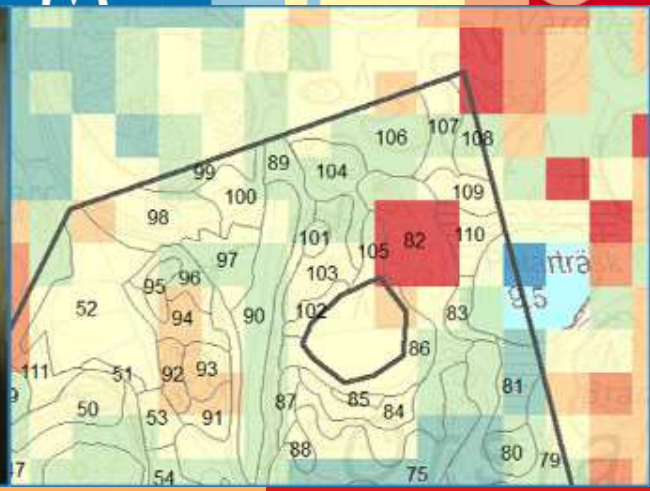
DECISION SUPPORT FOR ECOLOGICALLY BASED PLANNING

METSO



Spatial conservation prioritization of Finnish forests

METSO Forest Biodiversity

Current issues in forest conservation and biodiversity course *18th Nov 2021, UEF*
Lecturer: coordinator Ninni Mikkonen, Finnish Environment Institute (SYKE)

More information: https://www.syke.fi/zonation/en

What do I want to share with you today?

- Reasons that lie behind spatial conservation planning
- One method to help to tackle the biodiversity crisis

- Understanding of pros and cons of the(se) method(s)
- Give an insight of SCP and Finnish forests
- An example of your possible future work field within any region, nation, continent or union – as you are needed!

Decision support for ecologically based planning

Biologist, ecologist, wilderness guide

Zonation analysis coordinator 2010 >
Forest conservation 2012 >

PhD: The use of SCP to reinforce Finnish conservation network

Ecology & GIS +
co-operation & interdisciplinarity!

SYKE

METSÄHALLITUS
FORSTSTYRELSEN
MEAHCIRÁÐÐEHUS

UNIVERSITY OF HELSINKI

METLA

What is SCP?

Why are **spatial conservation prioritization** tools needed?

Forests and Z

Other cases

1.

SCP = Spatial conservation prioritization

Smart use of resources:
Why, how and where to use resources wisely?


CLIMATE CHANGE
Wood
Fresh air
Money
People
Food
CRISIS
Resources are limited
Yield
Land area for cultivation
Water
Heat protection
Peat
rea for living
Flood protection
Time
Energy
Prioritization needed


There’s no Planet B!
Data SIO, NOAA, U.S. Navy, NGA, GEBCO Landsat / Copernicus IBCAO U.S. Geological Survey PGC/NASA

Objective:
*Best possible **long-term** conservation outcome (persistence)*

Value: Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
(World Commission on Environment and Development, 1987)

1) Economic and 2) social development and 3) environmental protection

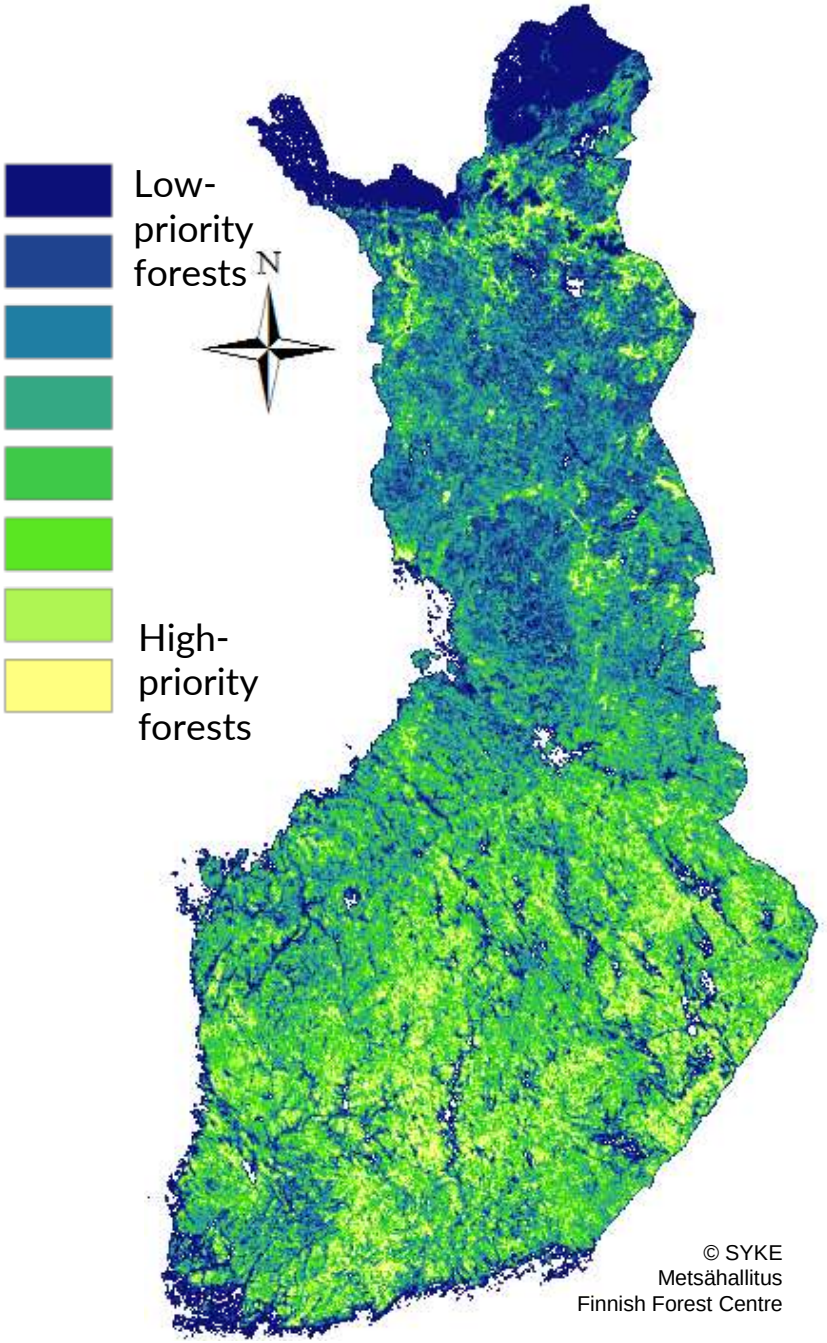
How to use biodiveristy related resources wisely?

Biodiversity crisis -> Actions

- Conservation*
- Management*
- Restoration*
- Recreating ecosystems*
- Cleaning*
- Diminishing impacts
- Reintroducing species
- ***Biodiversity offsetting & ecological compensation**

The most difficult question – where?

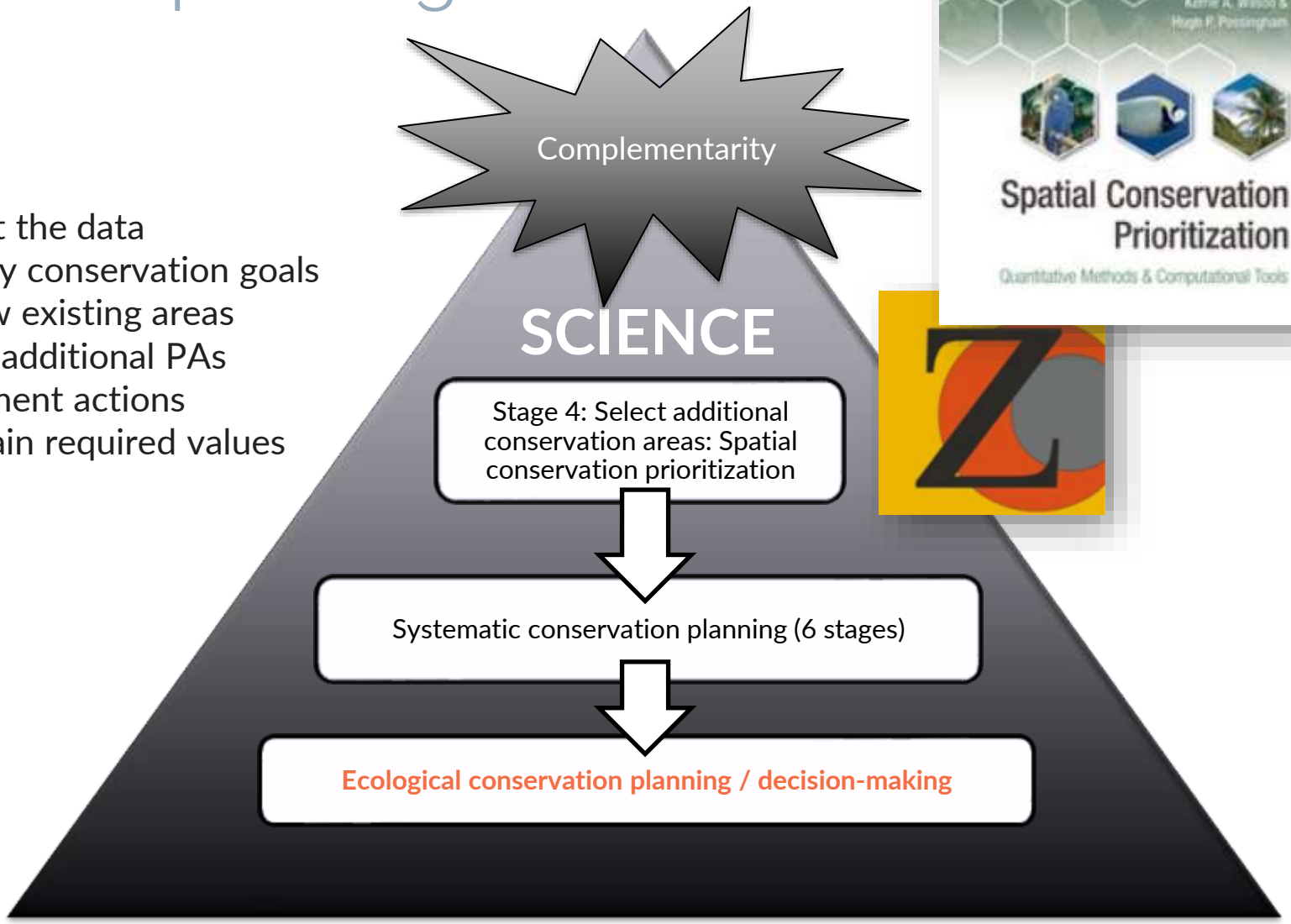
- For spatial questions > SCP
- Even more difficult:
  - Which actions?
  - Interactions?
  - Consequences?
  - Averted biodiversity loss?

