SustainBaltic

Valuable nature areas based on several GIS data sets and their integration to human activity in Satakunta ja Varsinais-Suomi regions

Document report of GIS data and analysis for D.T1.1.1

SYKE 31.8.2017

EUROPEAN UNION
European Regional Development Fund

1) Introduction

- This document shows what kind of GIS data, including both nature and human activity data, was collected and analysed in the Activity T1.1 of SustainBaltic project.
- This work focuses in the study areas of Satakunta and Varsinais-Suomi in Finland.
- Nature and environment data were divided in the following themes:
  - Forests
  - Mires and peatlands
  - Marine and coastal
  - Human pressures and impact
- Data processing and integration, and spatial analysis were done for all the data.
- Different data sets were first integrated to each others under each theme, for example three different data sources under the theme of forests.
- Then themes were integrated to each others, for example forest data to mires.
- Finally, human pressure and impact data were analyzed together with valuable nature data, aiming at to provide information for the further stages of the project, such as T1.2 ”Selection of case study areas” and T1.3 ”Preparation of ICZM plans”.
- Detailed explanations of the data and analysis are described in the document report in Finnish.

2) Scanning for possible data sources

- Large number of possible data sets were scanned in the beginning of the data, these included the following biotic, abiotic and human activity data:

Land cover:
Corine Land Cover (CLC)
Agricultural data (IACS)
Soil data
calcareous stone

Big Rivers:
catchments
estuarians (1130)
estuaries (directive/Natura2000 habitat type 1130)

Forests:
CLC
MS-NFI
Forest Centre forest data (Metsävara-aineisto)
Zonation Forest Value Maps
Primary Succession Forests

Traditional rural landscapes/habitats:
SYKE data sources

Bogs:
Mire patches (10 ha)
Hakila's letto locations?
Mire & peatland protection sites (SSTE)
New analysis for land up-lifting mires?

Birds:
MAALI
IBA
Goose fields
Foraging/molting areas of marine waterfowl in Satakunta
Breeding bird inventories in the outer archipelago
Breeding birds in mire areas
The nest sites for white-tailed eagle
The nest sites for osprey

Fish & fishery data:
Fish spawning areas (numerous different fish species)

Species:
Underwater spp. (Fucus, Zostera, algaes red, brown, green, Charophytes)
Benthic fauna
Blue mussel model
Ceranium tenuicorne Punahelmilevä model
Alien spp.
Endangered species

Coastal habitats:
dunes
coastal beaches
shore meadows

Underwater habitats (VELMU):
potential coastal lagoons (1150)
potential narrow brackish water bays (1650)
potential large shallow bays (1160)
potential sand banks (1110)
potential sand bank environments
potential reefs (1170)
potential reef environments
Zostera meadows model
Zostera marina observations
Phragmites australis vegetation
Fucus community model
Fucus spp. Model
Blue mussel community model

Abiotic variables:
bottom type (soft, hard)
oxygen model
photic zone
weather (temp, ice etc.)
secchi depth model from satellite images
seabed wave exposure
Likelihood of rugged seabed
depth model

Shore geomorphological characters:
hard shore line
un-constructed shorelines

2) Scanning for possible data sources

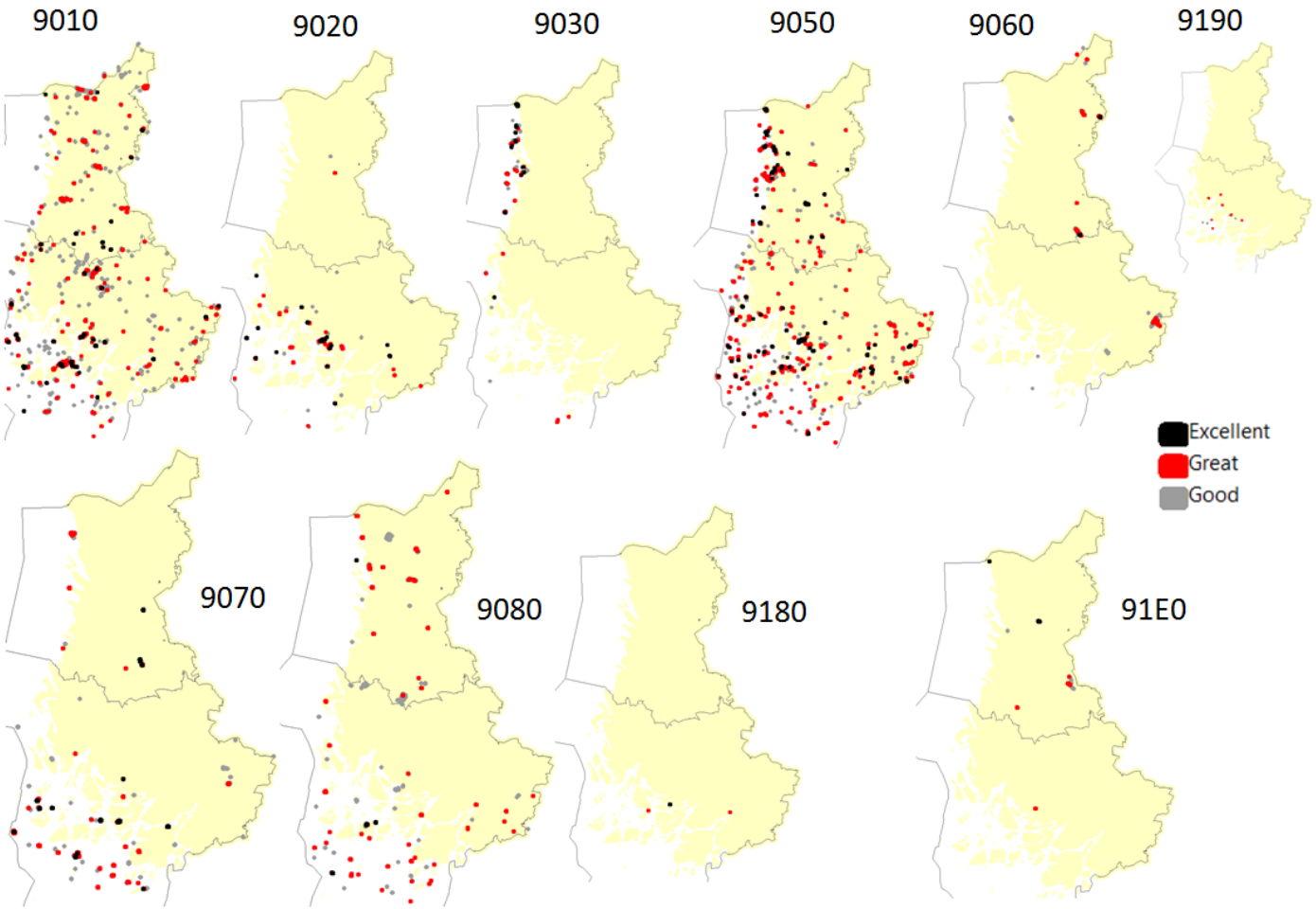
Cottages, permanent houses:
Permanent housings
Summer cottages

Human activities (Marine):
EU beaches
Cables
Gaslines
Pipelines
Commercial harbours
Ship, ferry and boat fairways
Wastewater or cooling water discharge sites
Dredging and dumping of dredged material
Aquaculture
AIS-data
Existing wind power
Planned wind power
Other energy production (inc. dams) and industry
Nord Stream natural gas pipeline
Boat harbours
Sand and gravel extraction
Ship wrecks
Oil spills
Shipping accidents
Phosporous loads
Nitrogen loads
Bridges
Shore consturctions
Wastewater treatment plants
SmartSea project data

Human activities (Terrestrial):
Road network
Wind farms (proposed)
Population demography
Electricity grid
Working places
Residential areas
Population centers
Noise areas
Regional plans
Master plans
Nationally and regionally important cultural environments
Nationally and regionally valuable landscapes
Agricultural areas

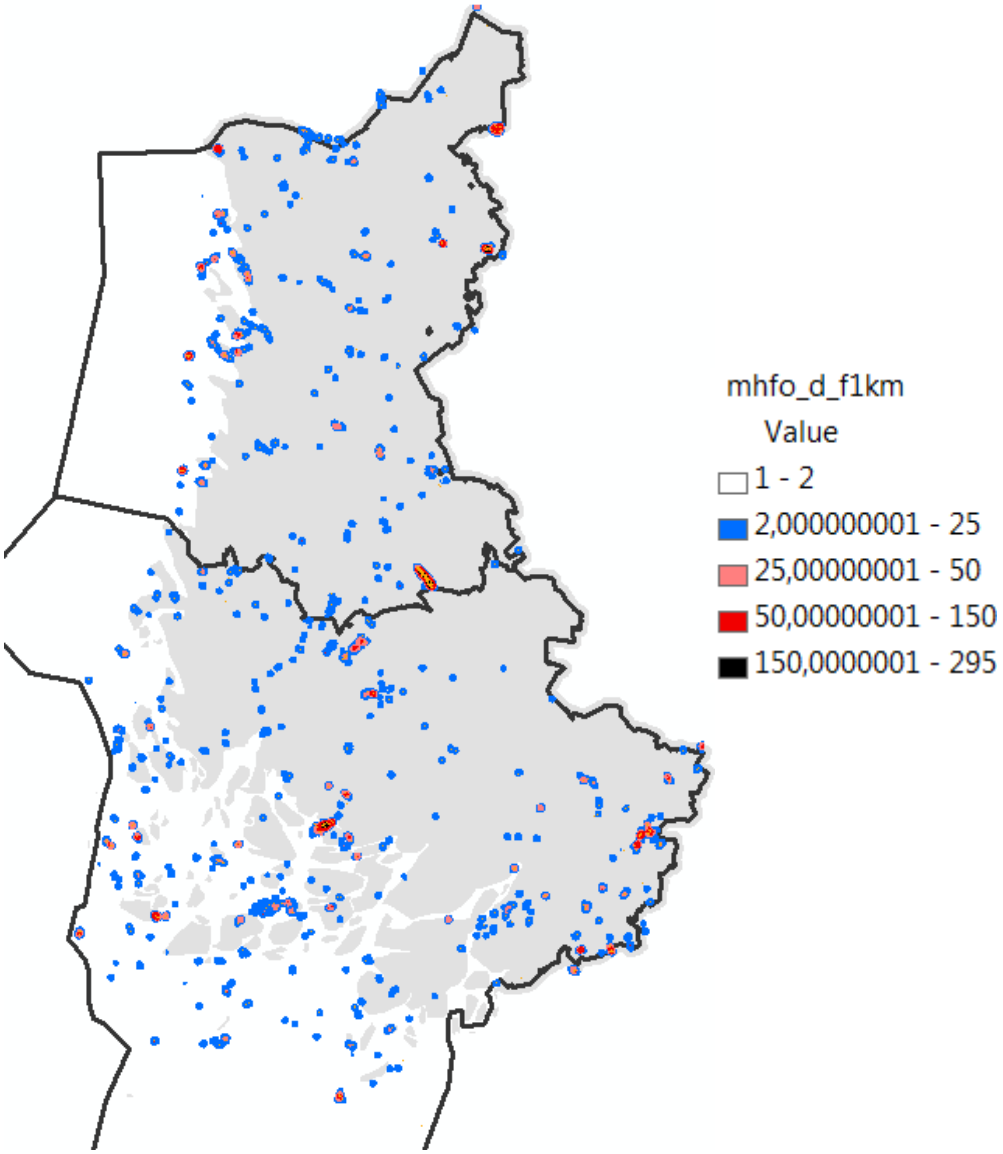
2) Forests

- Protected forests
- Types of habitat directive
- Data source : Metsähallitus (the Finnish Forest and Park Service)
- Scoring
  - Excellent 3p
  - Great 2p
  - Good 1p



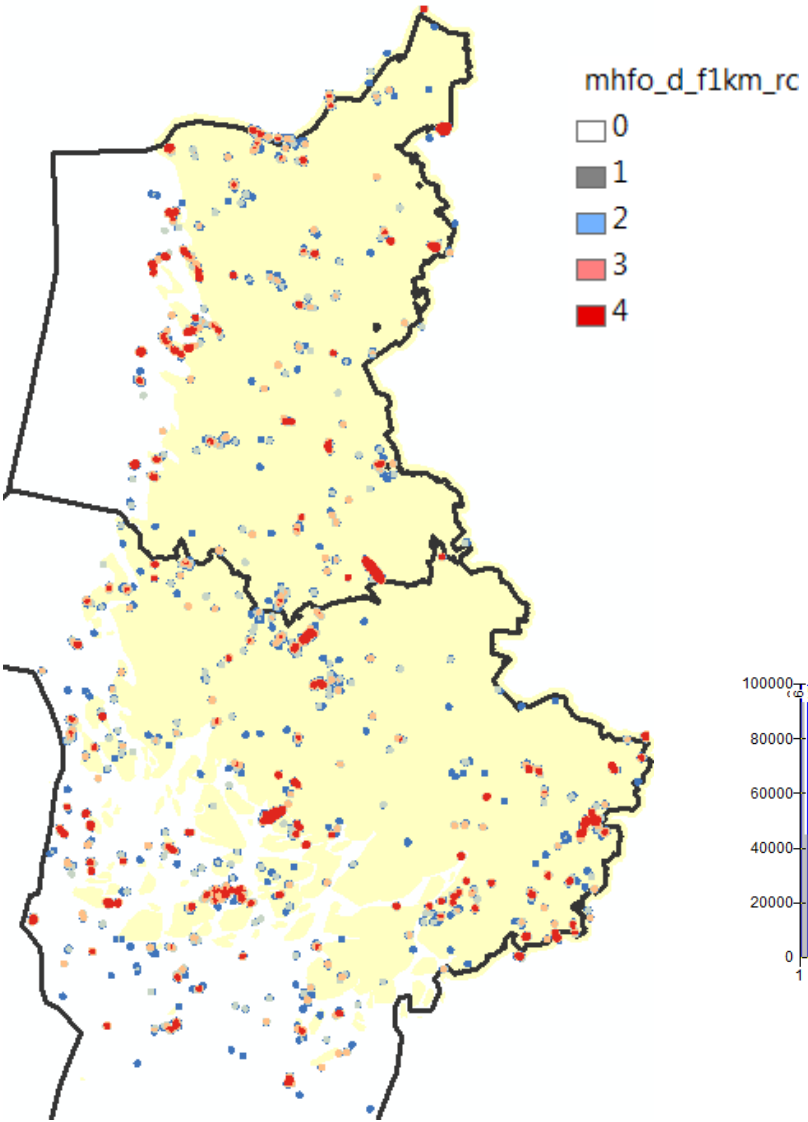
Protected forests

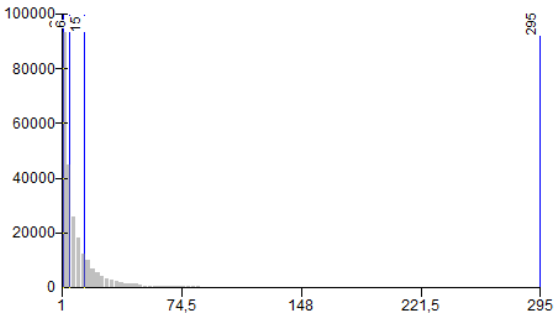
- All types of forests
- Moving window analysis
  R = 1km
  pixel 100 m
- Sum of quality scores



