



KLOOSTRIMETSA PEATLAND STUDY TRAIL

Kloostrimetsa peatland study trail

Texts: Eeva Jeletsky, Üllar Rammul

Photos: Tarmo Niitla (1 – 20), Olev Abner (21)

Prepared, edited and designed by: Eeva Jeletsky

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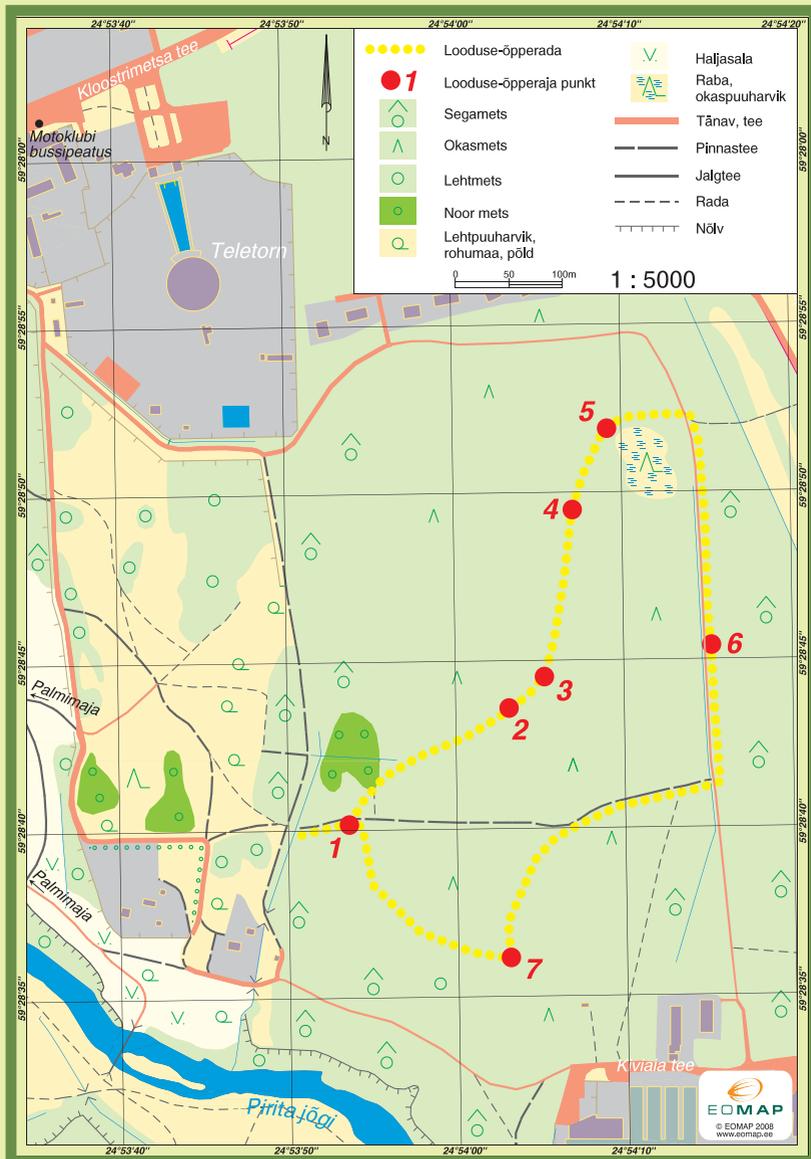
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Source materials

The former Kloostrimetsa bog with an area of approximately 20 ha is located in the Pirita River Valley Landscape Reserve. Today, the bog has been extensively damaged by human activity and has grown into a bilberry-pine drained peatland forest. The length of the Kloostrimetsa peatland study trail is 2.5 km and it passes 7 sites equipped with notice boards.



Estonian Mires

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Estonia has around 1 million hectares of mires – peatlands cover over 22% of Estonian territory. There are 143 expansive mires and mire systems, each with an area larger than 1000 ha. The largest mire systems are Puhatu, Soomaa, Endla, Emajõe-Suursoo and Alam-Pedja.

Mires are divided into three main types according to water regime and vegetation: fens, transition mires and bogs. Transition mires are a transitional stage between fens and bogs, both in terms of development and often also their surface area. A bog is a completely unique habitat – while plants growing in fens and transitional mires receive the nutrients they need to grow from groundwater, surface water and also rain



water, the plants growing in bogs only receive nutrients from rain water due to the thick peat deposits.

The **flora** is highly varied in fens (reed (*Phragmites australis*), marsh cinquefoil (*Potentilla palustris*), bog arum (*Calla palustris*) (photo 1), cranberry (*Oxycoccus palustris*), etc.), while plant species characteristic of both fens and bogs grow in transitional mires.