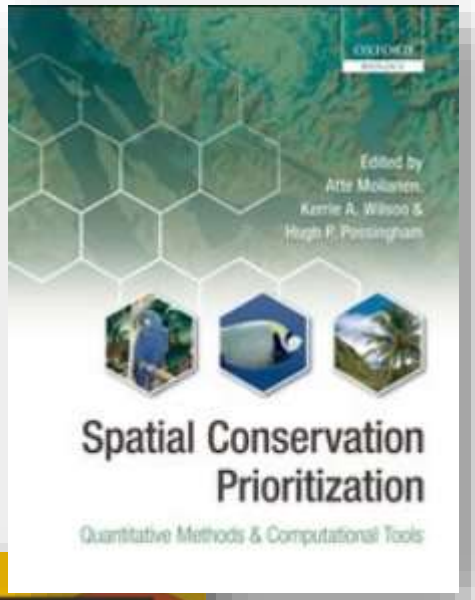


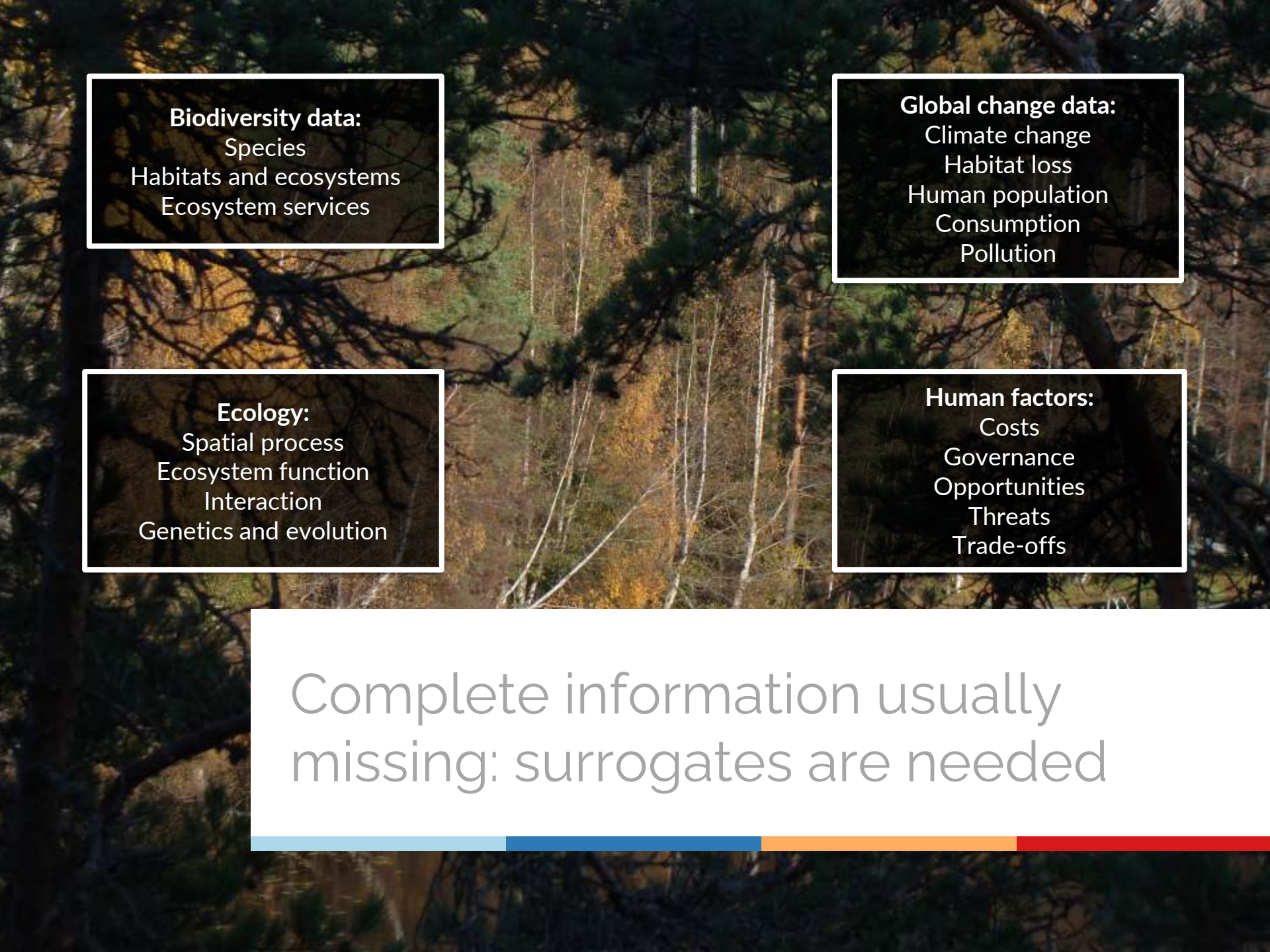
WHERE: Assess biodiversity for land use planning

6 stages:

1. Collect the data
2. Identify conservation goals
3. Review existing areas
4. Select additional PAs
5. Implement actions
6. Maintain required values

