APPROACHES TO VEGETATION MAPPING OF KOLA PENINSULA

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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)
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

<table>
<thead>
<tr>
<th>Average size</th>
<th>&lt;10⁶ km²</th>
<th>10⁴ - 10⁶ km²</th>
<th>10² - 10⁴ km²</th>
<th>&gt;10⁴ km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map scale</td>
<td>&lt;1:1,000,000</td>
<td>1:500,000–1,000,000</td>
<td>1:200,000–1:500,000</td>
<td>&gt;1:200,000</td>
</tr>
<tr>
<td>Scale</td>
<td>Global</td>
<td>National</td>
<td>Regional</td>
<td>Local</td>
</tr>
<tr>
<td>Key factors</td>
<td>Climate</td>
<td>Climate Geology</td>
<td>Climate Geology</td>
<td>Landscape Ecological factors (altitude, hydrology, soil) Disturbance</td>
</tr>
<tr>
<td>Hierarchical levels</td>
<td>Vegetation zone</td>
<td>Ecological region and subzone</td>
<td>Landscape</td>
<td></td>
</tr>
<tr>
<td>Definitions</td>
<td>Zonal and extra-zonal vegetation</td>
<td>West-Europe, East-Europe, West Siberia, Middle-Siberia, East-Siberia, Far-Eastern part</td>
<td>Subzonal forest type (north, middle, south types)</td>
<td>Forest type</td>
</tr>
<tr>
<td>Example</td>
<td>Taiga zone</td>
<td>European north boreal region</td>
<td>East Scandinavian (Kola Peninsula)</td>
<td>Piceetum fruticuloso-</td>
</tr>
</tbody>
</table>
Existing map of vegetation – *global level*

**Tree species areals**
- Picea Abies
- Picea Abies Sibirica
- Picea Obovata
- Pinus Sylvestris
- Larix
- Betula Pendula
- Betula Pubescens

**Ecoregions**
- Norway
- Sweden
- Finland
- Russia
- Estonia
- Latvia
- Denmark
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
water
cutting area
burned area
industrial barrens
The main used information sources:

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

**Field data**
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

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

<table>
<thead>
<tr>
<th>TYPES OF AUTHORIZED FOREST USE</th>
<th>Priority Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging</td>
<td>1</td>
</tr>
<tr>
<td>Game hunt</td>
<td>6</td>
</tr>
<tr>
<td>Agriculture</td>
<td>3</td>
</tr>
<tr>
<td>Recreation</td>
<td>2</td>
</tr>
<tr>
<td>Geological survey, mining</td>
<td>4</td>
</tr>
<tr>
<td>Construction, exploitation of power lines, roads, pipes, other linear infrastructure</td>
<td>5</td>
</tr>
<tr>
<td>Scientific education activity</td>
<td>7</td>
</tr>
</tbody>
</table>
Metallurgical plant "Severonikel" in Russia

- Impact zone
- Buffer zone
- Background zone

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 golsy 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

- 1-2.5 points
- 3 points
- 4 points
- 5 points

Legend:
- 0
- 1 (1-2.5)
- 2 (3)
- 3 (3.5-4)
- 4 (4.5-5)
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!