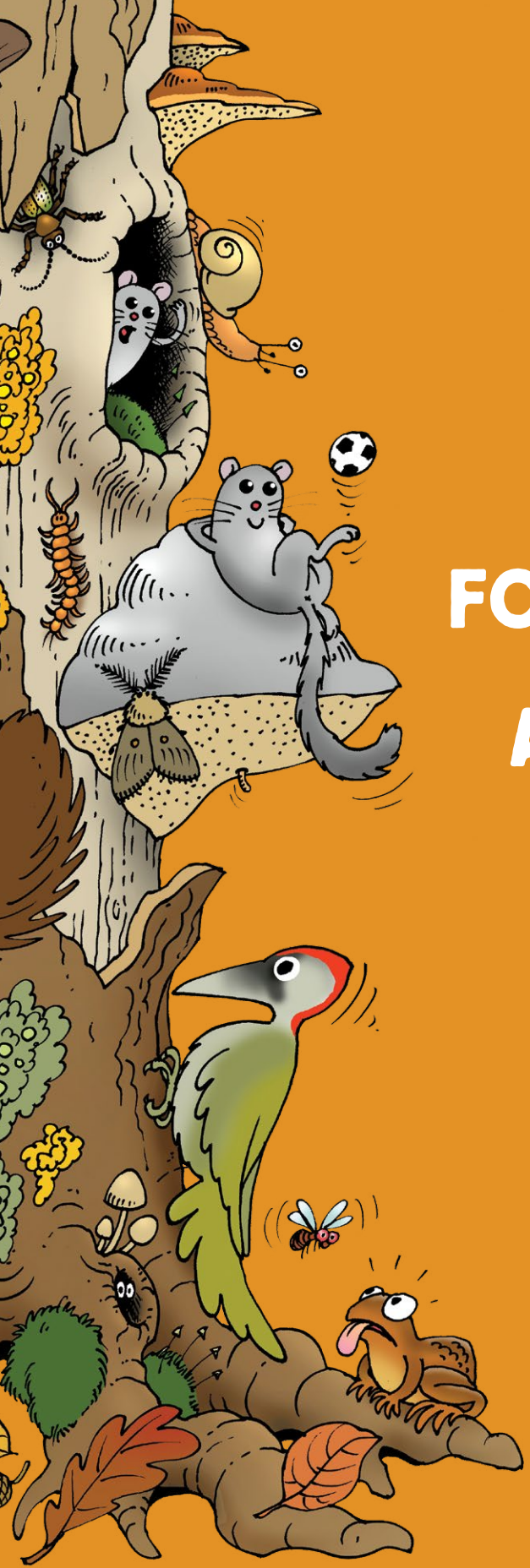

GOZD eksperimentov

HANDBOOK FOR LEARNING AND PLAY IN THE FOREST

Silva Slovenica

Collection: The Forest of Experiments

Editors-in-chief: Urša Vilhar, Boris Rantaša

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GOZDARSKI INŠTITUT SLOVENIJE
SLOVENIAN FORESTRY INSTITUTE

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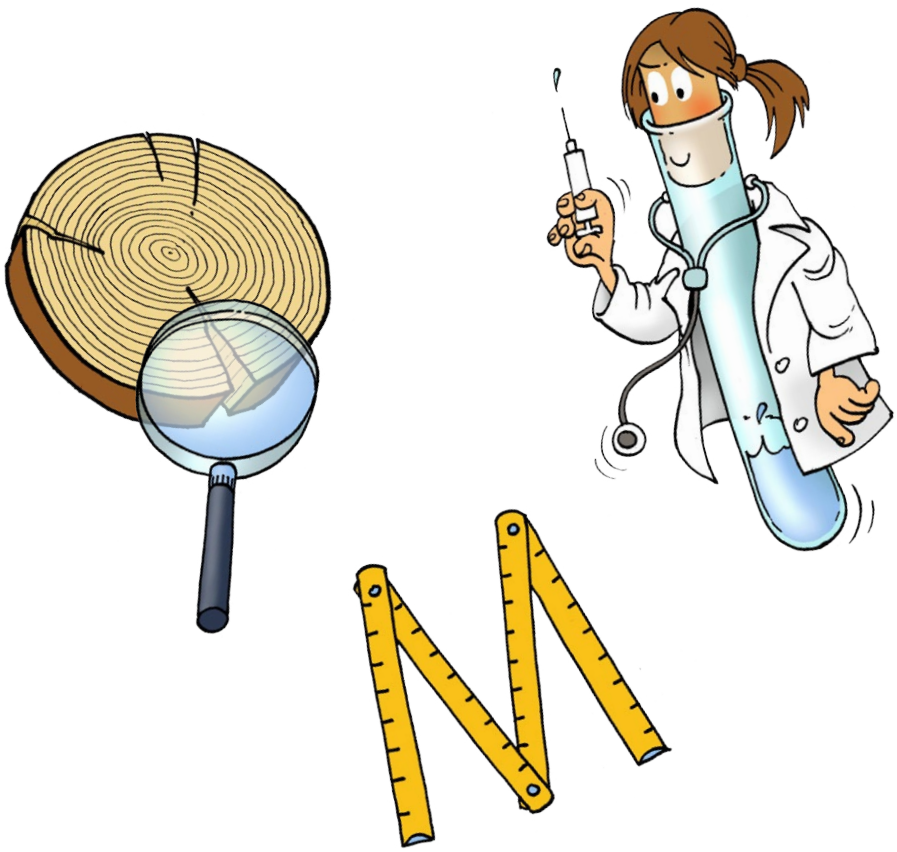
HANDBOOK FOR LEARNING AND PLAY IN THE FOREST



IN NATURE, WE LEARN DIFFERENTLY

When discussing about forests, we tend to express ourselves nicely, even admiringly. We usually like to say that forests cover a big part of Slovenia and that our country is one of the most forested countries in Europe. However, is this enough for a responsible attitude toward our forests?

Slovenian legislation gives the right of free access to forests and free gathering of non-wood forest products (such as mushrooms, berries, plants etc.) to all inhabitants of Slovenia. These rights are limited by special regulations. Do we know them well enough and respect them? Cleaning (waste collection) actions in recent years have shown that most illegally dumped waste is on forest edges. Most of forests in Slovenia are private property. There are more than 400.000 forest owners, but only a small part of them manage their forests properly. The government funding of forest protection, tending and rehabilitation activities does not match the rising demand.

On the other hand, we have a world-renown forestry science and practice, based on the principles of sustainability, multifunctional use of forests and close to nature forestry. All of this points to a diverse and changing attitude towards forests at different levels of our society. Hence the need for a permanent, lifelong education for a responsible attitude towards forests for Slovenians. This education needs to begin at an early age, so alongside forestry, the educational system plays an essential part.

Let's ask ourselves: are today's school lessons about forests in their current state and extent in schools today enough? Can we sufficiently present the diversity and wonderfulness of nature in indoor classrooms? The effort to answer these questions led to the concept and practice of »nature classrooms«. Some schools and kindergartens are involved in The Slovenian Network of Forest Kindergartens and Schools. Many of such initiatives exist abroad, but in Slovenia, this movement is at its beginning.

When trying to implement nature's classrooms in practice, educators and teachers face significant obstacles. Some parents fear about what could happen to their children during such activities. Their concerns and fears

often make it difficult for educators and teachers to lead children into nature. Furthermore, teaching in nature is methodologically challenging for educators and teachers.

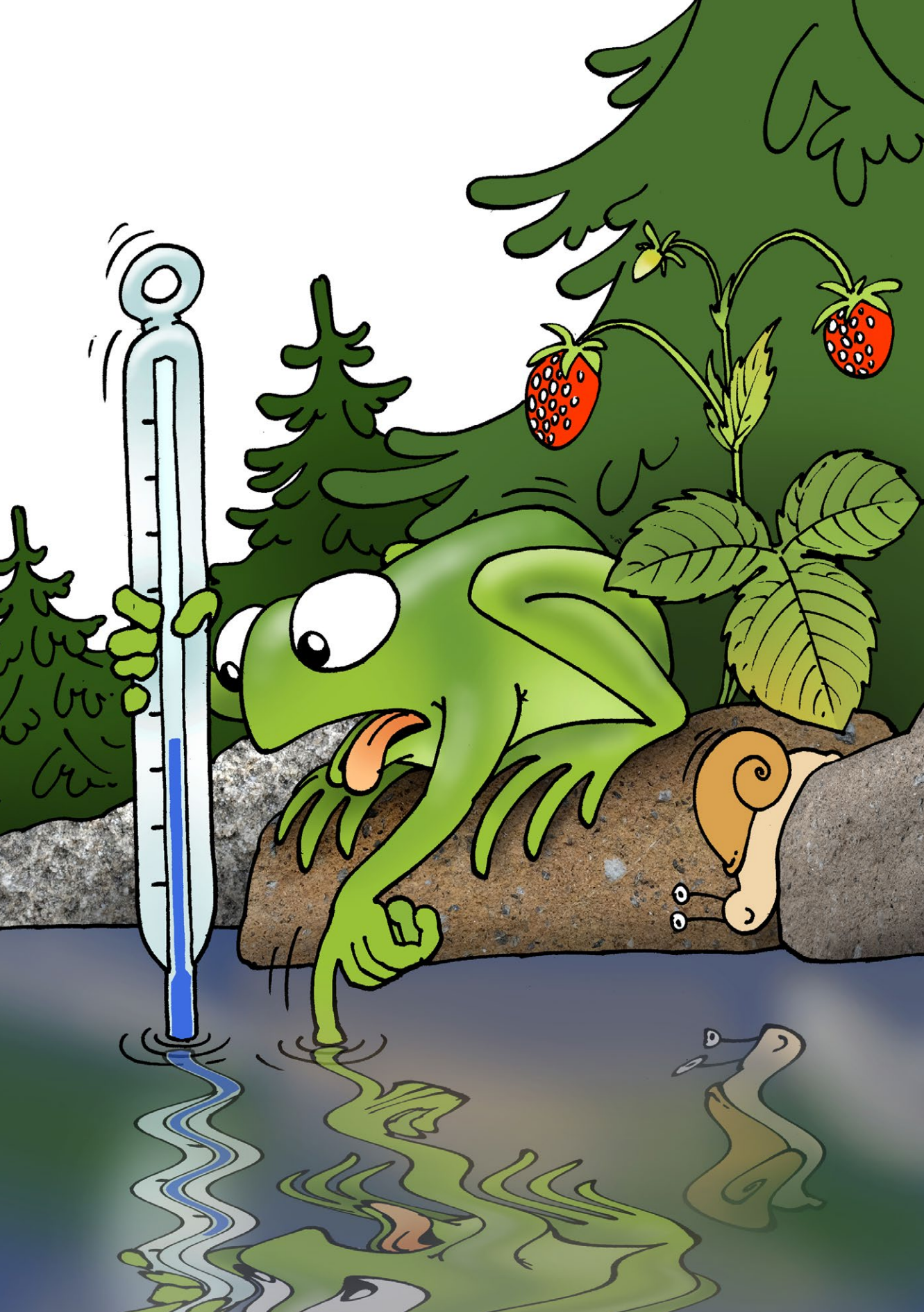
Outside, the teaching process is very different from the process in school classrooms. But contrary to the conventional (indoors) teaching, which is often accompanied by passivity, lack of interest and motivation, lessons in nature are often met with enthusiasm, interest and active participation from children and students. However, to overcome concerns and fear, ensure safety and an adequate delivery of teaching curriculum, appropriate methods are needed.

Foresters realised the importance of teaching about the forest in nature decades ago. This realisation led to the concepts of forest learning paths and the practice of forest pedagogy, in which alongside foresters many professional educators are taking part today. Today, another huge leap is happening, again originating from forestry - the development of forest pedagogy by scientists. The Slovenian Forestry Institute has correctly assessed that forest science, available only in the narrow circles of scientific institutions, has only a limited use for society.

The efforts of the Slovenian Forestry Institute to develop forest pedagogy for various target groups is reflected in many activities of the Forest of Experiments initiative. The Handbook for Learning and Play in the Forest is the latest contribution of forest science in the area of forest pedagogy. It includes a wide range of different activities and methods of learning and experience the forest with the instructions and guidelines for implementation and will help everyone dealing with forest pedagogy - foresters, teachers, nature educators and others. In addition to educating children, this handbook can also be used by resourceful forest pedagogues to work with adults.

I believe that they will gladly take into their hands and that its teachings are going to serve them well.

Tone Lesnik
Pro Silva Slovenia



CONTENT


SAMO JENČIČ 2016

1. Introduction

1.1 The Forest of Experiments: Ideas and New Knowledge to Support the Educational Process in the Natural Environment

Urša Vilhar, Saša Vochl, Špela Planinšek

The Slovenian Forestry Institute is a public research institute of national importance. It conducts research activities in the fields of forests, forestry, game and hunting. Increased attention has been given in recent years to the ecological and socio-economic functions of forests and the goods and services they provide. The focus of these research activities is on the impact of humans on forests and vice-versa, as well as on innovative approaches in the education of children and youth on environmental issues with aim of teaching them about sustainable development. To that end, we also rely on the knowledge provided by forest pedagogy.

The Forest of Experiments came about in 2011 as the initiative of the then-director of the Slovenian Forestry Institute, Dr Mirko Medved. It was established as a learning trail for the promotion of the forest and science in the direct vicinity of the institute in the Tivoli, Rožnik and Šišenski hrib Landscape Park in Ljubljana. The trail is used to show urban forest as an innovative green learning environment. Through yearly educational workshops for primary school children during Slovenian Forest Week, Fascination of Plants Day, BioBlitz, Researchers' Night etc., the Forest of Experiments has included numerous laboratories of the Slovenian Forestry Institute, has travelled all over Slovenia and even abroad with its equipment and measuring devices. The Forest of Experiments has grown into an innovative learning environment, within which the researchers of the Slovenian Forestry Institute prepare new educational methods, materials, and contents in the scope of the institute's projects. They are developed in collaboration with the Forest Pedagogy Institute and The Slovenian Network of Forest Kindergartens and Schools, and are presented at seminars for educators and experts in kindergartens, primary and secondary schools.

The objectives of the Forest of Experiments are to:

- present innovative educational activities in natural habitats, based on the scientific methods and research work of the Slovenian Forestry Institute;
- encourage creativity and innovation in the educational process;
- accelerate the inclusion of research approaches and content as a part of environmental education in the curricula of kindergartens and schools;
- raise awareness about the meaning of education for sustainable development;
- recognise the work and working environment of researchers of the Slovenian Forestry Institute and present opportunities for cooperation; and
- promote knowledge about forestry and encourage youth to decide for research career.

The Forest of Experiments wants to share its knowledge with other users of forests (e.g. educational institutions, NGOs, forest owners, associations of forest owners and other public groups). The positive responses of former participants of workshops and seminars inspire them to continue educational activities.

1.2. Slovenia is a Forest Country

Špela Planinšek

Almost 60% of Slovenia is covered with forests. Each Slovene has almost 0.6 ha of forest providing them with oxygen for breathing.

Are all Slovenian forests the same?

Slovenia extends from the High Alps down to the Adriatic Sea and the plains of the Pannonian Basin. There are thus many different types of trees and forests. We can be pleased to enjoy such a variety - many call Slovenia “the green jewel” of Europe. The most abundant trees are beech, spruce, fir, oak and pine. Natural forests in Slovenia are mostly beech, mixed fir-beech and beech-oak forests. All forests are unimaginably interconnected and perform many tasks and services for people and animals. One of those tasks is to welcome us – forest educators and pedagogues – with open arms time and

time again, and offer us a wide range of adventures and experiences under their tree canopies.

What do foresters do?

The task of a forester is to care for the forest, from the smallest trees to old trees ready for harvest. A forester must deeply know forests – from the care for young forests (seedlings and undergrowth) through the thinning and care of mature forests and final harvest. Forestry experts meet frequently with forest owners to discuss the future of their forests, necessary investments and urgent works. If forest owners need help with tree planting or tending works in a forest, the district forester is the person they can always count on. The work of a forestry expert also includes the long-term forest planning, planning of forest roads and careful monitoring and appropriate action during the outbreaks of pests, diseases and environmental calamities. The district forester is the person who usually and most successfully presents the forest to owners in terms of biodiversity and the provision of important services that they sometimes overlook (drinking water, avalanche protection, clean air etc.).

What do forest researchers do?

Forest researchers working at the Slovenian Forestry Institute perform research activities in the field of forests, forestry, wildlife, and hunting. Our goal is to deepen public knowledge and awareness about the importance of the forest within the environment and about the sustainable management of forests in general. Our activities are broad (e.g. research of phenomena in vast forested areas) or very specific and limited to a single cell (e.g. the search for the cause of changes in each tissue). We address less known topics (e.g. forest genetics) and solve complex issues. It could be said that the Slovenian Forestry Institute is a scientific and professional center for research and knowledge transfere in the filed of forestry, forest functions and services that all inhabitants of Slovenia enjoy for free.

What does the sustainable management of Slovenian forests mean?