Photo 1. Bog arum (*Calla palustris*) – Estonia's native calla.

There are no Estonian **mammals** living exclusively in mires. The species that temporarily live in mires include the elk (*Alces alces*) the mountain hare (*Lepus timidus*) the roe deer (*Capreolus capreolus*) and the red fox (*Vulpes vulpes*), who appear in mires mainly during the summer or incidentally during other seasons. On rare occasions, you can also meet the common shrew (*Sorex* sp.) and the bank vole (*Myodes glareolus*) in mires, but they can live only in areas that are not flooded, since a high level of surface water prevents them from digging deep burrows.

The birds living in mires include the tree pipit (*Anthus trivialis*) the willow warbler (*Phylloscopus trochilus*), the whitethroat (*Sylvia communis*), the common crane (*Grus grus*), the black grouse (*Tetrao tetrix*), the eurasian golden plover (*Pluvialis apricaria*), the willow grouse (*Lagopus lagopus*), the red-backed shrike (*Lanius collurio*) etc.

Reptiles generally avoid flooded and wet areas, but if you are lucky, you can catch a glimpse of the common lizard (*Lacerta vivipara*) (photo 2) or the adder (*Vipera berus*) in Estonian mires.

There are many **spiders** in the mires, most of whom inhabit the surface or topmost layers of moss, including the largest moss-inhabiting spider in Estonia – the raft spider (*Dolomedes fimbriatus*).

There are over 1500 species of **insects** in our mires, ranging from the familiar gnats and horseflies to many species from the orders Coleoptera, Hymenoptera, Cicadinea, Odonata etc.



Photo 2. The common lizard (*Lacerta vivipara*) prefers rather moist environment, but does not like floods.

Kloostrimetsa Peatland I Development and Flora

The total area of **Kloostrimetsa peatland** is approximately 20 hectares. Since the peatland is a small one in the Estonian context, scientists have not shown interest in its development or geology. Based on its location in the ancient valley terrace of Pirita, we can speculate that present Kloostrimetsa bog started to develop as spring fen.

Today, however, human activity has done great harm to the bog – it is probable that peat was cut from the bog for the surrounding farmsteads already in the beginning of the 20th century, while several ditches running in the east-west direction have been dug to drain the peat pits. The afforestation of the bog began after a drainage ditch was dug on its western edge in 1980 (during the construction of the Tallinn TV tower). This is indicated by the age of most of the trees growing in the bog, which is approximately 30 years. As a result, Kloostrimetsa bog has developed into a **drained peatland Vaccinium myrtillus pine forest** divided by peat pits and drainage ditches.



Photo 3. The cranberry (*Oxycoccus palustris*) is not bothered by the hot sunshine or the acidic environment, but will disappear when the bog is drained.

The tree layer of the bog is dominated by the Scots pine (*Pinus sylvestris*) and the occasional downy birch (*Betula pubescens*), while the tall shrub layer features the rowan (*Sorbus aucuparia*), the glossy buckthorn (*Frangula alnus*), the raspberry (*Rubus idaeus*) and willows (*Salix* sp.) along with Norway spruce (*Picea abies*) aftergrowth in many areas. The bilberry (*Vaccinium myrtillus*), the bog bilberry (*V. uliginosum*) and the cowberry (*V. vitis-idaea*) grow side by side in the low shrub layer. The tussock cottongrass (*Eriophorum vaginatum*) with its beautiful cotton-like tufts adorns the carpet of peat moss and the old peat pits and the bog occasionally offers you a sour refreshment in the form of the cranberry (*Oxycoccus palustris*) (photo 3). Typical bog plants that catch the eye in the Kloostrimetsa bog also include the wild rosemary (*Ledum palustre*), heather (*Calluna vulgaris*) and the cloudberry (*Rubus chamaemorus*).

Peat

Peat is an organic material consisting of the partially decomposed remains of mire plants and humus, generated in an exceedingly humid environment that has a poor oxygen supply. **The main components of peat are peat mosses (*Sphagnum* sp.)** (photo 4), 37 species of which grow in Estonia. In addition to peat mosses, several other mosses can form peat (*Polytrichum strictum*, *Drepanocladus* sp. etc), many herbs (reed (*Phragmites australis*), tussock cottongrass (*Eriophorum vaginatum*), sedges (*Carex* sp.) (photo 5)),



bushes (willow (*Salix* sp.)) and trees (Scots pine (*Pinus sylvestris*), downy birch (*Betula pubescens*). Peats are divided into fen peats, transitional mire peats and bog peats according to their species composition. Studying the species composition of different layers of peat allows us to gain an understanding of the age of the mire and its course of development, but also its other aspects.

