Center for Forest Ecology and Productivity RAS

APPROACHES TO VEGETATION MAPPING OF KOLA PENINSULA

T.Chernenkova, M.Puzachenko, I.Kotlov

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Presentation plan

- ☑ General aims, approaches and tools
- ☑ Our approaches to zoning and classification of vegetation at hierarchical levels
- ☑ General background on status of ecological regionalization and mapping at Russian national scale
- ☑ Specific examples for regional mapping area - Murmansk area, Kola Peninsula
- ☑ Results of cartography modeling of testing region
- ☑ Conclusion

Aims

- Application of Russian mapping experience in for developing of CBVM at global level
- Actual and potential vegetation mapping of Kola Peninsula (Russian part) at regional and local levels
  - Estimate of boreal forest dynamic under natural (climate) and anthropogenic (air pollution, fires, cutting) factors
  - Definition of the role of leading factor of forest types spatial distribution (at first - landscape)

Approach

- To develop zoning and classification for vegetation units at different levels (global, regional and local)
- To compare with the Circumpolar Arctic Vegetation Map (CAVM) on upper level
- The basic map units should be physiognomic thorough the usage of remote sensing data
- To combine ecosystem and succession approaches
- To define and to use the most significant indicators of forest biodiversity

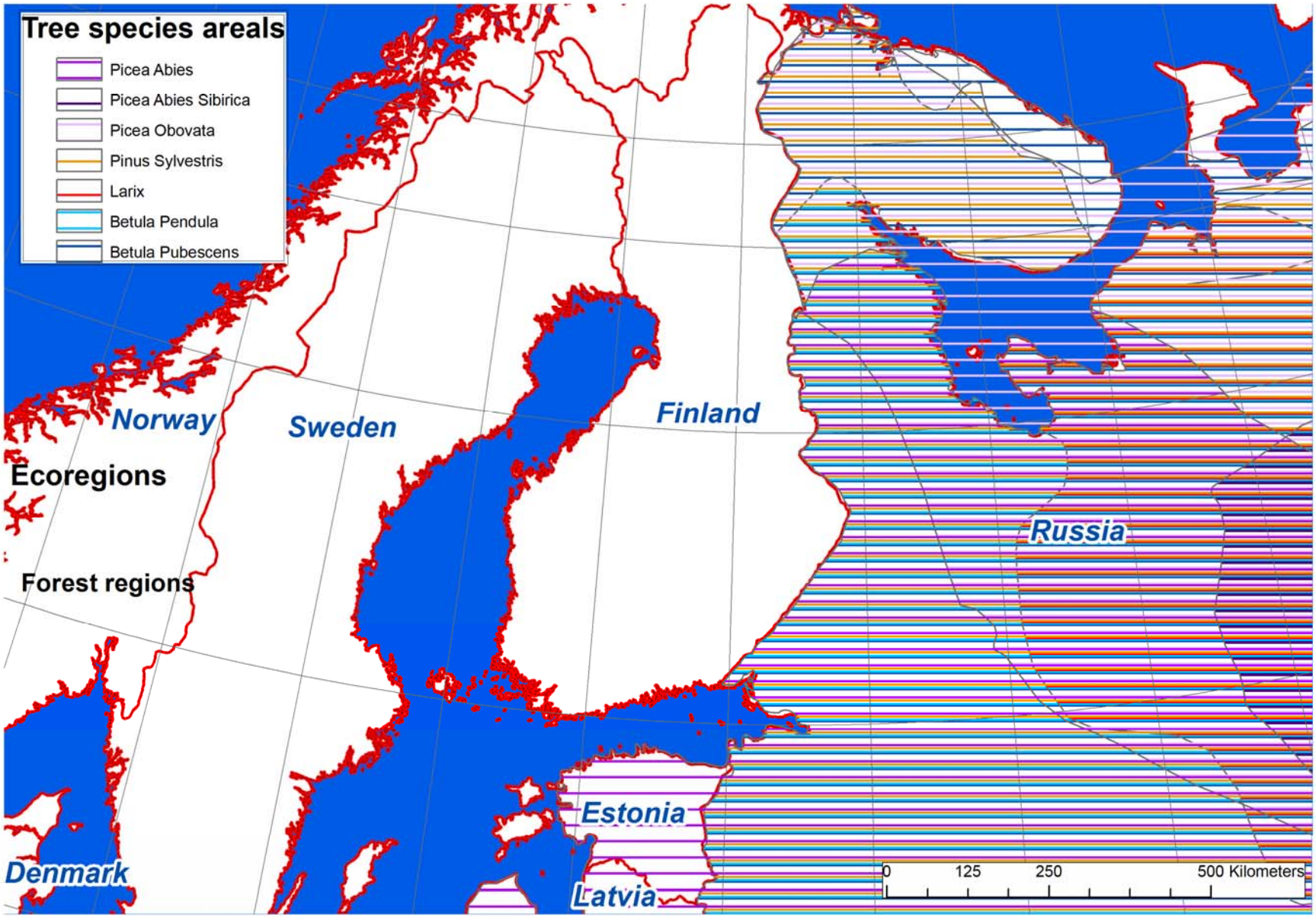
Tools

- ☑ Apply the integrate information basic supported for compatibility of all using tools
- ☑ Use and generalize all cartographical information of NW Russia
- ☑ Develop methods for creating large-area vegetation maps based on Landsat TM/ETM+ images for testing region
- ☑ Combine field and remote sensing methods for satellite images validation
- ☑ Use GIS means and mapping cartography
- ☑ Use landscape information (relief data) and climate date for create the potential vegetation map

Botanico-geographical zoning and classification of boreal vegetation at hierarchical levels

Average size	$<10^6$ km ^{2}	10^4 - 10^6 km ^{2}	10^2 - 10^4 km ^{2}	$>10^4$ km ^{2}
Map scale	<1:1 000 000	1:500 000 – 1 000 000	1:200 000 – 1:500 000	>1:200 000
Scale	Global	National	Regional	Local
Key factors	Climate	Climate Geology	Climate Geology Landscape	Landscape Ecological factors *(altitude, hydrology, soil)* Disturbance
Hierarchical levels	Vegetation zone	Ecological region and subzune		Landscape
Definitions	Zonal and extra-zonal vegetation	West-Europe, East-Europe, West Siberia, Middle-Siberia, East-Siberia, Far-Eastern part	Subzonal forest type (north, middle, south types)	Forest type
Example	Taiga zone	European north boreal region	East Scandinavian (Kola Peninsula)	Piceetum fruticuloso-

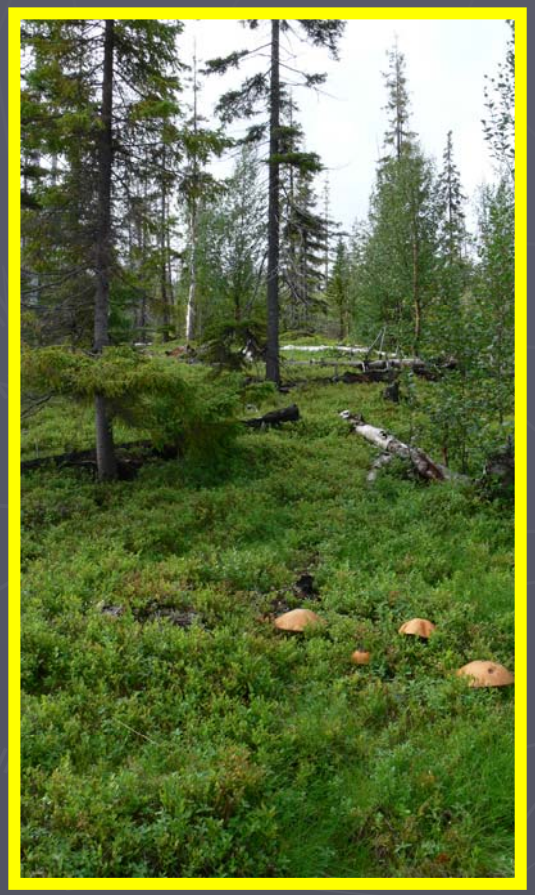
Existing map of vegetation – *global level*



