ELITE - A strategic framework and operational model to set priorities for ecosystem restoration in Finland

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METSÄHALLITUS

Restoration prioritisation committee of Finland

Working period February 2014 – May 2015

Governmental organisations,
Research organisations,
NGOs

c.a. 70 members in total

Juha Siekkinen

Restoration prioritisation committee of Finland

Steering group
and WGs:

1. Peatland
2. Forest
3. Grassland, cropland, urban
4. Alpine
5. Dyne and coastal
6. Rocky

Marine and freshwater habitats are prioritised through MSD and WFD implementation.

Restoration prioritisation in Finland

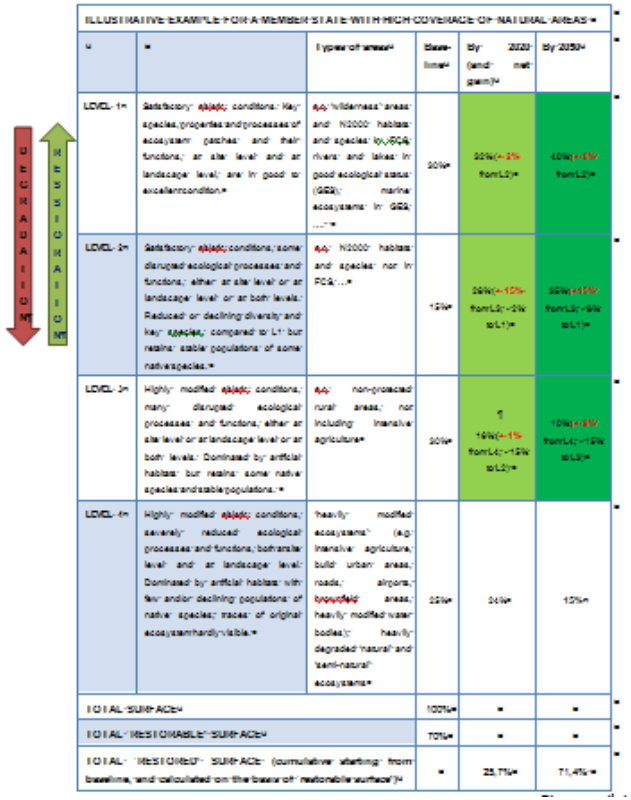
A target is to offer scientifically valid restoration prioritisation framework and operational model for decision makers:

-prioritisation between restoration measures

-prioritisation between focal ecosystems

Challenges in the 4-level model developed by Arcadis

- it does not properly take into account the magnitude of ecosystem degradation or improvement due to restoration
- treshold values between the levels
- it does not prioritise between restoration measures or between ecosystems



ILLUSTRATIVE EXAMPLE FOR A MEMBER STATE WITH HIGH COVERAGE OF NATURAL AREAS

		Types of areas	Base-line	By 2020 (and: mat-gem)	By 2050
LEVEL 1	Satisfactory ecological conditions. Key species, properties and processes of ecosystem (patches and their functions) at site level and at landscape level are in good to excellent condition.	e.g. 'wilderness' areas and N2000 habitats and species in GES rivers and lakes in good ecological status (GES); marine ecosystems in GES; ...'	30%	32% (+2% from L2)	40% (+8% from L2)
LEVEL 2	Satisfactory ecological conditions, some disrupted ecological processes and functions, either at site level or at landscape level or at both levels. Reduced or declining diversity and key species, compared to L1 but realms stable populations of some native species.	e.g. N2000 habitats and species not in PCA; ...	12%	28% (+12% from L3; -2% to L1)	32% (+12% from L3; -8% to L1)
LEVEL 3	Highly modified ecological conditions, many disrupted ecological processes and functions, either at site level or at landscape level or at both levels. Dominated by artificial habitats but realms some native species and stable populations.	e.g. non-protected rural areas, not including intensive agriculture	30%	↑ 16% (+1% from L4; -12% to L2)	16% (+8% from L4; -12% to L3)
LEVEL 4	Highly modified ecological conditions, severely reduced ecological processes and functions, both at site level and at landscape level. Dominated by artificial habitats with few and/or declining populations of native species, traces of original ecosystem hardly viable.	'heavily modified ecosystems' (e.g. intensive agriculture, build urban areas, roads, airports, [illegible] areas, heavily modified water bodies); heavily degraded 'natural' and 'semi-natural' ecosystems	28%	24%	12%
TOTAL 'SURFACE'			100%		
TOTAL 'RESTORABLE' SURFACE			70%		
TOTAL 'RESTORED' SURFACE (cumulative starting from baseline, and calculated on the basis of 'restorable surface')				25,7%	71,4%

