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KESKKONNAAMET

Estonia-Latvia Programme 2007-2013 project

„Tuned nature management in transboundary area of Estonia and Latvia" ("Green Corridor")

MANAGEMENT PLAN

Võru-Sigulda 2013

Content

Introduction

The Nature Conservation Agency and the Estonian Environmental Board Põlva-Valga-Võru region administration on November 1, 2011, launched the project "Tuned nature management in the transboundary area of Estonia and Latvia" (abbreviated as "Green Corridor"). Funding was allocated according to the Estonian-Latvian bordercooperation program. The project is carried out in Southern Estonia and Northern Vidzeme border region NATURA 2000 sites. Project area embraces Ape district, Haanja, Misso, Mõniste, Rõuge, Taheva, Varstu rural districts (including 17 N2000) in Estonia.

Nature is our common value, also the species knows no boundaries, especially in terms of migration. In border regions have remained little affected ecosystem complexes, which play an important role in the Baltic biological and landscape diversity conservation and development as well as strengthening ecological integrity. Therefore the need for a common understanding of the environment and current trends, joint research and concerted action becomes more pressing. Without the common understanding in the nearest future nature values in the border areas may disappear or be significantly threatened. Therefore the main objectives are to create a common database for environmental values that will help in responsible decision- making, as well as to develop a mutually agreed management and habitat management, monitoring and development activities in the cross-border area.

One of the main tasks was the identification of protected habitats and species, compilation of existing information and production of the new data. Particular attention was paid to the capercaillie, great snipe, flying squirrel, *Osmoderma eremita*, river pearl oyster, a variety of butterflies and dragonflies. Summarized the available information on the protected habitats and species in project area - Latvian project EMERALD inventory questionnaire, the current Natura 2000 mapping, researchers persons information (for *Osmoderma eremita*, flying squirrel, Great snipe), the conservation plans and habitat data mapping, forest inventory data and natural forest habitat information.

Although initially it was planned to establish a common methodology for conducting the inventory, the project implementation has shown that it is problematic, as in both countries in cases of inventory of protected habitats are already being used specific methods and forms, which are then used in a national level, gathering information on habitats. While preparing project application, this forms were not yet implemented in practice, so it was included in the application as a common methodology development. When inventories started, it was clear that it would be unnecessary resource consumption - the data collection through yet another method or form. It was therefore decided to use national methodologies, however, during seminars there was gained an understanding of the partners methodology and data collection forms, as far as possible using the findings to obtain the details of practical work.

The following summarize the species and habitat inventory methods applied in the project area, in some places showing differences of interpretation between countries (habitats).

1. Description of the project area

1.1. Landscape

In Estonia, the project area includes two landscape regions – Võru - Hargla Depression and Haanja Upland. In Latvia the project area includes Talava Depression and Aluksne Upland.

The most characteristic elements of Võru-Hargla Depression are Koiva and Mustjõe valleys. Mostly water sedimentary sand flatlands and sandy hillocks and mounds of different origin are common on their banks. There are proglacial flatlands with more difficult texture, formed as a result of recession of continental glacier, in Karisöödi and Mõniste. The altitude varies in Võru-Hargla Depression between 60-90 m above sea level (Arold 2005).

The western part of the territory - a protected landscape area "Veclaicene" area of geographical zoning perspective is in the North Vidzeme (Tālava) constituent Vidusgauja lowland. It`s western part consists of sandy Strenči ice lake plain, which is sharply demarcated from the eastern part by hilly terrain zone - Aumeistari wall.

The middle of territory is located in the Vidusgauja lowland Trapene plain. Characterized by hilly areas, gentle wavy terrain, surface height of 115.8 meters above sea level. The surface is wavy, it consists mainly of fluvioglacial and limnoglacial sediments. In some places can be found moraine hills and ridges.

The relief of the eastern part of the area is determined by its belonging to the highest landscape area of the Baltic States, it is part of Haanja Upland. Haanja Upland continues in Latvia as Aluksne Upland. The distinctive feature of this area is hilly mesorelief with ridges and depressions. In larger scale, Haanja-Ruusmäe hillocks stand out, the landforms with absolute heights of which reach Estonian-Latvian border. Haanja Upland continues there with Paganamaa hillocks. The complicated relief pattern of Haanja-Ruusmäe hillocks is balanced by more extensive flatlands both in the west and east. There is Vanamõisa or Luhasoo on a swamp and mesotrophic mire flatland in the west, and Misso depression, which has a more varied relief and is significantly larger, in the east. In the latter, stony sandy loam and loam flatlands vary with swamp and mesotrophic mire flatlands. Relief is more restless towards Haanja-Ruusmäe hillocks, flatlands are replaced by higher and higher hills and ridges both in east and west.

The absolute heights of Haanja Upland are in majority part of the upland area 200 m above sea level. The highest absolute heights of the project area are up to 250 m. The highest peak of Haanja-Ruusmäe Upland, which remains in the project area, is Paabumägi with its 254 m.

The eastern part is in Alūksne plateau, which as a the large-scale relief occurred at the end of the last icing in terms of different intensities of active glacier ice conditions, in the formation of basic moraine and deformation morain in two glaciers flow contact zone. Aluksne plateau terrain is divided into four areas: Veclaicene hillock, Vaidava abasement, Maliena hillock and Gulbene hill rampart. Jaunlaicene and Veclaicenes parishes differs with particularly rich diversity of relief forms. The major hills - Dēliņkalns (271.5 m above sea level.), which is recognized by the relatively large height (71 m), as well as with gorgeous landscape - steep, wooded slopes, and it is a popular destination for tourists and a popular place to ski (there are ski slopes), Apukalns or Opekalns (235 m above sea level, height 35 m), Garais kalns (Long Hill) - 233m above sea level, Saltupju Hill - 230 m above sea level etc. The whole area hill`s height reaches over 150 meters above sea level.

1.2. Climate

Project area climate as a whole is determined by its geographical location near the Baltic Sea, a region where the dominant air masses are from the Atlantic Ocean. Overall, in the territory prevailing are southwest and west winds that bring moist air mass.

Climate is formed depending on the hilly plateau terrain, causing excessive moisture conditions. In Haanja/Aluksne Upland rainfall reaches 700

- 800 mm per year, but the moisture evaporation is only 400 mm, while in Vidzeme Central plateau - 600-750 mm per year. In adjacent lowlands rainfall is less - 550 - 650 mm. In the plateau slopes there are less repetitive thunder and rain, but fog is seen more often. A significant number of cloudy days. Most rainfall is from June to September (76-89 mm), less - February - March (33 - 34 mm). The average annual relative humidity is 81%. The significant amount of rainfall, mild temperatures throughout the year leads to a higher humidity and cloud cover.

Project area is one of the coldest regions. Snow cover usually develops in mid-November and lasts until the end of March. Snow depth the central part of the district reaches 50 cm and in the lowlands - 25 - 30 cm. Lakes are also longer under the ice cover. Non-frost period is 125-130 days a year.

1.3. Protected territories

Veclaicene protected landscape area established in 1977., the total area of 20,892 ha.

Includes 3 nature reserves - Avoti forest, Dēliņkalns, Korneti-Peļļi. This area stretches into the Jaunlaicene, Markalne, Veclaicenes parishes, as well as in rural territory of Ape. In protected landscape areas are found protected habitats such as forests of slopes and ravines, intact raised bogs, transition swamps and quaking bogs, species-rich dry to mesic grasslands, alder swamps, etc., as well as a number of specially protected plant and bird species.

The most attractive objects are hills - Delinkalns, Pilskalns (Castle hill), Drusku hill, with a magnificent view of the Southern Estonia and the highest point of Baltics - Munamägi, God's hill, Sun hill, Ķauķu hill and others, as well Korneti-Peļļi trench with the current series of 12 lakes - Raipals, Mellītis, Dzērves (Crane) lake, Pilskalna (Castle) lake, etc. Landscape diversity is also provided by Vaidava River Valley with dolomite outcrops and sandstone "Randatu Rock", Dzenīši great willow (thickest in Latvia) and other trees, interesting habitats and biodiversity.

Northern Gauja Protected landscape area founded in 2004., the total area of 21,749 ha. Includes nature reserves Pirtslīča-Līkā atteka (distributary), Zemā sala (Low island), Pukši swamp. PLA has so far identified 126 Latvian protected species. Two insect species - *Osmoderma eremita* and *Xylomoia strix,* as well as two bird species - corncrake and lesser spotted eagle protection in the EU is a priority. Protected natural area has so far identified 26 EU Habitats Directive habitats (11 priority protected) and 14 Latvian specially protected habitats.

Six of these nature reserves (excluding Melnupe forests - in 2004 and Melnsalas marsh - 1999) is founded in 1977. In reserves can be found plants, insects and bird species and habitats that in the

Project territory contains following protected areas in Latvian side:	**Project territory contains following protected areas in Estonian side:**
8 nature reserves: Vadaiņi-marsh, Bedne swamp, White Marsh, Lepuri marsh, Melnsala swamp, Melnupe forests, Sloka marsh, Tetersala marsh	**3 nature protected areas:** Parmu, Mõisamõtsa and Pähni
2 protected landscape areas: Veclaicene, Northern Gauja	**7 protected landscape areas:** Luhasoo, Koiva-Mustjõe, Paganamaa, Peetri jõe, Hino ja Väike-Palkna maastikukaitseala
1 nature monument – Kalamecu-Markūzu ravine	**5 special conservation areas:** Koiva-Mustjõe luha, Peetri jõe, Vaidva jõe, Pärlijõe luha ja Majori järve hoiuala
4 microreserves - Meldrupītes forest, Melnupe forests, Vidaga forests, swamp forests of Gaujiena	**9 permanent habitats**: 8 capercaillie ja 1 lesser spotted eagle

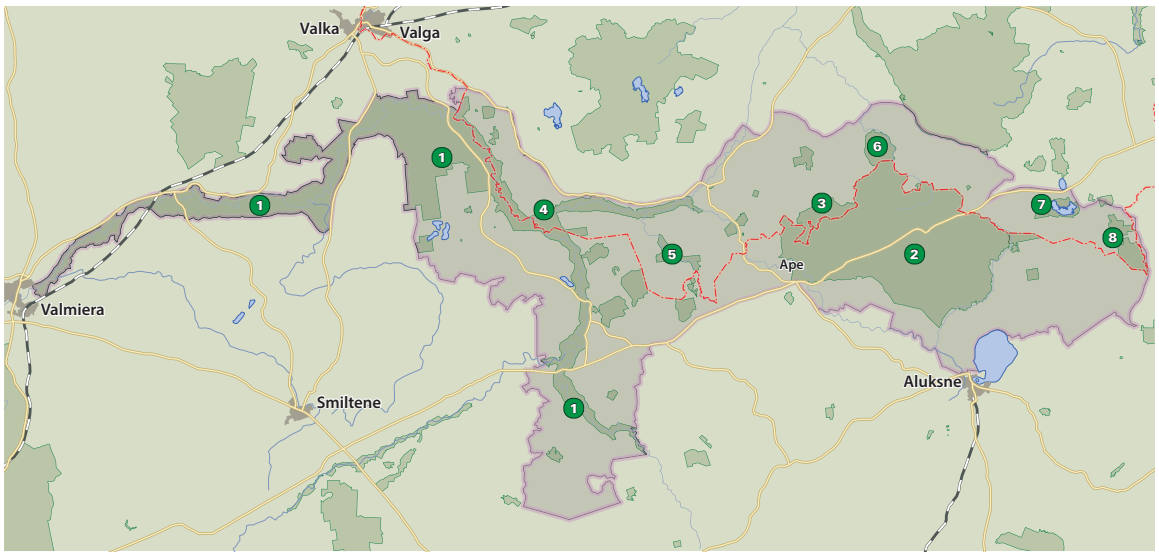

Fig. 1. Protected territories in project area. 1 - Veclaicene; 2 - Ziemeļgauja; 3 - Paganamaa, 4 - Koiva-Mustjõe; 5 - Peetri jõe; 6 - Luhasoo; 7 - Hino; 8 - Parmu.

EU Birds and Habitats Directives are listed as protected.

In the area is also found in a large number of giant (specular, big) trees and geologically significant objects - rocks, etc.

Paganamaa Landscape Protection Area (1024,4 ha) is located in Võru county. The main sights are the deep valley Piiriorg, that separates Haanja upland from the Aluksne upland in Latvia, the chain of lakes and Piirioja Brook, the varied kame relief and kettle holes, ravines and ancient cultural landscape. The highest peaks in the landscape protection area are hills Raadimägi (176,7 m), Kikkamägi (166,4 m) and Trumbipalo (161,4 m).

Peetri river Landscape area (497 ha) The Peetri River Landscape Protection Area is renowned for its geological diversity. Devonian limestone is only seen in Estonia as an outcrop on the banks of the Peetri River at Kalkahju. Beneath the rolling white stone is a cave with a spring, while the limestone and sandstone walls, river banks, meadows and forests provide a habitat for many protected plant species. Karisöödi Park is home to an oak tree which is around 300 years old. It soars to a height of 23 metres, while its trunk measures 4.4 metres in circumference. Peetri River is the habitat of 15 species of fish (including the grayling and river trout) and a spawning site for salmon and sea trout.

Koiva-Mustjõe Landscape protected area (3179 ha) - At the heart of this protected area on the southern border of Estonia is the Koiva River - the natural boundary between Estonia and Latvia - and the Mustjõgi River that flows into it. The symbol of the Koiva River is the meadows that surround it with their old oak, lime and aspen trees. This is also the only place in the country where you will find the European spindle growing naturally. The meadows are the grazing land of Hereford cattle. Tellingumäe is home to a 24-metre viewing tower, campsite and barbecue area.

Hino Landscape Protection Area (697,7 ha) - Is part of the Natura 2000 network of nature protection areas as an important bird and nature area. The protection area encompasses Lake Hino, Lake Idinä and Lake Mustjärv along with two rivers, the Kuura and Pedetsi Rivers. The most noteworthy is Lake Hino with its plentiful fish and many islands and its diverse shoreline and interesting water chemistry (207.1 ha). Over 40 species of birds have been spotted here, of which the most rare is black-throated loon.

The medieval Siksäla kalmõtõmägi burial mound that has been thoroughly studied and has yielded

many artefacts is located in the area between Lake Hino and Lake Mustjärve.