Photo 4. Peat moss (*Sphagnum* sp.) has a great capacity for absorbing water.

Peat is the main resource serving as the basis of economic interest in mires. In Estonia, peat has been produced and used for a long time. The excavation of peat for fuel was first mentioned in 1861 and the first peat-fuelled electric power plant began operating in 1918. In 1920, peat began to be used as litter in cattle sheds and in 1922 the National Peat Industry was created to handle the organization and coordination of peat mining. The mining of milled peat was started in 1938 when the first peat briquette factory was built.

The use of peat as fuel increased significantly after World War II. In 1959, a new briquette production complex was put into operation in Tootsi, while 1964 saw the launch of the Oru briquette factory and the Sangla briquette factory was opened in 1975.

The Estonian Peat Association was created in 1992. The use of milled peat has decreased locally, but peat mining for export purposes has grown due to the fact that the supply of high-quality *Sphagnum* peat is very limited in Western Europe. Currently, there are approximately 20,000 ha of milled peat fields in Estonia, which are exploited by more than 30 companies.

Taking into account that Estonian mires produce approximately 500,000 tons of peat annually, while the average mining capacity is 1 – 1.2 million tons per year, **peat cannot be regarded as a renewable natural resource when it is mined at the current rate.**



Photo 5. If there is enough moisture, peat will also be generated from sedges (*Carex* sp.).

Kloostrimetsa Peatland II

Fauna

The fauna of Kloostrimetsa bog differs from that of typical and extensive bogs.

The most important reasons for this include the afforestation of the bog as the result of draining and the relatively small area of the Kloostrimetsa bog. Nine species of mammals have been identified in the Kloostrimetsa bog: the common shrew (*Sorex araneus*), the common mole (*Talpa europea*), the squirrel (*Sciurus vulgaris*), the striped field mouse (*Apodemus agrarius*), the bank vole (*Myodes glareolus*), the brown hare (*Lepus europaeus*), the red fox (*Vulpes vulpes*), the roe deer (*Capreolus capreolus*) and the elk (*Alces alces*). It is also possible to encounter several species of bat, the western hedgehog (*Erinaceus europaeus*) (photo 6), the weasel (*Mustela nivalis*), the stoat (*Mustela erminea*),



Photo 6. The mixotrophic hedgehog (*Erinaceus europaeus*) can be seen on the edges of the bog.

the pine marten (*Martes martes*), the field vole (*Microtus agrestis*) and the mountain hare (*Lepus timidus*). The variety of mammal species is greater in the edges of the bog and the greatest in the south-east part of the bog bordering the Pirita river valley. There are less mammals, especially small mammals, in the centre of the bog, near the old hand-cut peat pitches. The species composition and numerousness of other representatives of the animal kingdom (insects, worms, arachnids, etc.) in the Kloostrimetsa bog has not been studied.

The most numerous mammal species in the Kloostrimetsa bog are the bank vole and the common shrew. Both species typically reside in forests and the drained peatland forest that has grown in the bog provides them with suitable habitats.

The **bank vole** (*Myodes glareolus*) is most numerous in forest stands that are up to 30 years old, it seldom moves on an open terrain and prefers the shelter of bushes and herbs. This small herbivorous animal eats both the green parts as well as the seeds and roots of plants. It is active both during night and day and its life expectancy in the wild is 1.5 years. The bank vole has the characteristic rust-red back.

The **common shrew** (*Sorex araneus*) is the most widespread of the several species of shrew living in Estonia – it inhabits various types of forests, meadows, parks and gardens. As an insectivorous animal, the common shrew mainly eats invertebrates: earthworms, snails, insect larvae, spiders and isopods – its daily consumption of food is comparable to its own weight. The common shrew can only survive for a day without food and its maximum life expectancy is 1.5 years. The common shrew is easily recognizable by its “tricolor” – a light brown stripe running down its sides separates the dark brown top half from the grayish-white bottom half.

Development and Classification of Bogs

Since bogs are very different compared to other vegetation habitat types, they have been studied and classified thoroughly. Estonian bogs are divided into three main categories according to their formation and stage of development: heath moors, transition moors and raised bogs. The different types are often hard to tell apart – each of them can be a habitat for typical moor flora, such as heather (*Calluna vulgaris*), wild rosemary (*Ledum palustre*) the cloudberry (*Rubus chamaemorus*), etc. They differ with respect to the properties of the surface layer of peat and the thickness of the peat deposit.

Raised bogs are the oldest variety and the thickness of their peat deposits ranges from one meter to several meters.

