



Chest of senses

Methodical instruction

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The chest is a kit designed to talk about nature and introduce children and adults alike to the biotic communities of forests, bogs and coastal areas.

The study aid is prepared using the examples of Riisa bog, Puhtu fresh boreo-nemoral forest and Matsalu coastal landscapes. It supports instructors and teachers as they attempt to introduce these places or biotic communities in general.

Thanks to realistic sample materials, tactile picture cards and models, the study aid can target several senses. The chest of senses is suitable for people with impaired vision and hearing.

Educational trail

Preparation of educational trail

Before the start of the study visit, it is recommended that the children's instructors cover:

- the size of the group, the number of accompanying persons, activities and assignments
- a description of the special needs of the children participating in the educational trail (vision, hearing, mobility disability, particular behavioural characteristics, etc.)
- the intellectual capabilities and/or study programmes of the children coming on the educational trail
- the language (complexity of vocabulary and terminology; to what extent they will require explanations for the main terms; whether there is a need for a sign language interpreter) of the children participating in the educational trail
- the length of the hiking trail and any particular features that the children and accompanying persons should take into account
- aids
- the structure of the conversations and the lesson, particular features and goals

Introducing the study aid

The chest of senses can be introduced before it is used by the teacher or the children. It is best if the group leader introduces the chest to everyone simultaneously. The accompanying persons of the children can subsequently provide more detailed information.

Upon introducing the chest of senses:

- start by introducing the shape of the study aid (semi-sphere) and the general division (upper part and lower part)
- talk about the construction of the study aid and the specific division (five compartments and pockets each with specific contents)
- describe the marking on the study aid and its elements
- guide the tactile examination of the model, help find the resources, draw attention to the written information (in Braille, large text, audible information and information in sign language, images)
- if possible, involve the children in the introduction process. For example: a child facing a compartment can choose from the objects contained therein and explain to others what they are

The resources used in the chest of senses are lifelike in order to feel as real as possible to children with special needs.

Objects establish a general link but also enable so-called subtopics to be learned.

Elements of the study aid

- **Picture cards.** The image on the picture cards is both visual and has raised contours. The Estonian and Latin name of the object depicted on the picture is written in ordinary letters and in Braille in the top left corner of the card. The back of the picture card contains simplified facts (in ordinary letters) about the image depicted on the picture. It also includes a QR-code with information in sign language as well as information relating to nature sounds.
- **Scent jars.** Scent jars are marked with a sticker.
- **Pelt fragments.** Pelts are marked with a sticker.
- **Tracks.** Life-size tracks are marked with a sticker.
- **Replicas of bird eggs.** Replicas are marked with a sticker.
- **Model depicting the development of mires.**
The model is marked with a sticker.
- **Beach findings.** The model is marked with a sticker.
- **Device for playing sounds.** To use the device, connect the speaker to a phone and scan the QR-code on the picture card to play the sound.

Educational trail

Enjoy your time together and in nature!

Treat a child with a disability the same as you would any other child who is simply gaining knowledge through other senses. Instructors act as mediators and the children are the ones acquiring experience. It is important to give them knowledge and experience. Allow them practicable independence and encourage them to try new activities.

The instructor of the study visit will carry out the nature hike according to the objective and the abilities of the group. The instructor will plan the activities for the lesson and if necessary also discuss the suitability thereof and any required modifications thereto with the teachers/accompanying persons. The positioning of the children during movements and study activities depends on the environment and the specific needs of every child (accompanying persons or children themselves can address this where required).

The introduction of the chest of senses should take place in a calm environment. It is convenient to use the chest without assistance provided that it is positioned on a stable surface such as a camping desk or the ground. It would be good if the children could sit or stand around the chest of senses. You should also take into account that some children may find sitting on the ground extremely uncomfortable or delimiting, whereas children may drop objects on the ground when forced to stand up.

An educational trail coupled with a chest of senses can be a mind-broadening activity even for children without disabilities.

What to keep in mind when teaching children with visual disabilities?

Make sure that any oral information given to the children is audible and that partially sighted persons can find a comfortable place and position (e.g. in a semi-circle in front of the instructor) to acquaint themselves with the resources.

It is best to sit at a desk to read Braille and view raised pictures. The chest of senses can also be used in natural science classes at schools to make them more varied and offer a more thorough take on the subject matter.

Blind people need time to acquaint themselves with the resources. A more detailed description should be provided of what exactly the hands of the blind person are examining. For this reason, it is more convenient to have several pieces of the same resource being examined or use a specific rhythm in group activities. If necessary, each person can be given the chance to examine the objects more thoroughly and calmly once the joint activities are over.

Since the intake of information and new experiences in unknown environments may be tiring for blind persons, it is recommended to take breaks or, for example, organise two hikes on the same subject – the first to provide an overall introduction and the second to cover the topic more thoroughly and reinforce the knowledge gained (where children are allowed to be more independent). It is important to make sure that not too much new information is delivered, as this would put a lot of strain on the memory function of blind children and they may confuse

different pieces of information if there are different impressions.