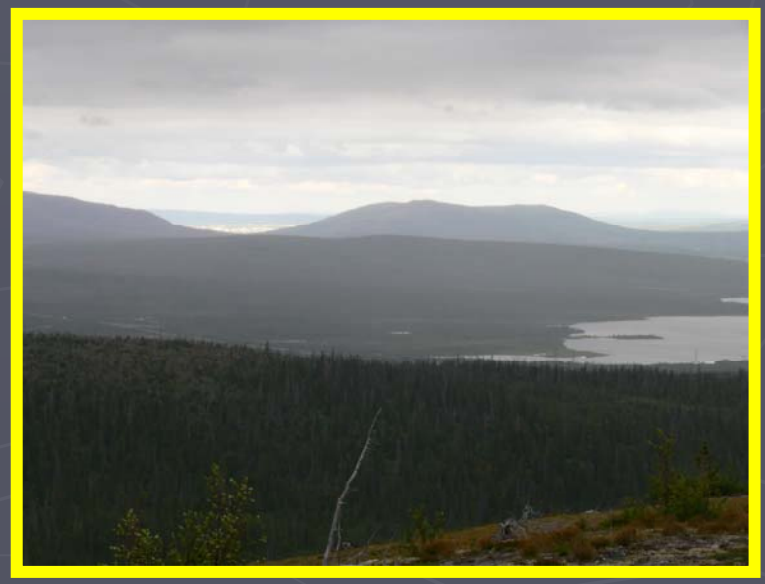
Murmansk area, Kola Peninsula – *regional level*

The area covering 144 900 km², situate between tundra in north and spruce-moss forest in south and characterised by various relief, altitude, climate, drainage and types of vegetation.

There are different type of anthropogenic influence at Murmansk woodland.



Total area: 144 900 sq. km
Population: 0,857 mill
Forest vegetation 37,2 %
Fair area - 0,34%,
Loggings - 2,94%