Transition moors have gone through the fen and transition mire stages in their development and are usually located at the edges of raised bogs, but can also form separate bog areas. The thickness of the peat deposits in transition moors is over 0.5 meters.

Heath moors are created on sand or clay saturated with rain water and have never gone through the fen development stage. The thickness of their peat deposits is usually less than 0.5 meters.



The abovementioned classification is mainly used in forestry, forest scientists and telmatologists more often use the following.

Bogs are also divided into three categories on the basis of the coverage and height of their tree layer: **bog forests, wooded bogs** and **treeless bogs**.

From the phytogeographical standpoint, Estonian bogs are divided into West-Estonian and East-Estonian types. **West-Estonian bogs** are characterized by a relatively steep and short slope, whereas the central part of the bog being more or less even (plateau bogs). **East-Estonian bogs**, on the other hand, do not have a clearly defined slope – they are generally curved (convex bogs). There are also some differences in the vegetation – plants that are characteristic of West-Estonian bogs include the tufted bulrush (*Trichophorum cespitosum*) and the bog myrtle (*Myrica gale*) (photo 7), while the leatherleaf (*Chamaedaphne calyculata*) is a plant typical of East-Estonian bogs.

A feature common to all bogs, however, is their exclusively precipitation-based (ombrotrophic) nutrition.

Photo 7. The bog myrtle (*Myrica gale*) is one of the plant species characteristic of West-Estonian bogs.

Kloostrimetsa Peatland III

Specifics on Flora 1

Scots pine (*Pinus sylvestris*) dominates the tree layer and is the most common tree in Estonian forests. It can grow in locations that are unsuitable for virtually all other species of trees – pines can be found both on dry heaths and in wet bogs. The only factor that inhibits its growth is lack of light, which is why you will not find pine trees in dark spruce or broadleaf forests. The pine can grow in extreme conditions due to the peculiarities of its roots which are able to penetrate deep into the earth, but also



Photo 8. Cloudberry (*Rubus chamaemorus*) flowers can be admired in the beginning of June.

Heather (*Calluna vulgaris*) is an excellent honey plant with blossoms that have a high nectar content – up to 200 kg of slightly bitterish honey can be gathered from a one-hectare heather field. Heather has also been used in folk medicine, for example to counter excessive weight gain and to calm one's nerves.

People have always held in high regard the yellow fruit of the **cloudberry (*Rubus chamaemorus*)** (photo 8), a typical bog plant, and have used the berries for making juice and jam. If you take a closer look at the aggregate fruit called the cloudberry, you can see that it consists of many parts and that each part contains a seed – this is known as a drupelet.

The red berries of its close relative, the **raspberry (*Rubus idaeus*)** are also aggregate fruit. It is easy to tell the difference between the raspberry and all of its related species by the white pannose underside of its leaves, as the leaves of its relatives are green on both sides.

The ferns that grow here include the common **spinulose woodfern (*Dryopteris carthusiana*)** with evenly pale brown scales and **spreading wood fern (*Dryopteris expansa*)** with scales that are scattered, brown with dark brown stripe, as well as the rare broad **buckler-fern (*Dryopteris dilatata*)** with scales that have clearly delineated dark brown stripe in the middle. You can also admire the wonderfully delicate **Arctic starflower (*Trientalis europaea*)** (photo 9) that is common in various coniferous and mixed forests.



Photo 9. The starflower (*Trientalis europaea*) grows in most of Estonia's coniferous and mixed forests.

grow outward from the trunk.

While the distinctive scent of **wild rosemary (*Ledum palustre*)** created by a highly volatile ethereal oil is pleasant for some and causes headaches for others, it doesn't go unnoticed by anyone. A very common bog plant, the wild rosemary was once used in folk medicine, but should not be used without supervision as it is poisonous.

Drained Peatland Forests

Drained peatland forests have developed from treeless mires and mires with sparse tree layers that have thick peat deposits and have been drained for extended periods of time. After draining, the areas are usually dominated by the Scots pine (*Pinus sylvestris*), occasionally also the downy birch (*Betula pubescens*) (photo 10) along with abundant Norway spruce (*Picea abies*) aftergrowth. The latter may become predominant in the following forest generations and lead to the development of a spruce forest. There are few species in the undergrowth of drained peatland forests and almost no characteristic species, which makes it similar to the undergrowth of dry boreal forests, fresh boreal forests or fresh boreo-nemoral forests. The **bilberry *Vaccinium myrtillus*** will dominate the less fertile soils, while the wood sorrel (*Oxalis acetosella*) will prevail on the more fertile ones. Drained peatland forests make up approximately 6% of Estonia's forests and are valued as good places for picking bilberries and other berries.