Challenges in operational ELITE model

- requires also a lot of data and a work
- needs also expert opinions

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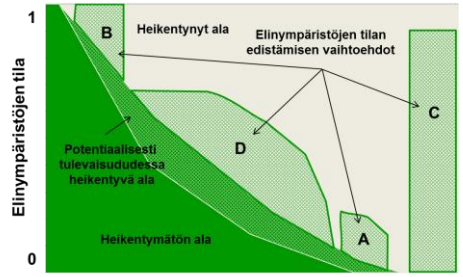
On the ground operational implementation of the ELITE – model

- Heuristic illustration of the framework



Pinta-ala kohteen heikennyksen mukaan kasvavassa järjestyksessä

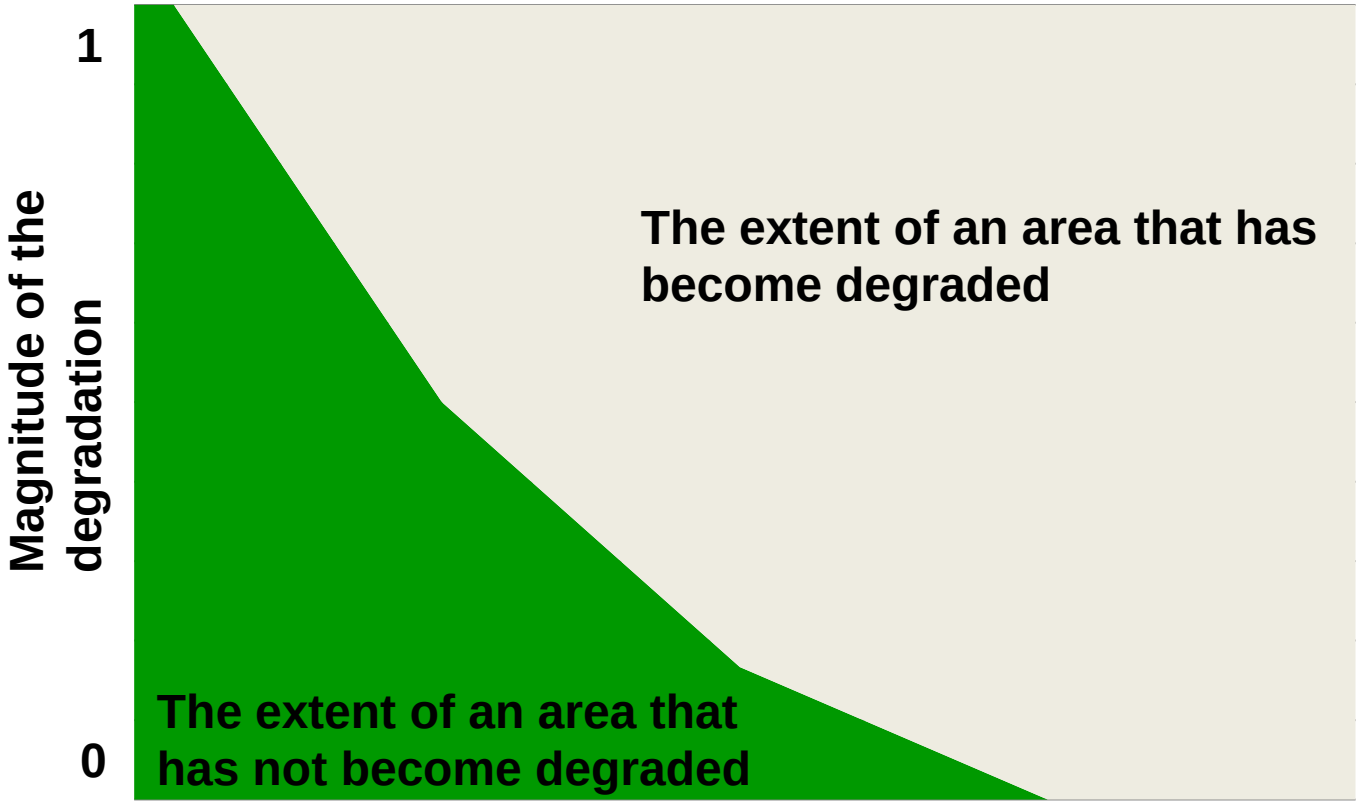
- Idea is dressed to formal mathematical models