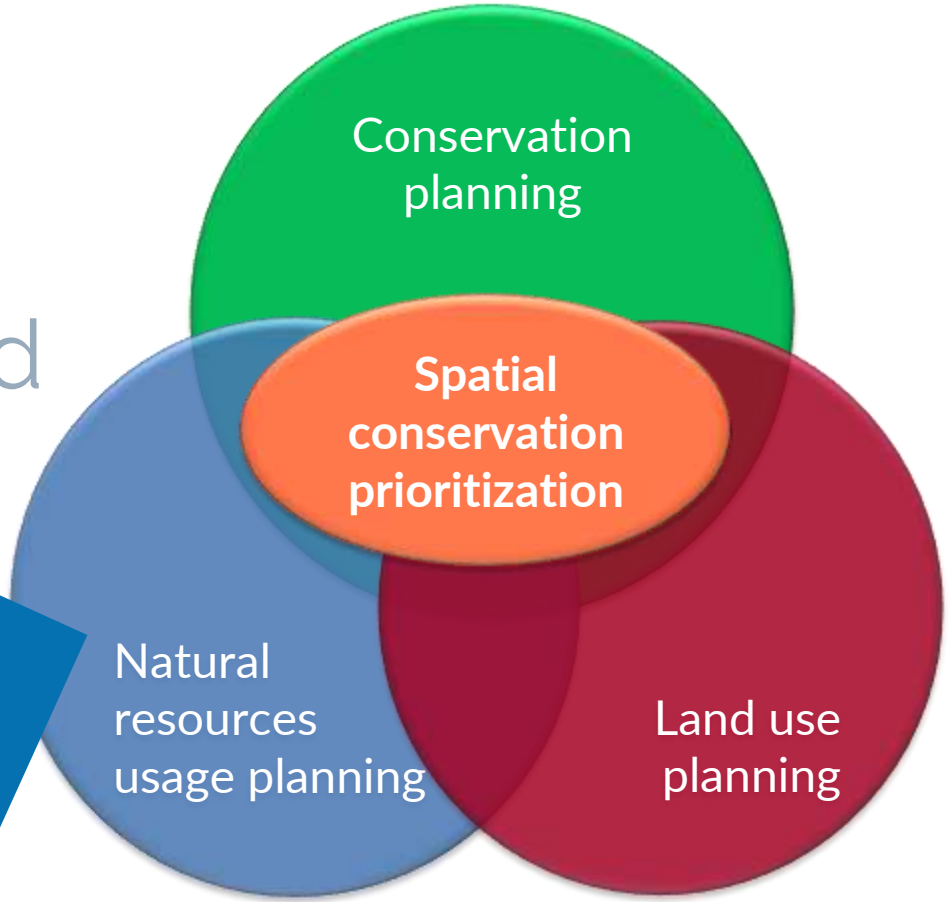






Complete information usually missing: surrogates are needed

In a perfect world

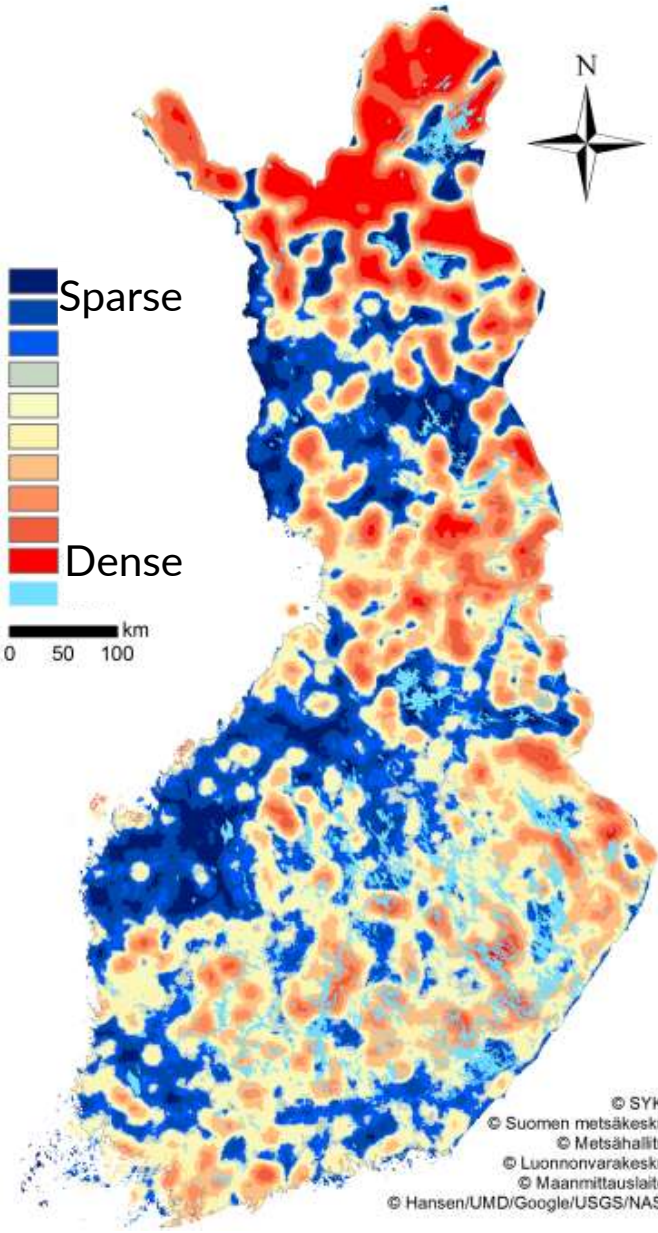


Decision-making needs spatial and good quality information

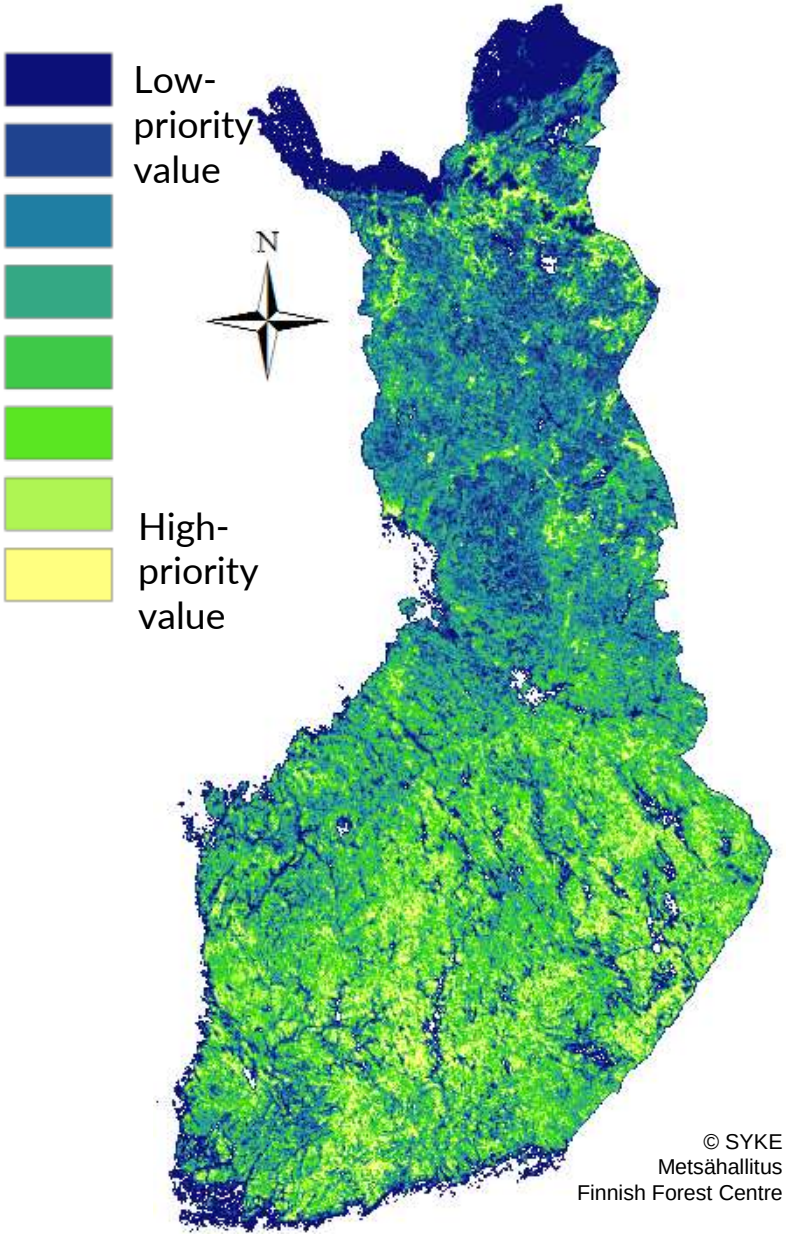
Land use decisions are a balancing act

Ferrier & Wintle 2009: *Quantitative approaches to spatial conservation prioritization: matching the solution to the need.* --- **in Moilanen, Wilson, Possingham, *Spatial conservation prioritization, quantitataive methods & computational tools***

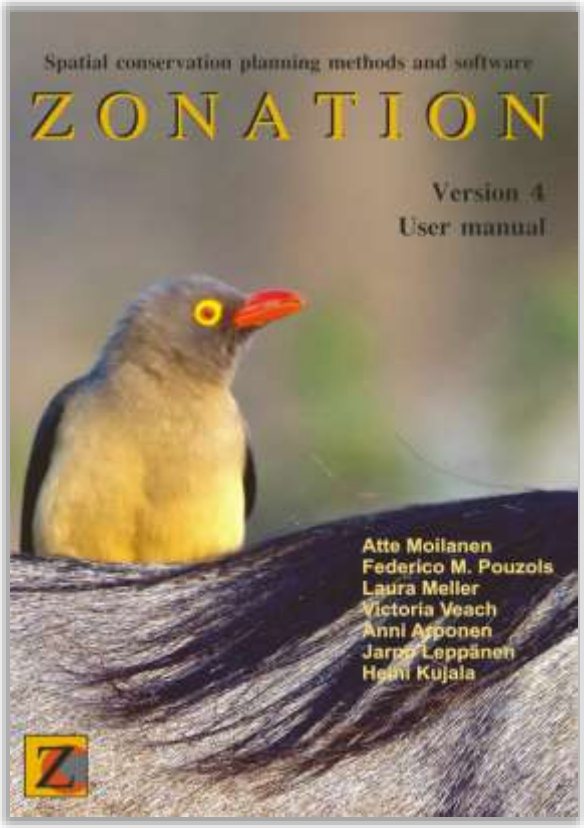
Before: terrestrial PA network



In the future: forest biodiversity ?



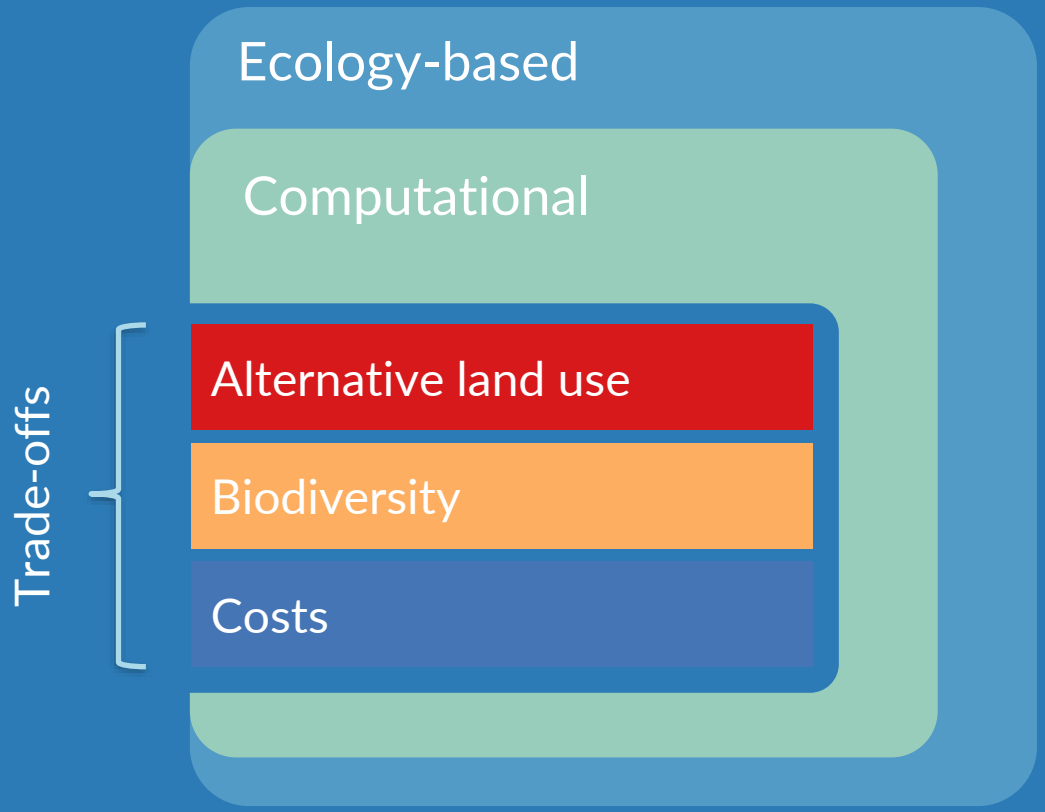
ZONATION
Conservation planning software



HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

- Zonation available since 2006
- Freely available: www.syke.fi/zonation/en


Ilkka Hanski European
Distinguished Service Award 2018
is awarded to
Prof. Atte Moilanen
"For extraordinary contributions to ecologically based,
computational methods to support conservation solutions
that successfully tradeoff biodiversity values, costs
and alternative land-uses
and conservation resource allocation."
Society for Conservation Biology
A global community of conservation professionals
© Ninni Mikkonen



Good solutions

for conservation resource allocation

ZONATION
Conservation planning software

Zonation – what is it for?