Drained peatland *Vaccinium myrtillus* pine forest that is predominant in Kloostrimetsa is the most common community in drained peatland forests.

Photo 10. The leaves of the downy birch (*Betula pubescens*) are round and hairy like its sprouts, while the leaves of the silver birch (*Betula pendula*) are triangular and have a shiny surface, and its sprouts are bald.

Occasionally, it is possible to see signs of **six-spined engraver beetle (*Ips sexdentatus*)** activity on the pines. The 8-millimeter beetle with a black cylindrical body can inhabit both live trees and fallen trunks. The beetle is polygamous – the male beetle creates a mating chamber beneath the bark and waits for the female beetles, each of whom will enter the chamber, mate and dig their own maternal galleries.

Bilberries often grow side by side with their relatives **bog bilberries (*Vaccinium uliginosum*)** and **cowberries (*Vaccinium vitis-idaea*)** (photo 11). The bilberry and bog bilberry are dwarf shrubs with dull deciduous leaves, while cowberry leaves are shiny and evergreen. The stems of the bilberry are green and their cross-section is rectangular, while the stems of the bog bilberry are brown and terete. The ripe fruit is red in case of the cowberry, blue in case of the bog bilberry and bluish-black in case of the bilberry.

All three berries are good for making jam, but cowberries are the most highly regarded of the three, since they contain the best proportion of sugars and acids for the human body. Due to their acid content, cowberries keep better than other forest berries both when fresh and boiled.



Photo 11. Both the berries and leaves of the cowberry (*Vaccinium vitis-idaea*) can be used for their curative effect.

Kloostrimetsa Peatland IV

Wild Birds

Much like the fauna of Kloostrimetsa peatland, the birds inhabiting the area are not typical of our bogs and the species represented are characteristic of coniferous and mixed forests.

The **sparrowhawk** (*Accipiter nisus*) who feeds on small birds and belongs to the protected category III nests in the thick crowns of spruce trees. The same environment is inhabited by one of the species the sparrowhawk preys on, namely the **chaffinch** (*Fringilla coelebs*), who consumes insects during its nesting period but is primarily herbivorous and whose song has been interpreted as an admonition: "You should not take a single chip of wood from this forest!" The favorite nesting place of the chaffinch is the spruce, but it inhabits all types of forest stands and is probably the most numerous species of bird that nests in Estonia. The spruce is also the favorite nesting place for the **common crossbill** (*Loxia curvirostra*) and the **bullfinch** (*Pyrrhula pyrrhula*), who mainly feed on spruce seeds, as well as the **Eurasian jay** (*Garrulus glandarius*), who loves to feast on acorns but also eats invertebrates and small rodents. High in the crown of the spruce, you can find the nests of our smallest bird – the mainly insectivorous **goldcrest** (*Regulus regulus*). The goldcrest is easily recognizable by the golden streak with dark edges that decorates the top of its head. Its song is a high-pitch fiddling sound bordering on the threshold of human hearing. Such insectivorous birds as the yellowish-green **willow warbler** (*Phylloscopus trochilus*), the **European robin** (*Erithacus rubecula*), with its brown back and rusty red chest, and the brown patterned **winter wren** (*Troglodytes troglodytes*) prefer to make their nest in heaps of branches, near the roots of a tree or even on the moss carpet. The latter two live in such similar biotopes that if you've seen one, you can be relatively certain of the presence of the other. The **tree pipit** (*Anthus trivialis*) nests on the ground, under the cover of



vegetation, and resembles the lark for its habit of singing during flight, yet has a different song. According to Estonian tradition, the pipit ("kiur" in Estonian) calls its own name at the end of its song: "Kiur-kiur-kiur!" A real forest concert is offered by the **pie'd flycatcher** (*Ficedula hypoleuca*), who skillfully catches flies in flight, the **song thrush** (*Turdus philomelos*), known in Estonia as the "mock nightingale" (photo 12), and the **Eurasian blackbird** (*Turdus merula*), who is often confused with the starling. The observant walker may notice that some trees and their surroundings exhibit signs of foraging by the **great spotted woodpecker** (*Dendrocopos major*) or the **black woodpecker** (*Dryocopus martius*), they may catch a glimpse of the tuft on the head of the **crested tit** (*Parus cristatus*), hear the distinctive song of the **great tit** (*Parus major*) – traditionally believed to be singing about chintzy-dress, notice the **common raven's** (*Corvus corax*) call (in Estonian, the raven sings its own name: "ronk"), or witness the **common woodpigeon** or **culver** (*Columba palumbus*) hooting like a crazed owl.

Photo 12. Song thrushes (*Turdus philomelos*) stealing rowanberries.