Attention. Nature education and immediate experience with nature places attentional demands on children with visual disabilities and requires a lot of focus. Listening to/hearing instructions in an unfamiliar environment or during movement may be impracticable. It is important to describe to the children exactly what they are experiencing (examining by hand, listening, smelling, tasting, etc.). Give them time to listen to, understand and analyse their surroundings.

Use of hands. Blind children use their other senses to collect information and can distinguish between the exact properties of objects by touch. Readiness to use hands or examine new things by touch may sometimes prove to be a complicated experience (due to touch sensitivity). Some people are afraid to experience new materials so encourage them to use their hands for exploration because developing sensory sensitivity helps blind people get a more versatile experience of the world. Describe what the child is currently touching.

Use of terms such as 'see' and 'look'. Feel free to use these words. They simply have a somewhat different meaning for people with visual disabilities.

Observable (visual) information. Children with residual vision are very limited in their ability to receive information through vision and it is also highly individual. It is primarily related to the size of their field of vision and their ability to use visibility. Children must be guided to pay attention to the characteristics of objects. Drawings should have contrasts and simplifications and place emphasis on important characteristics. In unknown environments, bright sunlight (light-sensitivity), shadows (trees, people, etc.), reflections (water surface, waves, laminated study materials, etc.) may all have an impact on children's vision. Allow children with visual disabilities to choose the distance and position from which they prefer to get acquainted with the object being examined.

Colours. In your descriptions, you can also use names of colours as this helps establish a general common information space. This allows blind people to develop an understanding of the usual colours of certain natural elements. At the same time, keep in mind that different partially sighted people may have different perceptions of colours.

Hearing and sounds. Take into consideration that we are surrounded by general background noise and specific sounds. Introduce new sounds and teach children to notice them. Unexpected sounds can sometimes be scary so warn them or point it out in advance, where possible. Make sure that the child gains the audio knowledge being shared. Save lengthier descriptions for when the group is standing and not walking. Choose an appropriate volume. Weather conditions (the wind, the rustle of trees, stormy sea) may also cause oral instructions to get lost. The number of accompanying people may also contribute as a noise factor. Give the children time to listen to, understand and analyse their surroundings or simply let them enjoy the silence and take a break.

Ground. Both hands and feet provide information through touch. Describe different types of soil and the materials you are walking over, e.g. moss, peat, pebbles, roots of trees, stumps, puddles, ice.

Pace and time management. Pick a suitable movement speed for the study visit. Safe movement across different surfaces sometimes requires a lot more time. Descriptions and the examination of objects also takes time.

Scents. Children with visual disabilities learn to recognise things and phenomena through their sense of smell, among other things. Describe new scents. If possible, establish a link between a specific aroma and its source (e.g. a plant and its scent, picture and uses).

Words to describe direction. Avoid using unclear expressions *here, there, this, that, come here, put it there*, etc. Instead, use specific concepts of direction such as *to the right, to the left, up, down, hip-level*, etc. Use these terms from the perspective of a blind person. Instruct and guide the finding of objects by talking or with a slight touch of the hand.

Terminology. People with visual disabilities can use terms whose actual meaning is unknown to them. Try to understand whether they comprehend the substance of the terminology used. Be brief, simple and precise when explaining new terms. When providing descriptions, it is preferable to establish connections with the child or a room or an object they are familiar with using measurements they understand.

Visual memory. People who have lost their sight or whose vision has declined during their lifetime may remember the shape and properties of items, meaning that they need less or different descriptions than those who were born blind.

Addressing. If possible, use name tags for children as this will help instructors or new teachers address children with visual disabilities. Blind persons may not understand an impersonal form of address. If there are no name tags, gently touch the child's hand or shoulder to let them know

that they are being talked to as well as the direction of the person who is talking to them. Be sure to introduce yourself before the hike to establish a connection between the person and the voice.

Select your **objectives and preferences** for descriptions and explanations: what is important, what is less important, what to focus on for longer and what to draw attention to next time. Your descriptions help broaden the world and life experience of the children.

Feedback. Ask control questions to understand whether and how children with visual disabilities understood the subject.

Work ability. Children with visual disabilities may tire more easily as they use all their senses to process information. Take small breaks during the hike, offer the children a variety of things to do or divide the topics between several hikes. Drawing attention, focusing on a subject, memory and new emotions all take their toll on children with visual disabilities.

Do not leave a blind person **alone in an unfamiliar environment** - let them know who they can expect to come to continue the activities.

What to keep in mind when teaching children with hearing disabilities?