1	Identifying ecologically most valuable areas
2	Identifying ecologically least valuable areas
3	Assessing existing nature conservation network
4	Expanding (developing) nature conservation network

1. Target

Get / find / modell data, integrate with features avaiable in the optimization

2. Ecological model

3. Zonation optimization

Take the advantage of the optimization compared to normal GIS

4. Relevancy

5. Usefullness

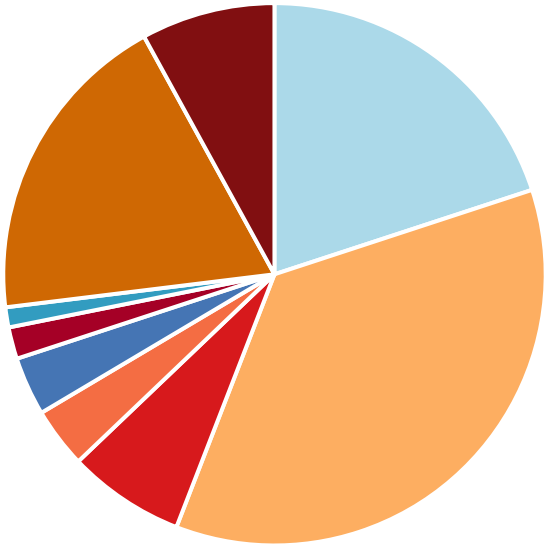
6. Follow up

SCP analyses , case Finnish forests

Forest and peatland analyses

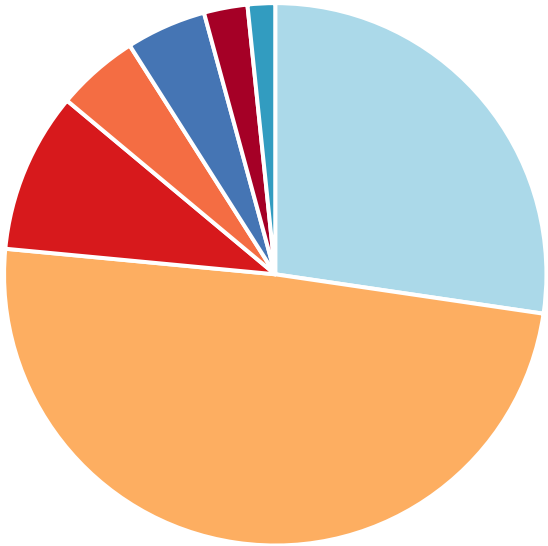
1. National-level forest biodiversity
2. Integrated forest biodiversity and carbon sequestration and storage
3. Complementary mire conservation network
4. Minimize BD loss in peat mining

Finland



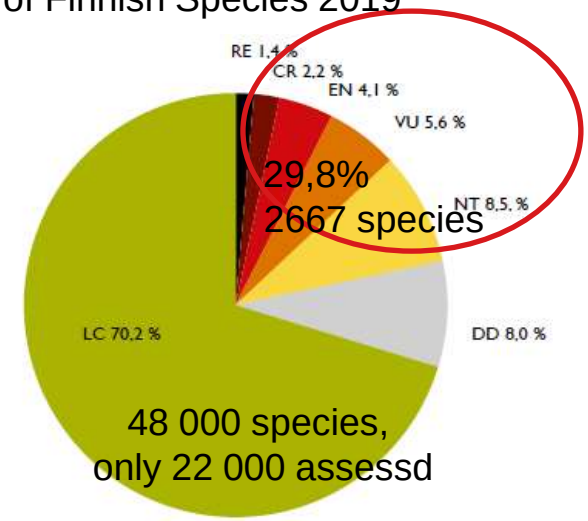
- Peatland
- Forests on mineral soil
- Agricultural areas
- Fjells
- Built environments
- Shores
- Rocky and esker habitats
- Sea
- Fresh waters

Finland without water areas



- Peatland
- Forests on mineral soil
- Agricultural areas
- Fjells
- Built environments
- Shores
- Rocky and esker habitats

Red List of Finnish Species 2019



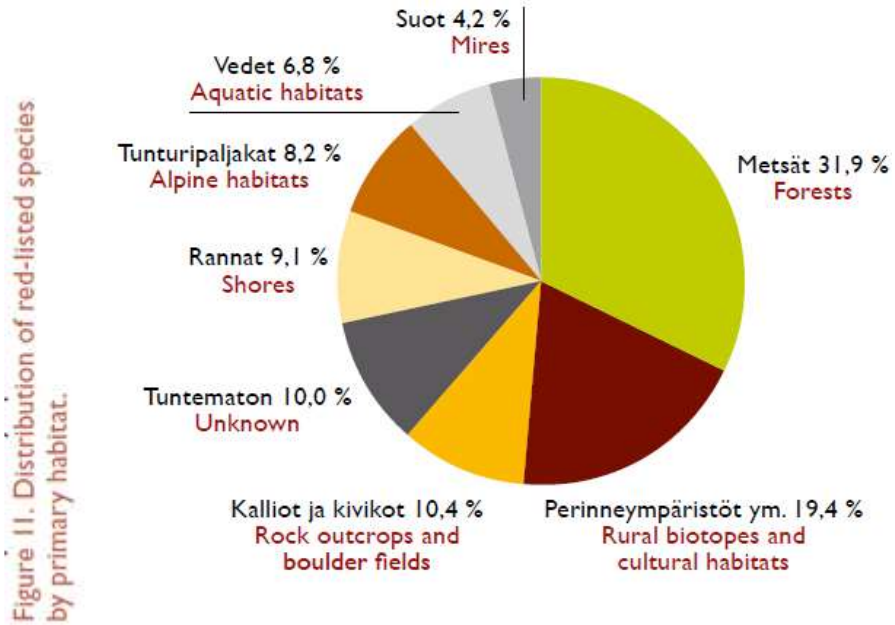


Figure 11. Distribution of red-listed species by primary habitat.


PAIKKATIETOIKKUNA
HAKU
KARTTATASOT
KARTTASELITTEET
KARTTAJULKAISU
TEEMAKARTAT
ANALYYSI
KÄYTTÖOHJE
OMAT TIEDOT
KOORDINAATTI-MUUNNOS
INSPIRE
Kirjaudu - Rekisteröidy
På svenska - In English
Palaute
3D
Historialliset ilmakuvat
1940
1931 1940 1950 1960 1970 1980 1990 2000 2010 2021
KARTTATASOT
KARTTASELITTEET
KARTTAJULKAISU
TEEMAKARTAT
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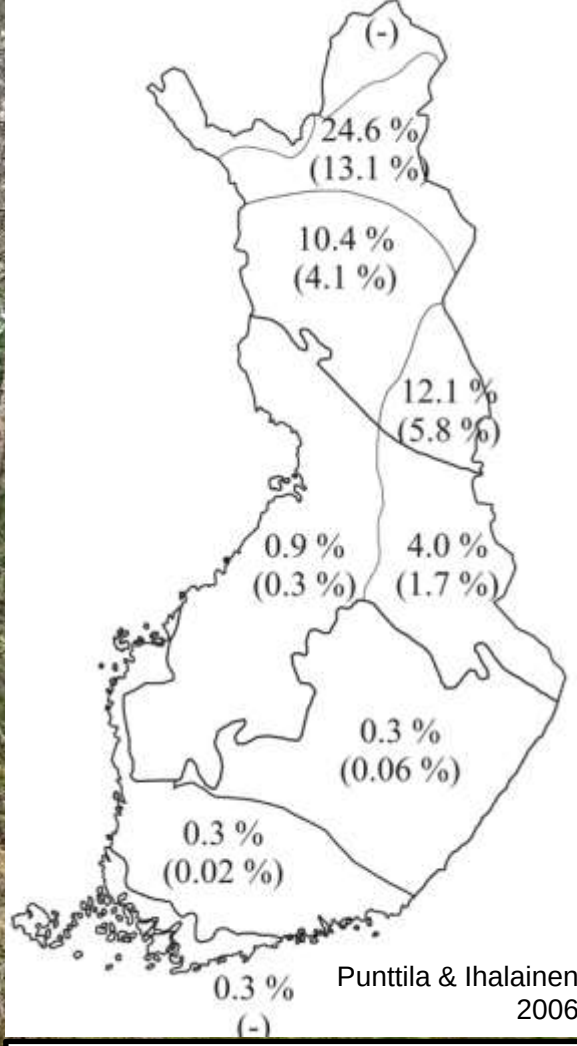
Palaute
3D
Historialliset ilmakuvat
2021
1931 1940 1950 1960 1970 1980 1990 2000 2010 2021
XY



Punttila & Ihalainen 2006

Northern Boreal 14,5% (6,8%)
Middle Boreal 2,0% (0,8%)
Southern Boreal 0,3% (0,04%)
Hemiboreal 0,3% (-)

Finland in total 4,4% (2,0%)
(permanently protected)