Restoration of Peatlands

We have increasingly come to understand the importance of mires as a part of the ecosystem – **they serve as the habitats of many rare plant and animal species, as well as regions that bond carbon.** If all Estonian mires were currently producing peat, the annual peat growth process could bond more carbon dioxide than is created by transport and industry during the same period. This is why the protection and conservation of bogs is very important.

There are no natural mires left in many European countries (the Netherlands, Denmark, Germany, France) and their area has significantly decreased in America (United States and Canada). Since there is nothing to conserve, the next option of recreating nature must be applied in these regions. There are two ways to restore nature: allowing nature to develop by itself by decreasing human influence as much as possible and letting the natural terrain regenerate, or “constructing nature” – artificially recreating a destroyed habitat after ascertaining its type. Usually, a middle-ground approach is taken, since it is impossible to recreate nature fully by artificial means, but purely natural development is a very slow process.

Photo 13. Kuresoo in Soomaa is the first among our bogs to be restored.



As a result of draining, peat formation has stopped in approximately 70% of Estonia’s mires. Draining was executed for excavating peat, accelerating forest growth or for agricultural purposes. After peat excavation is finished, mires become abandoned peatlands. If natural mires bond carbon dioxide from the air by photosynthesis and deposit it as peat for thousands of years, abandoned peatlands, on the other hand, function as sources of greenhouse gases.

This is why the issue of mire restoration has also become topical in Estonia (photo 13). The restoration of mires, however, requires that we create a moisture regime that is favorable for the growth of bog plants, close the drainage ditches, and bring in plant material, spread it onto the surface of the abandoned peatland, cover it with a layer of straw and let nature take its course. If there is a forest growing on the abandoned peatland, it must be cut down first. If the steps described above have been carefully followed and the weather conditions are favorable, the water level will begin rising in a few years, after which peat mosses will start to grow. Henceforth, the latter will form the suitable moisture conditions – the environment will become acidic, plant species characteristic of bogs will start to grow and the generation of peat will begin. **The restoration of mires is a time consuming, laborious and expensive process, while protecting and conserving existing mires is much easier and cheaper.**

Kloostrimetsa Peatland V

Specifics on Flora 2

It occasionally seems that white wool has been thrown around here and there in the bog – these “tufts of wool”, each one attached to a stalk, are the perianth hairs of the **tussock cottongrass** (*Eriophorum vaginatum*). The tussock cottongrass can be found in almost any fen or bog and it is an important component of peat. There are other species of cottongrass growing in our mires, but they differ from the tussock cottongrass



in that they have several tufts on the end of their stalks. The hair from the cottongrass spikelets has been used in the textile industry combined with wool or silk and as thermal insulation, but also as additional provender for reindeer in the tundra.

In places, you can see the **stiff clubmoss** (*Lycopodium annotinum*) with its evergreen stalks (photo 14), stretching its cones over tufts of moss. The stiff clubmoss is the most common of our clubmosses and can be seen in oligo-mesotrophic boreal forests, mesotrophic boreal forests, floodplain forests and peatland forests, but not in open bogs which would be too sunny for the plant.

A plant that loves the sunny sites, however, is the **cranberry** (*Oxycoccus palustris*), a dwarf bush that also grows in this forest and has berries that ripen by September but can be picked year-round. The reason for the berries keeping so long is the strong antibacterial effect of benzoin acid found in cranberries. The cranberry is a good medicinal plant, helping to alleviate fever and even high blood pressure.

Photo 14. Stiff clubmoss (*Lycopodium annotinum*) is used in making dried decorations.

As in other forests, you can find several types of grasses, including the **tall milletgrass** (*Milium effusum*), one of the most interesting species with its nearly 1.5 centimeter wide blades. Since few of our grasses have blades that are so wide, there aren't many species you could confuse it with. You can often see sparse clumps consisting of many thin culms – this is the **wood bluegrass** (*Poa nemoralis*), one of the most common grasses in our forests.

There are many species of moss here, in places covering the ground as an uninterrupted carpet. Occasionally, the moss carpet seems olive green, finely textured and very fluffy already from a distance – this is the **mountain fern moss** (**stair-step moss**) (*Hylocomium splendens*) (photo 15), one of our most common mosses. In order to make certain of the species, you can look at it more closely – if the “steps” are clearly visible, there can be no doubt – no other moss in Estonia forms such steps.



Photo 15. The mountain fern moss (*Hylocomium splendens*) forms “steps”.