General recommendations

- Before the hike, be sure to familiarise yourself with the level of hearing loss of the pupils, their ways and means of communication (whether/to what extent they are able to hear speech, how well they know sign language and Estonian, what their level of speech is) and try to find the best way to communicate to ensure mutual understanding.
- Make sure that children with hearing aids have the best possible environment for using them: eliminate any background noise and/or choose the least noisy environment to speak if possible, speak with a loud and clear voice and avoid talking to several people at once.
- In the case of hearing loss, it is always important to see the face/mouth of the person you are talking to in order to get as much information as possible. It is recommended to seat or stand the pupils in a semicircle to allow them to see the instructor as well as other pupils and ensure they have an unobstructed view of the speaker, the sign language interpreter and everything happening.

- Be visible to all pupils at all times:
 - make sure there is enough light and avoid reflections and light from behind you
 - when addressing the whole group, always position yourself right in front of them (do not walk around while talking and do not talk while behind them) to make sure everyone has a good view of you (especially your face and mouth)
 - keep enough distance from the pupils (being too far away or too close makes it difficult to receive visual information)
 - avoid colourful clothes if possible (to reduce irritating factors)
- Before passing on your message/work order, make sure that you have the pupils' attention, less they fail to get the message (do not speak when you have asked them to do something or when the pupils are busy reading/watching/doing something).
- You can use a visible cue or a sign that can be felt through the body to get their attention (e.g. switching the light on and off, waving your hand, slamming your foot hard on the ground, knocking on a hard surface or patting on a pupil's shoulder).
- Before passing on the main message, it is recommended that you give a prior order (e.g. 'Look here! Pay attention!').
- If you plan on having the pupils take turns to talk, make sure the entire group can understand who is about to speak or use sign language. If necessary, direct other pupils' attention to the speaker (otherwise it is likely that the information they are sharing will go unnoticed). The easiest way to put the speaker in the spotlight is to point at them. However, depending on the situation and ways of communication, you might also say their name or use sign

language to say their name (this option is better when the instructor is responsible for introducing the speakers).

- Remember that pupils' background knowledge may be very limited due to their hearing disability and the black-out it entails. As a result, you may have to explain even basic everyday things.
- People with hearing disabilities mostly or largely rely on their eyesight to get information. They learn through vision and need as much visual material as possible to facilitate understanding/receive information.
- The mind of a deaf person works in a very specific way so be as straight forward, precise and direct in your expressions as possible (do not use euphemisms, be frank about what you mean).
- If you are using visual examples give them time to examine the materials and avoid speaking at the same time (in order to keep up with what is being said, people with hearing disabilities need to be able to see the speaker's mouth or the sign language interpreter – they cannot look at the example material at the same time).
- Remember that Estonian is a foreign language for deaf persons who use sign language and it is very difficult for them to learn it. This also means that the level with which deaf persons use and understand Estonian is much lower compared with their peers who can hear well.

When using oral speech:

- face the pupil when you speak
- speak in a natural and clear way (there is no need to exaggerate the movement of your mouth in an attempt to seem more pronounced, this will likely make it harder for the pupil to understand you)
- speak calmly, do not rush and do not slow down your speech too much
- use your normal tone of voice (there is no need to shout)
- make sure your face can be seen well – avoid lighting sources from behind you that reflect in the pupils' eyes and keep hair, moustache/beard, scarves, etc. from blocking the view
- be clear and specific when expressing your ideas
- you should speak for a limited amount of time and your sentences/ideas should have a clear outline – avoid gushing over the topic (i.e. do not talk too much) and long sentences that are difficult to understand
- avoid overusing certain words and formulaic language (e.g. *right... you see... if you please...*)
- do not change the subject unexpectedly
- consider the age and language skills of the target group, use vocabulary and syntax that the children can understand
- be expressive when talking, feel free to use facial expressions, gestures and body language as this will help the children better understand the message
- try to rephrase things when the pupils are unable to understand you

Tips for using the services of a sign language interpreter:

- speak directly to the pupils, not to the interpreter
- provide the interpreter with written materials on the topics/assignments to be covered well before the hike/class to ensure mutual understanding and optimal cooperation. This will allow the interpreter to prepare and pass on the information to the pupils in the best way possible
- let the interpreter know what you plan to do, when and how so that they can prepare
- to avoid any misunderstandings with the interpreter, read about the general working principles and specific features of interpreters
- remember that the interpreter only acts as a mediator of information, they are not assistant teachers, support persons or other help

Activities to support the use of the study aid

The objective of these assignments is to help pupils attribute meaning to what they have learned and associate their gained knowledge with the real world. The assignments put children in a situation where they are forced to speak up, act, listen and think along. Activities, discussions and games planned by the instructor are adapted based on the needs of group members. For example, you can use just one type of study element (picture cards) or you can use different elements (picture cards, pelts, scents, sounds, etc.). The assignments can be given before the start of the hiking trail, while on the trail or after completing the hike. Learning activities and descriptions of nature should be complemented with various assignments, activities and games.

1. Assignment No. 1 (what is it?): the person conducting the lesson introduces an object from nature or the chest of senses while on the hiking trail. The children will examine the object and each of them will describe it with a suitable adjective. The person conducting the lesson will highlight special features that have gone unnoticed. The goal of this assignment is to introduce different species and specify terms.

