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KESKKONNAAMET

The Management Plan for Floodplain Grasslands—Instructions for the Management and Restoration of Communities

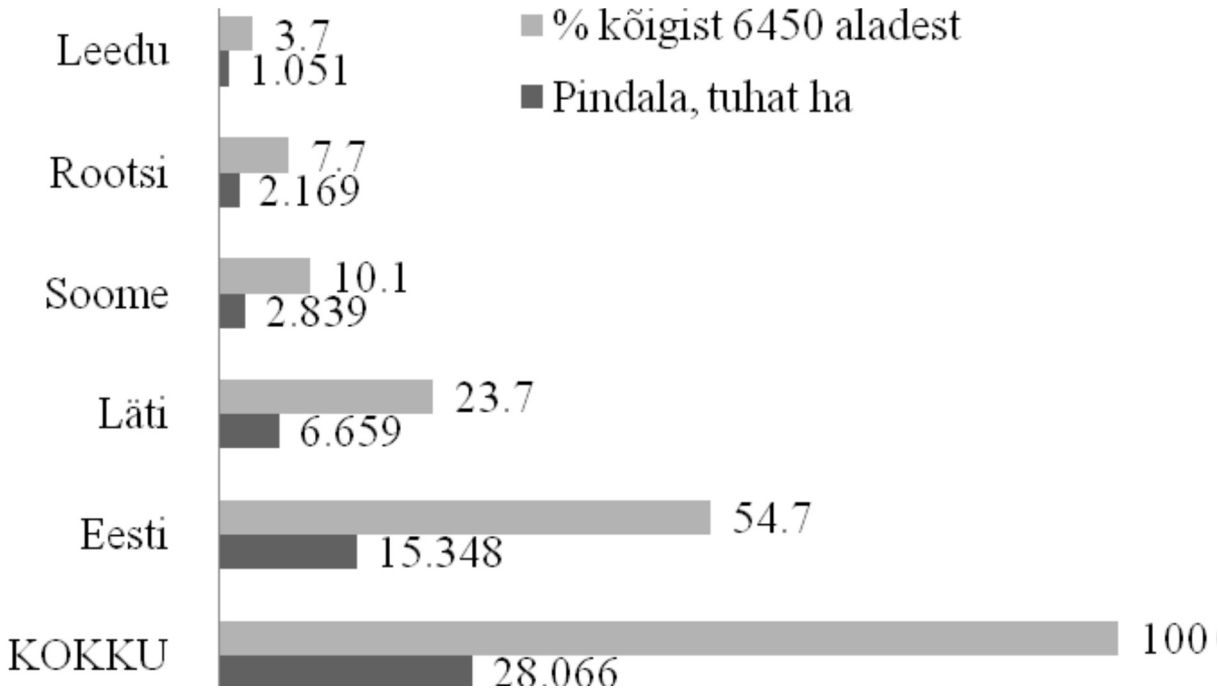
A brief translated summary of the manual compiled by Jaak-Albert Metsoja in 2011. The list of materials used and references can be found in the original manual.
(http://www.keskkonnaamet.ee/public/PLK/Lisa_4_Luhtade_hoolduskava_2011.pdf)

I Overview of Estonian Floodplain Grasslands

Floodplain grasslands are flooded grasslands that are situated in river but also lake valleys also known as floodplains. According to the EU Habitats Directive, 'Northern boreal alluvial meadows' (habitat type code 6450) are grasslands situated on the banks of large rivers, in sections with slow flow, which are frozen in winter and flooded in the spring–summer period.

Distribution in Europe and Estonia

Figure 1. The distribution of habitat type 6450 by country (*Leedu- Lithuania; Rootsi- Sweden; Soome- Finland; Läti- Latvia; Eesti- Estonia; % kõigist 6450 aladest- % from all the the 6450 areas; pindala, tuhat ha- surface area thousand hectares*). Floodplain grasslands can be found all over Estonia, most of them lie on the floodplains of larger rivers—Emajõgi, Põltsamaa, Pedja, Kasari, Halliste, Raudna, Piusa, Koiva, Mustjõgi, Narva headwaters—but also near lakes (Peipsi, etc.). The surface area of Estonian floodplain grasslands with a high nature conservation value is estimated to be 16,000 hectares.