-1165 vascular species.
-about 540 mosses species
-almost 1000 lichens

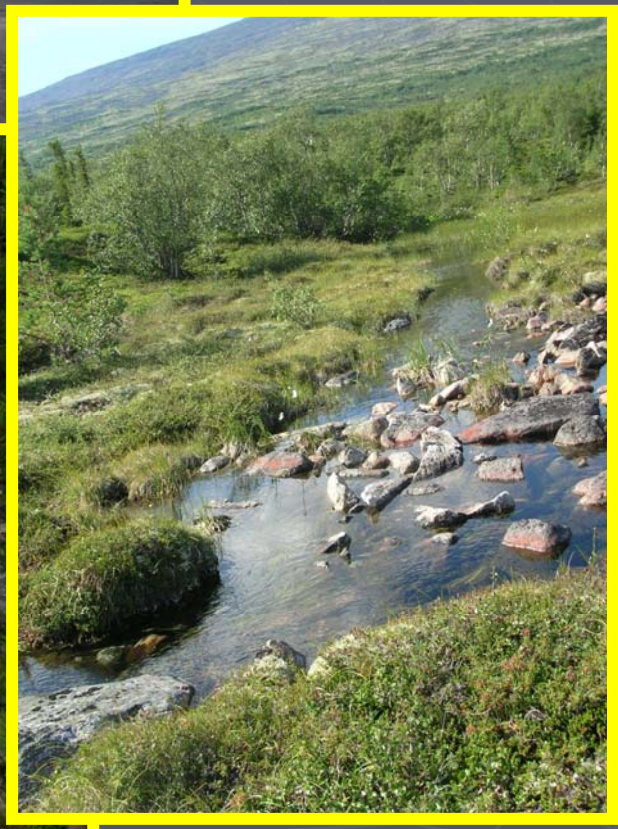
alpine tundra

open forests

pine and spruce forests

bogs

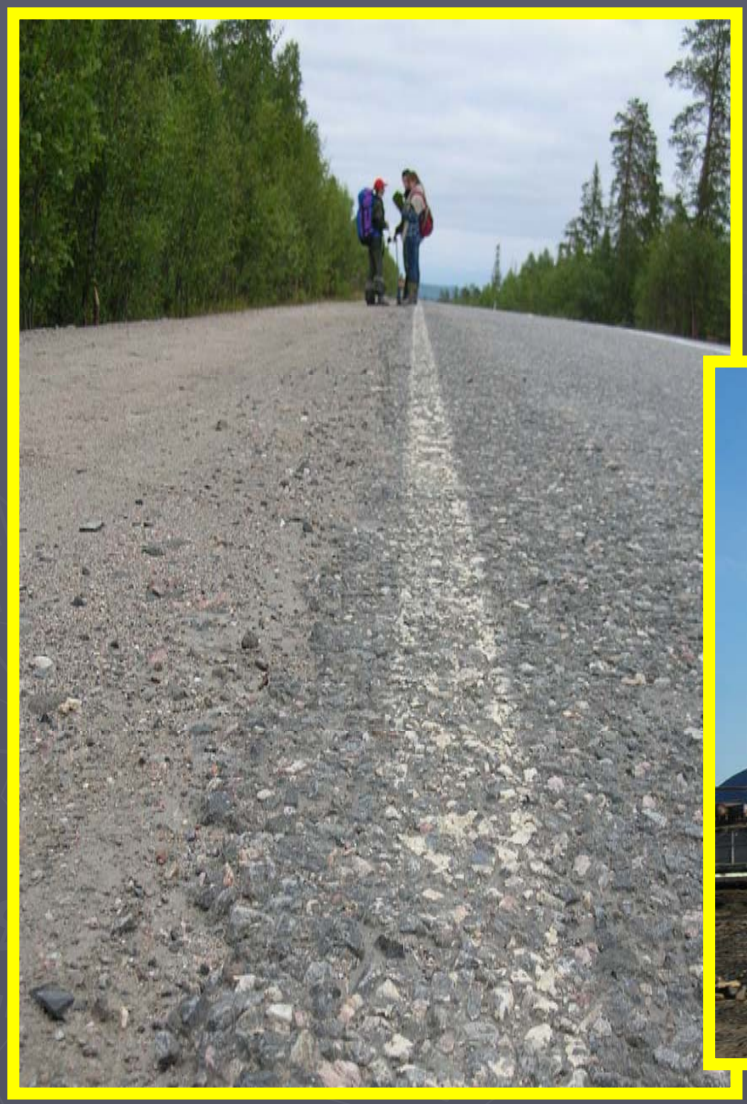
water



cutting area

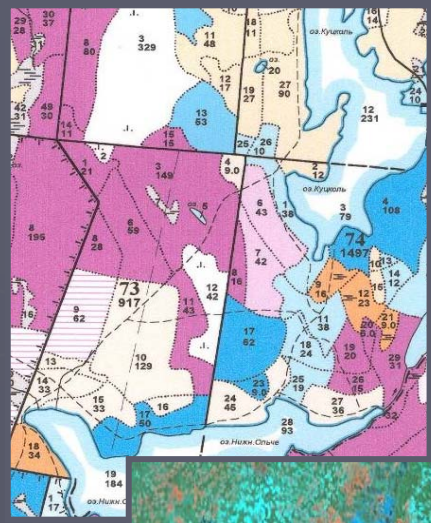
burned area

industrial barrens

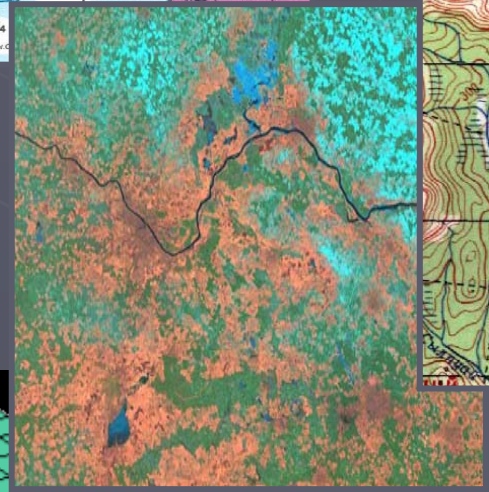


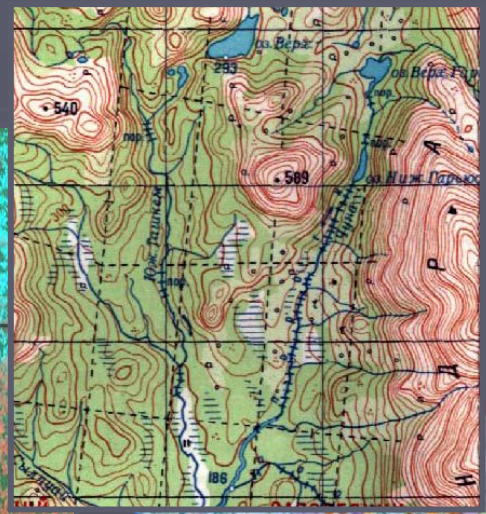
The main used information sources:

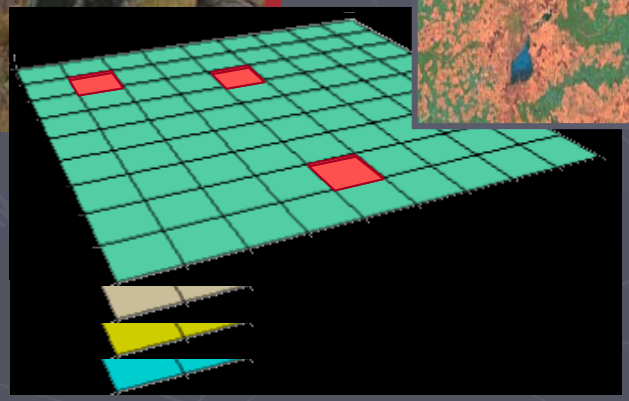
- *Field data*



- *Forest inventory data*
- *Landsat GeoCover™ imagery*
- *Topographic maps*
- *Vegetating maps*

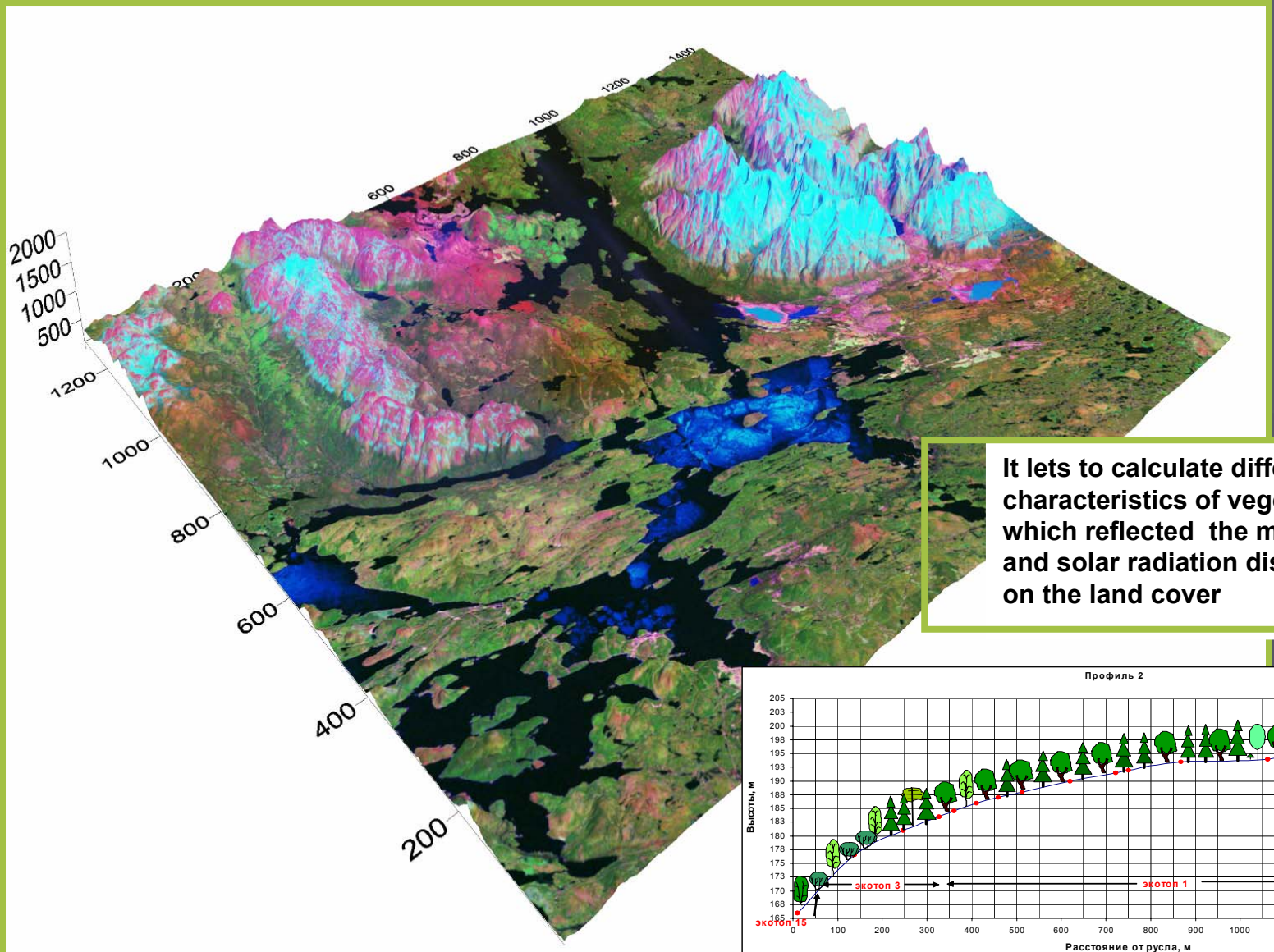




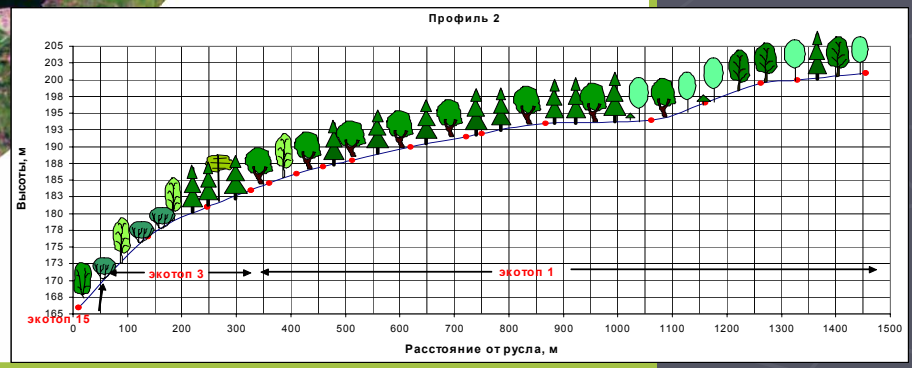


Digital elevation model of Imandra lake watershed

(1:200 000)