2. Assignment No. 2 (treasure hunt): children are asked to collect 3-5 interesting objects in small personal treasure bags. At the end of the hike, they examine their findings and share information. The goal of this assignment is to introduce different species and imprint the items in their mind.

3. Assignment No. 3 (notice the moment): the hiking group stops to feel and sense nature for 1-5 minutes. This is followed by a discussion (about the things they heard, felt, noticed) and an introduction of study elements from the chest of senses, where possible. The goal of this assignment is to sense the natural environment and introduce different species.

4. Assignment No. 4 (quiz): the person conducting the lesson presents questions corresponding to the level of the group. For example, about the descriptions of species. The questions may be presented with study elements (picture cards, scents, pelts, etc.). The addition of a competitive element can make this assignment more exciting: children who know the most correct answers get awarded with the title of the Forest Sage, for example. The assignment can be given before or after the lesson. The goal of this assignment is to introduce different species and biodiversity and reinforce the knowledge gained.

5. Assignment No. 5 (odd one out): the person conducting the lesson puts together a food chain in the pockets of the study aid by adding 1-2 species to the chain that do not fit in. The children must put the species in the food chain in the correct order and leave out any species that do not fit in. This assignment can be done in teams. The goal of this assignment is to introduce the ecosystem, its importance and connections between species.

6. Assignment No. 6 (grouping): the person conducting the lesson places different species in the pockets of the study aid. The children have to distribute the species based on the characteristics of the species, such as feeding: plants, herbivores, omnivores, etc. Species can also be grouped based on other characteristics. This assignment can also be done in teams. The goal of this assignment is to introduce different species.

7. Assignment No. 7 (finding pairs): the person conducting the lesson selects suitable pairs based on the characteristics of the species and then mixes all the species together. The children have to find suitable pairs from the collection of species. This assignment can be done in teams. The goal of this assignment is to introduce different species and the connections between species.

8. Assignment No. 8 (essence): children have to find something interesting or important about the nature of the place before the hike and then introduce it to others.

9. Assignment No. 9 (environment exploitation): children have to find 3-5 elements in the study aid that people may need for life. This is followed by a discussion on why people might need those things specifically, what they use them for and what happens when they fail to find any. Children may also bring other examples of the relationship between humans and nature. This assignment can be done in groups. The goal of the assignment is to show how people depend on the environment, introduce the benefits of the ecosystem and the need for nature conservation.

10. Assignment No. 10 (tree): children join hands and form a circle around the tree to measure its circumference. A fun assignment.

11. Assignment No. 11 (poisonous and edible): children will look for edible and poisonous plants from the forest. In the case of edible plants, it is a good idea to compare them with poisonous plants (e.g. ramson and lily of the valley, bird-cherry and alder buckthorn). The goal of this assignment is to introduce different species and provide practical information.

MIRE CHEST



Important species in Riisa bog



Mires and paludification

Relation to the study assignments:

Assignment No. 8 (essence)

Mires are ecosystems in which a certain part of plant matter forms beds of peat moss in consistently wet (and in later stages also acidic) soil and this in turn creates conditions for the development of unique biotic communities and landscapes.

Conditions that slow down the decomposition of plant matter promote the development of mires or paludification: sloping terrain, soil that retains water, frequent precipitation, high groundwater table and hypoxia caused by still water. In later development stages, peat mosses play a significant role in the paludification process as the mosses keep the soil moist and acidic.

In the previous century, it was estimated that a fifth of Estonia's land mass was covered with mires. Today, about a quarter of our former mires are in their natural condition, meaning that they can sustain themselves as ecosystems. The rest are strongly affected by drainage, have turned into forests or areas where the peat that once formed there is now decomposing.

Mire development

(see picture cards for additional information)

What happens before mires start to form

The locations of our uplands and lowlands and the original form of our hills and depressions have all been shaped by ice ages. The glaciers that moved in from the north ploughed through and flattened the territory of Estonia and covered it with glacial till. The water from the melting glaciers in turn redistributed what was built up by the glaciers, wearing it down in some areas and piling it up in others. Over time, this formed the terrain we know and love and the depressions and valleys which have now become picturesque mire landscapes.

The change in water level that happened around 10,200 years ago (8213 BCE) played an important role in the formation of the first mires. At that time, there was no Baltic Sea, but there was the Baltic Ice Lake whose waters discharged into the Atlantic Ocean through the current Swedish territory. This is known as the Billingen break and it caused the water levels to decrease rapidly to reveal ground. Valgeraba, the oldest mire in Soomaa, started to form after the Billingen break.

Estonian mires have developed in two ways: around 60% started from the paludification of land and around 40% due to sedimentation in water bodies.

Three stages of mire development

There are three main stages in the life of a mire: fens, transitional mires and bogs or raised bogs. We can usually tell these stages apart by assessing their overall look and plantation. In more difficult cases when different stages are in transition, it may help to drill into the peat layer and examine the findings.