ZONATION
Conservation planning software

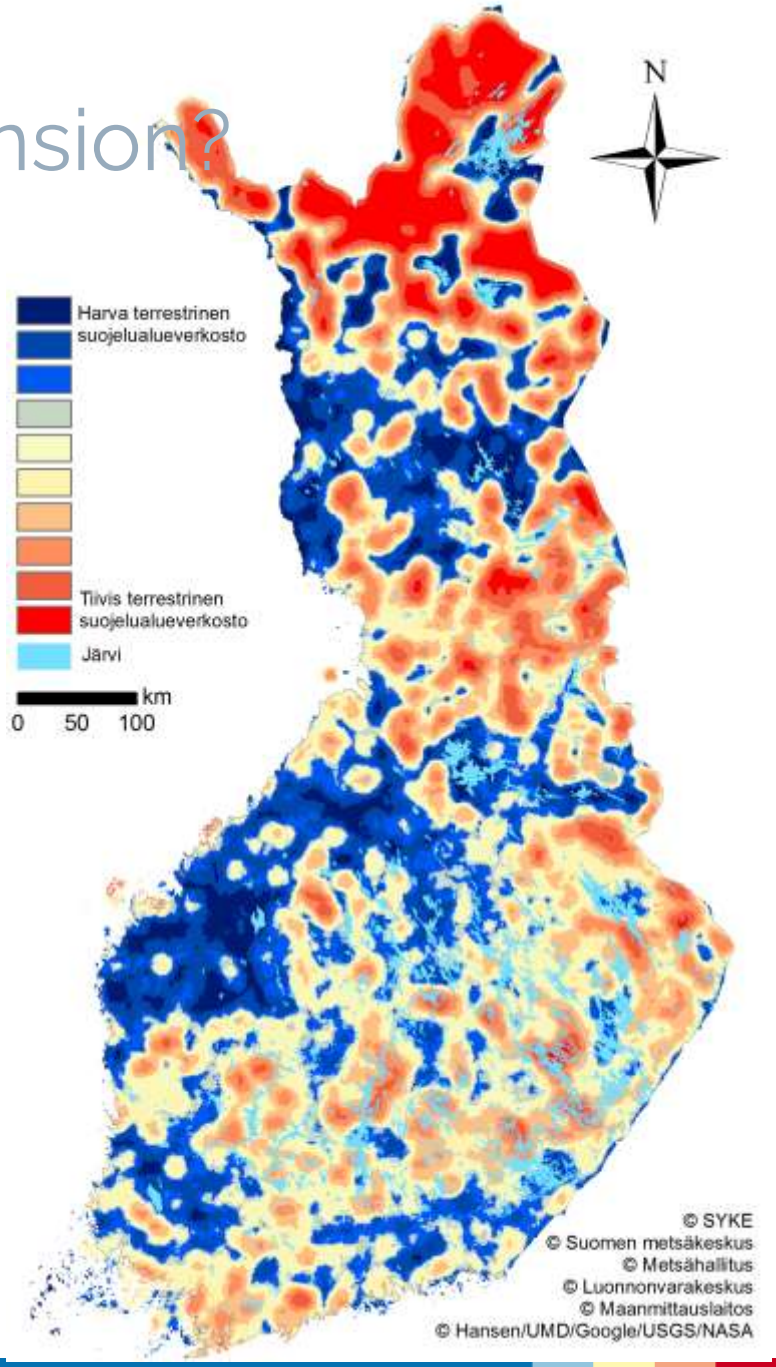
Zonation – what is it for?

1 Identifying ecologically most valuable areas

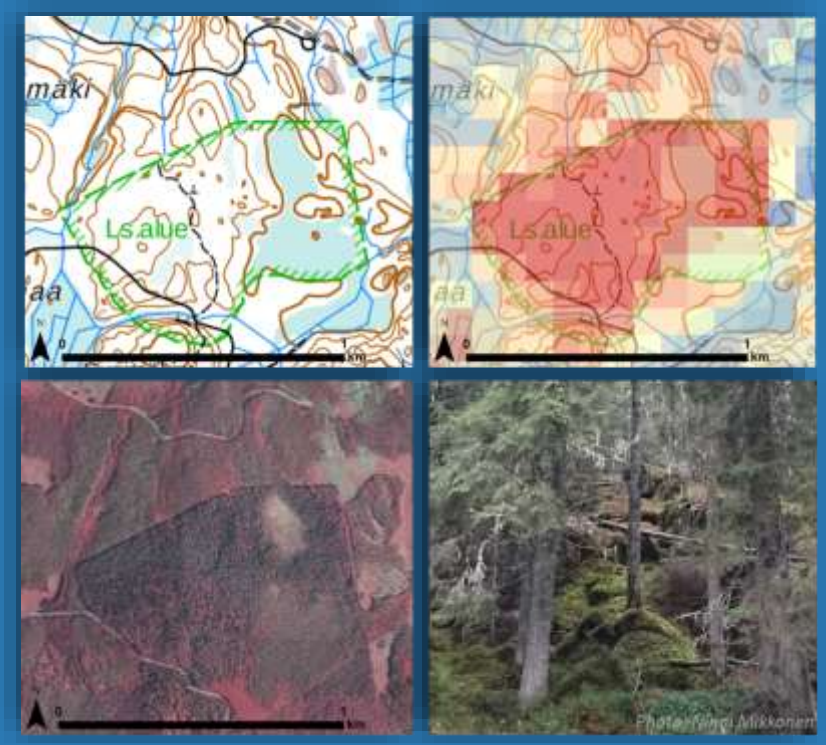
4 Expanding (developing) nature conservation network

Conservation area expansion?

- 10,5% is not enough
  - EU Target 30% by 2030
- ½ on poorly productive forests
- Biased towards less productive north
- + dynamic key habitats
- METSO-conservation programme:
  - New conservation areas?
    - Nature management?



What is the difference between Z and GIS?



Simultaneously:

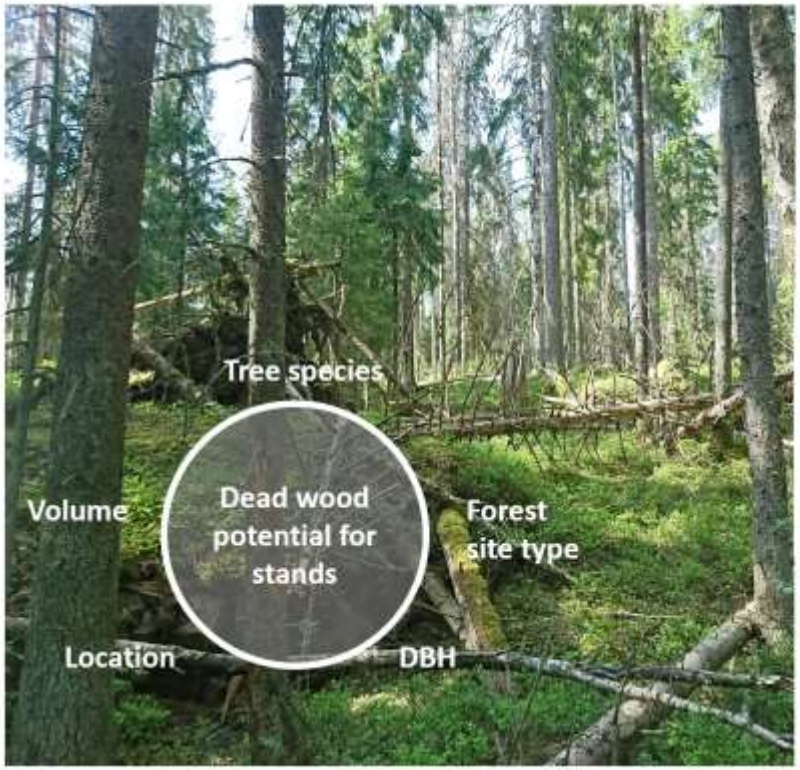
1. <u>Complementarity</u> of areas (vs. scoring)
2. **Balanced solution between input features (i.e, species)**
3. Prioritization of the whole research area (vs. targets)
4. Distribution: rarity
5. Connectivity, interactions…
6. Weights between
7. Replacement cost analyses
8. Costs, penalties, threats, uncertainties
9. …

It is time to use Zonation?

1. **When expertise is not enough!**
   - Big areas
   - Interdisciplinarity needed
   - Subjectivity needs to be reduced
   - Connectivity is needed
   - GIS is not enough

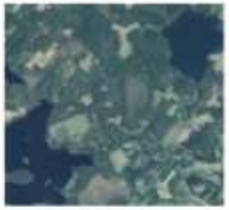
2. **When you have resources, not just an idea**
   - When experts, time, money and datas are available –Not a modelling tool

ECOLOGICAL MODEL



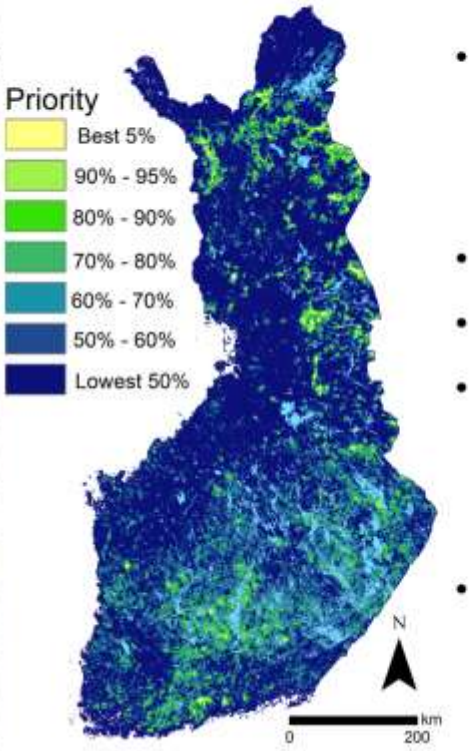
Biodiversity

Connectivity



Management

SPATIAL CONSERVATION PRIORITIZATION



- Maps help to identify previously unknown high conservation value forests
- Openly available
- Resolution 96 metres
- Information for landowners on the biodiversity values of their forests
- Enables ecological forest network planning

Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

SYKE

METSÄHALLITUS
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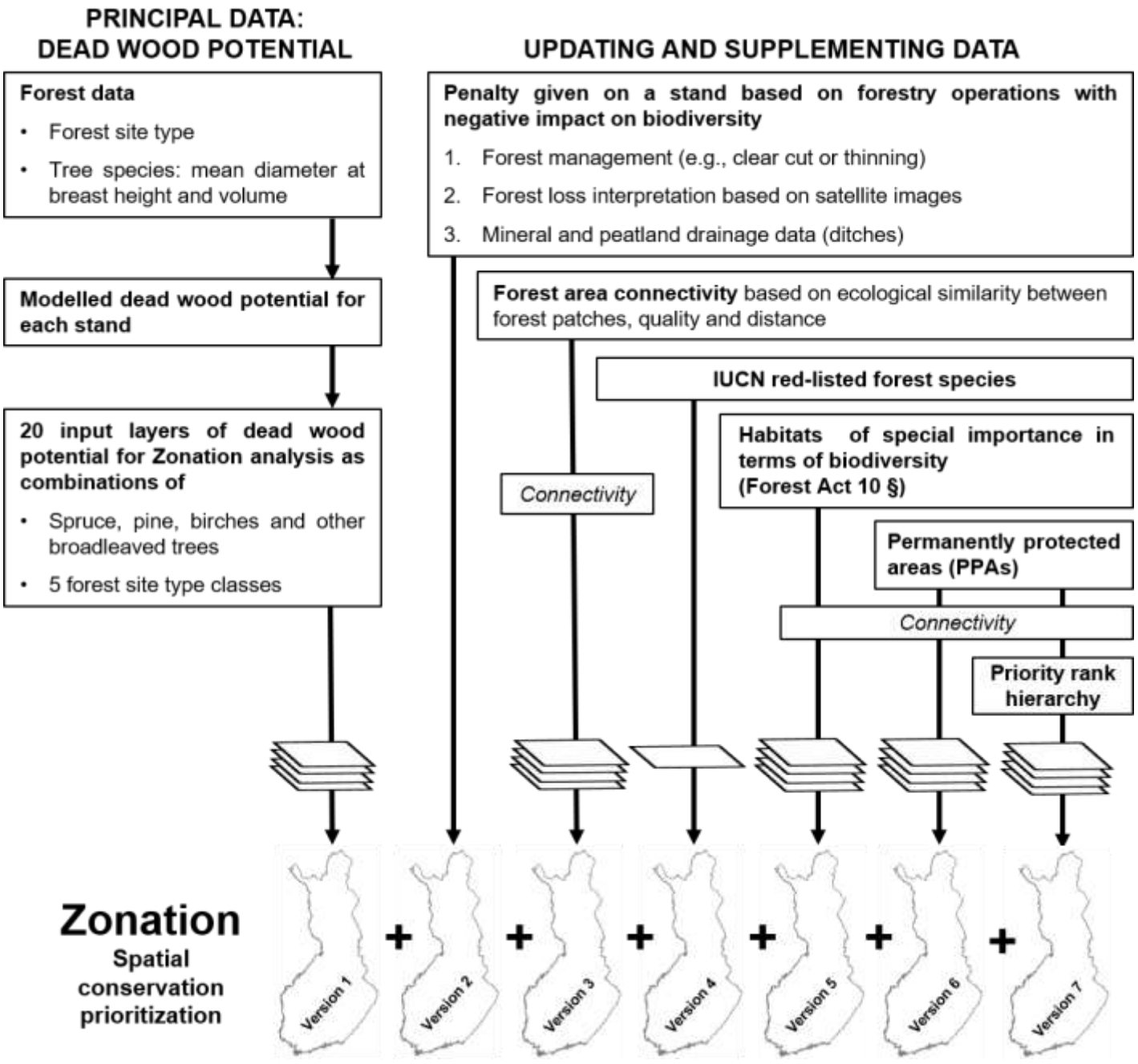
MEAHCIRÁÐÐEHUS

METSO
Forest Biodiversity


PRINCIPAL DATA:
DEAD WOOD POTENTIAL
Forest data
• Forest site type
• Tree species: mean diameter at breast height and volume
Modelled dead wood potential for each stand
20 input layers of dead wood potential for Zonation analysis as combinations of
• Spruce, pine, birches and other broadleaved trees
• 5 forest site type classes
UPDATING AND SUPPLEMENTING DATA
Penalty given on a stand based on forestry operations with negative impact on biodiversity
1. Forest management (e.g., clear cut or thinning)
2. Forest loss interpretation based on satellite images
3. Mineral and peatland drainage data (ditches)
Forest area connectivity based on ecological similarity between forest patches, quality and distance
IUCN red-listed forest species
Habitats of special importance in terms of biodiversity (Forest Act 10 §)
Connectivity
Permanently protected areas (PPAs)
Connectivity
Priority rank hierarchy
Zonation
Spatial conservation prioritization
Version 1
Version 2
Version 3
Version 4
Version 5
Version 6
Version 7

From ecological model To prioritization

20
Tree species & forest site type classes as input layers

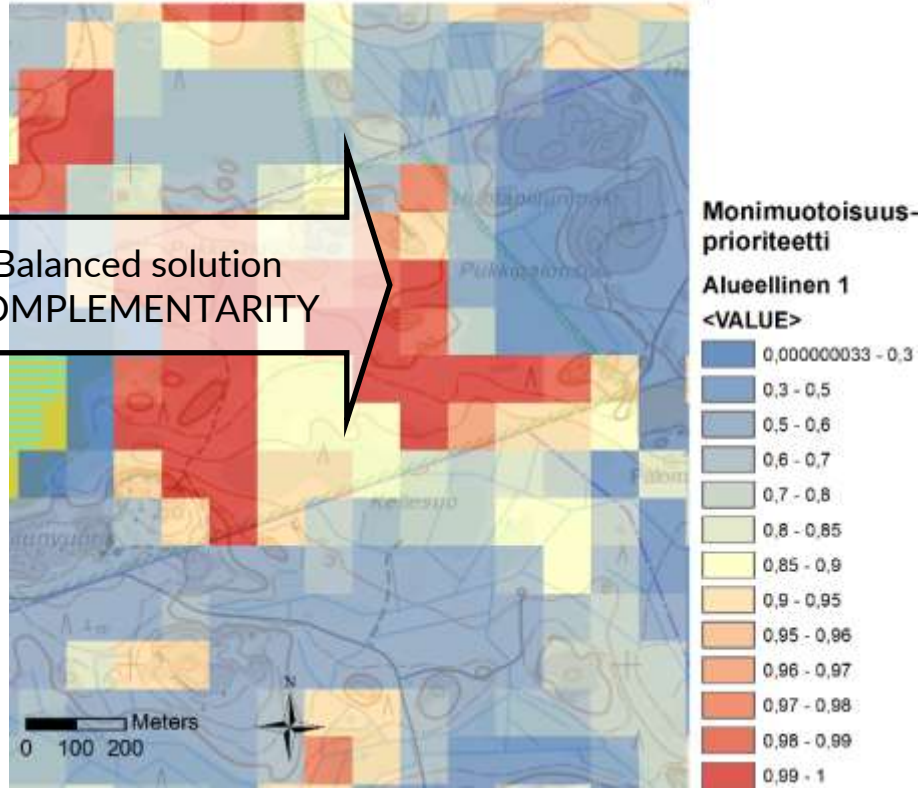
1. Data for modelling the input data

2. Model the input data = dead wood potential

3. Use dead wood potential as surrogate

Balanced solution
COMPLEMENTARITY

Analyysiversio 1:
paikallinen lahopuupotentiaali Zonation-ohjelmistolla priorisoituna



Verizona: are they beneficial?

- Uusimaa Region
- Polypores and carabides
- 88 spots, 215, forests stands, 205 hectares
- Spruce dominated mature forests
- Measured: living trees, dead wood + species

Luke
LUONNONVARAKESKUS

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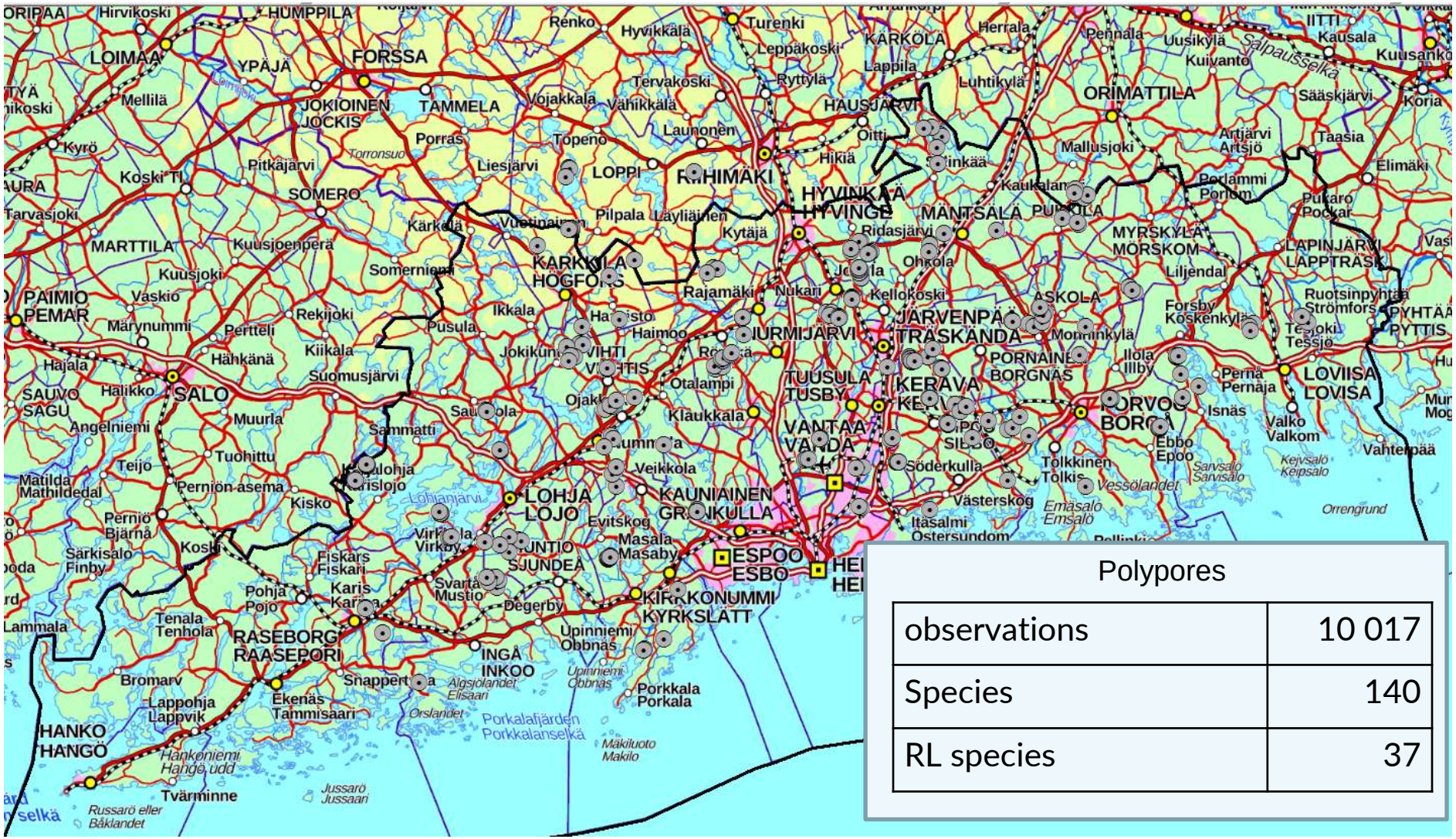
KONEEN SÄÄTIÖ