It lets to calculate different characteristics of vegetation which reflected the moisture and solar radiation distribution on the land cover



Estimation of vegetation structure includes the following steps:

- Pre-classification. Preliminary processing of remote sensing imagery set
  - Definition of optimal set of units for classification and types of information for autodetection of typological diversity of land cover
- Field survey.
- Classification. Using training sample set for cartographical modeling and estimation of reliability for defined units
- Standardization. Thematic interpretation and map validation including field data analysis.

Classification: the modeling scheme of vegetation cover structure

Field data

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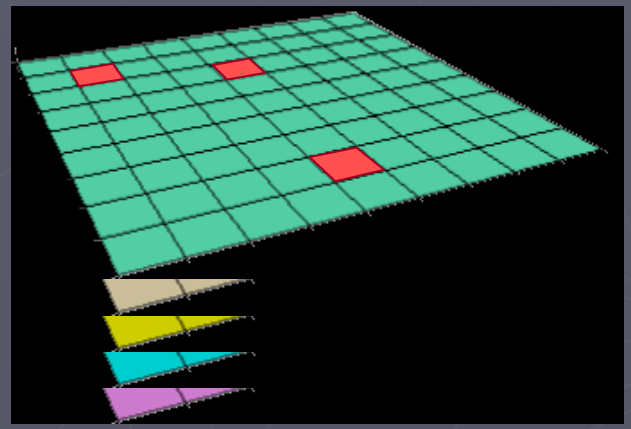
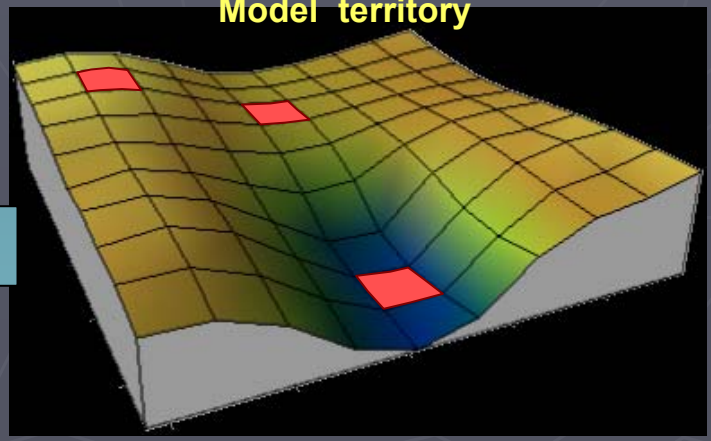
- Remote sensing data
- **DEM**
- Thematic maps

