A letter from UE — life in the soil	experiment, story, work with work sheet	research activities	all day	outdoor + indoor	142
12 Earthworm house	experiment, DIY project, work with work sheet	observation of the physiology and life of earthworms	45 min	indoor	147
13 Miss Nature	mind map	sorting of ideas and new knowledge	25 min	indoor	148
14 Advertising spot	video shooting, production	sorting of new knowledge and its use	45–70 min	indoor/outdoor	149
15 It warms, it cools	experiment, secret phrase	research activity	90 min	indoor/outdoor	149
16 Planting the seed	experiment, taking care of a plant	taking care of a plant	30 min, long term	indoor	151
17 Making clay hearts	DIY project	creative	30 min	indoor/outdoor	152





18	Closing ritual	celebration	conclusion of the chapter	45 min	indoor/outdoor	152
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## 1 Soil – what comes to mind?

**TARGET:** A motivating activity where pupils find out for themselves what they already know about soil.

**TIME:** 7 min

**AIDS:** Bowl with soil

**PROCEDURE:** Pupils pass the bowl of soil around. They smell and feel it. Then the bowl goes around several times. The pupil who holds the bowl in hand can speak. And he/she can always say one word that comes to mind in relation to the soil. The teacher takes part too and says some words. It should be stressed that they can say absolutely anything that comes to mind.

The teacher can guide the children when it is their turn to hold the bowl by saying: grain, trees, tractor, black, animals, earthworms, water...

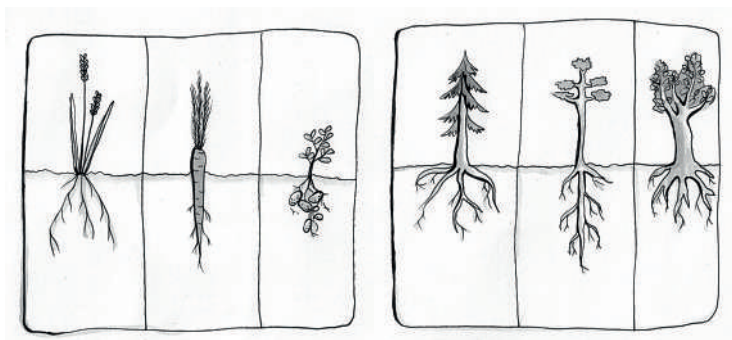
## 2 What is the land for?

**TARGET:** Pupils will learn about the function of soil and why it is needed for the life on Earth.

**1<sup>st</sup> to 2<sup>nd</sup> grade:**

**TIME:** 20 min

**AIDS:** Pictures, photos on the topic of soil function, flipchart, markers, papers, pencils



**PROCEDURE:** The pupils work in groups. They try to figure out what the soil is good for. Each group will be given pictures and photographs that can help them figure it out. They put their ideas down on paper. Together they share their ideas and the teacher writes them on the board (flipchart).

**3<sup>rd</sup> to 5<sup>th</sup> grade:**

**TIME:** 25 min

**AIDS:** Images, photos, short texts on the topic of soil function

**PROCEDURE:** The pupils work in groups. Each group is given a short text about one function of soil. Their task is to understand the text, choose from the many pictures and photographs lying in the middle of the classroom those that

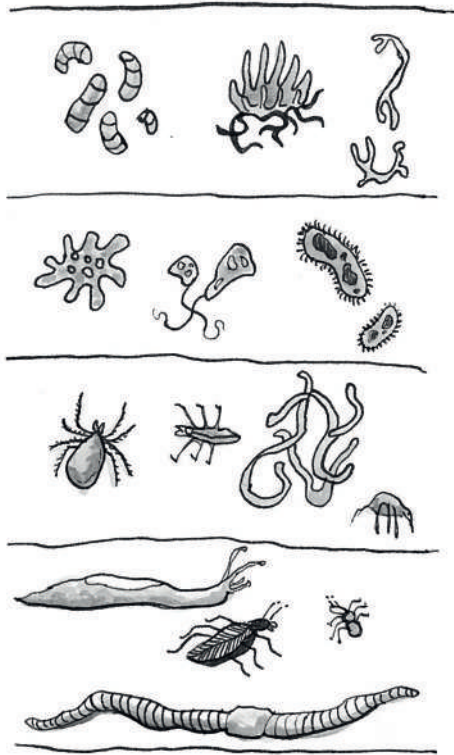


are associated with their text. After the time is up, the pupils describe the soil function in one sentence to the others and show the pictures associated with the given function.



1. Healthy soil is home to a huge variety of soil organisms, micro-organisms and animals that keep the soil alive and functioning. More organisms can live in one handful of healthy soil than there are people in the whole world.
2. Plants and trees use their roots to draw the nutrients they need to grow from the soil. It is a source of food for animals and people. Soil provides nutrients for all the plants we eat.
3. Soil works like a sponge, taking in rainwater and gradually releasing it to plants and soil organisms. Even in drier seasons, soil can sometimes provide water to plants.
4. Healthy soil binds carbon dioxide. The soil releases some of the carbon dioxide back into the air, and some of it is bound as humus, which makes the soil fertile.
5. Soil allows plants to grow, they are anchored in it by their roots. This allows us to grow the crops we eat. Without soil, plants would not be anchored and could not grow.
6. Soil breaks down complex substances into simple ones. Thus the soil prepares simple substances for plants and animals to take into their bodies as food.
7. Healthy soil full of living organisms purifies the water. Soil microorganisms take in water that contains dissolved nutrients and foreign substances from polluted water and air. They can then break down or otherwise dispose of most of these substances.





Source: www.istockphoto.com



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**Soil functions:**

It is home to many animals, microbes and fungi  
 It provides nutrients for plants and trees  
 It retains water  
 It binds CO<sub>2</sub>  
 It serves to anchor plants  
 It ensures decomposition of substances  
 Water purification  
 ...

**NOTE:** This activity can be skipped if you and your children are doing Activity 4 – The Secret Code.

**TIP FOR TEACHERS:** You can watch a complementary video with your pupils on the topic of the origin and purpose of soil. <https://edu.ceskatelevize.cz/video/302-vznik-a-smysl-pudy>

**ATTACHMENT:** Texts on the function of soil.

**3 Apple Earth<sup>7</sup>**

**TARGET:** A motivating activity to make pupils realise how “small” the amount of the Earth’s surface is made up of life-giving soil.

**TIME:** 15 min

**AIDS:** apples, knives, plates

**PROCEDURE:** The pupils follow the steps described below:

- Think of the Earth, our planet, as an apple.
- Cut the apple into quarters.
- Put three quarters aside. These represent the world’s oceans.
- The remaining quarter is land. Cut it in half. What you get is  $\frac{2}{8}$  of the planet.
- Put  $\frac{1}{8}$  aside. These are areas where humans cannot live (polar regions, high mountains, swamps, deserts, etc.)
- The remaining  $\frac{1}{8}$  is the area where people can live, but not everywhere people can grow the crops they need to live.
- Cut this  $\frac{1}{8}$  into 4 parts. You get  $\frac{4}{32}$ .
- Put aside three of them. These are areas too rocky, too dry, wet or cold. This includes places with land that have been developed by man with villages, towns, supermarkets, etc.
- You have  $\frac{1}{32}$  left in front of you. Carefully peel off the skin.
- The skin represents the size of the Earth’s surface which contains the life-giving soil on which the crops necessary for life can be grown.

**REFLECTION:** At the end, the teacher asks the pupils if they were surprised by anything, if they had any idea how little land man uses to grow food, etc.

**ADVICE FOR THE TEACHER:** To illustrate, it is a good idea to write the different parts of the Earth's surface (the world's oceans, land, etc.) on a large piece of cardboard and place the cut parts of the apple next to them.



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## 4 The Secret Code

**TARGET:** Motivation for erosion experiments, revision of the topic of soil function.

**TIME:** 45 min

**TERMS:** Erosion

**AIDS:** The teacher enters the classroom and says that the school has just received a message that there is an important document, an important letter, somewhere on the school premises. Attached to this message in the school mailbox was a map (map of the neighbourhood, school building, garden, etc.) that the teacher brings into the classroom. Together with the children, they try to figure out what the map is and where the marked place is located. Then they go looking for the place on the map. There may be a locked briefcase there with a message: "When you have run around three trees, done 5 squats, and together created one chair for each\*, you may open the case. If you open it too early, the secret message will burn to ashes. If you follow the instructions, it will be a proof that you are able to continue the task together..." Signature: UE (they do not know yet who wrote it).

There will be a secret code in the briefcase. In order to decipher it, they must obtain a key from the teacher. The children are divided into groups and each group must complete a task. For completing the task, the group receives a part of the key, which they combine together into one alphabet.

Each group is given a "packet" of texts and especially pictures, which should help the children to understand what the answer to their question is.

Group 1 task: *Choose 3 pictures to show to your classmates and describe what they show. Question for you: Why is soil important?*

Group 2 task: *How do earthworms and other soil animals help the soil?*

Group 3 task: *What do plants need to grow?*

The children manage to retrieve the key alphabet and together they crack the code:

CODE: "Our beloved Earth is suffering. The erosion is larger and more powerful than ever and is still gaining in strength. It is a great, mighty FORCE. People don't know how to deal with it. It is up to you to understand. Once you understand it, the erosion will begin to weaken and you can gradually win over it! Do not waste time."

After reading of the cipher, the teacher motivates the pupils to investigate together what erosion is and what causes it. And the Earth will be cured of erosion – erosion experiments follow.



### WATER AND WIND EROSION<sup>8</sup>

Erosion (water, wind) is a process of degradation of soil causing a reduction or complete loss of its productive capacity. By the action of water and wind, the soil surface is disturbed and soil particles transported to other locations where they settle.

Erosion is accelerated by certain farming practices, especially on large land units. In the Czech Republic, water erosion is the most serious type of land degradation (together with urban development), as it leads to irreversible soil loss.

The main consequence of water erosion is the washing away of topsoil, reducing the organic matter layer, humus and mineral nutrients in the soil. Erosion reduces the productive capacity of soils and accelerates soil degradation (through changes in soil properties, loss of organic matter and nutrients, reducing yields and consequently causing the need for increased chemical treatment and fertilisation). Soil particles carried by water clog watercourses and reservoirs, reduce the flow capacity of streams, and worsen conditions for aquatic organisms.

In the Czech Republic, 50% of arable land is threatened by water erosion and 14% of arable land is threatened by wind erosion.<sup>9</sup>

The soil is more threatened than it seems, but unfortunately there is little will to change anything about it. Stricter limits would cause significant changes in farming practices, which most farmers oppose. Changes towards greater soil protection are therefore difficult to enforce.

### WHAT TO DO ABOUT IT?

Soil erosion and loss of organic matter can be addressed in many ways.

The most affordable solution is to change the organisation of agricultural production. These are “organisational measures” (anti-erosion sowing practices, change of land types, ploughing methods, etc.). The anti-erosion crop rotation is, in simple terms, a method of rotating crops grown on a block of land designed so as to make sure that no soil exposure occurs on the given field at any time. Farmers use “intercrops”, which are ploughed into the soil for a certain period of time to increase the amount of organic matter. A suitable crop rotation thus creates a year-round vegetation cover that protects the soil surface from falling water droplets.

Another measure consists in the “contour line ploughing”. It is important to supply sufficient organic matter to the soil, or to grow grass on valley lines (the curves connecting the points of greatest excavation on the cross-section through the valley) or on entire blocks of land in unsuitable sloping locations.

Landscape elements such as bulks, groves, alleys, building swales (terrain waves), dividing blocks of land with grass strips and many others should also be restored. To prevent wind erosion, windbreaks are built to slow the wind speed over the field surface.



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## 5 Soil erosion experiment I – compacted vs healthy soil

**TARGET:** Pupils will understand what happens when water erosion occurs and that it takes place on compacted soil.

**TIME:** 20 min preparation + 25 min activity

**CONCEPTS:** Erosion, compacted soil, healthy soil

**AIDS:** 2 rectangular plat dishes approx. 30 cm × 15 cm (or bigger), loose soil, compacted soil, 2 teapots, water, toy tractors, work sheet (one for all erosion experiments)

**PROCEDURE:** Fill the pot dishes with soil. Dish A is filled with soil from the meadow (taken from under a sod), dish B is filled with soil from a field, which we press a little more with the palm of our hand. Place the bowls diagonally on the table as shown on the drawing (photo). The two dishes represent two different fields. The teacher and the pupils can invent the name of the village where these fields are located.

The teacher guides the pupils who work the field according to the instructions:

*“We have here two fields. One is farmed by a large agricultural cooperative in a conventional way, the other by a medium-sized organic farmer who uses the latest knowledge in agriculture and does not use artificial sprays against pests. He doesn't even plough the field. The tractor passes over the first field 10 times during one year. It can only cross the other field 3–4 times.”*

Children can use the toy tractor to simulate its driving across the fields.

Heavy rain will come that year. Question for students: What do you think will happen with the water that comes as heavy rain in field A and field B. Students try to formulate their hypothesis, which they write together on the board and in their work sheets.

Two selected pupils pour water on the top of the pot dishes with soil (field A and B) using two identical watering cans with the same amount of water and observe what happens.

Together they reflect on what has happened. On field A, the water has flown away faster and overflowed over the edge, even taking some soil with it – the water is cloudy = erosion. On field B, all the water has soaked into the soil.

**ADVICE FOR THE TEACHER:** For this experiment, it is very important that the experiment is done with soil from a conventional field (B) and preferably with soil that was taken from under a grass sod (A).





### DIFFERENT APPROACHES TO FARMLAND

Conventional agriculture: 7 to 10 passes of machinery – dragging (skidding), sowing, three sprays (against weeds, insects), fertilising twice, harvesting with a combine harvester, disc ploughing after harvest, ploughing ... too many passes in the field lead to soil compaction. In that case, less water is absorbed or hardly any is absorbed when the land is dried out – it behaves like concrete.

Progressive agriculture: The modern technology used allows for fewer machinery journeys. There are machines that can prepare the land for sowing (loosening), sow and fertilise (directly to the seed) in one pass. The residual material is not removed from the field but left as mulch in the field. Ploughing is not that frequent in progressive agriculture. This reduces the number of passes in the field during the season.

### SOIL COMPACTION<sup>8</sup>

Large blocks of land are farmed with large agricultural machinery. While the use of ever larger and more powerful machinery leads to more efficient agricultural production, it causes compaction of the subsoil. It is a compaction of soil caused by repeated passes of heavy agricultural machinery (tractors, harvesters), which leads to a reduction in soil's porosity and permeability, and thus to a reduction in its water retention capacity. This process leads to a reduction in its fertility too. More than 40% of soil in the Czech Republic is compacted by driving heavy machinery.

### WHAT TO DO ABOUT IT?

The size of land blocks is related both to how the land was used in the past in the Czech Republic (as a legacy of collectivisation of agriculture) and to the agricultural subsidy policy. Holding more land means more subsidies, so it is in the interest of farmers to farm large areas. Motivation (both financial and social) to restore landscape structures – planting groves, alleys, restoring field paths – can contribute to change, together with organisational measures such as setting a maximum size of land blocks and subsidy policy favouring new, more environmentally friendly farming approaches.





## 6 Soil permeability<sup>10</sup>

**TARGET:** Pupils will use their own bodies to see how healthy and compacted soil works in the rain.

**TIME:** 20 min

**CONCEPTS:** Permeability, compacted soil

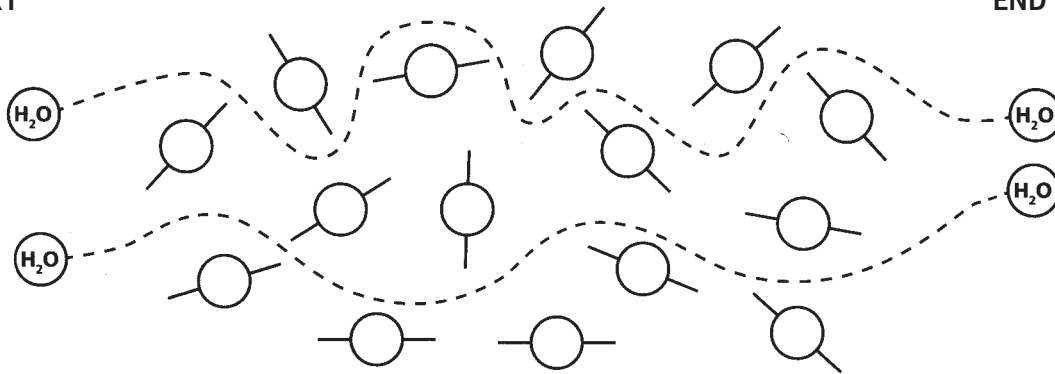
**PROCEDURE:**



1. Divide the pupils into 2 unequally large groups. The more numerous group (2/3) represents solid soil particles and the other one represents water.
2. The pupils representing the parts of the land will stand in place with their arms stretched out sideways, but they must not touch each other. The goal is for the pupils representing water molecules to be able to move between the standing pupils towards the other side of the classroom.

**START**

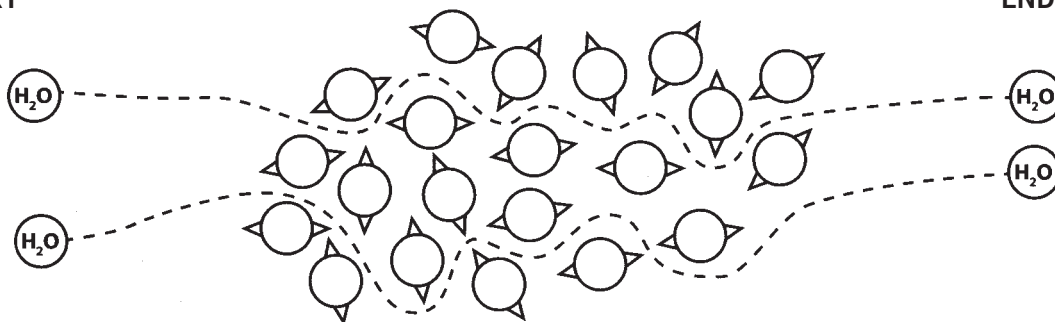
**END**



3. We continue by testing how water seeps through the soil, which has been run over by a heavy tractor several times. The teacher can illustrate theatrically the passing of a tractor. The pupils representing the soil particles stand with their hand at their hips so that their elbows are almost touching. And the other pupils (water molecules) try to get to the other side between the pupils representing the soil particles.