Forests play an important role in Slovenia due to the vast area they cover. At the same time, we can be proud of Slovenia's exemplary and long-term planning

of forest development, which is based on three pillars: multi-functionality, sustainability and taking natural processes into account (close-to-nature forestry). Slovenian forestry has a long tradition and has also been praised on many occasions by foreign experts due to its well-established professional and scientific connections, and because it takes into account the three above-mentioned principles. Our forest management method, called close-to-nature forestry, addresses the forest area as a whole, takes into account different habitats, encourages the natural restoration of forests, supports natural processes and structures in forests, maintains the biological balance of the landscape, is sustainable in terms of all forest services and strives for long-term economic effectiveness. Slovenian foresters live with the forest and aim to preserve it for the generations to come.

Understanding the concept of forest pedagogy

Forest pedagogy is an efficient and pleasant way of presenting knowledge about forests and the work of forestry experts to anyone interested in forestry and forests. Forest educators (pedagogues) working at the Slovenian Forestry Institute share numerous scientific discoveries from the institute, our labs and field measurements with people throughout Slovenia in a clear and useful way. We also aim to promote research work among younger generations. Our knowledge and approaches to forest pedagogy facilitate the successful transfer of knowledge between people (e.g. the Forest of Experiments in Ljubljana). A great deal of educational work is also performed by forestry experts from the public forest service (Slovenia Forest Service), who regularly lead guided tours of young people through the woods (forest learning paths). There are many civil initiatives and private institutes that encourage socialising in nature and forests, activities that we of course welcome. The forest is a perfect place for educational experiences, and environmental education is an infinite source of colours, scents, sounds, images, ideas etc. Forests give us countless opportunities for integrated learning in nature, as children gain new experiences, manage, refresh and connect them, expand their interests and gain a positive outlook on nature and the protection of its diversity. Through forest pedagogy (e.g. the qualitative education of young people) and the continuous presentation of the services and interesting features of the forest to all the people, we will succeed in presenting the forest as a basis for well-being and useful knowledge for Slovenia's sustainable development.

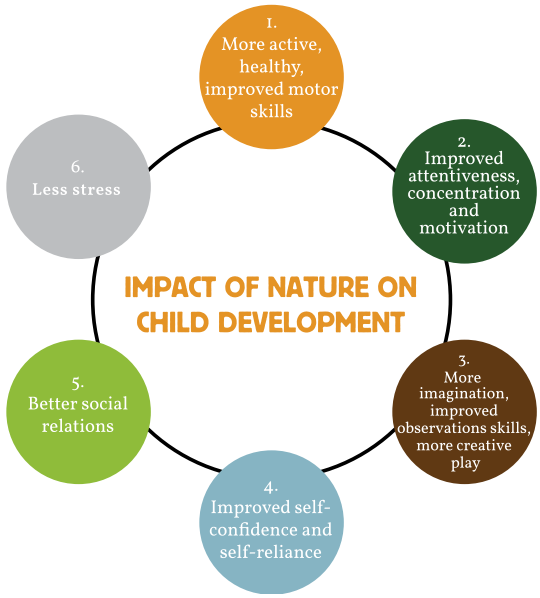
1.3 He Who Loves Forests, Loves Life!

Natalija Györek, Institute for Forest Pedagogics

Photosynthesis, the composition of the forest floor, types of trees and the water balance of the forest. What of the above inspires, piques curiosity and attracts school children? If we ask a ten-year old, they will answer in typical fashion, "It is all quite boring!" Topics might be interesting, but their enthusiasm wanes quickly in school during boring presentations and notes with little useful information, frequently from fragmented texts.

What if we connect the gathering of this knowledge with a visit to the forest? Can we make more sense of that knowledge and prolong its "expiration date"? Our ten-year old will say, "Wow, this is great. We should do it more often!"

Why is that? The forest changes a child's role from a passive role in the classroom to an active role more suited to him. In the forest, he is not only an active and participating forest researcher, he is also a researcher of his own actions and feelings. The forest, as a perpetually changing space, challenges the child and teaches him to be responsible to himself and others, which is not easy to do these days. It is an ideal educational space that stimulates a child in different areas.



Impact of nature on child development

Forest pedagogy requires the inclusion of active observations and experiences, as this is the only way to connect them with a child's learning and development. This means that we must allow children to climb over logs, splash through muddy puddles,

hang from branches, talk to beetles, laugh aloud, eat blueberries and strawberries, run, shout, listen to bird singing, observe colours, search for balance, hug trees, cooperate, quarrel, hide, gather fruits, research, build and demolish, count, measure, spill, discover the secrets of photosynthesis and make natural patterns. Such a work method, promoted through forest pedagogy, is a simple way not only for learning about the forest ecosystem, but also for one's health, integrated development, and active and successful movement through life.

Regular visits to the forest are not only good for children but also for nature, as children maintain their positive attitude towards nature, even as adults. We could say that forestry experts maintain the joys of childhood today and nature for tomorrow through forest pedagogy!

1.4. Flow Learning

Peter Železnik

"Give me a lever and a place to stand and I will move the earth," said Archimedes when he wanted to point out the importance of the lever. Simple tools can sometimes be the most powerful. Flow learning is one of them.

The method was developed by Joseph Cornell, an American educator and nature lover. Three of his books have been translated into Slovene.

Flow learning has four stages:

1. **Awaken Enthusiasm:** – Children learn when a topic has some meaning, is useful, fun or challenges their feelings. Time for creating a special atmosphere (curiosity, fun and personal interest) is priceless. When we awaken enthusiasm in an individual, it can be refocused to a lesson or experience.

2. **Focus Attention:** – Real learning is impossible without concentration. Activities during this stage are challenging in a fun and creative way. To overcome "challenges", children must concentrate on one of their physical senses. This makes them more relaxed, alert and open to their surroundings.

3. **Offer Direct Experience:** – Only when the interests and energy of children are awoken and focused they can sense nature. Activities during this stage have a dramatic impact that profoundly connects people with nature. Such games enable us to discover our deep sense for connectivity and understanding. Developing love and concern for the Earth is only possible through direct experiences, otherwise our knowledge remains merely theoretical, without touching us personally.

4. **Share Inspiration:** – This stage enables us to see what has been learned in an interesting way. In today's fast-paced world, students and teachers must increasingly jump from one activity to another, without a closer look at their experiences, which would otherwise strengthen and deepen those experiences. Not a lot of time is needed for this. It can be in a form of some simple answers to questions, by jotting down notes in a diary or by drawing. Goethe said, "A joy shared is a joy doubled." The learning of the entire group improves when we enable sharing. This also connects the group.

1.5. How is the Book Structured?

Saša Vochl

Play is the highest form of research. (A. Einstein)

The book is intended for anyone taking the first steps into forest pedagogy and for all those who choose the new, unexplored paths of teaching in nature. The authors are researchers from the Slovenian Forestry Institute who deal with different topics in the field of forestry. We are thus, at first glance, very different from each other. Some of us are dressed in snow-white lab coats hunched over microscopes in laboratories, while others are decked out in muddy boots under the treetops measuring trunk diameters. In one respect, however, we are much more similar than it seems. We appreciate and support all of those promoting for several years now the numerous benefits of learning processes carried out in nature and about the importance of environmental education for sustainable development.

We, as the authors, have already started with forest pedagogy and are more and more involved in the promotion of the forest as an outdoor classroom. We try to debunk the myth about the boring, lonely scientist, isolated from the world, discovering and accumulating facts in publications that nobody reads. Through interesting and fun educational methods, materials and contents about forestry, our goal is to bring the perpetually misunderstood scientist into the world of popular science, where young people and grown-ups alike will interact with him.

The book includes selected activities for outdoor learning and playing that are aimed at bringing scientific content from the field of forestry closer to young people of different ages and to their teachers. Those activities are divided into four chapters: Trees, Forest Animals, Water and Genetic Diversity. The chapters were designed according to the principles of flow learning with a special chapter on the latter. Flow learning has its own principles in a defined sequence of stages (Awaken Enthusiasm, Focus Attention, Offer Direct Experience and Share Inspiration) that prepare the participant for new content. Activities are carried out in the sequence stated in an individual chapter if we want to address a topic according to the curriculum or lesson plan. The other possibility is to choose one activity from each chapter according to the principle of the flow learning sequence. For example, we can awaken enthusiasm with a game from the chapter Water, focus attention with an activity from the chapter Trees, draw direct experience from the chapter Genetic Diversity and conclude with sharing inspiration from the chapter Forest Animals.

The four chapters begin with a brief general description of content, including basic knowledge that helps reader during activities. Each activity is additionally equipped with the following information:

Age: recommended age of children to perform the activity.

No. of persons: envisaged number of participants to perform the activity.

Duration: envisaged duration of the activity, including an introduction to the topic, an explanation of the rules and implementation of an activity. It is possible to shorten or extend some activities.

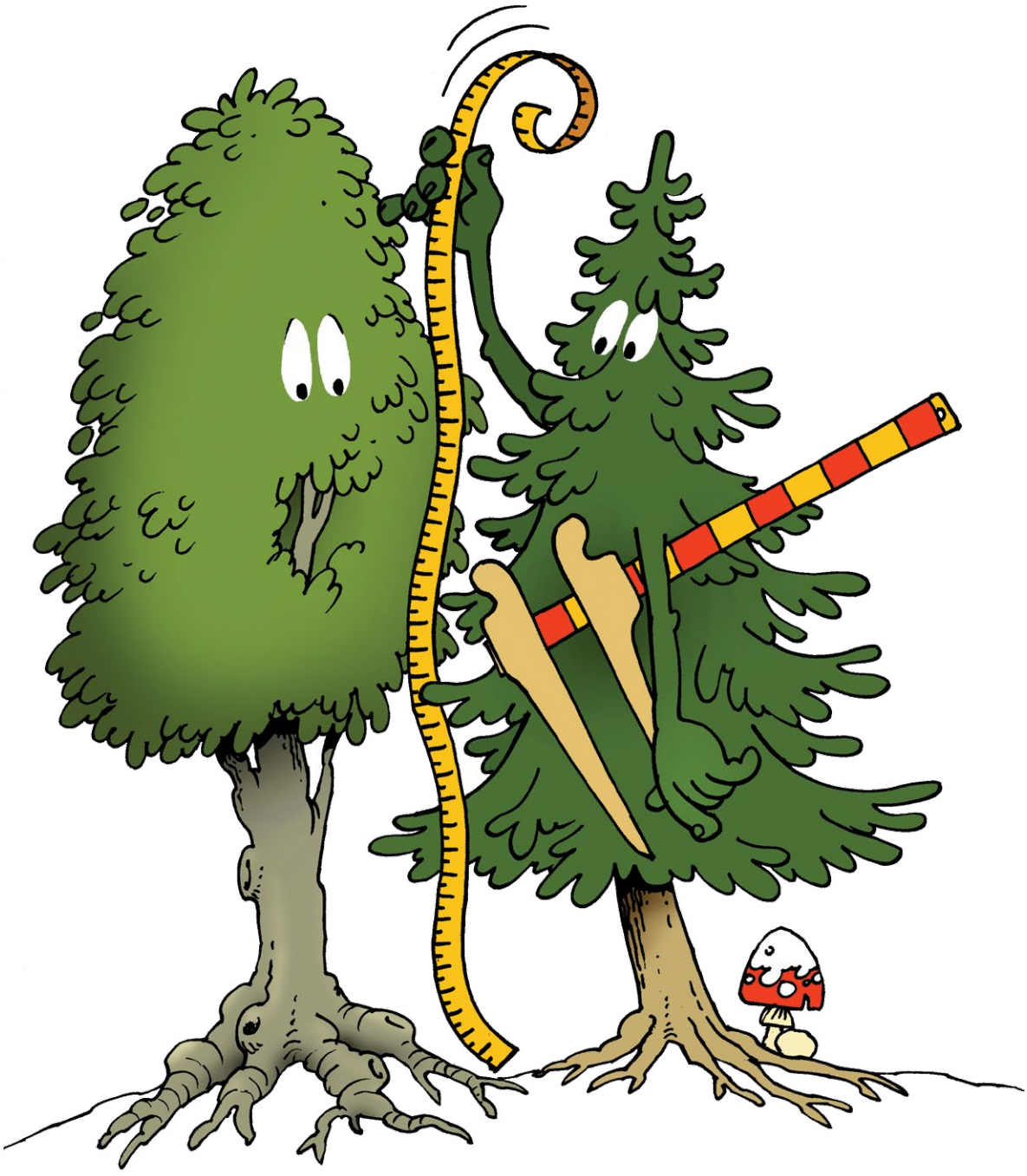
What will children learn: short description of the activity's content.

What do we need: tools needed to perform the activity.

Implementation: description of the course of the activity.

Learning objectives are added for kindergartens and schools to help achieve the described objectives of the educational process.

The book should be used above all to inspire new and interesting activities that will bring children from the classrooms into nature to gather experiences. Those experiences are frequently gathered when we think that the process might be out of control. It is, in fact, at that very moment when a group of frolicking children in a mud puddle in the middle of the forest begin their very own lesson of lifelong learning.



2. TREES
– The Largest Living Organisms on Earth

Špela Planinšek

Trees are perennial plants characterised by a woody trunk. The trunk continues as roots in the soil and grows upwards where branches and leaves grow to form the tree's crown. Most trees are long-lived plants that adapt well to their habitat and to changing environmental conditions such as the seasons.

In nature, trees frequently grow in clusters (stands and forests) that serve as a habitat for numerous other beings. They are among the largest and oldest land-based organisms. For example, the sequoia tree, also known as the giant or mountain sequoia (scientific name: *Sequoiadendron giganteum*) grows to a height of more than 75 m and a diameter of 29 m, and may live for several thousand years. The oldest known tree is a bristlecone pine (*Pinus longaeva*), which according to its growth rings is 5,065 years old.

We also have "giant" trees in Slovenia that excite both visitors and forestry experts. A double-trunk spruce measuring 160 cm in width grows in Triglav National Park, while the "Najevska lipa," a linden tree measuring 350 cm in width can be found in Koroška and is the thickest tree in Slovenia. A larch in Mala Pišnica remains the oldest tree, at 1,040 years.

Plants grow using a process called **photosynthesis**, which enables them to produce their own nutrients from substances that they extract from the earth and air. The leaves that sprout in the spring are unique nutrient-producing factories. There are tiny bodies, called **chloroplasts** in the cells of a leaf,

where the photosynthesis process takes place. Chloroplasts contains a green substance called chlorophyll, which gives plants their green colour. But plants do not grow equally fast throughout the year.

In Central Europe, in autumn plants slow down their activities and trees prepare for their **winter dormancy**. Growth must come to a halt, assimilation is reduced, and the intake of nutrients and breathing slow. There are certain chemical and physiological processes that take place in a plant to increase its resistance to low winter temperatures. Nutrients are transferred from leaves to the trunk and roots. The shortening of days and falling temperatures in autumn facilitate the production of separative tissue. If all process within a plant proceed unhindered, trees lose their leaves in November or during the first days of December.

Leaves differ according to their structure, function and composition. There are various shapes of leaves. A simple (single) leaf can be undivided or divided. A compound leaf has a surface comprising smaller leaves. Some trees have broad leaves (sycamore maple and plane trees) and others narrow leaves (willow). Some have leaves in the shape of needles (larch, pine and spruce), while others have fleshy leaves (holly). We can find different shapes, from the circular leaves of the crab apple to the oval leaves of the beech or the compound leaves of the ash.

The location of leaves on branches also differs. Some leaves have stalks, while others do not. Most trees have leaves on their branches. However, some trees such as the oak tree also develop leaves out of the trunk. Many plants rotate their leaves towards sunlight (to make the most of its benefits) and also protect leaves from excessive direct sunlight (to prevent damage).

The basic functions of the leaf are photosynthesis (the production of glucose and oxygen from carbon dioxide and water in the presence of light) and transpiration (the secretion of water), for which it is also anatomically adapted. Leaves are flat to absorb as much light as possible. They have stomata on their lower epidermis (and sometimes even on the upper epidermis), through which the processes of carbon dioxide gain and water vapour loss are carried out. The leaf also plays other roles such as storage, digestion,

support, protection and even cooling. Leaves have different upper and lower surfaces. Most trees have leaves with a greener and smoother upper surface, as fibres and veins are on the lower side.

The **trunk** is the backbone of a tree. Physically it is the strongest part of the tree, where sap flows from the tree's roots to its leaves via the trunk's transfer elements. The trunk is covered with bark to protect a tree's inside from rapid temperature changes and physical damage. It is economically the most important part of the tree, as it provides usable wood. A trunk without roots and branches is called a log.

A tree's **roots** draw water and dissolved minerals from the ground (soil). Similar to trunks, roots comprise vascular tissue or veins through which sap flows. Roots are covered with tiny hairs that facilitate the absorption of water. Trees develop very different root systems, depending on the tree type, soil and growing conditions. The majority of tiny roots, important for a tree's life functions, are found in the 30 centimeters directly below the surface of the ground. These tiny roots merge to form larger roots and finally primary roots. Tree roots may grow very long, even longer than the outer edge of the crown, where the intake of water is greatest.

In the past, the primary and almost sole objective of forest management was to produce wood. Today, other **forest services** such as protection, biotopical functions, water protection and recreation are also important to people. The great importance of the social and ecological services provided by forests is especially evident in developed countries and urbanised centres (large cities) where there are fewer trees and forests. The ecosystem services provided by forests, include the supply of drinking water (of high quality and sufficient quantity), the promotion of natural diversity, excellent and varied recreational activities, unique tourist possibilities and protection against natural disasters.

