Geo-ecological base for native taiga conservation in Lake Maksim (Maksimjärvi) area.

(Report on the expedition to the Lake Maksimjärvi area 09-14.07.2013)

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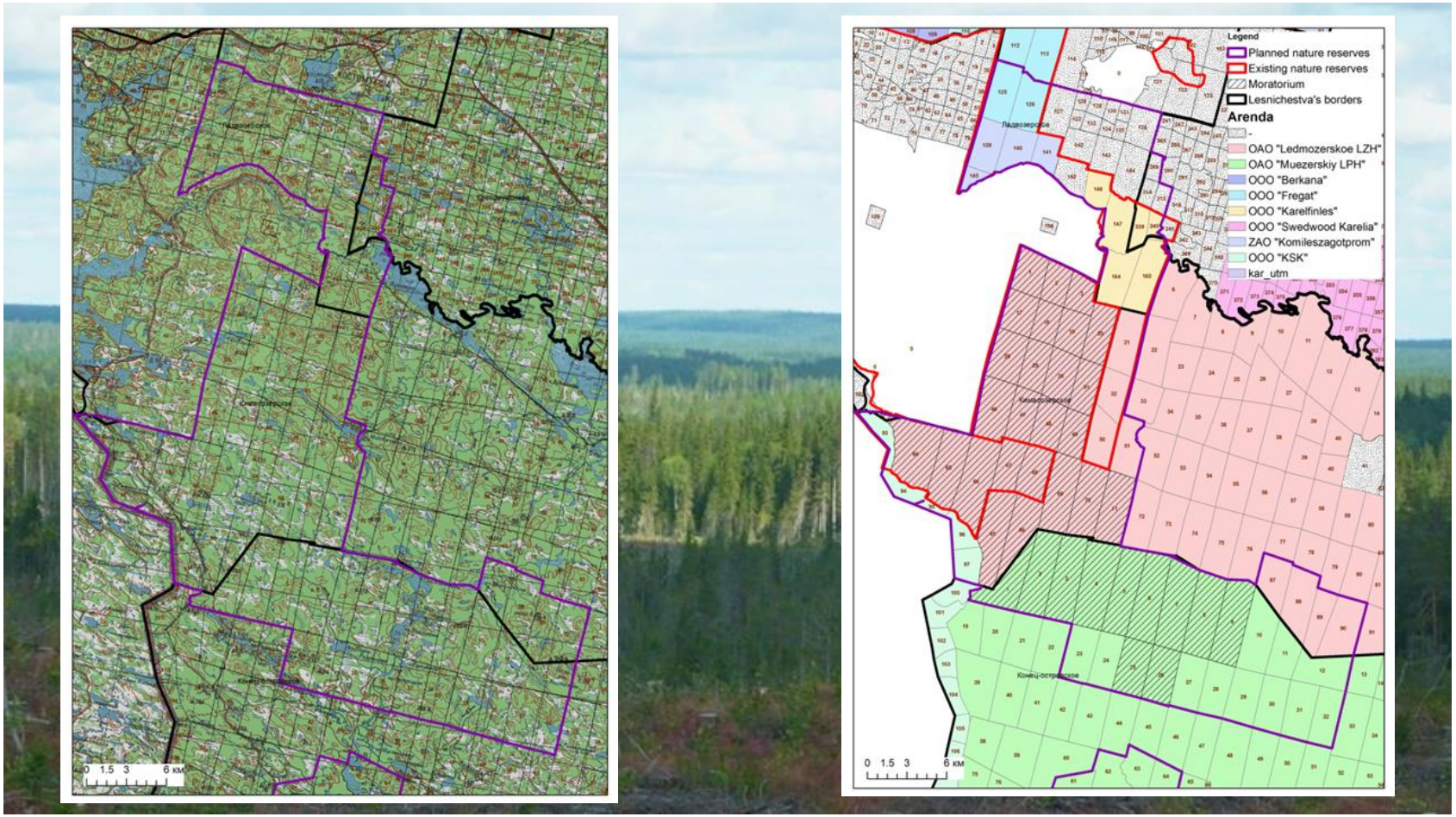
Basic information about the area of the District of Lake Maksim



Administrative and economic division of the territory around the lake Maksim (in the center of the map).

Landscape characteristics of and pristine forest types

The territory around the lake Maksim (Maksimjärvi) is the most common in the northern taiga subzone of Fennoscandian type of landscape.

