Connectivity of high conservation value forests along Finnish-Russian borders

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Categories of high conservation value forests (hcvfs)

Finland

Protected

- State protected territories (LsAlueValtio)
- Natura 2000 (NaturaSAC_alueet, NaturaSPA_alueet)
- Private protected territories (LsAlueYks)

Not protected

- *Old-growth forests owned by state and private persons*
    - Age more than 99 years

Russia

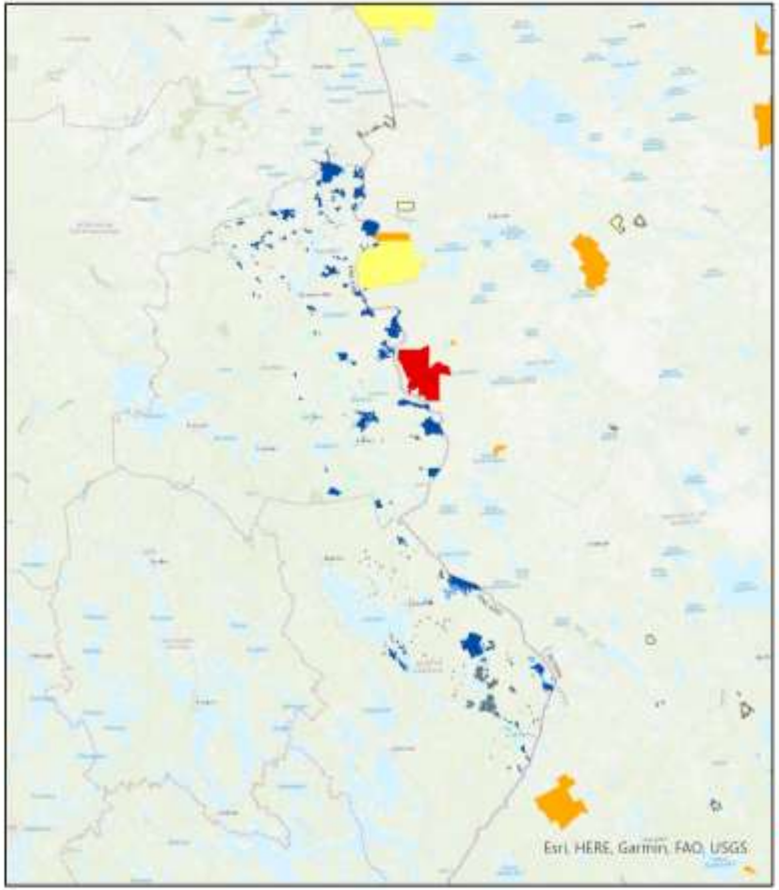
Protected

- State nature zapovedniks, including Biosphere reserves (biosphere zapovedniks)
- National Parks
- State nature protected territories (zakazniks).
- Natural Monuments

Not protected

- *Old-growth forests owned by state and leased by private companies*
    - Age more than 99 years

Protected high conservation value areas within Biokarelia study area 2021



Russia 85% of the total area, 7 patches
Finland 15% of the total area, 450 patches