2.1 AWAKEN ENTHUSIASM

2.1.1 Draw Your Tree

Learning objectives

Children (kindergarten):

- Nurture and stimulate a rich and varied response to the outer world
- Express their aesthetic side in nature through art techniques
- Learn about and compare living and non-living nature

Students (primary school):

- Describe and differentiate typical environments in Slovenia, as well as animals and plants (park, meadow, forest, orchard, field etc.)
- Recognise the most abundant species of plants, animals and fungi in their environment
- Describe the outer structure of plants

What will children learn?

Children identify and observe parts of plant (roots, trunk, branches and leaves) and are aware of tasks they perform. They observe growth and shape of trees. They differentiate between deciduous and coniferous tree.

What do we need?

Paper, A1 poster paper, adhesive tape, crayons or markers. If you are feeling adventurous, try using soil and green colour from crushed leaves.

Implementation

We pick up a prominent (notable, special) tree, and first discuss with children whether it is a deciduous or coniferous tree, as

well as how to determine that. We briefly present the species in front of us in the simplest way possible. We give children a chance to guess the name of the species. Children are asked about other species of deciduous or coniferous trees they might know.

Depending on the time available, every child draws a picture of the tree or a part of it such as a leaf shape. Others make an imprint of the bark, while still others draw the tree from a distance of at least 20 m. We then place green leaves, pieces of bark or branches on the A1 poster paper, and maybe add other information about the tree being observed.

2.1.2 Creating Seasons with Our Clothes

Learning objectives

Children (kindergarten):

- Discover and learn about cyclic phenomena in nature
- Learn that living beings are born, live, grow and die (decompose)
- Use and develop physical skills, as well as art expression using colours

Students (primary school):

- Chronologically research, determine and explain seasonal events and changes
- Sort, classify and arrange natural phenomena (e.g. sequence of events – seasons)
- Distinguish between and describe living beings and the environment in which they live, as well as the impact of changes on them (night-day, seasons etc.)

What will children learn?

Seasons in nature are a good illustration of seasonal dynamics in the growth of trees and plants.

What do we need?

Photos of trees or a forest in all the seasons (four photos or more) so that children can master the colour scale.

Implementation

Children wear clothes of different colours. During this game, we concentrate on observing the colours of upper articles of clothing (jackets and shirts). Using questions about what they already know, we discuss with them seasonal processes in plants.

What happens in spring that gives plants fresh green leaves? (green colour scale - SPRING).

When are plants most colourful?
Summer is the season when everything is in bloom and complete revival. We therefore enjoy the playfulness of colours (colours that are not seen during other seasons – SUMMER).

What happens to leaves in autumn?
The transition to autumn means subdued shades of orange and brown that may glow brightly on occasion (red colour scale - AUTUMN).

Why don't deciduous trees have leaves in winter?
When growth slows and trees no longer sprout, colours also rest and we only see cold winter colours (blue-grey colour scale - WINTER). We allow children to interpret for themselves why conifers remain dark green in winter.

The final photo should show four groups of children with distinct colours (from left to right: spring, summer, autumn, winter).

2.2 FOCUS ATTENTION

2.2.1 Find the Right One

Learning objectives

Children (kindergarten):

- Learn about and compare living and non-living nature
- Master basic concepts of motion
- Learn that everyone in society must cooperate and help to overcome problems

Students (primary school):

- Understand the need for cooperation and tolerance between people
- Understand that living beings are classified into groups based on their characteristics; recognise the basic characteristics of certain major groups of plants
- With the help of the group, recognise and name the most populous plant and animal species and non-living elements of nature in their environment

What will children learn?

With help of the group, they will be able to recognise and name the most common plant and animal species in their environment. Based on a description, they will be able to recognise species found in nature in their direct vicinity (tree species, stones, herbs, bark etc.). Group work is a prerequisite for success – group learning with individuals responsible for the results of the group.

What do we need?

- A bag with 10 leaves of deciduous trees and 10 needles of coniferous trees. The leaves / needles serve for division into two groups

- 10–15 pieces of natural material gathered in the area
- Description of individual items on a list (to help the group)

Examples of descriptions

Furry plant that loves humidity. **MOSS**
Conifer tree species, that grows near the upper tree line. **LARCH**
Deciduous tree that is a pioneer specie near rivers. **WILLOW**
Invasive plant with yellow blossoms that is found most often near rivers. **GOLDENROD**
Plant that only grows in areas with high ground water. **MARSH MARIGOLD**
A tasteful plant found at the forest's edge. **WILD STRAWBERRY**
Deciduous tree that grows fast and has heart-shaped leaves. **POPLAR TREE**
Deciduous tree whose leaf is a symbol of Slovenia. **LINDEN TREE**
A tree fruit with a large hat. **ACORN**

Implementation

Children must find the right plant, part of a plant, part of a tree or natural material described by the teacher. The class is divided into two groups according to items recovered from their bags (deciduous or coniferous tree, e.g. 10 oak leaves and 10 larch branches).

The class is divided in half. With the help of our questions, children describe the differences between the two types. Two groups are arranged into two rows, 10–12 m apart. In the middle of the two groups is a prearranged line of 10–15 items on the floor. The teacher reads a description of an item (playfully, ambiguously or clearly). After consulting, the group gives its answer. After the right answer is given (loudly so that everyone can hear; the teacher confirms the answer by lowering their hand), a race to the centre begins. One representative of each group runs towards the centre with 10–15 items on the ground and looks for the previously described item. The winner is the first to find and raise the item into the air. The teacher then describes the next

item and the game is repeated with next pair of representatives from the two groups. The whole group collects points.

2.2.2 Leaf Hunters

Learning objectives

Children (kindergarten):

- Are capable of distinguishing between the shapes of leaves

Students (primary school):

- Are capable of distinguishing between the shapes of leaves
- Discover that living beings are adapted to their local environment, and can further adapt to some changes in that environment
- Understand that food is produced in plants, while animals get food by feeding in their environment
- Learn about rare and endangered species in their own environment

What will children learn?

They will recognise the leaves of the most abundant tree and bush species that grow in their environment. They will take note of how plants adapt to conditions in the environment.

What do we need?

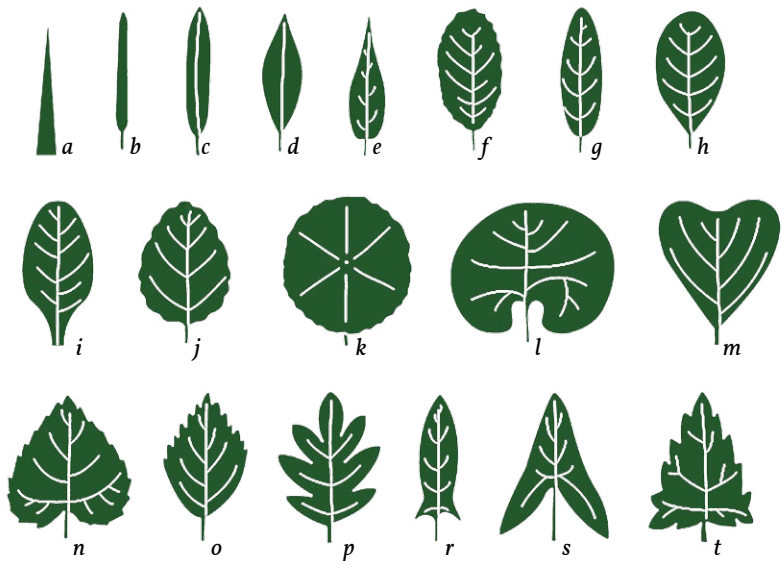
Forest, park with trees or mixed forest (edge of forest)
At least 10 transparent U-shaped folders for different types of leaves that will later be made into a herbarium or glued on posters

Implementation

As an introduction, we pose questions to students:
How do plants and trees "feed" themselves?

Where does that food come from?
What do you already know about photosynthesis?

Children then get to learn about the wide range of shapes of tree and bush leaves. Each pair of children has 10 minutes to find 10 different species of leaves in a limited area. They hold the leaves in their hands and carefully place them on the floor. A list of different leaf shapes may help them with searching:



Leaf shapes

a=subulate, b=needle, c=linear, d=lanceolate, e=aristate, f=ovate, g=cuneate, h=obtuse, i=obovate, j=elliptic, k=orbicular, l=reniform, m=obcordate, n=cordate, o=rhomboid, p=patched, r=spear-shaped, s=arrow-shaped, t=triangular

A puzzle: Flying from tree, having no wings. (Author: Josip Stritar)

If a group finds more than 10 different kinds of leaves and answers the riddle given above, they receive the official title of LEAF HUNTERS!

2.3 DIRECT EXPERIENCE

2.3.1 It Happened in the Forest! – Live from Forest TV

Learning objectives

Children (kindergarten):

- Develop the imaginative use of language and the ability to co-create imaginative stories
- Communicate in formal (radio) language
- Learn to tell stories independently

Students (primary school):

- Learn how to plan and perform simple research in a group, draw conclusions and report them
- Learn how to work with information sources: obtain, use and critically assess those sources
- Practice communication skills, develop a critical eye with regard to local events and express their opinions

What will children learn?

Children will learn about different components of the forest, how they are interconnected and give thought to their interdependence. Children can take in and see their entire surroundings. They learn about forest etiquette and the importance of environmental protection.

What do we need?

- A list of desired topics that is divided up, with one topic as signed to each group
- A good memory; children do not use pens

Implementation

Children find seven interesting items in a radius of up to 20 meters from a defined starting point. Natural materials are preferred: parts of animals, plants, stone etc. Those items are held in their hands during the game and returned to nature when the game is over.

The group's task is to make a five-minute media report for the local radio or TV station. The report should reach the entire local population (e.g. 100,000 residents). The main topic of the report is chosen in advance (and should be current). All seven items gathered in the vicinity must be connected in a logical manner. Children must imitate sounds from their surroundings and present a lively picture of the event in question. The voice of the reported must be clear and loud (like on the radio). The news must be positive and encourage people to visit the beautiful urban (or mountain or lowland) forest being reported. The report must also cover proper behaviour in the forest (forest etiquette), environmental protection etc.

Example: A magnificent BEECH TREE bathed in the sunshine while chatting with a neighbouring OAK TREE about yesterday's storm… (in our hands we hold one leaf from the beech, one from the oak, a broken branch from the oak etc.).

What happened to her/him? What also happened while she was sunbathing? What happened around her/him? Was anyone hurt? What do they intend to do about it?

2.3.2 From the Tiny Grows the Large (the Slow Lifecycle of a Tree)

Learning objectives

Students (primary school):

- Understand that every type of cell, tissue and organ has its own structure that facilitates various processes
- Recognise the role of transport systems within a plant
- Learn how to explain the meaning of wood, wood fibres and annual growth rings in a tree trunk

What will children learn?

Children will learn about the dynamics or "slow growth" of a tree (relative to childrens birth year). We must explain to them the process of radial growth of trees. Children learn how to find the centre (pith) of a trunk and how to count annual growth rings. The density of annual growth rings depends on water and nutrition availability and solar radiation. They must examine annual growth rings in detail. An annual growth ring consists of earlywood and latewood.

They attempt to determine where a tree gets the most water and why, and where it produces bark. Cambium produces inner bark (phloem or bast) and outer bark, and is very active in the summer.

What do we need?

Saplings found under other trees. A piece of cut-off trunk (you can use a tree stump if the annual growth rings are visible). Findings recorded on small pieces of paper. Arrows (from paper or carton) for pinpointing rings.

Implementation

The class may be divided into groups of two, such that children draw items from the bag containing pairs of the same items (two acorns, two snail houses, two pinecones etc.).

The task of the group is to mark the tree stump with arrows indicating points in time with the aim of learning how the tree grew and expanded in diameter. They first count the annual growth rings, provided they can be seen. When they determine that many rings are present (e.g. more than 30), we encourage them to place the arrows in the appropriate places on the stump.

Findings:

Hooray! It's my first birthday.
This is when I officially became an adult (18 years).
My 50th birthday!!
There was a tremendous amount of water this year, and I gained so much weight.
The draught of 2003 left me exhausted!
This is where my wooden part ends and my bark begins.
Most water flows right through here.
Something unusual happened!

More advanced findings:

Slovenia gained its independence in 1991.
SOMEONE came into the world (state your or your moms/fathers name and year of birth).
SOMEONE was born (state your/sisters/brothers name and the year of birth).

Children can also compare a sapling (e.g. a two-year old, 10 cm high beech or oak tree sapling with only a few leaves) with part of a trunk or stump: from the tiny grows the large. Question: This trunk or stump is part of which type of tree? Do you think this tree is older than you? What about your parents? Do you see anything surprising in its life?

2.3.3 Measurement of Trees for Young Foresters

Learning objectives

Students (primary school):

- Use measurements and learn the difference between counting and measuring
- Learn about methods used to measure length, height and volume
- Use technical measuring devices and be technically creative

What will children learn?

Students will learn how to measure and safely use measuring equipment and devices (tape measure, tree calipers, altimeter etc.). They will note examples of how plants adapt to conditions in the environment.

What do we need?

Trees with a visible peak, coloured tape to mark trees, paper and a pen.

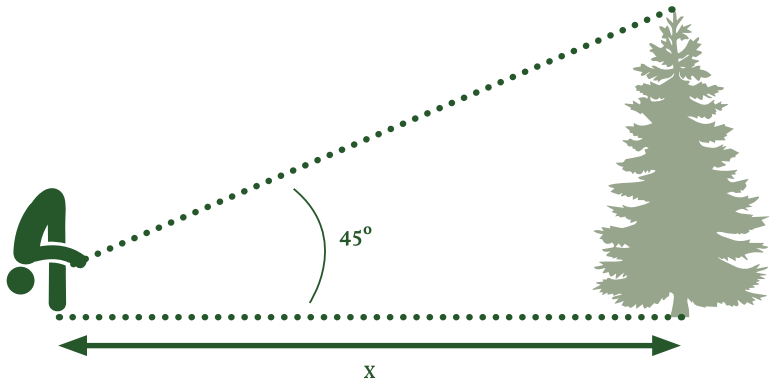
Implementation

- Measuring methods have been improved throughout history, but we only demonstrate a simple method. We explain why we measure trees (lumber production, carbon storage etc.) and also show more modern measuring equipment if available. With older students, we may combine this task with mathematical challenges (Pythagorean Theorem, volume, circumference etc.)
- We step away from the tree far enough so that we can see the treetop between our legs while bending over (see the figure below). We turn our back towards the tree and walk straight to it, counting our steps (steps should be approx. 1 meter long). The number of steps represents the approximate height of the tree in meters.

- We can also determine the height of a tree with the help of its shadow. We place a metre-long stick vertical to the level ground. We measure the length of the stick's shadow with a string. We mark the length of the string equal to the length of the stick's shadow. We then use the string to measure the length of the tree's shadow, counting how many string lengths fit into the length of the tree's shadow.
- We use a tape measure to measure the circumference of a fellow student's chest. Estimate together whether the circumference of the tree is greater or smaller. What is the age difference? We then measure the tree, as well. We can also calculate the volume of the tree or its growing stock.

We ask children if they know any simple method for measuring a tree. We ask them if in they believe that older trees are always thicker and higher than younger trees. We explain differences in radial growth using a tree in a park and a tree in the mountains as an example.

Each group should measure at least three trees, marking them with coloured tape. The groups compare their results, and then compare those results with teacher's "official" measurement.



Group	Tree species	Diameter or circumference	Height	Trunk volume

2.4 SHARE INSPIRATION

2.4.1 Let's Become a Tree!

Learning objectives

Children (kindergarten):

- Develop coordination and balance
- Master basic concepts of motion
- Discover and learn that the lives of living beings depend on other beings and non-living elements of nature

Students (primary school):

- Recognise how bodies move in the air and how the latter affects that movement
- Learn that environmental changes are sometimes favourable for animals and plants, and sometimes unfavourable
- Recognise how plants adapt differently to conditions in environment
- Develop empathy while assimilating with trees and their lives

What will children learn?

Children will learn to understand that living beings adapt the environment in which they live, and can only adapt to changes in their environment to a certain extent.

What do we need?

Trees for hugging.

Implementation

Children will become a tree for approx. 10 minutes. In that respect, it is important to remember that trees cannot walk. Trees anchor their roots in soil and remain in the same place.

However, trees move a lot during the year – with their crowns, trunks and leaves! It is the teacher's task to present this fact clearly. Before beginning the game, each child should be given the opportunity to touch a tree, to try move it and to hug it. Children are then encouraged to imitate their tree or any other tree based on the conditions that we vividly describe with the following tasks:

- Today it is sunny, but a bit windy.
- A strong north wind (bora wind) has been blowing all night and all morning.
- The first summer storm is there, accompanied by thunder and lightning. It is raining cats and dogs.
- The New Year is approaching and snow has fallen. Children are throwing snowballs at each other and one has just hit the tree.
- There is a lot of snow. It sticks to the branches, burdening them heavily.
- Spring has awoken the trees, which are happily putting forth new, fresh green leaves.
- A family of squirrels has made its home in the crown of the tree. They are jumping about and swinging from the tree's branches.
- A hurricane-force wind is blowing, toppling trees to the ground. Their roots are being torn from the ground.

Each task should take one minute. We allow children to play by themselves in order to feel difficulty of this game and the essence of the activities. We can adjust the game so that the other children guess what their classmate is imitating.

