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## Estonian Wooded Meadows and Wooded Pastures

*A brief translated summary of the manual compiled by Tiina Talvi in 2010. The list of materials used and references can be found in the original manual.*

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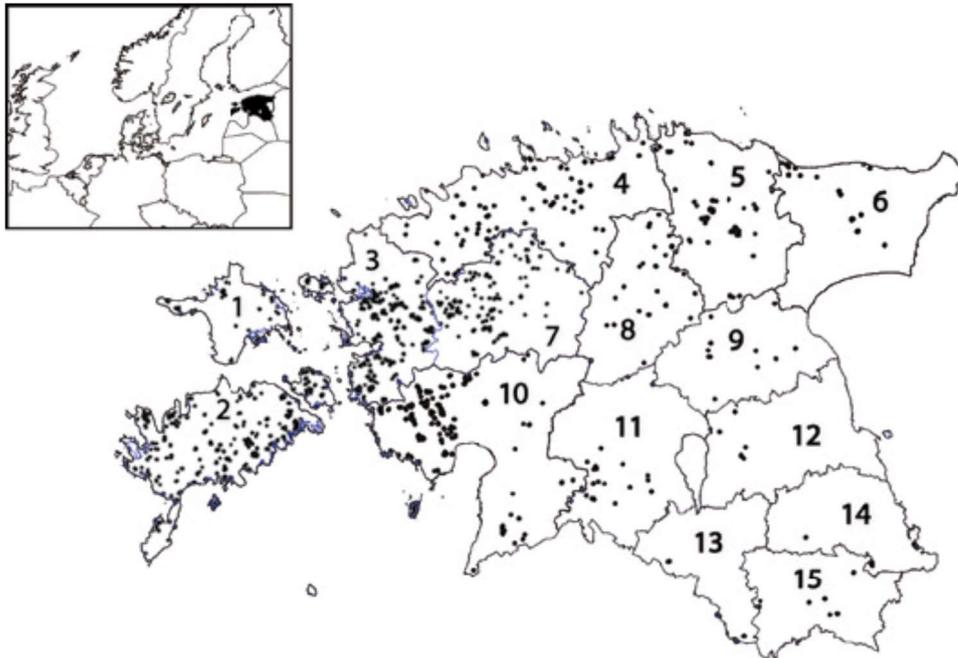
## **1. Overview of Estonian Wooded Meadows**

Wooded meadow is a sparse natural forest stand with a regularly mowed herb layer. Its preservation lies in annual mowing and the shaping of its tree and shrub layer. Wooded meadows can be categorised according to their use, the degree of human influence, site type, moisture regime, lime richness of the soil or plant communities. Based on their uses, communities similar to wooded meadows can be generally divided into grasslands and pastures. The current manual will treat these separately as semi-natural communities. Wooded meadow as a heritage community has a very important meaning in the Estonian national culture.

### **1.1. Historical Distribution and Use of Wooded Meadows**

The landscape characterised by wooded meadows probably appeared in Estonia with the first human settlements as a result of forest culling, scrub removal, grazing and making broad-leaved twig bundles and hay. Wooded meadows started to spread fast after the scythe was widely introduced, which made it considerably easier to store a large amount of winter forage. The spread of wooded meadows reached its height in the late 19<sup>th</sup> and early 20<sup>th</sup> century, when the demand for agricultural land was the greatest and natural grasslands may have even encompassed up to 1/3 of the surface area of Estonia. In the beginning of the 20<sup>th</sup> century, the surface area of wooded meadows and pastures reached up to 850,000 hectares, which was nearly 18% of the surface area of the country. Just like it was at the height of the distribution of wooded meadows and pastures, most of the preserved wooded meadows are nowadays situated in Western Estonia (Figure 1).

The entire 20<sup>th</sup> century saw a quick reduction of the surface area and distribution of wooded meadows. The main reason for the disappearance of wooded meadows was the replacement of manual mowing with respective machinery, which was mostly used to collect winter forage only from cultivated grasslands. Nowadays, the surface area of preserved wooded meadows with a high and very high nature conservation value is estimated to be close to 8,500 hectares (in 2010, 703 hectares were under management in Estonia). Wooded meadows can be formed primarily, but most of Estonian wooded meadows are secondary, developed as a result of human economic activity. In addition to Estonia, wooded meadows have also been widely spread in central and southern Sweden (especially on Gotland) and southern Finland (especially on Åland Islands).