Reclassification of protected forests

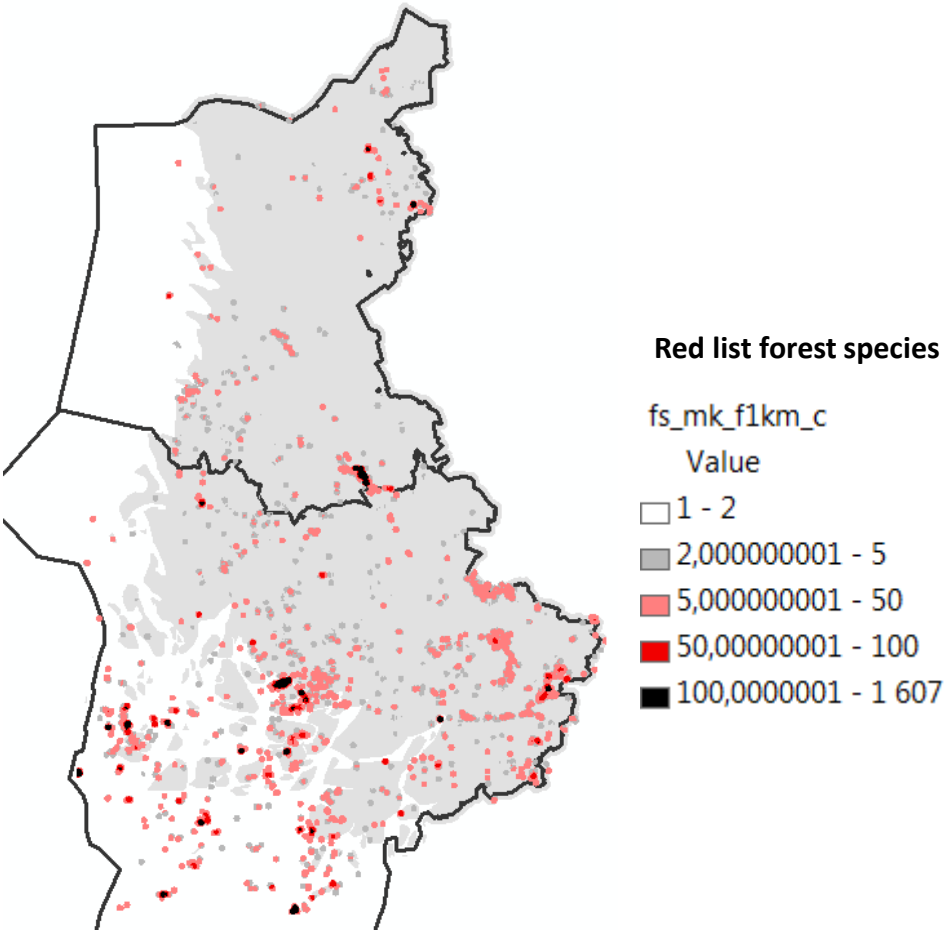
- Based on amount and quality



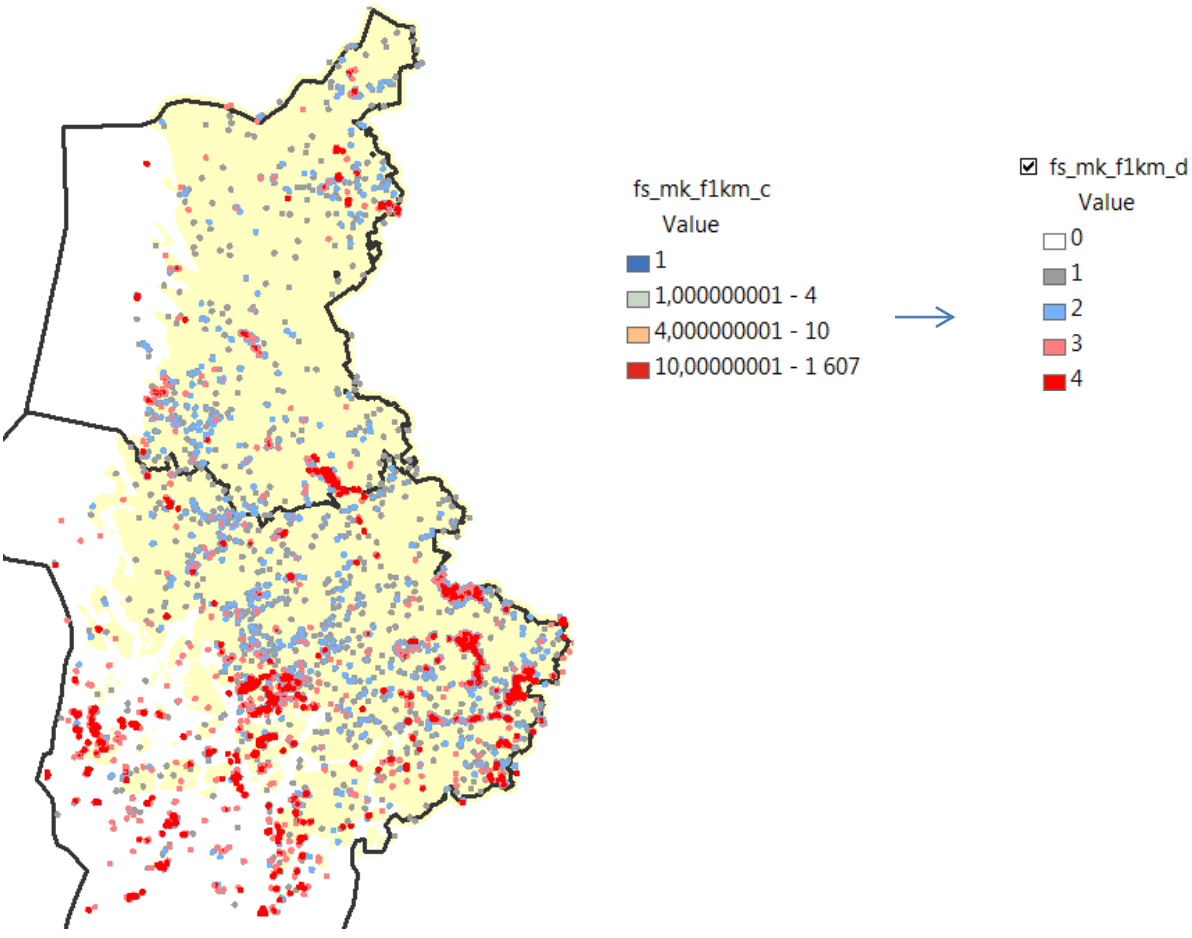


2b) Red list forest species

- Data source: Database of Threatened Species (SYKE)
- Scoring
  - CR 20p
  - EN 10p
  - V 5p
  - NT 1p
- Moving window analysis
  - r=1km
  - Sum of scores



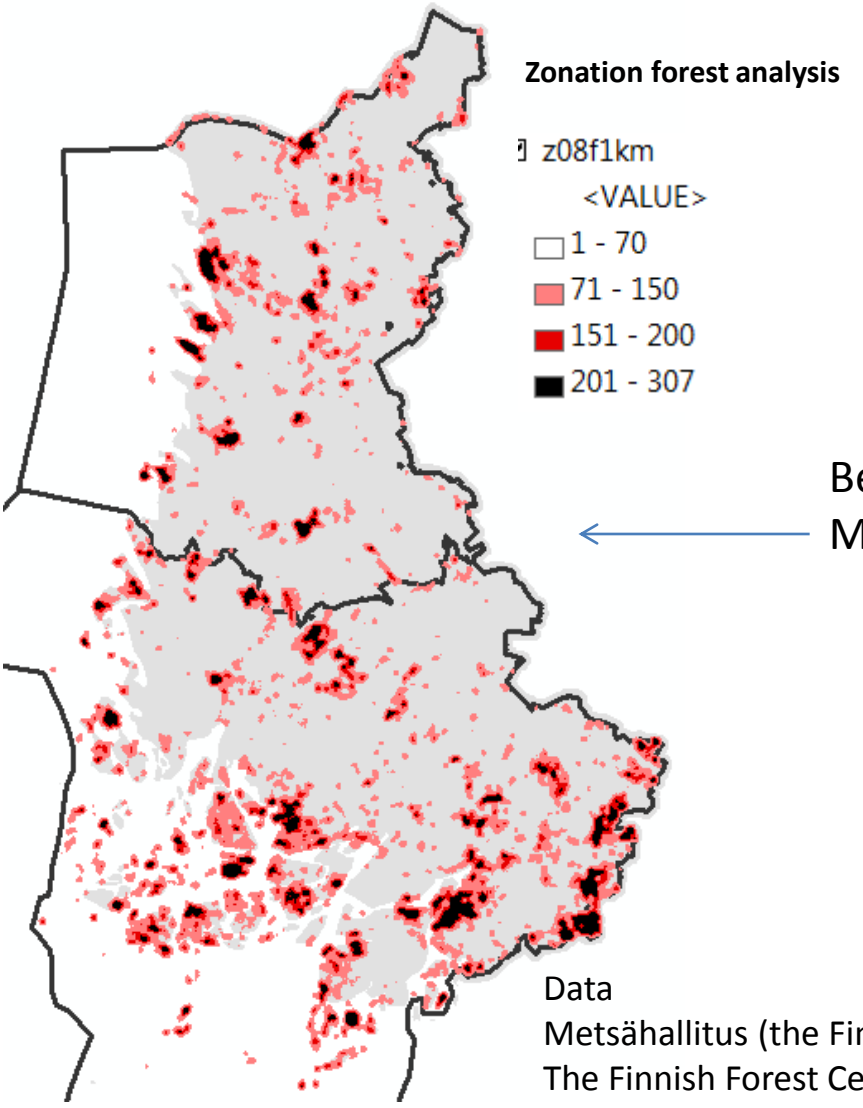
Endangered forest species – reclassification of scores



Best forest areas based on Zonation analysis

- Zonation - spatial priorisation program
- Tree species, volume,diameter, habitat type, key biotopes etc.
- Motti program (Luke)

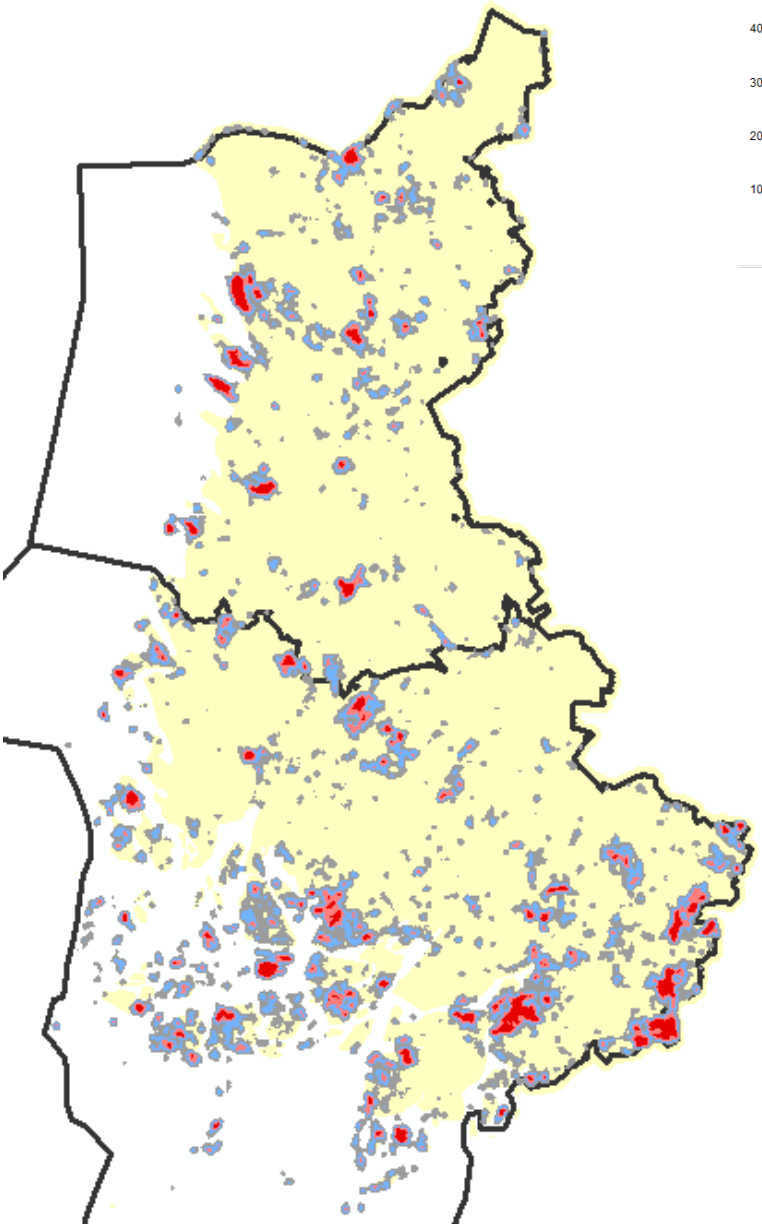
Amount of potential decayin g wood
>30 feature layers to Zonation

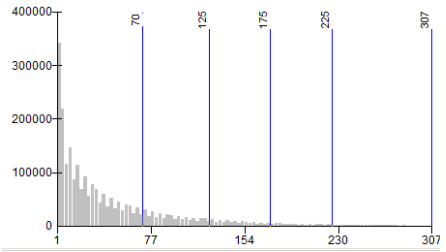


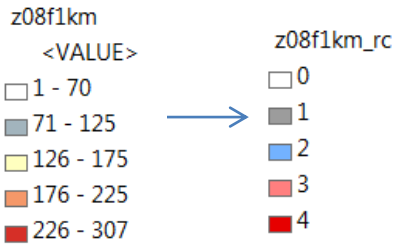
Best 20 %
Moving window analysis
-r= 1 km
-sum of scores

Data
Metsähallitus (the Finnish Forest and Park Service)
The Finnish Forest Centre
The Natural Resources Institute Finland