2.4.2 Forest Ecosystem Services – Free for Everyone!

Learning objectives

Students (primary school):

- Learn about limitations to and the excessive exploitation of natural sources (forests)
- Understand that excessive use of natural resources impacts the environment
- Recognise different ecosystems (with an emphasis on the forest) and the connection between those systems and humans

What will children learn?

Students will learn to recognise and classify the functions (services) that forests and plants offer to people: production, ecological and social functions/services.

The services provided by forests can be divided in five main categories:

1. Protection services (protection against landslides, erosion, wind, drought, and the purification of water and air).
2. Social services (area for gathering, tourism, protection of cultural heritage such as archaeological sites).
3. Recreational services (areas for leisure time activities, recreation and various sports).
4. Biodiversity services (diversity of the animal and plant habitats, and the protection of natural values).
5. Production services (timber, game, other goods from forests such as fruits, branches, greenery etc.).

What do we need?

Five sheets of A3 paper of various colours for different services. Pens, markers and sticky notes (i.e. Post-it). We will put sticky notes notes to the sheets after brainstorming.

Implementation

The easiest way to carry out performing this activity is after a walk through the forest or following a short break under the trees. The teacher should lead children through leaves on the ground, close to tree trunks, though ferns, across a stream etc. Children should focus on their surroundings. We encourage children to remember things that give them a sense of calm or comfort as well as the opposite, i.e. what makes them enthusiastic and laugh repeatedly.

Each group gets as many sticky notes as there are group members, multiplied by two. Each member must write on their sticky notes a forest service, benefit or good that they find important to them. Using this activity, you will identify what children saw as the best experience during your visit to the (the highest number of notes). During your next visit to the forest, you can reinforce this experience or direct children's attention to other, as yet undiscovered services of the forest.

3. Forest Animals

Saša Vochl, Katarina Flajšman

Animals hold a special place in our lives. This is not surprising, as the images of animals in books, tales and cartoons, as well as animal-shaped toys and pets have accompanied us since our early childhood. We can observe the attitude people have towards animals even during a typical walk through the park, where some parents enthusiastically or with a great deal of caution point out a passing animal of the four-legged variety. Animals evoke various feelings, from the most pleasant ones such as joy and content, to the less pleasant such as fear and disgust. We develop our feelings on the basis of prejudices and personal experiences, which in many cases are unfortunately the result of ignorance. The ability to understand animals that are similar to us in many ways, helps us to develop a responsible attitude towards people, the environment and ourselves. The chapter "Forest Animals" includes activities that help familiarise children with animals and their habitats. At the same time, children also learn and develop other skills. Below we have briefly presented several basic concepts that you will encounter in the activities included in this chapter.

A **habitat** is the area in which animals live. It contains everything they need for survival, e.g. **food, water** and **shelter**. Some animals only eat plants such as fruits, flowers, leaves and branches. They are called herbivores. **Herbivores**, like deer and hare can only live where their **food sources** grow. The wolf and lynx are representatives of the **carnivore**

group. These animals eat other animal species and inhabit areas where their prey lives. Humans eat food of plant and animal origin, which makes us **omnivores**, similar to pigs and bears.

Besides food, animals also need water, which can be found in streams, lakes, rivers, puddles, the hollows of trees, fissures in rocks etc. Thirst can also be quenched by eating juicy plants. While we find shelter in our homes, animals find shelter from danger and inclement weather under thick bushes, in the hollows of trees, in rock fissures or caves, and under overhanging cliffs. Deer move to dense spruce forests to avoid from deep snow and low temperatures, while squirrels search for hideouts high in the crowns of trees and make their nests in tree hollows.

Animals require a sufficient amount of space. Large animals usually need a lot of space compared to smaller animals. Bears, which are real wanderers, may travel up to 30 km in single day. In contrast, the small forest vole finds its food, water and shelter in the direct vicinity of its nest. Its habitat is therefore tiny compared to the bear's.

A lack of living space can have serious consequences. When there are too many animals in a certain area, their density is too high. Due to the lack of food, poorer living conditions and more frequent contact among animals, this can result in the outbreak and spread of diseases. Fortunately, nature strives for equilibrium. Diseases are a natural mechanism to return oversized populations back to balance.

During our walk through the forest we will see and hear large variety of animals. When we meet one, we should forget our prejudices and personal beliefs. We must try to treat any animal species we meet with the same amount of attention, enthusiasm and caution, whether it is a slimy frog or a beautiful and colourful butterfly.

3.1 AWAKEN ENTHUSIASM

3.1.1 If I were an Animal, I Could...

Learning objectives:

Children (kindergarten):

- Learn to recognise their own characters and physical traits and those of others, and to recognise similarities between people and animals
- Gain interest in the animal world and develop their imagination

Students (primary school):

- Better understand individual animal species, and learn how to distinguish between them
- Learn to present their own characters and physical traits and those of others
- Develop a positive attitude towards different animals and the protection of their habitats

What will children learn?

This acitvity develops imagination and mutual insight.

What do we need?

The activity requires no special instruments or tools, and can be played indoors or outdoors.

Implementation:

Children turn into an animal for one day. They may only select one animal; one that they know well or means a lot to them. You can encourage children with your own example of an animal that might be important to them or best most corresponds to their character.

Each child should first consider which animal they want to be and why. Each child presents their selected animal and the reasons they chose it to the group with a short sketch or description. We can enhance the game with a question about how an animal spends its day (e.g. what an animal would do that we humans cannot).

With a large group of children, we can limit the description to just three adjectives. For example: *"A wolf is fearless, it lives in a pack and is a good runner. As a wolf, I would scare the baker and then share all the sweets with my friends. At physical education, I would break a record in the long-distance run."*

3.1.2 Animal Circle

Learning objectives:

Students (primary school):

- Learn acting techniques, express themselves using the body and voice, practice pantomime, mimics, gestures, movement
- Learn to focus, relax and act fast
- Learn to coordinate a group
- Identify with an animal and raise awareness about it

What will children learn?

Children will learn about different animals, their characteristics, feeding habits, sounds etc.

What do we need?

The game is active and fun. Children are placed in a circle. Playing the game requires no special preparations or tools. It can be played indoors or outdoors.

Implementation:

We begin by asking children about the characteristics of different animals: *What do hamsters look like, what do they eat etc.*

The player in the middle of the circle tries to force someone to make a mistake and take their place in the middle. The player in the middle points at one of the other players and calls for activity hamster, frogs or monkeys (described below). The player who was selected stands up quickly. This also activates the players to their left and right. The three players must then show the selected activity with the help of movements and sounds. The one who makes a mistake has to replace the player in the middle. If they did not make any mistakes, the three players sit back down and the player in the middle chooses another player.

Activities should be repeated several times before the game begins. We must pay attention to the synchronisation of movements, the correct pronunciation of words, the sequence of movements and ensure the game flows smoothly. Speed and accuracy are also important and it is easier to make a mistake if the game is faster. The game thus becomes more dynamic and fun. When all three activities have been mastered, we replace them or add new activities.

We may think up three activities together or use activities prepared in advance. Some examples of animals include:

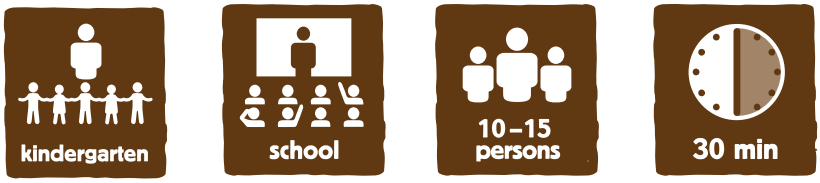
- **Hamster**: All three players rise simultaneously. The middle player crouches down. The left and the right players turn towards each other and hold hands to form a ring. The middle player rises immediately after the ring has been formed over their head. They then hold their chin with both hands and call out, “squeak-squeak”.
- **Frogs**: All three players rise simultaneously. The left and the right players crouch with their palms on the ground and say, “ribbit”. The middle player crouches, puts their palms on the ground and says, “quack”. As soon as the middle player

say, “quack”, the left and right players rise and say, “ribbit”. The whole sequence is repeated twice.

- **Monkeys**: All three players rise simultaneously. The right player covers their eyes and cries out, “I don’t see anything!” and stays in this position. The middle player immediately puts their index fingers in their ears and cries out, “I don’t hear anything!” and stays in this position with their ears covered. The left player covers their mouth and cries out, “I don’t speak!”

3.2 FOCUS ATTENTION

3.2.1 Pssst, I’m Listening!



Learning objectives:

Children (kindergarten):

- Recognise the direction a sound comes from by listening
- Recognise and jot down feelings, and learn techniques to present feelings with instruments from natural materials

Students (primary school):

- Search for the origin of some sound using the sense of hearing
- Besides hearing, learn about the other functions of an animal’s ears
- Recognise their feelings
- Present their feelings with the help of natural instruments

What will children learn?

Children calm down and use their sense of hearing to recognise different sources and the direction of sound. They also try to connect sound to different emotions. Animals’ ears have other functions besides hearing.

What do we need?

Materials found in nature that can be used to produce sounds (cones, sticks, rocks, leaves, nut shells etc.)

Implementation:

We first ask children questions about how animals make various sounds:

What sound does an elephant make?
What sound does a cicada make?
What about a frog?
Which organ do humans and animals use to sense sound?
How do our ears work?
What shapes of ears do we know?

Some animals can hear much better than humans do. They have more flexible ears than we do and they perform different functions. Have you ever wondered why an elephant's ears are so big and why it has no problem cooling itself? In addition to cooling, some animals' ears are used to communicate. For example, the position of the ears may be used to communicate an animal's disposition to other animals. Have you ever seen an angry horse? What about a dog watching his owner in the distance? The ears may be rotated to better determine the direction of sound. Animals use this function to identify danger in a timely manner. Children may also try to wiggle their ears.

How good is your hearing? Children are asked to close their eyes. Use different objects to produce sound. Change the direction of the sound by changing your position. Children should turn towards the direction they think the sound is coming from and try to determine the source. In a smaller group, everyone may try to produce sounds.

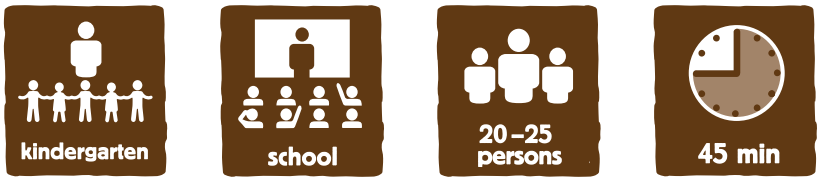
Examples:

- The rubbing of two pinecones together
- The striking of two sticks together

- The striking of two stones together
- A stone falling into water
- The rustle of leaves while walking
- The snapping of a dry branch
- The making of sound using a blade of grass
- The making of sound using Primrose
- The rubbing of two nut shells together
- The clapping of hands etc.

The game can be modified. We can ask children which emotions they recognise. Children can look for objects from nature and use them to give voice to different emotions (anger, sadness, joy, fear, love, surprise, good cheer, disgust etc.). They can also give voice to different animals. What sound do different animals make: a sad bear, a wolf with a toothache, an owl in love or a playful squirrel?

3.2.2 Can You Follow Me?



Learning objectives:

Children (kindergarten):

- Observe nature, and recognise and distinguish between animal traces
- Count and identify the most common animal species
- Role play
- Develop imagination

Students (primary school):

- Count signs in nature that indicate the presence of animals
- Observe and identify animals on the basis of the traces they leave in nature
- Observe nature

What will children learn?

This game stimulates creativity and imagination, as children think about animals' behaviour and their traces they leave behind in nature, teaches children how to observe nature and identify animal traces such as their shelters, remnants of food, paw prints and secretionsand, stimulates interest in and a positive attitude towards animals.

What do we need?

Materials that can be found in nature.

Implementation:

We begin by asking children how to determine which animal has recently been in the vicinity:

What traces do animals leave behind?

Have they ever found the secretions of some animal?

How do you determine which animal left tracks in the mud?

Animals leave behind numerous traces in nature. Their presence is indicated not only by tracks in the mud but by certain other traces. We can learn how to recognise those traces. Besides animal tracks, we may also find the following in nature:

- Various remnants of food left by animals (e.g. pieces of spruce branches indicate squirrels in the tree above; half-eaten sprouts of young trees are left behind by red deer; egg shells are left behind when a new animal hatches or after some night-time feast etc.);
- Animal secretions (which also indicates which animal they belong to);
- Traces on tree trunks (e.g. mud stains on the lower part of a tree are left behind by wild boar);
- Animal remains (e.g. feathers, or the horns of a red deer or a roe deer).

The game should be played in pairs. We set an area in the forest where the game will be played. Each pair should pick their own

area. The pair first observe their area and checks for animal traces. Children are told in advance to be precise and patient. They should try to remember as many observations as possible. The pair then splits up. One student withdraws from the selected area, shuts their eyes and waits for the other to "leave animal traces". The second student tries to be as creative as possible and to immerse themselves in the role of the selected animal. They can, for example, dig a small hole, gather pinecones and place them in a pile, use mud to make animal secretion etc. When everything is ready, the first student inspects the area and finds all the traces. Can they determine which animal left the traces? The players then switch roles.

3.3 DIRECT EXPERIENCE

3.3.1 Animal Habitat

Learning objectives

Students (primary school):

- Understand the concept of a habitat
- Recognise the habitats of different animals in their surrounding and develop their nature observation skills
- Distinguish between suitable and unsuitable habitats for animals
- Practice team work and public speaking
- Edit data and present findings using graphs and tables with the help of a computer program

What will children learn?

Children learn about the concept of a habitat and what animals need to do to survive. This is an outdoor activity.

What do we need?

Blank sheets of paper, a hard surface, pencils, survey sheets to assess the habitat and a camera (optional).

Implementation:

We begin by asking children to name the basic needs of every living being, using examples of various animals to assist:
What does a bee need to survive?
What does a bear need to survive? What about a blackbird?

When they've listed all points common to living beings (food, water and shelter), we explain the word habitat. We then divide the children into groups of two to three researchers. We give them a survey sheet and present some terms such as melliferous plants and other possibly unknown terms. We set limits to the research area and define a sound signal that will be used to mark the end of the research and a return to home base.

The activity can be continued in a classroom. Data gathered in the forest may be edited using a computer program and the findings presented using graphs, tables and photos. If a specific habitat is assessed as poor, the students can make a poster with measures for improvement (the planting of fruit-bearing plants, leaving wood biomass in the forest, the creation of pools etc.).

Assessment of the State of Habitats for Different Animal Species

FOOD	Nothing found				Many found
Fruits (acorn, beechnuts, walnuts, hazel nuts etc.)	1	2	3	4	5
Berries (raspberries, blueberries etc.)	1	2	3	4	5
Melliferous plants	1	2	3	4	5
Insects	1	2	3	4	5

WATER	Nothing found				Many found
Available all year round e.g. stream, lake or pool	1	2	3	4	5
Occasionally active e.g. pools and water in tree hollows	1	2	3	4	5

SHELTER	Nothing found				Many found
Thick bushes	1	2	3	4	5
High grass	1	2	3	4	5
Dead standing trees	1	2	3	4	5
Fallen trees	1	2	3	4	5
Cavities and caves	1	2	3	4	5

3.3.2 Expedition

Learning objectives:

Students (primary school):

- Observe and describe substances, objects and organisms
- Draw conclusions about the characteristics of organisms based on observations
- Record observations and present them in a clear and brief manner
- Role play

What will children learn?

This activity promotes research, observation, interpretation and public speaking. Students learn what the concept "habitat" means, learn what animals need to survive and what they need to create their living environment.

What do we need?

Blank sheets of paper, a hard surface, pens, a magnifying glass, cameras, nets, bags and plastic cups. This is an outdoor activity.

Research might also be conducted without the above described requisites, so that students only remember their observations and share them later with the group.

Implementation:

Charles Robert Darwin was an English natural scientist. He was still a very young man when he boarded the research ship, the Beagle. The maritime expedition included many different people: sailors, painters, land surveyors etc. Their task was to explore distant shores and the islands of Patagonia, Tierra del Fuego, Chile, Peru and certain pacific islands, all of which were previously unknown.

Similar to the expedition of the Beagle, we have also found ourselves in the role of researchers. We will depart on an expedition to a distant, unknown forest. Our mission is to explore the forest and take samples for detailed analysis.

We divide children into groups and give each group a task, thus enabling children to learn about different occupations. We use questions like the one below to assist us:
What does the work of a zoologist entail?
What do geologists research?
Why are cartographers important?
What does the knowledge of a botanist comprise?

Roles:

Zoologists are experts who study animals. Their task is to determine which animals live in our specific area based on various traces (sprouts damaged by chewing, tracks, secretions, paw prints etc.), whether there are animals where traces have been found etc.

Geologists will study the area in terms of rocks and the topography of the terrain. Which rock is predominant, are there water sources, what are the characteristics of the terrain (wet, sandy, muddy, brownish, black etc.), are there specific features such as caves and erosion, and traces of human activities (roads, fields, and other signs of agricultural or forestry activity)?

Botanists study plants and will therefore look at them closely. They are interested in which are the most abundant plants, their health and wether they grow in a deciduous, coniferous, or mixed forest. Botanists will ask themselves why is there so much/little undergrowth and whether there are some unusually shaped trees and why. By observing tree stumps, they will determine the age of the surrounding trees etc.

Cartographers will attempt to present the area using a map made from natural materials, which will be used as a tool to present the research findings of other groups (e.g. what they found and where).

