



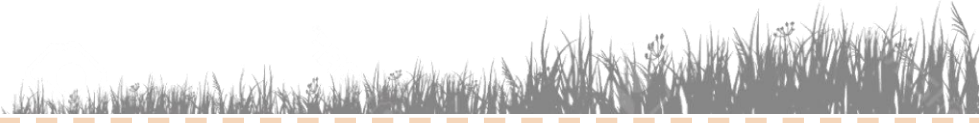
ESS analysis and Green Network by the example of the VivaGrass Project

Kalev Sepp, Miguel Villoslada

Estonian University of Life Sciences

DaRe to Connect Scientific Conference, m Online-Meeting on 15th April 2021

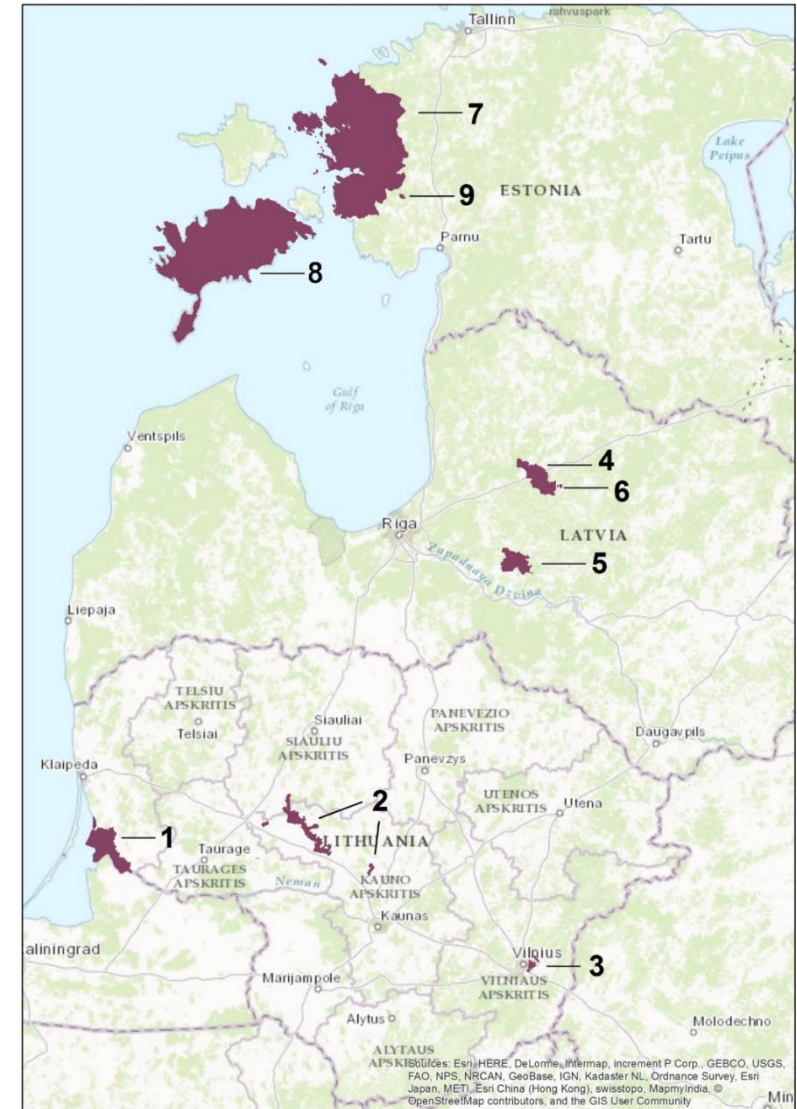
Project actions



- › Grassland ecosystem service assessment at the selected case study areas;
- › Development of the Tool by addressing socio-economic matter in nature conservation policies, enhancing the designated Green Network;
- › Analysis of the national policies and regulatory framework in the Baltic States;
- › Development of pilot scenarios for long-term grassland management;
- › Capacity building on applying the Tool for the relevant target groups and operating the Tool at national, regional, municipal, protected areas and farm level.

Challenges of mapping ecosystems and their services

- › Transboundary nature of the project: 9 demo areas in 3 Baltic States
- › Data availability, differences in thematic scales