*Figure 1.* The current distribution of wooded meadows in Estonia. The numbers mark the counties (1 – Hiiumaa, 2– Saaremaa, 3 – Läänemaa, 4 – Harjumaa, 5 – Lääne-Virumaa, 6 – Ida-Virumaa, 7 – Raplamaa, 8 – Järvamaa, 9 – Jõgevamaa, 10 – Pärnumaa, 11 – Viljandimaa, 12 – Tartumaa, 13 – Valgamaa, 14 – Põlvamaa, 15 – Võrumaa).

## 1.2. Environmental Conditions in Wooded Meadows

- 1) Regular and extensive mowing will create and maintain a balance between the cohabitation of forest and grassland species. Since the accrual of species to a community is a slow process, reaching a great species richness will require decades (centuries) of continuous grassland management.
- 2) Great habitat diversity has developed as a result of the intertwining of two very different natural communities (forest and grassland). The living conditions here are not the best, but still suitable for both forest and grassland species.
- 3) The lime-rich soils of Western Estonia and the islands contribute to the general species richness of plants.
- 4) Relatively modest and stable soil fertility—there are few different species of plants that grow on both poor and fertile soil. A considerable amount of nutrients is removed from wooded meadows along with the mowed grass every year. At the same time, the soil fertility will recover with the help of tree leaves and other litterfall, nutrients transported via tree roots and leaves and the atmosphere.
- 5) Great species fund. Since the plant community is an open system even in the sense of the circulation of species, great species richness can only be maintained if the surrounding biota does not become poor.

6) Even though the diversity of plant communities on wooded meadows is mostly supported by regular mowing, other traditional human activities also contribute to the diversity of vascular plants and many other biota groups.

### **1.3. Biota Characteristic to Wooded Meadows**

The biota on wooded meadows is very diverse. Wooded meadows are nowadays mainly known for their exceptional species density of vascular plants. The managed wooded meadows on the lime-rich soils of Western Estonia and Saaremaa may often be inhabited by over 50 plant species on one square metre. This is considerably more than in any other plant communities in the forest belt. Over 60 species per square metre have been described on seven Western Estonian wooded meadows (see chapter 3). This kind of species richness places Estonian wooded meadows on the top of the list of the world's plant communities. More than 600 vascular plants have been registered as growing on wooded meadows, which is almost 40% of Estonian flora. At least 30% of our protected plant species can be found on wooded meadows. In addition to diverse herbaceous vegetation, wooded meadows are also home for many different tree and shrub species.

## **2. Factors Endangering Wooded Meadows and Their Protection**

The two main reasons of the disappearance of wooded meadows and other heritage communities are the rearrangement of human settlements and considerable changes in agriculture.

- 1) The abandoning of manual labour in making hay. Mechanisation put an end to the management of too small and distant grasslands.
- 2) Reducing land deficiency and the rise of the productivity of cultivated grasslands has contributed to the disappearance of wooded meadows throughout the 20<sup>th</sup> century.
- 3) Cultivation (field ploughing and cultivation as clear grasslands).
- 4) Land improvement—the goal of which is to increase the productivity of grasslands as cheaply as possible via fertilisation and sowing seeds of cultivated hay.
- 5) Afforestation.
- 6) Changing the purposes of land ownership and use. Landowners can often choose between several subsidized ways of land use (the management of wooded meadows *vs* silviculture *vs* preservation of a protected forest), the management of wooded meadows, which demands more resources is usually not considered.
- 7) Contemporary centralization of rural economy, specialization, intensification and discontinuation of traditions are the main reasons for the disappearance of wooded meadows.

Pursuant to the laws regarding nature protection, wooded meadows are listed in the European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) annex 1 as priority habitat type 6530\* (Fennoscandian wooded meadows). Thus, Estonia is committed to and responsible for the international preservation of wooded meadows in long term.

### Applying for the Wooded Meadows Management Subsidy

Pursuant to the common agricultural policy of the European Union and Estonian Nature Conservation Act, the regulations issued by the Minister of Agriculture and Minister of Environment have laid down the national procedures regarding the subsidies for the restoration and management of semi-natural communities, including wooded meadows and wooded pastures.

### 3. Representative Wooded Meadows

The following list includes some well-known Estonian wooded meadows, which are probably of the highest nature conservation value. The list is not arranged in any order.