At the end, every group will report on its expedition and the most interesting observations and findings. We can add certain other roles such as artists, historians, journalists etc.

3.3.3 Food, Water and Shelter – the Basic Means of Survival

Learning objectives :

Students (primary school):

- Understand the term "habitat" and learn to name the basic elements animals need to survive

What will children learn?

This activity reminds us of the game, "Who is afraid of the big bad man?", which is played in a large outdoor area (meadow or forest clearing). Children learn what animals need for survival: food, water and shelter.

What do we need?

Level area (meadow, forest clearing or playground)

Implementation:

We begin by asking children to name the basic needs of every living being, using examples of various animals to assist:
What does a bee need to survive?
What does a bear need to survive? What about the blackbird?

When they have listed all points common to living beings (food, water and shelter) we explain the word habitat. Half of the group plays the role of wild boars while the other half represents the forest as the habitat of wild boars. When the wild boars get hungry, they lay their palms on their belly, when they get thirsty, they form a fist and imitate drinking out of glass, when seek shelter, they use their hands to form a roof over their head. The forest provides wild boars food, water and shelter, so the other group represents the forest and imitates all the three elements.

The wild boars stand on one side, the forest on the other. In between them there should be a distance of 10 to 15 meters. The wild boars and forest should stand with their backs turned to each other. When the sign is given, each wild boar indicates what it wants (water, food or shelter). Children representing the forest also indicate what they offer as the forest. When the signal is given, the wild boars turn around (still imitating their chosen element) and run towards the child that offers him that element. The forest stands still. The number of wild boars is equal to the number of forest trees. A matching pair (a wild boar and a tree from the forest) return to the wild boars' side and the population of that species increase. The wild boars that did not get the element they wanted remain in the forest and become a part of it. We stop the game when necessary. We can also use other animals and the habitat in which they live.

3.4 SHARE INSPIRATION

3.4.1 If Animals Could Talk...

Learning objectives:

Children (kindergarten):

- Role play and develop imagination
- Recognise the needs of other living beings

Students (primary school):

- Practice playing and relaxing
- Recognise the needs of different animals
- Assimilate with other living beings and develop respect and understanding for them

What will children learn?

This activity stimulates imagination and assimilation with other living beings.

What do we need?

Level area (meadow, forest clearing or playground)

Implementation:

Children form a circle. Everyone thinks of an animal. We ask children, "If you could understand animals, what would you say to us on behalf of your chosen animal?" We can say, for example:

"I speak on behalf of a fox named Brianne, who fears for her cubs. She is displeased with the people who drive through her yard on motorbikes."

"I speak on behalf of a beaver Franz, who lost his shelter for the second time this year when a farmer destroyed it, thinking it's no more than a pile of branches created by the flowing water."

3.4.2 Let's Repeat

Learning objectives:

Students (primary school):

- Practice and strengthen previously gained knowledge over a specific time period and in a clear and precise manner
- Practice public speaking skills and learn to better assess the time available for a presentation

What will children learn?

This activity strengthens speaking skills and the ability to summarise the essence when presenting a subject, as well as the ability to improvise.

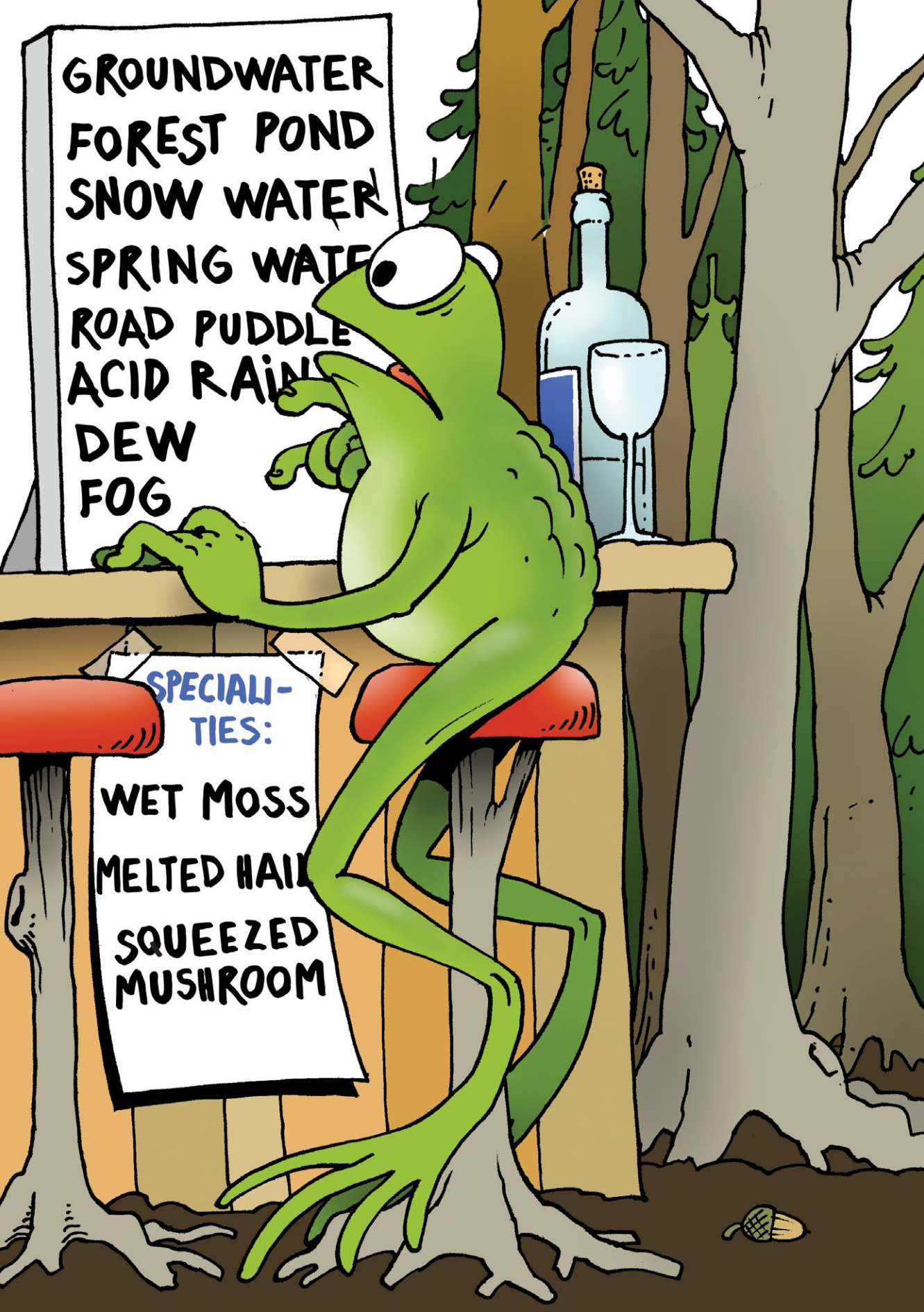
What do we need?

Ropes of different lengths. This activity can be performed indoors or outdoors.

Implementation:

Before beginning, we cut pieces of rope to different lengths. The number of pieces is equal to the number of children. Ropes can also be hung in the forest in advance and children look for them by themselves. Each child gets one length of rope. Children are then tasked with presenting their favourite animal, or interesting things and animals they have seen in the forest. When it is their turn, they start to wind the rope around their

finger, but not too tight. They can also wind the rope around a stick found in the forest. Each presentation may only last as long as it takes for them to wind their rope until the end. When the end is reached, the speaker must stop talking. We must remember that not every rope is of the same length and any rope will be too short for talkative children. Some children will soon discover that they can extend their speech if wind their rope slower.


GROUNDWATER
FOREST POND
SNOW WATER
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ROAD PUDDLE
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WET MOSS
MELTED HAI
SQUEEZED
MUSHROOM

4. Water

Urša Vilhar

Water is needed for all known forms of life, and is found almost everywhere on Earth. Nearly 71% of the Earth's surface is covered by water, 97% of which is salt water and 3% fresh water. Only 29% of the Earth's surface consists of land mass. Water found in nature can take on different physical states: solid form (ice), liquid (water) or gas (steam and water vapour). The transformation between different physical states can be achieved through heating or cooling. Surface water sources may take the form of running or standing water found on land: rivers, streams, channels, mill streams, seas and brackish water. Surface water sources are connected to form river basins, areas where many rivers and lakes flow into a single river or lake. Underground water sources comprise underground water that may or may not be directly linked to surface water. Underground water represents an important source of drinking water and is subject to special protection in Slovenia.

The water cycle, also known as the hydrologic cycle is the perpetual circulation of water between oceans, glaciers, polar ice, underground water, lakes and rivers, the atmosphere and different ecosystems. Water circulation is driven by the radiation of the Sun, which causes the evaporation of water into the atmosphere in the form of water vapour. The greatest amount of water enters the atmosphere from the oceans. Evaporated water condenses as it cools, with the help of rising air masses, and becomes fog, dew and clouds. Water vapour changes into hail, snow and ice due to sharp falls in temperature. When precipitation reaches the ground, the water circulation cycle is completed.

Water sources are limited and valuable, and must therefore be protected against excessive use and pollution. The quality of water can be determined on the basis of physical, chemical and biological characteristics, colour, taste and opacity. The level of pollution of water sources is determined by the concentration of undesired or toxic substances in the water. The main sources of water pollution are fertilizers and pesticides from farmland, dumps, solvents and detergents from households, as well as industrial sewage. Waste water from sewage is processed in treatment plants before it is released into the natural environment. The pollution of underground water in the Karst region is a major problem, as that water flows quickly (as much as several hundred metres a day), and results in the rapid transportation of pollutants from the point they entered the water system to distant areas. Water flows very quickly via some channels, or may stagnate for some time in others. It may thus take only a few hours for pollution to reach a water source, or it may remain in one place and accumulate underground for several days, weeks or months. To study flow paths of karst waters, tracing experiments are conducted in order to follow artificial tracing materials in large underground water systems.

Plants use their roots to extract water, nutrients and minerals. Water flows through the plant stem into the leaves. Some water evaporates through the stomata in the transpiration process, while some is used to produce sugars during photosynthesis. Sugars are then transported to other parts of plant, while oxygen is released into the atmosphere.

The forest forms a giant filter for air and water. With its thick crowns, forest intercepts pollutants in the air. At the same time, tree crowns, fallen leaves and the forest floor retain water so that it does not flow directly into surface or underground water sources, but evaporates to a pretty large extent into the atmosphere. This diminishes the erosive force of water. In addition, deep tree root systems stabilise the forest floor. That latter also acts like a natural water treatment plant, as the forest floor has a great capacity to retain pollutants and thus protect water sources in the forest.

4.1 AWAKEN ENTHUSIASM

4.1.1 Water Droplets

Learning objectives:

Children (kindergarten) and students (primary school):

- Recognise different forms of precipitation
- Distinguish between different physical states of water
- Undestand the importance of water for living beings and the importance of the forest for water retention etc.

What will children learn?

Children will learn about different forms of precipitation and name different physical states of water: water vapour, water, rain, snow, ice, etc.

What do we need?

Open area (meadow, forest clearing or playground).

Implementation

We begin by asking children:

Where does rain come from?

How does snow form and where does it disappear?

Why does hail form?

What are clouds made of and how do they form?

Does the water on Earth really circulate?

We then arrange children so that each has enough space to spin with their hands lifted at shoulder height. They imagine being water droplets falling from the sky. Now we tell them that a cold

wind has blown, making the droplets cold and bringing them towards each other. Children hold hands and became snowflakes. It then becomes extremely cold and the water droplets press together (children press together, back to back) and become ice.

4.1.2 How a Tree Extracts Water

From the book by Joseph Cornell "Sharing Nature: Nature Awareness Activities for All Ages"

Learning objectives:

Children (kindergarten) and students (primary school):

- Distinguish between different parts of a plant and understand their importance
- Learn how plants extract water, how that water is transported within plants, that water is also used in photosynthesis and that water transpires from plants into the atmosphere
- Understand the complexity of processes such as photosynthesis and transpiration
- Work as a team

What will children learn?

Plants and trees have organs, each of which has its own role. A tree uses its roots to extract water and minerals, which travel through the stem to the leaves. Some water evaporates in the transpiration process, while some is used in photosynthesis. During photosynthesis, sugars are formed from water extracted by the roots, carbon dioxide from the atmosphere and solar energy. Those sugars are then transported to other parts of a plant via the phloem, while oxygen is released into the atmosphere via transpiration.

What do we need?

- Open area (meadow, forest clearing or playground)
- Pads for lying on the ground if wet
- Birch juice or maple syrup

Implementation

We first ask relevant questions to refresh children's knowledge and collect their ideas about the subject:

Why do plants have roots?
What is the role of the trunk?
What occurs in leaves?
What gives strength and support to a tree?
How do trees manage water?

We then pick two or three tall children to stand back to back. These children represent the main part of the trunk, the core of tree, which provides support and stability, and primarily comprises dead cells.

The second group (3–6 children) plays the role of the tree's main roots. They gather around trunk and sit on the ground with their backs against the tree core. The roots extract water with nutrients and minerals from the ground and store substances. Roots also provide the tree support, as they are anchored in the ground. The third group (3–6 children) plays the role of secondary roots. These children lie down on their pads so that their feet are directed towards the main roots, with their hands and fingers spread wide. They simulate the tiny root hairs needed for roots to penetrate the ground and extract water containing nutrients. When we say, "Extract water!", the roots say, "Siiiiiiiiiiiiiiip!"

The fourth group plays the role of wood. We choose as many children needed to encircle the tree core. They face inwards and hold hands. They must take care not to damage the roots. Their task is to extract water from the roots and transport it via the trunk to the crown. When the roots finish extracting, we instruct

the wood, “Pump the water up!”, to which the wood responds, “Uiiiiiiiiiii!”, while the children raise their hands.

The fifth group of children surrounds the wood so their backs face inwards. These children represent the phloem that transports water containing sugar from the leaves to other parts of the tree. Children extend their arms, which represent branches, and shake their hands, which represent leaves. We say, “Produce food!”, and children raise their arms and shake the leaves. The process of photosynthesis in leaves creates sugars from water extracted from the roots, carbon dioxide from the atmosphere and solar energy. The phloem transports sugars throughout the tree. When we say, “Bring the food down!”, the phloem says, “Whoooooooo!”, and children lower their hands and crouch down.

We practice the sounds and movements in this sequence: “Extract water!”, “Produce food!”, “Pump the water up!” and “Bring the food down!” We practice until children master the sequence.

The rest of the children imitate the bark, which protects the tree against fire, insects, diseases, heat and knives. They gather around the phloem with their backs facing inwards. They place their closed fists over their chests and prepare for attack. We wait a moment and then imitate a hungry bark beetle attacking the tree. The bark defends the tree and turns away the attacker.

When the sign is given, the groups of children sound off in the given sequence and repeat several times, “Extract water!”, “Produce food!”, “Pump the water up!” and “Bring the food down!”

Following a successful game, we reward children with a cup of birch juice or maple syrup, and explain to them that both are collected by drilling holes into the trunks of trees, which play a game similar to the one we just played.

We can enhance the game by placing greater emphasis on the photosynthesis process.

4.2 FOCUS ATTENTION

4.2.1 Water Detectives

Learning objectives:

Children (kindergarten) and students (primary school):

- Learn about and recognise water and water sources in nature
- Distinguish between different physical states of water
- Name different water sources
- Better understand how water circulates

What will children learn?

Water can take on different physical states: water vapour, water, snow and ice. The Earth is a "water" planet: seas and oceans cover 2/3 of the Earth, while land covers just 1/3. Water sources are diverse. Surface water sources take the form of running or standing water: rivers, streams, channels, mill streams, seas and brackish water. Underground water sources comprise underground water that may or may not be directly linked to surface water. Underground water represents an important source of drinking water and is subject to protection in Slovenia. Water sources are limited and valuable, and must therefore be protected against excessive use and pollution.

What do we need?

A walk alongside a stream, pond or puddle, or pictures of a water basin, river, lake, ocean, stream, pond, clouds etc.

Implementation

During a guided walk, children search for water in any possible form (dew drops, clouds, puddle, river etc.), and give the names

of all water forms they observed (river, stream, cloud, fog, puddle etc.). We use questions to stimulate them to think about how all of the forms of water or water sources that they observed were formed, and what will happen to them in the future. Children learn that water "circulates". We help them with the following questions:

Where does rain come from?