This landscape is called tectonic denudation hilly and hilly-ridge, with a complex of glacial formations, average degree of waterlogging and a predominance of pine forests *(type "14 g (+glacial)" according to classification: Volkov et al, 1995).*

Here distinguished such sub-landscape structure elements (terrains) as:

1 - ridges and hilly terrain with structural relief which has tectonic denudation origin

2 - ridge terrain with sculptural relief which has glacio-fluvial origin (eskers, thermokarst depressions and thick moraine sediments).

Complicated relief and diversity of soil-formation materials (rocks, moraines with different composition, sands, various types of peat) have caused a variety of habitats and pristine forest types (Table 1)

- **Table 1**

Biogeocenotical structure and performance of indigenous forest types in the landscape 14 g (by: Volkov et al, 1995)

Type of biogeocoenose	Share from the forested area, %	Share from the pristine forest formations, %	The average width of this type of forest	Average yield class
Pine tree stand on the rocks	1	1	80	Va
Cranberry pine stand on the rocks	2	3	67	Va
Cranberry pine stand	6	8	104	IV,I
Blueberry pine stand on the rock	1	1	60	V,0
Blueberry-moss ("fresh") pine stand	35	48	130	III,9
Blueberry-humid pine stand	3	4	78	IV,6
Blueberry-sphagnum pine stand	3	4	71	V,0
Shrub-sphagnum pine stand	14	20	71	Va,I
Sedge-sphagnum pine stand	8	11	104	Vб,0
TOTAL PINE FORESTS	73	100	106	IV,7
Spruce tree stand on the rocks	1	4	80	Va
Blueberry-moss ("fresh") spruce stand	9	33	83	III,9
Blueberry-humid spruce stand	7	26	66	IV,9
Blueberry-sphagnum spruce stand	4	15	66	V,2
Ravine-type spruce stand (streamlet and fen)	3	11	62	IV,0
Horsetail grass-sphagnum spruce stand	1	4	42	V,6
Sedge-sphagnum sprucestand	2	7	72	V,I
TOTAL SPRUCE FORESTS	27	100	71	IV,6
All in all	100		96	IV,7

Degree and nature of waterlogging of the landscape

Degree and nature of waterlogging of the landscape varies depending on the type of terrain.

Paludified area reaches 30 - 45% in terrains with structural relief.

Open mires little prevail over the forest swamps, but in total, forest cover on the semi-hydromorphic (paludified) and hydromorphic (peatland) soils occupy significantly larger areas (on the 16%) than open mires (Table 2). Landscape is characterized by a relatively low degree of oligotrophic facies which are existing only as a plots of mires within their contours. These occupy 17% of the total paludified areas.

It should be noted sustained participation of paludified forests (on the thin peat deposits - up to 30 cm). These account for over 30% of all categories of all paludified areas. Spruce fens stable occupy 20% of the wetlands, or about 10% of the area of the landscape. Only the spruce fens form a large areas of spruce forests in surrounded of a pine forests, which dominate on a mineral soils and on a forest swamps (Table 2).

The role of paludified spruce forests of horsetail-, sedge- and blueberry-sphagnum types is very significant because, like a coastal ecosystems, these are the most important factor of coenosis and species diversity of this type of landscape.

- **Table 2**

Ratio between categories of swampy forests and mire lands according to types of forest formations and water-mineral nutrition in the type of landscape 14 g,% (by: Volkov et al, 1995)

Categories of land	Forest formations			In total
	Pine	Spruce	Birch	
Paludified forests	13	19	-	32
Forested swamps and fens	22	4	-	26
Total of forests	35	23	-	58
Categories of land	Mires			In total
	Oligo-trophic	Meso-trophic	Eutrophic	
Open mires	17	23	2	42
In total of mires				68
All in all				100

Features of natural fragmentation of forests

In the area around Lake Maksim is relatively low degree of paludification, which is not typical for the region and the landscape type. This is due to the predominance of large-convex hollow hills from crystalline basement rocks which are smoothed with a slightly eroded moraine surface. Outcrops of rocks are absent even on hilltops. These are open only on the vertical scarps.

Number of fragments of open mires per 10 km of the profile are on average less than ten. Open mires occupy about 40-45% of the total paludified area, these are not large in square, stretching from the NW to SE., with length from 0.5 to 3 km and a width from 0.1 to 0.5 km. Degree of limnetic and river network density also exceptionally low.

Thus, the forest cover has a weak fragmentation by hydrographic network and hydromorphic ecosystems. The main factor of natural fragmentation here were fires. Especially that the barriers of fires distribution are absent in the space of 10x10 km (10 000 ha) around lake Maxim.