*Table 1.* Notable Estonian wooded meadows.

<b>Wooded meadow</b>	<b>Location</b>	<b>Area under annual management (ha)</b>	<b>Known species richness of the vascular plants (species/m<sup>2</sup>)</b>	<b>Other values</b>
Laelatu	Puhtu-Laelatu PA	15	76	One of the best researched wooded meadows, continuous management over 300 years
Nedrema	Nerema-Kalli PA	100	54?	Largest mowed wooded meadow in Northern-Europe
Allika	Matsalu NP	4	61?	Traditional limestone hay barn
Mäepea-Laasma	Viidumäe PA	10	63	Under annual management at least 100 years
Tagamõisa	Tagamõisa PA	10	67	Long term protection status
Välja-Simmu	Orinõmme-Liigalaskma PA	6	?	Under annual management for a long time, traditional management methods used
Vahenurme	Vahenurme PA	3	74	Exceptional small

				scale species richness
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#### 4. Beneficial Nature Conservation Condition of Wooded Meadows

Old wooded meadows that have been managed for a long period of time are generally characterised by the alternation of clear grassland patches and groups of trees with varying density. The canopy cover of the tree layer is usually 20–40% in the best wooded meadows. The canopy cover of the shrub layer individually may exceed 10%. In addition to that, good condition is also indicated by the great species richness of vascular plants, tree and shrub layers with diverse species composition, low number of fast-growing tree species that give numerous vegetative shoots (aspen, grey alder), tree and shrub layers with a diverse age structure, trees and shrubs with specific shape, growth and vitality, culture heritage elements (different wooden and stone fences, hay barns, cairns, springs, wells, ancient roads, etc.).

#### Indicator Species Referring to the Good State of Wooded Meadows

We do not have conclusive data on the indicator species that characterise the nature conservation condition and history of maintenance of wooded meadows. The constancy of the vascular plant species found on test squares from 58 Estonian wooded meadows somewhat indicates to the existence of species characteristic to the most species rich test squares. The plants more constant in species rich test squares were: common bent, sweet vernal grass, downy oat-grass, quaking-grass, peach-leaved bellflower, harebell, mouse-ear chickweed, sheep fescue, wild strawberry, water avens, ribwort plantain, dwarf milkwort. The groups of indicator species describing the state of wooded meadows clearly show the general habitat preferences of said species. The species characteristic to a wooded meadow in good condition generally prefer dry grassland habitats, the indicator species that are a sign of irregular management grow both on different kinds of grasslands and deciduous forests, the species that indicate the condition where a wooded meadow has just been restored generally prefer deciduous and mixed forests as habitats.

#### 5. Potential and Purpose of Restoring Wooded Meadows

Firstly, preserved wooded meadow areas with the highest possible natural conservation value should be preferred over others when getting started with the restoring and subsequent managing processes. When choosing areas for restoration, one should pick the ones which are already situated close to semi-natural communities (preferably wooded meadows) that are already being managed (the key factor is the surrounding species fund). When considering this, one must also assess the location of the area and its access ways. Landowner's (henceforth manager's) willingness and capability to continue managing the wooded meadow for a long time after it has been restored plays a great role in this. Therefore, valuable wooded meadows should firstly be restored in existing protected areas where the protection regulations make it possible or compulsory. This ensures dependable continuity of the

management of heritage communities and does not create a legal contradiction after the landowner loses interest. A managed wooded meadow of any size is always better than an unmanaged wooded meadow.

## **6. Restoration of Wooded Meadows**

### **6.1. Restoration Planning**

A landowner or caretaker must consider all the future time-related and financial expenses regarding the restoration and management of a wooded meadow (at least in a 10 years' perspective). The plans for the restoration and subsequent management work must include solutions to legal and financial, technical, logistic and workforce matters related to the land use, as well as the further use of the material gathered from the wooded meadows during the restoration process and the crops collected in the following management process, etc.

### **6.2. Practical Restoration**

Even nowadays, wooded meadows can be restored using only traditional tools (handsaw, axe, machet, scrub scythe). However, in case of more extensive restoration work, it is reasonable to use contemporary tools (chainsaw and scrub cutter). When clearing a wooded meadow from trees, shrubs and scrub, the goal is easy—cleared areas should be suitable for mowing in the future. Therefore, the scrub on wooded meadows should be cut or sawed so low that the remaining stubs and stumps would not interfere with mowing.