Environmental Conditions

The most characteristic feature of floodplain grasslands is periodic flooding, which occurs mostly during the snowmelt period. Flooding that starts in autumn and lasts throughout winter is characteristic of floodplain grasslands with smoother relief and those that are situated near larger rivers. Floodwater carries alluvial sediments to the floodplain, which are divided zonally according to grain size and the speed of the water flow. The zonal division of the

alluvium shapes the soil conditions of the floodplain, which in turn influences the vegetation—it is often characterised by zonality.
River segments with a low stream gradient are characterised by meandering which occurs due to the continuous relocation of sediments. River meanders may be cut off from the main river during the formation of a new stream bed—as a result floodplain water bodies with or without cross-flooding—oxbow lakes—are created. Floodplains are often characterised by moderate ditching, but not extensive drainage.

Soil

Depending on the flooding and sedimentary conditions, the floodplain soils are more or less saturated with moisture. Even though floodplain peat formation takes place in hydrological conditions similar to fens, it is important to note that the soil here may be highly flammable due to the fluctuations in water level.

Characteristics of Vegetation

The habitats of floodplain grassland vegetation are considerably more varied in comparison to boreo-nemoral grasslands—26 different plant communities have been noted as opposed to the 13 of boreo-nemoral grasslands.
Habitats with more moisture and sediments have relatively abundant and species-poor vegetation, yet moderately moist floodplains with lime-rich sediment may at times stand out with their relatively high species richness. The vegetation of floodplain grasslands is often distributed in zones—the flora becomes lower and at the same time more species rich the further it is from the river. The overly moist conditions of floodplains are not suitable for the growth of trees and shrubs and, therefore, encroachment by scrub may take longer here than in other grasslands.

Classification

In addition to 6450, the type group of floodplain grasslands in the Classification of Estonian Vegetation Site Types may also include Natura 2000 habitat types 6430 (hydrophilous tall herb fringe communities of plains and of the montane to alpine levels), 6530 (Fennoscandian wooded meadows) and 9070 (Fennoscandian wooded pastures). For further information see table 1 in the original document- classification of floodplain grasslands according to Krall et al. 1980 and its comparison to systems by Laasimer (1965) and Paal (1997 and 2002).

Origin, History of Use

The grasslands in Estonia are mainly secondary vegetation types, which have replaced the primary community (forest) due to human influence.
In rare cases, floodplain grasslands may also be primary and there has never been a forest on the areas they inhabit. Floodplain forests on the banks of Emajõgi started to appear as wooded

meadows as early as the Atlantic climate period in 8,000–5,000 years ago. Floodplain areas started developing into grasslands more widely in the middle of the first millennium BCE and the introduction of the scythe in the middle of the first millennium BC allowed humans to significantly influence floodplain grasslands and Estonian grassland vegetation in general. Floodplain meadows have been valued places for collecting forage thanks to their abundant grass growth. The surface area of floodplain meadows was most extensive at the turn of the 19th century, after which it has reduced (see Distribution Dynamics).

Values

Above all, floodplain is a valuable habitat type; many living beings and ecological (also social) processes depend on its existence and good condition.
As a complete complex of an ecosystem, floodplains serve at least the following functions:
a) Flood regulation—rivers that flow in an undeepened, unstraightened and undammed natural stream bed serve as a hydrological buffer in case of a flood and relieve the influence derived from the fluctuation of water level on areas that are situated downstream.
b) Regulation of biogeochemical and energy cycles—nutrients (N, P) brought by flood water will accumulate on a floodplain, thus, floodplain soils will become rich in nutrients and flowing waters will be cleansed or, in other words, become poor in nutrients.
c) Bioproductive function—the most important from the origin perspective; hay from floodplain grasslands has been used as forage for hundreds of years; nowadays, it has alternative uses in bioenergetics.
d) Habitat for plant and animal species—feeding areas for both the birds who live on a floodplain or its surroundings and transit migrants, nesting places for floodplain breeding birds; nesting and feeding places for different land and water invertebrates and vertebrates; important spawning areas for fish.
e) Social functions—culture historical, aesthetic-recreational and scientific. Plant, bird, fish and insect species connected to the floodplains are discussed below in detail.