Reclassification of Zonation result scores

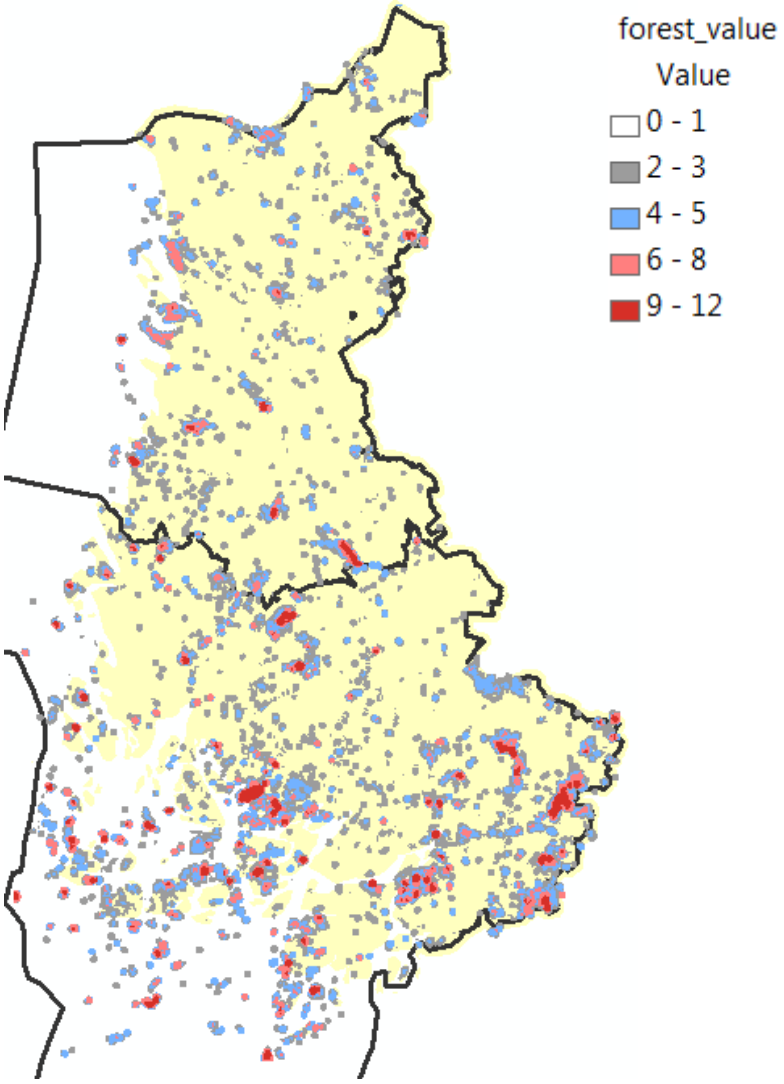






Integrating protected areas, endangered species and Zonation top areas

Sum of reclassfied data

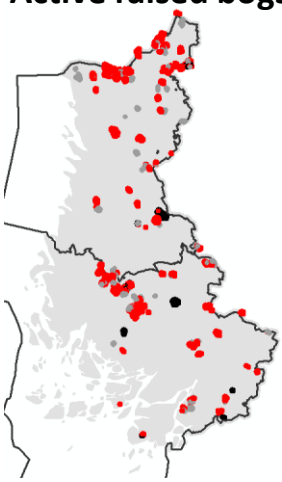


Mires

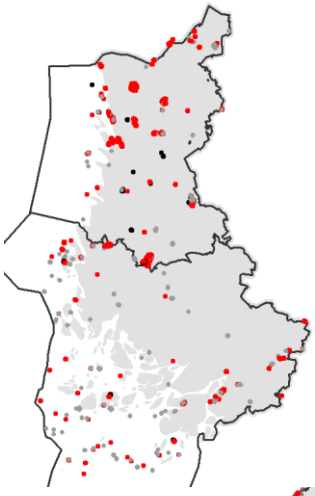
Protected mires

- Data source: Metsähallitus

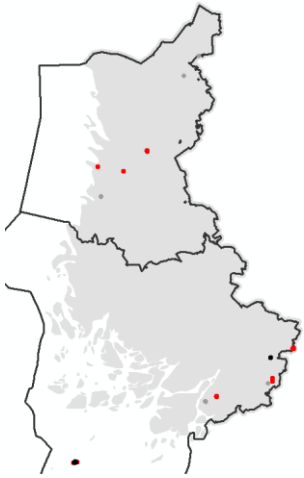
7110
Active raised bogs



7140
Transition mires and quaking bogs

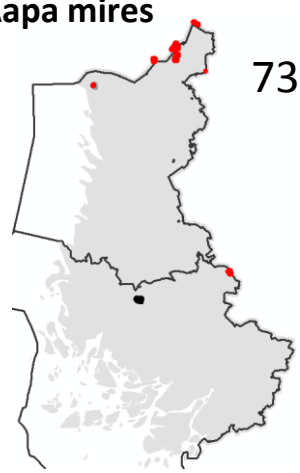


7230
Alkaline fens

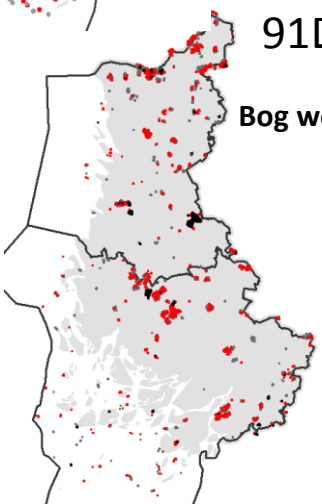


Aapa mires

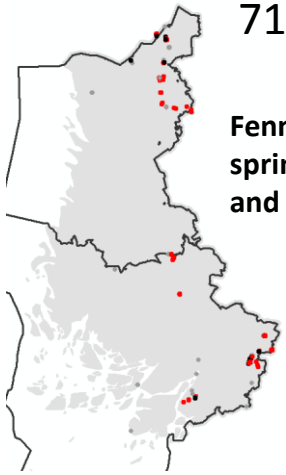
7310



91D0
Bog woodland

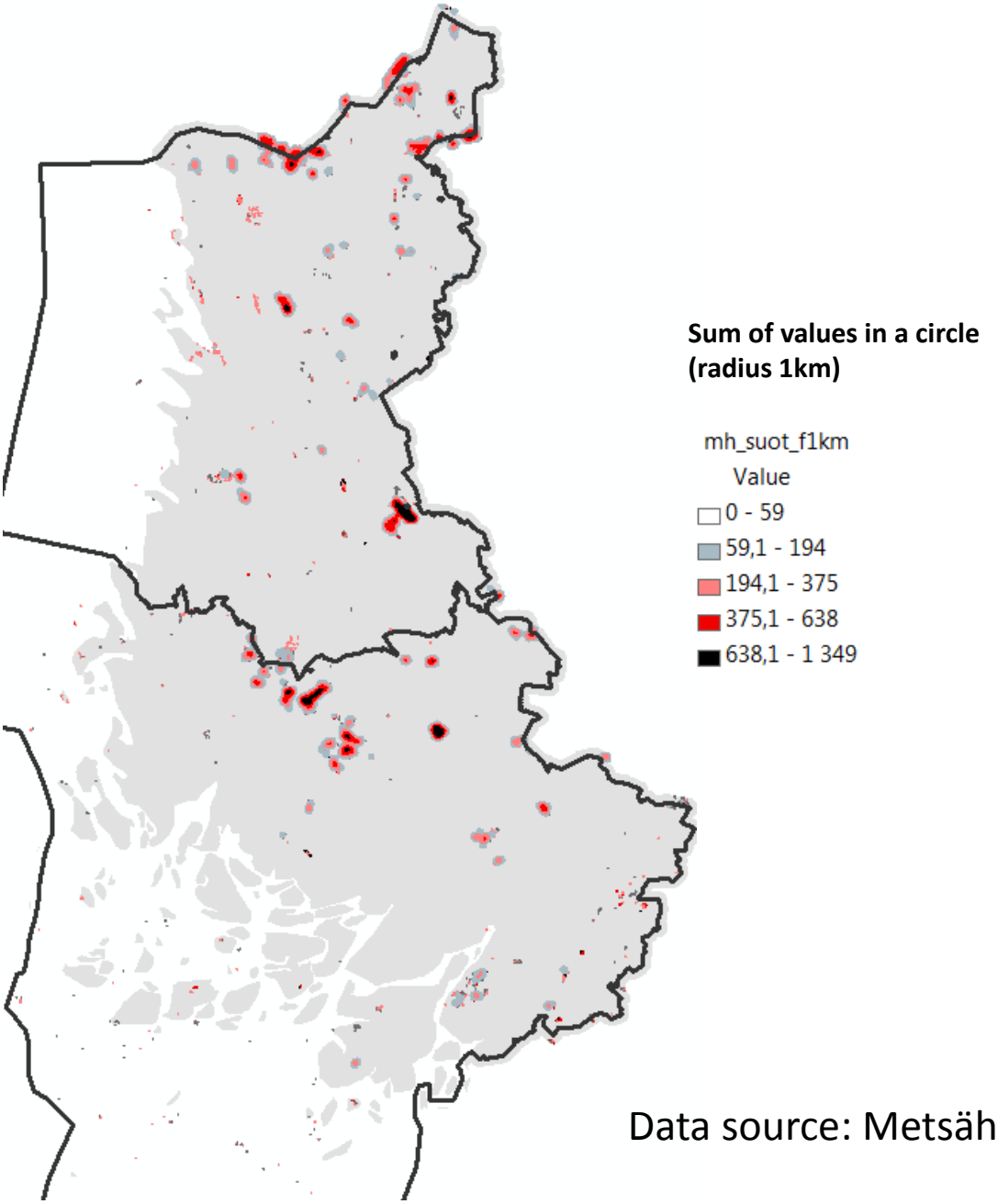


7160
Fennoscandian springs and springfens



Protected mires

- Moving windows analysis
  - r=1km, sum
- Scoring based on natural state
  - Excellent 3p
  - Great 2p
  - Good 1p

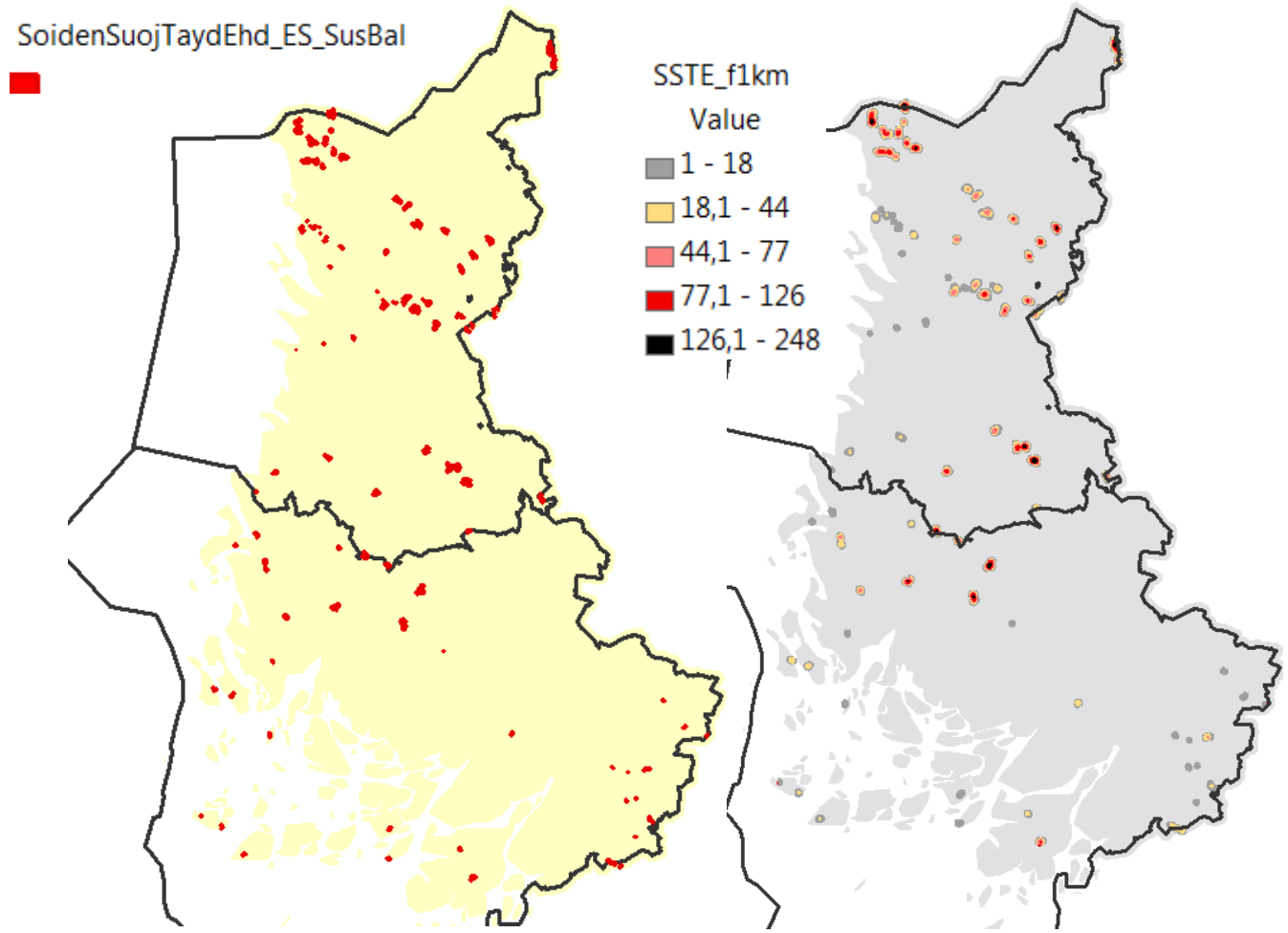


Data source: Metsähallitus

3b) Unprotected valuable mires (SSTE)

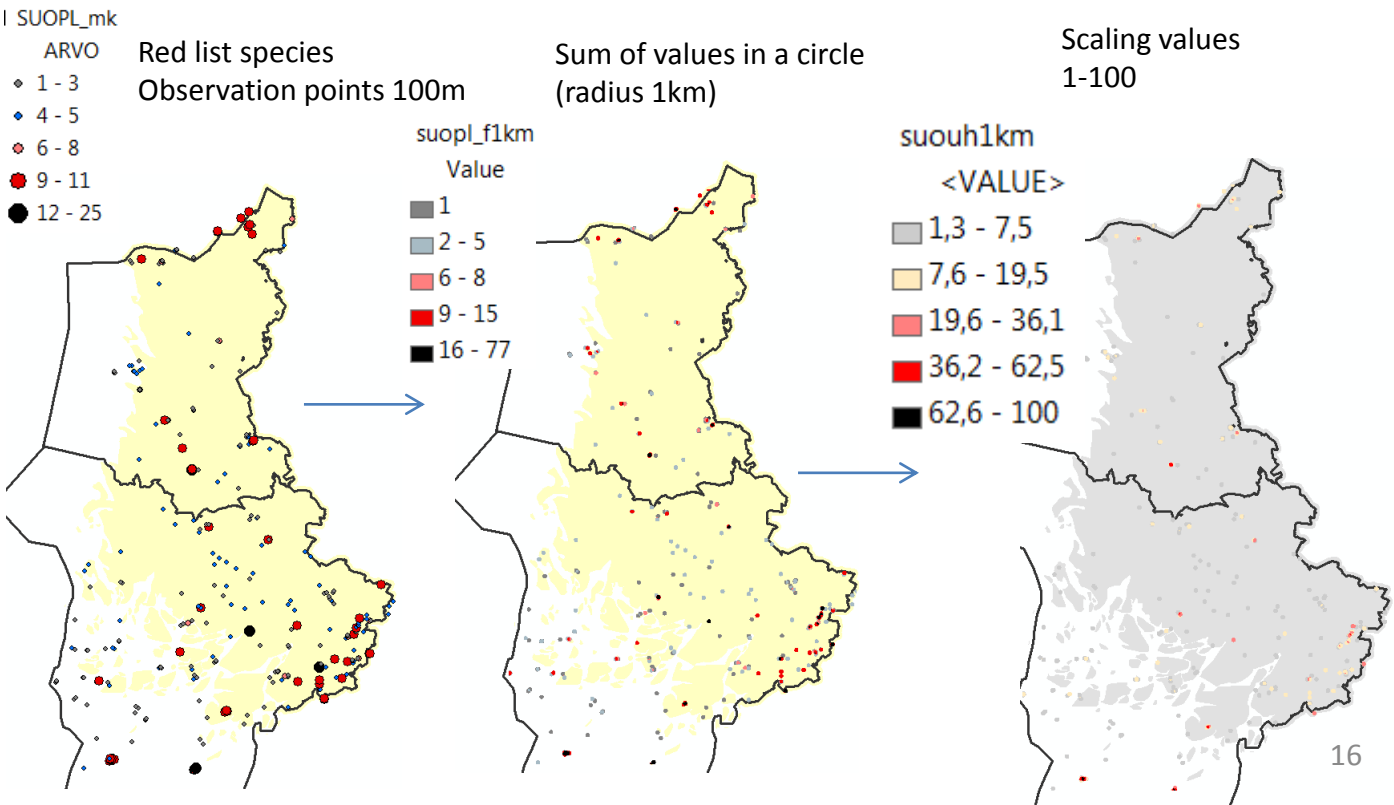
- Data source: National working group
- best unprotected mires which complement well existing protected mires
- Moving window analysis
  - R=1km, sum of scores

Unprotected valuable mires (SSTE)



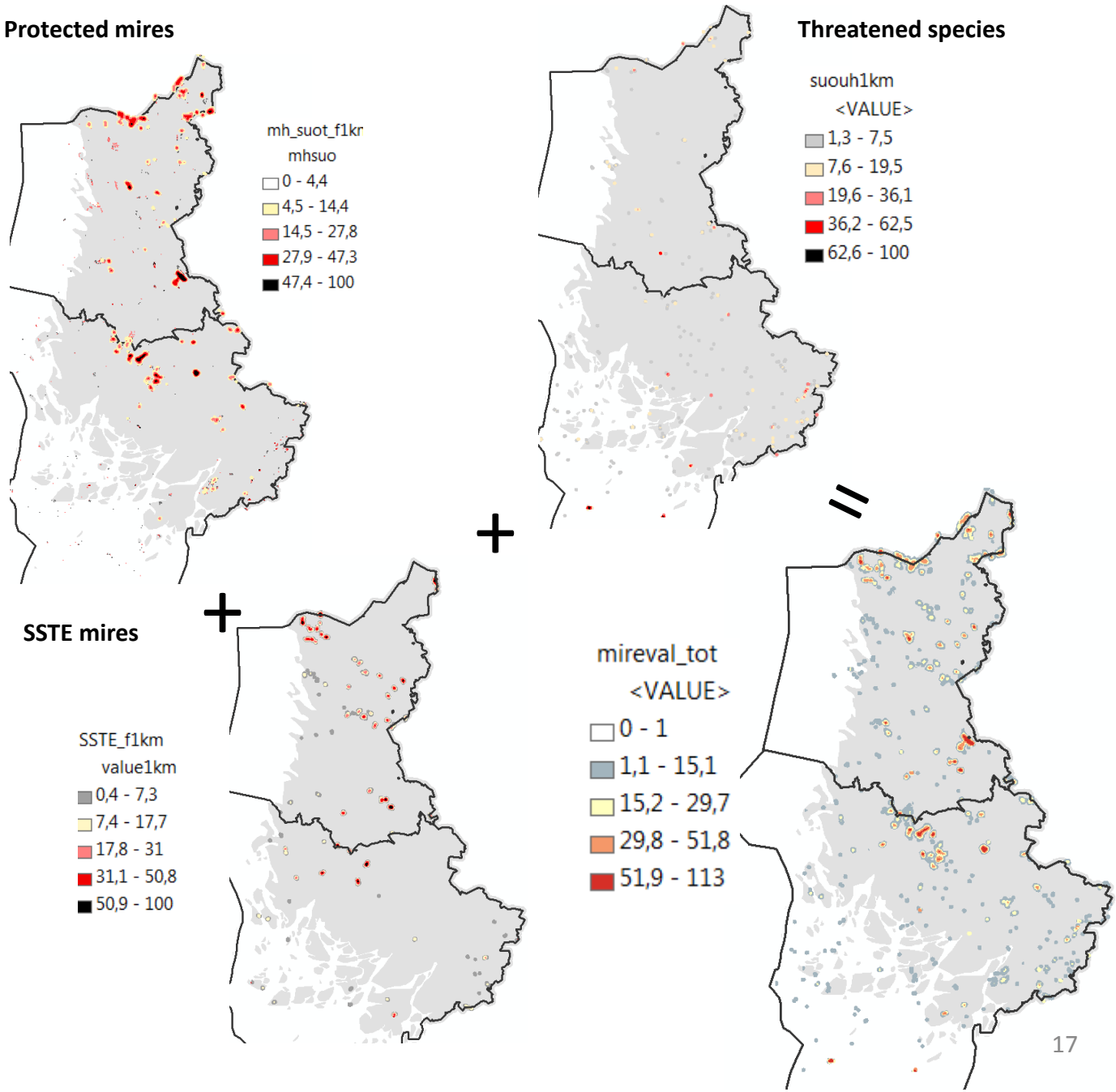
3c) Threatened and near threatened mire species