- Formal model is produced as an operational tool in excel template

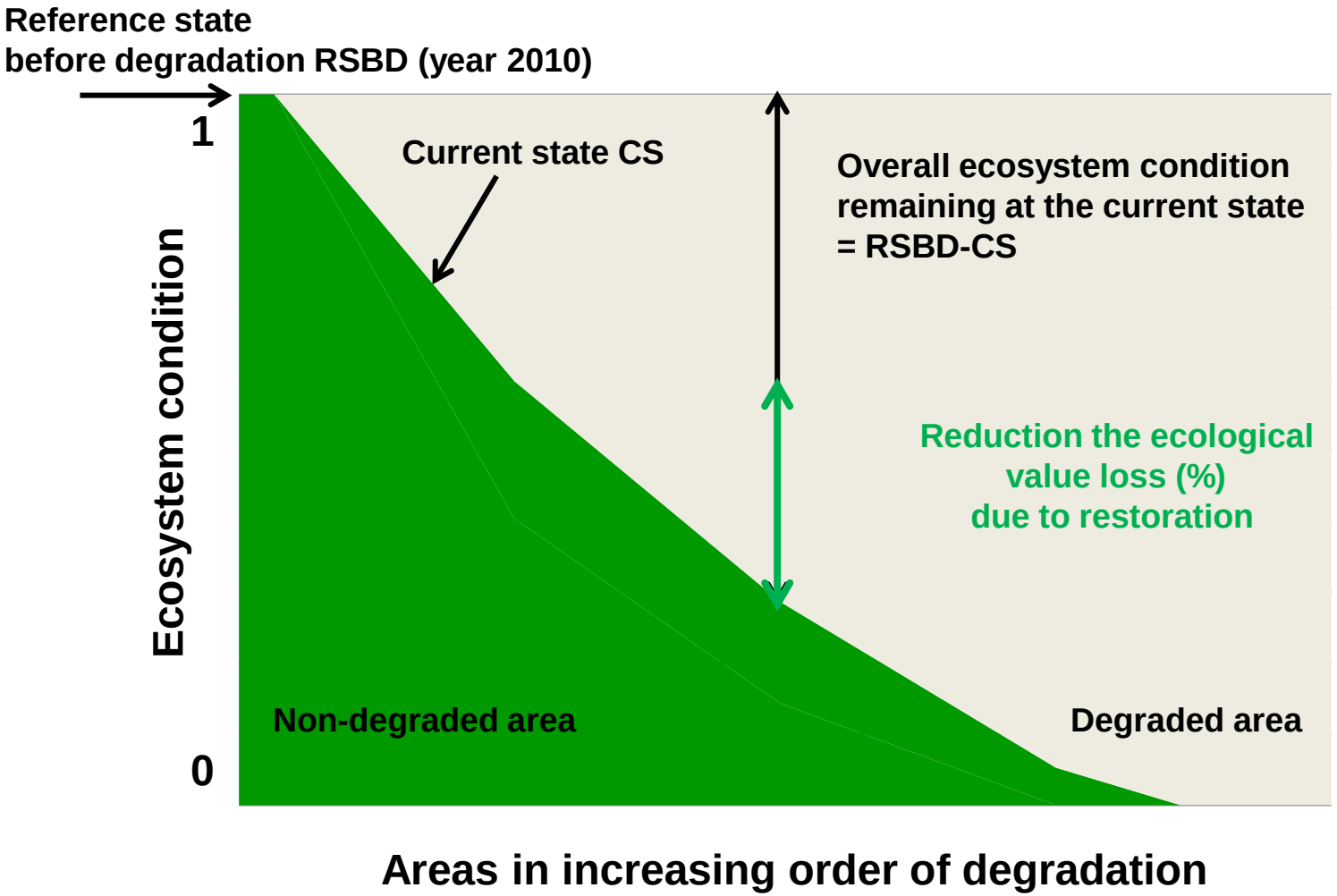
Focal ecosystem subcategory 1:	Fens degraded due to watershed drainage, fen itself not drained			
		Influence on ecosystem service 1	Influence on ecosystem service 2	Influence on employment
Name of the restoration measure	Cost efficiency %/€	Name of the ecosystem service	Name of the ecosystem service	
Establishment of conservation area	-0,01433	+ / - / 0 / ?	+ / - / 0 / ?	+ / - / 0 / ?
Establish conservation area and remove tree stand	0,00791	+ / - / 0 / ?	+ / - / 0 / ?	+ / - / 0 / ?
Redirection of waterflow	14,50499	+ / - / 0 / ?	+ / - / 0 / ?	+ / - / 0 / ?