The upper layer of peat can burn during forest fires on small massifs of mires. Outside of the perimeter the degree of paludification and square of mires are much more.

Anthropogenic fragmentation of forest cover

According to the snapshot «NATURA 2000» (http://natura2000.eea.europa.eu/ #), the forest is cut down by about 75% from the right bank of the river Maksim to Lake Luvozero. These cuttings adjacent to the "great" clearcuts in the east and then these extend up to the shore of White Sea and to the borders of the republic.

Pristine areas of the taiga here probably are absent, and small woodlands are separated by many kilometers of open clearings and mires. The same can be said about the territory situated on the south of Lake Maksim (pictured quarter number 50).

Deforestation, which are making the fragmentation the axial part of the White Sea-Baltic watershed. The picture of the south part from the Lake Maksim. *Photo – Victor A.Kolomytsev.*

Forest-mire ecosystems (forested of mire's boundaries) are preserved in their natural state.. *Photo – Victor A.Kolomytsev.*

Anthropogenic fragmentation of forest cover

The paludified spruce stand with grass- and blueberry-sphagnum plant cover before and after timber harvesting:

"a" – *ground vegetation cover before cutting,*

"b" – *paludified spruce forest (spruce fen) before cutting,*

"c" – the same forest after cutting . ***Photo – Victor A.Kolomytsev.***

a **b** **c**

Morpho-hydrographic characteristics (geo-ecological framework) and ecological corridors. Watershed area

Scheme of the watershed and catchment spaces, based on a map at a scale: 1:200 000, the boundary of the watershed and catchment spaces is marked as the red line.

Fundamental rocks on the tops of hills under a thin layer of moraine and soil-vegetation cover.

Photo – Victor A.Kolomytsev.

Watershed area Morpho-hydrographic characteristics (geo-ecological framework) and ecological corridors. Watershed area

On the top step of topography a plakors are dominated in "triangle" between the lakes Kamennoe, Luvozero and Maksimjärvi. The plot belongs to the large-ridgy and hilly type of terrain of type of landscape "14 g (with glacial deposits)" with outcrop of rocks on the ledges of faults (see map of watershed and catchment area). Absolute heights reach 260-270 m and the whole of the watershed area is located 200 m above see level. Vertical dissected relief reaches 60-70 meters. Crystalline rocks is covered by loamy moraine. Soils are represented by roughly- humus podzols and, rarely, by gley podzols on loamy moraine in a mixed forest stands.

Tongue-humus podzol on sandy-loam moraine (left). *Photo – Victor A.Kolomytsev.*

Relatively rare gley-podzol on loam-sand (heavy) moraine – (centre); mixed coniferous-deciduous forest stand that is growing on gley-podzol soils – (right). *Photo – Victor A.Kolomytsev.*

Morpho-hydrographic characteristics (geo-ecological framework) and ecological corridors. Catchment area

The catchment areas, which occupy the lower level of the relief, are mostly below of the isohypce 200 m (160-190 m). These characterized by a more levelling relief where there are glaciofluvial complexes and intrazonal periaquatic ecosystems. The vertical dissected relief rarely exceeds of 20 m. Here there are sandy moraine, which are distributed mainly on the contact with water- and glacial formations.

Tectonic fault of the Lake Maksimjärvi contributed to the formation of a large extended esker and water-glacial complex which occupy the southeast part from the lake. Height of sandy esker on some plots exceeds 20 m.

Fig.(3 on the left) Esker on the northern shore of the lake Maxim (left). ***Photo –*** *Victor A.Kolomytsev*

Fig. 2 on the right beneath) Water-glacial landforms to the south-east part from Lake Maksim (below right). *Photo – Victor A.Kolomytsev.*

Morpho-hydrographic characteristics (geo-ecological framework) and ecological corridors. Ecological corridors