- Data source: Database of Threatened Species (SYKE)
- Scoring
  - CR 20p
  - EN 10p
  - V 5p
  - NT 1p
- Moving window analysis
  - r=1km
  - Sum of scores



Integrating protected mires, threatened species and SSTE-mires to each other

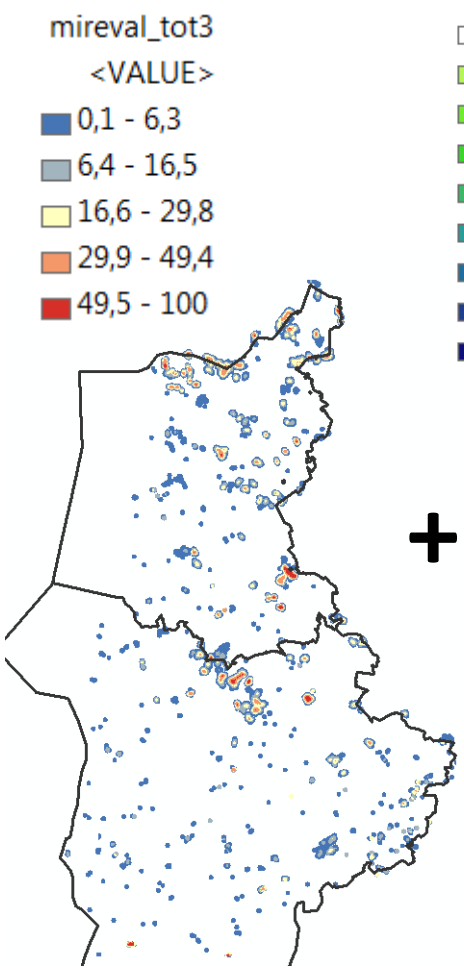
- Reclassifying data (0 – 100)
- Sum of scores



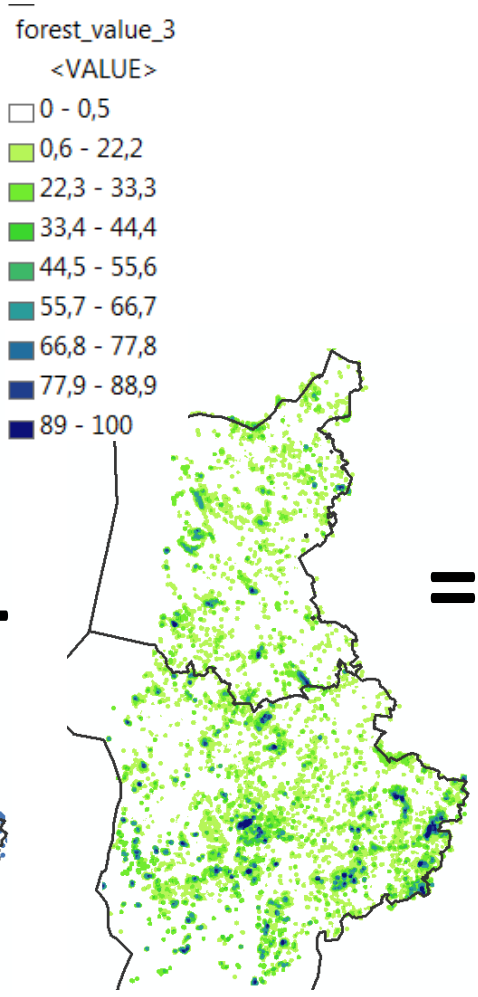
Integrating valuable forest and mires to ecah other

- Reclassifying data (0 – 100)
- Sum of scores

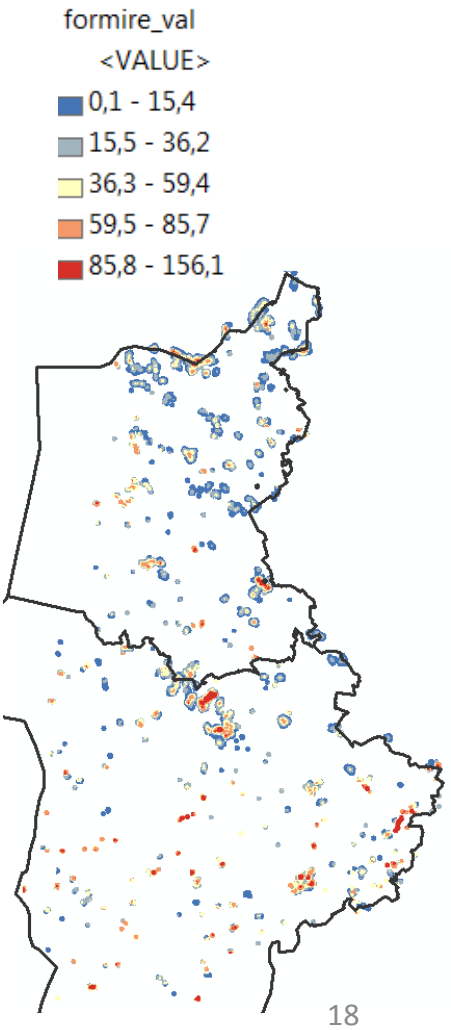
Valuable mires



Valuable forest



Valuable forest and mires



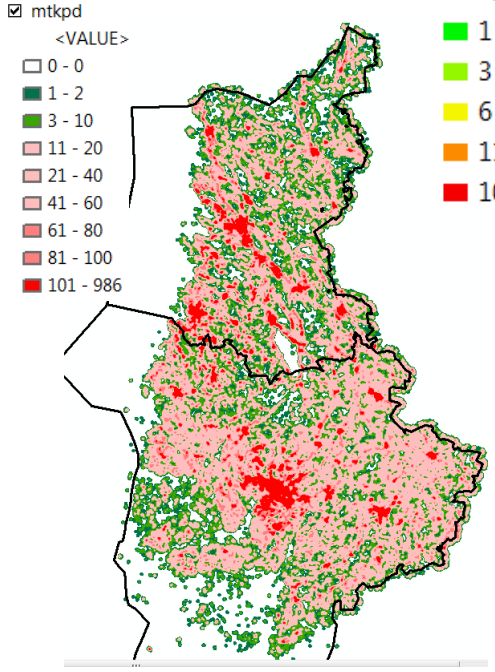
Integrating valuable nature areas and human impact

Buildings, densely populated areas and roads are indicators for pressures on biodiversity

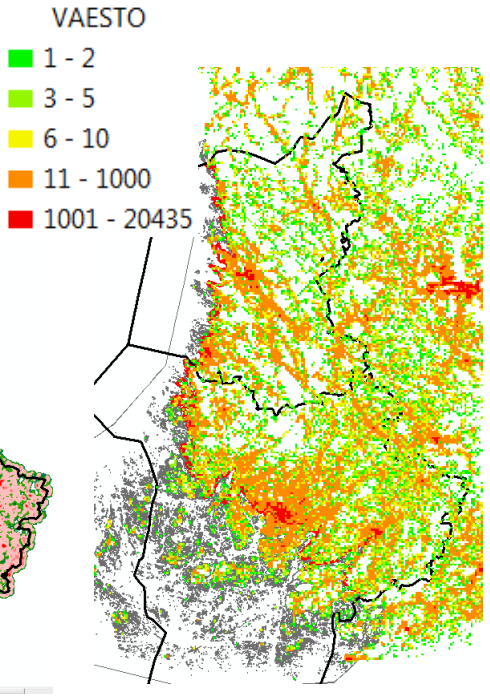
Data

- Building density (data: The National Land Survey's Topographic Database)
- Population density (data: Statistics Finland)
- Road density (data: The National Land Survey's Topographic Database)

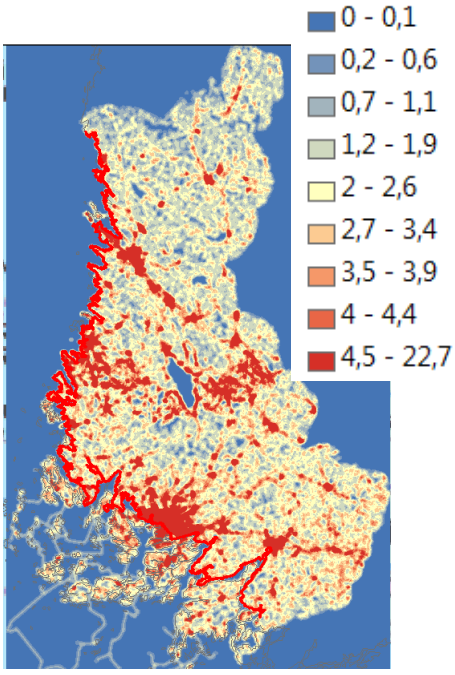
Building density



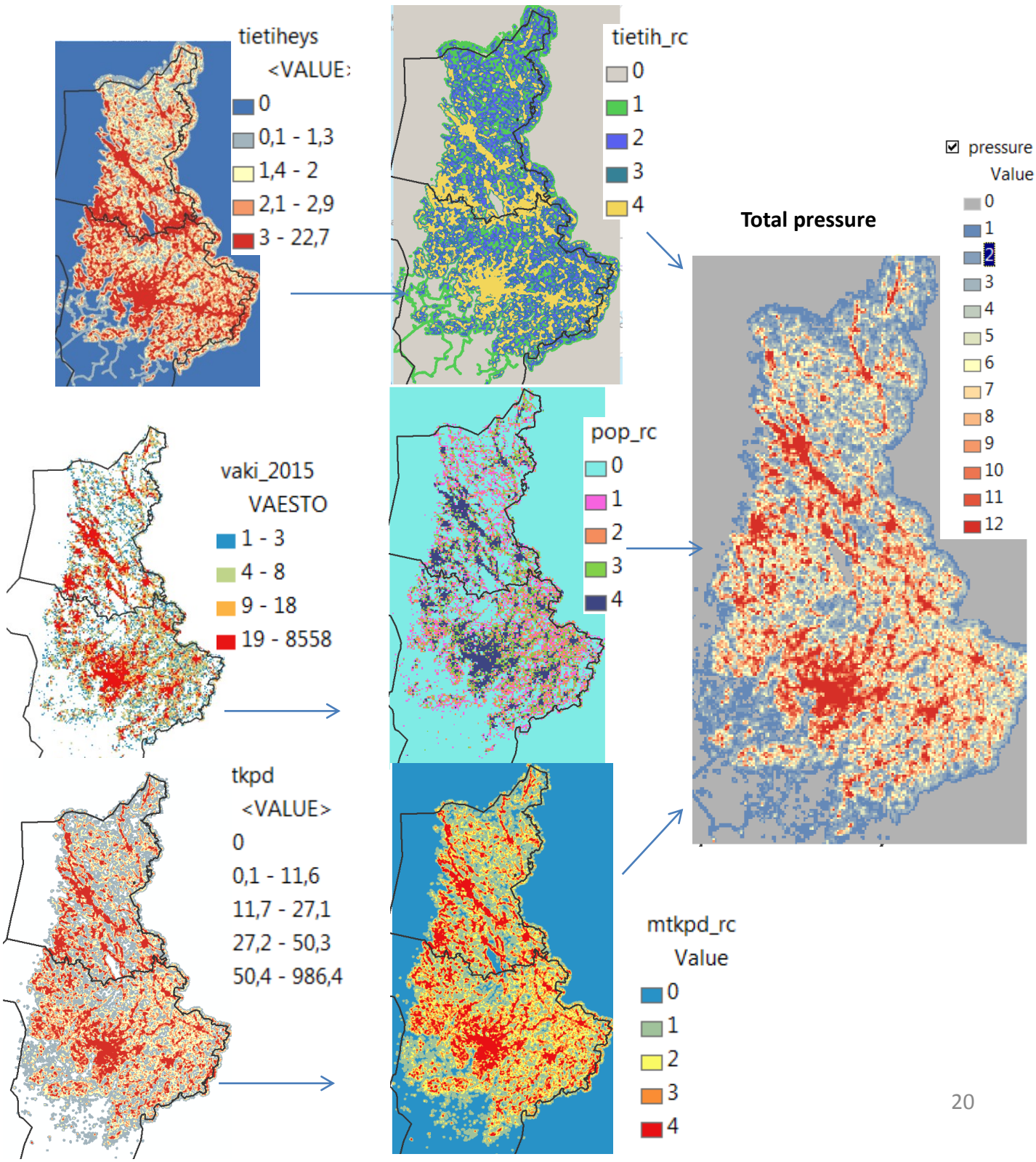
Population density (Statistics Finland)



Road density



- Reclassifying (1-4)building density , population density, road density
- Sum of pressures is a total pressure



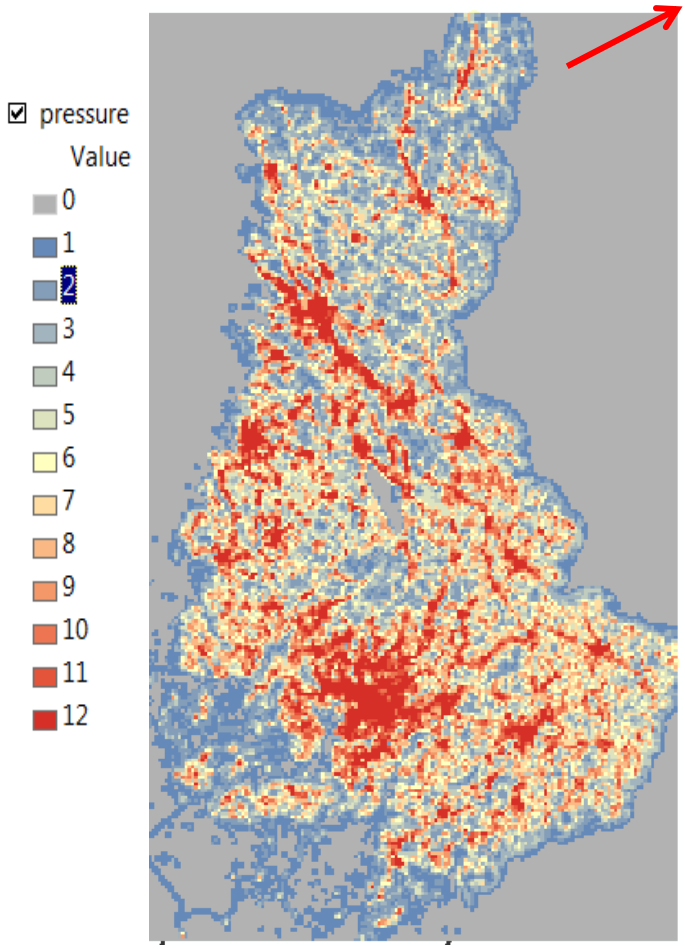
Undisturbed areas

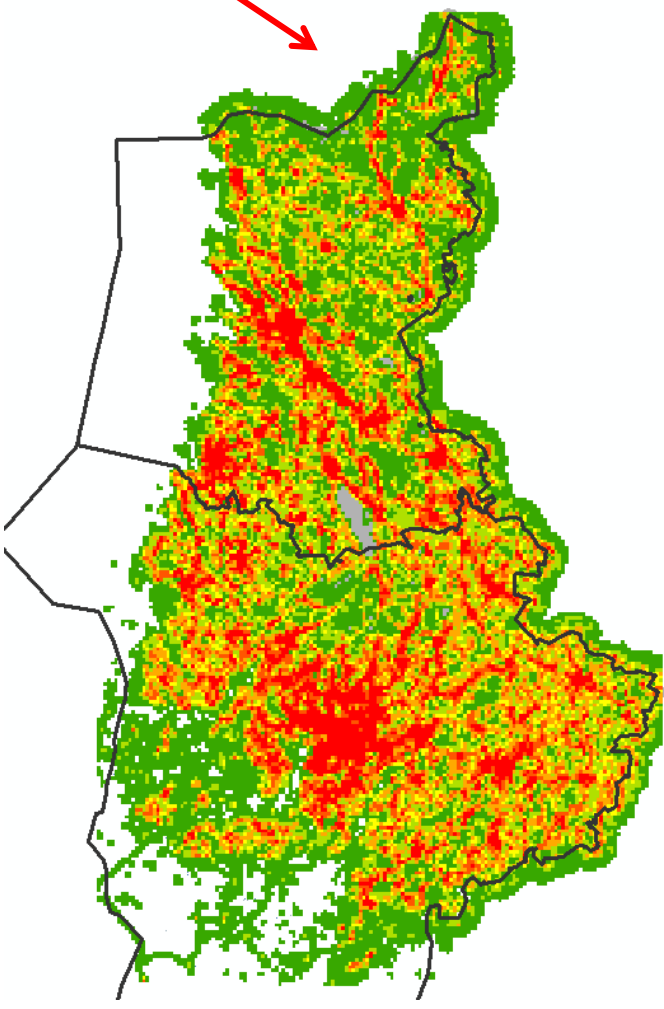
Opposite to pressure areas

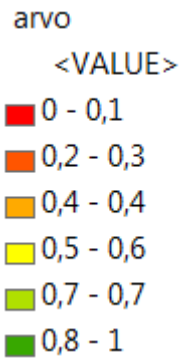
Pressure

Undisturbed areas

1-(pressure value/12)