	Deside area (ha) to be allocated to each restoration measure	Cost (million euro)	Reduction (%) in ecological value loss at the focal ecosystem
Name of the restoration measure			
Establishment of conservation area	1000	1,80	-0,05
Establish conservation area and remove tree stand	2000	3,60	0,06
Redirection of waterflow	120000	0,60	18,36
	123000	6,00	18,37

First, we need to realize that from an ecological perspective, ecosystem degradation has a minimum of two dimensions



What do we have to know that we could identify 15% target in practise?



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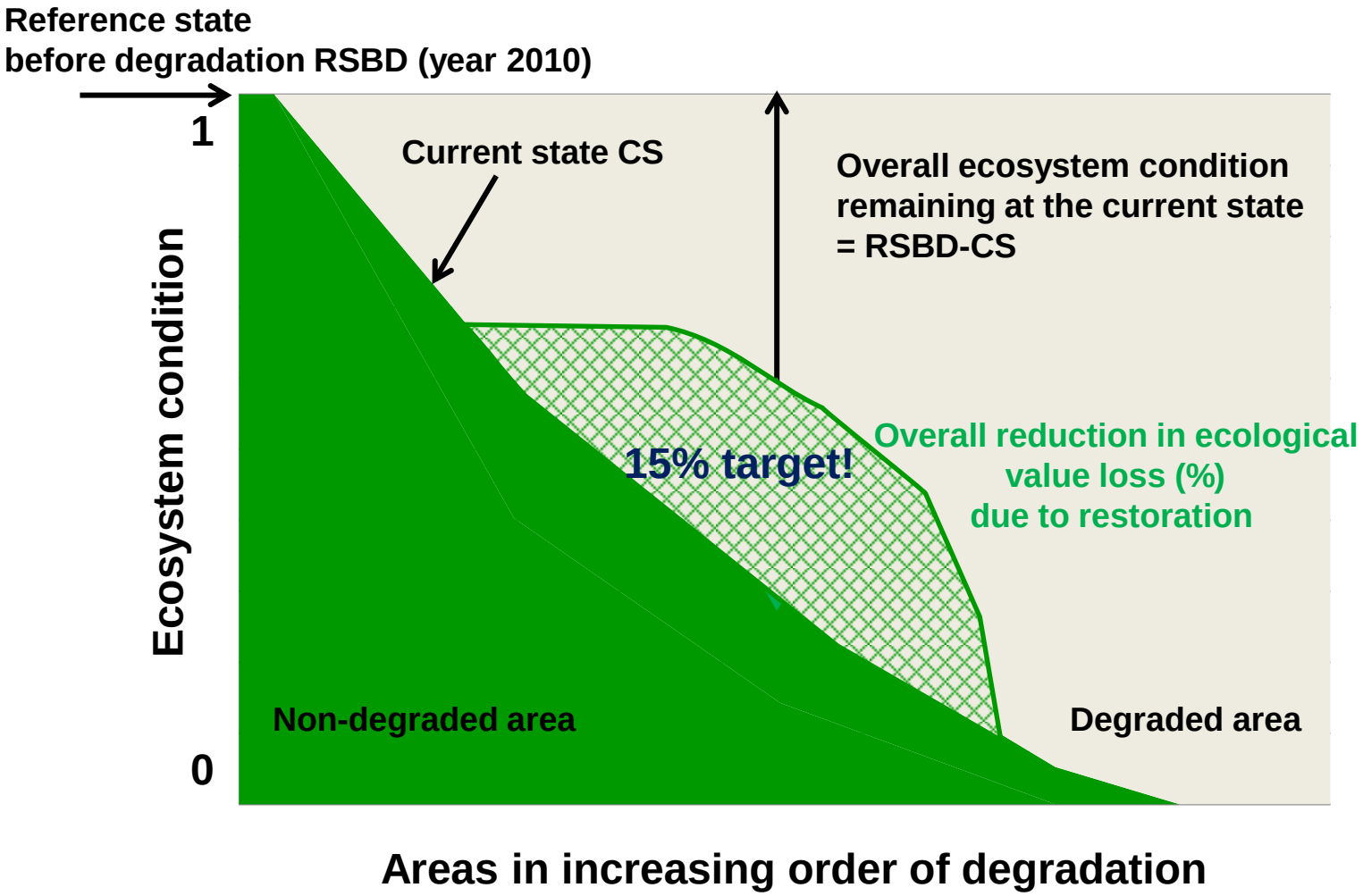
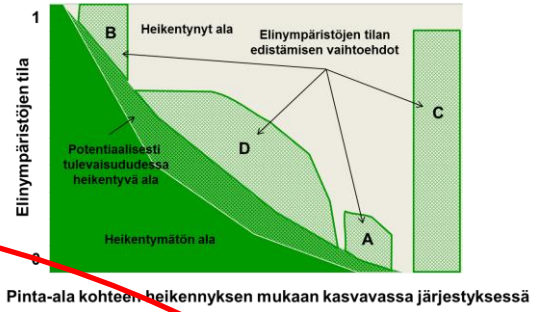