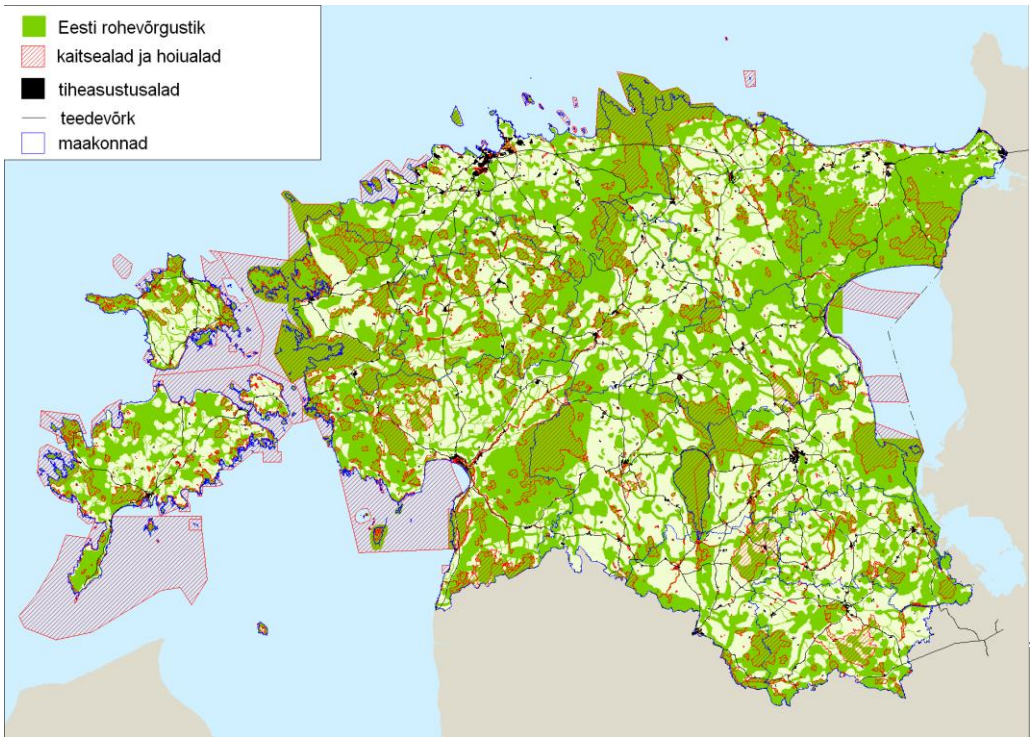


- The Governmental decree for second phase of county planning (1999-2004)
“Defining environmental conditions for the development of land-use and settlement structure”
 - Green Network
 - Valuable cultural and historical landscapes
- Responsible unit was: Department of Strategy and Planning, MoE, now MoFinance;
- We have a detailed methodology for defining green network at county level (Jagomägi, Sepp 2002).

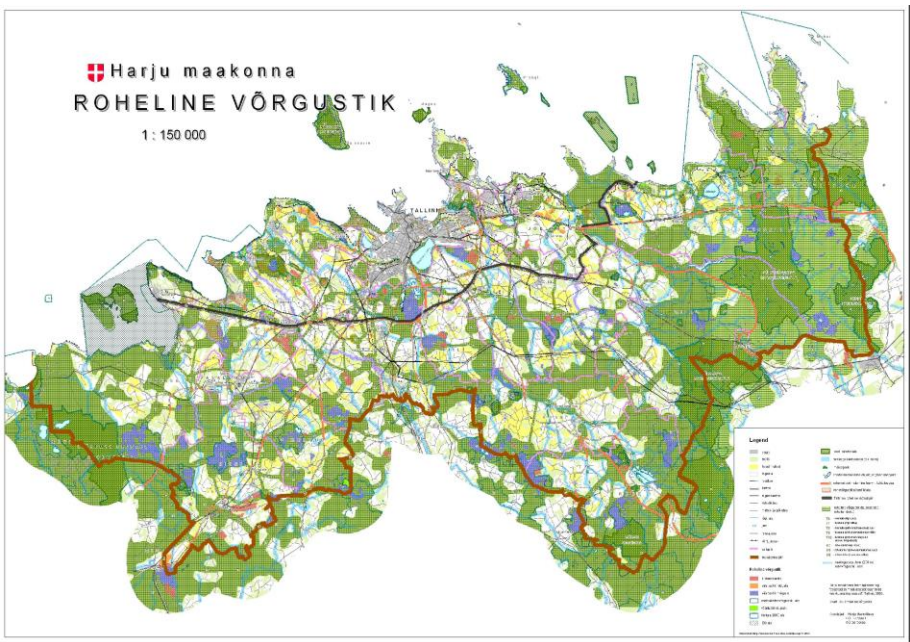
Criteria for designation structural elements

- › Nature conservation and environmental protection **values**, threats, conflicts
- › **Morphometrical parameters** of the elements
 - core areas – territorial extent
 - corridors – wideness
- › Ecological, environmental, socio-economic **landscape peculiarities**
- › Distribution of **species** and their **habitats**