Grazing during the years of scrub removal and in the following two or three years is a very practical and nature friendly way to restore a wooded meadow.

It is recommended to girdle the trees that produce many stump and root shoots (aspens, ashes, alders, crack willows) before felling and to leave them dry standing up for a few years. In order to girdle a tree, circles with 5–30 cm between them must be cut on the trunk at the height of 0.5 m and the bark in between must be removed completely.

The restoration of a wooded meadow produces a great amount of valuable wood, which is very suitable as fuel or for making wood chips. Thus, the traditional management of wooded meadows is linked to contemporary nature-friendly energy production.

Smaller twigs and scrub that are removed when restoring a wooded meadow should be collected and burned. The fire should not be built on places with good topsoil—rocky-gravelly crags with less soil, the surfaces of bigger stumps, holes dug by wild boars etc. are more suitable for this.

Heavy transportation should be allowed on wooded meadows only during periods when the soil is hardened. This is the best way to avoid damage to the surface and biota of wooded meadows.

## **7. Management of Wooded Meadows**

The best time to mow wooded meadows is July. Very early mowing might reduce the species richness of wooded meadows, since the plants do not have the time to form fruits. Early mowing also damages many other groups of biota (insects, spiders, ground-nesting birds,

reptiles). At the same time, late mowing does not allow for the lattermath to reach its full growth, which could then affect the feeding of butterflies active in late summer and other insects, and their preparation for winter.

The grass mowed on wooded meadows should be dried and removed. While the mowed grass dries, the fruits of many herbaceous plants will post-ripen and the juveniles of invertebrates will develop further.

Naturally, it is best to use the highly valuable hay collected from a wooded meadow—the result of hard work—as forage. If the hay collected from a wooded meadow is not needed as forage, it could be used for making compost for plant production or as mulch.

## **Wooded Pastures**

### **8. Overview of Estonian Wooded Pastures**

In Estonian natural science and nature protection literature, wooded meadows and wooded pastures are often regarded as two close subtypes of one semi-natural community. The versatile management of these two mosaic grasslands helped to avoid land exploitation, made it possible to use natural management methods in the area (scrub and shrub removal via grazing) and was probably simply practical from the perspective of farm housekeeping.

Grazed forests are very similar to wooded pastures. They are usually distinguished by the nature of the herbaceous plant layer: the herb layer of grazed forests is similar to the herbaceous flora characteristic to the natural habitat type of the given area; wooded pastures, on the other hand, are dominated by grassland species and there are weeds characteristic to pastures (for instance, spear thistle) or less valuable, yet more persistent grass plants (for instance, tufted hair-grass).

#### **8.1. Historical Distribution and Use of Wooded Pastures**

Historically, wooded pastures were probably the first human-influenced or semi-natural communities. At the emergence of continuous human settlement and agriculture, the previous similar influence of great herbivores was replaced by the grazing of grasslands and, slightly later, mowing. In the land use statistics and plans, wooded meadows and pastures were mostly marked the same, which probably reflects their intertwined use. Nowadays, according to experts, there are 4,000 hectares of preserved wooded pastures in Estonia, 50% of which are deemed highly valuable. In 2010, nearly 1,500 hectares of wooded pastures were managed using the subsidy for semi-natural communities.

#### **8.2. Environmental Conditions in Wooded Pastures**

Environmental conditions characteristic to wooded pastures are in many ways similar to those of wooded meadows (see chp 1.2.). Significant differences lie in the differences between management methods (grazing) and their influence. The influence of grazing: grazing reduces the biomass of flora; flora is kept low throughout the grazing period, it grows thicker, the size of plant parts reduces, but the number grows; the influence of grazing facilitates the growth of drought-tolerant plants in dryer habitats and moisture-loving plants in moist habitats; the flora

kept low throughout the vegetation period influences the microclimate of the area. The microclimate of the pasture will become warmer in spring and summer, colder in winter; the pasture's biogeochemical cycle will become faster, the amount of nutrients reduces a little in the long term; the pH level of the pasture's soil might rise slightly; the soil is compressed due to livestock's trampling, the soil's moisture and gas regimes grow worse; the excrements of grazing animals and slurry create local collection spots with high nutrient concentration (so called *rammumättad* in Estonian). The effect of local fertilisation is twofold—high concentration of nitrogen compounds and other substances is lethal to many species, but beneficial for others; grazing livestock disperses plant seeds (endo- and epizoochory); grazing livestock will eat selectively, the distribution and size of preferred plant species will reduce, neglected species might spread on the pasture; grazing increases spatial diversity on the pasture, since different plant communities and species are eaten selectively.