Luhasoo Landscape Protection Area (798,3 ha) - Largest complete bog area in Southern Estonia. It covers about 800 ha and is almost untouched by human activity. Luhasoo is very valuable in terms of environmental and landscape protection both as a uniform ecosystem and the habitat of protected species. The bog is unique for its 15 mineral islands that are on average 1 metre high and have sandy soil.

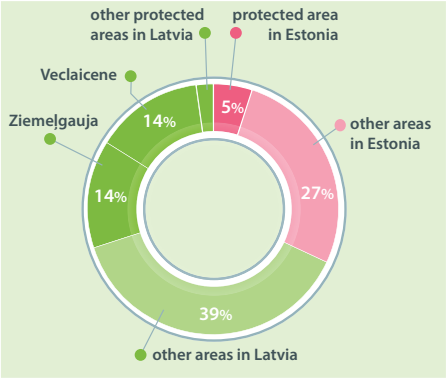

Fig. 2. Distribution of protected areas in project area

1.4. General economical background

The project area is generally sparsely populated, except bigger communities. On average, each municipality is home to about 500 residents, in the major towns the population is larger and the population density is greater: in Alūksne - 19 221 residents, Strenču ~ 1450 , Gaujiena ~ 1140, Ape town – 1083, Varstu- 431, Hargla -223. Spatial population outside the villages are small - 1.4 to 1.9 residents per km2, and now its significant increase is not predictable. On the contrary, over the last 10 years has been seen a gradual population decrease in the region.

Currently, the greatest impact on the area's natural values and landscape are related to logging. Agricultural land occupies about 30% of the territory. The area has quite a lot of small farms, most of them are small, with 1-2 animals. Natural conditions in the area are not suitable for intensive agriculture, although in some places during the middle of 20th century was done of agricultural land drainage and have been cultivated crops - mainly in Gaujiena, Vireši parishes and Zvārtava parish southern part. In the project area there are also abandoned agricultural land that is overgrown and, together with abandoned Soviet-era farm buildings, evaluated as a landscape degrading factor, but here it is not so striking, and overall landscape quality rated as high quality and has good potential of development. The area has a number of common mineral resources - sand and gravel mines.

In largest villages that are not yet towns, are developed small firms, mostly related to logging services, agriculture, tourism, beekeeping, trade. The region is popular for sheep and cattle farming, organic and non-traditional farming.

Main site visitor groups that use spatial resources, are water tourists who use the Gauja river for boat trips, other tourists who come to look at a variety of cultural, historical and natural values, mushroom and berry pickers, people who visit the area on weekends and holidays. According to SC "Latvia State Forests" data, a significant proportion of visitors are hunters (each of the territories hunting organizations has about 10 members, who each is visiting the site of an average of 2 times per month).

2.Tourism in the region

In recent years, tourism in the region is gaining popularity due to the relatively intensive advertising, and the overall rise of interest of eco-tourism, as well as through recreational infrastructure development. The region as a tourist spot is also promoted by local authorities, because the development of tourism is facilitating the development of the region as a whole, increasing economic activity and reducing unemployment.

The most popular tourist destination area is Gaujiena. In future there are expected that protected areas increase the number of visitors, due to the advertising and the growing popularity of recreational tourism in society and recreational infrastructure development in the region and in whole Latvia. Thoughtfully planning site surveys, cognitive and leisure infrastructure, it is possible to organize and direct the flow of visitors, including the shifting it off the highly sensitive nature values.

The area is attractive by its varied landscapes, natural resources and cultural monuments. In most areas are developed tourism infrastructure, organized recreation spots for water tourists, available accommodation.

Tourist attraction of the area is also contributed by the cultural and entertainment events. In Gaujiena since 1988 is being organized J.Vitols Music Festival, in which annually participate about 60 choirs from all Latvia. In Strenci annually in the third week of May takes place Raftsmen festival, in it`s frameworks is organized a raft trip down the Gauja, commemorating the timber rafting tradition in Gauja. In the first Saturday in August is Strenči town festival. During the summer season, between the rafter and the town`s festival celebration, every other Saturday night there takes place action "Evening Music" when musicians in a floating boat in the middle of Gauja are playing popular Latvian tunes.

2.1. Development opportunities

Project area is located Estonia, Latvia and Russia borderzone. It has great potential in nature tourism.

Problems:

- lack of infrastructure for tourism development;
- uneven quality of walking paths;
- lack of information near the tourism objects, information is mostly in native language;
- no joint marketing in the region.

Possibilities:

- joint marketing between the countries (Russia and Latvia joint route development Pihkva – Misso – Veclaicene – Haanja, Ape – Mõniste, Koiva river);
- cooperation between the countries to create tourism products:
- Developing seasonal tourism products: dragonfly survey, mushrooming, hunting tourism etc.
- Developing joint tourism infrastructure (walking paths, routes, bridges etc.) Between the Veclaicene LPA and Haanja NP; developing joint Enviroment educational and Tourism centres.
- Developing water tourism on Vaidava river (from Ape to Metsavenna bunker).
- Compilating informational maretials - homepage of the project area, booklets, mobile applications, detailed maps (in Estonian, Latvian, Russian and English);
- Tourism information in Latvian, Estonian, Russian and in English;
- Cooperation between different partners (nature protection specialists, foresters, businessmen, local municipalities, Regional Tourism Centres);
- Carefully plan the infrastructure, to guide mass tourism away from the sensitive areas.

3. Hunting impact for the nature values

The high abundance of beavers and their dams' effects on the ecosystem of water bodies and on plant community of the river banks

The impact of beaver's activity can be positive or negative depending on nature value. Beaver causes damage by damming up water on forest and agricultural lands. The biggest effect is indisputably on drained forests, followed by effects on water bodies and on banks habitations. Beavers' activity can bring significant economic damage on communities of water bodies and river banks, including salmons, the most important is hindering effect on spawning migration. As a positive effect, beavers' dams establish new habitats and hold large quantities of sediments carried by water, but cause excessive moisture of the banks.

One negative effect in the area results from beavers damaging or even felling old oaks on forest meadows. The riverside flooded forest meadows are characteristic to the region, where old oaks provide conditions for large population diversity. As the number of oaks is small and their growing up takes long time, then the loss of every oak is of big impact.

The main measures are regulating the abundance of beavers, demolishing dams and covering important and especially endangered trees with net. In Estonia hunting of beavers is managed by landowners. Landowner hunts beavers from damage focal himself or finds hunters with appropriate skills. Landowner can demolish the dams without permission if these cause flooding.

Increasing abundance of wild boars and small games due to additional feeding and the resultant negative pressure on nature values of the surroundings

Additional feeding is widely spread hunting measure, which objective is to preserve high abundance of games and to decrease damages caused by games. The main object of feeding is wild boar, for which the number of established

Roedeer. *Photo A. Ader*

feeding spots has doubled since 1991. In addition to wild boar also other mammals attend the feeding spots, for example raccoon dog (*Nyctereutes procyonoides*) and fox (*Vulpes vulpes*). The aggregation of the named species around feeding spots increases devastation of nests of ground-nesting birds (especially endangered are game fowls), damaging of Orchidaceae and aggravation of maintenance of meadow communities (wooded meadows).

Based on Nature Conservation Act the additional feeding of games on protected areas and on species' protection sites is generally prohibited in Estonia.

The negative pressure on nature values deriving from high abundance of small games

After utilization of antirabic vaccine in 2005 the abundance of foxes and raccoon dogs has increased considerably. There can be different reasons for changes in abundance of small games – hunting, diseases, large predators as abundance regulators, abundance of hunting objects. According to experts the spread of rabies has been stopped by vaccination in Estonia, but rabies is the disease that keeps the abundance of these species balanced.

Such dominance by certain species imperils the games that they hunt, including several endangered species (game fowls, Anatidae, but also ground-nesting birds on the fields like corncrake). At the same time the densification of competition on everyday hunting objects (rodents) affects endangered species like owls or spotted eagles.

The main measure is regulating the abundance of small games.

Damages on farm animals and domestic animals done by wolves

From way back people have regarded wolves and other large predators with scare and tried to exterminate them, as they are competitors on food, kill farm animals and have attacked people. At present, the damages done by large predators are the main source of conflict between men and large predators.

As a result of scientific research large predators are being increasingly appreciated in last decades as an important component of ecosystem, but also as nature and hunting tourism object. According to estimations the sustainable size of Estonian wolf population is 200 specimens. Concurrently, wolf abundance is high in Latvia and Russia and as there are no migration barriers such species of extensive movement can effectively migrate.

The main measures are regulation of abundance, compensation of wolf damages and support of protection measures. The hunting limit of wolves is determined on county level by Ministry of the Environment. Inside the county the hunting limit is shared by the Environmental Board according to propositions by Hunting Council. Hunting of problematic specimens is organized exceptionally outside the hunting season by the Environmental Board together with game monitoring department of Environmental Agency. Problematic specimens are wolves who have started to persistently damage people's assets (farm animals).

The compensation of large predators' damages is considered an important protection measure of big predators in Estonia, which improve the locals' attitude towards large predators and nature conservation in general. The damages are directly related to the herding traditions and applied protection measures. The effective protection of large predators' population on actively managed areas is not considered possible without measures to protect the cattle. In Estonia the important measures are chainlink fences the predators cannot come through or electric fence and watchdogs. The Environmental Board supports construction of new wolf safe fences for sheep and purchase of watchdogs up to 50% of the expenses.

4. Alien species

Alien species are species that appear outside their natural distribution area, where these could not spread without intentional or unintended help of humans. Invasive alien species are alien species that can endanger ecosystems, habitats or species and causing economic or ecological damage. The harmfulness of invasive species consists of the following:

- enter into local food chain;
- compete with other organisms filling the same niches;
- can be toxic to local species, including humans;
- carry pathogens and parasites;
- hybridisation with close species;
- weaken genetically the adaptation of local populations.

As of May 2011, 947 alien species are registered in Estonia, of which 739 are plants. The best-known alien species of the project area are Sosnovski hogweed, American mink and raccoon dog, but at present only Sosnovski hogweed is being intensively fought with. Large attention has been paid to monitoring of signal crayfish in boundary water bodies.

On the Latvian side of project area the **Sosnovski hogweed** is widely spread and landowners have to deal with its control. Therefore it is not effectively repelled in Latvia and the exact spread is unknown. On Estonian part there are 12 colonies of Sosnovski and giant hogweed with the area of 4 ha, of these colonies 11 are in Võrumaa and 1 in Valgamaa. The most spread is the hogweed in Misso parish in Võrumaa. In all the colonies hogweed weed killer is being manually used, organized by the Environmental Board with the help of state funds. Since 2007, 6 colonies have been exterminated; in 2010 one new colony was added, in 2011 two colonies, in 2013 one colony and in 2014 one new colony. The vitality of colonies where weed killer has been used for longer time has started to weaken.

Measures (Holm 2010): Detail mapping the spread of distribution, monitoring, constant repelling. Informing the public, involvement, raising owners liability.

Signal crayfish has brought to Europe from America and people have spread it to most European countries except Estonia and Norway. Latvia has encouraged the breeding of signal crayfish and therefore there is big risk on the project area that some specimens have escaped to the nature. The signal crayfish displace crayfish as they are more fertile, aggressive and resistant to diseases and tough environmental conditions. American crayfish are immune to crayfish plague and pass it on. More aggressive American male crayfish mate with native female one, but no offspring results from that and hence the abundance of crayfish decreases. Alien species are introduced into Estonian water bodies by intentional or unintended human activity.

Measures: Monitoring of the Signal crayfish. Informing the public, involvement,

Tab. 1. Alien species distribution in project region and measures.

Species	Distribution	Measures
Warty cabbage (*Bunias orientalis*)	Very rare in Latvia. Common in North-Estonia. Rare in the project area. Distribution is related with roadsides and farmlands.(Kukk &Kull 2005).	Mapping spread of distribution
Canadian Waterweed (*Elodea canadensis*)	Rare in latvia.Common in Eastern part of Etonia(also in the project area). Spreads vegetatively.(Kukk &Kull 2005)	Mapping spread of distribution
Sosnovski hogweedand, Giant hogweed (*Heracleum sosnowskyi, Heracleum mantegazzianum*)	Spreads rapidly in Latvia. In Estonia colonys under control. In Latvia -Alūksne, Maliena, Ape, Mārkalne-Volkova, Kolberģis, Korneti, Lārberģis, Raipala lake, Bērtiņu lake, Alsviķi-Trapene surroundings. Largest areasBārdaskrogs andKorneti surroundings, Popji surrounding, Garožu and Talešu lakes surroundings, 12 colonys (total area ca 4 ha) are found on the Estonian part of the project territory. 11 colonys are located in Võru county and 1 of them in Valga county. Abandoned agricultural lands, roadsides(Kukk &Kull 2005)	Mapping spread of distribution in Latvia. Consistent monitoring in Estonia. Informing the public, involvement, raising owners liability.
Eastern Galega (*Galega orientalis*)	Very rare in Latvia (Dēliņkalnsi surroundings). Common in Estonia.	Mapping spread of distribution.
Hairy Galinsoga (*Galinsoga ciliata*)	In Latvia - Ziemeri, Māriņkalns, Zeltiņi, Alūksne-Māriņkalns, Alsviķi regions. Common in South-Estonia. Gardens, fields. (Kukk &Kull 2005)	Mapping spread of distribution, Informing the public.
Gallant Soldier (*Galinsoga parviflora*)	Registrated in Ape. Rare in Estonia.Not registrated in the project area. Gardens, fields. (Kukk &Kull 2005)	Mapping spread of distribution, Informing the public.
Himalayan Balsam (*Impatiens glandulifera*)	Rare in Latvia - Alūksne, Ape, Maliena, Alsviķi, Māriņkalns regions. In Estonia70 localities (2011), in Valga county 3 and in Võru county2 localities. Forests, parks, banks of the reservoirs, roadsides. Spreading with horticulture(Kukk &Kull 2005)	Mapping spread of distribution. Invasive alien species. Consistent control and monitoring. Informing the public, involvement, raising owners liability.
Small Balsam (*Impatiens parviflora*)	Spreading in Ape, Alsviķi-Krāgaskalns, Gudupji, Alūksne, Jaunlaicene, Grūbe. Spread diffusely in Estonia. Gardens, parks, cemeteries, roadsides.(Kukk &Kull 2005)	Mapping spread of distribution

Large-leaved Lupine (*Lupinus polyphyllus*)	Very rare in Latvia(Alūksne). Common in South-Estonia Meadows (Kukk &Kull 2005)	Mapping spread of distribution. Informing the public.
Ox-eye daisy (*Telekia speciosa*)	Spread in Alūksne, Ziemeri regions. Parks, river banks, gardens. (Kukk &Kull 2005)	Mapping spread of distribution
Thicket shadbush (*Amelanchier spicata*)	Latvijā reti sastopama. Reģistrēta Jaunannas, Zamaņu (Alūksne-Māriņkalns) apkaimē. Rare in Latvia. Registrated in Jaunanna, Zāmani (Alūksne-Māriņkalns) region. Spread diffusely in Estonia. Registrated in the project area - Varstu, Rõuge regions. Naturalized species.	Mapping spread of distribution
Canada goldenrod (*Solidago canadensis*)	Very rare in Latvia, also in the project area. Spread diffusely in Estonia. Meadows, abondoned areas, roadsides. (Kukk &Kull 2005)	Mapping spread of distribution Sabiedrības informēšana
False Spiraea (*Sorbaria sorbifolia*)	Latvijā reģionā reti sastopama suga. Rare in Latvia Spread diffusely in Estonia. Old parks surroundings, abondoned gardens.(Kukk &Kull 2005)	Mapping spread of distribution

5. Protected species

5.1. Inverterbrates

There is not so much information about protected butterfly (*C. hero, E. aurinia, L. dispar, P. mnemosyne*) and dragonfly species (*A. viridis, L. albifrons, L. caudalis, L. pectoralis, O. cecilia*) on the project territory. In order to find out species distribution, size of the population and threats. Inventors that were carried out during the project, gave us new information about there situation in the border areas. Inventorys were carried out on the Natura 2000 areas and on areas located next to Natura 2000 protected areas.