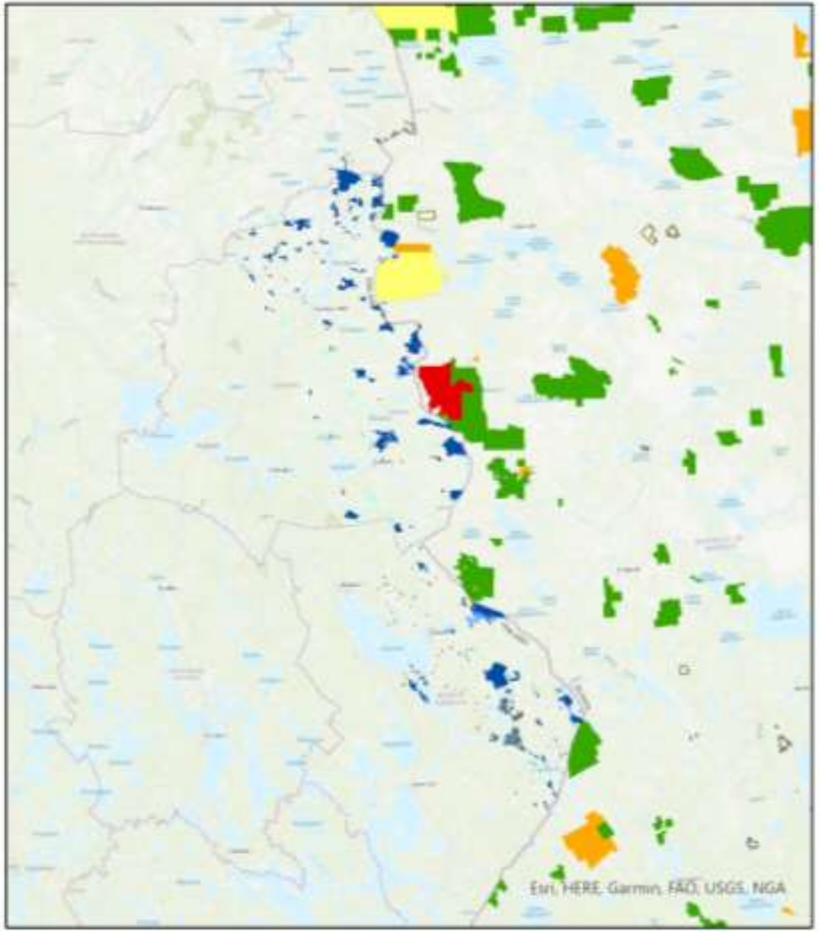
Russia is protecting the homogeneous area
Finland is protecting network of fragmented areas

Protected terrirories in Finland

- State protected territories (LsAlueValtio)
- Private protected territories (LsAlueYks)
- Natura 2000 (NaturaSPA_alueet)
- Natura 2000 (NaturaSAC_alueet)

Protected territories in Russia

- National Park
- Natural Monument
- State Natural Zakaznik
- State Natural Zapovednik



Potential future changes in the network of protected high conservation value areas within Biokarelia study area

Plans for creation of new protected areas in Republic of Karelia in 2012-2016

Protected terrirories in Finland

- State protected territories (LsAlueValtio)
- Private protected territories (LsAlueYks)
- Natura 2000 (NaturaSPA_alueet)
- Natura 2000 (NaturaSAC_alueet)

Protected territories in Russia

- National Park
- Natural Monument
- State Natural Zakaznik
- State Natural Zapovednik

- Planned protected territories

Key features of not protected high conservation value forests

Finland

- important role in connectivity between HCVFs
- preserved during last 100 years
- mature stands with high share of sawlogs or veneer logs
- relatively high amount of dead wood
    - important for biodiversity
    - fire risk

Russia

- state owned
- leased by the companies for timber harvesting
- ”pristine” forests without intensive management
- very high amount of dead wood
    - important for biodiversity
    - fire risk

Common challenge: **How to map remaining not protected high conservation value forests to evaluate the connectivity?**

Solution: **to combine forest management data with remote sensing data**

Finland

Stand-level information from Forest Center
- Annually updated data from 2021
- Age of the stands was verified in the field
- Stands with age of the trees more than 99 years in any tree layer for 2021

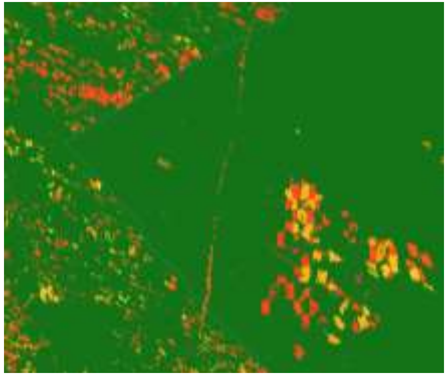
Database on protected territories from Syke

Russia

Stand-level information from Ministry of Ecology of Republic of Karelia
- Forest management inventory in 1987 - 2007
- Stand-level databases and paper maps were digitized in 2014 within ENPI Karlands project
- Age of the stands was verified in the field
- Stands with age of the trees more than 99 years in any tree layer for 2021