**START**

**END**



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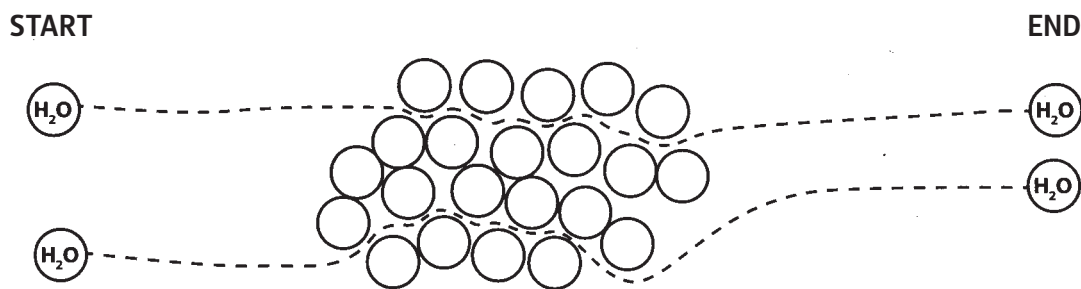
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4. Finally, illustrate with the students the soaking of water through soil that is compacted and often passed by heavy equipment. The pupils representing the soil particles stand with their arms stretched forward as close together as possible, preventing the water molecules from passing through. The other pupils (water molecules) try to pass between the pupils representing the soil particles without using force. They may succeed sometimes.



**TIP FOR TEACHERS:**

more info on the topic: [http://www.geology.cz/svet-geologie/ucitele/miniprojekty/Podzemni\\_vody\\_Liberec.pdf](http://www.geology.cz/svet-geologie/ucitele/miniprojekty/Podzemni_vody_Liberec.pdf)

## 7 Soil erosion experiment II – exposed vs covered soil<sup>11</sup>

**TARGET:** Pupils will understand another cause of erosion – bare soil without cover.

**TIME:** Time to prepare 20 min+ duration of the experiment 20 min

**AIDS:** 4 small low bowls, 2–4 large bowls, soil taken from various places (see below), small twigs, dug out grass divot

**PROCEDURE:** “In the previous experiment, we found that soil that is compacted and often crossed by a tractor cannot absorb water and suffers from erosion; the rain will carry the soil away irreversibly. Do you have any other ideas about what might influence whether or not soil is washed out of a field?” The children should work out on their own or with the help of the teacher that if the soil is covered with some plants, trees or grass, there will be less or no erosion. And on the contrary, when the soil is bare, erosion is high. The teacher encourages the children to try to think of an experiment on their own to test this in the classroom or outdoors. Once they have defined their experiment, they try to come up with a hypothesis, which they write in their work sheets or notebooks.

Hypothesis – example: Where the soil is bare, there will be great erosion. There will be no erosion where there is grass growing on the land.

The course of the experiment should be roughly as follows:

2–4 smaller bowls will be filled:

Bowl 1: soil from a field (or dirt taken from the field where nothing is growing, or the edge of the field)

Bowl 2: soil from a field (or dirt taken from the field where nothing is growing, or the edge of the field), but in addition, we will stick various branches (coniferous and deciduous trees) into it, which simulates the greenery growing in the field (groves, trees)

Bowl 3: a grass divot with soil at the bottom – it should cover the whole bowl.



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You can add any surface you still want to explore with your pupils (soil with oilseed rape, maize, corn...). The bowls are placed diagonally so that water can run down. Pupils pour equal amounts of water from watering cans into these bowls and compare where the soil was washed the most and where the least.

**EVALUATION:** The soil most susceptible to water erosion is that which is bare and unprotected; the least washed-out soil, almost none, will be in the bowl with the grass sod.



## 8 Erosion experiment III – along the slope line vs along the contour line<sup>12</sup>

**TARGET:** Pupils will understand another cause of erosion – poor soil management.

**TIME:** Time to prepare 15 min + duration of the experiment 20 min

**AIDS:** Two pot dishes (30 × 15 cm), soil, toy tractor, two containers for draining water, two watering cans with sprinkle heads (plastic bottles)

**PROCEDURE:** The teacher introduces the activity: *Children, here comes Mr. Farmer again, who needs to go to the field with his tractor. His name is Pepa. Only recently did he decide to try and start farming. He always enjoyed working with the soil. He also likes the fact that he can grow and deliver quality food to people. But he doesn't have much experience in farming. His farm lies in hilly terrain. Today, he can't decide how to ride the tractor on the field. Whether from right to left or up and down. Some advise him: "Drive from right to left, it's the best thing for your property." While others object: "No, if you do that, you will sit on the tractor with one wheel lower than the other, it's really uncomfortable to sit like that." Kids, let's try to give him some advice.*

How could we verify that? The teacher encourages the children to try to think of what such an experiment might look like. If the children are not very good at it, the teacher can gradually show them tools that should help them to come up with some ideas.

The course of the experiment should look like this:

Fill the two pots that have a shorter wall replaced by a net (to drain the water – see picture) with soil. Place them in an elevated position (e.g. on a box) and tilt them.





Use the toy tractor to make (push) grooves in the soil that go lengthways in one pot and crosswise in the other. Place a picture or toy tractor next to each box so that it is clear in which direction it was travelling on the soil. Place water containers to the ends of the pots where the net is (under the pots). Water both pots with the same amount of water. Observe the speed of the water and its colour. Compare the differences and write them in the table.

**CONCLUSION:** Pepa the farmer already knows that the best thing for the soil is to ride on sloping land following the contour lines, i.e. from side to side. If he were to run from top to bottom and back, he would create tracks through which water would run fast away during rains and carrying much of the soil with it. This would dry up Pepa's land which would gradually lose its fertility until he could not be able to grow anything on it.

**ACTIVITY TIP:** In a composition writing class, compose with the children a letter for Pepa the farmer, where the children describe what they have tried and recommend him how to drive around the field. The children can write that it is good that Pepa thinks about the soil in this way, or what the soil is good for, and also, for example, that they are thankful that he grows food for people, takes care of the landscape, etc. Children can also choose to create a comic strip, picture, etc.



## 9 Who does the soil belong to

**TARGET:** Pupils review what causes erosion and what is soil organic matter good for.

**TIME:** 18 min

**AIDS:** projector, video <https://edu.ceskatelevize.cz/video/1512-ci-je-puda-a-jak-se-vyuziva>

**PROCEDURE:** The teacher plays the video for the pupils from minute:

1.49 to 3.12. Here the teacher stops the video and together they discuss what they already know – that erosion is caused by bad and frequent passes of machinery on the soil.



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- 3.12 to 3.34 The teacher asks the children:  
*Why must fertiliser (manure/green manure/chemical fertilisers) be added to the soil)?*  
*Answer: The fertiliser supplies the soil with the necessary nutrients for the plants. If fertiliser was not added to the soil, there would be nothing for plants or soil organisms to "eat" and nothing would grow. But what happens when we only add chemical, artificial fertilisers to the soil? We will find out in the next section:*
- 3.12 to 4.31 The teacher asks again: *So, what is wrong with the artificial fertiliser?*  
*Answer: Artificial fertiliser does not support soil organisms. Earthworms and other organisms that loosen the soil, make tunnels, create humus (the fertile component of the soil) and allow water to soak into the soil, disappear. Soil without animals is much less able to absorb water and is thus at risk of erosion.*

## 10 The soil is home

**TARGET:** Using imagination, children will experience what it is like to have a home – land. Through their own experience, they can perceive the soil as a pleasant space full of life, they can look at the soil from a different perspective, which can bring the soil closer to them as something pleasant, important and beautiful.

**TIME:** 25 min

**AIDS:** Text for imagination

**PROCEDURE:** The teacher asks the pupils to spread across a meadow so that they have enough space around them, do not disturb each other and can hear the teacher well. "Choose a place where you feel comfortable." If it is warm and dry, the educator asks the students to lie on their backs and close their eyes. If it is colder or wet, the pupils just stand or squat, with their hands on the ground and their eyes closed. It is recommended to do the activity in dry and warm weather, it will bring more experience to the children. Do not do the activity in winter.

**ATTACHMENT:** text for imagination

*Close your eyes. Soil is very important for life on Earth. It is home to many small animals, it nourishes plants and provides sustenance to humans. It provides food and shelter for an unimaginable number of animals and plants and fungi. Imagine you are walking barefoot in a meadow, slowly your feet touch the grass, the flowers. Everything rustles gently. You walk and feel the sun warming your skin. You are comfortably warm.*

*You come to a place where you decide to stop. You feel good in this place, there are flowers growing around you and a huge tree growing out of the ground a short distance away. You can feel the bare earth under your feet, the loose soil. It cools you down nicely. You decide to touch the ground with your hands. Put your hands on it, run your fingers through it and you will be surprised how soft it feels. The soil invites you into its world. Come, let's transform ourselves for a moment and explore the enchanting world of soil. Imagine you are as tiny now as a little soil gnome. Look at your hair, your face, and the clothes you're wearing. You are now a gnome – the protector of the earth.*

*We can feel it surrounding us, the soil. We feel comfortable, as if we were wrapped in a soft brown blanket. There are lots of crannies in the soil around us, little capsules of air. A lot is happening in these little holes. There are small bugs, ants, true bugs and small animals you have never seen before. Some are looking for food, others are resting or carrying loads to build their dwelling. Some are smooth, others are hairy. It's very busy here, but pleasant. And no stress. We turn right*





*from the main loophole and find ourselves in the lair of a small centipede with sleeping cute little larvae, her children. She watches them and waits for them to wake up to pet and feed them. We're tiptoeing so we don't disturb them.*

*We move on now. We leave the hustle behind and get to a place where it is quiet. We will rest here for a while. Meanwhile, clouds appear over the horizon and the sky darkens. There is a smell of rain in the air. The first drops are already hitting the ground. And underground, everyone is getting ready for the celebration and the rain dance. It is raining above the ground, drops drumming on the ground (the teacher claps his hands, imitating the sound of rain). The droplets are already getting underground, into the soil. You take a deep breath (the educator takes a deep breath) and feel the moisture and the sweet smell of the damp earth. Water seeps in and the soil is becoming alive. Other animals come out of their hiding places and start dancing. They drink, swim, bathe and frisk about. You join them and together you celebrate the coming of the rain, the miracle. You shake a leg with a flatworm on your right, a small earthworm grabs you from the left, its touch is gentle, as if you were holding your dog or cat. You form a circle with the other beings and rejoice together. You are one!*

*The rain has stopped and the celebration is slowly coming to an end. But we know that the water in the little chambers and capsules in the soil will remain for some time, and will thus supply all the living things that need it to live. You are resting.*

*Lifting our heads, we see tiny roots making their way through the soil above us with tiny swaying movements. Here is the root of bluegrass, the most common grass in the meadow. It's really hairy... And here's a daisy root and a poppy. They look like white furry elves. Above the ground, beautiful white and red flowers, below ground branched roots that nourish the flowers and the whole plant and suck water from the soil. Feel as if your fingers are becoming roots. They are stretched out and suck water from the ground. (The sound of water being drawn in – three times in succession when breathing in). Use small root hairs to collect water from deep in the ground. Draw moisture from the earth and send it through your body into the above-ground world of your plant, into the stems, the leaves, the flowers. Feel how it first rises, flows in small trickles until it comes together into a great stream. You feel how important you are, you make the plant live. You feel grateful that you can live in the soil that gives you strength and life.*

*It's time to go back. Slowly, your hands float, bringing you from the underground world to the present moment. You are lying (sitting) on the ground (in a park in Broumov, Vyškov, in a meadow near Hustířany, etc.). Take three breaths together and open your eyes after the third breath. One, two, three (breathing together). We open our eyes, stretch first our arms, then our legs, we can yawn.*

The teacher slowly allows the children to sit down, wake up. There is no need to hurry.

**REFLECTION:** Together, the pupils and the teacher share their experience and feelings. *What part of the story spoke to them the most, what did they feel...? What is soil good for? Who uses it, what are its functions? Who has its home in it?*







## 11 A letter from UE — life in the soil

You will encounter a similar experiment in the Forest chapter. Include the activity if it makes sense in your teaching. It is interesting to see the difference between farmland and forest land. Forest soil is likely to be richer in soil life.

**TARGET:** Pupils investigate who or what lives in the soil. They will learn that soil is home to many animals and that animals are found where there is plenty of organic matter. They contribute to proper functioning of the soil.

**TIME:** All day

**AIDS:** Letter for pupils, boxes, aids for experiments (see individual experiments), work sheet

**PROCEDURE:** The teacher will bring a box to school, a postal package addressed to children – e.g. pupils of grade 3A at Suchý Důl Primary School. The package includes: Letter and tools (shovels, buckets, sieves, etc.).

**ATTACHMENT:** letter from PS

### ADVICE FOR THE EDUCATOR:

Together the pupils think about the answers to the questions and complete the work sheets:

*What animals could live in the soil? (earthworm, mole, centipede, beetles, etc.)*

*What do animals need to live? (water, air, food)*

*How could we find out what animals live in the soil? The tools in the packet will help us come up with an experiment (see experiments below).*

*How do we know if there is water in the soil? (Allow the soil to dry in the sun or radiator and observe the change in the soil over 2-3 days, apply a napkin or absorbent paper and see if it gets wet, or heat the soil in a test tube over a stove – the glass will steam up, etc.)*

*How do we know if there is air in the soil? (Water the soil – bubbles escape; the soil is loose – there is room for air, etc.)*

*Which soils have the most and least organic matter (humus)? (Most organic matter is in compost because we keep adding it regularly. Then under a tree, or in the forest, thanks to the falling leaves. Least organic matter is in the field of conventional agriculture. Soil with more organic matter should be most humid, because it can hold more water. Organic matter may not always be visible, it is already so small that it cannot be seen by the naked eye or with a magnifying glass, so the experiment may not always come out clearly.)*

*In which soils do more animals live and in which fewer? (The most animals should be where the soil is looser (has the most pores) and where there is the most organic matter, which is food for small animals.)*

### Option 1 – two soil samples:

We collect two soil samples from around the school. We pick two different sites:

- e.g. grassland regularly cut short vs site under a deciduous tree,  
grassland vs compost,  
bare flower bed vs meadow.

### Option 2 – four soil samples:

Four different soil samples are compared:

1. from a conventionally farmed field (sample taken at least 10 m from the edge of the field),





Dear children,

I want to thank you so much for the way you handled the erosion experiments. And how you were able to advise farmer Pepa. I'm thrilled with how well you are doing. You have earned my trust. Therefore, I turn to you with another request. I am sad. My friends and helpers live in the attic. But lately, when I walk, I'm more and more alone. I'm meeting fewer and fewer friends. I don't know exactly what is going on. In some places my helpers are plentiful, but in others, when I walk around, there seems to be almost no one. It is as if they disappeared or moved away. Or did they die? I don't know.

Can you please find out for me which soil has more animals and which has less? And why is it disappearing from some places? Do you think I will live to see a time again when my friends will be everywhere and I will be able to play with them again anytime I want?

What about the animals around your school?

Thank you very much.  
Yours UE



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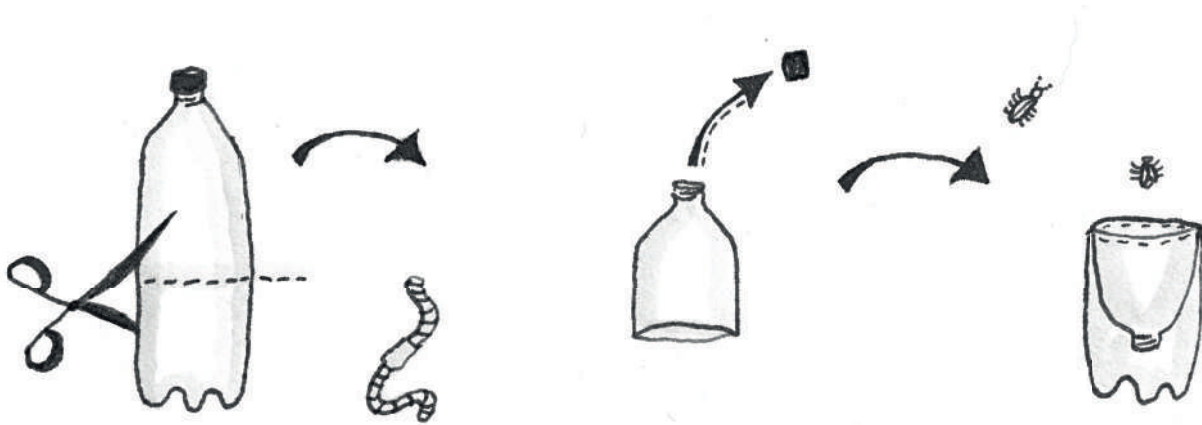


2. a meadow
3. soil from under a tree (or from the deciduous forest),
4. compost (if available, e.g. school compost).

**TIP PRO PEDAGOGA:** To speed up the activity, the teacher can prepare the samples themselves or assign it to the pupils for homework in advance.

a) Life in the soil<sup>13</sup>:

**AIDS:** : table lamps, plastic bottles cut off, soil samples, magnifying glasses, work sheet



Pupils first try to think of what the experiment might look like. Cut off the top third of a large plastic bottle. Unscrew the cap and put the top part back into the bottle, but upside down.

Fill the top part with soil.

Leave the bottle under the lamp for about 2 hours. Watch to see if any animals fall through the neck into the bottom of the bottle.

Complete the work sheets.

b) Searching the area:

**AIDS:** jars or yoghurt cups



While the pupils are waiting for the result of the previous experiment, they can also look for animals under rocks. They can also set up traps and leave them there until morning and check them next day to see if any animals have appeared there. They prepare the traps by digging a hole in the ground big enough for the cup to fit in. They insert the cup into the hole so that the rim is flush with the surface. They can then cover the opening with leaves or a stone – see drawing.





c) Determining the amount of organic matter:

**AIDS:** sieves, magnifying glasses, work sheet

Pupils take the same amount of each soil sample. The easiest way to do this is for one pupil in a group to take a soil sample in the palm. He/she puts it in a sieve and sifts the soil. They can also use a measuring cup. If the soil is in lumps, the children use their hands to grind it. Parts of soil with most organic matter should be left in the sieve. They can use magnifying glasses. Pupils write down in their work sheets what kind of organic matter they find in the soil left in the sieve: roots, fragments of wing cases, animal remains, white fungi "hairs", parts of leaves, number of different animals, etc.