Protection of Mires

The protection of mires is important in the entire world, **with the main reasons for their protection being:**

1) the protection of water supplies – mires are reservoirs of clean water, they have a good self-purification mechanism, they filter rainwater that has been contaminated in the air and regulate the natural draining process;



2) the protection of rare plant, bird and insect species and their growing environments and habitats – mires are the biotopes that have changed the least since the ice ages and serve as habitats for many rare and protected plants (the bog orchid (*Hammarbya paludosa*), the creeping lady's tresses (*Goodyera repens*), the black bog-rush (*Schoenus nigricans*), the marsh helleborine (*Epipactis palustris*), etc.) and birds (the golden eagle (*Aquila chrysaetos*), the common crane (*Grus grus*), etc.);

Photo 16. The round-leaved sundew (*Drosera rotundifolia*) is an insectivorous plant.

3) the protection of peat supplies – peat is a valuable raw material mainly due to its excellent absorption capability and unique chemical composition;

4) the protection of plant reserves – mires yield large berry harvests and serve as habitats for valuable peatland herbs (the bog bean (*Menyanthes trifoliata*), the sundews (*Drosera* sp.) (photo 16), etc.), and heather (*Calluna vulgaris*), a good honey plant;

5) mires are excellent sources of oxygen – all vegetation bonds carbon dioxide and produces oxygen, but bogs produce more oxygen than they use, since some of the plant material does not decompose;

6) mires are beautiful places that are great for relaxing in peace and quiet and gathering energy.

In Estonia, the need for protecting mires was understood already in the 1930s when people became worried about the bog island-based nesting places of eagles who were becoming increasingly rare. As a result, the Ratva bog in North-Eastern Estonia was placed under protection in 1938. The need to protect rare bog plant species and plant communities began to be understood after there were reports of the disappearance



of rare species in the spring fens of Saaremaa in the 1950s – four nature reserves, including the Nigula national nature reserve and the Viidumäe national nature reserve, were created in 1957.

In 1981, 30 mire reserves (mainly bogs) were created, encompassing a total of 122,190 ha. Today, the area of protected mires is about 170 000 ha in Estonia (photo 17).

Photo 17. Vällamäe – the bog with the thickest peat deposit in Estonia.

Kloostrimetsa Peatland VI

Mammals 1

Large mammals visit typical and expansive mires mainly in the summer or by chance, but may stay in drier drained peatland forests, including Kloostrimetsa, for extended periods of time.

The long legs and wide hoofs of the **elk (*Alces alces*)** (photo 18) are adapted for moving in mire forests. The elk is entirely herbivorous – it eats herbs and leaves from trees and bushes in the summer and the thinner branches of trees and bushes in the winter. It travels long distances and changes habitats depending on the season. Kloostrimetsa peatland is too small to be a permanent habitat for elk, but they do occasionally travel through it.

The coat of the **roe deer (*Capreolus capreolus*)** is rusty brown in the summer and greyish brown in the winter. The roe deer avoids large forests, preferring to stay in mosaic terrain, where open areas alternate with copses. In the summer, the roe mainly feeds on herbs, while shrubs as well as branches, sprouts and buds of trees and bushes make up its year-round diet. The roe prefers to live in a certain area and several roe deer can be seen at once in the Kloostrimetsa peatland. In the winter, many roe deer hoofmarks can be found on the snow. The roe deer moves around in twilight and rests in thick forest stands where the ground is characteristically scratched – its sleeping places can be found in the middle of the Kloostrimetsa peatland.

Similarly to the roe, the **red fox (*Vulpes vulpes*)** avoids large forest masses, inhabiting various places ranging from forests and mires to cultivated terrains. The habitats most suited to it, however, are small groves, which is why you shouldn't be surprised if you see the fox or its tracks in Kloostrimetsa peatland. Foxes eat frogs, snakes, lizards, mice, voles, hares, birds and bird eggs, insects, dead animals and, to a lesser degree, plants (berries, grains).



Photo 18. Elks (*Alces alces*) can be encountered on the edges of forests and bogs.

Pirita River Valley

The flowing water of Pirita river has eroded a canyon-like valley into the bluff during the last 9200 years due to the rising of the ground (by approximately 35 meters). There is no bluff precipice here, but the outcrops of sandstones and clays of the Lower Cambrium and the limestone of the Ordovician can be admired on the banks of the valley. The rocks exposed on the left bank of the river are 550 million years old. Quaternary deposits of various ages can also be seen the brinks of the valley also, along with terraces reflecting different sea levels (photo 19). On 11 July 1957, the Pirita river valley was declared a protected landscape reserve. The borders of the reserve have later been changed and expanded, with the current borders being established in 1999 and the protection rules instituted in 2005. The protection goal of the Pirita River Valley Landscape Reserve is the protection of the Pirita river valley, its terraces, outcrops and plant communities and forests. Different landscape forms account for the diversity of habitats and communities which, in turn, result in a remarkably rich variety of species.