Environmental characteristics for each pixel

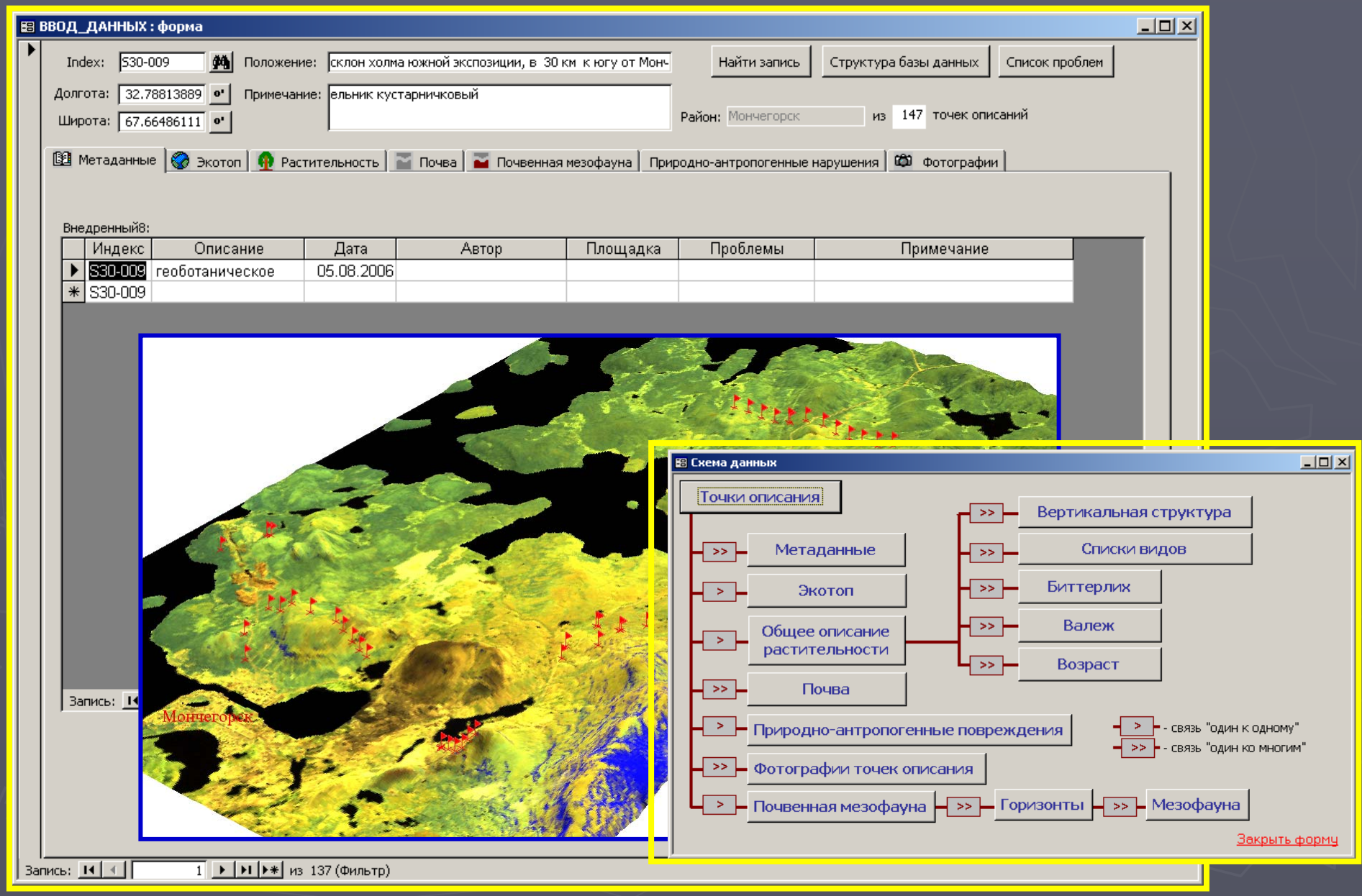


Model territory



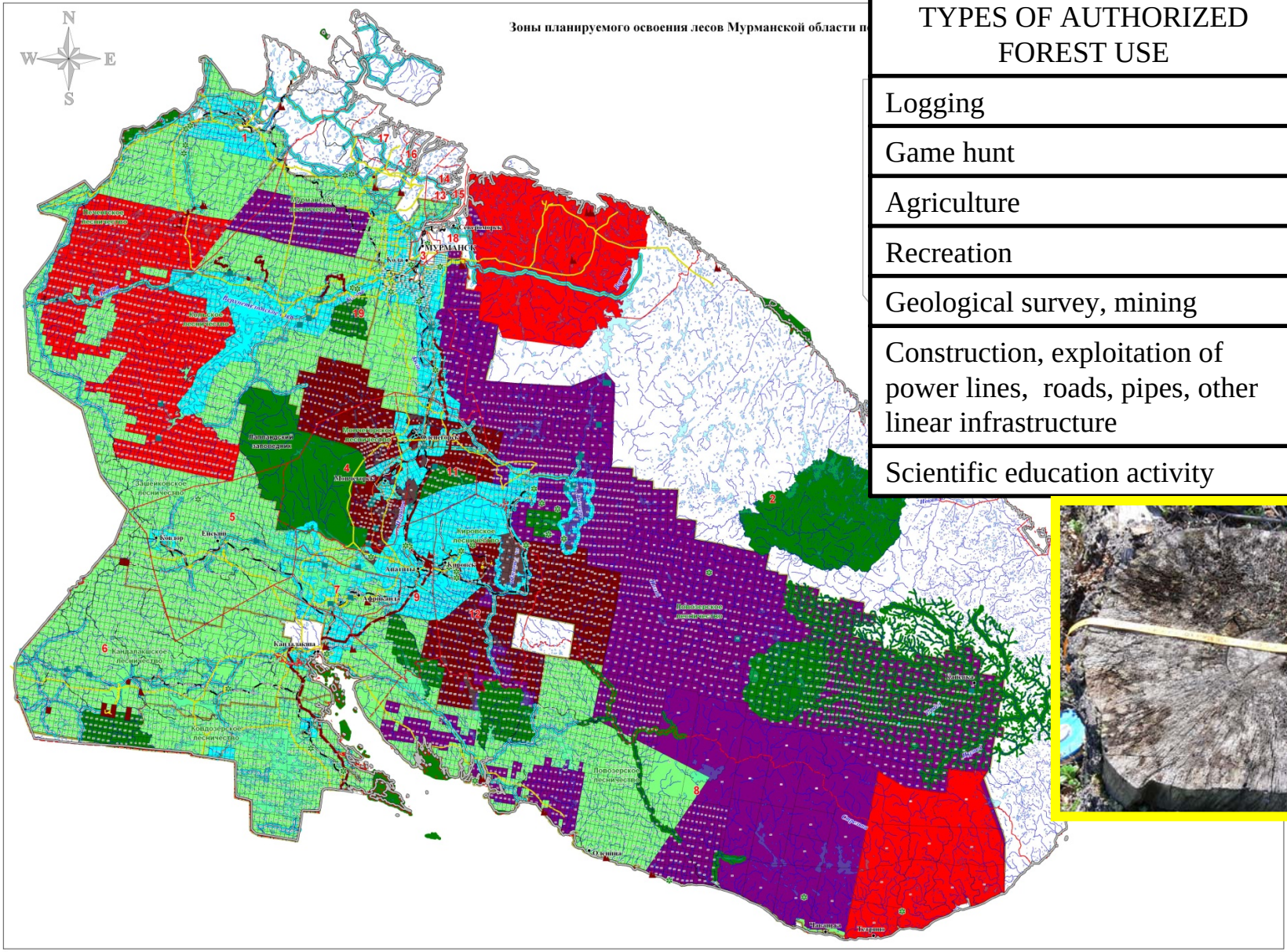
On the base of quantitative method of vegetation cover state assessment using field data, the remote sensing data and digital elevation model (DEM) the interpolation of forest biodiversity parameters on total model area were performed