Boundaries of protected territories

Updated using the satellite data for 1985-2019

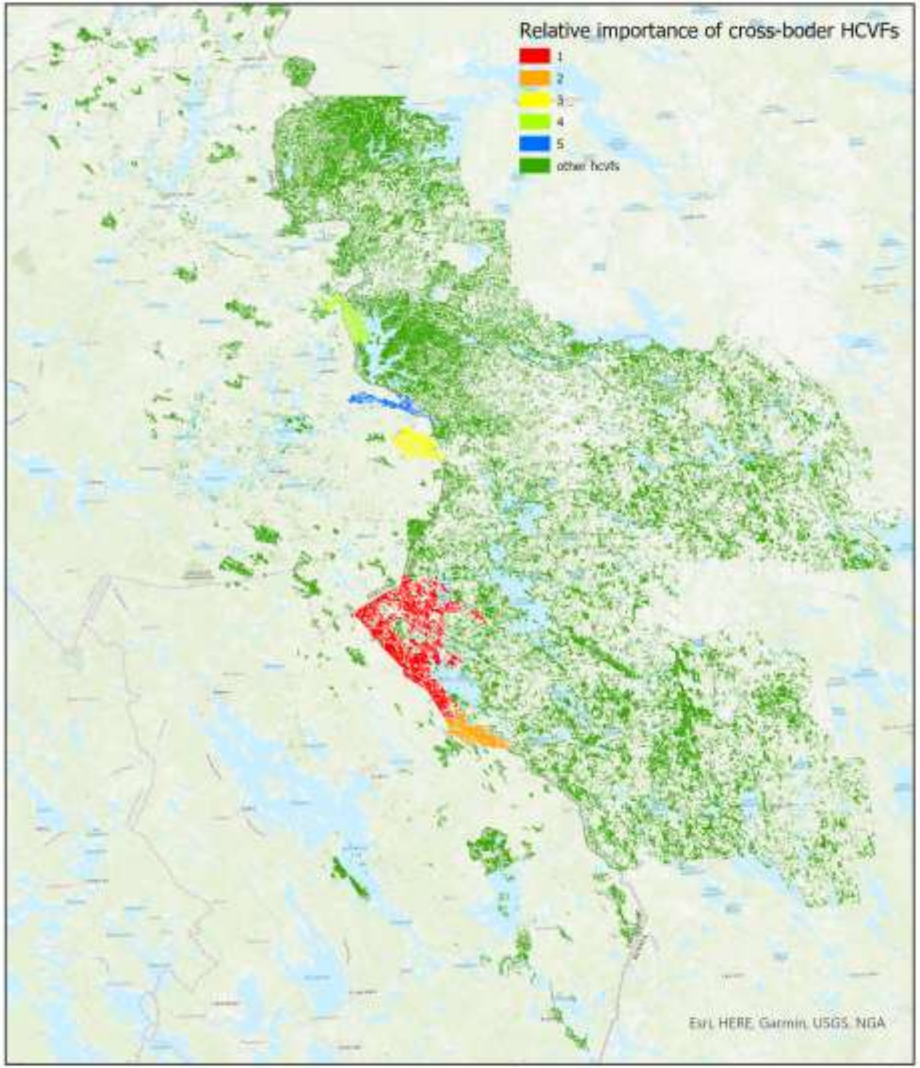


- Added forest corridors between the countries (to «no data» zone)
- Non forest areas were excluded (tree cover share less than 1%, clear-cuts)
- Used for correction of borders of old-growth stands only