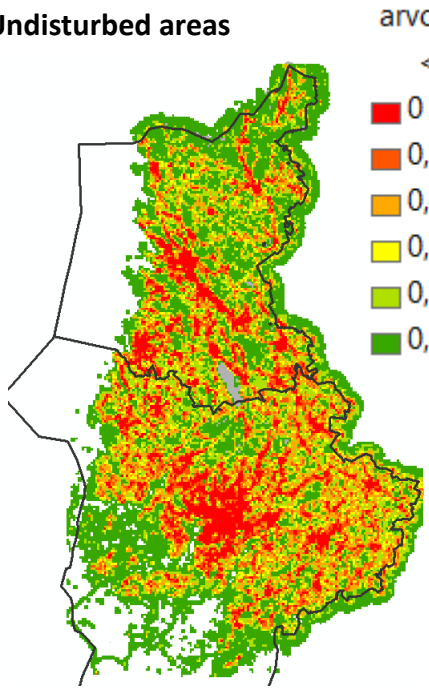






Integrating undisturbed areas and valuable forest areas

Undisturbed areas



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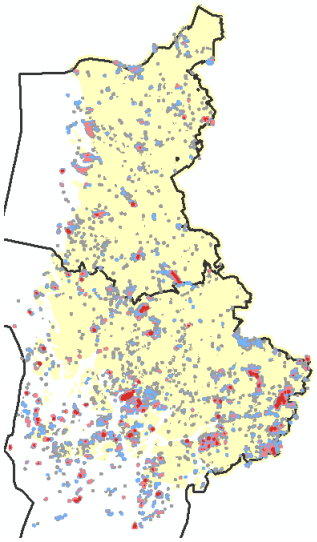
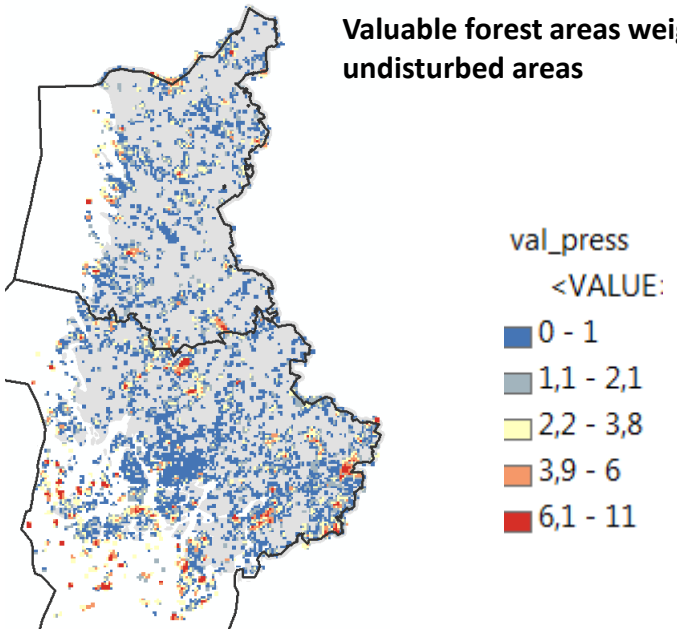
Valuable forest areas



Valuable forest areas weighted by undisturbed areas



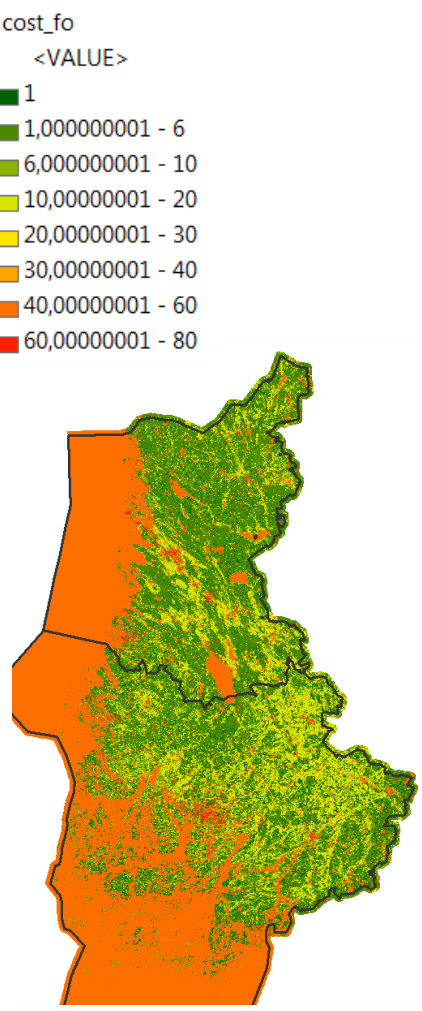
Cost distance analysis
Integrating the areas outside of valuable areas

How easy is to move from one valuble forest area to another?
Land use classes are scored

easy to move or live : low score (cost)

difficult to move or live: high score (cost)

Data for the cost table: Corine 2012, Multi-source National Forest Inventory



Cost	Corine class
80	Continuous urban fabric
60	Discontinuous urban fabric
60	Commercial units
80	Industrial units
80	Road and rail networks and associated land
80	Port areas
30	Airports
40	Mineral extraction sites
80	Mineral extraction sites
60	Dump sites
80	Construction sites
20	Sport and leisure facilities
20	Sport and leisure facilities
20	Sport and leisure facilities
20	Sport and leisure facilities
20	Non-irrigated arable land
20	Fruit trees and berry plantations
10	Pastures
10	Pastures
10	Land principally occupied by agriculture, wit
10	Agro-forestry areas
6	Broad-leaved forest
6	Broad-leaved forest
6	Coniferous forest
6	Coniferous forest
6	Coniferous forest
6	Mixed forest
6	Mixed forest
6	Mixed forest

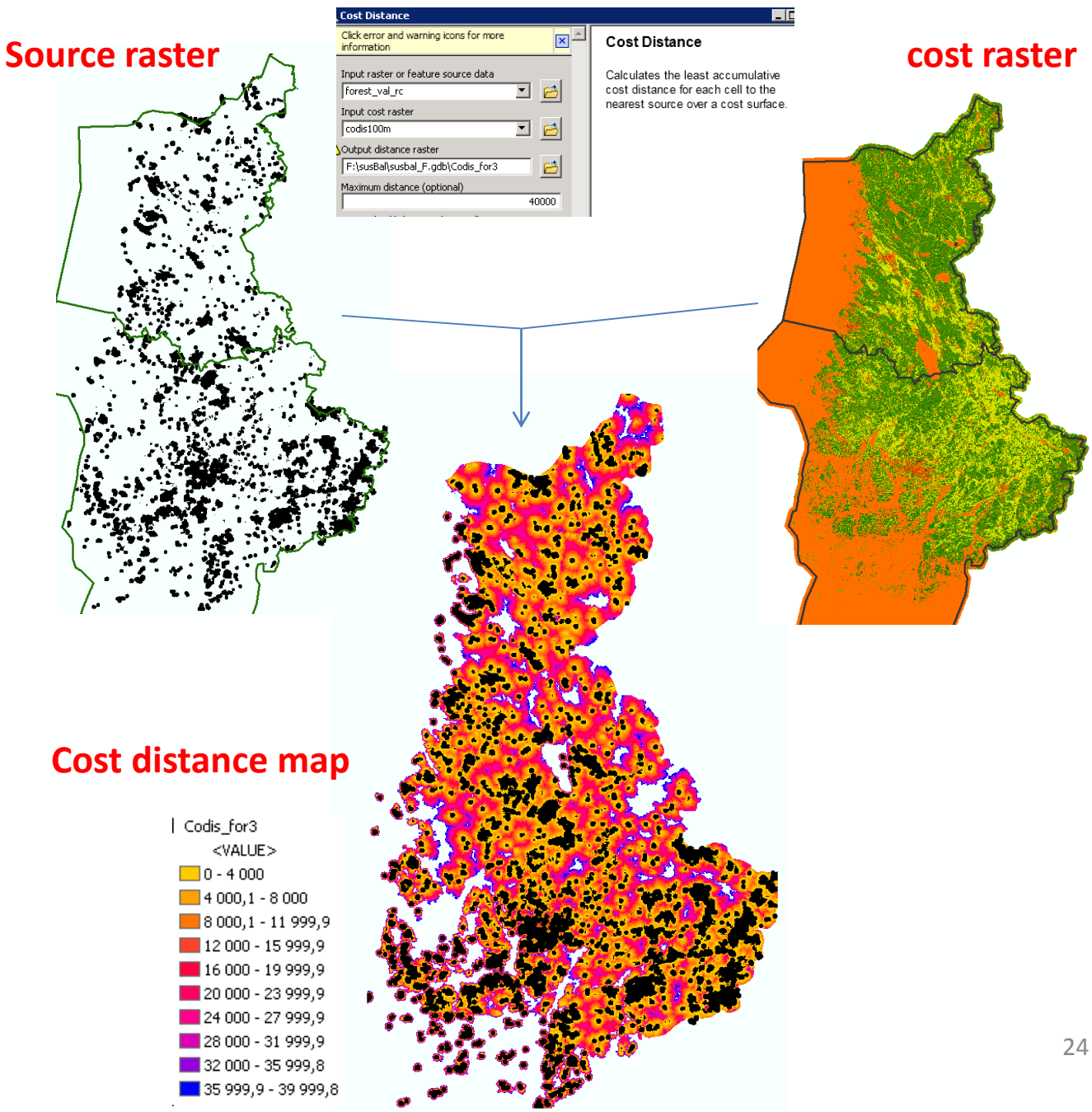
Cost	Corine class
10	Transitional woodland/shrub
40	Transitional woodland/shrub
10	Transitional woodland/shrub
6	Transitional woodland/shrub
6	Transitional woodland/shrub
6	Beaches, dunes, and sand plains
6	Bare rock
20	Inland marshes
10	Inland marshes
20	Peatbogs
20	Peatbogs
20	Salt marshes
20	Salt marshes
60	Water bodies
60	Water bodies
60	Sea and ocean

mVMI

If age >= 100 or vol >=250 then cost=1

Connectivity between valuable forest areas based on cost distance analysis

The blue and red areas in the cost distance map are not very well connected to valuable forest areas



Connectivity of the valuable mire areas based on cost distance analysis

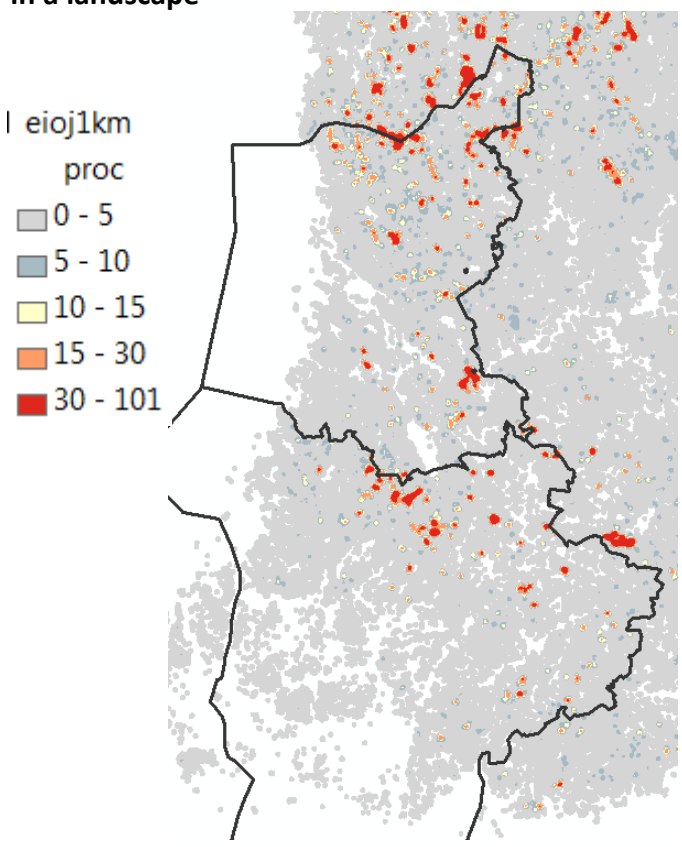
If there are a lot of unditched peatland in a landsape, it is easier to species move from one valuable mire to another

Cost map:

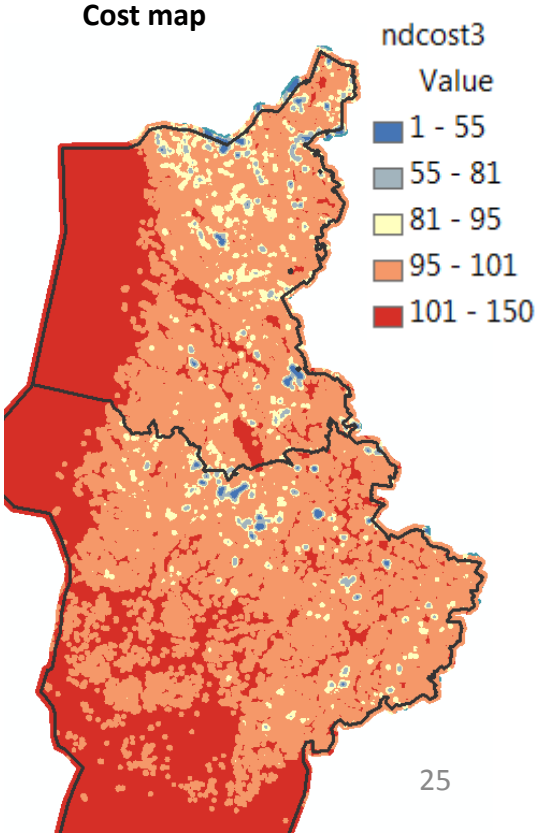
a lot of unditched peatland : low value
few unditched peatland or water: high value

Peatland data: SYKE, The National Land Survey's Topographic Database

Proportion of unditched peatland in a landscape



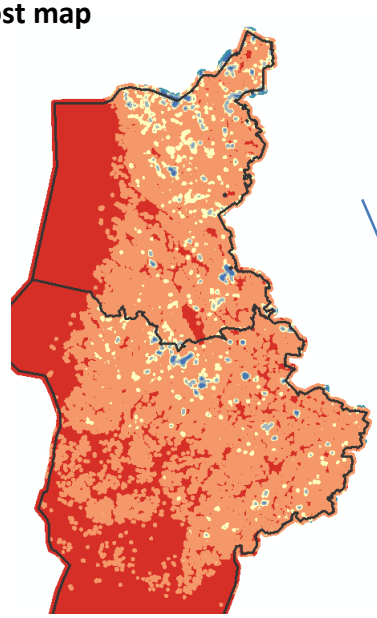
Cost map



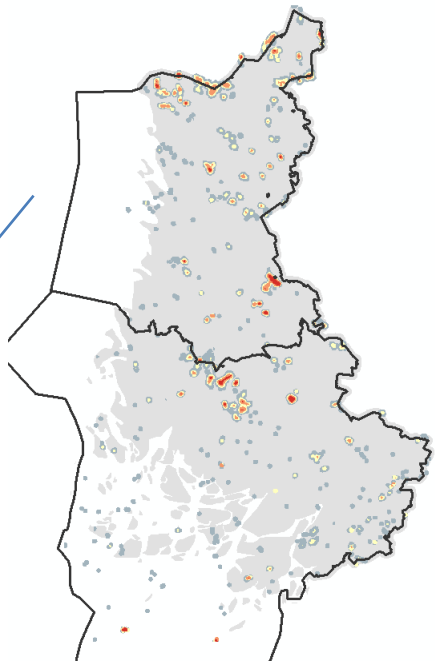
Connectivity of valuable mire areas based on cost distance analysis

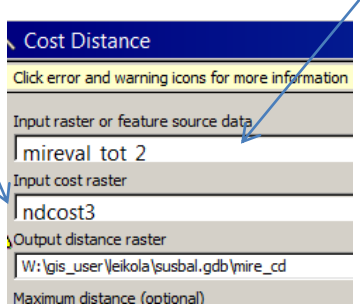
Black and red areas are better connected to each other than grey areas in the cost distance map

Cost map

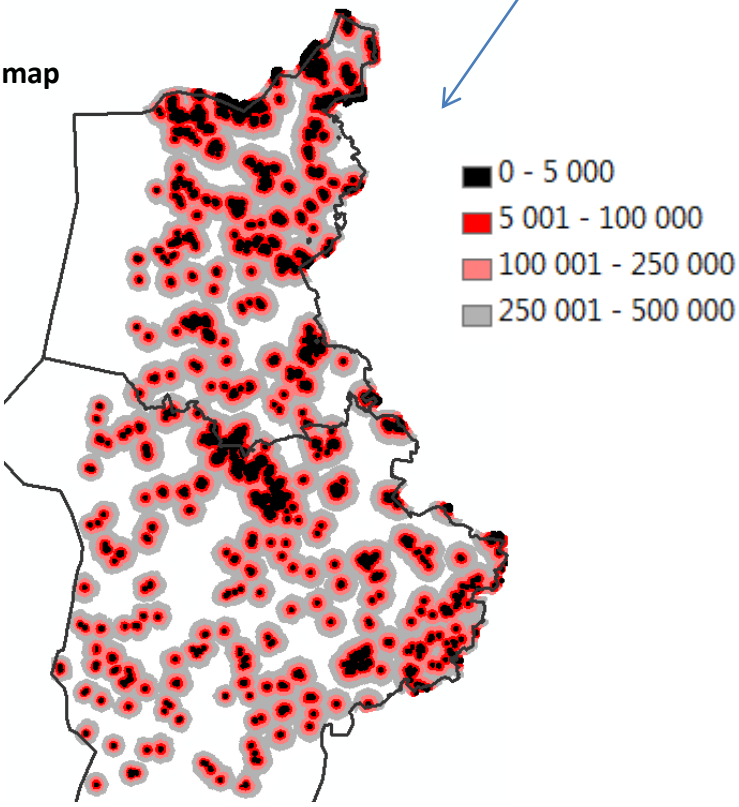


Core areas





Cost distance map



Marine biotope types

- Data used in the report has been gathered from the Finnish Environment Institute (SYKE), Geological Survey of Finland (GTK) and Metsähallitus (MH).