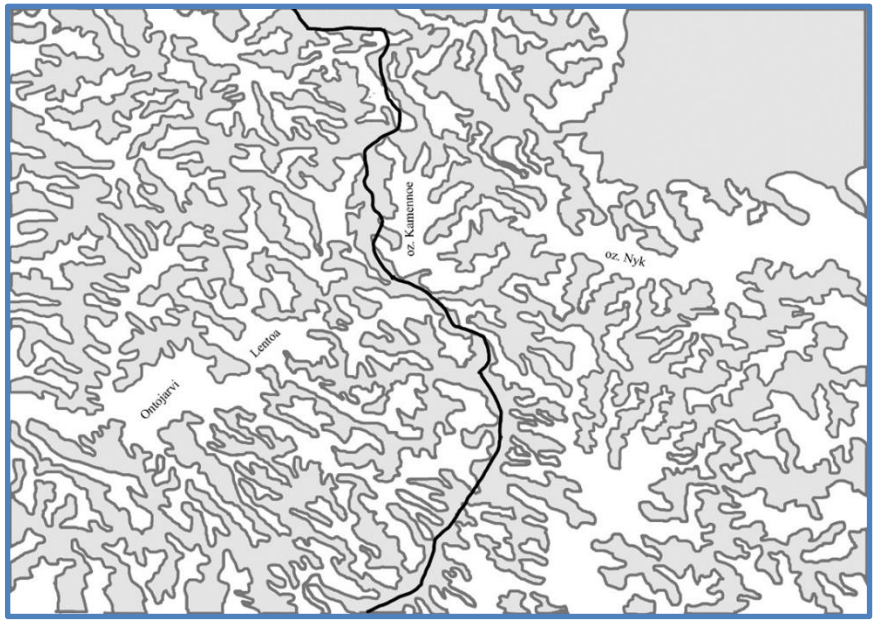
Ecological corridors on the basis of morpho-hydrographic structure is clearly attached to the White Sea-Baltic watershed (WBW) and its spurs of first order (see slide 7). Spurs branch off here to the north-east and south-west of the main watershed, ie perpendicular to it, in accordance with the local block structure of the crystalline basement.

Lakes Kamennoe and Labuka occupy a position near the main watershed. These form the core of two neighboring PAs (NR Kostamus and NP Kalevala) and these surrounded by the spurs of the WBW of first order with boreal ecosystems which were relatively weakly disturbed or has been restored naturally.

In this respect, the territory represent an ideal model for the formation of ecological corridors between protected areas and beyond by means of watershed spaces.

The plot of the watershed area between the lakes Kamennoe and Luvozero represents the only compact segment of White Sea-Baltic watershed where natural zonal structure of ecosystems are fully preserved.

Watershed (grey) and water cachment (white) areas of the Russian-Finnish border. District of Kuhmo - Kostamus (including the nature reserve)



Cutting

Cuttings are mainly fresh. Forest ground cover is disrupted and destroyed mechanically to 90% or more.

Destruction of ground vegetation on clear cuttings (photos - left and center)

Photo on the right shows an example of even-aged pine forest.

Photo – Victor A.Kolomytsev.

Age of tree stands

The average age of harvested wood is 100-200 years, that was estimated by the stumps and in stacks of defective (non-conforming) timber. The older generation of living trees with age 300-400 years has traces of numerous fires. Clearing areas with age over 2 or 3 years old were planted with seedlings of pine (see photo at right).




Fig. (3 photos on the left) The older generation of living trees with the age of 300-400 years has traces of numerous fires. ***Photo – Victor A.Kolomytsev***

Fig. (1 photo on the right) Pines are planted on a clear cutting places. ***Photo – Victor A.Kolomytsev*****.**

Discussion and conclusion

- As noted earlier, the landscape and forests near Lake Maksimjärvi are not unique on formal attributes. The same can also be noted for the mires and paludified ecosystems, except relatively low degree of paludification of areas surrounding the lake. These types of ecosystems are well represented in the "Kostamus“ NR and "Kalevala" NP.

- Image of modern native taiga around the lake Maksimjärvi testifies to its relatively coeval composition and predominance of mature stands before initial phase of the natural decay.

- We can assume that the decay phase of forest stands here does not occur over the last thousand years or more due to frequent and severe fires.

FIG. The predominance of mature stands up to the initial phase of the natural decay.
Photo – Victor A.Kolomytsev.

Discussion and conclusion

- Both nearest PAs cover only the slopes of the main watershed's space, while the largest of its spur with survived forests is situated on the north-west of the shore of Lake Maksim and so far has not yet been touched by fellings.

-This area is distinguished by the slightly swampy due to the topography and therefore it is subject to extensive fires.

- In the light of the ideas the formation of ecological corridors between protected areas of different status and commercial boreal areas, the preservation of this area will enhance the functions of the distributor of species diversity and the formation of zonal coenotic structure.

- The main advantage of this area is the complete absence of human influence and natural processes occurring here when compared with the existing PAs where human influence in earlier times has been stronger, e.g. selective loggings.