Fens usually have a thin layer of peat, at least 30 cm thick. Plant roots in fens can reach nutrient-rich groundwater or get nutrients from surges. Nutrient-rich environments support the development of biodiverse biotic communities.

Sedges, bogbean, purple marshlocks, common reed, meadowsweet, water horsetail, bog-myrtle and willows and white birch in the tree layer are species characteristic to fens.

A transitional mire is a transition stage from a fen to a bog. The peat layer in a transitional mire is thick enough to stop some of the plants getting through to the nutrient-rich groundwater or surface water. As a result, bog plants start growing on top of turfs, but fen plants remain in areas between turfs.

Bogs or raised bogs have a thick layer of peat. Plant roots cannot reach the groundwater here and have to feed off precipitation. As the thickening peat layer is higher than the edge of the mire, there is no way for surface water to flow there. This leads to biotic communities that lack diversity but are still unique.

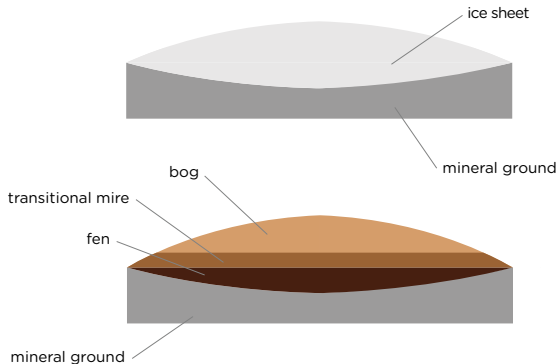
Peat mosses, hare's-tail cottongrass, cranberries, marsh Labrador tea, pod grass, beak-rush, sundews, cloudberries, heather, crowberries and pines in the tree layer are species characteristic to bogs.

How long do mires develop?

A bog is the last stage of development of a mire. This does not, however, mean that the mire is suddenly complete. In natural conditions, the peat layer of a bog grows by around one millimetre per year, meaning that the bog gains one metre in height every millennium. This can last for thousands of years. Our oldest mires are over 10,000 years old.

In several places, human activities have hindered the paludification process that has been ongoing for thousands of years. Ditching the peripheral regions of a mire trigger peat decomposition - the mire will decompose and grow a forest.

Model to teach mire development



The bundled-up model (see drawing) includes elements that explain the development of mires stacked on top of one another: mineral ground (dark grey), fen (dark brown), transitional mire (brown), bog (light brown), ice sheet (light grey).

Repositioning steps needed to use the model

1. Removing all layers from the model with the exception of the mineral ground. Attaching the ice sheet layer on top of the mineral ground layer - *our mires were preceded by an ice age.*
2. Removing the ice sheet layer - *the ice sheet is melting.*
3. Adding a fen layer on top - *if the conditions are right for paludification, a fen forms in a depression or a valley.*
4. Attaching a thin transitional mire layer on top of the fen layer - *when the peat layer of a fen grows thicker, it transforms into a transitional mire.*
5. Attaching a thicker bog layer on top of the transitional mire layer - *as the peat layer becomes even thicker, the transitional mire transforms into a bog.*

Mires as ecosystems

Riisa bog

Relation to the study assignments:

Assignment No. 7 (finding pairs)

Assignment No. 8 (essence)

We will use the example of Riisa bog to study the mire as an ecosystem. Riisa is a good place to learn about the biotic communities characteristic to mires thanks to its ease of access and its 4.8 km boardwalk.

Riisa bog is the smallest bog in Soomaa. It formed with the paludification of mineral-rich ground and its peat layer, which reaches up to six meters, indicates that the bog has been in development for around six thousand years. Today, Riisa bog is an example of the last stage of mire development. Even thousands of years of continued paludification will not change the nature here in any significant way.

Peat mosses as key species in bogs

Peat mosses have a wonderful ability to develop and maintain the bog habitat. In figurative terms, peat mosses set the rules that all other bog plants and animals have to follow. Of the 38 species of peat moss that grow in Estonia, 11 prefer to grow in a bog.

Peat mosses cover the surface of the bog like a thick carpet. Their population density here is extreme, 10,000-100,000 peat moss tillers per square metre. These mosses have no roots; they grow from the top and decompose at the bottom, forming layers of peat in the oxygen depleted environment.

Special water retention cells allow peat mosses to hold up to twenty times as much water as their dry weight. When water is abundant, they collect and store water and release it when it gets dry.

Peat mosses keep the aquatic environment in bogs acidic. The average pH level of bog water is 3-4. They also impact their surroundings through ion-exchange by taking up cations that have dissolved in water (Ca²⁺, Mg²⁺, etc.) and releasing protons in their place (H⁺).

The mass quantity, extraordinary water retention and acidification properties of peat mosses play a major role in paludification. Only plants that can grow in an extremely acidic environment deprived of nutrients can grow next to peat mosses.