On the ground operational implementation of the ELITE – model

- Heuristic illustration of the framework



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Step 1: Decide focal ecosystem categories

- We need to work one ecosystem at the time:
  - fen ecosystems are use as an example in this presentation
  - fens are a naturally open peatland type

Focal ecosystem category	Fens
Total area of the ecosystem type	2 150 000
Undegraded area of the ecosystem type	940 000

Focal ecosystems can be divided further to sub-categories

Step 2: Determine degraded components

- Consider degradation from the perspective of at least:
  - Biodiversity
  - Ecosystem services
    - Carbon balance
    - Climate change and adaptation to it
- We need a set of components that have degraded

Focal ecosystem subcategory 1:	**Fens degraded due to watershed drainage, fen itself not drained**			
Area (ha) of subcategory:	429 000			
		Component name		Brief explanation of the degradation
Degraded component 1		Hydrology		Hydrology has degraded due to watershed drainage, fen itself not drained
Degraded component 2		Tree stand		Tree stand has degraded the fen due to watershed drainage, fen itself not drained

Step 3: Determine current state and before degradation reference state

- We need two values (based on data, estimate, or expert opinion)
  - Before degradation reference state
  - Current state (starting point 2010)

Fens degraded due to watershed drainage, fen itself not drained					
Component name:		Reference state before degradation		Current state:	
Hydrology		100		60	
Tree stand		0		10	

Step 4: Determine the loss of ecological value related to each degraded component

- **Expert opinion** of the fraction of total ecosystem values lost at fens due to complete degradation:

Fens degraded due to watershed drainage, fen itself not drained	
Component name:	Proportion of condition loss:
Hydrology	0,95
Tree stand	0,2

Step 5: Determine overall loss of ecological value at the current state

$$R^H = \prod_{n=1}^{N^H} \left(1 - L_n^H (1 - n_{curr}/n_{ref})\right)$$

R^H, is ecological value remaining in the ecosystem
N^H is the number of relevant components in the focal ecosystem,
L_n^H is the loss of ecological value if component completely degraded
n_{curr} and n_{ref} are the state of component n in the current state and in the reference state, respectively

= empirical measure of the overall ecosystem degradation that is based on only three ±easily decided values for each degraded component

Focal ecosystem subcategory 1:	**Fens degraded due to watershed drainage, fen itself not drained**	
Component name:	Ecological value remaining:	Ecological value loss:
Hydrology	0,620	0,380
Tree stand	0,967	0,033
Overall	0,599	0,401

Step 6: Determine potential restoration measures and their costs

Focal ecosystem subcategory 1:	Fens degraded due to watershed drainage, fen itself not drained

Name of the restoration measure:		Cost (€) of the restoration measure per hectare
Establish conservation area		1800
Establish conservation area and remove tree stand		1800
Redirection of waterflow		5