High conservation value forests along the border

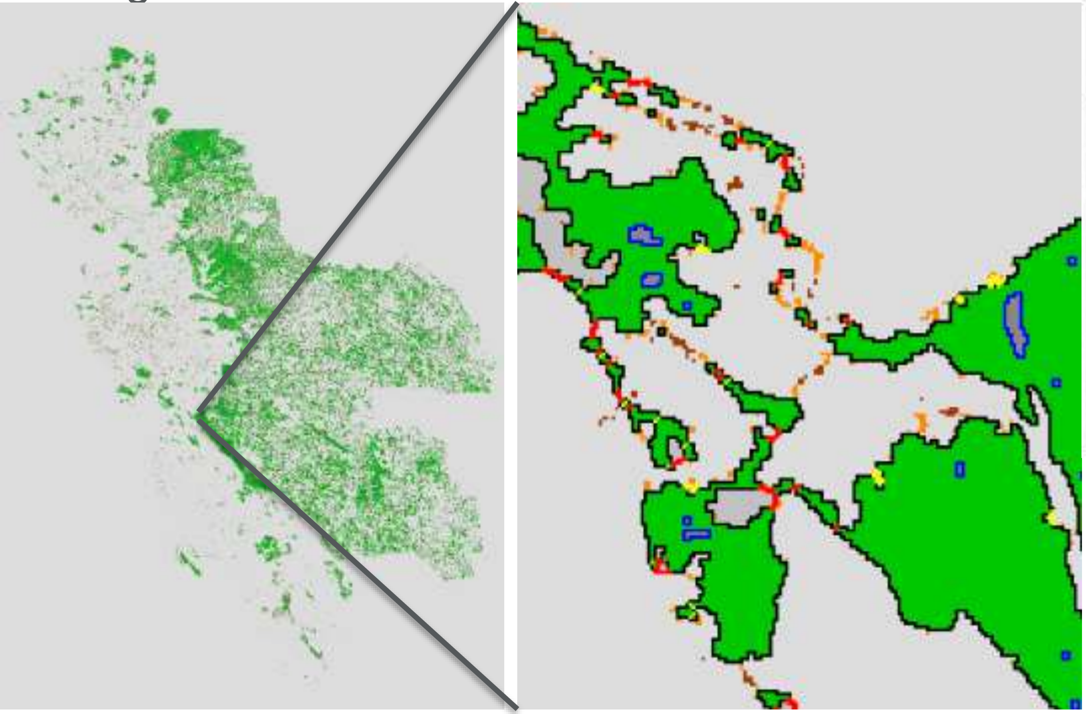
- 183 forest patches are crossing the border within the study area (= 183 biodiversity/fire crossing corridors)
- Relative importance of cross-border hcvf patches was calculated via area of the patch

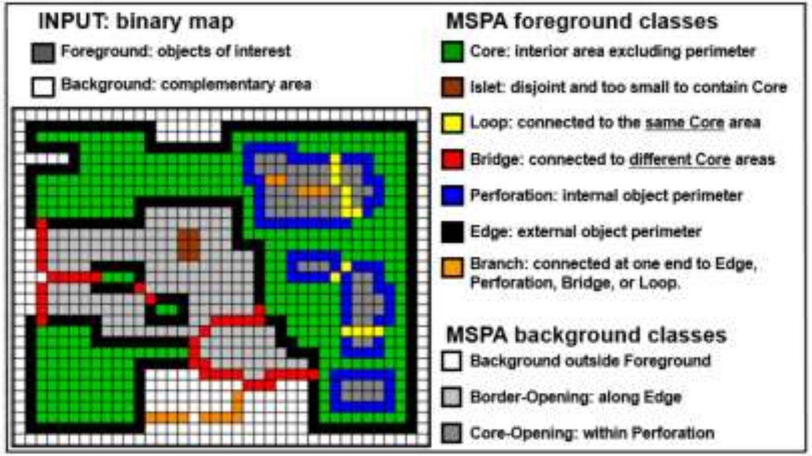
What are the most important connectors between the patches?



Solution: **Morphological Spatial Pattern Analysis followed by graph-theory analysis of the bridges**