Examples of connections between species

Relation to the study assignments:

Assignment No. 5 (odd one out)

Assignment No. 7 (finding pairs)

Cranberries are characteristic to bog landscapes. They can grow in nutrient-deprived bogs thanks to their association with fungi. Cranberries usually form mycorrhizal associations with species of sac fungi called *Rhizoscyphus ericae*. This association functions much like all mycorrhizae do, the fungus provides minerals for the plant and the plant receives organic substances from the fungus in return. This is a trick used by all plants in the heather family that grow in bogs (marsh Labrador tea, leatherleaf, bog-rosemary, bog bilberry, crowberry, etc).

The **great sundew** has found another way to survive in a place deprived of nutrients. It also consumes animal tissue by catching insects. Sundew leaves feature dewy droplets that effectively trap insects. There are three sundew species growing in Estonian bogs and all of them get some portion of their essential minerals from insects. At the same time, sundew plants need insects for pollination. They use different scents to attract pollinators and prey (their flowers and leaves have different aromas).

The **dark whiteface** can use the peat moss induced acidic aquatic environment to its favour by choosing bog-pools as the habitat for its naiads - the fish that eat its naiads cannot survive in acidic water. Furthermore, dark whiteface naiads are the same colour as peat moss, creating the perfect disguise for hiding between the peat moss tillers

growing in bog-pools. In addition to the dark whiteface, the northern white-faced darter and the small whiteface also prefer to live in bogs rich in bog-pools.

The **silver-studded blue** is a butterfly, the caterpillars of which can grow in bogs where they prefer to feed on heather. If the caterpillars of this species eat heather, then its imagines will pollinate the same plant.

The **black grouse** is one of the birds that is symbolic to bogs as one of the native landscapes of Estonia. Traditional black grouse courtship rituals usually take place in a bog field and it is common for these sites to retain their use. Bogs also provide food for black grouse. Older birds eat berries and chicks also eat the insects on heather. Fens become relevant for black grouse in the winter as they go there to eat birch buds.

The **peat-bog pine** *Pinus sylvestris var. nana* is a variant of the Scots pine that surprises with its ability to grow extremely slowly in a nutrient deprived environment. Three-hundred-year-old peat bog pines may be just 4-5 metres high. The trunk of old peat-bog pines only grows larger by 0.2 mm per year and may not grow at all in some years. Another thing that makes pines special is that, as they age, they become a key species in the ecosystem of the bog next to peat mosses. They hinder the growth of peat mosses in their immediate proximity. Peat bog pines also form mycorrhizal associations with fungi to obtain essential minerals.

A list of potential food chains

Relation to the study assignments:

Assignment No. 5 (odd one out)

Scots pine (peat bog pine) -> elk -> wolf

cranberry -> black grouse -> golden eagle

heather -> silver-studded blue -> great sundew

dark whiteface -> common crane -> golden eagle

The importance of mires

Material values

Relation to the study assignments:

Assignment No. 9 (environment exploitation)

Peat

Of all the resources gathered from mires, peat is certainly the most important. It has historically been used primarily as a source of fuel for heating (peat blocks). Today, it is used more in cropping as one of the components of artificial growing surfaces.

People have found new ways to use peat. It is used to produce eco-soaps, shampoos, masks and wraps in combination with medicinal herbs and aromatic plants. Peat fabric is made by carding wool and peat. This type of fabric is both warm and dries quickly.

Peat mosses

Peat moss is known for its exceptional water absorbing abilities and sterility. For this reason, it has been used to insulate log houses, preserve vegetables and in folk medicine to replace cotton wool.

Peat moss is even used as a cooking herb and used, for example, in the preparation of Scotch.

As peat moss is finding increasingly more uses, peat moss farms are being constricted in several places in Europe. This will help us preserve mire landscapes in the future.

Berries

Cranberries that grow in mires have also been called Nordic grapes. There are enough cranberries in our mires to supply all Estonians for the winter if we only found the time to go pick them. In addition to cranberries, mires also offer cloudberries and bog bilberries. Even the crowberries that grow in mires are edible, but Estonians have not taken a liking to these berries.

Bog ore

In ancient times, bog ore was extracted from our mires. Bog ore deposits develop in oxygen deprived iron-bearing groundwater as a result of the vital functions of iron bacteria.

Ecological values

Fresh water reservoir

When water is abundant, peat mosses can hold 10-20 times as much water as their dry weight. This effectively turns the bog surface and the water it collects into a freshwater reservoir that delivers water when the surrounding areas lack it. Therefore, mires and especially bogs function to balance our natural water regime to help prevent floods and mitigate the effects of drought.

Carbon reservoir

Mires only cover around 3% of the landmass on planet Earth but store a fifth of the carbon present in the ecosystems of the entire landmass. This means that all naturally

functioning mires play an important role in mitigating climate warming. At the same time, it must be said that the opposite applies in drained or burned mires – the quick decomposition of peat that has built up over millennia facilitates climate warming.

Preserving unique biodiversity

The biological diversity found in mires is unique. It features a significant number of species that could not live any place else, e.g. sundews, cranberries and peat mosses.