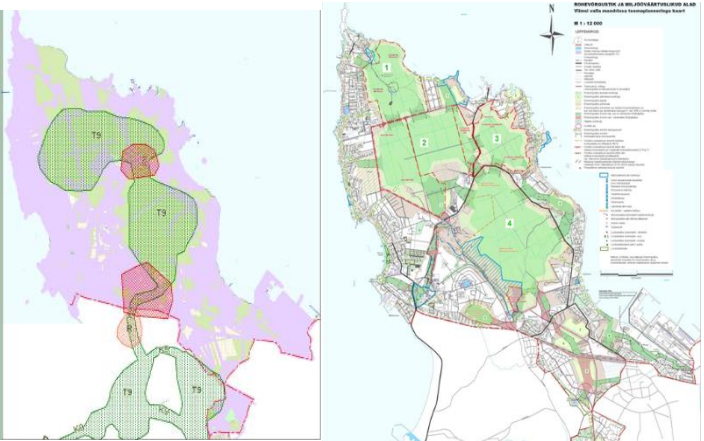
Green Network concept in Spatial Planning in Estonia



Ecological network compiled from 15 Green Network plans prepared at county level (2001-2007) and 2016-2018.



Green network plan at County level, Harju County.



Green network plan at Municipality level. Viimsi, Harju County.

Green Network in Estonian Spatial Plans

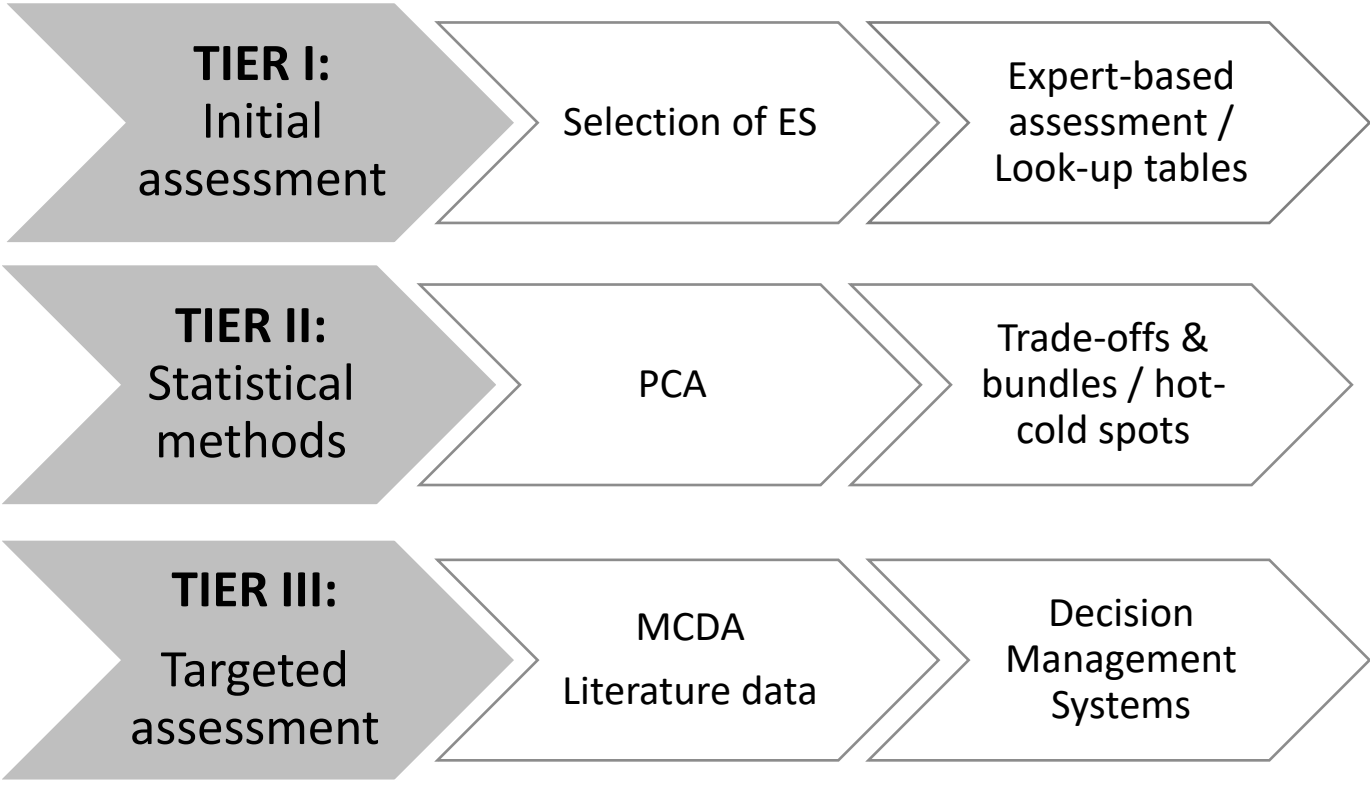
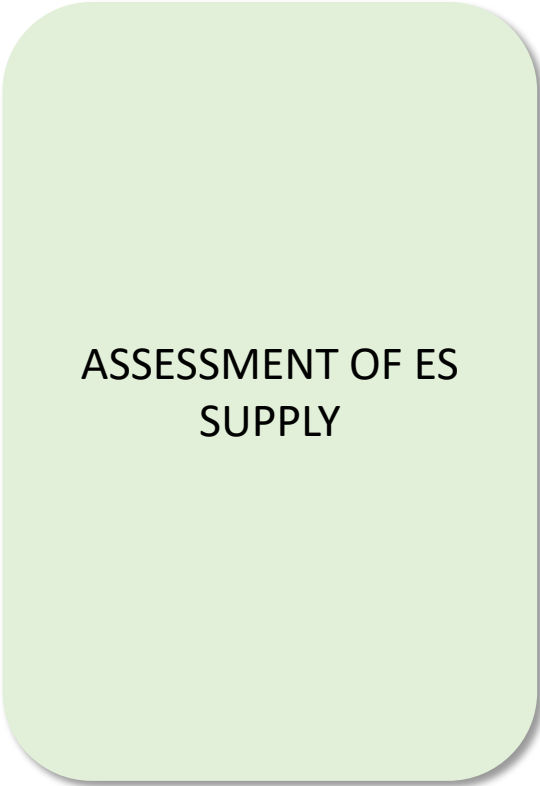
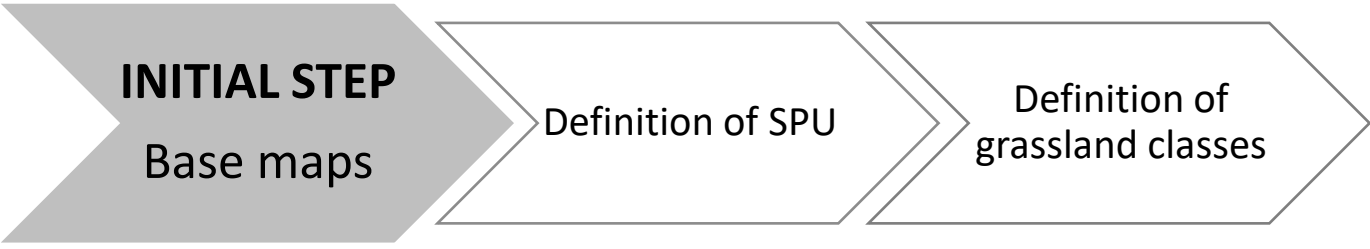
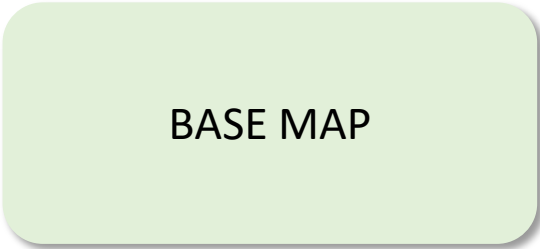
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- 2016-2018. Green Network at County level