In addition to key species some interesting findings were registered.

Dytiscus latissimus – identified in few lakes near Veclaicene and in one lake near Cirgaļi. The habitat is found at the species most northern distribution limits.

Cucujus cinnaberinus – identified in one habitat near Melnupe. The habitat is found at the species most northern distribution limits (also it is one of the 5-7 up to now know habitats). It indicates a presence of a highly biologically valuable forest in the area.

Hirudo medicinalis – found in lakes near Veclaicene and Alūksne. The findings suggest that it is more widespread as have been considered before.

Nehalennia speciosa – few new habitats were identified indicating that in the lakes of Ape-Veclaicene area a significant part of its population could be found.

5.1.1. Large White-faced Darter *(Leucorrhinia pectoralis)*

Large White-faced Darter belongs to Appendixes II and IV of the EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

It is a dragonfly of average size whose wings spread approximately 55 mm. There are dark spots on the rare wings. Compared with other marsh dragonflies, it is chunkier. Male dragonflies have wider head and thorax, wide and evenly chunky back part of the body, which is black at the bottom and has several red and one yellow triangular spot. Female dragonflies are slimmer than male creatures and there are large orange-yellow spots on the back part of the body.

Large marsh dragonfly prefers small lakes rich in flora, river crooks and canals with slow flow as habitats. Larvae are fond of flora and they live mostly in stagnant waters. The species is mostly endangered by eutrophication of water bodies and changes in landscape, as a result of which suitable habitats will disappear.

It is a rare species in Europe. In Estonia, the species has been scattered but more habitats can be found in South-Estonia. During the inventory of the project area, several habitats of the species were identified but there were no risk factors (e.g. eutrophication of water bodies and changes in landscape.

5.1.2. Lilypad Whiteface *(Leucorrhinia caudalis)*

It is a species belonging to Appendix IV to the EU Nature Directive. In Estonia, the species has been entered in II category of the species under protection and in the Red Book.

Lilypad Whiteface is a dragonfly of average size who is smaller than other marsh dragonflies (the wings spread up to 50 mm). Lilypad Whiteface has a white face and there are dark brown spots on the rare wings. It can be distinguished from other marsh dragonflies by abdomen, which is of club shape and very much wider from the top. Abdomen of male is black with a greyish blue film near the thorax. There are yellow spots on abdomen and wings of female dragonflies.

Suitable habitats are mesotrophic and eutrophic ponds and lakes (the species may be found in swamps as well). It prefers lakes rich in flora and water bodies with larger open water area. The species is primarily endangered by pollution of water bodies and changes in water bodies (deepening and changing the water level). An action plan has been prepared for the protection of Lilypad Whiteface, which foresees different

studies in order to work out necessary measures for the protection of the species.

The natural habitat of the species is not constant in the Central Europe. In Estonia the species has mostly spread in east and several of them are located in South-Estonia. A couple of habitats of the species were discovered during the inventory of the project area. It is not numerous in protected areas (only in some oxbow lakes of Koiva-Mustjõe), and in nature park of Paganamaa (Veskijärve), in oxbow lake of the Koiva River, the habitat is endangered by beavers.

5.1.3. Dark Whiteface *(Leucorrhinia albifrons)*

Dark Whiteface has been entered in Appendix IV to the EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

The wings of Dark Whiteface spread up to 60 mm. The species differs from other similar species due to its lower lip, which is black in the middle and light on sides. The lower lip of other marsh dragonflies is completely black.

Swamp is a suitable habitat, which has small endorheic lakes and bog-pools rich in flora. The species is endangered by the falling number of suitable habitats and loss of swamp and bog landscape.

Dark Whiteface has almost disappeared in Western Europe. This species has spread all over Estonia and some habitats are located on the project area. During the inventory, the appearance of the species was marked in Lagesoo lakes and bog-pools and in oxbow lakes of Koiva-Mustjõe. The species is endangered in oxbow lakes of the Koiva River by beavers but no action has been required for eliminating the risk.

5.1.4. Green Snaketail *(Ophiogomphus cecilia)*

Green Snaketail belongs to Appendixes II and IV to the EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

Green Snaketail is larger than average species of dragonflies. It has green eyes apart from each other, a thorax with wide green stripes and a black abdomen and feet with yellowish-green stripes. It can be distinguished from other snake-tails by the thorax, which looks completely green from the distance.

Larvae of Green Snaketail live on a sandy bottom of small streams with clean water and smaller quick-flowing rivers or on a bottom covered with a thin layer of mud. In order to stay alive they need water rich in oxygen. Imagines live near such water bodies.

According to protection action plan of Green Snaketail, the species is endangered by pollution, straightening, deepening of the water body, and changes in the water level (incl. construction of weirs). In order to preserve the habitats of the species, the above-mentioned activities should be avoided.

In Europe, Green Snaketail has spread until Germany and Denmark. The species has been discovered in places all over Estonia but mostly in South-West of Estonia.

During the inventory, the species was found in River Mustjõe, Peetri River, Laanemetsa stream, where the risk factor is household contamination from the farms close to the river, but no required activities have been foreseen for eliminating the risk. The species was also found in Parmu nature reserve (at the most east and south-eastern border).

5.1.5. Green Hawker *(Aeshna viridis)*

The Green Hawker is the invertebrate of Appendix IV to the EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

It is a large dragonfly, which is similar to other hawkers but it can be distinguished by green sides of thorax and slight brown shade at the tip of the wings.

Several water bodies with stagnant water are suitable to the species (ponds, lakes, peat pits). The species is mostly endangered by eutrophication of water bodies, draining of bogs and loss of water bodies rich in flora suitable for laying eggs and life of larvae.

The coverage area of Green Hawker is from Siberia to North-Europe. It is a rare species. The

biggest risk factors are eutrophication of water bodies, draining of bogs. In Estonia, the species has mostly been seen on the western coast but also in the area between Peipsi Lake and Võrtsjärve. The species was not found during the inventory of the project area.

5.1.6. Clouded Apollo *(Parnassius mnemosyne)*

The species belongs to Appendix IV to the EU Nature Directive. In Estonia, the species has been entered in II category of the species under protection and in the Red Book.

Clouded Apollo is a large butterfly (wings spread until 55 mm). The upper part of the wings is whitish, translucent. There are two black spots on the front edge of the front wings, and the outer edge of the wing is glassy. The inner edge of the rare wings is dark. The species is very similar to the Black Veined White but the latter does not have black spots.

It is possible to find the species in stream valleys, river flood-lands, meadows and at the edge of the forest. The species chooses edges of the forest open to the noon sun as habitat, as there is more food for caterpillar – Corydalis. The existence of the species is endangered by brushwood of meadows, agricultural activities, mining. The species also endangered by grass burning in spring as then the main nutritious plants of caterpillar sprout.

In Estonia, the species has been found in north-eastern, eastern and south-eastern parts of Estonia. During the inventory, a population of average number was marked in Parmu nature reserve as well as Koiva population was marked where single individuals were noticed. Parmu population is endangered by growing over and trash around the farm and meadow of the Pedetsi River. It is necessary to cut brushwood in suitable habitats and cut the grass on the meadow. After cutting, the grass needs to be taken away. Koiva population is endangered by crushing of the grass, which should be replaced by cutting and taking away of the grass.

5.1.7. Large Copper *(Lycaena dispar)*

The species belongs to Appendixes II and IV to the EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

It is a butterfly, which belongs among copper butterflies with the spread of the wings up to 27 mm. The upper part of the wings is glossy red with a dark pattern. The main colour of the lower part of the rare wing is light greyish-blue.

According to the protection action plan of Large Copper, meadows, flood-lands of rivers, swamps, damp high-grasslands and banks of water bodies are the most suitable habitats for the species. The species is endangered by draining of swamps, growing over of open landscape (no maintenance work) as well as long-term floods in habitats, soil contamination, usage of fertilisers and too intensive agriculture.

The species is wide-spread in Europe but it is a retreating species. In Estonia, it is spread all over the country but mostly on meadows, flood-lands of rivers, swampy meadows and banks of the water body in South-Eastern part of Estonia. During the inventory, the species was marked in Peeli River's beaver dam and on the meadows of Luhasoo landscape protection area.

Taking into account the currently good situation of the species in Estonia, it is foreseen in the action plan of the species that no mowing practices oriented to Large Copper need to be implemented in habitats. However, extensive grass cutting is needed in the habitat of the species – otherwise the habitat would be full of brushwood and nutritive plants would disappear. If possible, the grass should not be cut every year in the habitat but every 2-3 years. Further advice for maintenance and management can be found from the action plan of the species.

5.1.8. Marsh Fritillary *(Euphydryas aurinia)*

The Marsh Fritillary belongs to Appendix II to the EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

The wings of the Marsh Fritillary spread up to 41 mm. The main colour of the upper part of the wings is yellowish-brown with a blackish drawing and yellowish spots. The upper part of the rear wings has a number of black spots,

which distinguish this species from others. The edge of the lower part is greyish-yellow.

Suitable habitats for Marsh Fritillary are damp grasslands with low herbs, which can be found at the edges of swamps, on river banks and glades. According to the protection action plan of Marsh Fritillary, it is important to keep the nutritive plants (e.g. *Succisa pratensis*) surrounded by lower plants than they are in order to preserve the species. The eggs and caterpillars feeding in a cobweb should be exposed to sunlight, the soil should be moderately damp and this should be relatively stable (developed moss layer contributes to this), and there should be no risk of flood during vegetation period. In European scale, it is a retreating species. The species has spread all over Estonia but locally. As a result of the inventory, a small population was discovered in the south-eastern part of Luhasoo landscape protection area, where the risk factor is growing over of the area and waste. These are lands of a former farm, where grass should be cut and taken away from the point of view of preserving the species. In case of herding the habitats (in order to keep the meadows with low herbs), too intensive herding should be avoided not to destroy the flora and cobweb nests of caterpillars due to treading. It is recommended to herd animals there after several years or to keep 0.4 – 0.7 animals per 1 ha.

5.1.9. Woodland Brown
(Lopinga achine)

It is a species, which belongs to Appendix IV to EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

The wings of Woodland Brown spread up to 48 mm. The upper part of the wings is brownish, outer part of upper part of front and rear wings have a row of black spots surrounded by a yellow circle.

Brown Woodland prefers coniferous and broadleaf forest, oak forests and meadows with lush undergrowth as a habitat. The species is endangered by forestry (clear-cuttings as well as afforestation and growing of brushwood) as well as by agricultural activities.

In Europe, the species are spread from North Spain, northern part of the Balkan Peninsula to South Scandinavia. In the scope of Europe, it is a retreating species. In Estonia, the species has spread all over the territory in coniferous and broadleaf forests rich in species and with lush undergrowth and on meadows. The risk factors affecting the species are clear-cuttings, afforestation and growth of brushwood. During the inventory, the species was found from Parmu nature reserve and Luhasoo landscape protection area but no above-mentioned risk factors were found.

5.1.10. Scarce Heath
(Coenonympha hero)

It is a species, which belongs to Appendix IV to EU Nature Directive. In Estonia, the species has been entered in III category of the species under protection and in the Red Book.

It is a small butterfly (the wings spread only up to 25 mm). It can be distinguished from other species belonging to the family only by catching it or when the creature is feeding. At the back of the specie's front wings can be seen three swollen tracheas, the upper part of the wing is dark brown, lower part of the rear wings has a narrow white stripe towards tarsus from the line of eye spots.

It is a species that likes to be in damp broadleaf and mixed forests, brushwood, swamps and excessively damp areas. It is endangered by draining of habitats, agricultural activity, changes in grasslands and usage of forest areas.

The species is primarily spread in North-Western Europe but it can be found also elsewhere. In Estonia, it is spread all over the country but only in few known habitats. During the inventory, the species was found in Luhasoo landscape protection area and according to the expert, there were no risk factors.

5.1.11. Hermit beetle
(Osmoderma eremita)

Hermit Beetle is one of the largest beetle in Europe and also endangered.

The entire life cycle of the beetle can take place within the hollow of just one tree, this elusive species spends three to four years as a larva,

feeding on the rotten wood in the centre of the hollow. It pupates in autumn, constructing a cocoon out of its excrement and wood mould, and then emerges as a beetle the following summer. Dispersal is limited, as although the beetles can fly, very few do, and even then, rarely further than 100 metres. For this reason the beetles require a stable environment with suitable habitat very nearby. Usually, adult hermit beetles are found from July to September. In field studies, the lifespan of adults has been up to one month, while in the lab, hermit beetles, especially females, may survive much longer.

There is only one known population in Estonia in Koiva-Mustjõe landscape area. It was discovered on the oak tree in 1995 (Süda, 1998, 2003, 2004, 2006).

During the inventories (2012) in Koikküla, Laanemetsa, Mõniste, Rõuge, Viitina, Karisöödi and Ruusmäe parks and in Vastse-Roosa, new populations were not found.

Measures: Removing undergrowth around habitat trees.