Larger bog complexes give shelter to rare species that like to stay out of people's way: several species of eagles as well as large predators prefer to live on remote islands in the middle of bogs. People have also used mires to escape war.

Spiritual values

Relation to the study assignments:

Assignment No. 3 (notice the moment)

Mires are our native landscapes dating back more than 10,000 years. Mires provoke pristine natural power that inspires us and paves the way to deeper realisations. It is no accident that in addition to Tallinn Old Town, Estonia is also known for images of misty dawns over bog-pools.

Soomaa's tag line 'Run for the mire' sounds like a call to come here in search of spiritual values, silence, serenity and beauty.

The so-called book of nature hidden in the peat layer of mires is a value in its own right. Chemical and pollen analyses provide new information about our natural history.

Important species in Riisa bog

Relation to the study assignments:

Assignment No. 1 (what is it?)

Assignment No. 2 (treasure hunt)

Assignment No. 4 (quiz)

Assignment No. 6 (grouping)

Assignment No. 7 (finding pairs)

Assignment No. 11 (poisonous and edible)

Mire chest

Important species
in Riisa bog



Peat moss*Sphagnum sp*

Peat mosses have no roots. Peat moss grows from the top and decomposes at the bottom. If there is little oxygen and decomposing takes a long time; some of the dead moss tissue deposits (collects) as peat.

[Wiki] en.wikipedia.org/wiki/Sphagnum



Peat bog pine

Pinus sylvestris
var. nana



Pines grow extremely slowly in the nutrient deprived (with little nutrients) bog environment. It takes around five years for pines to gain 1 millimetre of girth. Seeds collected from peat bog pines can grow into strong trees when sown in forest soil.

[\[eE\] elurikkus.ee/bie-hub/species/6318?lang=en](https://elurikkus.ee/bie-hub/species/6318?lang=en)



Marsh Labrador tea

Ledum palustre



The marsh Labrador tea is the most aromatic bog plant. It gives a unique (specific) smell to the entire mire. This aroma has a different effect on people - some find it energising, others get a headache.

[\[Wiki\] en.wikipedia.org/wiki/Ledum_palustre](https://en.wikipedia.org/wiki/Ledum_palustre)

[\[eE\] elurikkus.ee/bie-hub/species/5418?lang=en](https://elurikkus.ee/bie-hub/species/5418?lang=en)



Cranberry

Oxycoccus palustris



Cranberries are the most important berry plants in our bogs. Cranberries have been referred to as Nordic grapes and there are enough of them to go around for everyone who has the opportunity to pick them. Birds such as black grouse, wood grouse and common crane also eat cranberries, as do bears. Cranberries are an important source of food for bears after hibernating – the berries help boost their metabolism.

[eE] elurikkus.ee/bie-hub/species/6060#overview?lang=en



Common heather

Calluna vulgaris



At the end of the summer, heather can be seen flowering in bogs and heaths. Both places lack nutrients (have little nutrients) and are open to the sun. The nectar (sweet liquid generated inside blossoms) found in heather flowers is important for late-summer pollinators.

[\[Wiki\] en.wikipedia.org/wiki/Calluna_vulgaris](https://en.wikipedia.org/wiki/Calluna_vulgaris)

[\[eE\] elurikkus.ee/bie-hub/species/3309#overview?lang=en](https://elurikkus.ee/bie-hub/species/3309#overview?lang=en)



Great sundew

Drosera anglica



Sundew plants eat insects. They use scent to attract them and trap them with sticky slime on the surface of their leaves.

[\[Wiki\] en.wikipedia.org/wiki/Drosera_anglica](https://en.wikipedia.org/wiki/Drosera_anglica)

[\[eE\] elurikkus.ee/biehub/species/4458#overview?lang=en](https://elurikkus.ee/biehub/species/4458#overview?lang=en)



Mire chest

Important species
in Riisa bog

HERBIVORES

Elk

Alces alces



Elks are the largest animals living in Estonian forests and weigh as much as 500 kg. Elks mainly eat tree and shrub branches and twigs - more than 30 kg per day. They eat about 150 different species of edible plants.

[Wiki] en.wikipedia.org/wiki/alces_alces

[eE] elurikkus.ee/bie-hub/species/32111?lang=en



Mire chest

Important species
in Riisa bog

HERBIVORES

Black grouse

Tetrao tetrix



The black grouse is symbolic to bog landscapes. Its courtship rituals have taken place in the same bog fields (areas in the bog without trees) for centuries (for hundreds of years) and even longer. Where peat has been collected on their courtship fields, they still come together on the peat field.

[\[Wiki\] en.wikipedia.org/wiki/Tetrao_tetrix](https://en.wikipedia.org/wiki/Tetrao_tetrix)

[\[eE\] elurikkus.ee/bie-hub/species/104298?lang=en](https://elurikkus.ee/bie-hub/species/104298?lang=en)



Mire chest

Important species
in Riisa bog

HERBIVORES

Silver-studded blue

Plebejus argus



When heathers are in blossom, the silver-studded blue is the most distinctive butterfly in our bogs. Heather is an important source of food for these butterflies. Their caterpillars feed off its leaves and imagines suck (eat) its nectar, pollinating them in the process.