1 Stage: MSPA



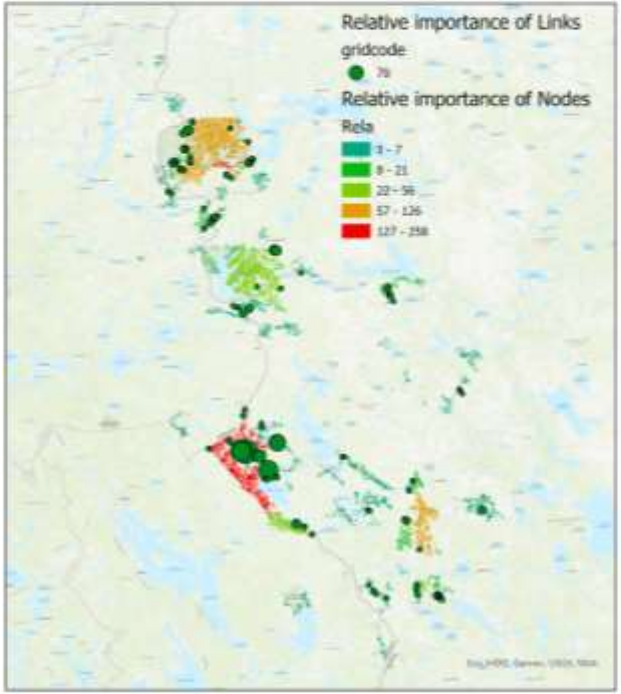


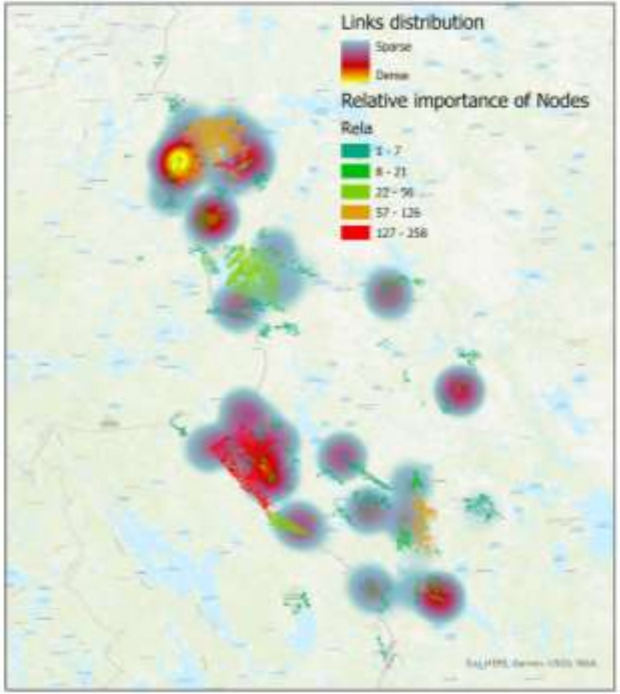
P. Vogt & K. Riitters, 2017: GuidosToolbox: universal digital image object analysis. European Journal of Remote Sensing (TEJR), DOI: http://dx.doi.org/10.1080/22797254.2017.1330650

Guidos Toolbox 1.8.1
https://forest.jrc.ec.europa.eu/en/activities/lpa/gtb/

Solution: **Morphological Spatial Pattern Analysis followed by graph-theory analysis of the bridges**

2 Stage: Connectivity importance for each node and each link of the network





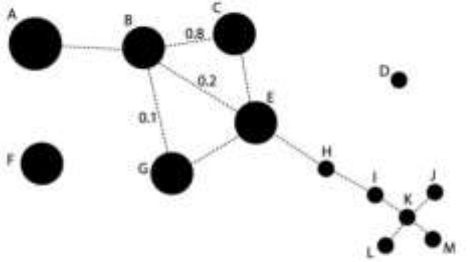
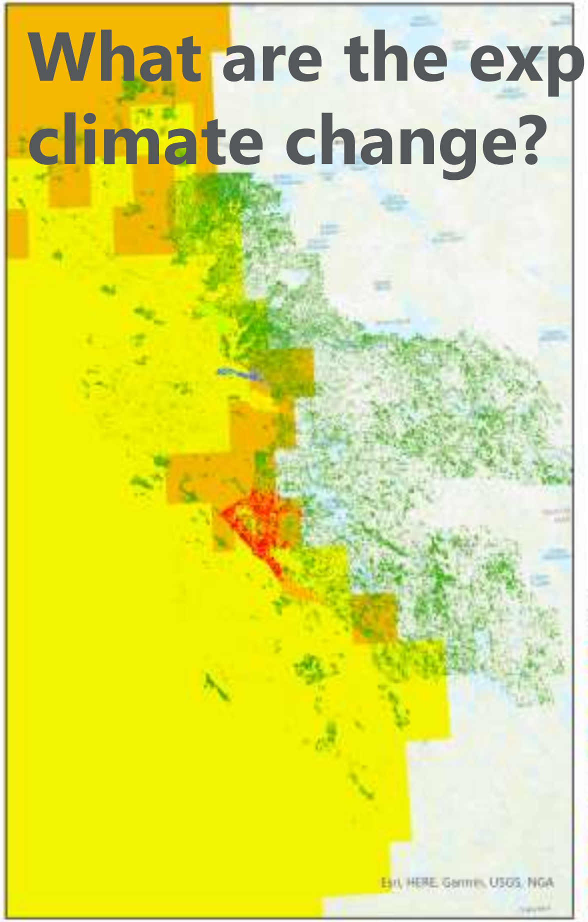