**RESULT:** Most organic matter is in compost.

d) Finding and identifying animals:

**AIDS:** spade, or gardening trowel, buckets, magnifying boxes, work sheet

The children use the trowel or spade to retrieve samples from different sites, place them carefully in a bucket or directly on the ground and use box magnifiers to investigate how many animals live there. Use the identification key to identify and record the species of animals on the work sheet. They note whether there are corridors in the soil that the animals left there.

**RESULT:** The most animals should be where the soil is looser (has the most pores) and where there is the most organic matter, which is food for small animals. Organic matter also holds moisture in the soil, which is also good for animals. Most of the animals should be in compost, then in a deciduous forest, or in the soil in a meadow near a tree. Fewest animals should be in a conventional field. There are more animals where there are trees, bushes and balks compared to a bare field.

Chemical sprays are also used in the field that kill not only the targeted pests but also animals and microbes in the soil. If the experiment does not work out this way, the teacher can ask the children why the results are like that and not the way they should. They may mention that the fields are cultivated sparingly, for example, leaving a lot of organic matter. You might have just stumbled upon a parched, sun-warmed spot in the woods. A meadow is not a meadow, but just a lawn that is mowed regularly and frequently, which is not the best for soil life and moisture. They couldn't find all the organic matter because it is so small that the naked eye or a magnifying glass can't see it. Etc.

**ADDITIONAL ACTIVITIES:** The teacher can show images of soil life to the pupils using a data projector:

[https://web2.mendelu.cz/af\\_291\\_projekty2/vseo/print.php?page=3971&typ=html](https://web2.mendelu.cz/af_291_projekty2/vseo/print.php?page=3971&typ=html) – click to open the photo on full screen.

[https://web2.mendelu.cz/af\\_291\\_projekty2/vseo/files/150/12024.jpg](https://web2.mendelu.cz/af_291_projekty2/vseo/files/150/12024.jpg)

[https://web2.mendelu.cz/af\\_291\\_projekty2/vseo/files/148/11324.jpg](https://web2.mendelu.cz/af_291_projekty2/vseo/files/148/11324.jpg)

<https://www.youtube.com/watch?v=HdeXbE1uMnc> - FILM footage 7:35-8:00 min – soil animals visible to the eye; 8:38-9:40, 16:35-17:09, 23:18-23:40 – soil animals magnified by a microscope.

More pictures and detailed images can be found in the publication by L. Miko *Život v půdě*.

**REFLECTION:** The children write a reply to UE (whose identity is still unknown) about what they found out. Why they think there are animals somewhere and why there are far fewer elsewhere. What is the cause.





### LOSS OF ORGANIC MATTER<sup>8</sup>

The organic part of the soil is essential, as it binds water and makes the soil fertile. It serves as food for animals and microorganisms living in the soil; together they the fertility and health of plants. The water-holding capacity of the soil is also increased.

When the soil on a slope is improperly cultivated, soil particles wash away into streams. Maintaining a favourable organic matter content depends on farming practices, with the biggest danger being insufficient fertilisation with organic fertilisers, i.e. adding good quality organic matter to the soil. The trend is to fertilise with artificial fertilisers – this will add the necessary minerals to the soil for the plants, but will not affect the volume of organic matter. Soil without organic matter gradually degrades, its biodiversity decreases and it cannot retain water in the landscape.

The activities of soil organisms are extensive and multifaceted. Their main source of food is mostly dead plant biomass, which the organisms continuously transform and break down, thus contributing significantly to the formation of organic matter. They move and mix the soil, enrich it with their own biomass and metabolic products, retain atmospheric nitrogen and accelerate loosening processes.<sup>2</sup>

## 12 Building the earthworm house<sup>13</sup>

**TARGET:** Pupils learn about the life of an earthworm and its effect on the soil.

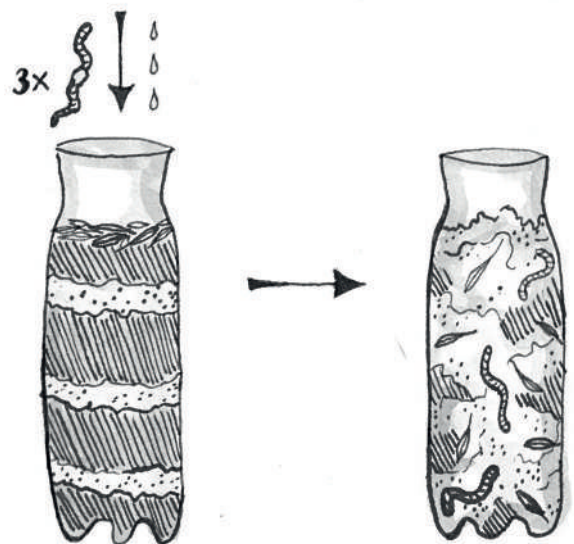
**TIME:** 45 min

**AIDS:** Plastic bottle, soil, leaves, sand, 5 earthworms, black paper, work sheets

**PROCEDURE:** Pupils cut off the top of a plastic bottle. They fill the bottle with layers of dirt interlayered with thin layers of sand. They put dry leaves on top and pour some water. They study the earthworms under a magnifying glass. Then they carefully place 3 earthworms in the bottle.

They cover the top of the bottle with transparent kitchen wrap and make a few holes in it to let the air in. They stick dark paper around the bottle. Every day they add a little water and after two weeks they remove the dark paper. Earthworms mix the soil and create tunnels. Return the earthworms to their natural habitat and add the dirt to the plants in the classroom or on flower beds.

Record your findings in the work sheets.



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**CONCLUSION:** The earthworms not only mix and aerate the soil, but also help to break down the organic matter, in this case leaves. They helped the leaves to get lower into the soil and make them available to other organisms that eat them. They also make the soil richer. All the soil that passes through the earthworm, i.e. its excrement, is full of nutrients and enzymes that help plants grow.

There are a plethora of organisms, animals, bacteria and fungi in soil that are so tiny that we cannot see them, but they work just as well and as intensively as earthworms (you can go back to the photos and links in the previous activity).

### EARTHWORMS

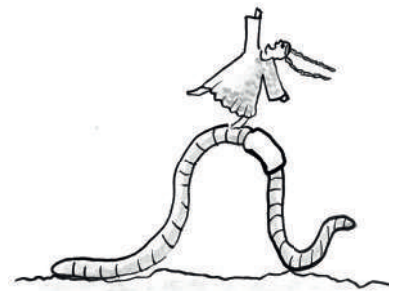
Earthworms are of considerable importance to the ecosystem. Their activity creates small channels in the soil that aerate and loosen the soil. Earthworms absorb as much food as they weigh in 24 hours. Earthworms harbour a huge number of microorganisms in their gut, so their excrement has far more microbial activity than the soil they ingest. Up to 250 tonnes of soil can pass through the digestive tract of earthworms in a hectare per year. The decomposition of dead plants is twice as fast with earthworms than without earthworms. Earthworms contribute to the soil profile. Earthworms transports plant debris from the soil surface downwards. Some species in turn transport soil and other particles from deeper layers upwards.<sup>14</sup>

## 13 Miss Nature

**TARGET:** Children sort their knowledge about landscape features.

**TIME:** 15 min

**AIDS:** flipchart (blackboard or large paper), markers, crayons, work sheet



**INSTRUCTIONS:** The teacher draws a large picture of Miss Nature in a dress on paper or flipchart or prints Miss Nature from the appendix on a larger sheet of paper. Her dress is empty for now, without decorations.

The teacher compares landscape to the lady and her dress. To make Miss Nature feel good, she needs colourful dress, with pictures and ornaments. The ornaments, decorations and pictures should be made up of the landscape features that make the landscape colourful and diverse. Children, can you think of anything we could paint on her dress? Children say, paint or write in Miss Nature's dress anything they can think of in connection with the terms "landscape features" and "colourful and diverse nature". The teacher or the children write down and draw all the concepts mentioned. They can also use the space around Miss Nature, where they add what the landscape features contribute to and what their role in nature is. They use various colours. The teacher encourages the pupils to think about what more the landscape features and the diversity of the landscape contribute to and what is their function. What landscape features do they know.

Landscape features: treeline (alley), pool, wetland, balk, solitary tree, group of trees, pond, lake





What do landscape features contribute to, what do they support:

more animals  
 home for animals  
 food for animals  
 shelter for animals  
 more plants  
 more organic matter (more leaves, grass, roots)  
 more soil animals = healthier soil  
 more water retained in the soil  
 shadow = cooling effect  
 landscape more beautiful to look at, greater aesthetic value  
 tree, balk, alley, treeline, bushes  
 wind barrier (less windy)  
 food source for humans  
 etc.

### LARGE-SCALE AGRICULTURE<sup>8</sup>

The reasons behind the loss of water from the landscape are also related to the intensification of agricultural production and large-scale production, which began in the Czech Republic after 1918 and then fully erupted after 1948. Balks, groves, alleys and meadows disappeared from the fields and with them the many functions they fulfilled: erosion prevention, greater biodiversity, cooling effect, landscape aesthetics, production of organic matter, etc.

Farming was simpler thanks to the large fields – but at the cost of reduced soil protection. The impact of human activity on the landscape was enormous – in our country it was one of the most significant in Europe. The landscape was unified into large blocks of land. While the size of field (where one crop is grown) used to be 0.23 hectares, today it is 20 hectares – a hundred times more.

Since 1948, 50,000 kilometres of balks, 4,000 kilometres of tree alleys, 3,600 hectares of various greenery and 158,000 kilometres of field roads were lost (Figala, 1997), thus greatly increasing the threat of soil erosion caused by water and wind and reducing biodiversity.

## 14 Advertising spot — additional activity

**TARGET:** Pupils summarise their knowledge about soil using digital technology. They think about how to use this knowledge to successfully persuade people who have a significant impact on the quality of land to restore the landscape.

**TIME:** 45–70 min

**AIDS:** Mobile phone for filming, pencils, crayons, paper

**PROCEDURE:** The pupils' task will be to create an advertising spot, a short video, for farmers, people with land use



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rights, the municipality, etc., to convince them to plant a tree line, build a grove, pond or a similar feature on their land and thus revive their fields, local wetlands, local landscape...

Instead of a commercial, pupils can choose to create a comic with the same purpose. They can work in groups or individually, at school or at home.

**REFLECTION:** *What topic and method did you choose for the task? How did you cope with the task, was it difficult for you to work on it? How was it difficult and what did you enjoy?*

If the authors agree, present each other's work in class

*Do pupils want to present some of their work publicly? Can they think of an occasion where this would be appropriate? Does anyone know any friendly or progressive farmers/representatives of a municipality to whom they would like to show their work? If the pupils are willing to do it, encourage them to take the initiative and look for ways to build on their work and awaken civic engagement.*

## 15 It warms, it cools

**TARGET:** Pupils will realise that soil temperature is affected by its cover – the vegetation.

**TIME:** 90 min (2 lessons)

**AIDS:** Text about UE, work sheet with crossword puzzle, digital thermometer for measuring surfaces, pencils, papers to record temperature measurements

**PROCEDURE:** The children read the text together:

*Our friend UE is in big trouble. Drops of sweat soaked all of his little clothes. He's so hot he can hardly breathe. His mouth is open, his tongue sticks to his palate, his throat is dry, he is completely parched. He won't open his eyes because they're glued shut. He's lost his green hat and now misses its cooling shadow. He's close to his death. He is unconscious, he doesn't communicate, we may never meet him again. And he so wished to meet you in person!*

*He has wandered into Neverland, where the colour brown, heat and nothingness reign. The sun is burning, there's no water to refresh him, not a living thing to save him.*

*But there is still a small chance to save him! If we figure out what his full name is, it will give us a clue as to where he might have wandered off to. Where in his world it is hottest and where in his world it can get cold. Let's get to work.*

Using the crossword in the work sheets, pupils find out the name of the mysterious UE.

After completing it, the teacher tells the students that we finally know the name of the mysterious UE. *So where does the Underground Elf live? What is his world?* (Answer: underground, soil, caves, underground cavities, under rocks, mouse holes, etc.)

*Where in his world will it be hottest?* (Possible answers: desert, asphalt, rocks, etc.)







The teacher tells the children that it would be necessary to investigate how it is in the Czech Republic with surface temperatures in the landscape. He/she challenges the children to try to figure out where the surface is the most and least heated. The children themselves will find that they need a thermometer with which to measure the temperatures of different surfaces.

On a warm to hot day, find two spots (or three) – one with exposed soil, the other with natural cover (not a short-mown lawn). It is possible to add a third place, i.e. a short mown lawn or road. Have the pupils make a guess as to which place will have the highest temperature and why.

Then measure the temperatures of each surface with a digital thermometer designed for this purpose. Repeat the measurement three times. Each pupil records the measured temperature on the work sheet.

**CONCLUSION:** Bare soil will be the warmest, as it is dark and the dark colour absorbs the most heat.

The area with the most natural vegetation will be the least warm, as it naturally cools the ground by its respiration, water evaporation and shading. If we take measurements at a third site with short mown grass, the temperature there will also be high and the soil poorly protected against high temperatures. Now give the pupils space to talk about whether it is necessary to mow grass so short in cities. *Why is grass cut in cities? (Allergy sufferers who are irritated by pollen from flowering plants often require it). Do the pupils know of any solutions? Or have they encountered unkempt lawns in cities before?*

Here are examples of towns where flowery meadows are already being grown in some places instead of the short-cut lawns:

Prostějov:

<https://www.prostejov.eu/cs/aktuality-archiv/kvetnate-louky-ve-meste.html>

Bohumín:

<https://www.mesto-bohumin.cz/cz/volny-cas/naucne-stezky/kvetnate-louky/>

Prague:

<https://wave.rozhlas.cz/ve-mestech-mizi-hmyzi-opylovaci-projekt-praha-kvete-poskytne-zahradkarum-osi-vo-k-8569846>

Frýdek Mýstek:

<https://www.frydekmystek.cz/cz/o-meste/0699322-lucni-louky-v-centru-mesta.html>

Hradec Králové:

<https://hradec.rozhlas.cz/kvetnata-louka-zpestri-cestu-pres-simkovy-sady-v-hradci-kralove-kopretinove-8347046>

The trend of growing flowery meadows has spread to many other cities.

Now a puppet of a little elf or an actual living elf may appear. He is still not feeling very well.

He tells the children that he went out for a walk, but that he got lost on the wide fields where nothing grew. He had no idea which way to go or when the field would end. He is thirsty and parched.

The children can offer him water and then carry or walk him to a place with more vegetation where he will feel comfortable. He will thank them warmly for their help. A place with vegetation can be a tree in the school garden, or a plant that gives shade. They can also place the elf symbolically under a picture of a flower or a tree in the classroom.

If the pupils are older, stand in a circle holding hands and shouting out loud together: "Plants cool the planet!" Or "More trees more breeze!" Etc. This will save the elf's life.





## 16 Planting the seed

**TARGET:** Children develop a relationship to a flower. They learn to care for the flower entrusted to them. They can capitalize on the knowledge they have acquired.

**TIME:** 30 min for seeding, long term

**AIDS:** Pot, trowel, soil, compost, sand, leaves, pea seed

**PROCEDURE:** The teacher says to the pupils: "Children, you already know a lot about soil. Today we will each plant a pea seed. You mix the soil in the pot yourself in the way you think is best for your seed and future plant. What you put in the pot will be all the wealth for the future plant."

If the teacher is not able to find different types of materials (dirt, sand, compost, etc.), he/she will get soil from the garden shop and talk about it with the children. They learn what it contains, how it was made, etc.

They then plant and water the seed. They can grow it on the window in the classroom or take it home. They can even name the seed and the future plant.

## 17 Making clay hearts

**TARGET:** Children will practice fine motor skills. They will get know the soil by touch.

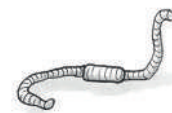
**TIME:** 30 min

**AIDS:** Ceramic clay, or self-hardening clay or clay soil

**PROCEDURE:** The children make a small heart out of clay soil, ceramic clay or brown self-hardening clay. They can hang its around their necks when it is finished. When modelling, remember to make hole for a string. The heart will be used in the closing ritual.

We talk about the clay while working. Interestingly, the name of the first man who, according to the Bible, walked on Earth, comes from the Hebrew word "adam", which means a human. Quite fitting, isn't it? Another theory says that the name comes from the word "adamah", which means soil or earth. The name would then mean a human connected to the soil, meaning that clay can also serve people as a material for making objects. The class can also look together into the history of how and what things were made from clay before. They can also discuss how the clay feels in their fingers and how they like working with it.





## 18 Closing ritual

**TARGET:** The children will celebrate the end of the big chapter on Soil. It will strengthen their positive relationship with the land.

**TIME:** 45 min

**AIDS:** Large enough bowl, clay (soil) for all pupils, clay heart from the previous activity, music, PC/recorder to play music, leather or cotton string (depending on number of pupils)

**PROCEDURE:** As a homework assigned in advance, the children are to bring a bit of dirt (soil) either from their garden, or from a pot where they have a flower growing at home, or dirt from near their house (in a box or bag).

Together they all sit in a circle. The Underground Elf can be in the circle with younger children. Everyone has the little clay heart and the bit of soil they brought with them from home. The teacher plays a song or some music at the beginning and they listen together in silence. The teacher tries to evoke a festive atmosphere.

After listening to the song, the teacher says that they have gathered that day to thank the land, the earth, for all that it brings them. That is why they made the clay heart that they will hang around their necks in a few minutes to remind themselves of that day and the love they give to the land.

The teacher gives the leather string to each pupil. Children thread the string through the little hole and tie a knot. But they do not hang it around the neck yet!

The teacher sends the bowl around the circle and everyone adds the soil they brought from home.

When the bowl gets back to the teacher, he/she says several words of thanks to the soil. He/she then explains to the children that they can show their gratitude to the soil by first placing their clay heart on their heart space, then in the bowl of clay, and then hanging it around their neck. They can also say words of thanks. The teacher will emphasise that there should be complete silence in the circle during the entire ceremony. Before sending the bowl, he/she ask the children to close their eyes and take a deep breath. First, we take 3 deep breaths together. With each exhalation, they can exhale the thoughts that distract their minds. With the next 3 inhales, they breath in the energy of the Earth, which travels upwards through their bodies. With the exhale, they can send to the Earth any heavy thoughts. With 3 inhales they take in the energy from the sky and lead it back to the Earth, with 3 exhales that receive the energy from the Earth and from the sky, and these meet and merge in their hearts. If the pupils have any wishes, they can send them out into the world with love from their hearts as they exhale. The teacher himself/herself demonstrates this and sends the bowl around again. Music can be played for this stage too.