5.2. Birds

5.2.1. Western Capercaillie *(Tetrao urogallus)*

Western Capercaillie is the largest member of galliformes in Europe. The feathering of male Western Capercaillie (the cock) is mostly dark grey and black, and of female Western Capercaillie (female) brownish. A female bird is bigger than a heath hen, who is distinguishable by a large rust-red spot on the chest, and a longer and more round top of rusty tale (Cramp et al., 2004; Jonsson 2000). Western Capercaillie has a strongly represented sexual dimorphism: male is clearly distinguishable from female.

Western Capercaille belongs to Category II of the types of birds under protection in Estonia (RT I 2004, 44, 313). In the last report of the Estonian Red Book (2008), Western Capercaille belongs to the class vulnerable, the hazard factor of which is noted to be forest draining, changes in the age of the forest, clear-cutting and disturbance (Report of Estonian Red Book 2008).

Western Capercaillie is a sessile bird in Estonia and its circulation coincides mainly with that of the pines and ordinary blueberry. These two species are the most important source of food for Western Capercaillie respectively in winter and in summer. The playing areas of the Western Capercaillie are mostly in the pine forest around bigger or smaller bogs, where the forest is most often 81-126 years old. Mostly they visit traditional playing areas, which may be used for decades by cocks. Older cocks come to the same playing area during sequential years. The average scattering distance of Western Capercaillie is considered to be 10 km.

The Western Capercaillie game lasts from March to the middle of May, and the game is the most active during the period when female Western Capercaillie visit the playing areas, which lasts usually for a couple of weeks. The nest is mostly in the forest close to the playing area and the hatch may move later to the suitable feeding area, which is located hundreds of meters further. The mortality of chicken is the highest during three first weeks after hatching when chicken eat only insects, depending at the same time a lot on their mother in order to keep their body heat.

Western Capercaillie eats mostly vegetarian food. Pine needles constitute the main food basis in very snowy winters. In spring, after the snow has melted, Western Capercaillie eats mostly pine needles and buds, blossoms of hare's-tail cottongrass, leaves of Andromeda and sprouts of blueberries in Estonia. Summer is the most energy-consuming period of time for Western Capercaillie as body energy reserves need to be restored after the game period in spring and moulting begins. During this period, male Western Capercaillie chooses fur forest growing on nutritious earth for their living place, and at the same time the usage of old natural forest increases during the whole summer. In this habitat, the cocks feed on plants, which are rich in proteins and they contain easily assimilated energy such as the species belonging to blueberry family, herbs and Pteridophyta. The cocks are not territorial in summer and they often appear in groups during the whole summer, and cocks of the neighbouring games may share one and the same habitat in summer. Female Western Capercaillies without a family are more often to be found in younger and thicker coniferous

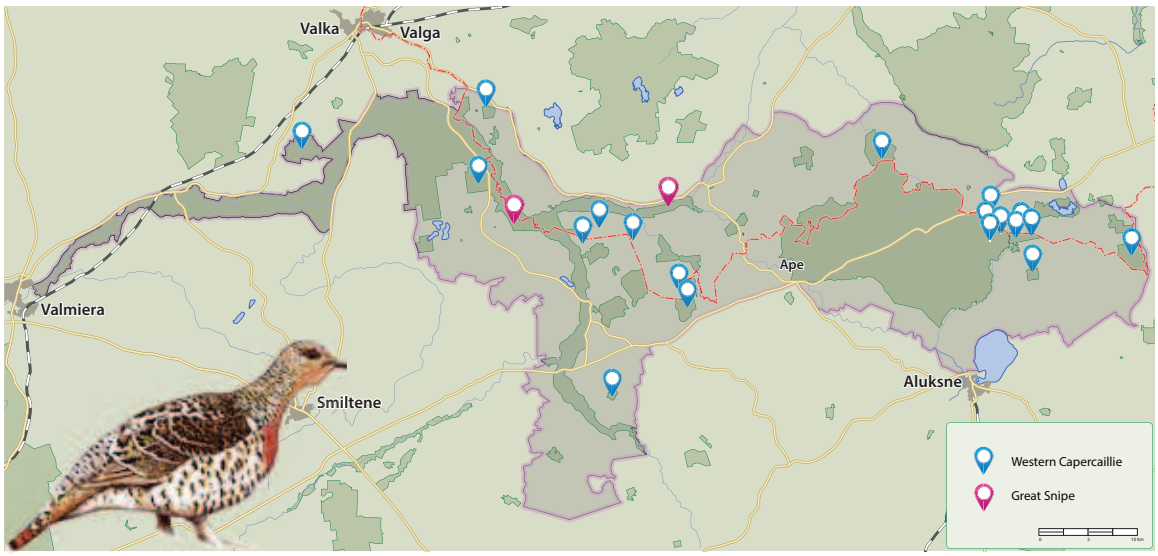

Fig. 3. Lekking sites of Western Capercaillie and Great Snippe in project area

forests. In winter, Western Capercaillies prefer old pine forests close to their playing areas.

According to the analysis of coherency of habitats, efficiency of defence and condition of habitats of Estonian population of Western Capercaillie (*Tetrao urogallus*) (Leivits 2012), the forest population of Estonian Western Capercaillie is divided into core areas, which are three-dimensionally distinguishable, consisting of coherent games. According to this analysis, there are three core areas of Western Capercaillie in the project area – Hargla, Misso and Rõuge. These core areas form together 54,588 ha (5.6% of the habitat predicted in Estonia), they include 15 games and 30 cocks (2.9% of Estonian population). Almost all playing areas are under protection but abundance has decreased in most of the games.

The average scope of the Western Capercaillies' games has significantly decreased in all Estonia in the perspective of 25 years. The most important negative risk factor to the scope of the game is considered to be the effect of ditches. Clear-cutting in habitats of Western Capercaillies is considered to be a risk factor of great importance as well as long-term changes in landscape, whereby the games are in danger of staying in isolation and fragmentation of preferred habitats. Predatory and disturbance by people are considered to be a risk factor of average importance.

5.2.2. European Roller *(Coracius garrulus)*

Bird prefers to nest in sparse pine or oak forests. The main cause for the rapid decline in the roller population in Europe is due to major changes in agricultural practices and forestry (lack offnesting and feeding sites, use of pesticides). Information on mortality in wintering areas and during the migration is rather poor. In the 1950s, thousands of pairs were breeding in Estonia, yet a rapid decline occurring in the European population also affected the Estonian population. In order to improve the breeding conditions and to enhance the population growth of rollers, which is cut off from the southern population, a nestbox program was launched in 2000 (Lüütsepp, 2011).

In project site the European Roller´s inventory was performed in Northern Gauja landscape protected area, which is known as a historic Roller´s nesting territory.

European Roller tracking is performed by checking certain known cages, as well as gathering information about local landowners

observations. Latest news from the landowners says that in 2011 spring the European Roller have been observed, but not anymore in 2012. During 2004-2005 in area were located 46 cages. Cages were yearly tested up to 2006.

In 2012 tested cages were not found any signs that the European Rollers are nesting there. There were found other species - The common starling (*Sturnus vulgaris*), The European Pied Flycatcher (*Ficedula hypoleuca*) and the Common Redstart (*Phoenicurus phoenicurus*).

Measures: Placed cages should be monitored further, as well as should continue displaying new cages, repairing and routine testing

5.2.3. Great Snipe *(Gallinago media)*

During the late 19th and early 20th century, populations of great snipe started to decline. According to experts opinions 25-30 years ago was great snipe widespread species. In 2002 there were 500-700 nesting male birds in Estonia. Nowadays there are 400-600.

Great snipe populations inside the protected areas are quite stable (Alam-Pedja, Matsalu, Soomaa, Koiva-Mustjõe). Populations outside of the protected areas are declining. Interesting is that some lekking sites are growing quite large (there are 3 known lekking sites where number of male birds is 30-40).

In the project area, there are 4 known great snipe lekking sites in Estonian side and 2 in Latvian side. Together they are forming one vital population in a small area close to Koiva river and Mustjõgi.

During the inventorys in 2012 there were counted 9 birds in Estonian side and 6 birds on Latvian side of the project territory.

Major threats for the species are overgrowth in the great snipe lekking sites and insufficient quality of maintenance.

Measures: habitat maintenance

5.3. Flying Squirrel *(Pteromys volans)*

Flying Squirrel has received its name from hairy folds of skin between its fore and hind legs which help it to make jumps up to 50 metres from one tree to another.(Timm 2012). Flying squirrel is nocturnal and require mature trees with classic understory with fallen rotting logs for nesting and a food source. The rotting logs have a fungus that is an important food source. In recent decades intensive woodcutting has decreased the number of old forests and particularly old hollow aspen trees that are suitable for Flying Squirrels. It is considered vulnerable within the European Union.

6. Habitats

Based on the analysis of the collected information, forest and meadow habitat mapping was done in Veclaicene landscape protected area and in Koiva-Mustjõe, Hino, Peetri river landscape areas. O for the areas Natura 2000 habitat information was available. Northern Gauja updated information on the habitat " Wooded meadows" (code 6530) spread using remote sensing data. River habitats inventory done in Latvia, in Estonia river habitat mapping has been done in previous years.

Habitat identification is based on the European Commission 2007´s "Interpretation Manuel of European Union Habitats". Each EU member state can develop its own interpretation of the method by adjusting the country´s situation, vegetation and habitat types. For Latvian habitat inventory used in 2010 published " The European Union habitats in Latvia. Determination Guide". In Estonia Habitat Directive Handbook was used.

During inventory for each habitat polygon was filled a certain form of questionnaire. Standardised questionnaires since 2012, are used in all Latvian habitat inventory and mapping of N2000 sites, also in N2000 habitat monitoring, as well as other various projects inventories and surveys (such as JSC "Latvian State Forests" performed eco-forests inventories) for the country to collect data in a joint form, so it would be comparable and includable in a joint database (Database OZOLS in Latvia and database EELIS in Estonia)

6.1. Forests

Forests cover up to 64 percent of the area of this project. According to a basic map of Estonia there are 31160 ha of forests in the Estonian part of the project. The average percentage of forests is thus higher than the average in Estonia, but the landscape includes few large ancient forests. A large part of the forests started to grow on former farmlands after the last war and most of those are birch or grey alder forests and diverse coniferous forests that have developed out of the two previously mentioned.

Densely forested areas are:

- Areas covered with coniferous forests near the Koiva River (Koiva-Mustjõe landscape protection area). This is a homologous mass of forest where the habitat types are not particularly diverse and are differentiated mainly due to the age of forests.
- Pähni – Mõisamõtsa – Villike area stretching from south to north within the middle part of the area. This is a semi-natural landscape where the forests make up an important part of the diversity of the landscapes. This area has a long history of human impact. The forest within this area can be divided into coniferous forests and bog woods.
- Eastern set of forests (Parmu, Hino). The main assets of this area are the ancient farmlands. The high amount of natural forests in this area is caused by the complications of maintaining a forest due to the high number of swamps. Most common types of forests include coniferous and fen woods.

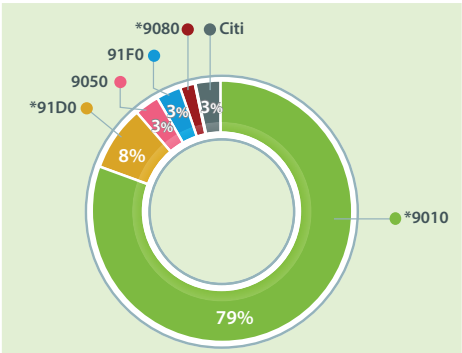

Fig. 4. Distribution of forests according to forest habitats inventory

Half of the forests in this area are middle-growth stands, the second highest proportion are old-growth stands and the smallest proportion belongs to young-growth stands (according to the Forestry Management). The amount of

middle-growth birch and alder forests shows massive desertion of farmlands and over-growing.

52% out of all the forests within this area belong to the state. The most common type within the project area is the coniferous forest growing on eskers, kames and outwash plains on oligo- to mesotrophic sand and gravel soils. Second most common are coniferous forests growing mostly on a sand and clay mixed soil on moraine hills.

30% of forests in this project lie within protected areas, of which 9% lie in conservation zones and 21% in restricted areas. Protected areas with the largest amount of forests are Koiva-Mustjõe Landscape Protection Area, Parmu Nature Reserve and Paganamaa Landscape Protection Area. Considering the protection of forests, Mõisamõtsa Nature Reserve, Pähni Nature Reserve and Hino Landscape Protection Area are important as well.

Forest communities were taken in stock only in protected areas. 2194 ha (28%) of valuable forest communities have been surveyed. 1744 ha of those are western taigas (9010) in good protectable condition, followed by 182 ha of fen forests.

Factors affecting forest habitats:

- Trampling of tender plant communities (unregulated visiting, off-road motor vehicles)
- Uncoordinated forestry, ignorance of forestry restrictions, fragmentation of habitats due to the building of infrastructure, arefying of forests, establishing of new strip mines in ancient forests
- Exploitive deforestation, stealing
- Danger of fire

6.1.1. Inventory of forest habitats in Estonia

The inventory of forest habitats was organized in Estonia in 2012 where altogether 3959 ha of forests were surveyed. Inventory included 7 protection sites for Western Capercaillie, 1 site for Osprey and conservation zones of Hino, Peetri and Koiva-Mustjõe Landscape Protection Areas. Based on the methods, a database for forest habitats was compiled where in addition to the borders of protection sites, filled forms and pictures from the fieldwork were added. Standardized field work forms for forest habitats inventory were used. 1518 ha of forest habitats, of which more than 1/3 were in Koiva-Mustjõe Landscape Protection Area, were mapped as a result of this project.

38% out of the inventoried area (3959 ha) turned out to be some sort of forest habitat, of which 23% has a good quality (A or B presentability).

More potential habitats could have been mapped as generally only important connecting buffer zones with other habitats or zones with a clear and high value were mapped as protected areas. This presupposes sustainable use of resources in the protected areas and that most forests should conserve at least some sort of a reservational value even while being continuously maintained.

The largest homogenous areas were bog wood (*91D0) and western taiga (*9010) habitats according to the size of the areas. The smallest and less common were representable broad-leaved forests (*9020), scree forests (*9180) and deciduous swamp woods (*9080).

6.2. Meadows

Semi-natural communities, also known as natural heritage, are communities with a natural set of species that has evolved over time due to continuous moderate herding and mowing. Maintaining semi-natural communities is one of the most important areas of responsibility. Semi-natural communities include alvars, dry meadows, flood meadows, marsh like meadows, wooded meadows, coastal meadows and wooded pastures. Semi-natural communities are described through a large diversity of plants which fulfils the necessary requirements for other communities of species to develop.