Figure 1. A simple landscape graph to illustrate the dPC_k fractions and the contribution to overall habitat availability and connectivity of different habitat patches (shown in black) and links (dashed lines). Habitat area (circle size) is the patch attribute (a_i), which corresponds to 1 area unit for patches D, H, I, J, K, L and M, 6.8 area units for patches B, C, E, F and G, and 10.5 area units for patch A. All of the links are assumed to have a direct dispersal probability ($p_{ij} = p_{ji}$) of 0.5 except for those where a different value is explicitly shown (links BC, BE and BG). All of the rest are assumed to be unconnected ($p_{ij} = 0$). The resulting values of the dPC_k fractions for each of the patches and links in this landscape graph are shown in Table 1 and 2.

Saura, S. & L. Rubio. 2010. A common currency for the different ways in which patches and links can contribute to habitat availability and connectivity in the landscape. **Ecography** 33: 523-537.

What are the expected changes in fire risks due to climate change?



15 – 89% increase number of days with high fire risk

Data source:
http://www.nic.funet.fi/index/geodata/ilmatiede/forest_fire_danger/

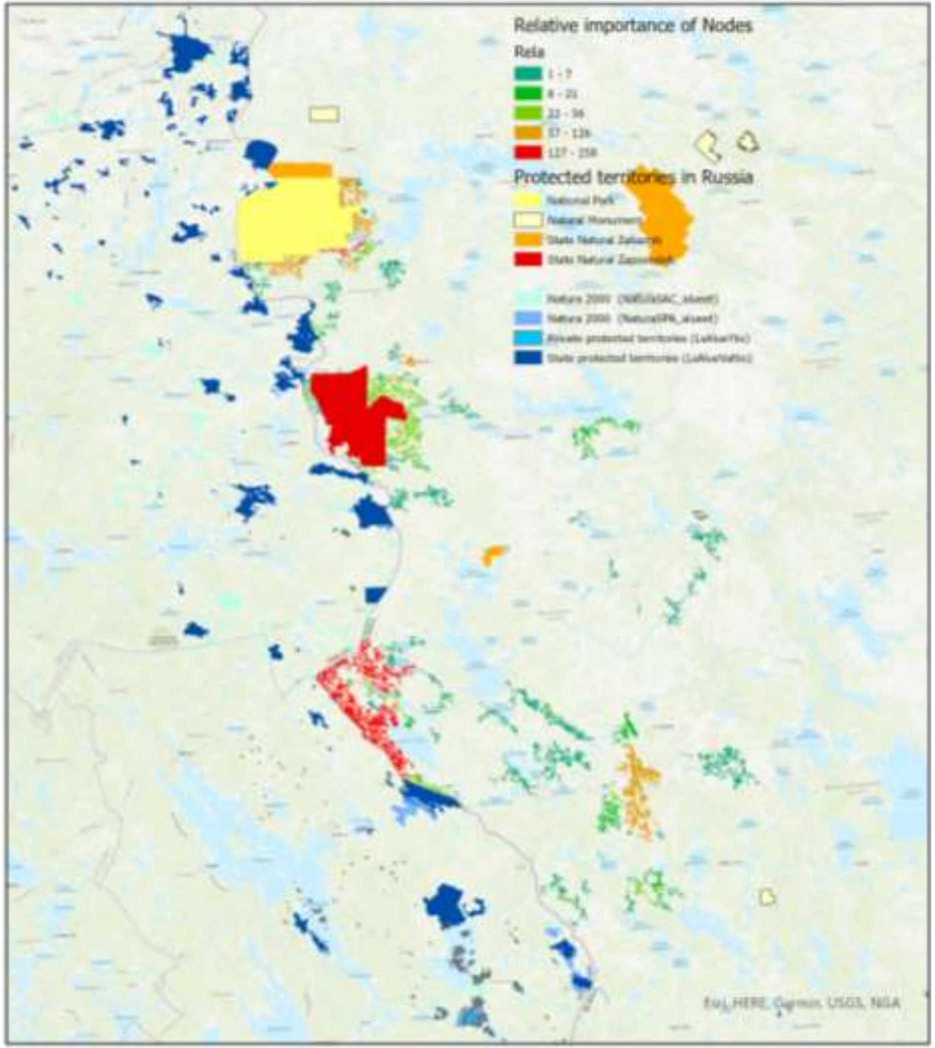
Lehtonen, I., Venäläinen, A., Kämäräinen, M., Peltola, H. and Gregow, H., 2016. Risk of large-scale forest fires in boreal forests in Finland under changing climate. Nat. Hazards Earth Syst. Sci., 16, 239-253, doi:10.5194/nhess-16-239-2016;