We end the ritual together.

### Video to review the chapter:

<https://edu.ceskatelevize.cz/video/1511-puda-jak-vznika-a-proc-je-dulezita>

<https://edu.ceskatelevize.cz/video/9421-jak-vratit-pude-zivot>

<https://jdeteven.cz/games/cz/8-divu-blata> – games with clay



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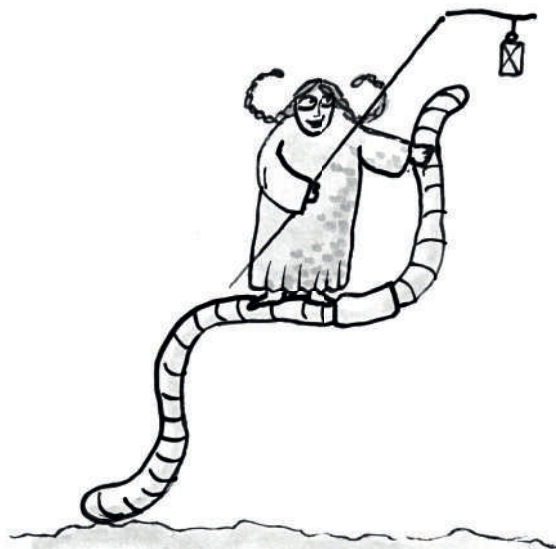
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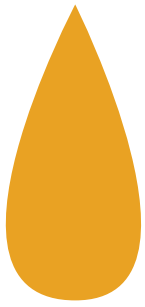
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“If you are waiting for a sign,  
it is a sign already.”

(Lars)



“One or thousand miles to go,  
the first step is always the first,  
for the second cannot be done  
until we have taken the first.”

(M. Gándhí)





The climate is changing. That is something that nobody questions anymore and the fact that humans play a significant role in climate change is also undisputed. Only recently did we, as a society, allow ourselves to accept this reality. However, we believed that the starting changes wouldn't show until decades later, that they would be a problem of our children and the solution would be dealt with by someone else, not us.

But it is all coming down way faster than we thought. We are experiencing the changes first-hand in real time. From our ancestors' weather proverbs and folk sayings, we know that they were able to predict the weather in the nearest future, but today, the climate that has surrounded us for hundreds of years, is becoming unpredictable and sometimes changes from day to day.

The term "climate change" means much more than rising global temperatures and CO<sub>2</sub> emissions. All the phenomena of the "climate puzzle" are interconnected, and a change in one piece triggers a series of other causes and effects. To see what the climate puzzle can look like, go to

<https://faktaoklimatu.cz/infografiky/schema-klimaticke-zmeny><sup>1</sup>

Simply put, the primary driver of climate change is the combustion of **fossil fuels (coal, oil and natural gas)** amplifying the otherwise natural and for life on Earth vital **greenhouse effect** (this will be explained in more detail in Task 7 of this chapter). In just a few decades, we have released into the atmosphere the amount of carbon that took millions of years to be stored in Earth's ecosystems. This is a huge amount of stored energy released in an incredibly short time!

Other sources of gases amplifying the greenhouse effect (carbon dioxide – CO<sub>2</sub>, methane— CH<sub>4</sub> and nitrous oxide N<sub>2</sub>O, etc.) include, among others, deforestation, cattle farming, rice cultivation, and the use of industrial fertilisers.

**The greenhouse effect is natural and essential for life on Earth.** It keeps the Earth's temperatures within the range suitable for life. The **balance** between natural greenhouse gases and the temperature is very **fine**. Humans disrupted this balance and keep disrupting it further. Once the climate changes take place, this balance will stabilise again, but it is very likely that the new equilibrium will provide conditions no longer suitable for life as we know it. Therefore, if we want to continue inhabiting the planet Earth and enjoy all its gifts, we must immediately start fixing what can be fixed (there are changes that cannot be stopped or reversed anymore).

How do we do that? Climate change is not just about releasing greenhouse gases. It concerns an **overall degradation of ecosystems**. Functioning ecosystems (soil, forests, tropical rainforests, etc.) absorb and store carbon, but many of them are already damaged so badly that they are **on the verge of collapse**. The **speed and magnitude of the changes** that are taking place is crucial for the ecosystems. **The ecosystems simply cannot keep up and adapt to these changes**. The current warming occurs 10 times faster than the natural warming that occurred at the end of the last ice age.

<https://climate.nasa.gov/vital-signs/carbon-dioxide/>



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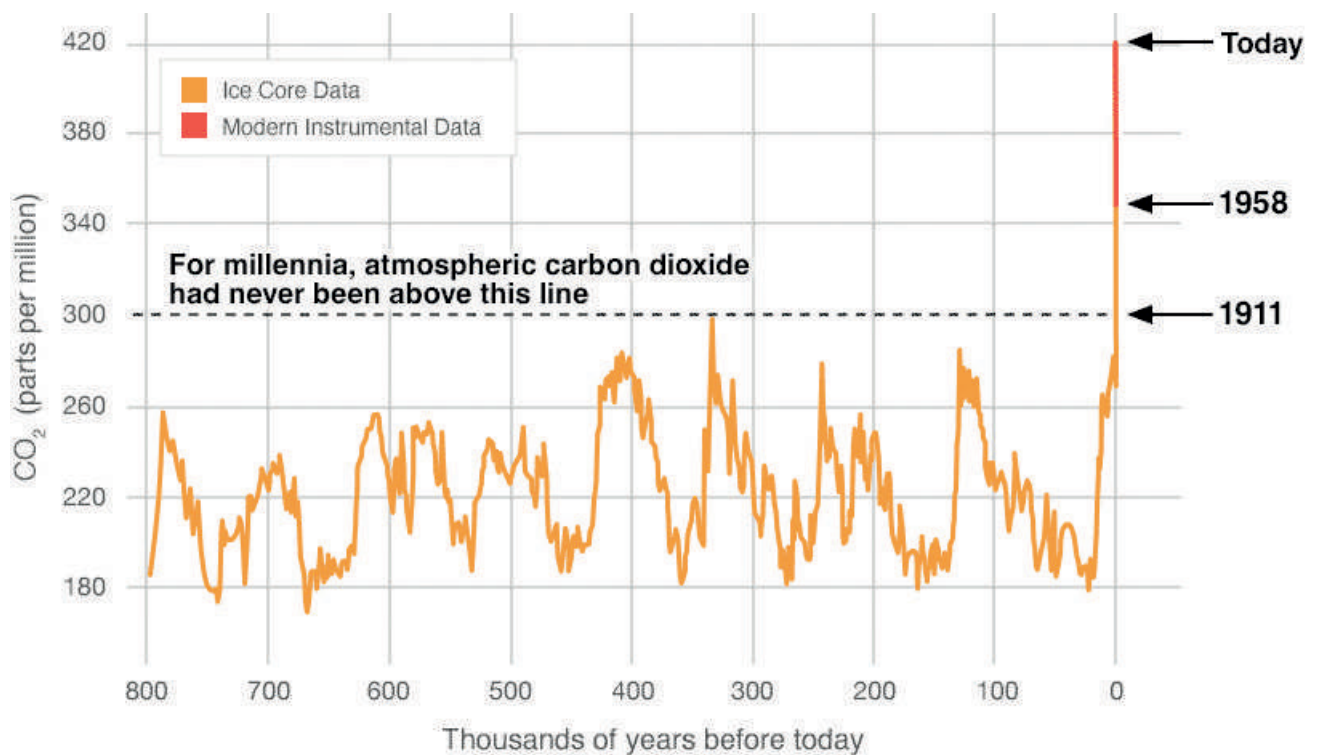
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Source: <https://climate.nasa.gov/vital-signs/carbon-dioxide/>

There are many things that can be done to protect the climate. It is simply untrue that an individual is powerless against climate change. Just as the pieces of the climate change puzzle trigger chain reactions, the actions of an individual or a small group of people can set the ball rolling and show the way to the others. In our project, we focus on one piece of the puzzle – manifestations of **drought, floods and landscape care**. In the future, the landscape will be exposed to more frequent and stronger extreme weather conditions (intensive rainfall, long droughts, unexpected weather events, etc.). We need to be prepared for these extremes and learn to prevent their consequences – floods, drying water sources, damage to the landscape and property, crop failure, etc.

If we want to help nature and ourselves, we need to implement measures that will help to retain more water in the landscape, increase reserves of ground- and surface water, slow water runoff, start the restoration of the "small water cycle" (we will learn more about it in the chapter called Water and Landscape). One of our important goals must also be to awaken and strengthen love, respect, positive relationship and humility to nature in children. This is because solving the climate crisis is not just about numbers and technical solutions to the problem. It is first and foremost about becoming aware of the fact that **healthy planet = healthy individual**. Reckless plundering of natural resources leads to degradation of both nature and human society. We must move from the "exploitation" of our planet and its resources to cooperation and cohabitation with nature.



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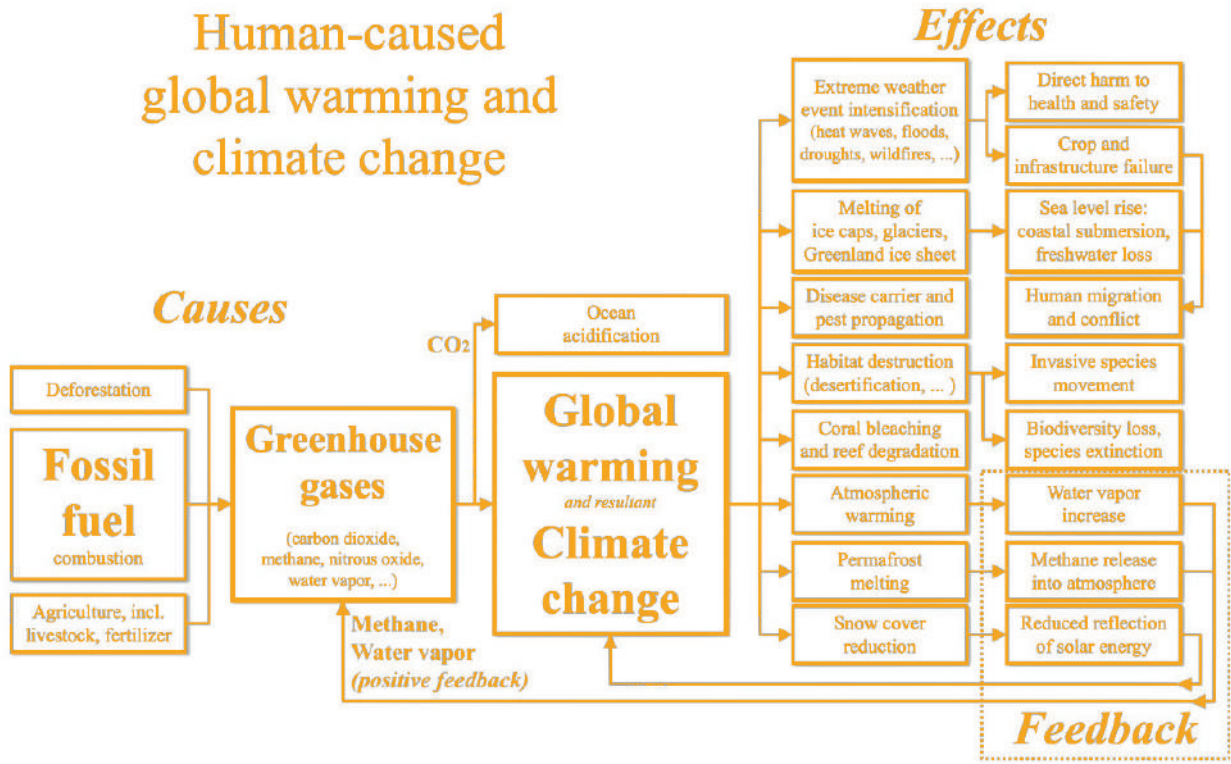
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[https://en.m.wikipedia.org/wiki/File:20200101\\_Global\\_warming\\_-\\_climate\\_change\\_-\\_causes\\_effects\\_feedback.png](https://en.m.wikipedia.org/wiki/File:20200101_Global_warming_-_climate_change_-_causes_effects_feedback.png)



Climate change is a complex and wide-ranging topic. In this chapter we have tried to make it a little simpler and lighter. We have focused on getting to the bottom of the basic phenomenon affecting climate change – explaining the greenhouse effect and presenting the consequences that we can all see around us today or hear about from various sources. We consider activities in which pupils can think about small or large personal steps they can take to improve the state of nature to be very important. They are introduced to the ways in which they, their families and their neighbourhood can contribute to a positive change. Active participation makes sense, it gives us hope for the future – active hope!





Activity name	Activity type (e.g. experiment, video sample, artwork)	Activity information (relevant to what the activity is about: e.g. summary or topic)	Duration (min.)	Environment	Page
1 <b>The invisible wind</b>	sensory, physical activity	motivation/introduction to the topic	10 min.	indoor/outdoor	158
2 <b>Weather — a burning topic</b>	massage	motivation/introduction to the topic	10 min.	indoor/outdoor	158
3 <b>Fun with the weather</b>	anecdotes	motivation/introduction to the topic	10 min.	indoor/outdoor	159
4 <b>Home project ideas – weather forecast based on nature</b>	observation of nature	weather forecast based on natural phenomena	varied	indoor/outdoor	159
5 <b>Climate and weather are not the same thing</b>	work with work sheet/ observing outdoors	difference between climate and weather	30 min.	indoor/outdoor	160
6 <b>Hot and cold regions on our planet</b>	experiment	how climate zones are formed	60 min.	indoor	160
7 <b>Why is the Earth warming up?</b>	experiment	understanding the greenhouse effect	120 min.	indoor	162
8 <b>Greenhouse effect</b>	physical activity (game)	experiencing and explaining the greenhouse effect	30 min.	outdoor	163
9 <b>Role of man in global warming</b>	scale/work with work sheet	human activities and global warming	45 min.	indoor	169
10 <b>The effects of climate change and how do we figure it out?</b>	work with cards/ descriptions	how can I contribute to climate change mitigation	45 min.	indoor	171
11 <b>Flower of Power – how can I help</b>	work with work sheet	my options / my contribution to change	25 min.	indoor	177
12 <b>Climate change</b>	mind map	summary of the topic, my contribution to change	30 min.	indoor	177
13 <b>Two mules</b>	cooperation	ability to cooperate	15 min.	indoor	178





## 1 The invisible wind

**TARGET:** Pupils are introduced to the topic through experience, physical and sensory perception.

**TIME:** 10 min.

**AIDS:** optional: balloon, papers, mirrors, flour, scarves/ribbons, other light materials.

**PROCEDURE:** The teacher introduces the activity: No one has ever seen the wind, but we can hear it and see its presence around us. Or asks: *Has anyone ever seen the wind? Sometimes it makes itself felt quite strongly, even threateningly, but it can also be gentle. What sounds does it make? How would you describe it?* The teacher puts down several words expressing the intensity of the wind (e.g. verbs: blows, takes what comes its way, whistles, tickles...). Then we engage the body and do simple breathing exercises. We let our breath blow with varying intensity. Pupils can try blowing into a balloon, paper, mirror (evidence of water in the body). If the conditions allow it, we can even use powdery materials, like flour.

**POSSIBLE EXTENSION OF THE ACTIVITY:** Using body movements (arms, shoulders) to show how the wind blows with various intensity. We can use scarves/ribbons to demonstrate this. The pupils then go around the classroom – the teacher acts as a strong wind and “blows” the children away; a volunteer from among the pupils takes over the teacher’s role; pupils take turns and each chooses different intensity of the wind. In the end, pupils can also pretend they are trees moving in the wind (good exercise for calming, grounding). The activity can include a contact. If the atmosphere and collective spirit are favourable, the pupils who represent the wind can gently caress their classmates with their fingers or a scarf, tickle hair like a breeze, etc.

## 2 Weather — a burning topic

**TARGET:** Pupils are introduced to the topic through experience, physical and sensory perception.

**TIME:** 10 min.

**AIDS:** Creating space in the classroom or space outside.



**PROCEDURE:** At first, the teacher sets out the rules for physical contact with the classmates. The touch should be gentle – children must move in a way to avoid hurting anyone or doing things that are unpleasant for others. Pupils stand in line one behind the other. They stretch their arms forward so they stand at an arm’s length distance from one another. Then the pupils (the entire line) start moving (faster/slower) in a certain direction. Meanwhile, the teacher is telling a story:

“The sun is shining and light breeze is playing with your hair. Each child gently strokes the child in front of him/her. Heavy clouds are gathering and the first drops of rain begin to fall. Each child starts tapping the shoulders of the child in the front with his/her fingertips. The wind is getting stronger... a storm is coming; it is now raining heavily and hail is drumming on your back.” – The teacher estimates the appropriate length of the hail and when the children’s backs are “massaged”, the sun starts to shine again. Depending on the level of attention, the story can be repeated several times.





**VARIATION:** Children stand in a circle, not moving, so they can concentrate more on the message.

**REFLECTION:** *How did they like the massage/if they didn't like it, why? Have they ever actually experienced a similar "weather massage" outside (got soaked or found themselves in a proper blizzard)?*

### 3 Fun with the weather

**TARGET:** Uvedení do tématu klimatické změny.

**TIME:** 5-10 min.

**PROCEDURE:** The teacher reads/tells an anecdote and talk with the children to see how they understood it, why is it that they laugh and then follow up on the theme of the weather. The teacher explains why the weather, and especially weather forecasting, is frequently subject of humour. These days, weather forecasts are often less accurate – link to climate change. But weather is still a popular conversation topic. See the short text in the next activity.

*"Why do skeletons make excellent weathermen?  
They always know when it is going to rain because they can feel it in their bones."*

*An angry man calls to the weather forecaster and screams:  
"I have a dozen buckets full of that partly cloudy weather of yours in my cellar!"*

### 4 Home project ideas — weather forecast based on nature<sup>2</sup>

The teacher can give the children weather observations as homework:

#### **EVENING RED CLOUDS: LONG-TERM OBSERVATION:**

The setting sun is a great indicator of the weather: if the sunset colours the sky with bright red tones, it is a sign that the next morning will be sunny.