Within the area of the project, one can find flood meadows, marsh like meadows, wooded meadows, coastal meadows and wooded pastures with the most important places being the valuable flood meadows, wooded meadows with ancient broad-leafed trees, dry meadows with junipers and sandy, dry herdable pastures around Koiva river and Mustjõgi. Meadows around Koiva are unique in Estonia – plant communities can be found there that are more common in western Estonia and are attracted to limestone.

Main factors endangering semi-natural communities are as follows:

Overgrowth

Overgrowth endangers all meadow communities with high diversity of species, where a lot of species depend on traditional maintenance. Lack of maintenance has many important reasons including lack of economic interest against maintaining a semi-natural community, missing knowledge considering nature preservation and demands upon maintenance of semi-natural communities, small settling in rural areas, sophistication of maintenance and the cost (meadows are often found in places hard to reach or which are easily flooded), lack of maintenance equipment, lack of use for mowed hay and the cost of transport.

Although different schemes for financial support have been established for reconstructing, maintaining and investing, people tend to think of them as to complicated and thus forsake the maintenance. The reconstruction takes place with yearly agreements or contracts, which does not offer continuity and creates uncertainty in participants.

Mismatching maintenance and insufficient quality

Wrong measures of maintenance and insufficient quality are the reasons why the situation of semi-natural communities has not improved in all areas under maintenance. Improper maintenance is referred by the decreasing amount of plant species related to semi-natural communities (natterjack toad and eurasian woodcocks), even if the area under maintenance is growing.

Common problems are mismatching maintenance patterns and the impact of herding, wrong technical methods (hacking, crushing) and failure to clean up the hay. Most common is the low frequency of mowing and low load due to herding, excessive mowing or herding is not dominating, but can happen. Mismatching maintenance is a bigger problem regarding flood meadows (also dry meadows). Maintenance needs consideration due to the different needs of different species of plants.

Culturing of semi-natural communities

Culturing can be understood as a change of species in habitation (seeding hay), as fertilization and is a problem especially outside areas under conservation. Culturing endangers (and has endangered) dry meadows in special.

Biomes such as wooded meadows can be divided into meadows and pastures according to their use. Due to the natural similarities they are usually thought of as two similar subspecies of one semi-natural community. The main difference lies in the handling: wooded meadows are taken care of through mowing and wooded pastures through farming. Wooded meadows are natural meadows with sparse growth of trees and bushes. Yearly mowing and shaping of trees and bushes is a necessity for the wooded meadows to endure.

Landscapes similar to wooded meadows could have been developed by our ancestors a long time ago by continuous disbudding, herding and later, hay making. The pasture is historically probably the first semi-natural landscape. The development of wooded meadows strongly evolved with the use of scythe in the second half of the first millennium AD. The heyday of wooded meadows, as of other half-natural landscapes, was the end of 19th century and the beginning of the 20th, when the demand upon farmlands was the highest and such meadows could have embraced one third of the total area of Estonia.

The 6000 ha of wooded meadows in Estonia have retained a high or average geobotanical and preservational value. In addition there are around 4000 ha pastures. Around 2700 ha of wooded meadows (32% of total area) are located in different nature preserves. 45% of wooded meadows with a high preservational value are under protection as are 35% of meadows with an average value and 24% of meadows with low value, but which can still be restored.

Wooded meadows and pastures are mostly common to the western part of Estonia but are sparse in southern Estonia. One of the most representable locations is found in the landscape protection reserve of Koiva-Mustjõe where 133 ha of wooded meadows are registered. The wooded meadows of Koiva are unique in the whole of Estonia. The micro relief of meadows and thus the vegetation varies a lot due to a large

part of the wooded meadows lying within flood plains. Trees, of which broad-leafed are most common, and bushes differ from each other in groups. Such wooded meadows in southern Estonia are of high value due to the content of carbonates in soil. Accordingly, species that are keen on limestone and can usually be found in western Estonian semi-natural habitats are located there.

Main factors affecting wooded meadows/ pastures are:

- Overgrowth/reforestation
- Lack of mowers/herders (even potential), lack of interest in restoring and maintaining.
- Wrong methods (no mowing and continuous herding)

During the inventory within the project, only wooded meadows currently being taken care of and the bordering restorable areas were described. Areas charted elsewhere where marked as pastures due to lacking evidence of mowing. The composition of plant species almost uniformly referred to herding. Existing or overgrown sparse tree fronts were considered as wooded pastures, not areas with single groups of trees or areas and groves with a developed tree front.

Generally typical wooded meadows can not be found in this area as mostly one can find single groups of trees or single trees on levees and the surroundings of oxbow lakes. Thus the trees and bushes are in a large way spatially separate from the meadow and have historically been very sparse, meaning that the amount of trees on the meadow has always been very low. Oaks and other broad-leafed trees are still vital for the habitat. Maintenance of a pasture is based on herding (with a load of 0,3-1 animal units per hectare) and occasional disbudding and pruning of bushes and trees. It is not necessary to remove all the bushes as the animals will keep their growth under control. The distribution of trees and bushes should not be too regular. In terms of forestry the pastures have a certain value, the trees should be selectively fallen according to necessity. Herding load should be kept at the optimum and under, or excessive herding should be avoided. In case of low load from herding, some of the plant species will not be eaten enough and they will start to dominate the community. If the load is too high, unnecessary roads, trampled gathering places and piles of excrements will occur, the animals will be short of food, will begin eating the bark of the trees and attempt to escape the pasture. The pasture should be divided into smaller paddocks for a balanced load.

6.3. Rivers

6.3.1. Gauja / Koiva

.Koiva River is part of the Livonian bay watershed. To protect the river and the species within, the river has been added to the Koiva-Mustjõe flooded meadow natural area. The Koiva-Mustjõe landscape preservation area is considered an important site based on the nature protection directive of habitat types (rivers and lakes, 3260) and the species mentioned in the appendix II and III.

Koiva river is dark watered, rich in humic matter and according to the results of surface water monitoring the water in Koiva river is of a high quality (Program of preservation for the Koiva-Mustjõe landscape protection area and Koiva-Mustjõe preservation area from 2010 to 2018). The water quality and system is influenced by tributaries of which the biggest is Mustjõgi.

Koiva river, Mustjõgi, Peetri river and Vaidava river are either fully or in parts included in the list of rivers for salmon, brown trout and grayling for spawning and living.

The length of the Koiva river is 452 km long (24 km along the border between Estonia and Latvia) with a gradient of 234 m and a basin of 14 380 km^2.

6.3.2. Mustjõgi

Mustjõgi is the largest and most voluminous tributary of the Koiva River. The source is a lake called Suur-Sarjärv. The water system and quality of water depends heavily on the tributaries feeding Mustjõgi. Mustjõgi belongs to the Koiva-Mustjõe flood meadow area and Koiva-Mustjõe landscape protection area and is considered an important site based on the nature

protection directive of habitat types (rivers and lakes, 3260) and the species mentioned in the appendix II and III (Environmental registry, 2013).

Following species protected by the nature directive have been found in Mustjõgi: spined loach, European bullhead, salmon, European river lamprey and large white-faced darter.

The river has been altered at some places through dredging or straightening (Koemetsa and Kurgjärve marshes for example) so it has not remained fully natural. The upper course is sparsely inhabited and mainly consists of marshlands. Mid-course runs mainly between farmlands and within couple of hundred meters one can find settlements. The river banks consist mostly of forests (Järvekülg, 2001).

No information of pollution sources at the banks of Mustjõgi exist. According to the national hydrobiological complex monitoring, the situation of the river within the Koiva-Mustjõe landscape protection area and Koiva-Mustjõe water meadow reservation area is considered very good or good. Benthic habitat is considered to be in a very good condition. Trophic diatom indexes valuate the situation of the river as being mediocre, but there is no reason for it. According to the fish stock, the situation of the river is in-between good and mediocre.

The river, its habitat and its situation needs additional investments, less pollution from settlements, and farming can also be a hazard (although the situation of Mustjõgi is good). As it is a good fishing river, illegal fishing is a potential threat but can be prevented through regular monitoring.

Mustjõgi is 84 km long with a gradient of 30 m and a basin of 1820 km^2.

6.3.3. Vaidava

Vaidava river, the largest tributary where the rivers join, is the fastest, clearest and coldest, especially in the summertime, thus having an important impact on Mustjõgi.

The water in upper course is dark, the flow is slow and the river is relatively deep and warm throughout the summer. The bottom is muddy and full of organic debris. The banks are swampy and unevenly wide (pond-like widening) with growth of *Phragmites australis* through 5 km after flowing out from the lake Muraste. Flow rate is less than 0.2 m/s and the river complies with the habitat type 3260.

Up to 2 km from a forest road before Ziemer, the flow rate increases. The banks are usually flood-meadows that have not been taken care of and are overgrown. The bottom is usually sandy with muddy places and organic debris. The plant habitat is poor, major species are *Phragmites australis* and *Phalaroides arundinaceae* and the more uncommon ones are *Sparganium emersum*, *Nuphar lutea*, *Elodea canadensis*.

The width of the river downstream from the Grübe mill is 15 to 20 meters. The bottom varies - dolomite, sand, pebbles and some rocks. High sandstone outcrops can be spotted, with the most famous ones in Ape being 8-10 meters high and up to 100 m long. The left bank, burrowed by the Vaidava River, is called ‘The Witch cliff’. The flow rate of the river is more than 0.2 m/s and the habitat is in compliance with the Natura habitat type 3620.

Vaidava River in Estonia is considered a natura habitat type 3620 from Vastse-Roosta to the mouth of the river, a total of 11 km, The river is almost fully in its natural basin. The outflow is near to its natural conditions.

Species protected by Natura include: European river lamprey, salmon, grayling, asp, spined loach, European bullhead, thick shelled river mussel, *Ophiogomphus Cecilia*.

One of the main threats in the Estonian part is the dam in Vastse-Roosa. The main threat of this dam, lying outside the Natura areas, is its thwarting of fish migration, raising the water temperature during the summer, raising the threat of pollution through sediments and its impact on the hydrological water regime. Beaver made dams have a similar, but significantly smaller impact. Main threats are temporary and in case of very low water levels only. In Estonia, beaver dams have not been reported yet, but in Latvia the chopped trees in addition to the dams can be a cause for erosion on the banks, changes in the quality of the habitat and can thwart fish migration. Pollution from farming is minimal due to a large buffer zone between the banks and farmlands.

The best solution to preserve the communities and the river would be to destroy the dam or to lower the water level of the dam and the building of a natural rapid. In addition beaver dams should be demolished, trees fallen to the river should be removed and illegal fishing should be stopped, especially during the migration in the spring (second half of April until the beginning of May) and autumn (the end of September until October).

Vaidava River is 72 km long (61 in Latvia) with a gradient of 107 km and a basin of 557 km^2.

6.3.4. Peetri river

Peetri River is the second largest tributary river of Mustjõe, after Vaidava River. The springs constitute a small proportion in feeding the river, thus the amount of water flowing is significantly smaller during the low water level periods (compared to the Vaidava river) and the proportion of water from rain or forested areas is large, causing the water to be brown (high amount of humic substances).

Peetri river. *Photo A. Ader*

17,8 km from the source of Peetri river are considered as Natura habitat (3260). The river is almost fully in its original channel and the river mouth is similar to its natural situation. Species protected by Natura include: European river lamprey, spined loach, European bullhead, thick shelled river mussel, *Ophiogomphus Cecilia*.

One of the biggest threats are beaver dams inhibiting fish migration and changing the impounded parts of rivers unsuitable for fish and invertebrates. Beaver dams can also change the water quality, for example raising the water temperature and exacerbating the gas systems in water. Manmade impediments can also be dangerous-stone dams can be easily passed by fish that are good swimmers (such as salmon, grayling, trout) but can inhibit fish migration of other species. Pollution points influencing the quality of water have not been found and the distributed pollution from farming can be considered as minute due to the sufficient buffer zone between the river and farmlands. Peetri River (as Vaidava River) is endangered by illegal fishing, although fishing is forbidden throughout the whole year.

To preserve the river and the species within, beaver dams and stone dams should be demolished. The fishing prohibition should also be eased, but only on some parts of the river (form the mouth of the river to the bridge in Karisöödi).

Peetri river is 73 km long (58 km in Latvia), with a gradient of 132 m and a basin of 424 km^2.

6.3.5. Pärlijõgi

Pärlijõgi (Pearl River) is the biggest tributary in the mid-course for Mustjõgi. The river source can be found in the Raipala Lake in Latvia and ends on the left bank of Mustjõgi. Pärlijõgi does not flow fully in its natural channel, because it has been dredged and straightened (Järvekülg, 2001).

The upper course of the river lies within marshes and partially flooded meadows. Afterwards the river finds its way to hilly moraines and the character of the river changes significantly as the flow rate increases. The bottom is mainly sandy with few stones, but at some points the bottom can be rockier. At the rocky bottom in concealed places with a high flow rate, thalloid algae Hildebrandia rivularis can grow. During a project a part of this river up to a former mill was

cleaned of fallen trees. This part of the river is in compliance with the Natura habitat type 3620.

The river passes through 600m of abandoned grasslands downstream from the mill. There are sparse plant communities with dominant species such as *Phalaroides arundinaceae*, *Phragmites australis*, *Sparagnium emersum*, *Elodea canadiensis*. The river bottom heading north for ca 1 km has been dredged and straightened.

An area near the Estonian border, where the bottom is sandy with few stones, has once again been marked as Natura habitat type 3620. Colonies of Hildebrandia rivularis have also been found here.

Pärlijõgi is partially included in the Pärlijõe preservation area with the aim to protect the habitat type rivers and creeks (3260) according to the nature directive and to protect the species European bullhead, *ophiogomphus cecilia* and thick shelled river mussel (Environmental registry, 2013).

Pärlijõgi is endangered by beaver and manmade dams (Järvekülg, 2001). In Estonia, three of these dams have a fish pass, but two (Sarlase and Pärlijõe dams) lack a fish pass thus inhibiting fish migration. A good solution for creating a path for fishes is lacking at the moment. Dams are also dangerous as they can change the rate of water flow, raise the water temperature and exacerbate the gas systems in water thus influencing the whole hydrological equation. Manmade dams are under discussion, but beaver dams are considered being demolished.