DATABASE ARCHITECTURE AND INPUT OF FIELD DATA
in integrate geoinformation system

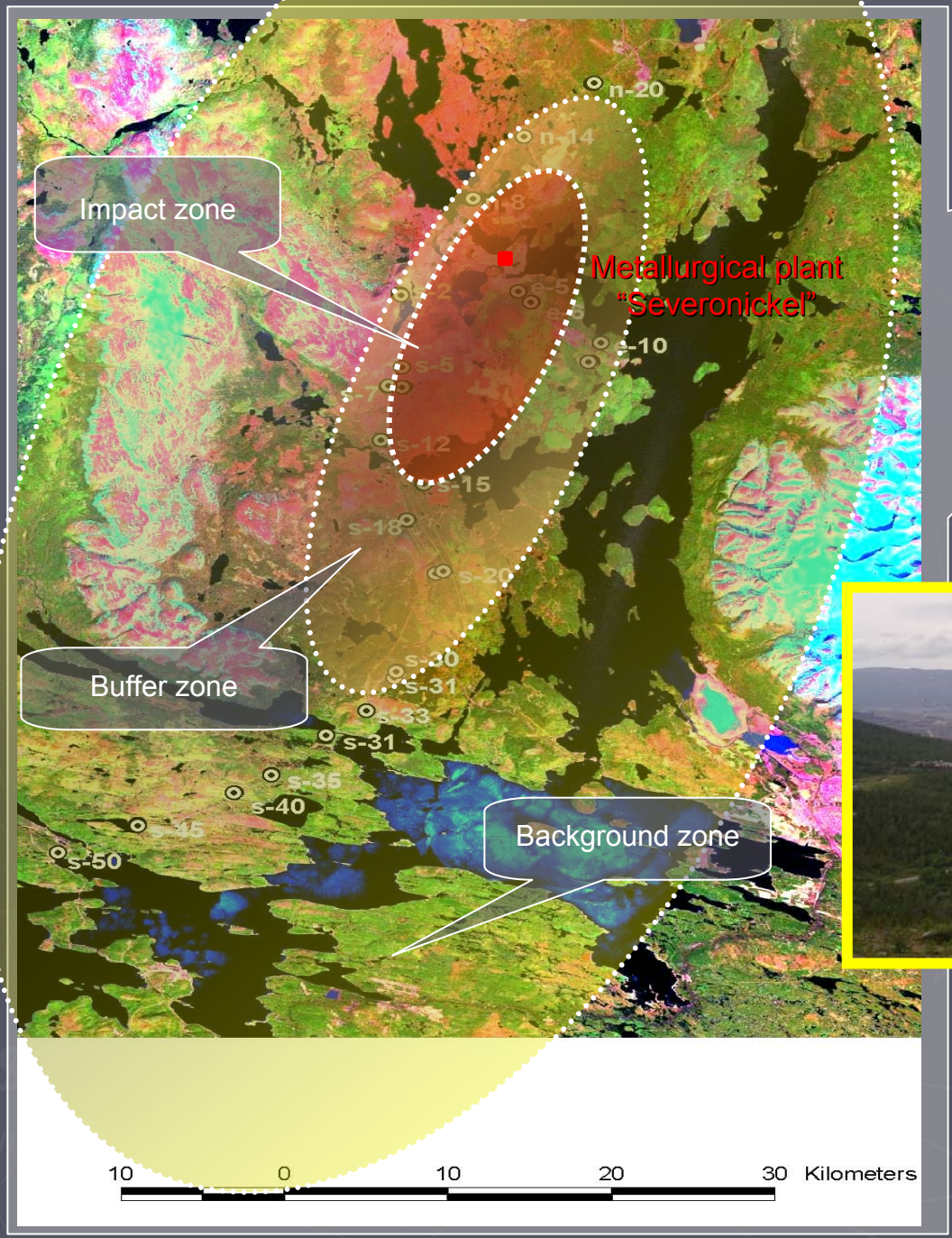


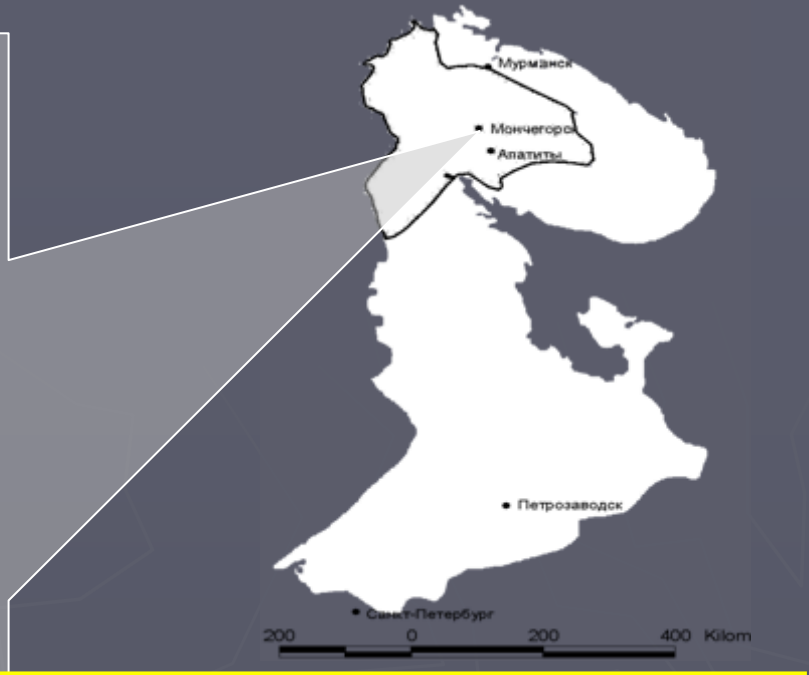
Implementing classification of potential vegetation we should reveal the features of spatial distribution of forest types due natural dynamic and as the result of anthropogenic influence

Zones of planed anthropogenic use

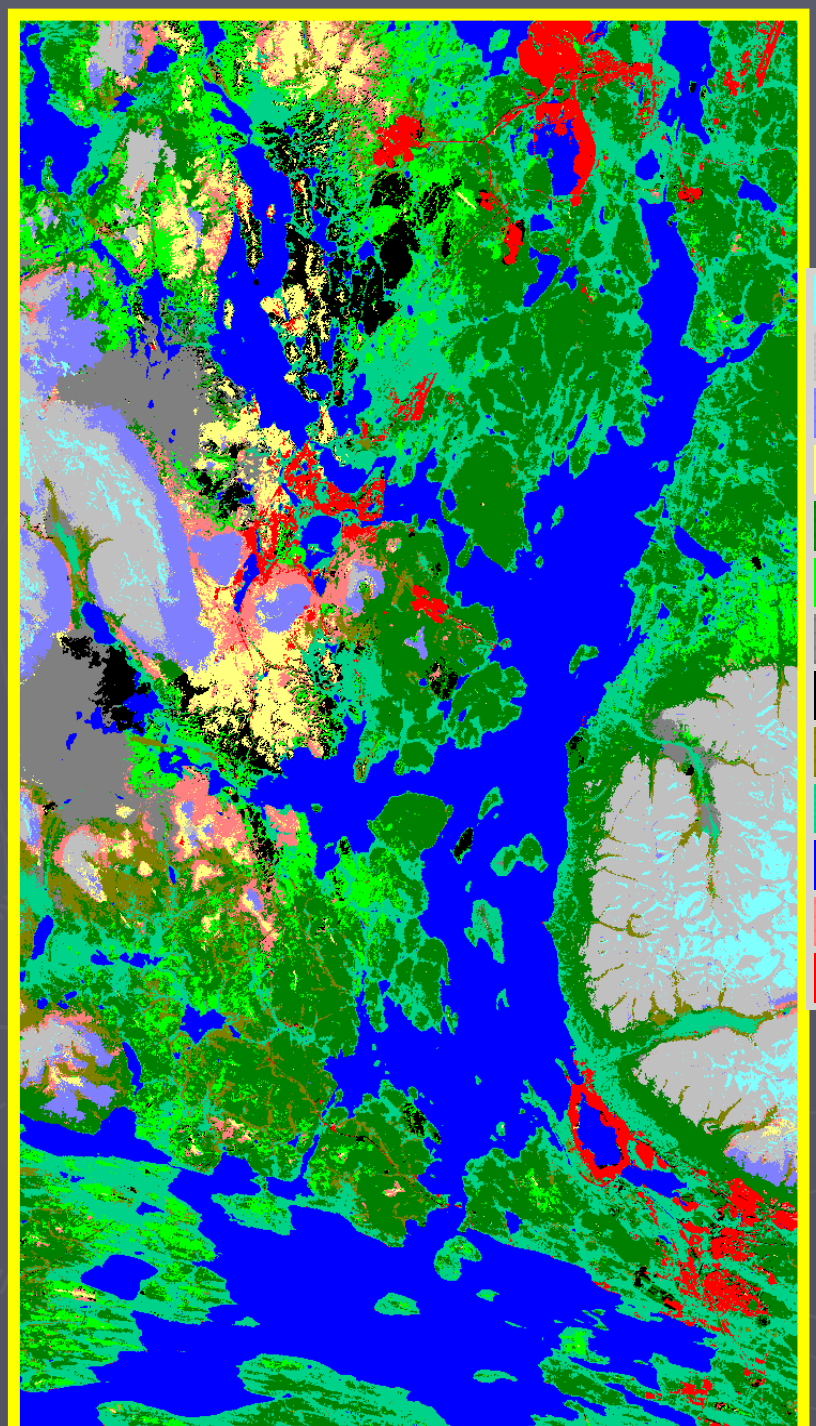


TYPES OF AUTHORIZED FOREST USE	Priorit yllevel
Logging	1
Game hunt	6
Agriculture	3
Recreation	2
Geological survey, mining	4
Construction, exploitation of power lines, roads, pipes, other linear infrastructure	5
Scientific education activity	7