(Explanation: bad weather in our part of Europe comes mostly from the West; lack of clouds on the West logically predicts good weather in the next couple of hours.)

#### **WEATHER FORECAST WITH PLANTS:**

We can always rely on the daisy.

*It grows almost anywhere (and everyone knows it). If these little flowers do not grow in your garden, it would be a great idea to reserve one corner of the lawn for them. Just one look at their white and yellow blooms and you know whether you should hang your laundry outside or rather keep it inside. When there is rain or a storm coming, the daisy heads close. Some of their flowers even hang down so that not a single drop falls into them. But it only works during the day, because daisies are closed in the evening, like many other plants.<sup>2</sup>*





What other weather forecasting indicators have the students heard of? (falling dew, fish jumping, pain in the knuckles, swallows, bees, tree frogs, etc.)

## 5 Climate and weather are not the same thing

When it comes to weather, we are no different than our ancestors – people have always like to talk about it and it was important to them. Historical records in chronicles focus, of course, on important events, such as the quality of crops and wars, but the role of weather is no less significant. This is because the weather has greatly influenced the cultivation of crops. At that time, food was not easily “imported” from abroad if the harvest was poor. People depended on the weather and spent a lot more time outdoors. Today we spend 80% of our time in buildings and cars, yet we are still curious about the weather. It is, among other things, a conversational topic that people talk about when they meet with neighbours in their front porches, at bus stops and elsewhere throughout their day. We can talk about the weather anytime and with anyone. The weather connects us and so does the climate, as neither of the two knows what and where the borders are. We are all in this together. Let’s not just talk about climate, let’s do something about it together!

**TARGET:** Pupils know the difference between climate and weather.

**TIME:** 30 min.

**AIDS:** One copy of the Weather and Climate work sheet for each pupil.

**PROCEDURE:** The teacher asks: *Why do you think we care so much about the weather? How does it affect our lives? How do we depend on it? Have you noticed any changes, for example during holidays or in winter? What activities do we do (ones that we enjoy) when it is sunny, cloudy, raining, snowing, windy?*

Use the work sheet to arrive at a definition of weather and climate – focus with your pupils on the suggested **key-words**. Complete the task as instructed: pupils draw a picture for each type of weather and complete the activity. They add typical weather conditions for individual climatic zones (for small children: only cold and frost/warm/humid/hot/dry) and specify typical animal and plant species. Finally, they will complete and write down the definition of weather and climate.

**ADDITIONAL ACTIVITY — WALK AND OBSERVATION IN NATURE:** The work sheet can be completed also outside during a walk in nature. The teacher refers to the current weather and seasons and asks the pupils about their observations, experiences and feelings.



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## 6 Experiment: hot and cold areas in our country<sup>3</sup>

**TARGET:** Through the experiment and exploration, the pupils will understand why there are climate zones on the planet.

**AIDS:** Player/mobile phone, PC to play the song, balloon or ball, dark permanent marker, string about 40 cm long, flashlight/torch with a narrow light cone, partially darkened room, work sheet

**TIME:** 60 min.

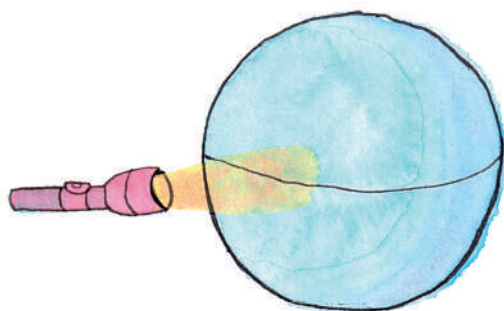
**MOTIVATION:** Together we will embark on a journey from the North Pole to the Equator. The teacher can play songs and hand out lyrics and sing together with the children. Tune in for an "expedition" to the North.

<https://www.karaokeexty.cz/texty-pisni/nohavica-jaromir/gronska-zem-43774>

### PROCEDURE:

**Research question:** How come there are cold and hot areas on Earth? Why isn't the same climate everywhere? What caused that?

**Hypothesis:** collect the pupils' opinions/ideas/guesses and formulate a common hypothesis based on the discussion. We encourage pupils to formulate their opinion on the topic, they can also propose an experiment to verify their opinion, the teacher can also give space to these experiments proposed by the pupils (if feasible). Based on the discussion, we formulate a common hypothesis/presumption, which we will then disprove or confirm.



### Disproving/verifying the hypothesis by experiment:

**PROCEDURE/EXECUTION OF THE EXPERIMENT:** Children work in pairs, they inflate a balloon (representing the planet Earth) and tie it up (with the help of an adult, if needed). Wrap a string around the widest part of the balloon/ball and trace the line with a dark marker (see picture). The line represents the equator. One pupil in each pair will hold the balloon with the "equator" in a horizontal position. The second pupil will direct the torch light (which represents the sun light) directly to the equator. Then they switch roles. They both watch closely the light reflection on the balloon. Then the first kid again holds the balloon horizontally, and the other one moves the torch upwards away from the equator. Then they switch again. **It is important that pupils are mindful and think about each step of the experiment and anticipate the consequences.**





### Formulating the conclusion of the experiment:

The teacher asks questions to find out what the children have learnt and how they understand what the experiment has shown... Then they return to the originally proposed hypothesis and discuss whether it has been confirmed or disproven. They talk about the predictions and compare their guesses with the results of the experiment. Then they formulate a conclusion, e.g.: The sun rays hit the equator directly (perpendicularly), which is why it is the warmest region.

Because of the planet's rounded shape, the sun rays hit the Earth's surface at different angles. They fall perpendicularly and more directly to the equator and are therefore more concentrated = more heat. Towards the poles, the sun rays are more diffused = less heat, that's where the cold regions are. As a result, the climate zones are formed.

If the hypothesis is not confirmed, it does not mean that the experiment has failed and it is no reason to be disappointed. Pupils will then record the experiment, create a drawing and sum up the conclusions of the experiment.

**TIPS FOR EXPANDING/INTERCONNECTING THE ACTIVITY:** How people live in different climate zones.

**MOVING ON TO THE NEXT ACTIVITY:** The light and warmth of the sun give the Earth a climate which is suitable for the life of humans, animals and plants. Besides that, the Earth is surrounded by an invisible layer of air – the atmosphere. It contains various gases and oxygen that we breathe. These gases have a special task – they make sure that some part of the sunlight (heat) that reaches the planet is not reflected back into space, but remains on Earth – they create a giant greenhouse. This phenomenon is called the **greenhouse effect (see the table below)**.

## 7 Why is the Earth warming up?<sup>4</sup>

**TARGET:** Through the experiment, pupils will understand the principles of the greenhouse effect and global warming.

**TIME:** 120 min. (preparation 20 min., 60 min. pause for heating the water, 40 min. to finish and write down a record)

**AIDS AND CONDITIONS:** 2 glasses, 1 large glass bowl in each group, 1 thermometer in each group, water, window and direct sunlight.

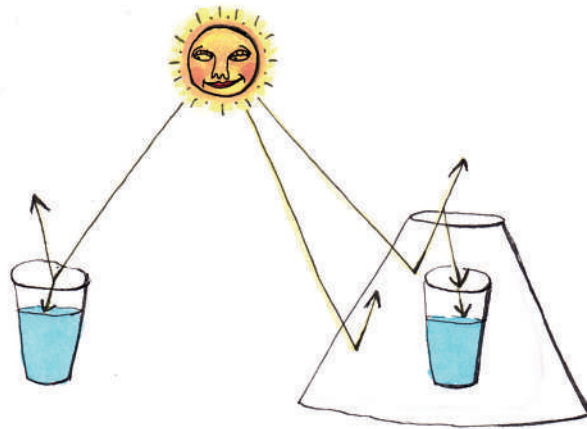
**PROCEDURE:** Pupils fill both glasses with the same amount of water and cover one of them with the glass bowl. The teacher asks them the research question: In about an hour from now, in which glass are we going to measure a higher temperature? Before the hour passes, the pupils prepare the work sheet and formulate/write down their hypothesis. We recommend using the remaining time for another activity on the topic of the greenhouse effect and global warming (e.g. activity no. 5, 9). After about 1 hour, pupils will first test the temperature of the water in both glasses with their finger and then measure it with a thermometer.

The glass with water represents the planet Earth and its surface, the glass bowl is the Earth's atmosphere which contains CO<sub>2</sub> and other gases. Solar radiation penetrates through the atmosphere, some of its energy is absorbed and transformed into heat, part of it bounces back into space. If the layer of greenhouse gases becomes thicker (which is currently happening), the sunlight cannot bounce back away from the planet, the heat is trapped by the atmosphere and it warms up the planet's surface.





A sketch for the experiment:



Source: [www.allgaeu-klimaschutz.de](http://www.allgaeu-klimaschutz.de)

### GREENHOUSE EFFECT

The Earth maintains its thermal stability through a delicate balance between the incident shortwave solar radiation and the radiated thermal radiation that escapes from the Earth's atmosphere into space. Gases present in the atmosphere, such as water vapour, carbon dioxide or methane, trap some of the radiant heat in the atmosphere warming it up. This phenomenon has come to be known as the "greenhouse effect". The greenhouse effect is natural and necessary for life on Earth. The natural greenhouse effect keeps the Earth's surface about 33 degrees Celsius warmer than it would be without it. It therefore makes possible the existence of life on Earth as we know it. However, the excessive presence of greenhouse gases in the atmosphere caused by humans is overheating the atmosphere, which results in a range of adverse consequences for humanity.<sup>5</sup>

## 8 Greenhouse effect<sup>6</sup>

**TARGET:** Pupils can explain the concept of the greenhouse effect and experience how it works through movement and fun.

**TIME:** 30 min.

**AIDS:** Prepared laminated cards / optional: pupils can draw the cards (Sun and planet Earth 1×, CO<sub>2</sub> 10×, yellow and red cards 50×); graphic instructions, 2 boxes (size A4 or smaller), string to delimit the space.

**SETTING:** Outdoors, area with flat surface – playground/meadow, gym.

**PROCEDURE:** Place the Sun card on one side of the play area and the Earth card on the other side. Place the yellow cards (with arrows representing sun rays) near the Sun and the red cards (heat rays) near the Earth. Put the CO<sub>2</sub> cards with the string in the centre. One child stands in the middle where the CO<sub>2</sub> card is and hangs the card around his/her neck, becoming a CO<sub>2</sub> particle.



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All the other students go to the Sun and take the yellow arrows that represent sun rays (shortwave radiation). Once they hear the cue "greenhouse effect", the sun rays walk/run towards Earth, turn into heat – they leave the yellow cards near the Earth, each takes a red card out of the box and returns to "space". When emitted, they turned into long waves that the CO<sub>2</sub> kid can catch, i.e. by catching or touching the other kid. If CO<sub>2</sub> captures someone, they must return to Earth (as reflected radiation) and leave the red card there. This red card is not used again and the caught child will re-enter the game as a sun ray with a yellow card. The children that were not captured by CO<sub>2</sub> return to space – they leave the red card near the Sun and start over as sun rays. During the game, the teacher moves the yellow cards back to the Sun into a box as needed.

So far, the greenhouse effect is working as it should. In the first round, the Earth warms up to a temperature necessary to maintain life on the planet, there is not much CO<sub>2</sub> in the air.

### CONTINUATION AND CHANGE:

In the following rounds, the number of CO<sub>2</sub> particles/children will increase up to 10 (that is the maximum number of these cards) and the result will be obvious. The more CO<sub>2</sub>, the more heat remains on Earth, that represents the current state – the climate change. Conclusion: The concentration of CO<sub>2</sub> in the atmosphere is subject to delicate equilibrium, which may be disturbed by humans.

**ATTACHMENT:** Cards to print.



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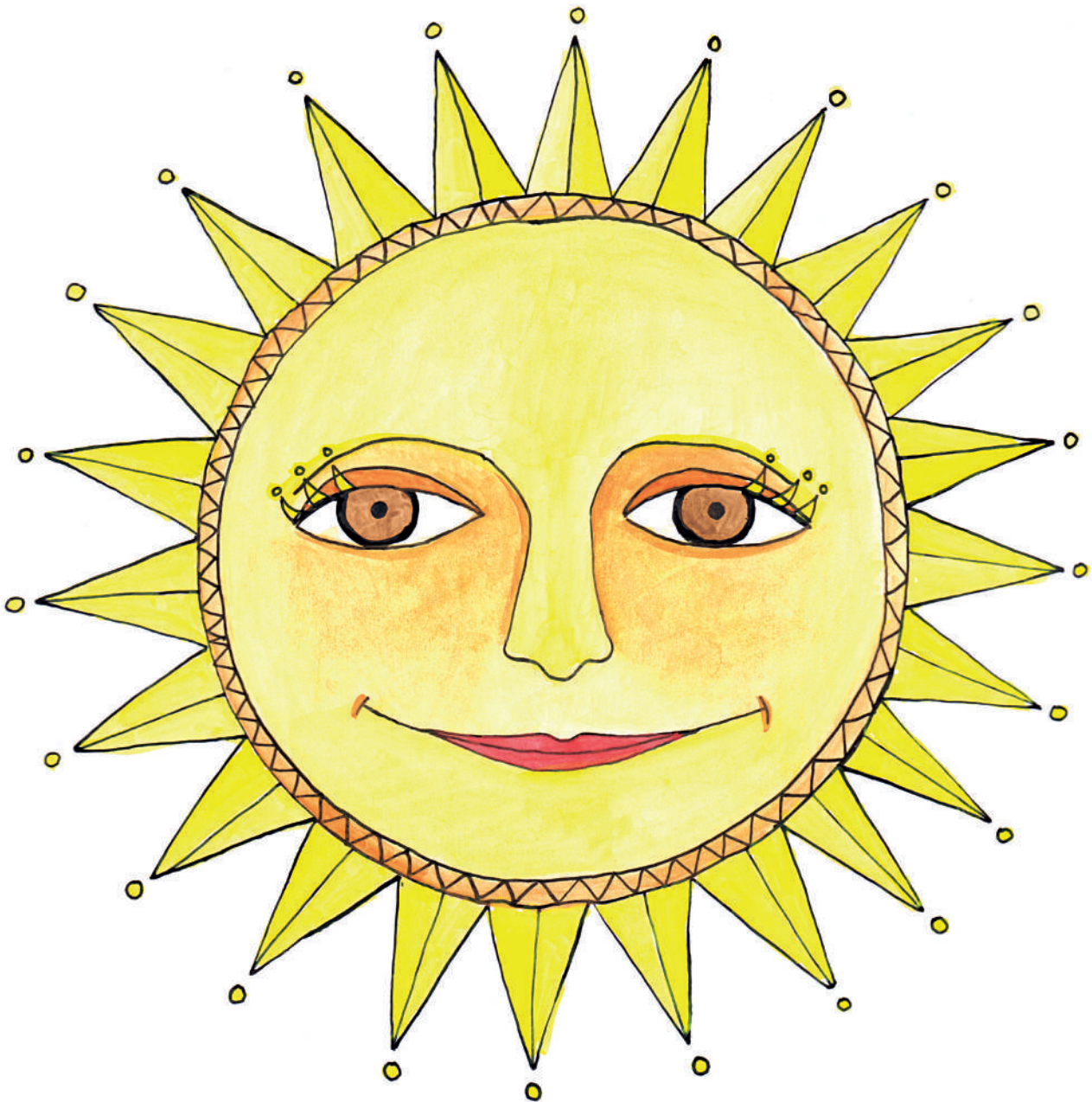