In the mid- and lower course farmlands and forests can be found. Several small villages can be found next to the river, of which Sänna village is the largest (Järvekülg, 2001). Large pollution points do not exist, but the general sparse pollution is endangering the river. At some places the tributary creeks are also outfalls for waste outlets (Environmental registry, 2013).

The river is endangered by land amelioration, development and breaches of law (illegal fishing, damaging of banks and redesigning of the water body). To preserve the natural situation of this river, influences on the river should be minimised (the effect of arefying) and dangerous activities to be forbidden or supervised.

Pärlijõgi is 39 km long (6km in Latvia) with a gradient of 96 m and a basin of 203 km^2.

7. Joint monitoring

The monitoring of nature value in Estonia can provisionally be divided in two: national monitoring and performance monitoring. The main objective of national environmental monitoring is the consistent monitoring of environmental state. The objects are capercaillie, great snipe, osprey, butterflies. The monitoring takes place according to fixed methodology in pre-agreed habitats or transects and the single transects of the named monitorings are on the project area. The organizer of environmental monitoring in Estonia is Environmental Agency that was established in 2013.

The objective of performance monitoring is to estimate the state of species and habitats being the values of protected areas, and the effectiveness of protection measures. The organizer of performance monitoring is the Environmental Board. As performance monitoring is more flexible and targeted towards determination of the state of local values, the partner for joint monitoring is the Environmental Board.

The need for joint monitoring derives from the fact that on boundary areas exist separate populations of capercaillie, great snipe, protected dragonflies and butterflies. In order to get an objective overview of the population of these species, it is necessary to assemble inventory results from Estonia and Latvia. The named species together with habitats important to them (rivers, flood meadows and forests with nature values) are the main monitoring programs.

The more detailed methodology of monitoring programs is provided below. In addition to uniform monitoring methodology a constant exchange of data and experiences is necessary. The joint monitoring data collected on the project area will be assembled into joint database and every end of the year a collective seminar between the employees of the Environmental Board and Latvian Nature Conservation Agency will be held. It is reasonable that the seminars take place in Estonia and Latvia by turns. The inseparable parts of the seminars are field trips to protected area to become acquainted with their values and protection regime.

Photo S. Ikauniece

7.1. Forests

Selecting the sites of survey:

In Latvia and in Estonia the sites were chosen based on the National Forest Registry data, selecting for research the grownup and overaged - starting from the stands, where the dominant specie has reached the cutting age and younger stands in moist forest growing condition types, as well as on the basis of groves selection criteria in natural forest habitat inventory methodology.

Time of survey: April - November

7.2. Grasslands

Selecting the sites of survey: In Latvia for site selection used information biologically valuable grasslands (BVG) in parishes, as well as visual aerial photo and topographyc map review. BVG are natural grasslands, which are not sown, andhave not been tilledfor an average of 20 years. They are natural meadows, rich in flowering plants, which are extensively managed with traditional methods - mowing and grazing. Long-term management of thesegrasslands have developed into complex ecosystems with high biodiversity.

Potentially the most valuable areas are steeper hill slopes. After surveying topographic maps, there are selected slopes with potential grassland habitats. Then there are selected rivers, in which floodplains could be floodplain grasslands and lakes with potential grasslands on their banks.

Time of survey: May – October.

Process of survey:

An assesment is made of grassland structure (characteristic species of habitats, unimproved grasslands indicating species, herb and moss cover, layers, expansive species presence), functions and processes (humidity, current management) and restoration capabilities.

BVG can be recognized by a large number of plant species, occurring plant and bird species. Natural grasslands often differ from cultivated grasslands in species composition and diversity, also in vegetation structure. Natural grasslands are generally not expressed in dominant species. There is great diversity of species, including many different species of grass plants. Typical is also a well-established turf, which consists mainly of dense grass plants roots mesh. By contrast, in cultivated grasslands usually dominate 1-3 species (sown cereal plants), other species would be negligible, and the turf is sparse and non-connected.

7.3. Wooded meadows and wooded pastures

Selecting the sites of survey:

In Latvian interpretation habitats “Fennoscandian wooded meadows” (code 6530) and Fennoscandian wooded Pastures” (code 9070) have been joint into one - “Fennoscandian wooded meadows” (code 6530). Very rare throughout the whole Latvia. Mostly found in the river valleys, possible on different soils, with the exception of deep peat soil, mostly in ancient river bank slopes and valleys, including floodplains, (floodplains during inventory time is defined as 6530, highlighting the importance of management, less the alluvial processes)

Since 2010, habitat interpretation has changed a little, so it was necessary to revise the habitat mapping in PLA “Northern Gauja”, where have concentrated the best Latvian areas of habitat.

Process of mapping:

1) Defining the reference points and polygons - on the orthophoto base notes the ancient woodland situation elements (woodland trees and sparse forests) to be found in nature;

2) Determination of the ancient woodland situations - according to the above- checked elements, draw polygons around them in radius of three lenghts, and then specify the polygon boundaries in relation to demarcation lines given by terrain, water, forest, ancient maps - the result isa map of ancient woodland situation polygons;

3) Woodland meadow and pasture final mapping - from the ancient woodland situations distinuished those that do not have any factor that could contribute to the restaration of management functions or they have no prospect because of natural conditions, the other situations are the ultimate wooded meadows anspastures maping, without

distincting sites of the importance of quality and protection.

Habitat determining structure indicators in nature:

- The proportion of soil cover specific to the grassland vs. the whole habitat area;
- Non-wooded trees that are higher or similar along the wooded tree stand;
- Undesirable undergrowth;
- Viable park trees
- Grassland quality indicators;
- The number of protected species
- The woodland tree stand-related natural forest habitat indicator species and it´s specific specie

7.4. Rivers

Selecting the sites of survey:

Surveying the rivers, the following EU habitats were mapped: "Water courses of plain to montane levels with the Ranunculus fluitans and Callitricho-Batracion vegetation" (code 3260) and "Rivers with muddy banks with Chenopodion rubri pp and Bidention p.p. vegetation" (code 3270).

The most importants habitats are rapids (3260), which is characterized by high degree of overgrowth, in the species composition one of the dominant species at all stages in Potamogeton pectinatus that grows in nutrient-rich, eutrophic waters. Habitat also includes natural unchanged river stages, regardless of the speed of the stream. Impounded, dug a new anddeepened sections of river where the current speed of the stream is less than 0,2 m/s, are not considered as this habitat. Habitat is defined in two versions: 3260 1st - The rapids and 3260 2nd - Natural unmodified river stages. mapped also habitat 3270 spread in slow and sandy river sections with a lot of sand banks where sparse stands of annual plants can grow..

Process of survey:

Riverhabitat assessment is carried out using a questionnaire developed for the habitat survey. Small and medium-sized rivers are surveyed by walking along the shore or wading in the river, the largest river - by boat. i different river micro-habitats are collected samples of aquatic invertebrates, as well as aquatic plant species that are difficult to recognize on-site.

Forrivers there are defined several factors, such as:

1) Upstream/downstream
2) Width, depth
3) Soil composition
4) Color of the water
5) Shading %
6) Speed of the stream
7) Beaver dams, debris, piles
8) The river is /is not straightened
9) Protected habitatis /is not found
10) Characteristic species
11) Characterizing benthic inverebrate species
12) Number of reofil invertebrate

7.5. Great snipe

Selecting the sites of survey:

The appropriate areas for Great snipe are defined by the specie feeding options - Great snipe feeds almost exclusively on earthworms obtained by stabbing the beak into loose soil. Therefore, the Great snipe populated areas have moist, crumbly soil, rich in earthworms. In Latvian conditions the most the most favorable are floodplain meadows, but it can also be found in other big and wet meadows with a suitable mineral soils. For the Great snipe, important are continuous grasslands, shrubs, however, are permissible and even in some degree, in terms of the meadows heterogeneity, even desirable. While shrubs does not significantly decrease the meadow area , they do not jeopardize the existence of the specie overgrowth, so this process there is considerably slower then in other grasslands, where the overgrowth begins already a few years after abandoment.

All the sites should be surveyed twice - the first time in late April and in the first decade of the May, visiting them during the day to assess habitats, and at night to search for the Great Snipe leking sites. The areas where during the first visit the Great Snipe leks were not found,

but their habitat assessment leads to consider them suitable for the specie, can be surveyed again - in the second decade of June.

Process of survey:

To select the areas, which are important for surveying from the view of Great Snipe inventory, the available remote research (Landsat satellite images and aerial photos), and other cartographic materials detailed studies should be done.

Meadow area has to be assessed in conjunction with the appropriate Great snipe feeding habitat availability in a wider area, as a part of both sexes, attending leks, can eat outside mating meadow. As the criteria for the selection of potentially suitable sites can be used information on the watercourses and the adjacent areas of open space, terrain and spectrac information of satellite images to assess moisture and vegetation. There are selected survey areas, calculated the size of the total area, and they are grouped into 3 categories according to their potential suitability for Great snipe.

7.6. Flying squirrel

For flying squirrels theoretically suitable forest stands are classified into four categories (in Latvia):

- potential habitats - usually they are young aspen stands, no hollow trees no second level spruce;
- poor habitats - primarily those stands with very few mature aspen or are very sparse;
- suitable habitats - mature and mixed aspen - spruce or spruce - aspen groves;
- very good habitat - old, mixed aspen - spruce or spruce - orspruce-aspen groves.

Process of survey:

Mainly the survey is performed by finding and surveying the suitable habitats for flying squirrel. To be able to examine the flying squirrel presence in these habitats, it is important to choose proper survey time, when can be found the excreta - spring or winter. In particular, a lot of excrement can be found by the root of the trees, and on the fat horizontal branches, at the trunk below the hollows, usually - in large heaps, tens of pieces in one place. Survey habitats can be selected using the forest database, selecting from them the stands older then 50 years, which include aspen. Forest stand suitability for flying squirrel must be assessed in nature both in specially protected areas and outside them - in commercial forests.

7.7. Osprey

Time of survey:

Best search results are in July, when the osprey are big and the male regularly (ate least four times a day) has to carry the fish to the nest.

Process of survey:

If the osprey is regularly and within short intervals seen at the feeding sites, that indicates that the nest is fairly close. Fairly good search results are given by the testing suitable habitats (marshes, glades, beaver activity areas) or the surrounding watching from the good of visibility. Safe way is to check the known previous years´ habitats and nests, but should focus on searching for new nests in places where ospreys are observed but where are no known nesting sites. But it must be noted that osprey can fly up to 20 miles from their nest to the feeding sites, but more often it is not more then 10 km.

Duding 2012 were checked five areas, populated in previous years, in 4 were identified a number of babies. Nest monitoring should continue every year. More attention should be paid to searching for a new areas.

7.8. Capercaillie

Survey sites:

Capercaillie counting should be performed in the previously defined leking sites. In order to ensure an even distribution of surveys and numericaly representative presentation of the country, it is neccessary to choose a leking sites who are located in all parts of Capercaillie population, regardless of administrative tenure and and farming practices.

Time of survey:

Capercaillie leking site visits during the spring time is a mating disturbance, so the stay in the leking site should take the shortest possible time.

In latvia it is recommended to survey three times a season - the first record from the 25th march to 5th April, the second from 10th April to 20th April, a third from the 1st May to 10th May. Given the seasonal differences between the Latvian eastern and western regions, in the west this surveys should be performed in beginning of these periods, but in the eastern regions - in the end of the periods.

It is very important to pay attention to the meteorological situation, and perform surveys only in appropriate weather conditions. In case of unfavorable weather conditions, surveys should be postponed until a suitable time, even if the records have to be made after the dates indicated in surveys.

Capercaillie droppings (excrement) mapping in leks is best to be done around 10th May, when the leking site has lost its intensity and the cocks are no longer attending to it

Surveys:

1) Visual/acoustic recording at night or "seating"

Must enter the lek site when it´s still light, to get to the observation / listeningspot in no later then 2 hours before sunset. When the sun is setting, and the dusk is thickening, capercaillies are flying into the leking area and siting in scattered trees where they settle for the night in the three crowns, often flying over to the nearby trees. Efforts should be made made to fix arriving birds landing sites and to distinguish them from the overflight times. When darkness is thickened, and for at least 30 min have not been heard anynoise, it is time to end the survey.

2) Visual/acoustic recording in the morning

Must enter the lek site with an aim to get to the observation / listening spot in no later then 2 hours before sunrise. It means to move in the dark (until the songbirds have not started to sing) to the chosen ocation at which must sit down and wait for the light. Keep in mind that during a full moon the dark is conditional and birds start to sing earlier.

In anticipation of the lights, all observations (singing cocks and chickens) from the moment you walk into a lek site, should be noted the plan. At the moment, when for at least 30 min there have been no changes - no longer can see or hear any capercaillie, but no sooner then 2 hours after sunrise, survey ends. In the plan shall be noted the found capercaillie exceta piles, regardless of which survey it is.

3) Dropings mapping

At the latest by the 10th May, when the lek has lost its intensity and the mating cocks are no longer attending, can be performed a dropings (excrement) mapping. At this time, the number of droppings ina mating season is at its peak, as they have accumulated during the whole spring period, as capercaillies are staying in trees, singing and walking on the ground, that is, staying just in the lek. Noting of the dropping piles is very important, because along with information about the heard and visually listed birds, there can be relatively accurately (up to 1-2 males) determined the size and location of the lek in the current year. If there is a snow , then the mapping is very easy, because the excreta on the snow can be seen in several tens of meters. It is easier to find dropping in dry lek sites (pine forests, Callunosa), where the vegetation is short, it is more difficult in wet leks, particulary in areas withs stands of evergreen undershrubs like Ledum palustre.

Compact excreta piles indicates the capercaillie accommodation, as well as singing places, while the dispersed (scattered beneath the pine canopy, dominated by the "broken", half the size) indicates that this is a feeding tree (capercaillie moved from branch to branch), which´s canopy from the bird eating off the needles, has become more scarse than the side trees. It sis therefore essential to note the number of excrete and if the pile is compact or dispersed.

8. Monitoring programmes and process

Land

Land cover monitoring, within which, LVĢMC participates in an international CORINE program, obtaining information on land cover, including land use change and mapping. Within Corine – data are obtained once in every five years. Monitoring data are gathered by analyzing the satellite images (decoding) together with other relevant consumable materials. Changes are recorded only for those areas larger than 5 ha.

Monitoring of radioactivity in the soil within which analyzes the artificial radionuclides 137Cs and 90Sr concentration in the soil (10 sample gathering spots).