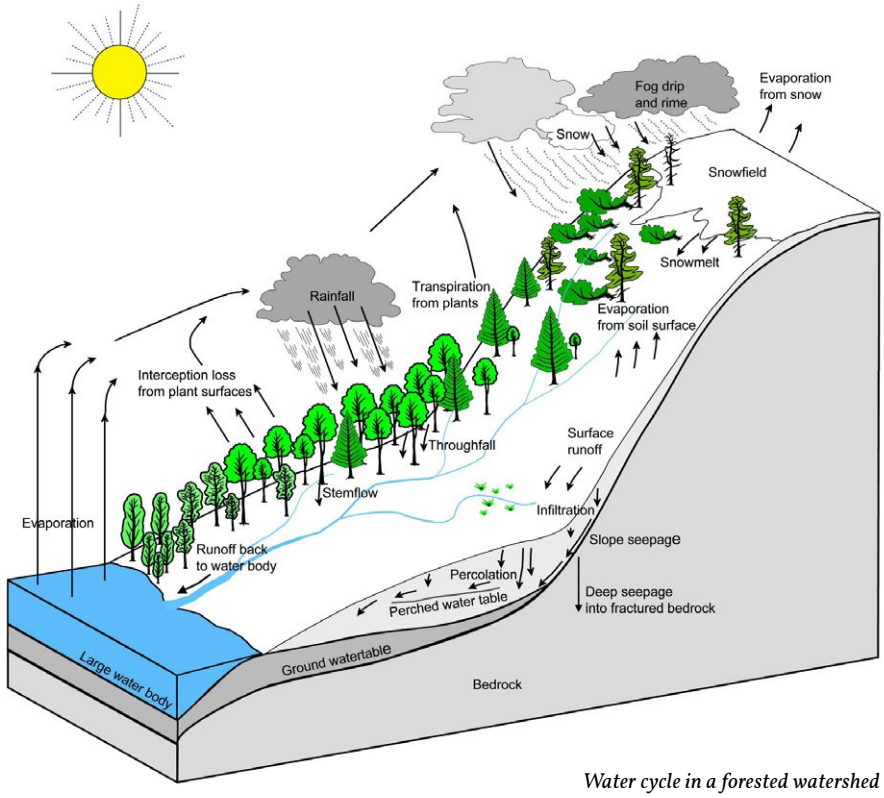
Where does the water that forms a pond come from and where does it go from there?

How does snow form and where does it disappear?

How does a puddle form?

Why does hail form?

What are clouds made of and how do they form?



Water cycle in a forested watershed

4.2.2 Let's Make a Water Map!

Learning objectives:

Children (kindergarten) and students (primary school):

- Observe water and water sources in nature
- Distinguish between different physical states of water and name various water sources
- Practice orientation skills and the skills needed to draw a map
- Better understand water cycle and recognise the role of the forest in that process
- Better understand why the protection of water sources is important for clean water

What will children learn?

Children recognise and name water in various physical states, as well as water sources: stream, river, pond, spring, marsh, puddle, clouds, rain etc. They learn the basics of cartography and draw a map of water sources observed during a walk.

What do we need?

- Walk along a stream, river, pond or puddle
- Topographic chart or a simple map of the area where the walk will take place
- Blue pen

Implementation

During a walk, children search for water in any possible form (dew drops, clouds, puddle, fog, river etc.) and name all observed water sources (stream, river, pond, marsh, sea, puddle etc.).

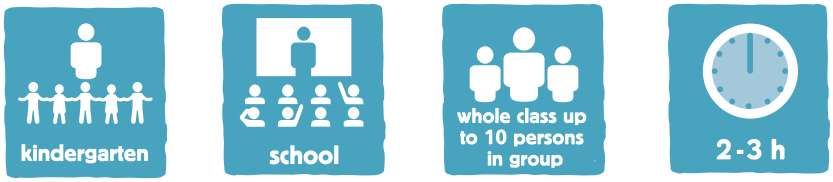
Children view a map (or topographic chart) and learn the basics of topography. A blue pen is used to mark any water source observed during the walk.

Children compare the maps of water sources they have drawn and consider why we need maps, how the first maps were created and what devices we use today instead of maps.

Children consider how the forms of water and water sources they observed were created and what will happen to them in the future. We ask them if the water they observed was clean or polluted. They learn that the Earth is a "water" planet: seas and oceans cover 2/3 of the Earth, while land covers just 1/3. Water sources are limited and valuable, must therefore be protected against excessive use and pollution.

4.3 DIRECT EXPERIENCE

4.3.1 How Watery Are Plants?



Learning objectives:

Children (kindergarten):

- Distinguish between different parts of plants and understand the importance of water for their survival
- Learn how plants extract water and how water is transported within plants

Students (primary school):

- Learn that water is needed for photosynthesis and that it transpires into the atmosphere

- Better understand the complexity of processes such as photosynthesis and transpiration
- Learn how to measure the quantity of water that has evaporated from leaves through transpiration

What will children learn?

Children recognise different parts of plants (leaves, stems and roots). They learn that plants contain up to 90% water, while people are comprised of 60%–70% water. They learn that plants extract water and minerals through their roots, and that water is transported through plants and evaporates into the atmosphere through stomata (transpiration).

What do we need?

- A walk through the forest, meadow or park
- Different parts of fresh plants (leaves, stems and roots)
- Two empty bottles
- Plastic bag
- Scotch tape and a spoon
- Measuring cylinder
- Paper and a pen

Implementation

During a walk, children gather different parts of fresh plants and name them. We help them with the following questions:
What is the task of roots?
What occurs in the leaves?
Why do plants need flowers and fruits?

They tear off a piece of the gathered parts of plants and squeeze out some juice. They learn that the plants pumped water from the soil using their roots. Water then flows through conductive tissues, which can be best seen in the veins of a stem and leaf, similar to the way human blood flows through veins, which children can see on their hands.

We ask children how much water can be found in plants and humans. Plants contain up to 90% water, while people are comprised of 60%–70% water. We mark horizontal lines representing 90% and 65% on empty bottles. On the first we stick the silhouette of a plant and on the second the silhouette of a human. Children pour water into the measuring cylinder and then into both bottles up to markings. Children determine which bottle contains more water: the one representing a plant or the one representing a human. We point out the importance of drinking water regularly for people and watering for plants.

In a sunny spot in a city park or on the edge of the forest, we select branches with leaves at a height that children can see well. Children wrap a branch with green leaves in a plastic bag and seal it tightly. After a specified amount of time (2 hours, 24 hours, etc.), they observe whether any drops of water have accumulated on the bag. When there is enough water, they pour it into the measuring cylinder and record the quantity. Children learn that water evaporates through stomata in a process called transpiration.

4.3.2 How Clean is the Water?

Learning objectives:

Children (kindergarten):

- Observe water and its characteristics: colour, smell, taste and opacity
- Distinguish between clean and dirty water

Students (primary school):

- Learn how to take samples of water and how to filter dirty water
- Better understand why the protection of water sources is important for clean water
- Are aware of their responsibility for a clean environment

What will children learn?

The quality of water is indicated by its colour, smell, taste and opacity.

What do we need?

- A walk through the forest, meadow or park
- Water source (pond, stream, puddle etc.)
- Containers with covers for water samples
- Samples of water from a pond, stream, puddle, tap etc.
- Pen
- Gauze
- Rubber band
- Containers

Implementation

During a walk, children collect different samples of water in containers, from cleaner water (tap water) to muddy water (from a puddle). They indicate on the container what type of water is inside. Children compare samples of water in terms of colour, opacity and smell. We help them with the following questions:

What kind of water do people drink?

How do you recognise clean water?

How do we treat water to make it potable?

They secure gauze over the containers using an elastic band. They pour water from the tap into the containers through the gauze. The same is repeated with the water samples from a stream and puddle.

Children compare deposits left on the gauze and determine which water has a higher opacity and which has a lower opacity. They consider the sources of pollution and suggest solutions.

4.3.3 What is the Stream Velocity?

Learning objectives:

What will children learn?

- Measure the velocity of water in a stream and the speed of a running child
- Observe water and its characteristics: velocity, colour and cleanliness
- Better understand how to determine the flow of underground water using tracing materials and how to trace pollutants
- Work as a team

What will children learn?

The velocity of water in stream may be determined by dyeing it. The tracing of water and pollution in Karst areas where water flows underground is carried out in a similar manner.

What do we need?

- A stream
- White foil placed on the bottom of the stream
- Dark liquid food colouring (red, blue, green or purple)
- Measuring tape (at least 10 m in length)
- Two poles
- Stopwatch
- Pen
- Paper
- Flat surface that is suitable for running (meadow or playground)

Implementation

Using a measuring tape, children mark off a length of 5 m or 10 m alongside a stream, marking the start and finish with two poles. One group stands near the starting point and waits to pour the

food colouring into the stream. The second group, which places the foil on the stream bed, waits near the finish point.

A third group stands near the finish point with a stopwatch. When told to do so, the first group pours the food colouring into the stream. The third group starts measuring the time and waits for the second group to indicate that the food colouring has reached the finish point. Children can repeat the entire process several times to record the most precise possible time that the water needed from the start to the finish point. The fourth group record results, writes them on a piece of paper and calculates the velocity of the water in meters per second ($m\ s^{-1}$).

During the second part of the experiment children measure and mark off a distance of 10 m suitable for running. The teacher holds the stopwatch and gives the signal for children to run the marked-off distance. The time to run the distance is recorded. The result is calculated in meters per second ($m\ s^{-1}$). At the end, children compare the velocity of the water in the stream with their running speed to determine who was faster.

Children consider where else it is possible to use similar "tracing tests" to determine the velocity of liquids. We explain how tracing experiments using tracing materials are carried out in Karst areas where water flows underground. In addition to tracing colours, it is also possible to trace pollutants and determine how quickly they spread. We ask children how it is possible to reduce water pollution in their household, school and city, town or village.

4.4 SHARE INSPIRATION

4.4.1 Silent Walk by a Stream

Learning objectives:

Learning objectives:

- Calm down and relax
- Observe the water and take in the sounds it makes

What will children learn?

Relaxing, moderation and the connectivity of a group

What do we need?

Walk by a stream, river or pond.

Implementation

Children arrange themselves in pairs and walk by a stream or river. They relax and listen to the sounds of the water, alone with their thoughts.

4.4.2 Recipe for Clean Water

Learning objectives:

Children (kindergarten) and students (primary school):

- Calm down and relax
- Observe water and the living beings for which water is important
- Better understand why the protection of water sources is important for clean water
- Are aware of their responsibility for a clean environment
- Search for solutions and work in groups

What will children learn?

Relaxation, moderation, the connectivity of a group and responsibility for a clean environment

What do we need?

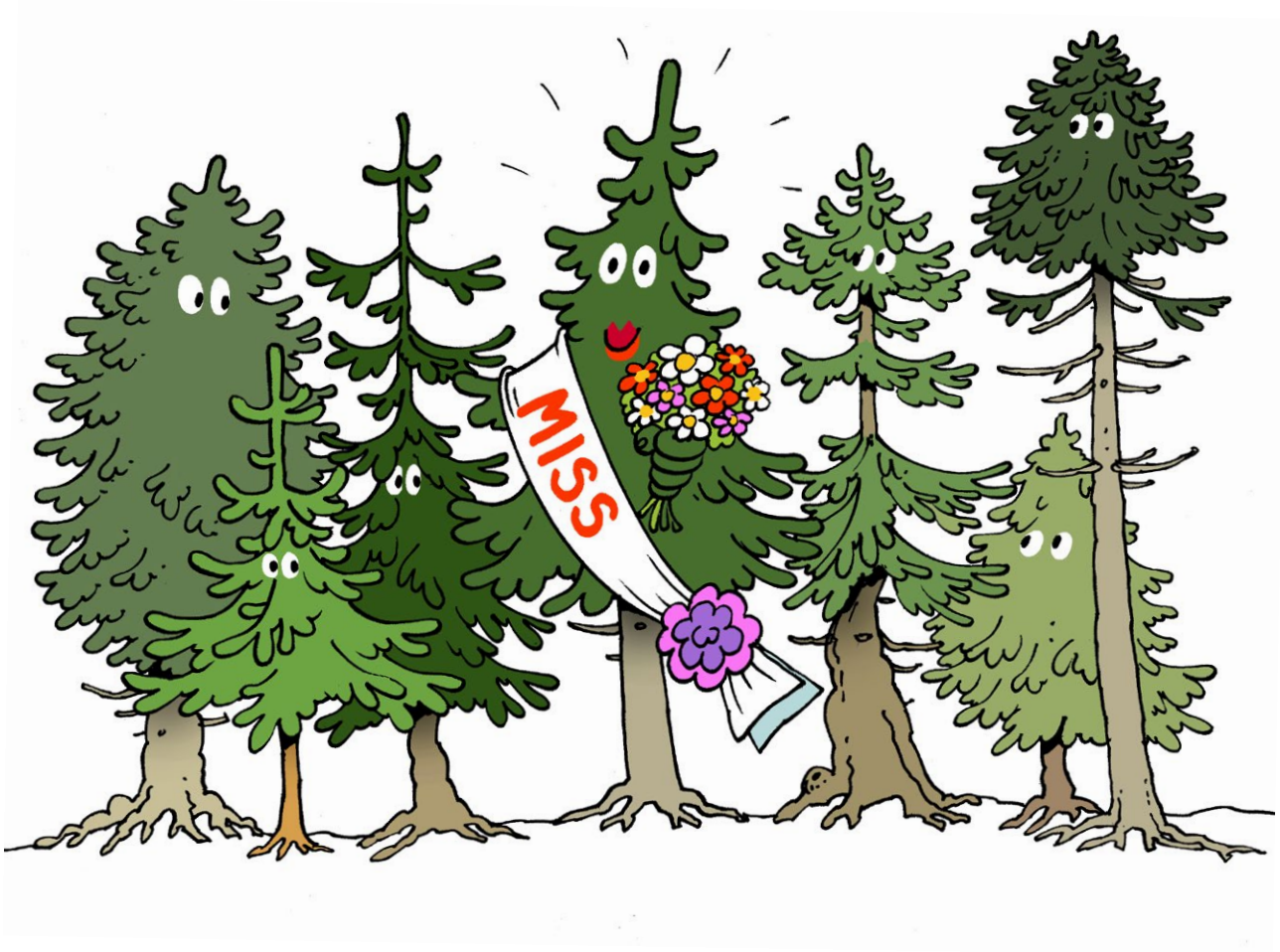
- Walk towards a stream, river or pond
- Paper
- Pen

Implementation

Children arrange themselves in pairs and walk silently towards a stream or river. They relax and listen to the sounds of the water, alone with their thoughts.

When they gather again, children write suggestions on a poster on how to preserve the clean water in the stream, river or pond they visited. They brainstorm about pollutants and substances that do not belong in the water etc.

They describe which animals and plants live in or near the water, and why clean water is important for their existence.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5. Genetic Diversity

Marjana Westergren, Boris Rantaša

Trees grow in different environments; the same species may grow from the coast of Mediterranean to the Alps. Every tree carries "instructions for growth and development" in its DNA. These instructions are called the **genotype** of a tree. The total span of all genotypes, i.e. variation that is attributable to differences in genes of a species represents the species' **genetic diversity**. Genetic diversity is expressed in differences between single trees and tree populations. It is essential for their survival and adaptation to a changing environment. This means that in a certain tree species population there might be also trees that could adopt to higher air temperatures or can cope with a new disease. The genetic characteristic that enabled the survival of this tree in a changed environment is transferred via seed to the offspring. A population adapts to new conditions in the environment and the forest, althought changed at first sight, continues to provide all functions or ecosystem services.

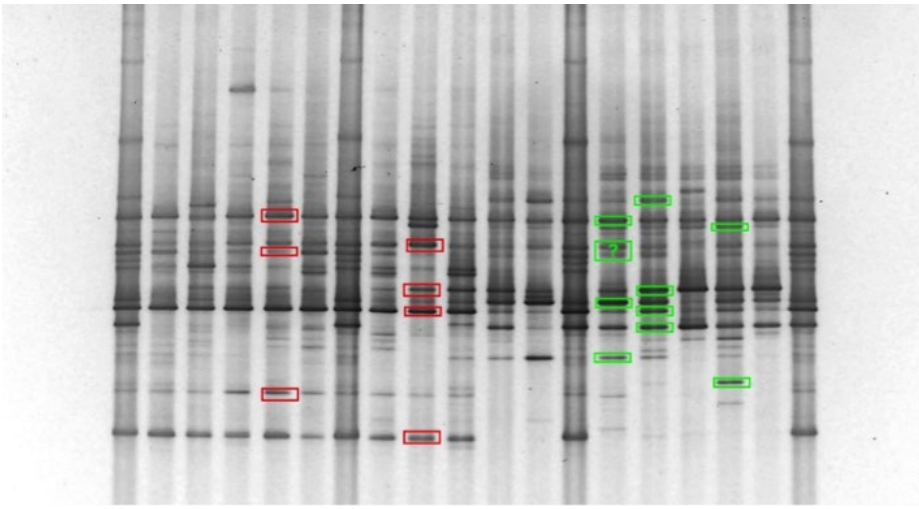
Genetic variation within a single species is easiest to observe as differences between single trees at the molecular level in laboratories (**genotype**) or as differences in phenotypes. A **phenotype** is the sum of visible characteristics of a tree that can be observed and measured such as leaf colour, the shape of a trunk and early or late leaf development in the same environment, as well as the occurrence or absence of diseases. A phenotype is affected by the genotype and the environment in which a tree grows.

The current distribution and structure of the genetic diversity of tree species are the result of resettlement following the last ice age and adaptation to the environment through natural selection. Human exploitation of forests has also had a significant impact.

Today's genetic diversity of populations of forest trees is threatened primarily by deforestation and fragmentation of forest areas, and the spread of agriculture and urbanisation, particularly where the forests are already small and fragmented. It is also threatened by climate change and the resulting arrival of new diseases and pests, and by reforestation using seeds and seedlings from unsuitable environment that are not adapted to new site conditions, in which they are planted.

A forest **seed** is a "living organism" that facilitates the transfer of genetic information. It contains all information on the tree that will grow from it. A seed comprises an embryo, cotyledons, food source and a seed coat. The seed coat can be hard or juicy and together with the seed forms a fruit. In favourable environmental conditions seeds germinate and give rise to new trees.