Flora

Floodplain grasslands are considered valued and protected habitats in both Estonia and other European countries. Even though there are no rare species among the plant communities in floodplain grasslands, several of them should be regarded as endangered, since they will disappear due to the lack of management. At least 350 species of vascular plants have been found in Estonian floodplain grasslands, 22 of which are under protection. The maximum small-scale species richness of Estonian floodplain grasslands is 39 vascular plant species per square metre. 45 of the species characteristic to semi-natural communities (668 species) are only found in floodplain grasslands. Vegetation is more species rich in relatively dry floodplains where the soil is less productive due to the lack of sedimentation. The most species rich communities emerge at the convergence of these factors (see table 1). Very rare plants are found in moist and lime-rich conditions.

Avifauna

Approximately 20–22, maximally 30 bird species are native to floodplains. Its characteristic birds are *Charadriiformes*: the northern lapwing, common snipe, great snipe, Eurasian curlew, common redshank; *Gruiformes*: the corn crake, spotted crake. A characteristic species, but one with reducing numbers is the black-tailed godwit; the ruffs have practically disappeared, and the dunlin only has a historical connection to floodplains. Typical water birds are dabbling ducks; the black tern; little gull. All harriers use the floodplain as a feeding place: the western marsh-harrier, montagu's harrier, hen harrier, white stork, black stork, greater spotted eagle, lesser spotted eagle, white-tailed eagle and common cranes who moult and do not nest. During transit migration, floodplains are important stopping and feeding places for not only swans and geese, but also a great number of waders—mainly northern lapwings, ruffs, wood sandpipers and other sandpipers, godwits and snipes. Floodplains are important feeding, breeding and nesting areas for the great snipe.

Fish Fauna

There are approximately 40 fish species connected to oxbow lakes and floodplains, of which European weather loach, spined loach, bullhead and asp are under protection, the last two are only found in oxbow lakes. Oxbow lakes and floodplains are important spawning areas for fish. Therefore, in order to protect the fish fauna, it is necessary to keep the grasslands that are connected to oxbow lakes free of reeds and scrub. In addition to that, oxbow lakes must be connected to the river's main stream bed in order to allow the fish to travel from the river to spawning areas and back after spawning, and also from oxbows to the river in case of oxygen deprivation—especially in winter and midsummer.

Invertebrates

Imagos of aquatic insects like dragonflies, mayflies, caddisflies, some true flies, true bugs and beetles comprise the majority of floodplain insects. The larvae of these invertebrates (dragonfly and caddisfly larvae) that dwell in water—quaking bogs, ditches, oxbow lakes—serve as food for waders. The habitat and feeding preferences of the Clouded Apollo have been studied on the floodplain grasslands of Ahja River and the results showed that this butterfly species depends on bank stretches lined with alders where fumewort, the food plant of the caterpillars grows; adult specimens also use the floodplain corridor for migration and the stretches of alders as hiding places. The hermit beetle, whose preferred habitats are old oaks on floodplains with plenty of light, has been found on the Koiva-Mustjõe floodplain wooded meadows.