The valley is home to various protected plant species: the sea thrift (*Armeria maritima*), the small pasque flower (*Pulsatilla pratensis*), the Baltic orchid (*Dactylorhiza baltica*) the creeping lady's tresses (*Goodyera repens*), the broad-leaved helleborine (*Epipactis helleborine*), etc. **Pirita river valley has also been selected as a candidate Natura 2000 site.**

Pirita river valley is also an important traveling corridor for mammals.

The reserve is located in Tallinn, in the city districts of Pirita and Lasnamäe, and in Iru village, located in Jõelähtme rural municipality in Harju county. It also includes the ruins of the summer manor and park in Kose and parts of the Laiaküla and Kloostrimetsa urban regions.



Based on archeological excavations it is believed that the ancient Iru fort located near the Iru overpass was used as a settlement already during the second half of the 1st millennium. For a long time, it was one of the most important centers of Rävåla county, but was abandoned after the erection of the fortress in Toompea. The first written records of Iru village date back to 1241. The village belonged to the Pühavaimu alms-house from 1359, to Våo manor during the 16th century, was annexed into the holdings of the Nehatu town manor in 1733, and in 1975 most of the village was finally incorporated into the city of Tallinn. According to census data from 2000, there were 162 residents in the village, but the number of residents reached 800 after real estate development was started in 2007.

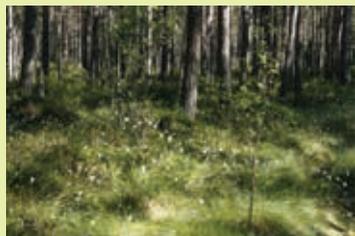
Photo 19. Rocks from various periods are exposed on the banks of Pirita river.

Kloostrimetsa Peatland VII

Mammals 2

In addition to typical forest species, animals typical of forest edges and open terrain are seen in the Kloostrimetsa drained peatland forest (photo 20).

The **brown hare** (*Lepus europaeus*) primarily inhabits the edges of forests and open terrains and rarely visits coniferous forests. In Kloostrimetsa, too, the brown hare or



signs of its activity are seen mainly on the edges of the bog. The brown hare prefers to stay in one area and is primarily active in the twilight hours. The narrow paws of the brown hare are adapted to fast movement on open terrain. The brown hare eats grasses during the summer and tree and bush branches and bark during the winter. The coat of the brown hare is brownish gray in summer fur and light gray in winter fur.

Photo 20. Kloostrimetsa bog features habitats suitable for both forest species and species that inhabit forest edges.

The **mountain hare** (*Lepus timidus*) is smaller than the brown hare and lives in the forest where the snow is less compacted. As a result, its paws are wider and hairier and its tracks larger than those of the brown hare. The presence of the mountain hare in Kloostrimetsa is likely, though there is no firm data to confirm it.

The **striped field mouse** (*Apodemus agrarius*) is another species that typically inhabits edges of forests as well as shrubbery, but moves into buildings during winter. The striped field mouse is active during daytime and its maximum life expectancy is 4 years. The striped field mouse can have both an herbivorous diet (seedlings, buds) and a carnivorous diet (insects, insect larvae, worms, snails).

There are few **common moles** (*Talpa europea*) living in forests. They can, however, be seen near forest edges and forest paths. It is important for the mole that its holes be located above the soil that is oversaturated with water. As elsewhere, the molehills in Kloostrimetsa peatland are located near the edges of forest paths. The mole is active throughout the day and its periods of activity last for a few hours, alternating with periods of rest during which the mole sleeps in its den, considered a part of its complex system of tunnels, in an upright position, holding its head between its forelegs. The mole avoids acidic soils, as these do not contain earthworms that constitute the staple diet of the insectivorous mole. The mole can live for up to 7 years.

In Estonia, the **red squirrel** (*Sciurus vulgaris*) (photo 21) lives mainly in coniferous and mixed forests, but often also in parks, gardens and cemeteries. In Kloostrimetsa forest, the squirrel or signs of its activity can be seen in the area bordering the bank of Pirita river. The squirrel is active during daytime and its preferred diet includes spruce and pine seeds. The squirrel prepares for the winter by gathering nuts and acorns in the tree hollows and between roots of trees near its den and by hanging mushrooms on the branches of nearby trees. The squirrel has a coat that is reddish-brown in summer and grayish-brown in wintertime and it uses its long-haired tail as a steering device when jumping.



Photo 21. In summer, the squirrel (*Sciurus vulgaris*) doesn't have tufts on its ears.

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