Biodiversity encompasses diversity at ecosystem, species and gene levels. Genetic diversity represents the basic level of biodiversity. Therefore, its conservation must be treated as an integral part and an additional element



Example of a genetic analysis

of the protection of the biodiversity at species and ecosystem level. The genetic diversity of forest trees (forest genetic resources) is best protected within the forest itself (*in situ*). This facilitates the continuous adaptation to changes in the environment. At the same time, conservation of forest genetic resources in the forest is supplemented with conservation of genetic diversity in forest gene banks (*ex situ*), in which seeds, tissues or clones are stored for emergency cases. In Slovenia, conservation of forest genetic resources is carried out through a network of gene conservation units (or forest gene reserves) in forests complemented with a forest gene bank at the Slovenian Forestry Institute.

5.1 AWAKEN ENTHUSIASM

5.1.1 Lifecycle of a Tree

(modified Pyramid of Life game: www.sharingnature.com)

Learning objectives:

Children (kindergarten):

- Understand concepts such as seed, seedling, sapling, tree and the lifecycle of a tree (how do trees grow and change)
- Learn numbers by counting and sorting cards and children that represent individual cards
- Participate and develop coordination (if we decide to build a pyramid)

Students (primary school):

- Learn concepts such as more and less, same and different
- Understand the main principles of living nature, basic biological concepts and trees as a broader category of organisms
- Learn concepts such as reproduction, growth, development and life-cycle using the tree as a basis
- Learn to describe the lifecycle of a tree and put its development phases in sequential order

What will children learn?

We show and explain to children the lifecycle of a tree. We help them with the following questions:

Do trees grow?

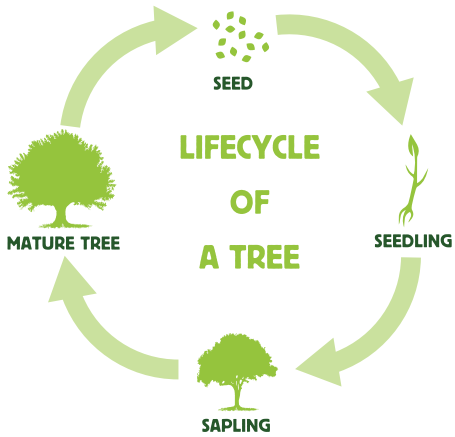
From what does a new tree grow?

Does a single tree have many or few seeds?

When a tree produces seeds, it produces thousands. Out of these a proportion will germinate, and o proportion of these seedlings will live to become full grown trees. The seeds who will give rise to trees should fall into a favourable spot (habitat), get a sufficient stock of food and possess the characteristics required to survive in a given environment.

We explain that many trees die during different phases of the lifecycle. Some trees do not survive due to the environment and some due to their genetic make-up, while some trees are harvested by people for their needs. Trees that survive, grow and when mature, produce their own seeds.

For the lifecycle to complete, the number of trees of the same species (mothers and fathers) that remain in the forest must be high enough to ensure pollination among unrelated trees, and thus the exchange of genes (genetic diversity) and new generations of seeds (children).



What do we need?

- A walk through the forest or forest clearing
- Cards illustrating the lifecycle of a tree that we make ourselves (paper, coloured pencil and scissors)

Implementation

We begin by asking children:
What is a seedling?
From what does a new tree grow up?
Does a single tree have a lot of seeds?
Are all seeds the same?
Which fruits contain seeds?

1. Preparation of cards. The number of cards should correspond to the number of children. We write the following on the cards: seed, seedling, sapling and mature tree, and add the tree species (fir seed, oak seed, beech seedling, beech sapling, cherry tree, maple tree, pine tree etc.). Along the upper edge of each card, we also write the phases of the lifecycle (seed = 1, seedling = 2, sapling = 3, mature tree = 4). For 25 children, we prepare, for example, 12 seed cards, seven seedling cards, four sapling cards and two mature tree cards.
2. We distribute one card to each child. Children should look at the card.
3. We ask all the children with a seed card (number 1) to step forward and turn towards the other children. We ask them, "Are you seeds?" When they answer "yes", we invite them to introduce themselves ("I am a spruce seed."). These children kneel or sit on the floor.
4. We ask all the children with a seedling card (number 2) to step forward. We ask them, "Are you seedlings?" When they answer "yes", we ask them to introduce themselves ("I am a spruce seedling."). These children step behind the "seeds".
5. We ask all the children with a sapling card (number 3) to step forward. We ask them, "Are you saplings?" When they answer "yes", we ask them to introduce themselves ("I am a spruce sapling."). These children step behind the "seedlings".

6. We ask all the children with a mature tree card (number 4) to step forward. We ask them, "Are you mature trees?" When they answer "yes", we ask them to introduce themselves ("I am a oak tree."). These children step behind the "saplings".

We ask children if they are prepared to build a pyramid to illustrate growth from the tiny to the large. We explain that there are fewer specimens on each level. "Seeds, are you ready to bear the weight of all the others?" "No!" "OK. Today we will not build a lifecycle pyramid. You may relax." If the "seeds" answer "yes", you can try to build a pyramid in such a way that each subsequent phase of the lifecycle climbs on preceding phase. We must, however, take great care for the safety of children!

Activities may be enhanced by having children search for and recognise seedlings, saplings, mature trees, seeds/fruits etc. Children can also be given the task of finding the seedlings, saplings, grown trees and seeds/fruits of a specific tree species.

5.1.2 Trees in the Wind

Learning objectives:

Children (kindergarten):

- Learn about the properties of the body
- Develop coordination of movement and link it with instructions
- Imitate trees as living beings that cannot move

Students (primary school)::

- Understand the main principles of living nature, basic biological concepts and trees as a broader category of organisms

What will children learn?

Children will learn that trees are stationary. They cannot move no matter the threat: drought, flooding, high air temperatures or storms. For this reason, it is especially important that tree populations have a high level of genetic diversity with which they will eventually adapt to changes in the environment.

What do we need?

A walk through the forest or a meadow.

Implementation

Children arrange themselves in a given area. We tell them that they represent trees. We help them with the following questions:
Do trees move?
What is the task of roots?
Is a tree able to move to another place?

Trees have roots that fix them to the ground. They cannot walk, but only stand still. When the wind blows, trees move their branches (hands and upper body), but remain rooted to the same spot. If the wind becomes too strong, trees may break, fall or become uprooted.

When we say “the wind is blowing”, children may move their bodies except for their legs. When we say “the wind has died down”, children stand still until the wind blows again. Whoever moves their legs, breaks/falls/uproots. They are no longer in the game and must kneel.

5.2 FOCUS ATTENTION

5.2.1 What is Genetic Diversity?

Learning objectives:

Children (kindergarten):

- Observe and perceive their body, and similarities and differences between people
- Think about similarities to their parents and relate their findings to trees

Students (primary school):

- Understand the main principles of living nature and basic biological concepts
- Learn through observation
- Understand biodiversity and the concept of heredity
- Learn to find differences and similarities between the same species

What will children learn

Children will learn about concepts such as species, diversity and the transfer of hereditary information to offspring.

What do we need?

A walk into the forest.

Implementation

1. We arrange children in a circle and tell them to each observe other. We ask questions and they answer:
"What similarities do you share?" Everyone has a head, two hands, a nose in the middle of their face, eyebrows etc. We belong to the same species – human.

"What differences do you see?" Eye and hair colour, height etc. Despite being the same species, there are differences between us. Those differences are the result of genetic records and illustrate human genetic diversity.

"Do you resemble your mom, dad or both?" Similarity to our parents illustrates that information regarding appearance is passed down from parents to their offspring.

2. Children look about and observe the forest around them for several minutes. They then turn back towards each other and answer variations of the above-stated questions. Before that, they describe what they have just seen. *"Are trees the same or different?", "In what ways are they similar?" "In what ways are they different?" "Have you also seen saplings?" "Are saplings similar to grown trees?"*

5.2.2 The Hunt for Interesting Trees

Learning objectives:

Children (kindergarten):

- Observe and learn about nature, discover the forest (or a specific area)
- Orient themselves in an area and follow instructions
- Invent and use symbols to describe and interpret a situation
- Practice bodily coordination through free movement in the forest

Students (primary school):

- Learn about the forest and its biodiversity
- Recognise tree species
- Recognise and name living beings and their habitats

No. of persons: whole class in groups of 3–5 children

What will children learn?

Children walk through the forest and observe the trees. They practice perception, their orientation skills, their ability to follow instructions and learn about the diversity of the forest. The diversity of the living organism that they observe is the result of genetic diversity.

What do we need?

- A walk into the forest
- A piece of paper and hard surface
- A pen and coloured pencils
- A toy (ball, cube, notebook etc.)

Implementation

1. We divide children into pairs or smaller groups. We instruct them to draw a map of a path to an "interesting" tree while they walk towards this tree. They draw a starting point (where they are standing), points of interest, signs along the path (rocks, groups of flowers, prominent trees etc.) and at the end mark an interesting tree ("treasure") with an X. They should also describe or draw their "interesting" tree (e.g. tree species, is it the tallest tree in the forest, does it have an abundance of branches or a straight trunk etc.). They hide a toy close to the roots that a later group will find and bring back using a map they receive from the first group. Children are also instructed to maintain eye contact with the teacher during their walk into the forest. Each group receives a piece of paper, hard surface to write on and coloured pencils, and is told to come back when given the signal.

2. Groups search for their interesting tree and draw a map of the path to it. They hide a toy close to the roots of the tree. They describe or draw the tree on their map. They have 30 minutes to complete this step before returning to the teacher.

3. Groups arrange themselves in a circle. Each pair gives their map to the pair on their right. Each pair then has 30 minutes to find the "interesting" tree and retrieve the toy.

4. At the end, all children gather together and report on the "interesting" trees that they discovered.

5.3 DIRECT EXPERIENCE

5.3.1 Observing the Phenological Development of Trees in Spring and Autumn

Learning objectives:

Children (kindergarten):

- Observe and recognise the development of and changes in living beings (leaves develop in a certain chronological order, from bud to a fully developed leaf)
- Recognise seasons and link them with seasonal events

Students (primary school):

- Observe, classify, arrange and draw conclusions
- Assist in experiment planning
- Systematically observe, record observations, edit and process gathered data, and draw conclusion based on observations
- Use modern technology to gather and process data, and to interpret information
- Recognise that experiments involving living organisms can be lengthy

No. of persons: whole class in groups of 3–5 children

What will children learn?

The populations of trees are adapted to the environment in which they grow. Phenology is one way to observe that adaptation. During a single walk through the park, children will observe buds bursting forth on some trees and leaves forming on the other trees.

What do we need?

- A walk through the park (we may also observe a hedge), two to three times at weekly interval
- Coloured pencils and a sheet of paper (or a camera/telephone with a camera)

Implementation

We begin by asking children:

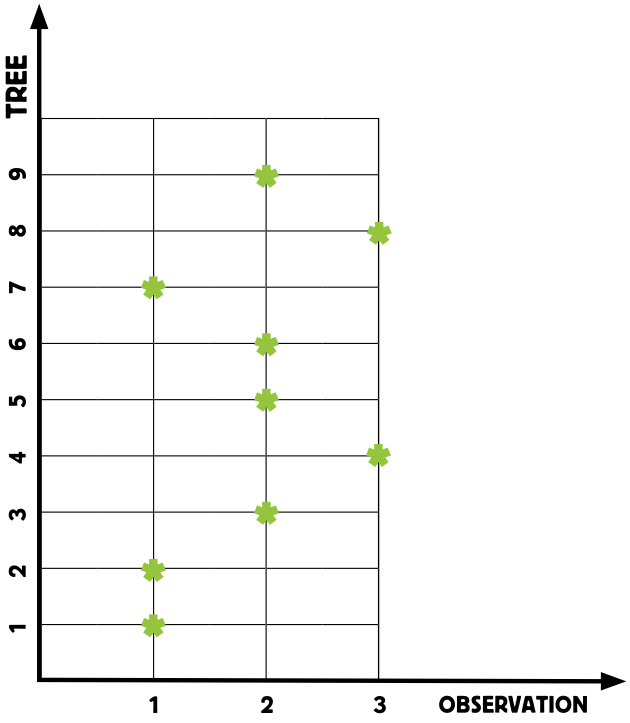
How do plants change during the seasons?

When do the first leaves/needles form?

Do leaves in mountains form at the same time as in valleys?

What happens to leaves in autumn? What happens to needles in autumn?

Why do leaves change colour to yellow in autumn?



Graph of bud burst and leaf formation

Every child (or group of children) picks one tree and records the species. They observe the tree every week and make a drawing or take a photo of the same branch with buds/leaves. When the

observation period is complete, the pictures are arranged into a series and compared with the picture series of trees observed by other children (groups). Have all trees sprouted leaves simultaneously? Which tree was the first to sprout leaves? Was the sequence of events the same? In spring, children may observe buds bursting forth and leaves forming (broadleaves) or the bursting forth and growth of buds (conifers). In autumn, they may observe how leaves change colour and fall (broadleaves).

We can also help children make a graph of the bud burst and leaf formation for a particular tree species. We present observation numbers (1, 2, 3) on the X axis and the appearance of the first leaf on the axis.

The activity can be enhanced by the year-round observation of a selected tree and the creation of a "tree calendar" in the form of a graph.

5.3.2 DNA Isolation

Learning objectives:

Students (primary school):

- Understand the main principles of living nature and basic biological concepts
- Learn through experimentation and the handling of biologic material
- Recognise DNA as a carrier of hereditary information

No. of persons: whole class in pairs

What will children learn

We show children what DNA is using items found at home in the kitchen or bathroom.

What do we need?

- Fruit (easy to mash like banana (1/3), strawberries (2–3), kiwi (1) etc.)
- Water
- Alcohol cooled in the refrigerator (at least 70% isopropanol alcohol or ethyl alcohol)
- Salt
- Liquid washing up detergent
- Plastic zip bag for freezing
- Coffee filter
- Small stick or toothpick
- Two clean glasses (2 dcl)

Implementation

We use questions to test the knowledge and ideas of children about DNA, and refresh or enhance that knowledge.

What is DNA?

Where is DNA found?

Why is DNA important?

What does DNA look like?

DNA is in the nucleus of every cell. To isolate DNA, we have to physically break down plant material. We then use detergent to break cell walls made of fats or lipids to set the DNA free, similar to when we remove grease when washing the dishes (step 3). Salt in the detergent helps keep the DNA together. In the next step, we use a filter to remove unneeded plant material (step 4). Water with dissolved DNA flows through the filter. The DNA must be separated from the water, which we do with the help of cooled alcohol (step 5).

1. We put some fruit in a bag, remove the air and seal the bag. We thoroughly mash the contents to get fruit pulp. We put the bag to the side.

2. We fill a glass half way with water. We slowly add two teaspoons of detergent and ½ teaspoon of salt. We mix slowly to dissolve the salt, while taking care not to create bubbles.

3. We add approximately ¼ of the prepared mixture of water, detergent and salt to the bag with fruit pulp (the fruit pulp should be still thick enough not to see through). We remove the air from the bag and reseal it. We mix the contents gently and leave the detergent to work for 10–20 minutes, so that as much DNA as possible is separated.

4. We put a coffee filter in a clean glass and pour in our mixture of fruit pulp and detergent. We can gently squeeze the filter to speed up the filtering process, but must be careful not to tear it. Approximately 1 cm of filtered liquid is needed in a glass.

5. We pour the cooled alcohol down the side of the glass, trying to get a layer of alcohol to float on the fruit pulp. The DNA will separate at the point where the fruit pulp and alcohol meet and will look similar to cotton in terms of its structure.

6. We let the separation process continue for a few minutes. We can then remove the DNA from the glass using a stick or toothpick.

5.3.3 Seed Germination

Learning objectives:

Children (kindergarten):

- Learn about the reproduction and growth of living beings, and how this process takes place in trees
- Learn the principles of preparing and monitoring an experiment
- Recognise that growth takes time
- Count and compare results (concepts of more and less)
- Observe and coordinate their body while gathering spruce cones in the forest

Students (primary school):

- Participate in and plan an experiment, and recognise that biological experiments can be lengthy
- Gather, analyse and interpret data
- Recognise that a plant grows from a seed, and perceive and identify the process of germination
- Systematically observe, record observations, edit and process gathered data, and draw conclusions based on observations

No. of persons: whole class in pairs or in groups of 3-5 children

What will children learn?

Trees (a spruce tree in our case) reproduce through the germination of a seed, from which a new tree grows. Certain tree populations (provenances) require more time and others less time to germinate. Some have a higher and others a lower germination rate. The higher the germination rate, the more seeds will contribute genetic material to the next generation, and thus enhance genetic diversity. In our experiment, the seeds gathered from a single spruce tree will represent the tree population. These seeds have the same mother but different fathers.

What do we need?