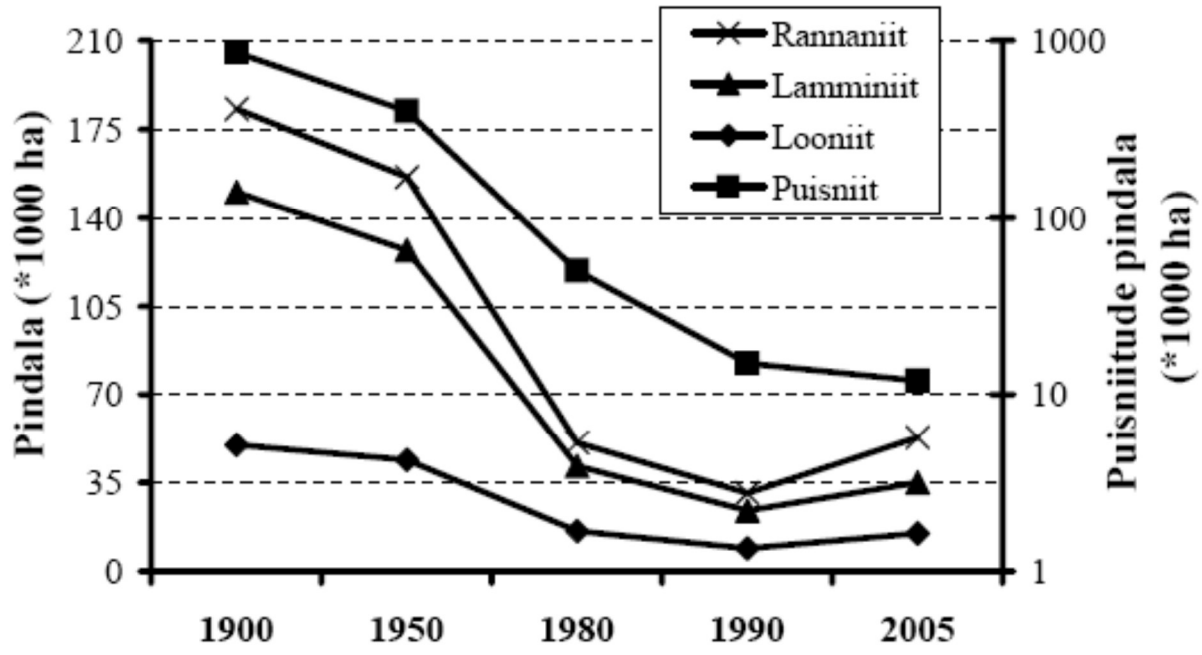
Guaranteeing Protection

The protection of floodplains is regulated by several national and pan-European legislative acts and conventions. The protection of floodplain grasslands means management—mowing and/or grazing, which is preceded by restoration, if necessary—the removal of shrubs and turfs. The management of the semi-natural communities in the Natura 2000 area added to the environmental register is funded by the European Union. The restoration and management (outside the Natura areas) is funded by the Estonian state. Applying for funding for the restoration of floodplain grasslands (including the restoration of the infrastructure) is possible, e.g., through the projects of different foundations.

Inventories, Distribution Dynamics

Several inventories have been organised in order to obtain an overview of the nature conservation condition of floodplain grasslands. As of 2009, the data base of the Estonian Seminatural Community Conservation Association (ESCCA) includes 20,233 ha of floodplain grasslands; in 19,050 ha of those, floodplain grasslands were marked as the first habitat type (in other words, most of the surface area is floodplain). The maximum surface area of Estonian floodplain grasslands was reached at the turn of the 19th century—over 150,000 hectares. By the middle of the previous century, the surface area had reduced to 83,999 hectares and by the end of 1970s—to nearly 26,000 hectares. In 1990, the surface area of floodplain grasslands was estimated to be 20,000 hectares, after which it has been somewhat growing thanks to national and European subsidies, yet the surface area does not considerably exceed 20,000 hectares (ibid.).

Figure 2. The dynamics of the surface area of some Estonian semi-natural communities in the 20th century (ATTENTION! The surface area of wooded meadows is in a logarithmic scale and also describes wooded pastures). (*rannaniit- coastal meadow; lamminiit- floodplain grassland; looniit- alvar grassland, puisniit- wooded meadow; pindala- surface area*)



Condition, Risk Factors

Since the Estonian floodplain grasslands (unlike those in Western Europe) that are being restored have been extensively managed before they fell into disuse, the local vegetation species fund is in a sufficiently good state and creating the conditions of an open grassland is usually sufficient for restoring the species richness. The floodplain grassland water regime has also been changed less in Estonia than in Western Europe. The biggest risk factor is the discontinuation of management and the subsequent encroachment by scrub, the drop in species richness and reduced surface area. In case of smaller floodplains with dense scrub, the fragmentation of communities may also be important—if the species characteristic to grasslands have disappeared, grassland plants from the outside will not spread to the area. One more specific danger that could have a negative effect on floodplain wild birds is mulching (also chipping or grinding—mowing with a rough-cut mower, during which the grass is cut into 10 cm pieces and left on the site afterwards) which is used on several floodplain grasslands.

Representative Estonian Floodplain Grasslands

Extensive (at least about 1,000 ha) representative floodplains can be found in Matsalu and Soomaa national parks, Alam-Pedja nature reserve and Koiva-Mustjõe landscape protection area.