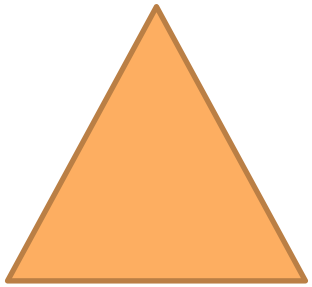
METSO


Polypores
observations 10 017
Species 140
RL species 37

The holy trinity of conservation planning

The most important

Quality



These two define the carrying capasity of the ecosystem in question

Area

Aggregation /connectivity

Defines how the populations can move and distribute

In best solutions you shoud have them all!
(In Southern Finland case, it’s going to be veeeeery difficult…)

Results

- 96 m x 96 m resolution too big in this fragmented landsacpeto identify very small high conservation value spots
- The bigger the area and the more there is dead wood the more there are polypores (all species)
- The higher the prioritization the more there is **red-listed** polypore **species** or their observations
- More detailed results will be published soon. By then, you can use ththe maps to your own joy and needs:
- https://www.syke.fi/en-US/Research__Development/Nature/Specialist_work/METSO_Programme/Zonation_supporting_METSO

Utilization

- Finnish Forest Centre:
  - Informing private landowners about forest conservation values through metsään.fi service
  - Nature management and restoration planning in privately owned forests
- Ministry of environment: budget planning for METSO programme, decision help for big areas
- Centres of Economic Development, Transport and the Environment: land use questions, conservation area expansion (METSO)
- Finnish Environment Institute: conservation studies, new Z-analyses
- Regional Councils: land use planning

Utilization of the resuts was

▷ **Promoted by**

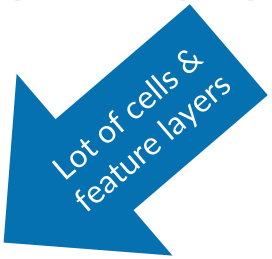
- Real need
- Communication with end-users durig the process
- Data became open
- Reporting with end-users mother tongue
- Expert education
- Right people in right places
- Financial conitinuum for the work
- Determination
- Permanent key personnel

▷ **Hindered by**

- Conserving is voluntary
- Un-open data
- Limited GIS skills and software
- Difficulties with data
- Conflict between forest biodiversity and forestry
- Complicated ecological modell
- Scale of decision-making

Everything has two sides…

Strengths of Z



- Can process very **big data sets** and take into account very difficult factors such as connectivity
- Effective and analyses are easy to repeat (or to develop new) when data are ready
- Planning process is transparent, which reduces subjectivity

Weaknesses of Z

- Might seem complicated from the perspective of interest groups
- SLOW if prepared data is not available
  - Expensive in the beginning
  - Quality problems with data
- One can never have everything essential in one analysis

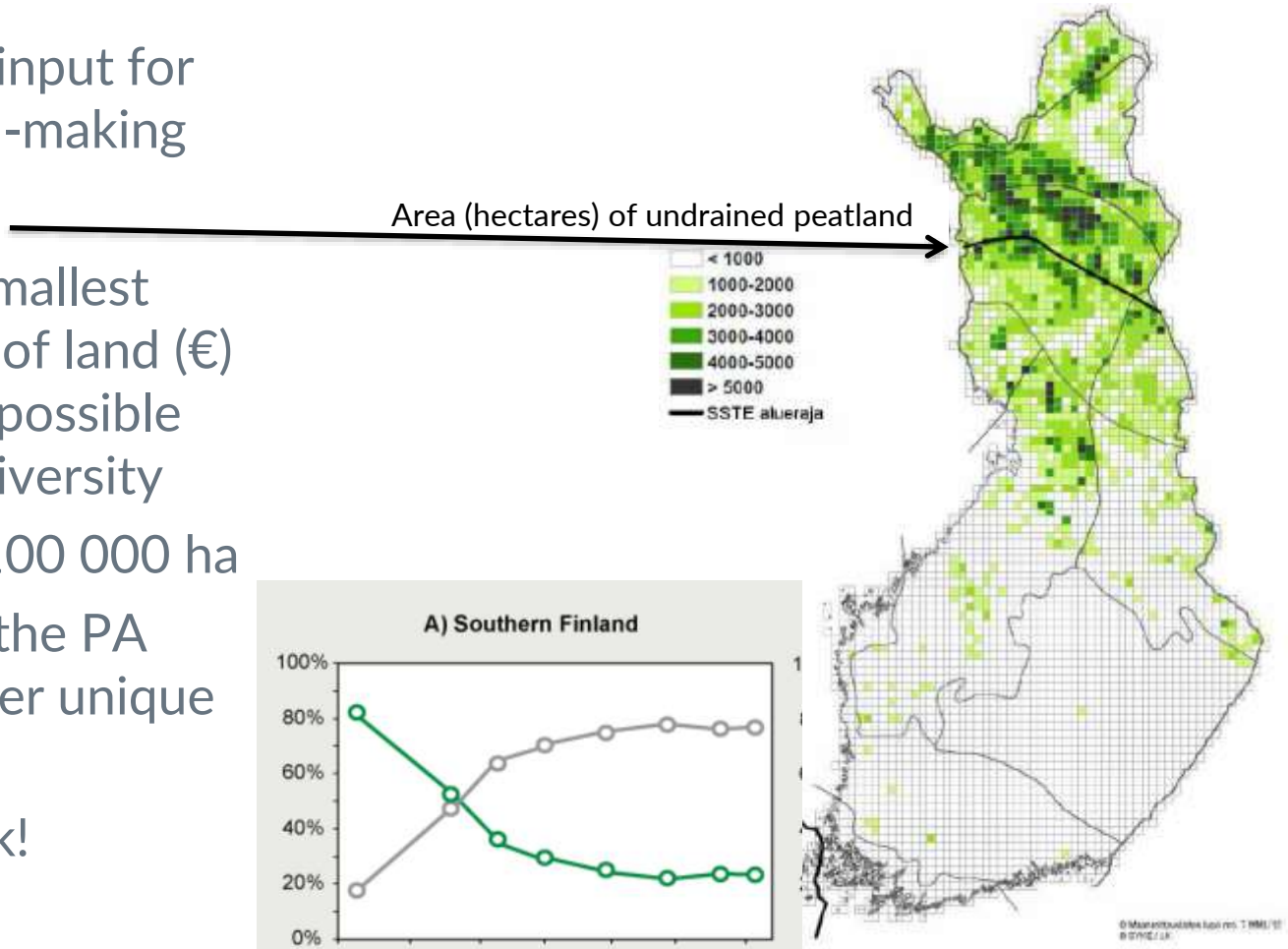
ZONATION
Conservation planning software

Zonation – what is it for?

1	Identifying ecologically most valuable areas	2	Identifying ecologically least valuable areas
3	Assessing existing nature conservation network	4	Expanding (developing) nature conservation network

Mire conservation complementary program (MCCP) –
Which mires would be the most effective addition to our recent network?

- Zonation as one input for the final decision-making
- Almost national
- Effective = the smallest possible amount of land (€) with the biggest possible addition for biodiversity
- Target: approx. 100 000 ha
- Best addition to the PA network and super unique spots
- Lots of field work!
- Tight schedule
- Experts available



MCCP process

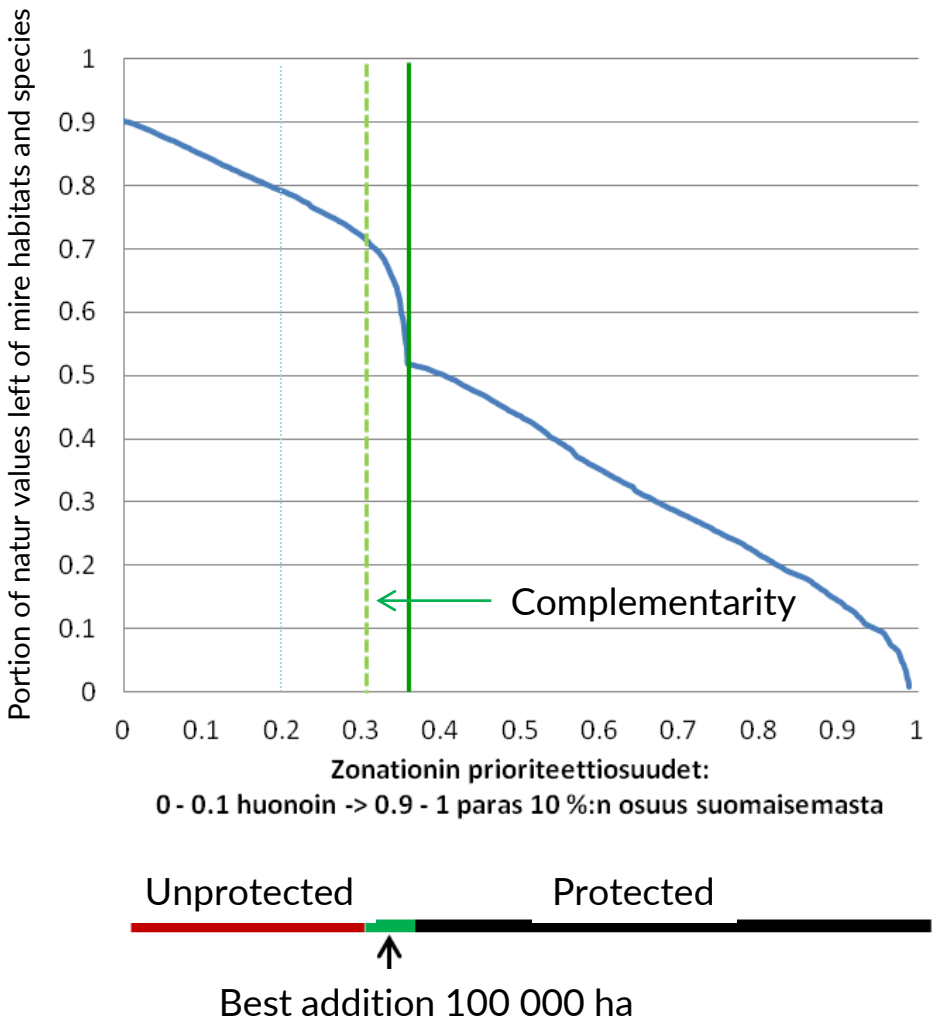
Political will

Project group with participants from different interest groups making decisions about the ecological model

Money for field work!