[eE] elurikkus.ee/bie-hub/species/91161?&lang=en



Mire chest

Important species
in Riisa bog

OMNIVORES

Brown bear

Ursus arctos



Bears are the largest predators in Estonia. Bears measure (from nose to tail) up to 280 cm and can weigh up to 315 kg. Bears are plantigrade (walk on soles of feet) just like humans. The hind tracks of a brown bear are similar to human footprints (look like the footprints of a human).

[\[Wiki\] en.wikipedia.org/wiki/Ursus_arctos](https://en.wikipedia.org/wiki/Ursus_arctos)

[\[eE\] elurikkus.ee/bie-hub/species/108642?lang=en](https://elurikkus.ee/bie-hub/species/108642?lang=en)



Mire chest

Important species
in Riisa bog

OMNIVORES

Common crane

Grus grus



The common crane has inspired the name of the most important berry in our mires – cranberry. As they are fond of eating plants, they also eat cranberries.

[Wiki] en.wikipedia.org/wiki/Grus_grus

[eE] elurikkus.ee/bie-hub/species/62543?lang=en



Mire chest

Important species
in Riisa bog

OMNIVORES

Viviparous lizard

Zootoca vivipara



The viviparous lizard gives birth to live young. The young develop inside eggs and hatch (come out of the egg) while they are being laid (when the eggs come out of the body). They have adapted (a property the organism uses for life and reproduction) in this way to be able to live in moist and cool areas.

[\[Wiki\] en.wikipedia.org/wiki/Zootoca_vivipara](https://en.wikipedia.org/wiki/Zootoca_vivipara)

[\[eE\] elurikkus.ee/bie-hub/species/110557?lang=en](https://elurikkus.ee/bie-hub/species/110557?lang=en)



Mire chest

Important species
in Riisa bog

OMNIVORES

Moor frog

Rana arvalis



There are two brown-coloured frogs in Estonia, the moor frog and the common frog. The name 'moor frog' can be confusing because they do not live exclusively in moorlands. These frogs also manage in bogs as well as drier areas. The water in bog-pools is too (very) acidic for the tadpoles (baby frogs) to develop.

[\[Wiki\] en.wikipedia.org/wiki/Rana_arvalis](https://en.wikipedia.org/wiki/Rana_arvalis)

[\[eE\] elurikkus.ee/bie-hub/species/95678#overview?lang=en](https://elurikkus.ee/bie-hub/species/95678#overview?lang=en)



Mire chest

Important species
in Riisa bog

CARNIVORES

Wolf

Canis lupus



Wolves live in packs (in a large herd). There is a specific hierarchy (order of subordination) within the packs. The hierarchical order (subordination) of the specimens (animals) is determined based on playtime and fighting. The wolf is the national animal of Estonia.

[\[Wiki\] en.wikipedia.org/wiki/Canis_lupus](https://en.wikipedia.org/wiki/Canis_lupus)

[\[eE\] elurikkus.ee/bie-hub/species/43123?lang=en](https://elurikkus.ee/bie-hub/species/43123?lang=en)



Mire chest

Important species
in Riisa bog

CARNIVORES

Golden eagle

Aquila chrysaetos



Golden eagles build their nests on rock formations in the mountains, but in Estonia they prefer to nest in open bog landscapes. There are ancient nesting sites in Estonia where golden eagles have lived for hundreds of years. Older nests constructed by golden eagles can be several metres high.

[\[Wiki\] en.wikipedia.org/wiki/Aquila_chrysaetos](https://en.wikipedia.org/wiki/Aquila_chrysaetos)



Mire chest

Important species
in Riisa bog

CARNIVORES

Common snipe *Gallinago gallinago*



The bill of the common snipe is around the equivalent of half their body length. They are also able to open just the tip of it to feed (eat) without getting mud inside the bill.

[eE] elurikkus.ee/bie-hub/species/60968?lang=en



Mire chest

Important species
in Riisa bog

CARNIVORES

Dark whiteface

Leucorrhinia albifrons














The dark whiteface benefits from the acidic aquatic environment of bog-pools (bodies of water in bogs). It chooses bog-pools as habitats for its offspring because bog-pools do not contain fish that eat its naiads.

[Wiki] en.wikipedia.org/wiki/Leucorrhinia_albifrons

[eE] elurikkus.ee/bie-hub/species/70695?lang=en



Peat moss		
Peat bog pine		
Marsh Labrador tea		
Cranberry		
Common heather		
Great sundew		
Elk		
Black grouse		
Silver-studded blue		
Brown bear		 
Common crane		

Viviparous lizard



Moor frog



Wolf



Golden eagle



Common snipe



Dark whiteface



Mire model



Peat briquette



Peat soap



Peat fabric