Step 7: Determine ecological value gain related to each restoration measure

Focal ecosystem subcategory 1:	**Fens degraded due to watershed drainage, fen itself not drained**	
Name of the restoration measure:	Degraded component name:	Ecological value gain of each degraded component per ha	overall reduction in ecological value loss (%) due to restoration
Establish conservation area	Hydrology	0	-25,7903
	Tree stand	-50	
Establish conservation area and remove tree stand	Hydrology	5	14,2367
	Tree stand	5	
Redirection of waterflow	Hydrology	30	72,5250
	Tree stand	5	

Step 8: Cost-effectiveness of restoration measures

- Cost-effectiveness = Benefits/Costs

Name of the restoration measure		Cost efficiency %/€
Establishment of conservation area		-0,01433
Establish conservation area and remove tree stand		0,00791
Redirection of waterflow		14,50499

Select the best measures to a ”restoration measure portfolio” using cost efficiency and ecosystem services

Restoration prioritisation in Finland

A target is to offer scientifically valid restoration prioritisation framework and operational model for decision makers:

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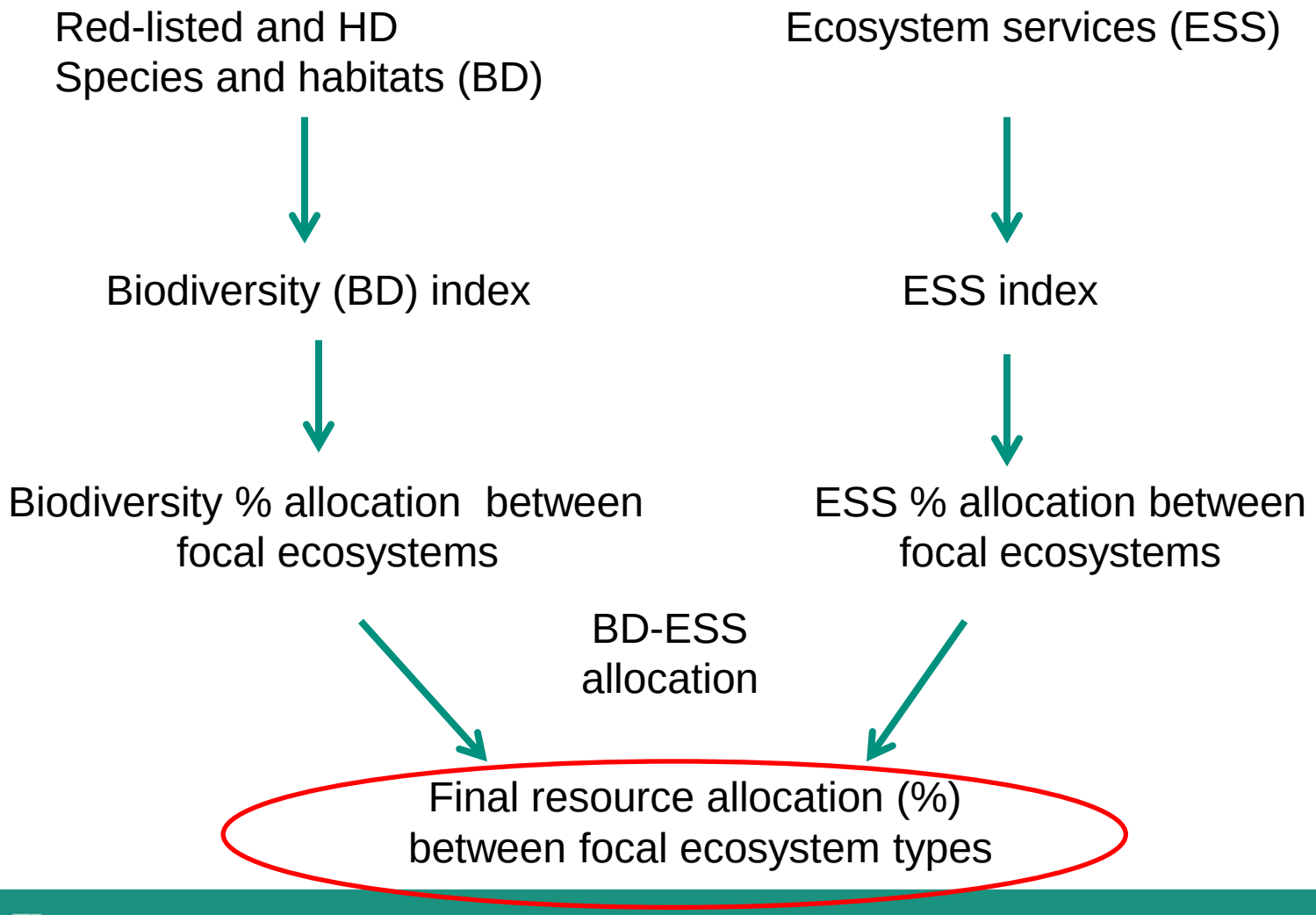
-prioritisation between focal ecosystems

Prioritisation between focal ecosystems



RESULT: Operational framework to set priorities for ecosystem restoration in Finland.