Lehtonen, I., Ruosteenoja, K., Venäläinen, A. and Gregow, H., 2014. The projected 21st century forest-fire risk in Finland under different greenhouse gas scenarios. Boreal Env. Res. 19, : 127–139;

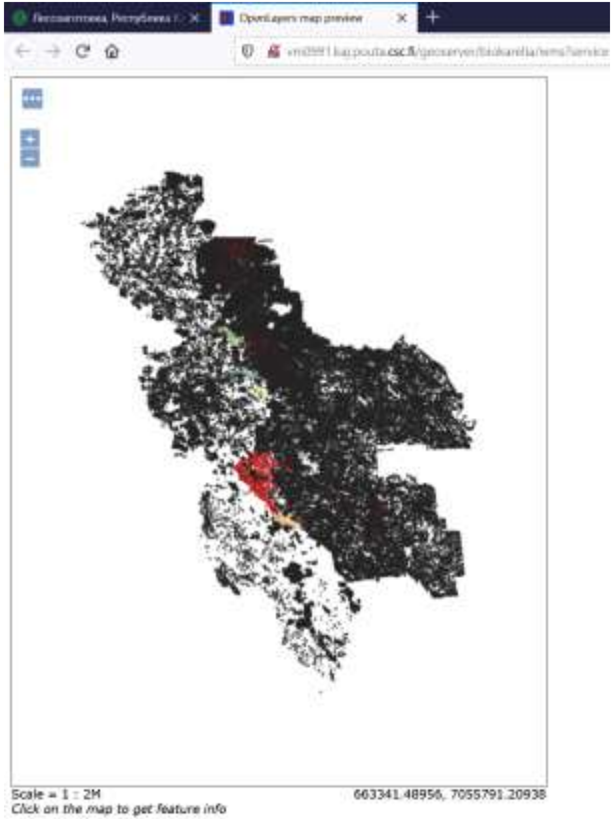
Vajda, A., Venäläinen, A., Suomi, I., Junila, P. and Mäkelä, H., 2014. Assessment of forest fire danger in a boreal forest environment: description and evaluation of the operational system applied in Finland. Meteorol. Appl., 21: 879-887, DOI: 10.1002/met.1425.

Results

1. The biggest nodes of hcvfs are along the border
2. The functional connectivity along the border is presented by 45 nodes (most important patches) and 13 links (small patches connecting more than 95% of nodes)
3. All nodes in Finland are protected territories
4. Only 2 nodes are protected in Russia
5. The most important node for connectivity is not protected in Russia, leased by wood harvesting company, ongoing harvesting by Segezha group
6. Under moderate emissions climate scenario the number of fire danger days will increase on 15 – 89%



Results are published in the form of online GIS layer



http://vm0991.kaj.pouta.csc.fi/geoserver/biokarelia/wms?service=WMS&version=1.1.0&request=GetMap&layers=biokarelia%3Ahcvf_20m&bbox=547406.6444699252%2C6924340.912875272%2C808086.6444699263%2C7268520.912875275&width=581&height=768&srs=EPSG%3A3067&styles=&format=application/openlayers

Key

Прошлые пожары к лесах высокой природоохранной ценности

Идеи

Презентация по Биокарелии

текущая связность

как будущий климат повлияет на риски пожарной опасности в текущей связности

как связность менялась со временем по снимкам

вырубки добавить к текущей связности, т.е. реконструировать слои назад на 20 лет

Биокарелия

мозаику Sentinel

статью