A couple of tens to a couple of hundred hectares of representative floodplains can also be found in the Lahemaa national park, Linnuraba and Keeri-Karijärve nature reserve, Struuga, Ropka-Ihaste and Pajaka landscape protection areas, Käntu-Kastja, Tagajõe and Pärlijõe special conservation areas. The distribution of representative floodplain grasslands in Estonia (areas on the environmental register layer, the representativeness of which or the general nature conservation value of which is ‘A’ and none of the mentioned values are lower than ‘B’) is given on figure 3.

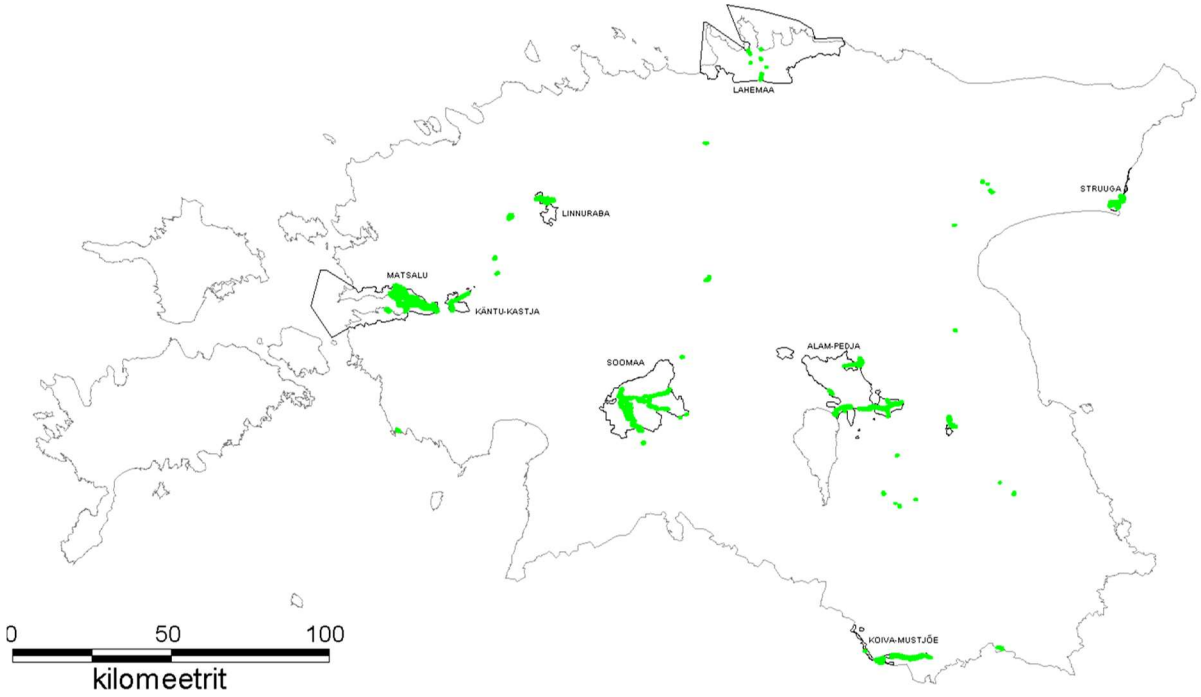


Figure 3 The distribution of Estonian representative floodplain grasslands (altogether 9,195 ha) according to the database of the environmental register as at the beginning of 2011. The most important floodplain protection areas according to the author are also marked on the map.

II Practical Instructions
Condition Indicators of Floodplain Grasslands

Floodplain grasslands in good condition are characterised by functioning flooding and an unspoiled water regime. The floodplain landscape is in a natural state—the (micro)relief is unchanged. There are very little or no shrubs in the area. The indicators of bad floodplain grassland conditions include turfs, vegetation that is higher than in a managed area and sparser topsoil / density of shoots, but also the depth and density of the dead herbage. Managed floodplain grassland is characterised by the occurrence of species connected to a clear floodplain (see "Values"), especially *Charadriiformes*, but also ducks. Floodplains in good condition are characterised by species rich fish fauna and its regular spawning on the floodplain. Species rich insect fauna is mostly connected to the varied grassland conditions.

The occurrence of protected species adds to the value of a floodplain from the perspective of all groups of biota.