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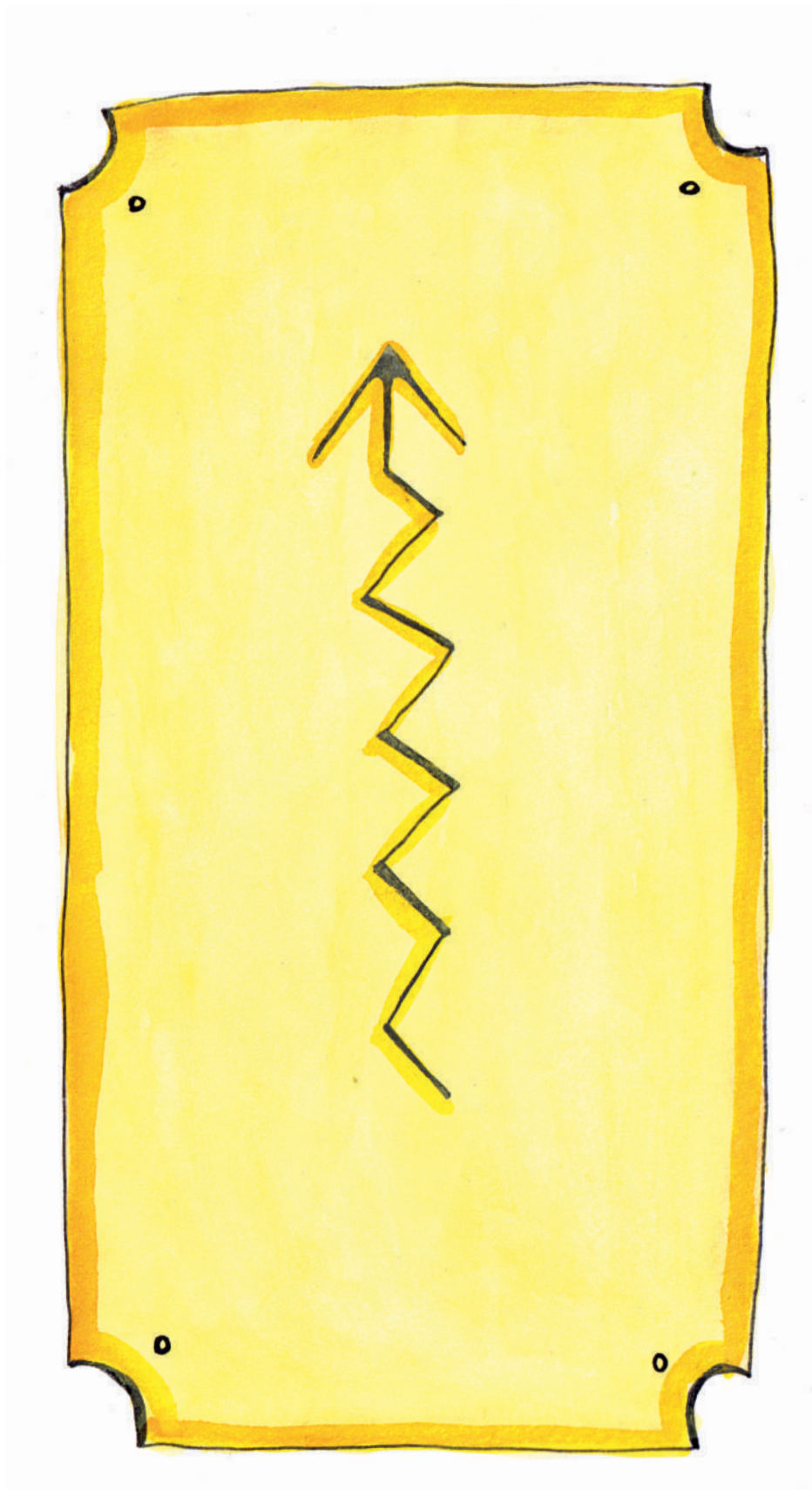
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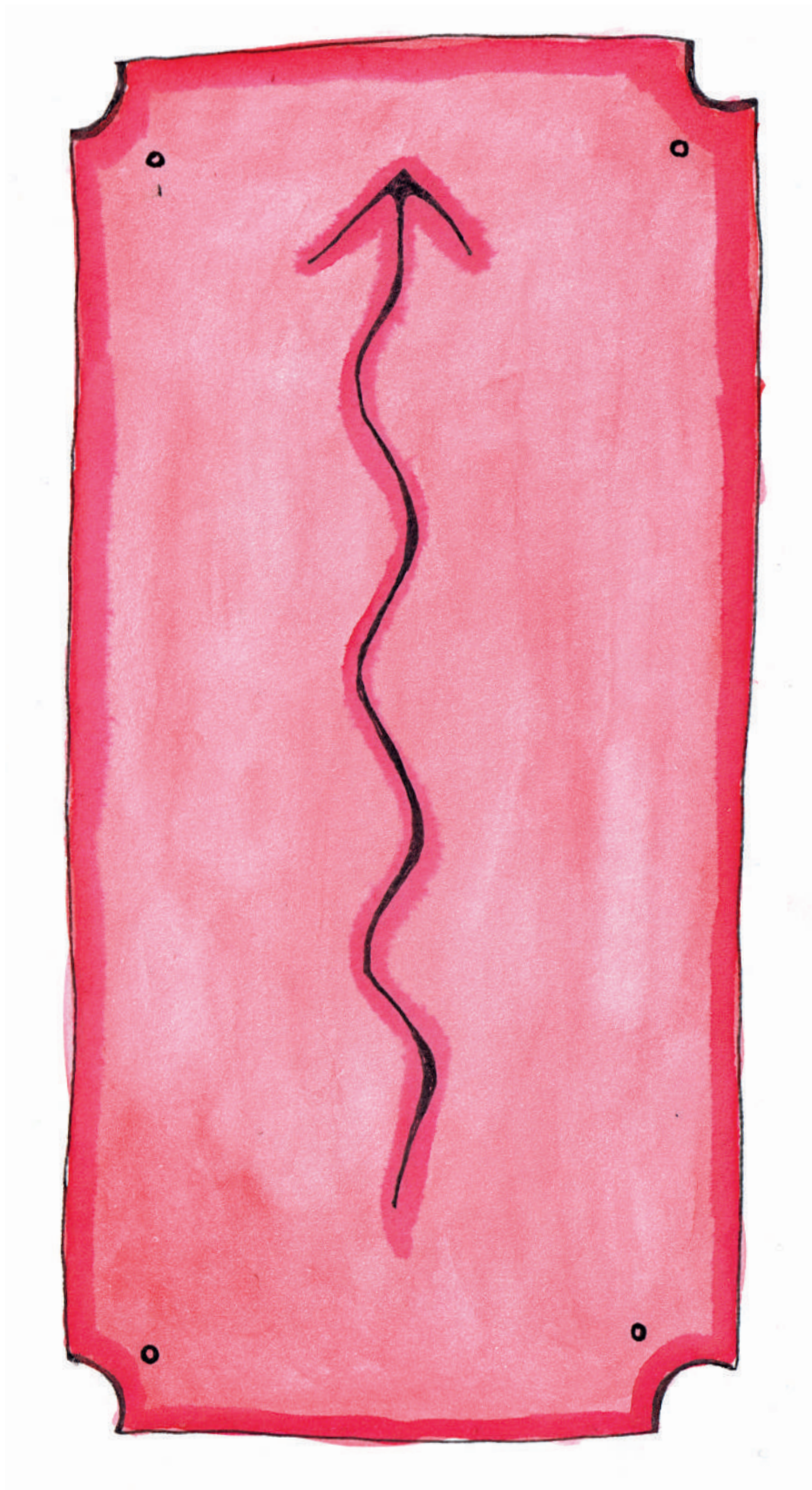
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## 9 Role of man in global warming<sup>9</sup>

**TARGET:** Students can explain what causes global warming.

**TIME:** 45 min.

**AIDS:** Work sheet Global warming for each pupil, adjusting the classroom to make space for the scale.

**PROCEDURE:** The teacher introduces students to the topic using a scale. He/she asks them to stand up. One by one, the teacher reads statements about human activities or has them written down in advance on a board/big sheet of paper or shows pictures to younger children.

The teacher divides the room into 2 sides: **YES** will be on one side, **NO** will be on the other side and **I DON'T KNOW** will stay in the middle. The pupils will think about each statement/sentence and come to stand on that side of the room that represents their opinion. The closer to the middle of the class they stand, the less convincing is their YES/NO, it means that they agree (YES) / disagree (NO) only partially. If a pupil does not know or hesitates, he/she may stand in the middle. The teacher encourages children to rely on their knowledge and experience and not be afraid to make mistakes. The pupils may not know much about the given topics, but they may have heard about it somewhere and may have captured some information either at school or at home. The teacher will give the right answer after each statement.

The teacher will follow up with a work sheet; the children will first go through it and fill it out according to the instructions or after explanation by the teacher.

A discussion follows: what other human activities still cause the formation of greenhouse gases and thus contribute to global warming? Think about your everyday activities and things and about their impact on the environment.

Statements for scaling: (the teacher can add his/her own statements)

What (human) activities produce greenhouse gases and contribute to global warming:

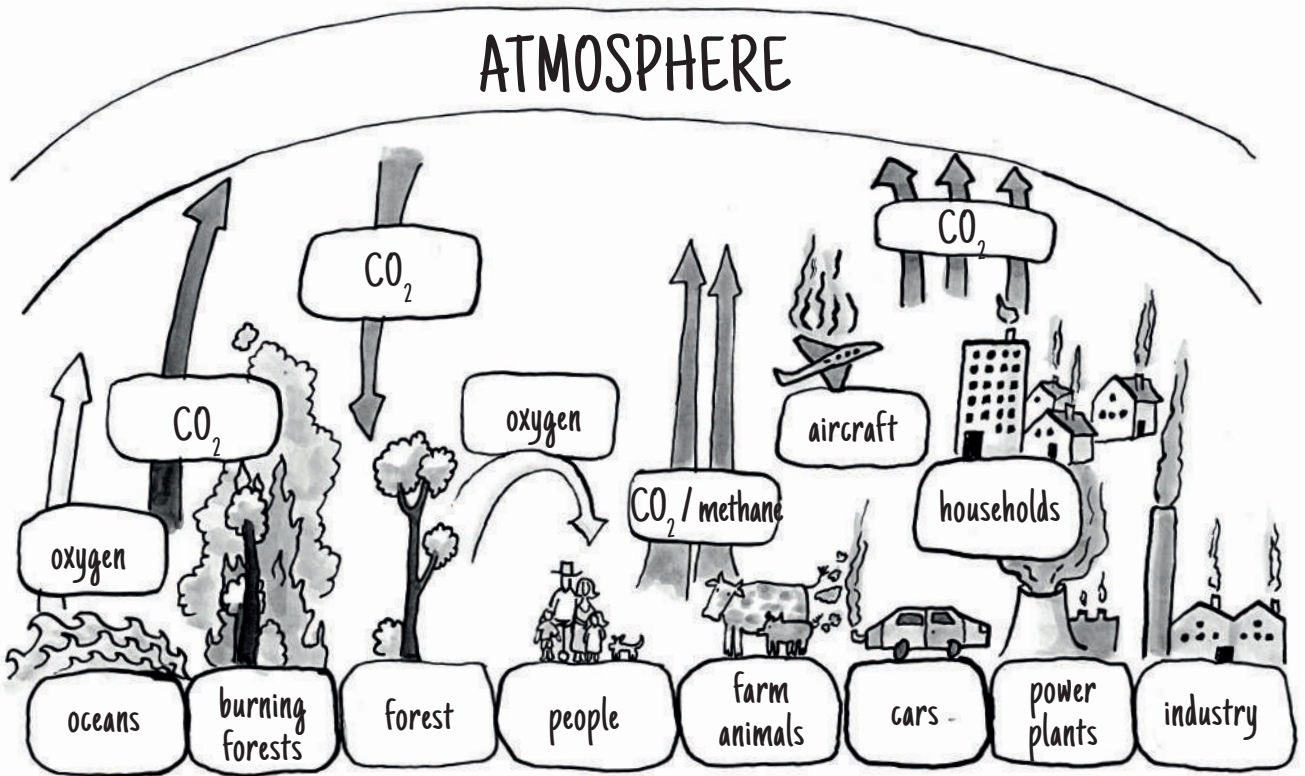
Pupils respond by moving to the YES or NO side (or somewhere between)

1. Riding a bike.
2. Driving a car (running on fuel) generates a certain amount of CO<sub>2</sub> during combustion depending on the car's consumption.
3. Playing football.
4. When we leave heating on at home/school even though it is not necessary.
5. Planting trees creates greenhouse gases.
6. Far away from us (in South America, Africa and Asia), forests are being burned to create pastures. This produces a large amount of CO<sub>2</sub>.
7. Using textile bags and sacks when shopping.
8. If I leave out meat some days, because animal farming generates a large amount of greenhouse gases.





SOLUTION:



cars - people - CO<sub>2</sub> - oxygen - aircraft - CO<sub>2</sub> - oceans - industry - oxygen - forest - CO<sub>2</sub> - burning forests -  
 farm animals - power plants - CO<sub>2</sub>/methane - households



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## 10 The effects of climate change and how do we figure it out?

**TARGET:** Students will learn about the possible consequences/effects of climate change, as well as the possibilities to mitigate these consequences and to participate actively. They will realise the impact of their actions on climate change and their power to do something to avert it. They will learn about behaviours that lead to improving the climate.

**TIME:** 45 min.

**AIDS:** 2× A3 paper/board, picture with Bobby 2× A4 (for the class), set of laminated (or printed) cards Consequences of Climate Change 15 pcs, laminated cards My contribution to mitigating the threat of the Climate Change 25 pcs (the number may change), empty cards (see attachments)

**PROCEDURE — EVOCATIVE INTRODUCTION:** Read the interview in the picture with the pupils and answer Bobby the dog's question about what the *climate* is. *Have you ever heard of climate in the news? Have you been involved in a conversation about climate / climate change? Why is it important to talk about it?* If you want, you can add more "bubbles" to the picture.

**VARIATION – DRAMATISATION:** The texts in the bubbles represent a script, selected pupils/volunteers choose their roles (family members, the dog, a TV reporter) and the group plays the scene from the picture to the class.

**PROCEDURE:** Printed/laminated cards + labels hidden earlier by the teacher on various spots in the classroom. Introduce the activity to the pupils in the following manner: *Climate change can put us at great risk in the future, but not everyone is aware of it, some don't see it and some even don't want to see it. You are among the people who know something about the topic and realise how human activities are harming nature. Look for cards hidden in the classroom and learn what could happen to the planet in the future.*

When pupils find all the cards and stack them on larger paper, they match the right labels to the corresponding threats or they can try to figure out what threat is shown in the picture by themselves.

The teacher asks if the kids would like such a world. *Would it make them happy? Their answer will most likely be negative, so he/she asks the kids for ideas on how to avoid it, how to make things better?* They can discuss this briefly and then the children write their ideas on the prepared empty cards in the form of a footprint – heart – hand. Then the teacher places the set of cards with the pupils' contributions and ideas in the classroom (elsewhere than where the threats are, e.g. on the other side of the classroom). All ideas are put down on the papers as follows:

- in the shape of a hand — because they give a **helping hand** for a better world/for nature
- in the shape of a footprint — because they represent the **first footsteps** that must be taken even for others
- in the shape of a heart — because we do it for nature which **we love**







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Children will then read the cards and tune in to their content (the teacher will make sure that younger pupils understand their content). They choose one of the cards. The card will represent their actions – steps to improve the situation of the world. The class's common task will be to create a symbolic path using their cards that will lead from the paper/board with the threat cards in a **different direction**.

1. I ride a bike and walk.
2. I know the types of renewable energy sources.
3. I eat seasonal fruit.
4. I try to avoid plastic packaging when shopping.
5. I know what a mixed forest is.
6. I plant trees.
7. I eat less meat.
8. I know that air travel produces a lot of CO<sub>2</sub> (greenhouse gases), so I will use different means of transport to go on vacation.
9. I am willing to help adults build pools, restore wetlands...
10. I know that frequent mowing of lawns and meadows destroys biodiversity / diversity of species and I can tell my parents and friends about it.
11. I turn off the drinking water tap if I don't need it.
12. I prefer a shower to bath.
13. I try not to buy products with palm oil.
14. I don't buy things I don't really need.
15. I switch off the light as I leave the room.
16. I sort waste.
17. I would rather play outside than play videogames.
18. I only heat as much water in the kettle as I need.
19. I know that an insulated house saves a lot of energy.
20. I take part in environmental projects.
21. I suggest to my family and friends to buy more organic food.
22. If something breaks, I try to fix it first, because I know that a lot of energy and water have been used to make it.
23. I save paper because to make it, trees must be cut down and a lot of water and energy are consumed. When I have the option, I go for recycled paper.
24. I take good care of my things/toys; when I don't need them anymore, I donate them.
25. I am willing to make a financial contribution out of my pocket money (if I receive any) to support a project that improves the environment.

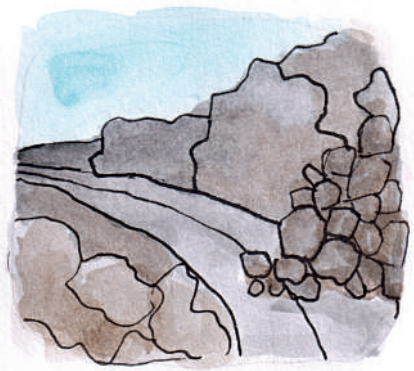
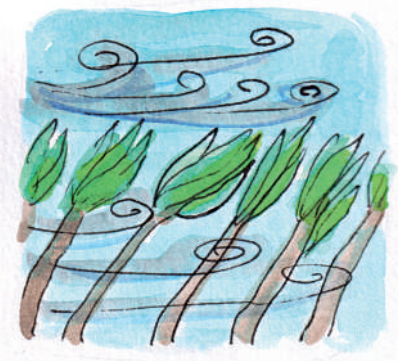
**FINAL REFLECTION:** *How did you like the tasks? How would you describe your experience, how did you feel about it? How did you choose your steps/actions to save the planet? Would you do that in real life? Would you be willing to tighten your belt if it would help both you and nature in the future?*

Statements for *My contribution to mitigating the threat cards* (pictures: footprint, hand, heart) For teachers and pupils to "pave the way" out of the climate crisis (to be printed or written in the pictures).





Consequences of climate change



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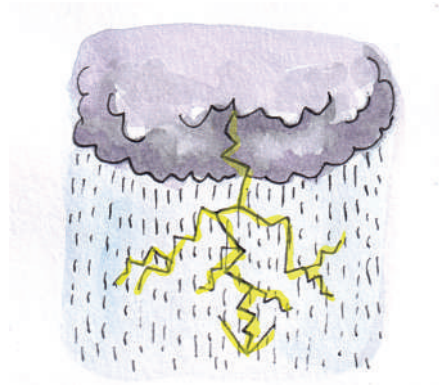
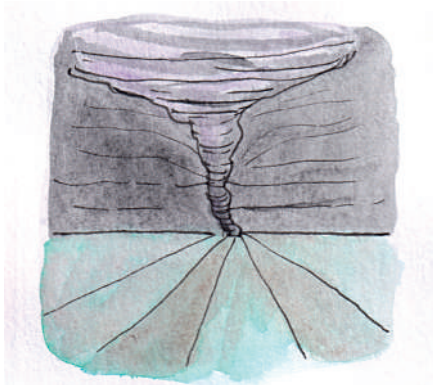
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Steps





## 11 Flower of Power — How can I help<sup>7</sup>

**TARGET:** Pupils will find out their ability/power in relation to climate change and become aware of their potential to contribute to climate change mitigation.

**TIME:** 25 min.

**AIDS:** Work sheet Flower of Power for every pupil, flipchart paper.

**PROCEDURE:** The pupils first complete the Flower of Power work sheet individually. The teacher can remind them of everything they have already learned about climate change. He/she asks the pupils to calm down, focus on their breath for a while and perceive their whole body and think about different areas of life related to climate change (young pupils can be reminded of these areas). They assess how they can influence the individual areas and what is in their power to do about them. If they find it difficult to write their ideas down, they can also try drawing.

They first work individually, then share their notes in pairs. Finally, the pupils write all their ideas on the flipchart paper to create a list of steps to improve the state of the given area. They can continue to work with this list as part of a longer-term school project.

**REFLECTION:** *How did you find coming up with your own moves? In what area did you feel strong? Where was it harder for you, did you feel powerless? What ideas of your classmates interested and inspired you?*

**ADDITIONAL TEXT SOURCES:** Climate x weather (source text: <https://junior.rozhlas.cz/co-je-klima-8051071>)  
<https://ekolist.cz/cz/zpravodajstvi/zpravy/predpoved-pocasi-jak-bude-v-roce-2050>

## 12 Climate change<sup>8</sup>

**TARGET:** Pupils summarise the information about climate change in the form of a fun mind map and take notes.

**TIME:** 30 min.

**TARGET:** Mind map work sheet per child (or according to teacher's decision), coloured pencils, possibly pictures on the topic and glue.