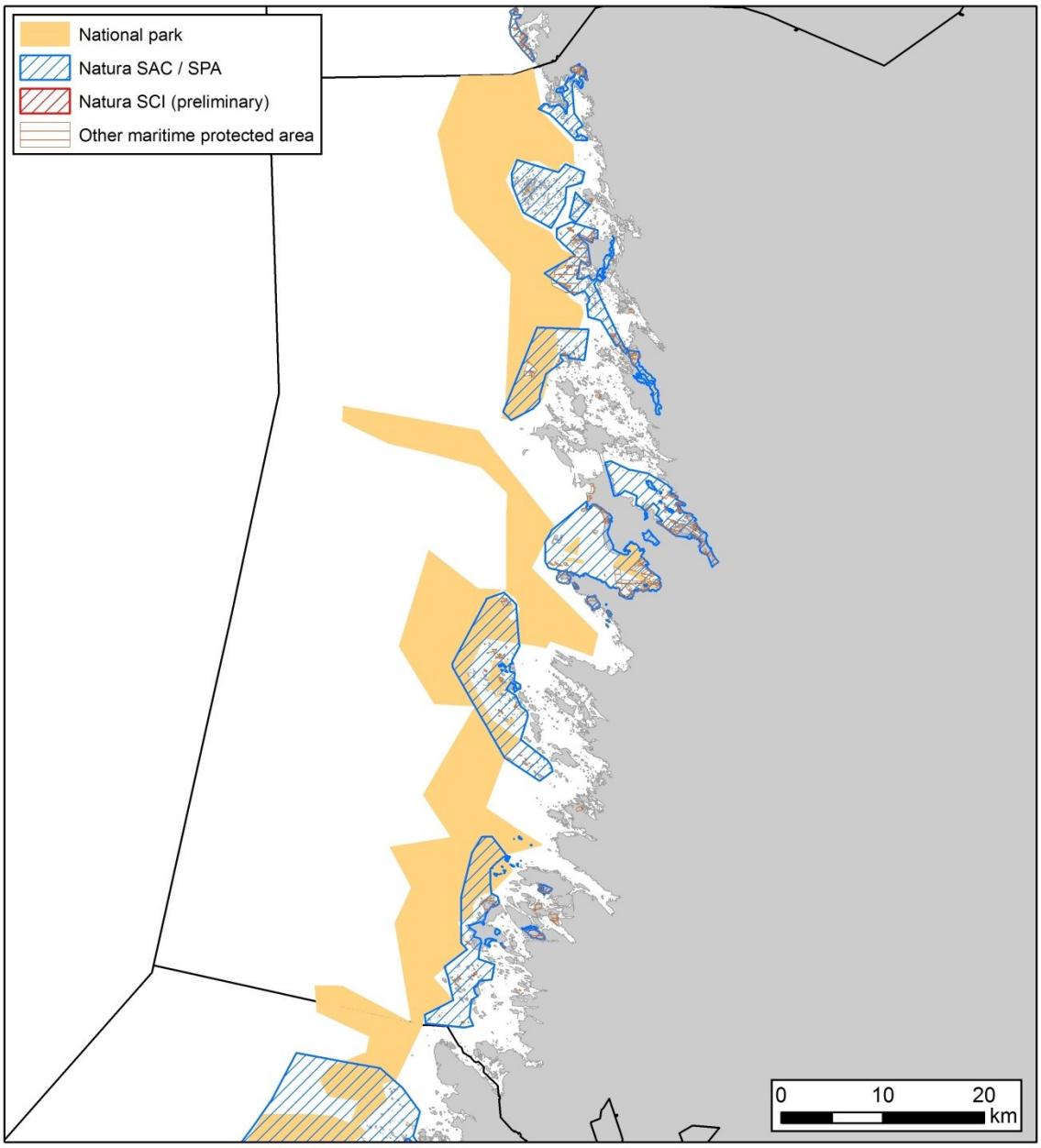
- The flad data was supplemented with data from a flad report from 2013 done written by Centre for Economic Development, Transport and the Environment.

- The reed data is based on satellite images and was produced in SYKE.

- The data for valuable underwater biotopes and species is based on findings in the inventory project VELMU, which have been analyzed with the NANNUT tool.

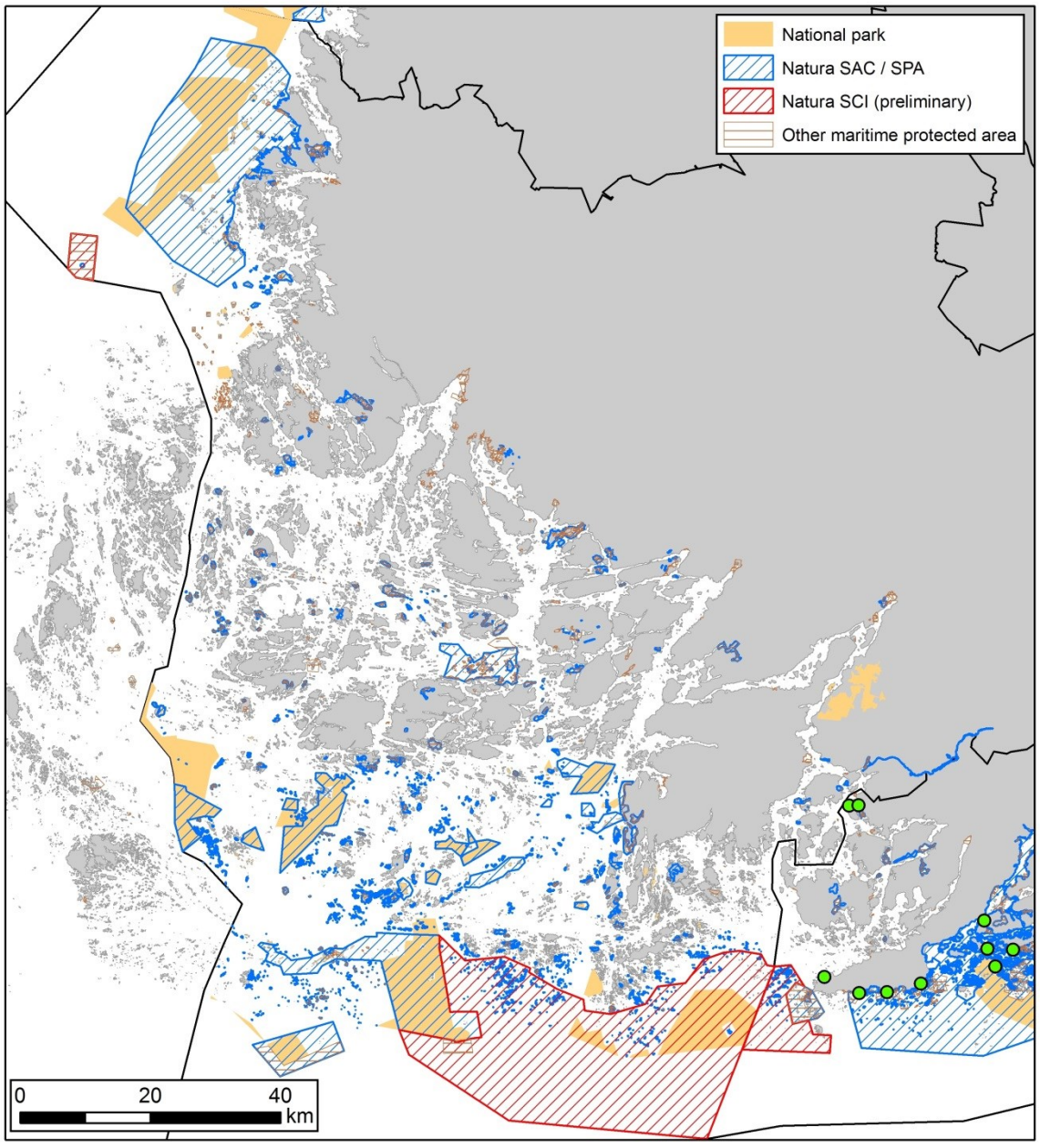
Nature protected areas and the national park at the Bothnian Sea

- The national park covers a large amount of islands and reefs. A special exception for limited fishing and hunting has been granted at the national park.



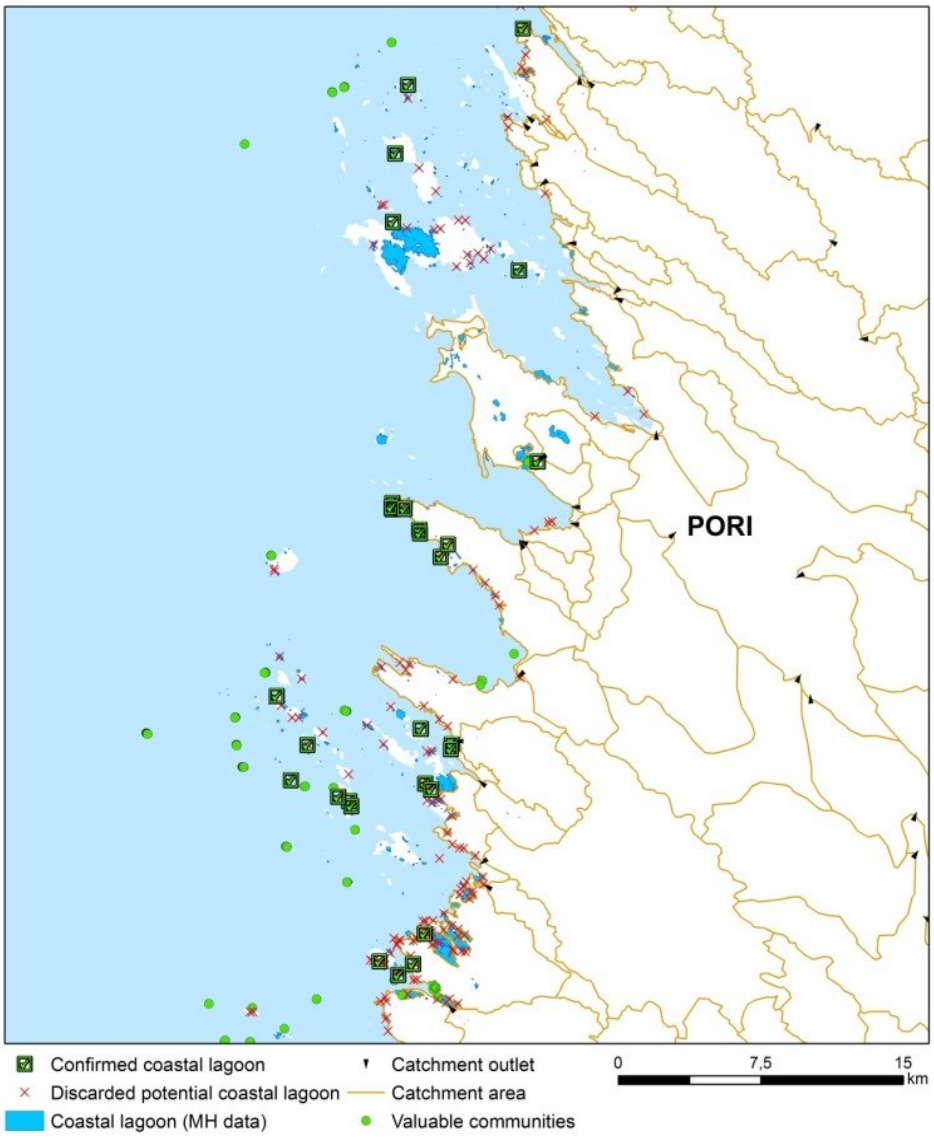
Nature protected areas and the national park at the Archipelago Sea

- The northern parts are composed of a mosaic of private protected areas and Natura.



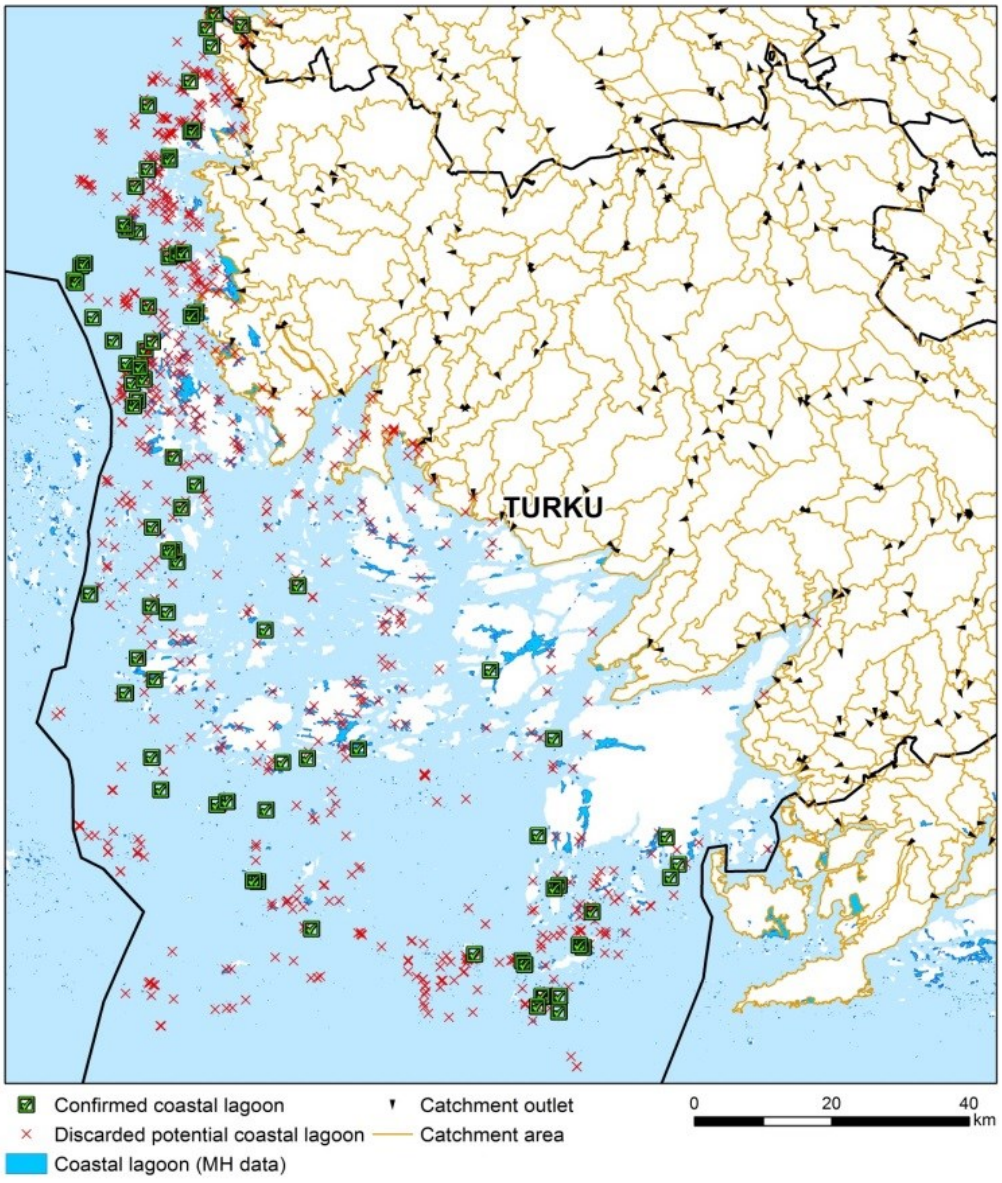
Marine biotopes – bays and flads

- The bay data was produced using satellite and aerial photographs.
- The flad data is supplemented with field surveys.