Restoration

Selection of the Area

Restoration starts with selecting the area. The possibility of restoration and necessary activities must be assessed from all aspects. Can the restoration equipment and later the management equipment be transported to the area using the current access way? If not, then the first stage of restoration must see to the restoration of the access way, bridges, culverts, etc. Is there any scrub in the area and what kind of equipment is needed to remove it? Are there many turfs in the area and what are the possibilities for their removal? If there are many ditches in the area and one wishes to restore the natural water regime, one should start by filling the ditches and removing the scrub. Is the area a part of the surrounding floodplain grassland complex or does it happen to be only a small solitary fragment? It may be useful to restore even small areas, if it ensures the unlimited spread of species between surrounding floodplains. Is there an idea of how the area is going to be used after the restoration?

Activities

Different kinds of technology can be used to remove scrub: rough-cut mower, guillotine cutter, plow, scrub mulcher, stump mulcher. Scrub can also be removed manually (using a chainsaw and a scrub cutter) from places that are difficult to access. Grazing livestock can easily manage with lower scrub, in case of higher scrub, one must help them. In addition to scrub, rough-cut mower can also be used to remove turfs. Meadowsweet tends to be abundant in places previously inhabited by scrub. In this case, long-term mowing may not help, yet sheep have proved to be efficient in removing it. Low ditches are harder to restore than other parts of the floodplain, therefore there is the danger of leaving the scrub and reeds unmowed in those spots, or they are mowed down too high. Clearing river banks from scrub may prove reasonable in some places, not only to protect the spawning spots of fish, but also to create vistas, additionally, the scrub/forest streaks on river banks may obstruct the free spread of plant propagules. Cleaning the silted mouths of oxbow lakes might be necessary so that fish would have the opportunity to spawn and to travel to the oxbow lake and back even outside the spawning period and so that their young could also travel to the river after hatching. The restoration of the old manually dug ditch systems should be thought through most carefully. Ditches have been dug on floodplains for centuries and their purpose has been to create better mowing conditions on a floodplain, but the drying influence of manually dug ditches was very local and quite different from the current large and deep machine-dug ditches. Since floodplain grasslands are often situated in areas difficult to access and people have stopped using those decades ago, the access ways and ditch/river crossings have often fallen apart.

Management

Mowing

Mowing is the most suitable management method to preserve or increase the species richness of floodplain vegetation. The grass should definitely be removed after mowing and it should be cut low (at 5–7 (maximum 10–12) cm). Grass must be collected in order to stop it from turning into litterfall, which will intervene with the germination of plants and turn the plant litter layer on the top unsuitable for soil biota; nutrients that travel deeper have a negative influence on bird fauna in their turn. It is very important to mow ditches, puddles and oxbow lake and river banks at low height. In order to protect the fauna (including, most importantly, the corn crake), mowing should be done using the "from one side to another" or "parting from the middle" methods, since mowing from sides to the centre will kill the animals and birds who have hidden in higher grass at the last mowing. The mowing time should be connected to the ebbing of the flood—on the nesting areas of the corn crake and the great snipe the mowing should not take place earlier than two months after the ebb of flood waters. Collected grass is traditionally used as forage (bovines, horses). Alternative uses for hay should be found in case of areas that are not grazed or are situated in places where the forage needs of the surrounding area have been satisfied. The options include burning, composting, fermentation of silage in a biogas reactor. Alternative uses should be actively developed for areas which do not have a traditional use for the hay.

Grazing

Grazing will create a more mosaic floodplain community than mowing, since animals eat plants selectively, shape the landscape with moving paths and gathering places, and the structure of vegetation is also influenced by excrements. However, a more mosaic community does not mean greater species richness, since selective grazing will provide certain plants with an advantage point for growing and, on the other hand, the relative importance of the species eaten by animals will decrease.

Since different animals have varied food preferences—for instance, sheep prefer herbs, cows tall juicy plants, while horses are not very selective—it would be best to graze different animals on the floodplain. Floodplains which have been used for grazing historically are the most suitable for livestock. Beef animal breeding is the most widespread practice nowadays. Highland cattle, which are often used for this purpose, are tough and not very demanding, they will manage even in winter conditions and they are also relatively 'wolf proof'—they form defensive circles.