Focal ecosystem	Resource allalocation between ecosystems, %	Resource allalocation between restoration measures within focal ecosystem, %
Peatland	20 %	measure 70%, measure 20%, measure 10%
Forest	40 %	measure 70%, measure 20%, measure 10%
Cropland	5 %	measure 100%
Grassland	10 %	measure 60%, measure 30%, measure 10%
Urban	5 %	measure 90%, measure 10%
Alpine	5 %	measure 70%, measure 20%, measure 10%
Dyne and coastal	10 %	measure 60%, measure 40%
Rocky	5 %	measure 90%, measure 10%
TOTAL	**100 %**	

Note that all numbers are fictious

RESULT: Operational framework to set priorities for ecosystem restoration in Finland

Focal ecosystem	Political decision, million € by 2020
Peatland	200 m€
Forest	400 m€
Cropland	50 m€
Grassland	100 m€
Urban	50 m€
Alpine	50 m€
Dyne and coastal	100 m€
Rocky	50 m€
TOTAL	**1 000 m€**

Note that all numbers are just fictious

RESULT: Operational framework to set priorities for ecosystem restoration in Finland

Focal ecosystem	Political decision, million € by 2020	Restoration measure portfolio per each focal ecosystem, ha	Reduction in ecological value loss at the focal ecosystem, %	Effects on ecosystem services and employment, description
Peatland	200 m€	measure 100 000 ha, measure 20 000 ha,	0,03 %	Effect positively to the following ESS…and negative
Forest	400 m€	measure 500 000 ha, measure 400 000 ha,	0,05 %	Effect positively to the following ESS…and negative
Cropland	50 m€	measure 300 000 ha	0,0075%	Effect positively to the following ESS…and negative
Grassland	100 m€	measure 50 000 ha, measure 10 000 ha…	0,015 %	Effect positively to the following ESS…and negative
Urban	50 m€	measure 20 000 ha, measure 10 000 ha…	0,01 %	Effect positively to the following ESS…and negative
Alpine	50 m€	measure 45 000 ha, measure 15 000 ha	0,01 %	Effect positively to the following ESS…and negative
Dyne and coastal	100 m€	measure 5 000ha, measure 2 000 ha…	0,02 %	Effect positively to the following ESS…and negative
Rocky	50 m€	measure 1 000ha, measure 1 000 ha	0,01 %	Effect positively to the following ESS…and negative
TOTAL	**1 000 m€**		**0,15 %**	Effect positively to the following ESS…and negative

Note that all numbers are just fictious

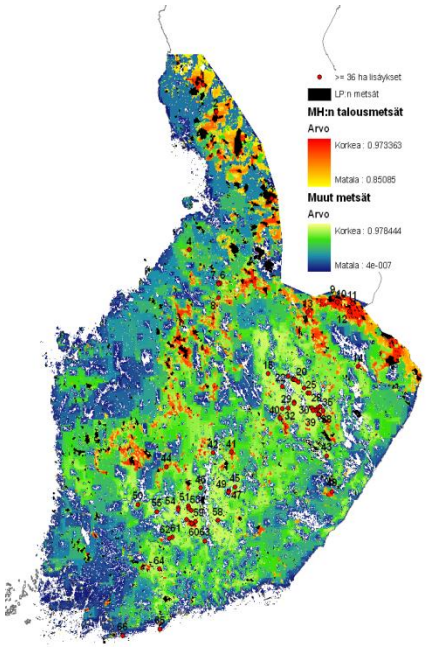
Future

- Monitoring is based on restored hectares / restoration measure / focal ecosystem

⟶ ELITE-model gives reduction of ecological value loss %

- How to target restoration at national / local level?

ZONATION
Conservation planning software



Nature is our **National Heritage** and its value is relative to the value of biodiversity