Today's geological processes monitoring, marine and river coastal risk areas of geological processes (erosion) observations in determining the rinsed area. Monitoring station range covers all coastline of Latvia (coast of Baltic sea and coast of Riga gulf) including different coast types that are subject of constant erosion. Monitoring has to be carried out in 100 stations and 417 profiles.

Air

Air quality – air pollution influence on natural vegetation. The net covers whole territory of Latvia, altogether 101 moss sampling spot in pine forest ecosystems where Hylocomnium splendens and Pleurozium schreberi are found. Moss sampling happens once in each five years, there are detected heavy metals and nitrogen.

Water

In programme there are set several sub-sections:

1) The surface water monitoring program provides information on the surface vater bodies quality and hydrologic regime, as well as radioactivity of the largest Latvian rivers, lakes and some drinking water abstraction spots.
2) The quality of groundwater - Quantitative situation monitoring and groundwater chemical status monitoring. Quantity monitoring net (59 stations) historically developed to assess the possibility of risks in all groundwater objects. Quality monitoring stations – 51 station.
3) Quality of sea water data on sea water (sediment, shellfish, fish, algae) quality and the quality of transitional and coastal waters; data on radioactive contamination and changes in the Baltic Sea and the Gulf of Riga.
4) Agricultural run-off water monitoring program (3 permanent monitoring stations and 3 point pollution monitoring spots near large livestock farms with high livestock density).

Biological diversity monitorings

Purpose - to provide information on the size of populations of species and habitat trends in the area. Unlike the Natura 2000 monitoring, which is made only for special areas of conservation, background monitoring provides monitoring of species and habitats, which shows the situation of the territory as a whole. In Latvia currently are carried out three programs: the birds nesting, Nightbirds, fish. Has stopped such programs as bats and small mammals, also butterflies are waiting for the implementation of the program, also overground fauna.

Special monitoring

Purpose - to provide information on ecological processes happening in ecosystems and the inter-dependencies of organisms. Monitoring Objects - protected species, that in the Latvia context have significant populations or organisms from which they are dependent. They also provides with information about other group or habitat conditions such as changes in bird populations may be indicative of forests or agricultural lands area or state changes.

Natura 2000 monitoring

- Provides the latest data for Natura 2000 Databases standard data forms;
- According to the Habitats Directive, 11th, 17th chapter and the Birds Directive 12th chapter.
- Are collected site-specific data on species / habitat (HD Annex I and II, BD Annex I and migratory bird concentration areas)
- Every place (327 land + 7 sea) have a unique monitoring plan

- 1798 reporting units from 327 places
- Full monitoring cycle – 6 years

8.1. Other monitorings

At the same time with national monitoring programs, that are concentrating on the environmental quality changes, in country are being implemented a variety of smaller monitorings, carried out by a variety of educational institutions, organizations or enthusiasts, obtaining answers to their questions. For example, JSC "Latvian State Forests" has launched several monitoring to assess their management's influence. One of those is the ecological tree (retention tree) monitoring carried out in the clearcuts that started in 2002. Maintained ecological trees are surveyed in each several years. The results help to make better decisions on selection of tree species to set aside and placement of these trees. For several years, monitoring is made in Beaver activity areas, for each Beaver activity area providing their necessary management activities. Depending on the flooded area ecological value, condition and the surrounding stands, the decision is made either to keep Beaver activity area by controlling water levels and by monitoring or to eradicate it.

8.2. Necessary monitorings in Project territory

The project site is monitored, relating to biodiversity assessment and in accordance with the national monitoring programs. This monitoring process, depending on the state budget options will also take place during the upcoming years.

One of the largest and most important is the Natura 2000 species and habitat monitoring, which in 2014 will begin a new cycle. This monitoring provides answers on habitat quality and changes in species status, so a special additional monitoring of protected habitats and of a large proportion of protected species is not necessary.

During the inventories of project area experts have identified a number of specific monitoring needs, because in frameworks of the existing system it is not possible to get information about species specific situation in the project area.

1) Great snipe (*Gallinago media*) – regarding to the little studied species status in the project area in Latvia and the lack of information, there is a need to pay special attention to monitoring of the specie.

- Two territories, where have been detected leking sites, have to be surveyed every year (territories AA002, AA003, AA004, AA005). Survey should be done each year, during the leking time, 2x in a season (see the inventory methods).
- AA001, AA008, AA009 desirable to survey 1x in 3 years.
- Other areas in should be surveyed, if there is undertaken any habitat restoration.

2) European roller cages monitoring in Latvia - it is desirable to survey the placed cages at least 1x every two years. Although finding European roller is uncertain, it is possible to find other rare bird species, which tend to use the same cages (Upupa epops, Columba oenas), and to obtain additional information on the area's biological values.

8.3. Management monitoring

Lai saglabātu bioloģisko daudzveidību un uzlabotu esošo biotopu stāvokli vai saglabātu aizsargājamu sugu dzīvotnes, valstī dažādu projektu ietvaros tiek veikti biotopu apsaimniekošanas un atjaunošanas pasākumi. Tie parasti saistīti gan ar koku ciršanu, gan zālāju pļaušanu vai hidroloģiskā režīma izmainīšanu. Plašāki apsaimniekošanas pasākumi parasti notiek LIFE projektu ietvaros. Atsevišķas aktivitātes ir veikušas pašvaldības vai nevalstiskas organizācijas. Valsts mežu teritorijās plašākus apsaimniekošanas darbus atsevišķās aizsargājamās dabas teritorijās vai dabiskajos meža biotopos veic AS LVM.

Lai gan biotopu stāvokļa uzlabošanas pasākumi atbilstoši esošajām zināšanām tiek veikti, pēc darbu pabeigšanas turpmāko novērojumu veikšana ir ļoti ierobežota. LIFE projektos parasti ir ietverta prasība veikt apsaimniekoto biotopu monitoringu, bet diemžēl parasti periods, kurā tas tiek darīts, ir tikai projekta norises laiks.

Pēc projekta beigām monitoringa iestrādnes netiek turpinātas tāpēc, ka trūkst pietiekoša finansējuma vai speciālistu, izņemot atsevišķus gadījumus, kad pētījumus personiski turpina konkrēti ieinteresēti zinātnieki. Gadījumos, kad biotopu apsaimniekošanas pasākumi ir veikti AS LVM regulāro plānoto aktivitāšu ietvaros vai kāda sabiedriska pasākuma rezultātā (piemēram, talkās), apsaimniekošanas rezultātu monitorings vispār netiek plānots un netiek veikts.

Projekta „Zaļais koridors" ietvaros plānoti apsaimniekošanas pasākumi 3 biotopu veidos – mežos, uzlabojot dzīvotnes apstākļus mednim, parkveida pļavās, palieņu pļavās, uzlabojot dzīves apstākļus ķikutam, un upju straujtecēs. Diemžēl projekta ietvaros nav paredzēts finansējums biotopu apsaimniekošanas monitoringa pasākumiem, kā arī projekta norises laiks ir pārāk īss, lai saņemtu atbildes par ilglaicīgākām izmaiņām biotopā un veikto darbību ietekmi uz sugu stāvokli.

Tālāk apskatītas iespējas veikt projekta laikā apsaimniekoto biotopu monitoringu esošo monitoringa sistēmu ietvaros vai ieviest jauninājumus atbildīgo institūciju darbā.

1) Capercaillie leking sites maintenance

Management is resulting in reduced forest undergrowth and tree density on the 2nd floor of forest, improving spatial transparency and mobility conditions, that are very important factors for capercaillie. There is peformed cutting of trees and bushes, by scattering them in the compartment or withdrawing them from the stands. In some places have started tree cutting in combination with hydrological regime restoration in drained forests. Potential monitoring can be divided into two parts, performing observations of certain changes in vegetation and recording the change in the number of capercaillie population in territory. While such measures in Latvia territory have been carried out in a number of protected areas, vegetation monitoring of these places has not be made and there are no plans to open one. Management impacts are assessed by monitoring changes in capercaillie numbers, usually - fixing the number of leking cocks. Measures in accordance with the company's designed methodology in Latvia is organized and provided by the JSC "Latvian State Forests" specialists, so the results so far for the larger public are not available.

2) Restoration of wooded meadows

Restoration of wooded meadows in the project area in Latvia was carried out in 2006 within a LIFE project in PLA "Northern Gauja" territory which are concentrated Latvia`s largest and highest quality habitat areas.

During wooded meadows restoration projects are usually carried out cutting of bushes in overgrown meadows, ie., the site preparation for future management. Further habitat maintenance are dependent on the site operator's needs and abilities.

In some areas, due to the personal initiative of scientists, is performed a restored grassland monitoring. Butin most cases, observations are not being made. Also in the "Green Corridor" restored wooded meadows in Latvia, monitoring is not planned and opportunities to integrate it in other activities are not found. It is mainly due to the lack of funding and staff in NCA.

3) Swift river restoration

The swift river habitat degradation usually occurs in several cases - result of eutrophication by overgrowing with aquatic plants, the formation of tree trunks and branches congestion in the watercourse, also important are beaver activities in building dams and flooding the rapids.

Over the past 4-5 years, in Latvia great popularity and attention have gained the activities that are aimed at improving the quality of the swifts, often linking it with habitat improvement for salmonids species. Activities are conducted both in various small projects, and as voluntary public events (clean-ups). Effectiveness evaluation of the measure is usually performed visually or based on anglers experience.

The monitoring system is not designed for management assessment and evaluation is not performed. To some extent, this also due to the mentioned lack of funding and staff, also traditional aquatic habitat quality are evaluated using specific scientific methods that require special knowledge. For water quality evaluation it would be possible to make a good use of forms developed under the voluntary monitoring program, also should be performed a regular observation

of the managed site by defining the responsible institution.

For simplified observations, to compare the situation before the habitat management and after works, the project produced the observation protocol, which was tested during habitat management. NCA staff, in whose controlled territory are situated the managed rivers, will continue observations for several years after the works. Developed protocol will be presented to other NCA colleagues and leadership, considering the idea to include observations of the managed swift river habitats in the regular work tasks.

In Estonia swift river restoration is not been carried out in very large territories.

4) Restoration of habitats for Great snipe

As the great snipe normally inhabits and leks in river floodplains, which are characterized by periodic floods and low overgrowing with shrubs, the main activity for habitat restoration in the project is associated with cutting the bushes and grazing.In Latvia this activity has not been carried out but it would be necessary.

8.4. Voluntary monitoring

Voluntary monitoring program`s main purpose is to obtain objective data on condition of different nature objects, involving the local society in the process. It was started in North Vidzeme Biosphere reserve in 2005.

In wildlife watching there are invited to participate anyone who has an interest in what is happening in nature. In order to be more agile to make observations and the data would be reliable and easily comparable, it is proposed to use a simple study materials prepared by scientists. Observations can be made on secular trees and scenic trees, alleys and rows of trees, hogweed and orchids, air and water quality, white storks, migratory birds and sand martins, beavers, bats, hermit beetle, molluscs and shellfish, dragonflies.

Guidance materials can be easily used by all interested parties without any special prior knowledge, although in some programs relevant knowledge is good for registering, for example, birds living in a farmstead. Other programs have specially prepared guides of species that can be used, for several purposes such as determining the quality of water for the growing plants. Other observations needs just a measuring tape and familiarity of their neighborhood, for example, while noting the observations on the alleys or trees.

During observation, everyone with look more carefully to the nature, gaining knowledge about the processes in nature, and understanding why this is happening. Public monitoring program engages students, local researchers and stakeholders.

Since 2010, the program is publicized throughout the country, bringing more new potential observers. Teachers and children in the program finds the opportunity to develop a project-week scientific works, local regional researchers can make use of their knowledge of the surrounding objects, while scientists use the data collected. Data can also be practically used, for example, in spatial planning, destroying hogweed stands or for nature-based tourism development.

In Estonia a similar program has not yet been implemented, but there are a variety of research nature education centers. In frameworks of the project “Green Corridor” in some programs observation recording forms have been translated into English and EEB experts are now familiar with the system. Consideration is being given to first use this idea in nature education centers.

Voluntary monitoring is also taking place in Estonia, but it is not very well organized. People interested in nature can enter the observations into nature observation database. In addition Estonian Ornithological Society collects data about migrant birds and white stork from the interested people. Schoolchildren can participate in a project “Hallo spring”, where data about arrival of migrant birds are collected and most active nature observers are invited to nature camp in the summer.

9. Management activities

The following chapter gives an overview about management actions, according to inventories results.

Topic	Description of activities	Period
Protected species	Management of Large Copper (*Lycaena dispar)* habitats (mowing interval 2-3 years)	2015-2016
	Maintenance of March Fritillary (*Euphydyas aurinia*) habitats (mowing, grazing). Grazing after every few years or0,4-0,7 animal units per ha.	Constant
	Establish permanent habitat of Scarce Heath (*Coenonympha hero*)	2015
	Removing undergrowth around Hermit Beetle (*Osmoderma eremita*) habitat trees.	2014
	Removing undergrowth in Capercaillie lek sites.	2014-2016
	Monitoringknown cages of European Roller. Repairing old cages. Supprtig grazing in important habitats.	2014-2015
	Management of Great Snipe (*Gallinago media*) habitats.	Constant
Habitats	Restauration and maintenance of the semi-natural habitats.	Constant
	Eliminating dams on Vaidava river. Eliminating beaver dams, fallen trees from the river and improving supervision.	Constant
	Eliminating beaver dams on the Peetri river and Pärlijõgi.	Constant
Joint moonitoring	Habitats monitoring(grasslands wooded meadows and pastuses, rivers, forests)	Constant
	Monitoring of the protected species (Great snipe, Flying squirrel, Osprey, Capercaillie)	Constant
Hunting	Regulating the abundance of beavers, demolishing dams and covering important and especially endangered trees with net..	Constant
	Regulating the abundance of small game.	Constant
Alien species	Sosnovski hogweedand Giant hogweed- mapping spread of distribution, monitoring, constant repelling. Informing the public, involvement, raising owners liability.	Constant
	Signal crayfish– Monitoring, Informing the public, involvement.	Constant
	Himalayan Balsam– repelling, monitoring, mapping spread of distribution.Informing the public, involvement	Constant
	Other Alien species– Mapping spread of distribu-tion, Informing the publicand involvement.	Constant

10. Strategic crossborder coopertion

Nature never recognizes borders between the countries. But borders create artificial barriers to the management of these valuable natural resources. The places where protected areas share a common political boundary bring these issues into sharp focus and need special consideration.