MCCP results

- 5% addition to area, 20% addition to conservation values of PAs
- Programme cancelled due to political fuss
  - Changed to voluntary



Kareksela et al. 2019. Combining spatial prioritization and expert knowledge facilitates effectiveness of large-scale mire protection process in Finland. *Biological Conservation.* 10.1016/j.biocon.2019.108324

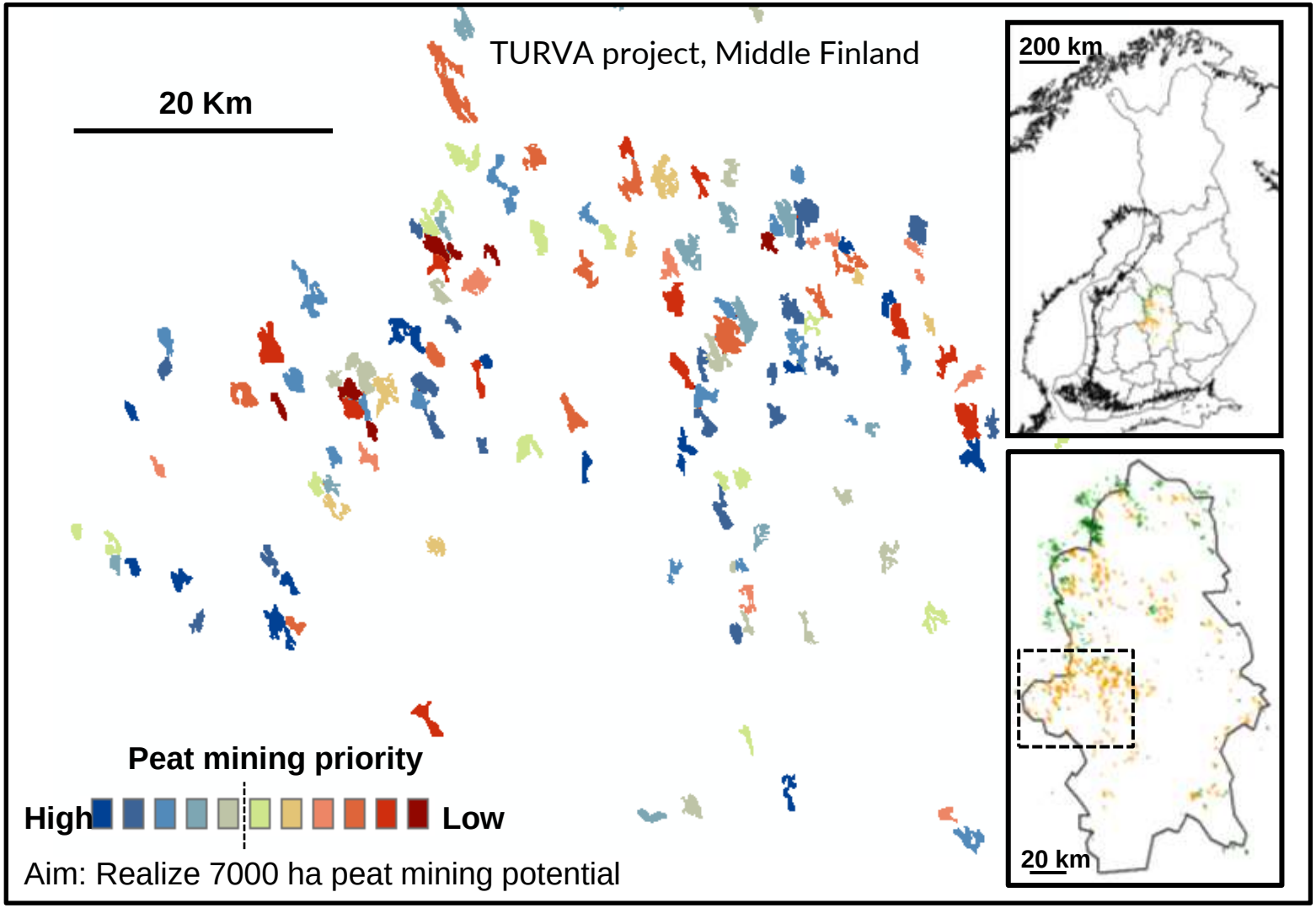
ZONATION
Conservation planning software

Zonation – what is it for?

1 Identifying ecologically most valuable areas

2 Identifying ecologically least valuable areas

7000 ha peatland for mining – Which should be saved?



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Climate change & + biodiversity crisis mitigation

- Where are forest areas important for forest biodiversity, carbon sequestration and storages, or both?
- IBC-Carbon = Integrated Biodiversity Conservation and Carbon Sequestration in the Changing Environment

strategicRESEARCH

CARBON STORAGES

CARBON SEQUESTRATION

CO_2

VALUE
HIGH
LOW

OLD GROWTH FORESTS

INDICATOR SPECIES

THREATENED SPECIES

Conservation areas

DEAD WOOD POTENTIAL

FORESTRY

EFFECT OF ACTIVITY
No management
Strong management

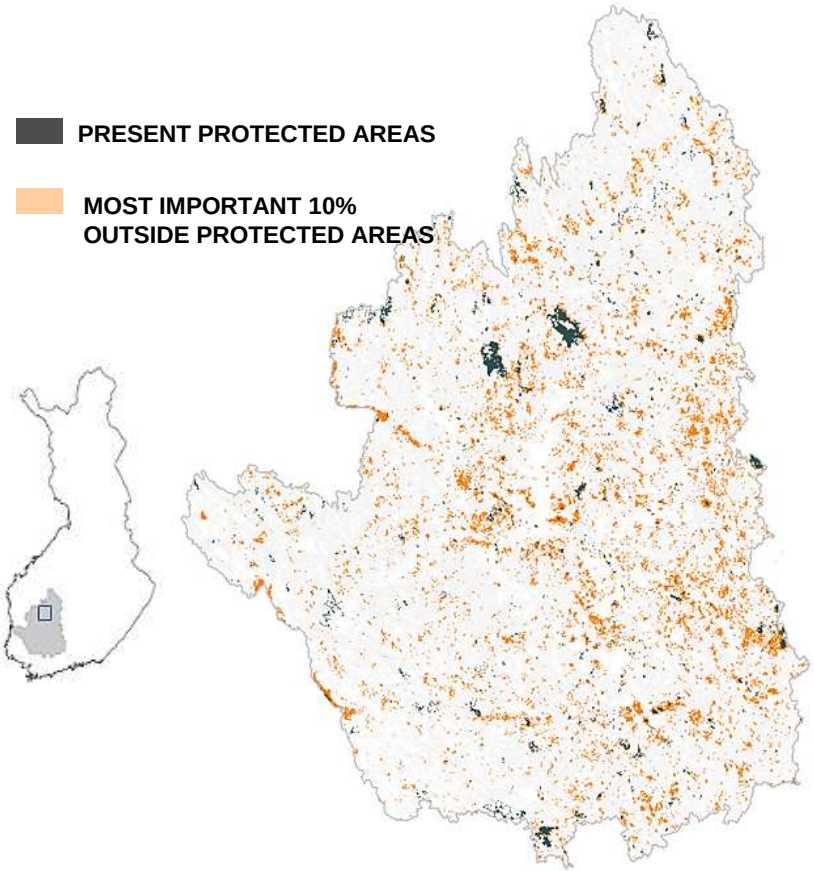
ZONATION
Conservation planning software

integration

PRIORITY MAP OF FORESTS

VALUE
high
low

AREAS IMPORTANT FOR BOTH, BIODIVERSITY AND CARBON, IN KOKEMÄKIJOKI REGION



RESULTS

- BD and carbon co-exists, especially as storages in old forests
- Protecting biodiveristy also mitigates climate change but not vice versa

IBC-CARBON

Developing a spatially explicit modelling and evaluation framework for integrated carbon sequestration and biodiversity conservation: Application in southern Finland. Forsius et al. 2021.
https://doi.org/10.1016/j.scitotenv.2021.145847

Have a nice studying!

- Study and digest information now– now is time to build your ”knowledge-base”
- Identify your own interest –inner motivation will take you futher than pressures from outside
- Study interdisicplinary or various sides of your field of science – there’s no one sided truth anymore
- Get experienced: intern periods, summer jobs, exchange studying

Thank you!

Questions?

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Forest Biodiversity Conservation Programme METSO:
metsonpolku.fi/en

Zonation software: www.syke.fi/zonation/en

More information

- Zonation in general: www.syke.fi/zonation/en
- Zonation supporting Forest conservation: https://www.syke.fi/en-US/Research__Development/Nature/Specialist_work/METSO_Programme/Zonation_supporting_METSO
- Project: https://www.syke.fi/en-US/Research__Development/Research_and_development_projects/Projects/Decision_support_for_ecologically_based_planning__MetZo_III