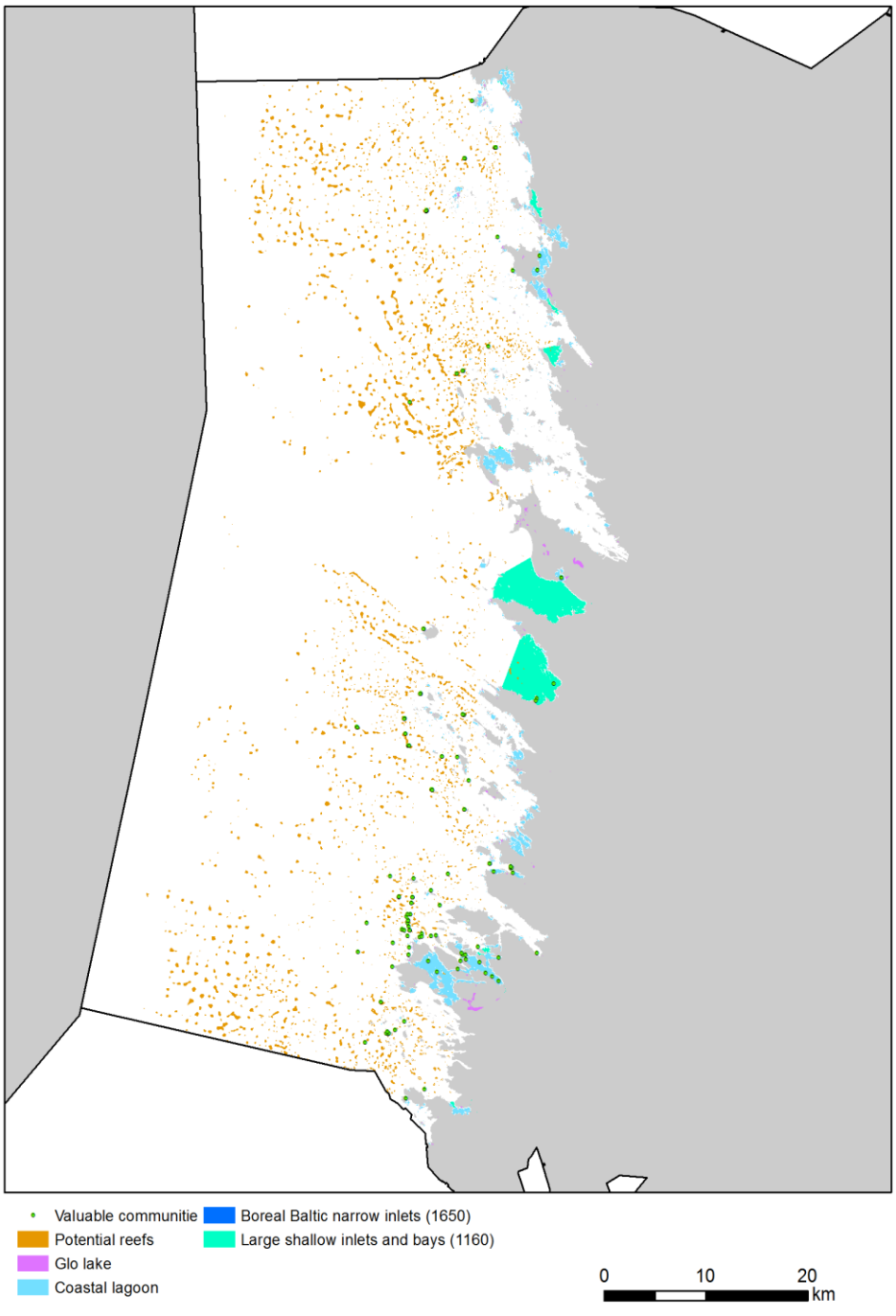
Marine biotopes – bays and flads

- Flads in a natural state in the Archipelago Sea are mostly found in the outer parts of the area.



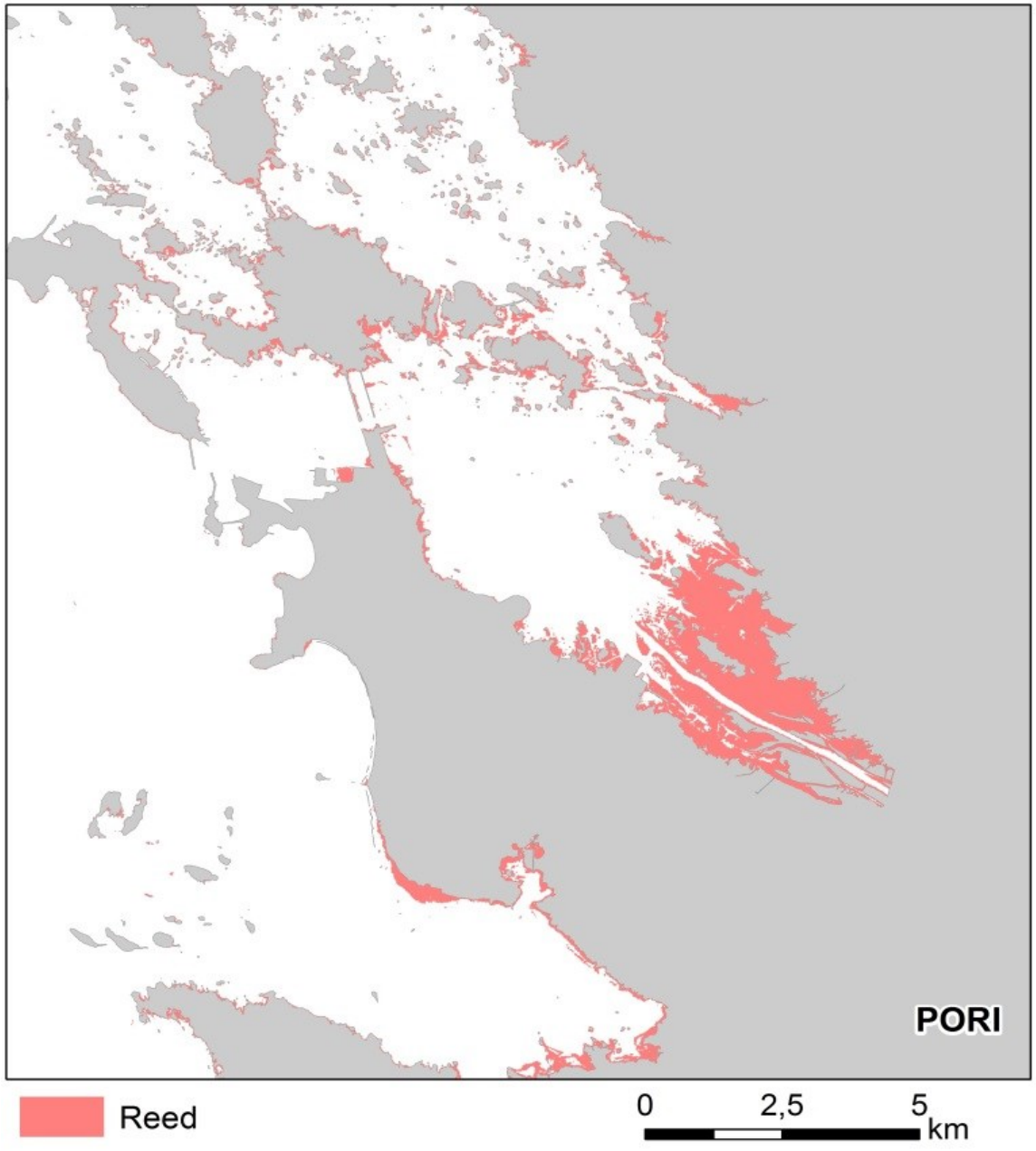
Marine biotopes – potential reefs and large shallow inlets and bays

- Reefs in the Bothinan Sea are the most extensive and well preserved in the Gulf of Bothnia.
- Shallow bays here have extensive sand areas.



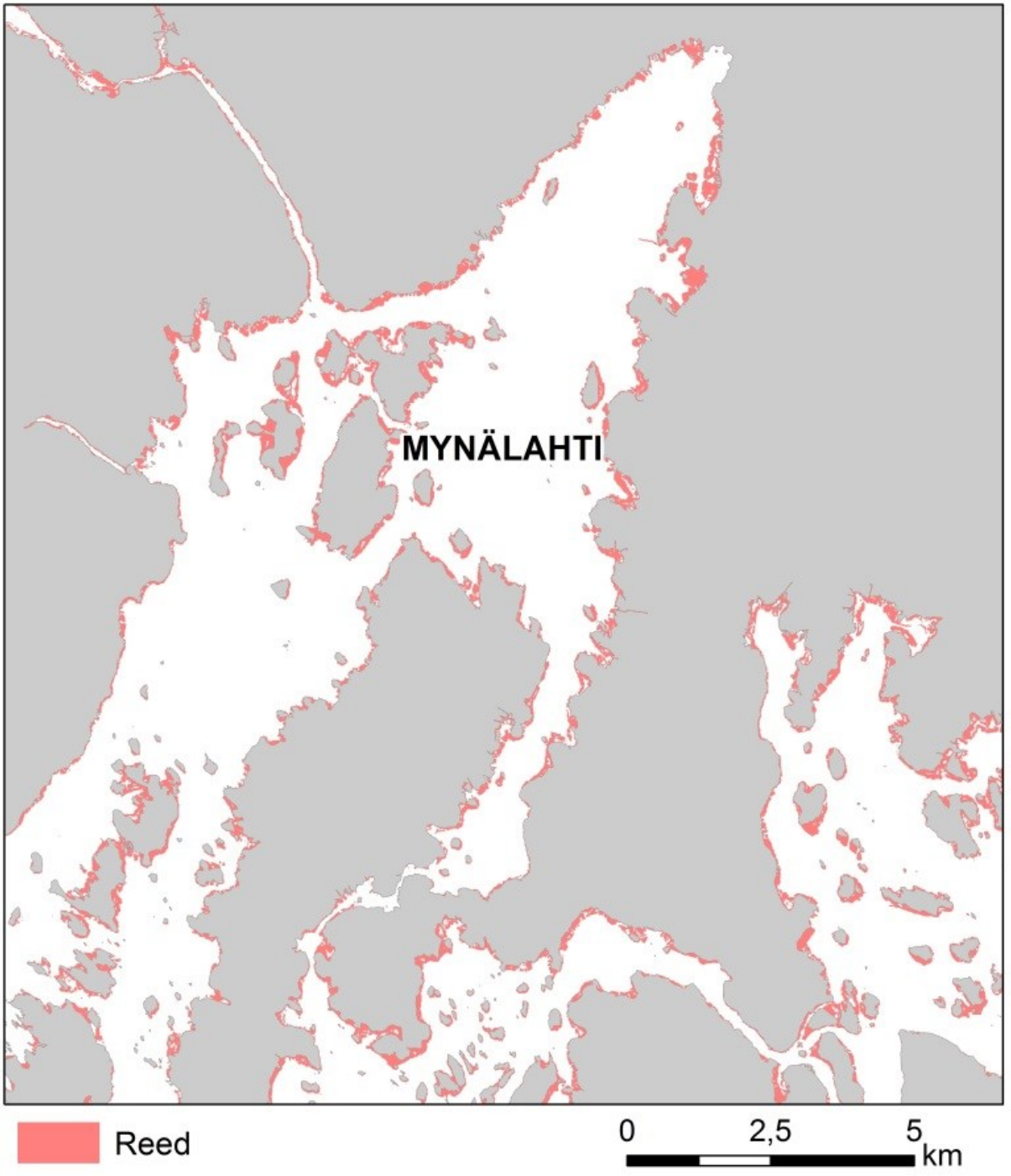
Marine biotopes – Reed (Pori area)

- At the Bothnian Sea the largest reed areas can be found at Kokemäenjoki river's eutrophic delta



Marine biotopes – Reed (Mynälahti, Archipelago Sea)

- Reed can be found almost everywhere along the shoreline of the Archipelago Sea.

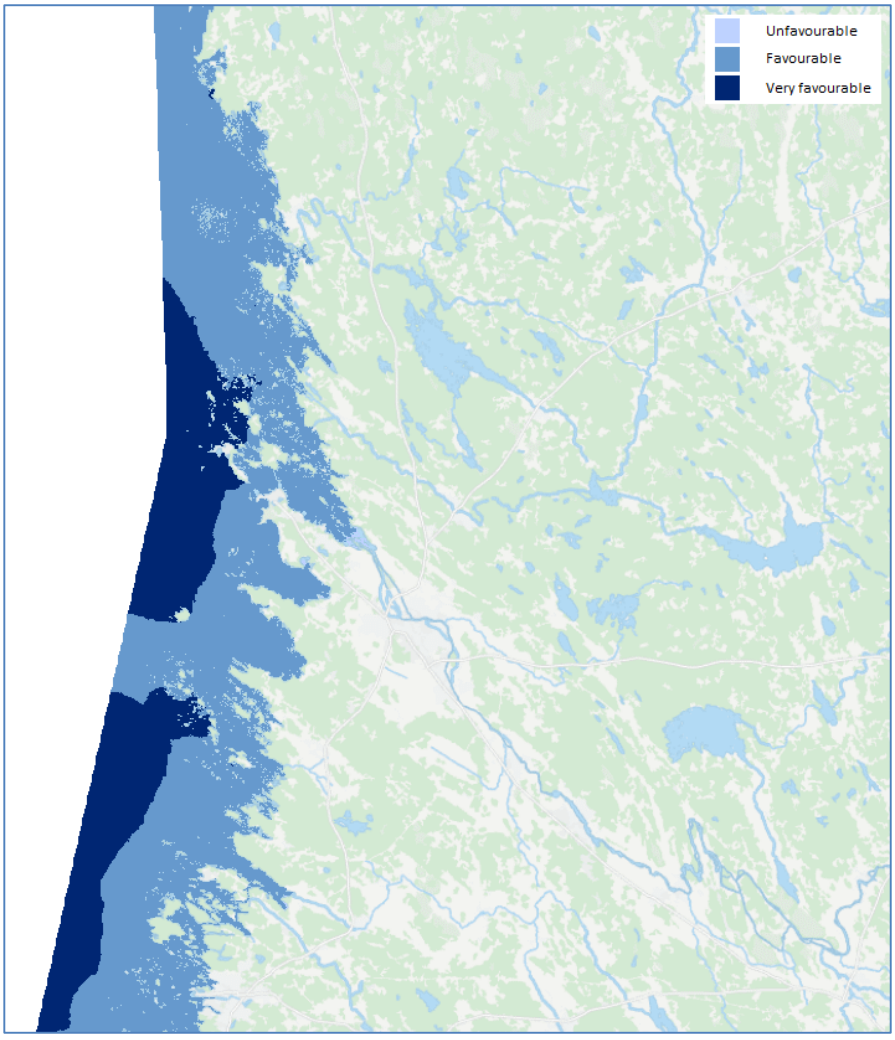


Reproduction areas for commercially used fish

- In 2015, Luke modelled fish reproduction areas along the Finnish coast.
- The maps can be used to get a general impression of the size and extent of fish reproduction areas along the coastal area.
- The models were produced using material gathered during the years 2007-2014 on fish fry sightings and prediction variables.