**PROCEDURE:** Four already painted branches lead from the central *Climate* picture. The pupils add 1–5 words on the subject to each of them. They gradually add more information/thoughts in the form of more lines/twigs to form a structure similar to a crown of a tree. It is good to use colours, to draw or glue pictures.

**ABOUT THE METHOD:** Working with a mind map is based on the involvement of both brain hemispheres in the learning process. Usually, we use primarily only one half of the brain, that is, only half of the brain's potential. A mind map helps us stay focused on the main topic and related issues. It takes advantage of the fact that the human brain thinks in colours and images, improves the way information is remembered and develops creativity.





## 13 Two mules<sup>7</sup>

Cooperation and the ability to resolve conflicts is one of the key competences for the future challenges that today's young generation is likely to face.

**TARGET:** Pupils will learn about the possibility of non-violent and cooperative problem solving.

**TIME:** 15 min.

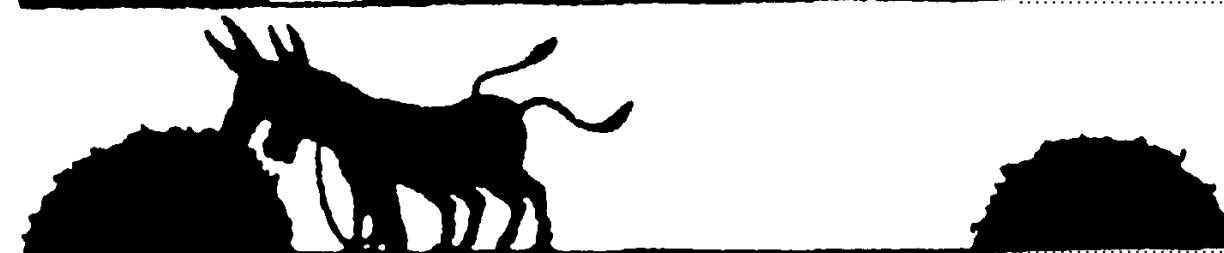
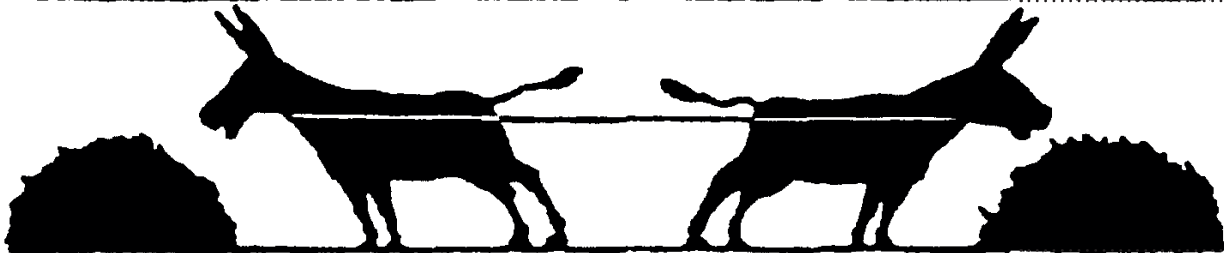
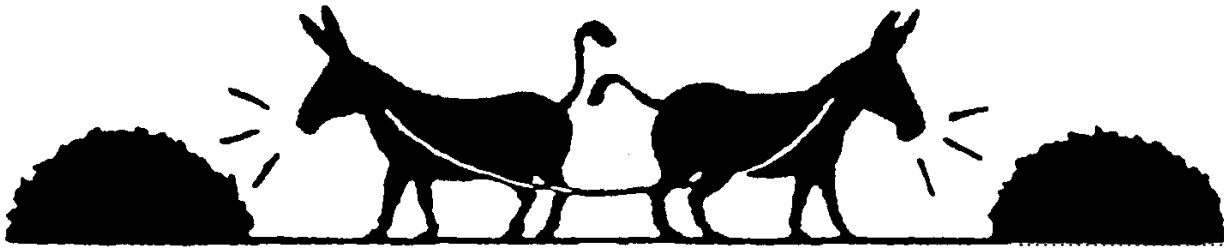
**AIDS:** A set of images cut out from the Attachment.

**PROCEDURE:** The pupils work in groups of four and receive a cut out set of pictures which have been shuffled. First, each member of the group looks quietly at each picture. Their task is to line up the pictures so that they best describe the story of two mules. It is important to listen to each other's suggestions and agree on one story. The goal is to agree on one version of the story.

To entertain the pupils, you can play them a fun video: [https://www.youtube.com/watch?v=fUXdrI9ch\\_Q](https://www.youtube.com/watch?v=fUXdrI9ch_Q)

**REFLECTION:** *How did you like working together? What did the agreement/negotiation in the group look like? How did you manage to get your proposal/idea through? What would you do differently if you were doing this for the second time?*





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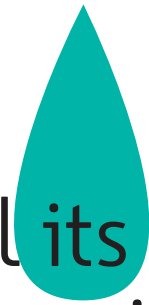
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“Direct sensuous reality, in all its more-than-human mystery, remains the sole solid touchstone for an experiential world now inundated with electronically-generated vistas and engineered pleasures; only in regular contact with the tangible ground and sky can we learn how to orient and to navigate in the multiple dimensions that now claim us...”

(David Abram)



“To look is to establish a reciprocal relationship and that is something that has been forgotten.”

(Václav Cílek)



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We were born on planet Earth and just as we have an innate attachment to our loved ones, we have an innate attachment to the environment we grew up in and live in. We are in constant interaction with the landscape around us. We experience a relationship that constantly affects us and the landscape. Through the activities presented, our intention is to create and develop in pupils a sense of belonging to nature and a respectful relationship with the landscape. We need not only to heal the landscape, but also to heal our relationship with it. We provide ways of perceiving the landscape and 'how to read it'. Therefore, we consider the practical exploration of it in the field with the potential for active involvement in practical conservation to be an important part of this.

The activities in this chapter are a contribution to place-based learning and can serve to inspire you and give you ideas for grasping the theme of our relationship with the landscape.

Activity name	Activity type (e.g. experiment, video sample, artwork)	Activity information (relevant to what the activity is about: e.g. summary or topic)	Duration (min)	Environment (outdoor/ indoor activity)	Page
1 <b>Image of the landscape</b>	sensory activity, handcraft	motivation	30 min	outdoor	183
2 <b>Sounds of the landscape</b>	sensory activity	motivation	30 min	outdoor	183
3 <b>Landscape and a map of feelings</b>	observation, perception	developing awareness, working with feelings	30 min	outdoor	184
4 <b>Landart</b>	artistic activity	forming a relationship	45 min	outdoor	185
5 <b>Map of places close to the heart</b>	school project	presentation/community/ public involvement	long term	outdoor + indoor	186
6 <b>Marketplace</b>	movement activity + work with work sheet	summary	45 min	indoor	186
7 <b>Memoirs of the landscape</b>	school project	presentation/community/ public involvement	long term	outdoor + indoor	188
8 <b>Creating a drought and water map</b>	school project	landscape survey	long term	outdoor + indoor	190
9 <b>Joint survey of the landscape</b>	school project	landscape survey	long term	outdoor + indoor	191
10 <b>Mosaic for the landscape</b>	school project	osobní příspěvek pro změnu	45 min	indoor	194





## 1 Image of the landscape<sup>1</sup>

**TARGET:** Pupils get to know the landscape and form a relationship with it through direct contact and focused attention.

**TIME:** 30 min

**AIDS:** Cardboard, scissors, string (for exhibition), outdoor environment, pads for sitting

**PROCEDURE:** Pupils make frames out of boxes and go for a walk in the countryside. They find a view that they like, that attracts them. They focus on a particular section/part of the landscape, they observe the landscape closely, trying to capture every detail. They then show this particular view (the view from their spot) to others – if the environment allows, they hang, place or hold their frame for a moment for others to look through it. They may/may not comment on each other's views. It will be a natural landscape gallery for the whole class.

**VARIATIONS:** Change of perspective: the landscape looks at us, perceives us, how we live, act, move in it... *How does it see us/what does it think of us? What would it say about us? What would it find interesting about us?*

**REFLECTION:** *Were you successful in your landscape observation? Why did you choose that part of the landscape? What makes it special and why are you interested in it? What surprised you? What other images of your classmates were you attracted to or liked?*

**TIP FOR TEACHERS:** can be linked to activity 5 Map of remarkable/loved places

## 2 Sounds of landscape<sup>2</sup>

**TARGET:** Pupils perceive and recognise different types of landscape through their senses (hearing).

**TIME:** 30 min

**AIDS:** Outdoor environment, pads for sitting, papers, pencils

**PROCEDURE:** The teacher takes the class for a walk, finds a pleasant place, a space big enough for everyone. A nice place where we enjoy silence, listen to and explore sounds. The teacher will instruct the children to find a place where they can sit comfortably for about 10 minutes (it can be less or more depending on the pupils' age) and relax. First, they should bring awareness to their body and breath. Then the teacher and pupils listen to all the sounds around them and to the sounds coming from far away. They only listen, they do not evaluate the sounds as pleasant or unpleasant, they do not think about them, they just listen attentively. Then they draw the sounds on paper as a simple drawing. They add a description, e.g. a pigeon, a fly, a car, children screaming... The children look at each other's drawings.

**REFLECTION:** *How did you like the task? How did you feel listening to the sounds? What worked well/what disturbed you? What was surprising? Is there any sound you wouldn't hear if you weren't so quiet, for example if you were walking through the countryside? What would you do differently next time (e.g. find a more comfortable/quiet place)? Did you recognize any sounds in the drawings of others? Where did the sounds you heard come from? Focus on the origin of the*





sounds and use them to characterize the landscape you are exploring (urban, natural...). Talk about the different types of landscapes, what people use them for, what they provide, etc.

### 3 Landscape and a map of feelings

**TARGET:** Pupils develop a relationship with the landscape and the place where they live. They improve their emotional skills.

**TIME:** 30 min

**AIDS:** Work sheet Map of feelings/wheels of feeling for each pupil

**PROCEDURE:** During a walk through the countryside, the pupils find different stops where we can stay and be quiet for a few minutes, e.g. a view of a town/village, a stream, a forest clearing, traces left by humans (e.g. waste). We bring out attention to ourselves and then to the landscape around us. We focus feeling the surrounding landscape brings up. We make association of our feelings – we say them out loud or we can mark them in the work sheet Map of feelings (or, on the contrary, take inspiration from the map). Later, we share feelings together if we feel good about it.

**ATTACHMENT:** Map of feelings (source: Klíčové kompetence a jejich rozvíjení, Portál 2001)

**TIME:** 30–45 min

**AIDS:** Large paper heart, sad paper smiley – for each pupil, 3 smaller hearts and 3 sad smiley faces – with a picture inside: tit, hedgehog, butterfly, sitting mats (according to the season)

#### PROCEDURE:

Large paper heart, sad paper smiley for each pupil, 3 smaller hearts and sad smileys with a picture on the inside of a tit, hedgehog, butterfly; pads for sitting Procedure:

1. The teacher chooses in advance a spot where the class will stop on their walk through the landscape. The spot should be such that has both positive and negative features that can be discussed. They can also make multiple stops during the walk and evaluate multiple places through their own feelings.
2. Everyone is sitting or standing in a circle. The rule is that pupils must be in sight of the teacher. He/she then invites the pupils to see, explore, walk around and become aware of how they feel about the landscape and the environment they are in. If they find a place in the neighbourhood where they feel comfortable, they place a big heart in that particular spot. If they feel unwell somewhere, they place a sad smiley face there. Then they return to the circle. When everyone is back, they go through the marked areas together and talk about their feelings and the locations of the hearts and sad smiley faces.
3. Everyone stands/sits in a circle again. The teacher talks to the pupils about other organisms that live in the landscape – animals, plants. They can try together to name animals that might live here. What do such animals need to live and be happy? Together they come up with the answers: suitable nutrition, shelter, nest, den, enough water, space to move around, sometimes other individuals of their species...
4. Now the pupils will not evaluate the landscape through their own feeling, but by becoming a tit, a hedgehog and a butterfly in their imagination. They try to see the landscape through their eyes. They think about whether they have everything they need to live here. Would they like it here? They place hearts or sad smiley faces in the landscape accordingly.





5. Once again, they gather in a circle and share how they felt in the skin of the animals. Is there everything they need for their lives? What is missing in the landscape?

### What do animals need, examples:

**butterfly:** flowering plants, shade and sun, taller grass

**hedgehog:** shelter, insects, worms, small mammals, space, water

**tit:** insects, trees with cavities or birdhouses, bushes, water



## Landart

**TARGET:** Pupils develop a relationship with the landscape, creativity and sensory perception.

**TIME:** 45 min

**AIDS:** Outdoor environment, natural resources (found, brought)

**PROCEDURE:** In a pleasant spot in the woods/meadow the pupils will divide into small groups (3-4). The teacher will explain the meaning of the word: land-art (landscape art/art in the landscape). They choose a place they like, explore it, consider what its natural features remind them of, etc. At first, they just observe the place for a while, taking in everything it has to offer (branches, fruits, flowers, grass, water, different corners, snow in winter...), what inspires them, what topics come to mind. Then they agree on what they will work on – the pupils use only natural materials they found nearby or brought with them. The result of their creative process is a trace in nature in the form of a work of art. The teacher will encourage the pupils to be original and spontaneous, to relax, express themselves and enjoy the experience of creation, to let their imagination run wild. He/she will emphasise that the process of creation is more important than the result. At the end, we invite other students to view the jointly created land-art works. When everyone has seen all the works, we sit in a circle together and reflect on the process of creation. You can take photos of the works and create a gallery in your classroom or school hallway.

**REFLECTION:** *How did you like the creative process? What did you do well/not well, like/dislike? What are you taking away from it? How did you like working together in groups?*

**TIP FOR LEADING THE ACTIVITY:** Make sure that the pupils do not disturb the habitat of animals or plants in the site.

**INSPIRATION – FAMOUS LAND-ARTISTS:** Andy Goldsworthy, Christo, R. Smithson



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Image autor: Michaela Schererová



## 5 Map of remarkable/loved places

**TIP:** School project – can be linked to the Map of feelings

**TARGET:** Deeper familiarisation with the surroundings, developing a relationship with the closest landscape and nature around us. Active involvement in protection of the landscape in the area.

**TIME:** Long-term project

**AIDS:** Copy of an enlarged map of school/municipality surroundings (size A3) for each student or pair, flipchart paper, glue, crayons

**PROCEDURE:** First, the class goes for a walk through the surrounding landscape. The teacher encourages the pupils to be observant, as based on their journey they will create a remarkable map. Each child chooses/finds a place/item that he/she likes, is intrigued by, associates with a pleasant experience. We will focus on natural features in the area (a tree, a view, a group of bushes, a nice stone, a home of a squirrel, etc.). The selected spot is put on the map. The pupils draw a picture or take a photo of the place and add a brief description of their own experience, why they value the place ("nice place to sit, butterflies are flying here, it is quiet, peaceful..."). They also think about how important this place is in terms of its ecosystem. They add this information to the map, e.g. "the habitat is a home for birds, provides food/water for animals, is a home for squirrels, or retains water in the landscape". Some pupils may even write a poem or create a story about their place.

This way we will get set of remarkable places to walk around or for other people to visit (classmates, family, the public). This map will be presented as an invitation for such visits in the area to the whole school/school community.

**ADDITIONAL ACTIVITY FOR A SCHOOL PROJECT:** involvement and presentation at the municipal office/town hall

The class will make suggestions for improving the selected places, e.g. "plant a tree, place a birdhouse, clean up, label with information, create a seating area – a bench", etc. This map of the selected places with descriptions and **suggestions for improvement** will be presented and displayed by the pupils at the town hall or other public space, if available. After the presentation, they can try to move to the next step – arranging a meeting with the relevant authority or institution to discuss the individual proposals and their potential for implementation.



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## 6 Marketplace

**TARGET:** Pupils will understand the difference between healthy and damaged landscapes and learn about ways to make a difference towards restoration.

**TIME:** 45 min

**AIDS:** Printed pictures of damaged landscapes and healthy landscapes for reference, printed work sheets Let's restore the landscape on for each pair, a box of sand or similar

**INITIAL MOTIVATION:** The teacher brings a box of sand representing a dry landscape – a desert + a picture of eroded soil in Moravia. He/she tells the pupils that they can save this landscape, transform it, but they need both knowledge and power (not only). They can discuss at the end what more they may need. It is important to help the landscape retain water. After completing the movement tasks, they are given pictures (there are 9) from which they create a living landscape using the prepared work sheets. That is how the landscape will come to live again.

**NOTE:** we have tried this in combination with the water retention experiment, which is in another chapter, but it doesn't matter.

**PROCEDURE:** Before the pupils start the movement activity, the teacher writes the pupils' ideas/suggestions for transforming the landscape on the board. He/she then introduces a set of pictures of landscape features (see the work sheet below) they can win as a reward for the exercise and their efforts. The teacher adds that implementing landscape restoration in practice also costs something – not only money, but also time and effort.

The teacher writes on the board tasks simulating the physical activity required in field work, water retention modifications in the landscape, and landscape transformation:

- building/digging a pool = engaging shoulder muscles = push-ups
- planting trees = push-ups + bending over and ideally touching the ground with the palms of the hands, when planting tree alleys we can increase the number of push-ups and forward folds
- landscape mapping = long walking = running in place for 2 min, because we have to get to know the landscape well enough first to discover the right places for building pools, where trees are missing, etc.
- digging out drainage pipes = shoulder exercises = push-ups against the wall + squats

Pupils gradually gain elements (water features and greenery, fauna: amphibians, insects) needed to restore the landscape. In pairs, they place (glue) them on the work sheet. They can use crayons to spruce up the work sheet with drawings.

**ATTACHMENT:** Work sheet photos – print in pairs for pupils to cut and glue.

**REFLECTION:** *Have you "worked"/practiced a lot to revive the landscape? Was it a difficult task? How do you think it is in reality? When you compare the landscape in the picture before and after the animation, what differences do you see, how do you feel about the picture? Which landscape would you rather go for a walk in and why? What else is needed to revive the landscape (finances, time to deal with the authorities, a certain profession, etc.)?*



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## 7 Memoirs of the landscape

**TARGET:** Pupils describe the place where they live – the landscape features that have shaped it across time, and search for and compare information in a timeline about the place. They will understand how and why the landscape changes over time. Development of cooperation, communication and presentation skills.