### **8.3. Biota Characteristic to Wooded Pastures**

In general (especially in the case of tree and shrub layer), the biota of wooded pastures resembles that of wooded meadows. A mosaic area with varied grazing intensity creates many different habitats for both light-loving and shade-tolerant species. The herb layer of wooded pastures is characterised by the abundance of nitrogen-loving plants and pasture weeds. As a result of selective grazing, the percentage of true grasses and sedges will grow and the number of herbaceous plants will diminish. The importance of some sedges and true grasses will rise in comparison to wooded meadows as a result of grazing. Wooded pastures are home to biota that is connected to manure. The fauna of vertebrates in wooded pastures greatly resembles that of wooded meadows. It should be pointed out that wooded meadows are the preferred habitat for the European roller and European green woodpecker, which have nowadays become extremely rare in Estonia.

### **9. Factors Endangering Wooded Pastures and Protection**

The risk factors influencing wooded pastures are similar to those of wooded meadows (see chp 2). Some risk factors connected to grazing and changes in that tradition may be added: the discontinuation of the management of a traditional wooded pasture, which happens due to intensification and specialisation of animal husbandry. Grazing livestock will eat selectively, they avoid eating spruces, junipers and also some broad-leaved shrubs. Therefore, wooded pastures under weak or unvaried management are in greater danger of becoming encroached by vegetation than wooded meadows.

### **10. Representative Wooded Pastures**

Tahula swamp wooded pasture in Saaremaa, Ratla wooded pasture in Saaremaa, the wooded pasture of Metsa-Johani farm in Saaremaa, Suur-Tulpe wooded pasture in Saaremaa.

### **11. Beneficial Nature Conservation Condition of Wooded Pastures**

All indicators of the beneficial nature conservation condition of wooded meadows (see chp 4) also apply to wooded pastures. In addition to the indicators of the beneficial nature conservation condition given in connection to wooded meadows, we may also add: landscape diversity. Since achieving the smoothest and largest grassland surface in order to ease mowing is not necessary in case of wooded pastures, the natural conservation and aesthetic value of wooded pastures is enhanced by varied relief and landscape elements. In addition to the aforementioned nature conservation and aesthetic meaning, the listed elements are also important from the perspective of animal health and wellbeing. Thus, the grazing animals living on the pasture will be granted natural drinking, bathing and hiding places.

## **12. Restoration of Wooded Pastures**

The principles of the restoration of wooded pastures, preparation and restoration works are the same as the ones for wooded meadows (see chp 6). Nowadays, cattle is transported to faraway pastures and therefore it is highly necessary for the wooded pastures to have proper access ways. If possible, one must consider constructing an artificial water body when planning the restoration of a wooded pasture.

## **13. Management of Wooded Pastures**

**Grazing Livestock** Different types of grazing livestock prefer to eat different kinds of plants. Bovines are not very picky when it comes to plant species, but tend to eat bigger and juicier plants and, similarly to horses, avoid plants that grow around excrements. Sheep are very selective about food plants, they prefer herbs and other plants that are not very coarse-textured. Sheep and especially goats gladly eat tree and shrub leaves and bark. Horses are not very demanding, they will happily eat tree leaves and bark. Considering the surface area of our managed wooded pastures and the number of domestic animals, grazing different kinds of livestock on wooded pastures should still be considered very important.

### **Grazing Intensity**

The selection of grazing intensity depends on the extent and productivity of grassland flora in the wooded pasture, the nature of the soil, its trampling tolerance, the species of grazing livestock, their breed, age, energy needs, the time of grazing and its duration, climate, etc. The grazing intensity of a wooded pasture should be somewhere between 0.3–1 livestock units per hectare. It is recommended to have at least half of the grass on the pasture grazed low. The best way to regulate grazing intensity is to use the paddock system. If the grazing intensity is still too low, animals have grazed very selectively or if the pasture is still in the recovery stage and it is inhabited by a number of plants the animals will not eat, it is reasonable to mow the wooded pasture in late summer. In semi-natural communities, grazed animals must not be given any additional forage and the wooded pasture may not be connected with a cultivated grassland.