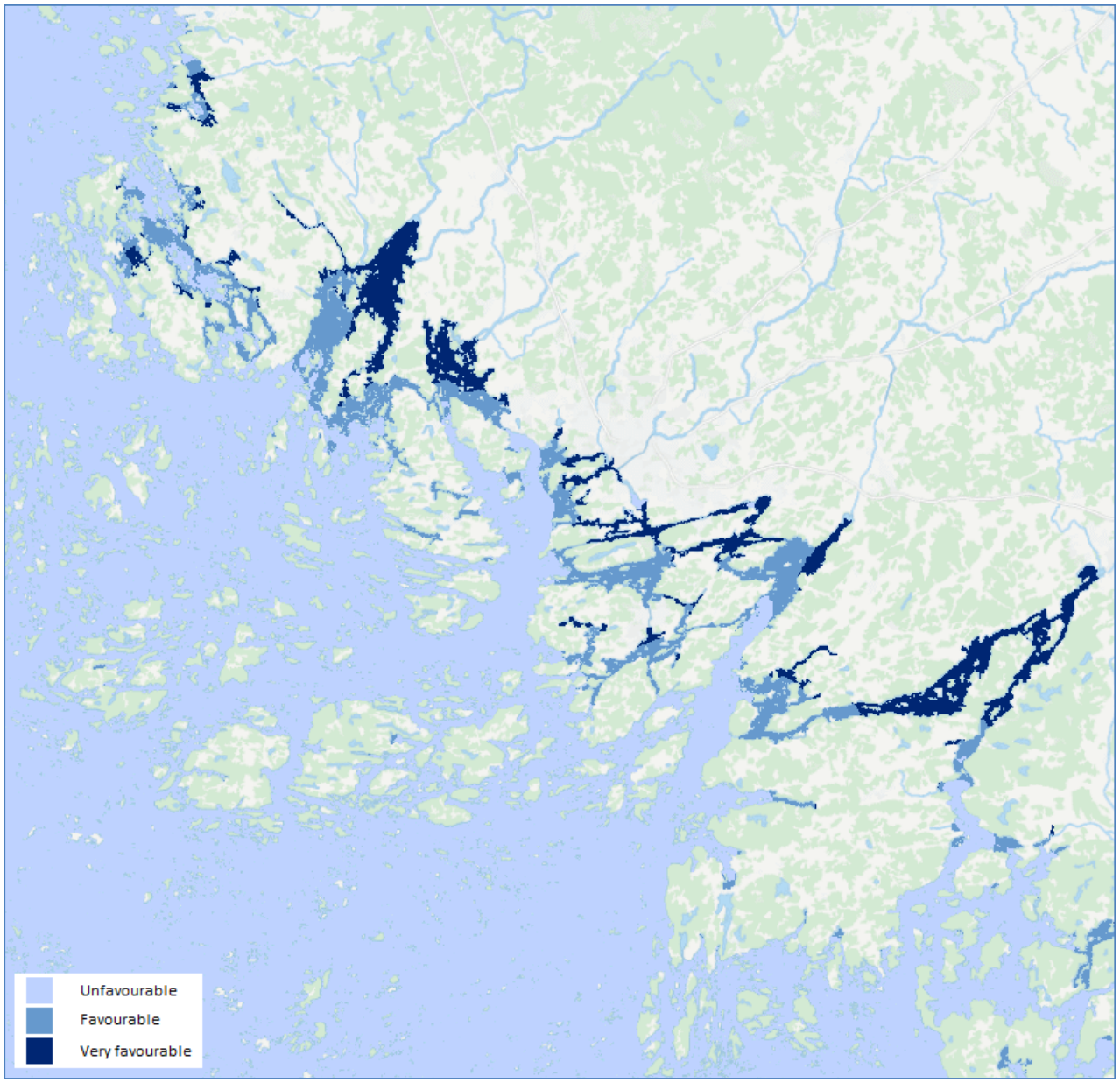
Fish reprodution areas – Baltic herring, Bothnian Sea

- The most probable reproduction sites are the reef areas.



Fish reproduction areas – Zander, Southwest Finland

- The murky bays of the Archipelago Sea produce most of the entire coast's zander population



NANNUT-classification

- Underwater nature is alien to most municipal decision makers, and the aim of NANNUT-classification is to simplify the complicated datasets and bring forth threatened and valuable species and habitats.
- Key habitats evaluated in this analysis are bladder wrack communities, blue mussel colonies, red algae communities, underwater mosses, stonewort communities and submerged vascular plant communities.

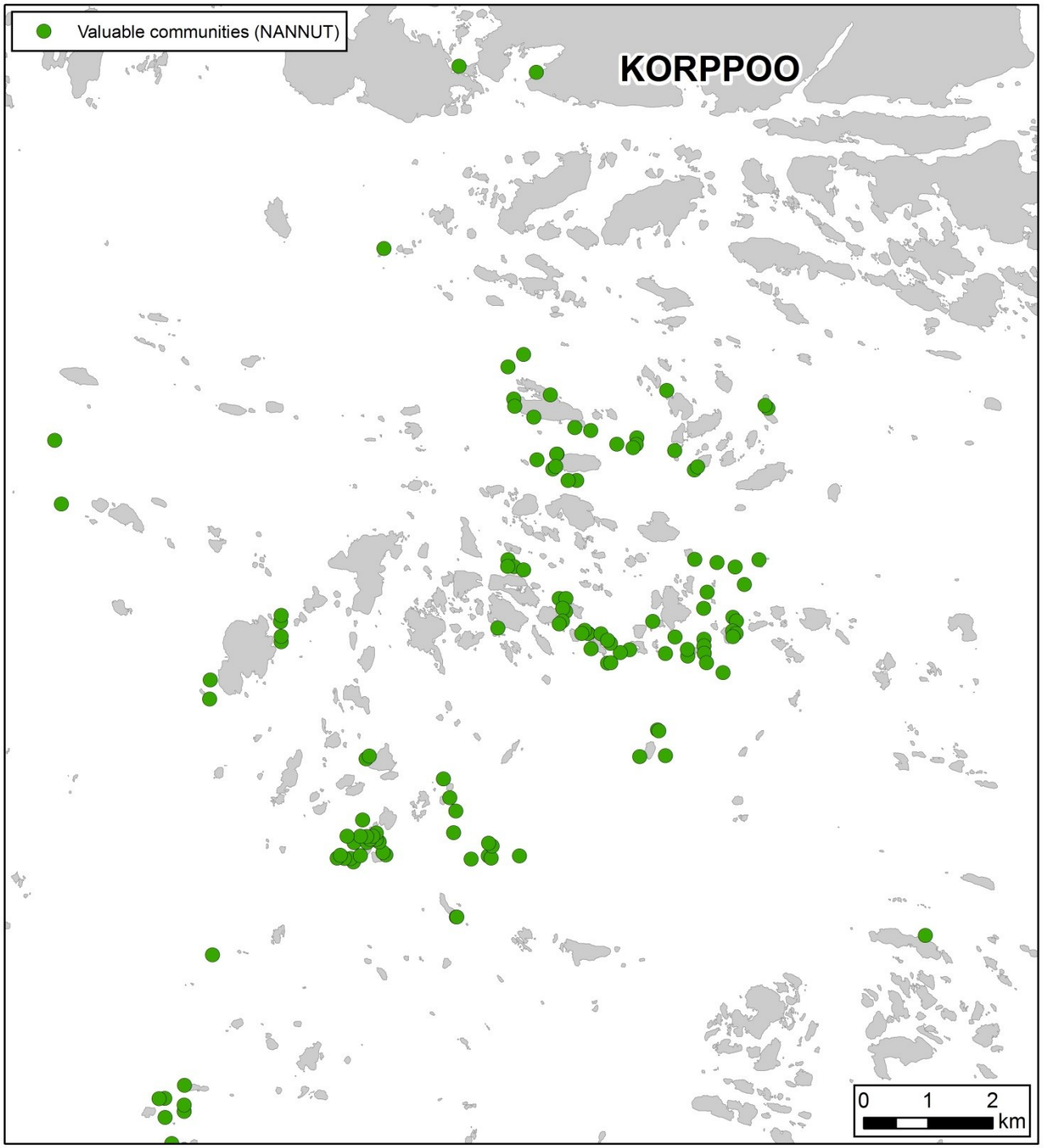
NANNUT-classification

- Dataset is based on individual observation points. Each point is classified based on either one or several key species / communities.
- Value for each point is based on diversity, abundance and depth of the community.

NANNUT-classification

- In this report only the highest two classes of NANNUT-classification are illustrated to emphasize the especially valuable areas.
- The highest value (5) represents threatened species or habitats. The second highest value (4) covers either high abundance of key species or high species diversity. Steady key communities most likely support a wider range of ecological services for the area surrounding the observation point.

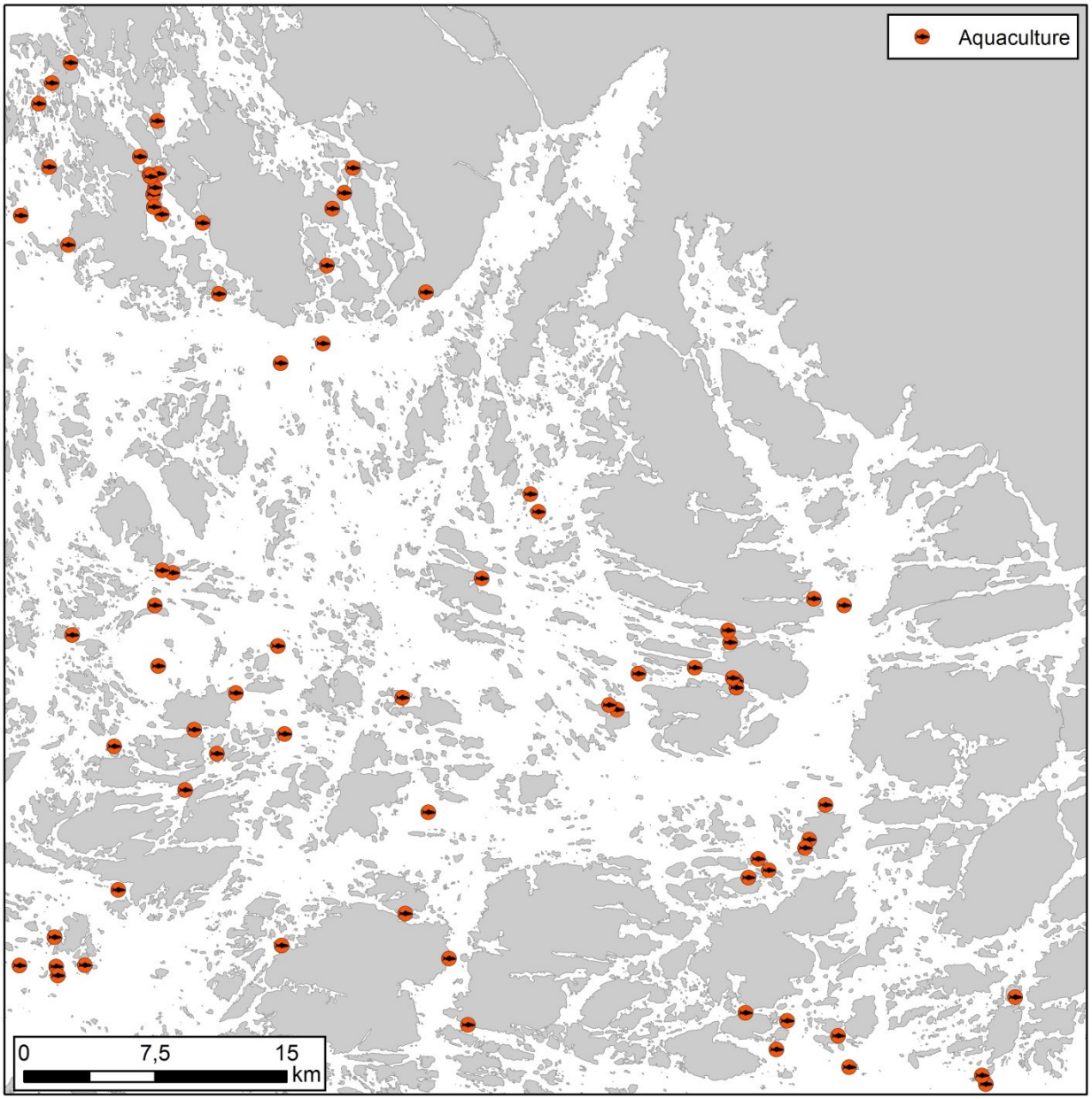
NANNUT-classification: Outer archipelago, The Archipelago Sea



The most significant human pressure: eutrophication

- The excess nutrients Farming and forestry flow to shallow bays in the coastline. In the areas with low water mobility the visibility grows poorer, light substrate and organic matter accumulates on the bottoms and species diversity declines. Diverse shallow plant communities provide a number of different ecosystem services and supporting the natural state of them help keeping the coastline functional and vivid.
- In the open sea area the most significant individual source of nutrients are fish farms. Depending on local currents, their effects can spread over wide areas.

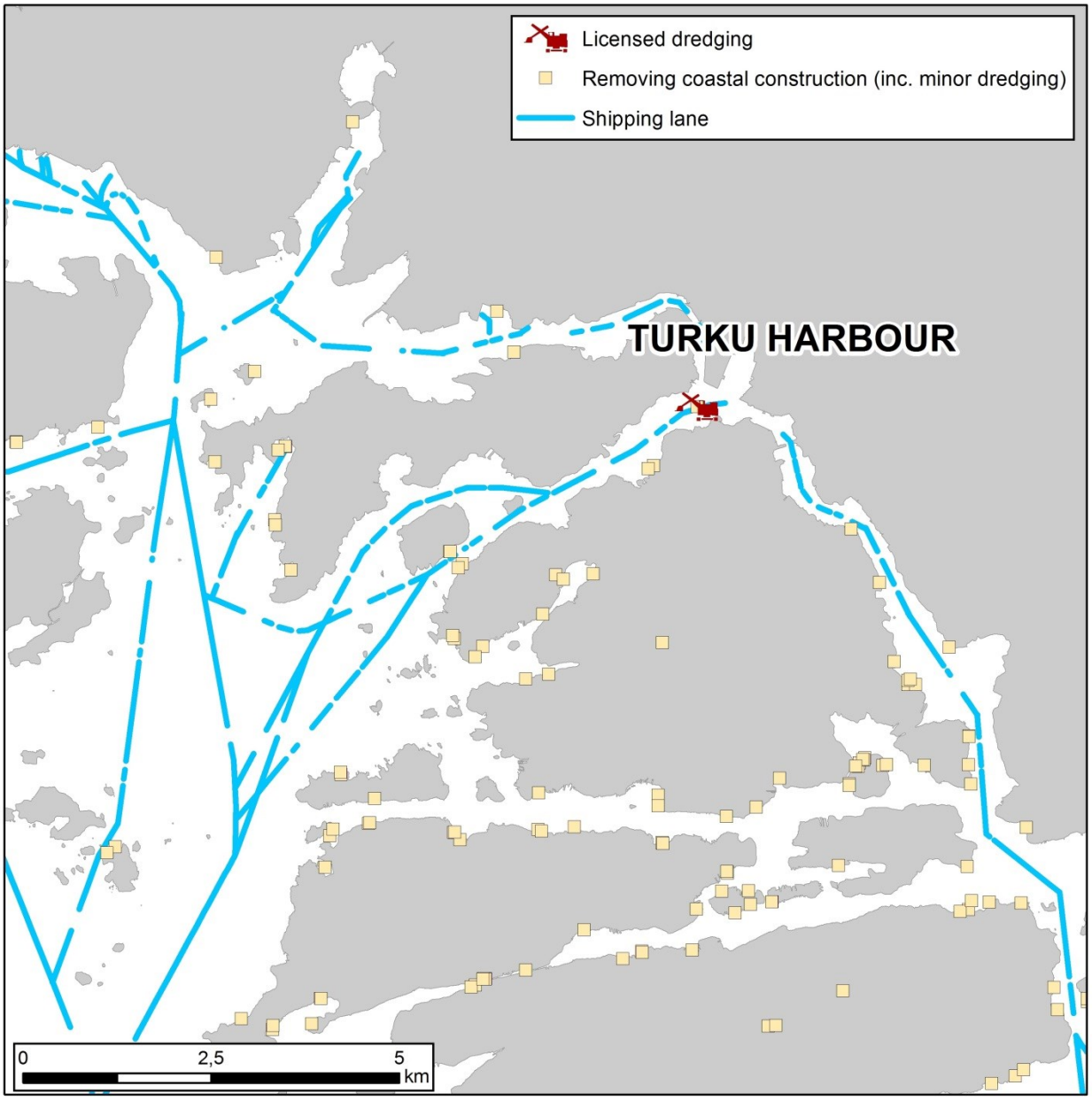
Open water fish farms in the Archipelago Sea



Mechanical pressures in the coastline

- Dregding and shoreline building manipulate the water flow in shallow water areas. Bottom opening procedures destroy habitats locally and change the force and direction of currents, as do covering procedures.
- Baltic Sea is heavily trafficked. Ships cause bottom disturbance by propellers and waves, and underwater noise is a stresser to many species. These different effects should be taken into account when planning harbours and ship routes. Valuable environments should be avoided as well as possible.

Dredgings and main shipping routes outside Turku



Integrating land and sea datasets

- Coastal areas are under high demand from both natural values and human pressures. It is crucial to look for ways to keep the area busy without compromising the environment. Most of the marine ecosystem services extend far towards the open sea as well as inland, and most of the human pressures can be mitigated by long term planning. Conservation areas and areas of with low human pressures should be extended across the water line combining valuable terrestrial and marine areas. By surveying both the land and the sea, it is possible to find sustainable solutions between the land use and conservation in coastal areas.