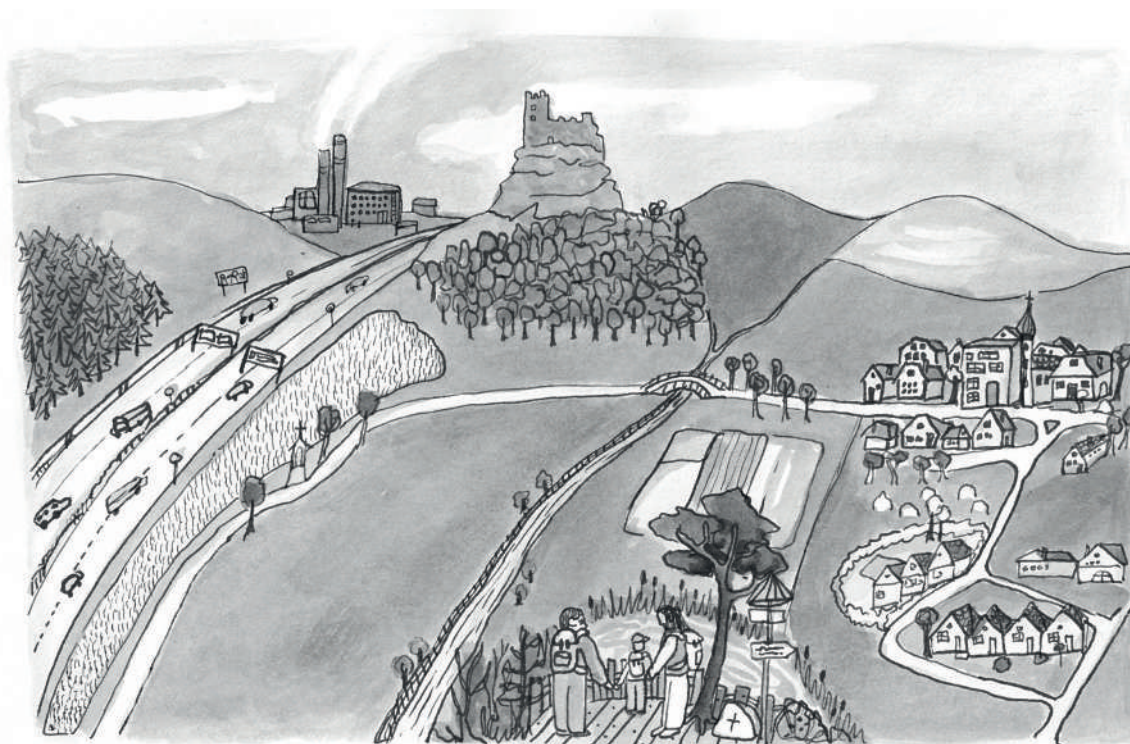
**TIME:** Introductory activity 45 min + long-term school/class project

**AIDS:** Moving chairs, pencil and paper for each pair, hard mat, picture of a landscape for each pair (see attachment); the teacher may use another suitable picture (photo), the pictures may or may not be the same for all pairs

### PROCEDURE PART 1: Initial tuning to the theme – Landscape from a different angle

Pupils are divided into pairs, sitting in pairs with their backs to each other – the backs of their chairs are touching so that the pupils can hear each other. Pupil A will describe, pupil B will draw. They decide who will be A and who B. Pupil A receives a picture/photo, he/she holds the picture close to his/her body so that the partner cannot see it. He/she describes in his/her own words, but accurately and in detail, the picture of the landscape to pupil B. Pupil B draws it and tries to capture the most perfect replica (copy) that matches the original in size, shape and detail. Pupils work together, pupil B can ask questions. Pupil A's task is to answer and help his/her classmate to create as accurate a picture of the landscape as possible. When the time is up, the pairs look at the image they have created and compare it to the original.

**ATTACHMENT:** Landscape image



They will then describe/label the images – both copies and originals – based on 2 questions.



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They will then describe/label the images, both copies and originals, following these two questions.

1. Find and label the elements that were created by nature and those created by man.
2. Find elements that man has created in recent history and those that are very old.

Pupils will then show their answers/solution on the landscape image. The teacher asks a third important question:

3. How has the landscape changed over time under the influence of human activity?

A joint discussion follows. The teacher writes the ideas and opinions of the pupils and the conclusions of the discussion on the board and the pupils write them on the other side of the picture.

**REFLECTION:** *How did you feel working back-to-back in pairs? How did you like working together? Has the cooperation changed during the task? How did you manage to communicate with your partner? What would you do differently next time?*

### PROCEDURE PART 2: Classroom/school project **Memoirs of the landscape**

**DATA COLLECTION:** Pupils, with the help of the teacher and the parents, search for information about the past of the landscape where they live. To obtain information and fill in questionnaires, they collect testimonies: they ask parents, grandparents, old people – survivors, local farmers, beekeepers who were born in the area or have lived there for a long time. They can use the local library, search for information in the local chronicle or visit the municipal office or town hall. We also recommend exploring written sources: local histories, legends and stories. Old postcards, photographs and maps can also be used. Pupils document their data collection, e.g. by taking photos of the people they have spoken to or recording a short report. They compare the information obtained with the present by **comparing** what the landscape has gained and lost. They present the findings of the project either at school or publicly in the municipality where they collected the information (at the town hall, local museum, etc.). The project may also be concluded by proposing a change in the landscape, e.g. restoring an avenue, an old orchard, building a pond in place of a former wetland, etc. Pupils can focus only on part of the questionnaire for the presentation, e.g. water features, forests, fauna... depending on how many testimonies they managed to collect and what they found most interesting.

#### Questionnaire for pupils on the project **Memoires of the Landscape:**

1. Was there any mining in your area?
2. How have local water sources and features changed? Streams, wells, ponds, lakes?
3. Were there any wetlands or springs in your area in the past?
4. Is there a memorable tree in your village? (What is its story?)
5. Find out where the old roads used to lead in the past and where the wayside crosses used to stand.
6. Where were the alleys/old orchards located in the past?
7. What did people in the region do for a living in the past?
8. What crops were grown in the fields around where you live and what crops are grown today?
9. What animal species living in your area are extinct/at risk of extinction?
10. What kinds of forests were there in the past in your area?

**Forms of project presentation (during and at the end of the project):** For the presentation, focus on comparisons in the context of time, e.g. grandmother and grandchild's view, photos from 80 years ago and today, etc.

— Creating posters depicting the process of collecting and processing information



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- Playing short theatre sketches
- Creating comics/art collages
- Exhibition of photographs and pictures from the project
- PowerPoint presentation
- Letter to the mayor or some other relevant organisation (AOPK [Environmental Protection Agency], local association, etc...)
- Article for local/regional newspaper
- ...

### MORE IDEAS FOR STUDENT PROJECTS:

#### PHOTO COMPETITION/SHOW:

The teacher/school will announce 3 categories of competition:

1. My favourite place in the landscape
2. A place that was hurt by man
3. A place man has helped

The best photographs are selected by a jury and displayed at a preview in the classroom/school premises.  
(Source: OU Ametyst)



## 8 Creating a drought and water map

**TARGET:** Pupils pay attention to and get to know the landscape, understand what happens in it, what processes and activities damage it.

**TIME:** Long-term school/home project

**AIDS:** Map of the school/place of residence, maps created by pupils, surroundings of the school/municipality

**PROCEDURE:** Children will draw their own simplified map based on the real map (you can copy the map and work with the copy) – A3 format. They record important landmarks, e.g. the location of a bus/train station, the location of the school, the church... On the map, pupils draw a direction line or a north arrow. The map should also include a title, scale and legend (explaining all the elements shown on the map). For this activity, pupils become researchers. Before going out into the field to investigate, the teacher asks if the pupils know *what the effects of drought and water excess (flooding) are. Why is it important pay attention to these manifestations and investigate them?* Based on the answers, the teacher explains that their goal is to create a modern map – a map reflecting the manifestations of climate change. These records can be used for useful conservation projects in the future.



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**Detected traces of drought or flooding** (this could be made into a nice infographic)

1. Locate and mark places where water or snow accumulates and where waterlogged areas appear.
2. Locate and mark the places where soil erosion occurs, including erosion furrows and soil splashed from the fields. (aid: picture of eroded soil from the Marketplace activity)
3. Find and mark places where drought and its manifestations have occurred – e.g. dead and dying trees and other greenery, dried out watercourses, dry wells, cracked soil – write in the comments which of these it is.

The pupils can display the maps in the municipality/school, send them to the municipal office/town hall or make an appointment at the office and submit them as a basis for landscape changes.

## 9 Exploring landscape together

**AIDS:** Map of the surrounding landscape, pencil, markers, descriptions and photographs of landscape features – see Attachment below.

In pairs, the teacher distributes a printed basic map of the area where that the pupils will explore. Together they walk through the area and record the features they discover on the map. They describe what the individual spots look like. They take photographs. They notice especially these elements:

Wetlands, swamps, alleys, groves, solitary trees, pools, ponds, meanders – these are marked on the map in shades of blue, green, brown.

Drainage trench, pipe, straightened flow, fortified flow, large field without greenery, erosion – marked by shades of orange to red.

When they arrive at school, they paint each of the marked points on a large common map in the classroom. They give the spots numbers. They can also add elements they found when doing homework. The teacher can print out the photographs taken at the marked locations and the pupils can use them to create accompanying material for the map, each photograph bearing a number identical to the number of the point on the map.

Do not forget to create a legend for the map. E.g. dark green point – solitary tree, red point – drainage trench outlet, etc.



**ATTACHMENT:** Description of landscape features.

**Wetlands** – places in the landscape where water is often held. There are many plants that like water and a wide variety of animals live here (butterflies, dragonflies, frogs, ...). It is an area of marshes, peat bogs, etc.



**Alley** – or tree line. Groups of trees planted in a line, usually at regular intervals. Usually an accompanying feature of water-courses, property boundaries or traffic routes.



**Bosk** – it is a part of the landscape that is a natural shelter for small and larger animals in the open space. They are covered with various shrubs, trees and other lush vegetation.



**Solitary tree** – a tree/shrub planted or growing naturally alone.



**Sinkhole** – a depression in the ground filled with water. Water can be kept in it permanently or only for part of the year. Even if it dries up part of the year, it is home to many animals or helps to hold back or slow down heavy rains.





**Pond** – a man-made body of water. It is used mostly for breeding fish and waterfowl.



**Meander** – a bend in a river caused by erosion. Formed when the banks are washed away on one side of the channel and depositing material on the other side.



**Drainage ditch** – a small to medium channel for water runoff.



**Amelioration** – the term amelioration generally refers to all measures leading to an increase in soil fertility. However, the term reclamation has come to be used primarily for systems that drain the landscape by technical measures such as pipe drains and ditches.

**Drainage pipe** – pipe drainage or “goosenecks” buried in the ground, pulling and draining water from the surrounding area. The photo shows a drainage pipe outlet.



**Melioration shaft** – the point of confluence of 2 or more drainage pipes, or a control point of a drainage system. Often visible in the landscape as a concrete cliff in the middle of fields.





**Straightened, regulated flow** – artificially created shape of a stream channel. In the past, channels were artificially straightened as part of regulatory measures. Today, the opposite process is sometimes occurring, with water managers beginning to return streams to their original river and stream channel forms. The straightened channel can be enriched with concrete fortifications, preventing the water from changing the shape of the channel. It significantly accelerates the flow and runoff of water, making it impossible for most aquatic animals to live.



**Large fields without greenery** – areas of fields without hedges, solitary trees, avenues... Often large areas of fields are sown with one type of crop. For many organisms it is a 'desert'. Generally not conducive to life.



**Erosion** – the transport of soil by water or wind

a) rill



b) sheet



## 10 Mosaic for the landscape — final activity

**TARGET:** Pupils develop the ability to cooperate, self-confidence, creative thinking. They strengthen the ability to be attentive to themselves and to classmates. Strengthening confidence in one's own abilities and possibilities.

**TIME:** 30 min

**AIDS:** Picture of a nice healthy natural landscape – large format, glued on cardboard and divided into pieces (like a jigsaw puzzle) according to the number of children in the class/group.



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**PROCEDURE:** The teacher introduces the activity: each of us is unique and has unique abilities. He/she can refer to medieval knights for motivation. In the past, every knight had a shield and a coat of arms on it. In the coat of arms, the knights had one of their virtues (a good quality) depicted. Then each pupil takes a moment to reflect on a skill they can use to protect nature and the landscape. Helpful questions: *What are you good at? What do you like to do? How can your skills/traits be useful?*

The skill can be social or general (e.g. the ability to communicate, observe, love of nature, love of animals, thoughtfulness, documentation skills: taking photos, making videos, drawing, etc.) – each skill contributes with something to the whole. Each student writes a characteristic he/she is proud of, a strength that forms part of a mosaic. Then they put together a picture of a healthy landscape. Pupils can display the mosaic of the landscape and their skills in the classroom, they can return to it and build on its content in the implementation of school (not only) ecology projects. (pozn. asi by se dalo zas navázat na realizaci...)

**REFLECTION:** *Did you find it difficult to think about and come up with your strengths? In your opinion, does everyone have a gift/talent that can contribute to the protection of the planet? How did you like working together in the process of creating the mosaic? How does it feel to see that together we have so many great skills? Do you have any ideas on how we could use them for landscape/nature conservation?*

## 11 DESIGN OF NATURE-FRIENDLY MEASURES IN THE LANDSCAPE

Final activity building on previous activities in this chapter, in particular the Joint Landscape Survey and Mosaic for Landscape.

**TARGET:** Learning about the chosen ecosystem, practical exploration of landscape features, development of contextual thinking, development of communication and presentation skills, education for civic engagement, understanding of the concept of biodiversity.

**TIME:** school project (3 months, recommended March–June)

**AIDS:** depending on the chosen form of the project – art supplies, computer, presentation software (PowerPoint), atlases, educational science literature, internet, information and photos from previous activities if available, contacts at the municipality/city office, etc.

### PROCEDURE:

1. Determination of the project's intention (design and presentation of nature-friendly measures – e.g. design of pools, modification of a part of a stream – building dams or dams, protection of springs, planting trees, building of trees, etc.).
2. Planning of activities, forms of project elaboration (“what, where and how, with whom, for whom ... we will do”, proposal of time schedule).
3. Preparation of documents – processing and using information and knowledge from previous activities (photos from walks, cards with description of animals and plants and their relation to the proposed action, mind map, etc.) and obtaining and processing information from other sources (educational literature, printed materials, internet, etc.)
4. Creation of the proposal and presentation materials (artwork, photographs, information gathering, practicing argumentation).
5. Presenting the proposal in public.



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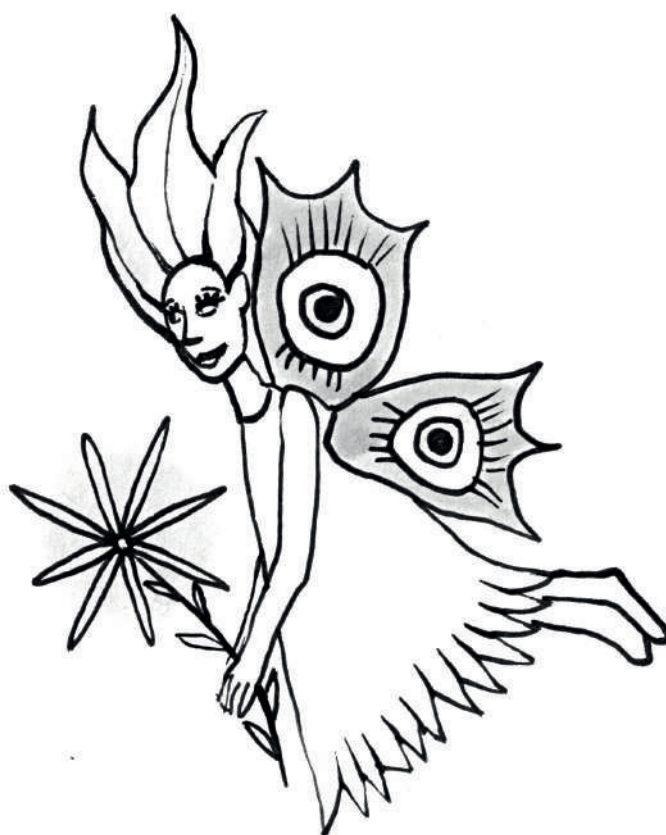
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**OUTPUT:** Presentation of the project to municipal or city authorities (officials of relevant departments, councillors, etc.), foresters, fishermen, nature conservationists, landowners, etc., by means of artistically processed pictures and photographs or PowerPoint presentations and personally communicated information and arguments according to the situation on a specific site. Here is an example of a presentation made:

[https://docs.google.com/presentation/d/1QXrBVcG4XG933RLhJyGNNDExJiOTgwBHJlr1-3D\\_We8/edit?usp=sharing](https://docs.google.com/presentation/d/1QXrBVcG4XG933RLhJyGNNDExJiOTgwBHJlr1-3D_We8/edit?usp=sharing)

**REFLECTION:** After the presentation, the teacher will give the pupils the opportunity to reflect on the whole project, to express their opinions and feelings about the whole process, possible questions for reflection: *How do you feel about the public presentation? What was challenging for you? Did the project meet your expectations? Is there anything that surprised you? Would you do this project again? What would you change for the next project: in preparation, implementation, presentation itself? What did the project bring to you personally and what did it bring to nature/the world?*



#### References:

1. Adjusted according to: Collective of authors: *Krajina nápadů*. Chaloupky, Třebíč, 2021.
2. Adjusted according to: KŘÍŽ, M. et al.: *Zamiluj si přírodu*. Chaloupky, Třebíč, 2020.
3. Adjusted according to: ALDERSLOWE, L., AMUS, G., DESHAIES, D.: *Péče o Zemi, péče o lidi a spravedlivé dělení ve vzdělávání. Manuál, jak sdílet permakulturu s dětmi*. 2018 [online]. [cit. 19.5.2022] Available from: <[https://issuu.com/childreninpermaculture/docs/cz\\_manual](https://issuu.com/childreninpermaculture/docs/cz_manual)>.
4. Source: OU Ametyst - aktivita 7



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