As global threats, including climate change and other global change factors, impact species and habitats worldwide, connectivity conservation areas on larger scale will need to be considered.

Transboundary protected areas are one tool that can help support global and continental connectivity conservation.

International organizations recommend cross-border cooperation in nature conservation. But collaborating with neighboring countries brings its own particular challenges, adding another layer of complexity to the already difficult task of managing a protected area. There are several basic standards and actions that should be taken into consideration and implemented between countries, while planning a transboundary protected area:

- **Common vision** - In addition to the vision for their respective areas, the managing bodies of the trans-boundary protected area should have a common vision, a future orientation which can only be implemented together with the respective partner.
- **Official agreement** - An official agreement is signed at the appropriate management and political decision-making levels for facilitating the creation and progress of the trans-frontier protected area within a given time frame.
- **Guiding rules for cooperation** - The partners establish and put into practice compatible rules which guide cooperation and ensure permanent exchanges of information, the running and documentation of joint meetings, joint decision-making and dispute settlement. The rules are based upon the mutual consideration of each partner's working methods, time management, native language, administrative structure and decision-making procedures
- **Sustainable financing** - The financing of joint trans-frontier projects should be secured. Project proposals for international funding are to be jointly prepared and submitted. The use of funding from international programs e.g. European Union, Global Environmental Facility is to be mutually agreed.
- **Joint fields of work for cooperation** - All fields of work should be set with the frame of a mid-term work plan and include work in the primary and secondary fields indicated below, administrative capacity-building and the training of staff from the partner protected areas.
- **Exchange of data** - The mutual exchange of data between all partners on the natural, historical and cultural aspects of the area should be in progress.
- **Joint ecological monitoring** - The partners should have commenced the systematic linking of their resources for the ecological monitoring of the shared ecosystem.
- **Joint research activities** - The partners should develop and implement common mutually agreed research and monitoring programmes.
- **Joint conservation activities** - Cooperation in the field of nature and landscape conservation should be developed through concrete activities and projects, e.g. the establishment and management of cross-border systems of inter-connected habitats and biotopes, the practical implementation of agreed management aims and plans, joint projects on biodiversity / species conservation, etc.
- **Cooperation in education and communicatio**n - Trans-frontier cooperation in the field of education and communication should cover a range of joint activities providing information, raising awareness and communicating the message of the trans-frontier protected area as a whole. This work will include, for example, the development of a common identity, the publication of joint bi- or multilingual

publications, maps, and video or web presentations, the organisation of guided visits for different target groups on both sides of the border, events for pupils and schools etc.

- **Staff exchange** - Permanent communications at all level of staff in a process of familiarisation should have been established and (a) facilitator/s for collaboration identified. Staff with responsibility for cooperative activities should meet regularly to discuss project management, evaluate progress and exchange of knowledge and experience. In addition, staff should periodically carry out joint field trips and on-site activities in all partner areas. A joint steering committee is recommended.
- **Foreign language communication** - Foreign language communication, translation arrangements and facilitation should be ensured in the main areas of transfrontier cooperation.
- **Cooperation in recreation and tourism** - Trans-frontier opportunities for people to experience nature and enjoy the landscape should be developed. This includes, for example, coordinated visitor management systems, visitor facilities and trails, and trans-frontier public transport systems. This field of work also includes the development of sustainable trans-frontier tourism initiatives covering, for example, the contribution of tourism to regional development, or the support of protected areas for marketing of local ecological products.

Visitor tower in Paganamaa LPA. *Photo A. Ader*

11. Management plans practices in the region

Management plan for Paganamaa landscape protection area and Väike-Palkna landscape protection area during 2010-2019

the main asset of the Paganamaa Landscape Protection Area is the diverse natural and semi-natural landscape on the western border of Haanja uplands with its kame fields. Main elements of the landscape include Piiriorg (a 600 m wide and 55 m deep U-shaped valley which narrows towards the middle of the protected area into a 200 m wide and a sharper, more V-shaped, valley with a slope gradient up to 35-45 degrees. In the western part of the protected area, the valley changes back to a smoother valley. Piiroja River runs in the bottom of the valley), kettles which have developed into swamps and are known as the 'footprints of the devil'; there are also gullies, of which the biggest is Luukraav, but the most famous are Väike and Suur Liivakraav (Small and Large Sand ditch). In addition, historic buildings, traditional farmlands and ancient places or heritage objects (locations that have been related to the devil, stone tumuli in Pedaku (also known as Kalmu) and Vorotka).

Considering the nature directives, many forest habitats can be found here as more than 80% of the protected area is covered with forests (western taiga (9010*) 40 ha, herb rich spruce forests (9050) 27 ha, corneous forests on glaciofluvial eskers and kame fields (9060) 8 ha and bog woodlands (91D0) 17 ha). Lakes (Kikkajärv – area of 21,4 ha, deepest point 22,3 m, Sarapuu Lake – area of 2,4 ha, deepest point 8,8 m, Liivajärv – area of 4,2 ha, deepest point 19,8 m, Mudajärv – area of 0,8 ha), springs and creeks (Piirioja – with a high gradient (6 m/km), runs in its natural riverbed) are considered important habitats. Out of all the lakes in Paganamaa, Kikkajärv and Liivajärv have been named as oligotrophic to mesotrophic standing water habitats (3130). Väike-Palkna has been named as an oligotrophic water habitat containing sandy plains (3110). Several semi-natural meadows can be found within cultured landscapes which increase diversity (habitat type *6270, species-rich dry to mesic grasslands on soils lacking calcium with an area of 16,2 ha habitat type 6430, hydrophilous tall herb communities with an area of 7,3 ha and boreal alluvial meadows (6450) with an area of 13 ha). The most noticeable of rare and protected species is the black stork which nests in the protected area. In addition, several protected plant species from the III category have been found.

Diverse landscape and habitats in Paganamaa are fit for nature studies or for scientific and recreational purposes. The area has been accordingly used for a long time.

Management plan for Mõisamõtsa nature reserve during 2006-2015

The main assets of the nature reserve are forest habitats, as 93% of the reserve is covered with forest. Especially interesting are boreal forests, which make up more than half of all the forests and areas covered with broad-leaved, coniferous, fen and bog woods. Grassy forests and woodlands on arefied lands are less common. The value of this area is increased by the high amount of forests that could be put under protection (21,5 %) and because of the high diversity of Natura 2000 forest habitats. Dominating habitats include naturally conserved forests like western taiga, herb rich spruce forests and deciduous fen and swamp woods. Natural rivers (3210, part of the Vaidava River from Mustjõgi to the mill in Vastse-Roosta) with steep riverbanks, a continuously changing relief and flooded meadows add value to the area and are one of the most important habitats within the protected area.

Management plan for Koiva-Mustjõe landscape protection area and Koiva-Mustjõe limited conservation area 2010-2018

The main elements of this protective area are the biggest rivers Koiva River, Mustjõgi, Peetri River and Vaidava River, which all comply with the Natura habitat type rivers and springs (3210). All previous rivers have been recognized as spawning places for salmon. Boreal alluvial meadows (habitat type 6450, area 1030) on flood plains of rivers and lowlands (habitat type *6270, area 120,3 ha). Prominent wooded meadows of Southern Estonia are here found only on a small scale (*6530, 133 ha). The wooded meadows of Koiva are unique in the whole of Estonia. The plant communities and micro reliefs are diverse because a lot of the meadows can be found on

flood plains. Dry meadows (4030, 21,2 ha) as types of semi-natural communities can be found in three separate areas.

There are approximately 1550 ha of forests on the landscape protection area. The biggest assets in the Koiva Landscape Protection Area are the broad-leaved forests on flood plains of Mustjõgi and Koiva River (91F0). The forests are habitats for humulus, being endangered and rare in Estonia. Broad leafed flood plain forests take up 73 ha. Western taiga (*9010) takes up 1065 ha in the Koiva Landscape Protection Area. Most of these forests are coniferous forests and pine forests on heaths. Understory of oaks is distinctive for pine forests in Koiva.

Diversely used farmlands of Taheva parish in Koiva-Mustjõe protected meadows are notable because it is the only place in Estonia where the European Roller nests. The meadows near Mustjõgi are also important for the nesting of Great Snipe (Gallinago media) and living areas for the Western Capercaillie (Tetrao urogallus) have been built in the protection area.

Conservation plans in Valga County with the headline 'Factors guiding settlements and use of land' defined the meadows and forests in Koiva-Mustjõe Landscape Protection Area to be of a national importance, constituting the core for a green belt (which continues in Latvia). Koikküla, Laanemetsa and the surroundings of Taheva manor are the most important of all the historical semi-natural landscapes, where the main value is the village milieu with its architectural heritage. This is the reason for conservation of historic use of land as well as mental and material heritage, including preserving and appreciating the activities and behaviour related to the river.

Koiva-Mustjõe landscape protection area lies within the resting area of the Centre for State Forest Management. Camping places in Kõrgeperve and Tellingumägi, the latter has a tower for sightseeing, are within this area. It is possible to see the meadows of Mustjõgi and Latvia with its characteristic old rivers. The area is popular amongst people hiking on water trails.

Conservation plan for the nature reserve of Parmu 2013-2022

Natural landscapes along the border are valuable assets of the Parmu Nature Reserve. Western taiga covers 240 ha, sedge mire and bog woods cover 28 ha and deciduous fen and swamp woods 55,4 ha of Parmu Nature Reserve. Natural landscapes and little interference are prerequisites for the nesting of the Black Stork, Western Capercaillie and the Lesser Spotted Eagle. Other notable species within this territory are Early Purple Orchid and Clouded Apollo.

Conservation plan for Luhasoo landscape protection area 2013-2022

Luhasoo is the biggest and almost untouched swamp in Southern Estonia. The local landscape protection area was created to protect the hallmark swamps that have evolved from lakes and where several habitats can be found. This swamp front (*7110, area 261,57 ha) covers most of the swamps in Luhasoo. In addition one can find transition mires and quaking bogs (7140) on 9,03 ha, deciduous swamp woods (9080) on 20,9 ha and bog woodlands (91D0) on 32,1 ha. Three swamp lakes in Luhasoo (dystrophic lakes and ponds, 3160, area 8,4 ha) are leftovers of one former lake. On the edges of the protected area is western taiga (*9010), 10,32 ha. Luhasoo Landscape Protection Area has a high protective and landcape value in addition to being a habitat for protected species.

The main value of the protected area is the 5 km long nature learning trail which in its farthest end on a swamp island called Meiesaar has a heated cabin.

CONSERVATION PLAN FOR PAGANAMAA LANDSCAPE PROTECTION AREA AND VÄIKE-PALKNA LANDSCAPE PROTECTION AREA DURING 2010-2019	
Assignment	**Description of the assignment**
Maintenance of existing semi-natural landscapes (37,6 ha)	Known semi-natural landscapes will be maintained (ca 29,10 eek/ha), there is roughly 25 ha of maintainable land.
Atklāto ainavu atjaunošana	Tiks atjaunoti bijušie zālāji, kuriem būs iespēja nodrošināt arī turpmāku apsaimniekošanu. Novērtētā platība 100-150 ha
Esošo zālāju apsaimniekošana	Esošajās atklātajās ainavās, vismaz pašreizējo Lauksaimniecības reģistru un informācijas dienesta datu apjomā (apm. 165 ha) un perspektīvā apm. 200 ha
Jauna skatu torņa izbūve	Vecais tornis tiks nojaukts, tā vietā vietā paredzēts izbūvēt jaunu, nedaudz augstāku torni
Pārgājienu taku izpļaušana	Pārgājienu taku (apm. 14 km) izpļaušana 4x gadā (1 reize 5000)
Dēļu celiņu kopšana	Dēļu celiņu sakārtošana un atjaunošana (ik pēc 5 gadiem)

CONSERVATION PLAN FOR KOIVA-MUSTJÕE LANDSCAPE PROTECTION AREA AND KOIVA-MUSTJÕE LIMITED CONSERVATION AREA 2010-2018	
Assignment	**Description of the assignment**
Removal of obstructions influencing the natural water balance	Natural obstructions, such as trees fallen into the water, which heavily influence the water system and interfere with the migration of fish will be removed. It is important to re-establish the flow of water, not the removal of the whole obstruction. The removal of beaver dams is also important. Obstructions can be removed on a larger scale only near official resting sites for aesthetic reasons (can be done as communal work).
Communal work to maintain semi-natural communities	At least twice a year.
Improving the approaches to meadows	Building of the necessary infrastructure to gain access to problematic meadows (on state lands).
Determining the necessity for culverts and accordingly, installation (on state lands)	Determining the needs for infrastructure to gain access to meadows that are hard to reach (6 culverts - 15 000).
Purchase of machinery	Purchase of machinery that is necessary to maintain the complicated meadows.
Purchase of animals	20 specimen of cattle and 3 horses that have been bought and are in use.
Complex monitoring of river habitats and Natura species	2 consecutive years, inventory of LD river habitats and species.
Addition inventory of habitats on meadows	Borders of Natura habitats will be specified and exact economic guidelines will be presented especially for wooded meadows and pastures. The data in the inventory has to correspond with the demands of PRIA.
Ornithological monitoring on the meadows	The impact on birds due to maintaining, or due to the lack of it, will be monitored.

Specifying inventory of forest habitats	Borders of Natura habitats will be specified as well as the conformance of forest habitats with the criteria.
Full plan for forestry in the protected area	Forest maintenance will be planned according to the aims of the protection and general principles of forestry.
Gathering of information of insects and monitoring of selected populations	Gathering of information and compilation of a plan for monitoring (monitoring of populations: Clouded Apollo, Conifer Dark Beetles, Hermit Beetle), consideration of the demands for habitats.
Directing visitors	Building and maintenance of infrastructure for hikers using waterways (access to boats, stairs to Kõrgeperve and other resting places).
CONSERVATION PLAN FOR LUHASOO LANDSCAPE PROTECTION AREA 2013-2022	
Maintenance of paths, visiting centres and resting places	Maintenance of the nature study trail in Luhasoo.
CONSERVATION PLAN FOR THE NATURE RESERVE OF PARMU 2013-2022	
Renovation of communities	Regular maintenance of meadows.
Gathering of information of insects and monitoring of selected populations	Gathering of information and compilation of a plan for monitoring (monitoring of populations: Clouded Apollo, Conifer Dark Beetles, Hermit Beetle), consideration of the demands for habitats.
Directing visitors	Building and maintenance of infrastructure for hikers using waterways (access to boats, stairs to Kõrgeperve and other resting places).

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