- A walk through the forest or a park in autumn during which we will gather spruce cones from different trees (or cones from a garden or nearby park); the cones should be brown in colour
- Filter paper (a coffee filter may be used)
- Petri dish or transparent plastic box with a cover
- Water sprayer
- Water

Implementation

We begin by asking children:

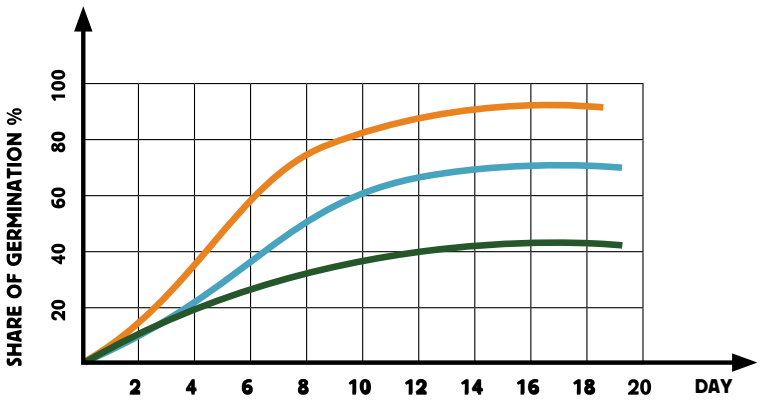
How do trees reproduce?

Why do they need seeds?

What does a seed need for successful germination?

1. Put a filter paper on the bottom of a Petri dish (or transparent box).
2. Extract 40 seeds from every cone. If we encounter problems extracting seeds, put the cones in a dry place at room temperature; the scales will open and the seeds will fall out. Every cone should be kept in its own paper bag. Arrange the seeds on the filter paper in the Petri dish and spray in enough water so that the paper becomes moist. Cover the Petri dish.
3. Add water every other day to keep the paper moist. Count the number of seeds that germinate. Repeat until all the seeds have germinated, or 21 days.
4. Draw a graph of the germination process. Present the number of days on the X axis and the number of germinated seeds on the Y axis. The result is a germination curve.

Note: For higher primary school grades, we may repeat the germination process for each tree and present the average germination period on a graph.



Curve of a seed germination

We compare the results and make observations with children:
Were all seeds of equal size? Are the differences larger within a single tree (cone) or between trees (cones)?

How many seeds from an individual tree germinated? Is the germination rate of all trees the same?
The seeds of which tree germinated the fastest? Which seeds germinated the slowest?

5.3.4 Autumn Pictures – Visualisation of Genetic Diversity

Learning objectives:

Children (kindergarten):

- Observe and recognise differences between trees/leaves
- Recognise how trees prepare for winter
- Learn herbarium techniques and how to express themselves using pictures, and recognise the difference between fresh and dry tissue (fragility)

Students (primary school):

- Observe and recognise differences between the leaves of specific tree species, which can be used to determine species, and learn to distinguish between tree species
- Recognise the differences between leaves from the same tree species and learn how trees prepare for the winter

Duration: in forest 45 min, two weeks for drying, in classroom 45 min

What will children learn?

Leaves of different tree species have different shapes. The leaves of one species also differ in terms of shape, number of veins, number of laminas etc. This is easiest to observe in oak leaves.

What do we need?

- A walk through the autumn forest
- Newspaper
- Heavy books
- Paper
- Glue

Implementation

1. Children observe and gather leaves in the forest. They then arrange the leaves on the ground and answer questions:

"Is their shape the same?"

"Is their size the same?"

"Are they from the same tree species?"

"Are leaves from the same tree species the same or different?"

"Have all leaves changed colour?"

2. Children bring the leaves they have gathered to school/ kindergarten. They put one leaf between two sheets of newspaper. They repeat the same procedure for all leaves. When they are done, they put the sheets of newspaper in a pile and place heavy books on top. Twice a week, they place their leave between new sheets of newspaper (initially, if the leaves are very wet, the sheets of newspaper are changed every day). After two weeks, the leaves are dry and flat.

3. Use glue to create beautiful autumn pictures, in which we can clearly see the diversity of tree species, and a wide range of leaf shapes and sizes. We then repeat the questions the children answered back in the forest.

Alternative: Instead of drying and gluing the leaves, we can use fresh leaves to produce stamps on the paper. For this we need finger paints.

5.4 SHARE INSPIRATION

5.4.1 Silent Walk Through the Forest

Learning objectives:

Children (kindergarten) and students (primary school):

- Calm down, relax and sense the diversity around them

What will children learn?

Children will learn to perceive using different senses: sight, touch, smell and hearing. They will also learn about the diversity of life and forms.

What do we need?

A walk through the forest or a forest clearing.

Implementation

Children arrange themselves in pairs and walk silently through the forest. They observe, touch, smell and listen. They observe the diversity of plants and animals, as well as differences and similarities, and are left alone with their thoughts. Prior to the walk, we encourage children to touch trees, leaves, flowers and the ground.

The activity may be enhanced in the forest or later in the classroom with the activities “Group picture” and “Recipe for preserving the bio- and genetic diversity of the forest”.

5.4.2 Group Picture

Learning objectives:

Children (kindergarten) and students (primary school):

- Perceive the diversity around them and express it through art
- Work together and make compromises while organising a group picture

What will children learn?

Children will realise that each of them remembered something different about the forest. Just as we are different and see the same things through different eyes, so are the trees different; not one tree is the same as another.

What do we need?

- A walk through the forest or a meadow
- Paper
- Coloured pencils
- Alternative: glue and scissors

Implementation

In the forest (or after returning to the classroom) we set a large sheet of paper and coloured pencils on a hard surface. Each child draws one tree, animal, mushroom, bush or flower; something that they remember most from the walk. We come up with a diverse forest, a forest for everyone and anyone.

Alternative: Each child makes a sketch of the thing they remember most from the walk. The sketches are then cut out and glued to a sheet of paper to make a collage.

5.4.3 Recipe for Preserving the Bio- and Genetic Diversity of the Forest

Learning objectives:

Students (primary school):

- Consider the natural environment around them, the importance of conserving that environment, and the impact of man on natural resources the sustainability thereof
- Search solutions and work together
- Develop a responsible outlook regarding environmental preservation

What will children learn?

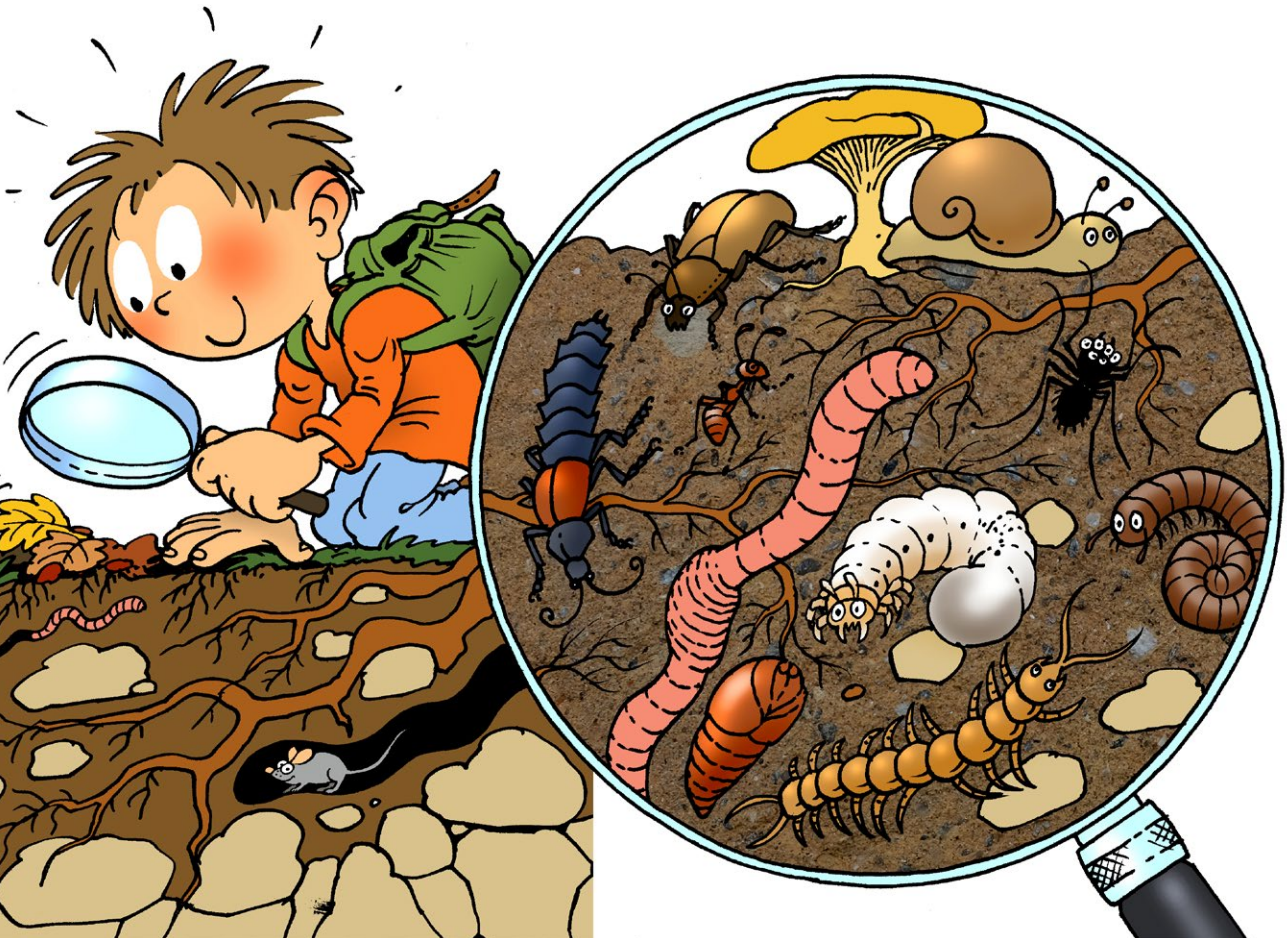
Children will think about nature and about what is needed to conserve nature in a good condition.

What do we need?

Paper and pen.

Implementation

Children write down suggestions on how to preserve the bio- and genetic diversity of the forest they have visited. Each child picks one suggestion and presents it to the entire class. Children also give thought to what harms diversity, e.g. too many of one tree species, all trees having the same parents, clear-cutting etc.



6. TABLE OF ACTIVITIES

Table of activities regarding the curriculum for kindergartens and syllabus for primary school

	Activities for learning and play	Kindergarten	1st - 3rd class of primary school	4th - 6th class of primary school	6th – 9th class of primary school
TREES	Draw Your Tree	• Art • Nature	• Environmental science • Art		
	Creating Seasons with Our Clothes	• Art • Nature • Motion			
	Find the Right One	• Motion • Nature	• Environmental science		
	Leaf Hunters	• Nature • Motion • Art	• Environmental science • Mathematics	• Natural science and engineering	• Natural science • Biology
	It Happened in a Forest – Live from Forest TV	• Society • Nature • Language	• Environmental science	• Natural science and engineering • Society	
	From the Tiny Grows the Large (the Slow Lifecycle of a Tree)	• Society	• Environmental science • Mathematics	• Natural science and engineering	
	Measurement of Trees by Young Foresters			• Natural science and engineering • Mathematics	
	Let's Become a Tree!	• Art • Nature • Motion	• Environmental science	• Natural science and engineering	
	Forest Ecosystem Services – Free for Everyone!				• Natural science • Biology
FOREST ANIMALS	If I were an Animal, I Could...	• Motion • Language • Society • Nature		• Natural science and engineering	
	Animal Circle				• Elective subject – theatre club
	Pssst, I'm Listening	• Motion • Language • Society • Nature	• Musical art • Environmental science	• Society	• Natural science

FOREST ANIMALS	Can You Follow Me?	• Motion • Nature	• Environmental science	• Natural science and engineering	• Natural science
	Animal Habitat			• Natural science and engineering • Computer science	• Natural science
	Expedition				
	Food, Water and Shelter - the Basic Means of Survival			• Natural science and engineering	
	If Animals Could Talk...	• Language • Society • Nature			• Theatre club
	Let's Repeat	• All	• All subjects	• All subjects	• All subjects
WATER	Water Droplets	• Motion • Nature	• Environmental science	• Natural science and engineering	• Natural science • Biology • Physics
	How a Tree Extracts Water				• Natural science • Biology
	Water Detectives				• Natural science • Biology • Physics • Geography
	Let's Make a Water Map!				
	How Watery are Plants?	• Motion • Nature			• Natural science • Biology • Physics
	How Clean is the Water?				• Natural science • Biology • Physics • Chemistry
	What is the stream velocity?				• Natural science • Physics • Mathematics
	Silent Walk by a Stream	• Motion • Nature			• Natural science • Biology
	Recipe for Clean Water				

GENETIC DIVERSITY	Lifecycle of a Tree	• Motion • Nature • Mathematics	• Environmental science	• Natural science and engineering	• Natural science • Biology
	Trees in the Wind	• Motion • Nature			
	What is Genetic Diversity?	• Nature • Society			
	The Hunt for Interesting Trees	• Motion • Nature • Mathematics			• Natural science
	Observing the Phenological Development of Trees in Spring and Autumn	• Nature			• Natural science • Biology
	DNA Isolation				
	Seed Germination	• Motion • Nature • Mathematics	• Environmental science		• Natural science • Biology • Mathematics
	Autumn Pictures – Visualisation of Genetic diversity	• Motion • Nature • Art	• Environmental science • Art	• Natural science and engineering • Art	• Natural science • Biology • Art
	Silent Walk Through the Forest	• Motion • Nature	• Environmental science	• Natural science and engineering	• Natural science • Biology
	Group Picture	• Motion • Nature • Art	• Environmental science • Art	• Natural science and engineering • Art	• Natural science • Biology • Art
	Recipe for Preserving the Bio- and Genetic Diversity of the Forest		• Environmental science	• Natural science and engineering	• Natural science • Biology

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Project LIFEGENMON

LIFE FOR EUROPEAN FOREST GENETIC MONITORING SYSTEM

This handbook was published in the frame of the LIFE project LIFEGENMON (LIFE13 ENV/SI/000148), supporting long-term adaptability of forest ecosystems to environmental changes with the development of a systematic forest genetic monitoring. One of the key project results will be guidelines for forest genetic monitoring, dedicated to decision makers, professionals and other stakeholders. The guidelines will provide knowledge and tools for establishing forest genetic monitoring at a national, regional and EU scale.

The project lasts from July 2014 till June 2020 and involves 6 partners from three European countries (Slovenia, Germany and Greece). The project is coordinated by prof. dr. Hojka Kraigher from the Slovenian Forestry Institute. The project is co-financed by LIFE, EU's financial instrument, supporting environmental, nature conservation and climate action projects.

The project's communication and dissemination strategy is focused on the promotion of knowledge about forests, forestry, forest genetics and climate change. A large part of project activities is dedicated to children of different age groups (from kindergarten to school) and their teachers. The project team members are performing workshops for children in kindergartens and schools in Slovenia and abroad. Children and teachers are also often invited to our Forest of experiments at the Slovenian Forestry Institute. In addition, seminars and trainings for teachers are organised in the cooperation with The Slovenian Network of Forest Kindergartens and Schools.

We kindly invite you to visit our homepage for more information or contact us through social networks:

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Project ManFor C.BD

This handbook was published in the frame of the LIFE project ManFor C.BD. - Managing forests for multiple purposes: carbon, biodiversity, and socio-economic wellbeing (LIFE09 ENV/IT/000078). The project is co-financed by LIFE, EU's financial instrument, supporting environmental, nature conservation and climate action projects. Project aims were to test and verify the effectiveness of forest management options in meeting multiple objectives (timber production, environment protection and biodiversity conservation, etc.), providing data, guidance and indications of best-practice. The project was coordinated by dr. Giorgio Matteucci from National Research Council in Italy and involved 4 project partners from Italy and the Slovenian Forestry Institute from Slovenia.

In different forest ecosystems in transnational transects, located along a North-South transect in Italy and an East-West transect between Slovenia and Italy, 10 demonstration areas with varying forest management goals have been selected and monitored in order to assess the effects of forest management on carbon cycling, biodiversity and social well-being. Special emphasis was given to the development of a manual of best practices in sustainable forest management (http://www.manfor.eu/new/wp-content/uploads/2017/04/BPManual.pdf).

Established demonstration areas are perfect tool for knowledge transfer and dissemination of project results to forest professionals as well as general public. Biodiversity conservation, carbon sequestration and timber production are also main topics, presented to teachers at seminars and trainings as well as at workshops for children in kindergartens and schools in Slovenia and abroad. At the same time several conferences and meetings were organized in order to raise awareness and knowledge about forest ecosystems, their ecosystem services and to promote sustainable and multifunctional forest management.

For more information visit:

http://www.manfor.eu/

http://www.gozdis.si/

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"The Handbook for Learning and Play in the Forest presents a broad selection of various activities and methods for learning about and experiencing the forest, and includes instructions and guidelines for implementation. It will serve as an aid to everyone involved in forest pedagogy: foresters, teachers, educators and others interested in outdoor learning."

Anton Lesnik, Pro Silva Slovenija

"This handbook is a valuable treasure-trove of opportunities for integrated learning in nature and the forest. It contains a variety of interesting activities, which were developed and tested in practice by researchers from the Slovenian Forestry Institute. I believe that this handbook will be well-accepted and widely used."

Barica Marentič Požarnik, prof. emer., Faculty of Arts, University of Ljubljana, Slovenia

"Education about forests is of great importance for our future. The development of forest pedagogy at the Slovenian Forestry Institute is thus highly valued. I am glad that with the help of this handbook we can present forest science to the generations that will soon be responsible for the sustainable future of our forests."

Primož Simončič, Director of the Slovenian Forestry Institute

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