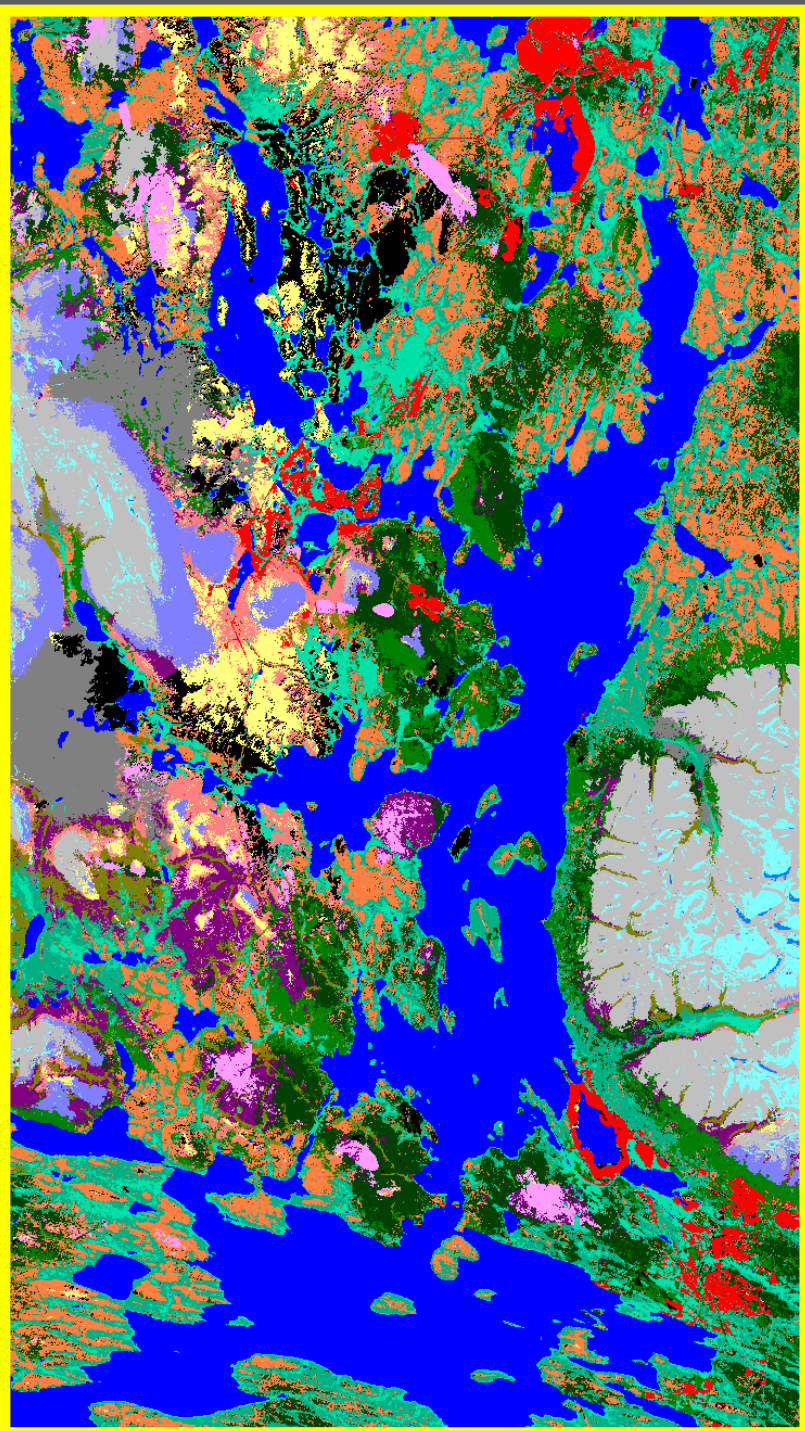


Damaged zone near pollution source



Types of ground cover

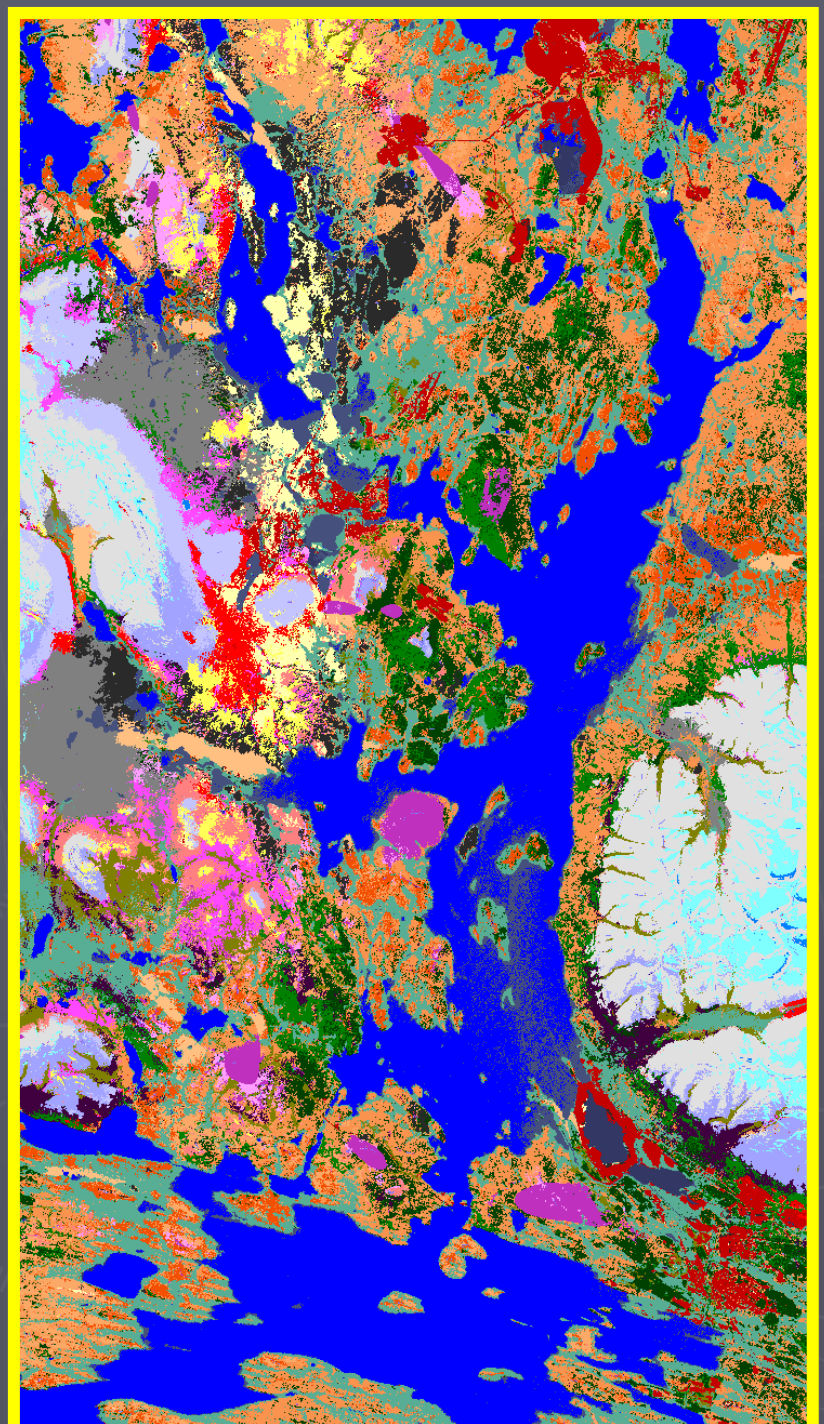
- Nival-glacial
- Stone goltsy
- Tundra
- Birch crooked-stem forests with spruce and pine
- Forest
- Open forest
- Cutting area
- Burned area
- Swamps
- Floodplains and lowland swamp
- Lakes, rivers and settlers
- Industrial barrens (patches of birch and birch-willow sprouting)
- Wastedumps and careers



Subtypes of vegetation cover (formation groups)

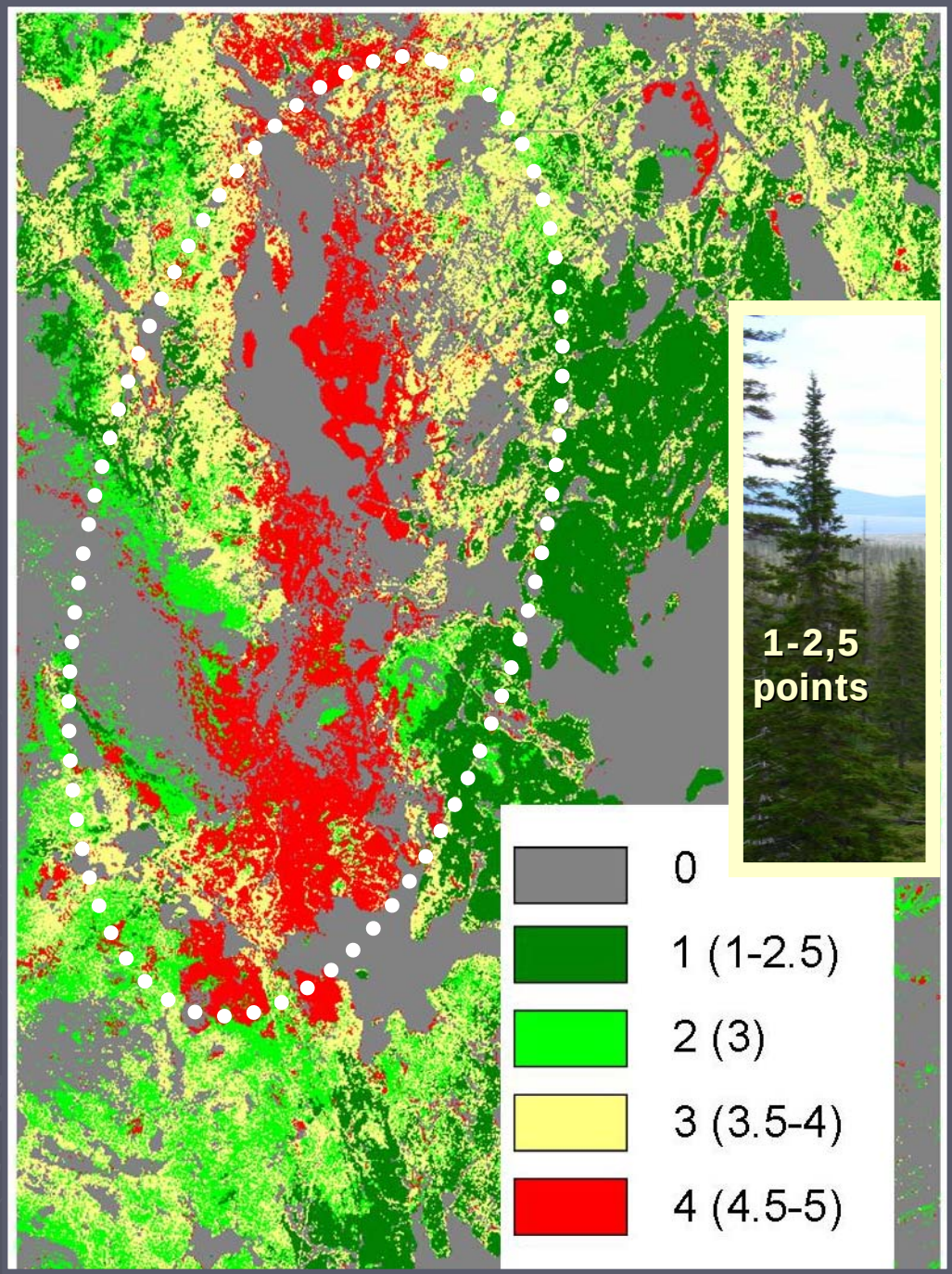
	Glacial
	Nival
	Stone goltsy barrens
	Tundra
	Birch (*Betula tortuosa*) crooked-stem forests with spruce and pine
	Spruce forest
	Pine forest
	Spruce-birch and pine-birch forest
	Birch (*Betula subarctica*) forest
	Spruce open forest
	Pine open forest
	Cutting area
	Burned area
	Swamps
	Floodplains and lakesides
	Lowland swamp and swamp forests
	Lakes and settlers
	Industrial barrens (patches of birch and birch-willow sprouting)
	Wastedumps and careers

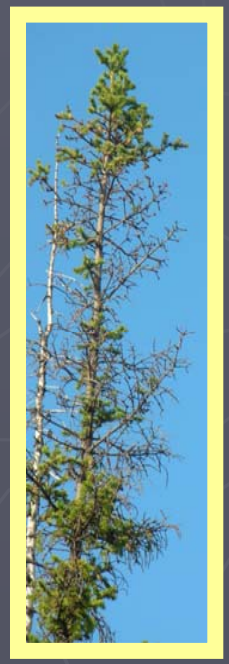
Plant communities with and without visual disturbances



	Glacial
	Nival
	Stone goltsy barrens
	Tundra with dwarf-shrubs and lichens
	Tundra with dwarf-shrubs
	Tundra with dwarf-shrubs and dwarf-shrubs-lichens, sedge-dwarf-shrubs
	Birch (*Betula tortuosa*) crooked-stem forests with spruce and pine dwarf-shrubs semi-dead ground layer
	Birch forest with dead ground layer with sparse dwarf-shrubs
	Spruce forest with green mosses and lichens and dwarf-shrubs and green mosses
	Spruce forest with dwarf-shrubs
	Spruce forest with dwarf-shrubs semi-dead ground layer
	Open pine forest with lichens and lichens and green-mosses
	Open pine forest with dwarf-shrubs
	Open pine forest with dwarf-shrubs and lichens
	Open pine forest with lichens semi-dead ground layer
	Spruce-birch and pine-birch forest with dwarf-shrubs and green-mosses and lichens
	Birch (*Betula subarctica*) forest with dwarf-shrubs and dwarf and green-mosses
	Open spruce with dwarf-shrubs and *Deschampsia flexuosa*
	Cutting area
	Burned area
	Mires with sedge-sphagnum and herbal- sedge-sphagnum sometimes with dwarf-shrubs and shrubs
	Hummock-hollow bogs: dwarf-shrub-sphagnum on hummocks, sometimes with pine and sphagnum hollows
	Lakes and rivers
	Polluted lakes
	Settlers
	Industrial barrens (patches of birch and birch-willow sprouting) with dwarf-shrubs
	Industrial barrens (patches of birch and birch-willow sprouting) with dwarf-shrubs-semi-dead ground layer
	Wastedumps

Vital status of trees, points





Conclusion

- It is necessary to create 2 Circumboreal Vegetation Maps – Actual and Potential vegetation
- The base map units should be physiognomic thorough the usage of remote sensing data
- To reveal a set of levels and reflect forest vegetation on different scales
- To develop zoning and classification for vegetation units at different level (global, regional and local)
- For imaging of forest cover dynamic to replace current state each 10 (for example) years at Actual Map
- For creating potential Map some tools and approaches should be use for example DEM, climate parameters, region data


Thank you for your attention !