The Viva Grass Integrated Planning Tool

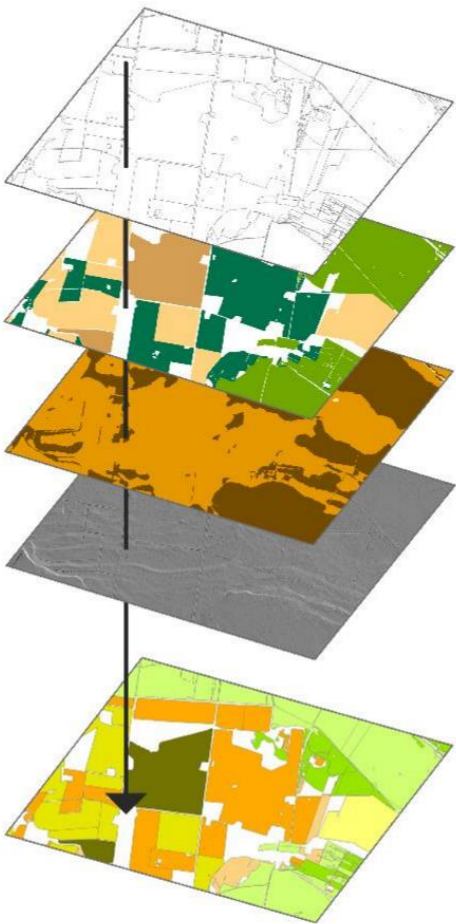


- › Spatially locate **ecosystem services** and **ES bundles** and **hotspots** provided by grasslands;
- › To **integrate** the **ecosystem services framework** into planning processes, specifically addressing grasslands in **green network**;
- › Link ES, planning processes and grassland management scenarios in the **Integrated Planning Tool**.

General scheme

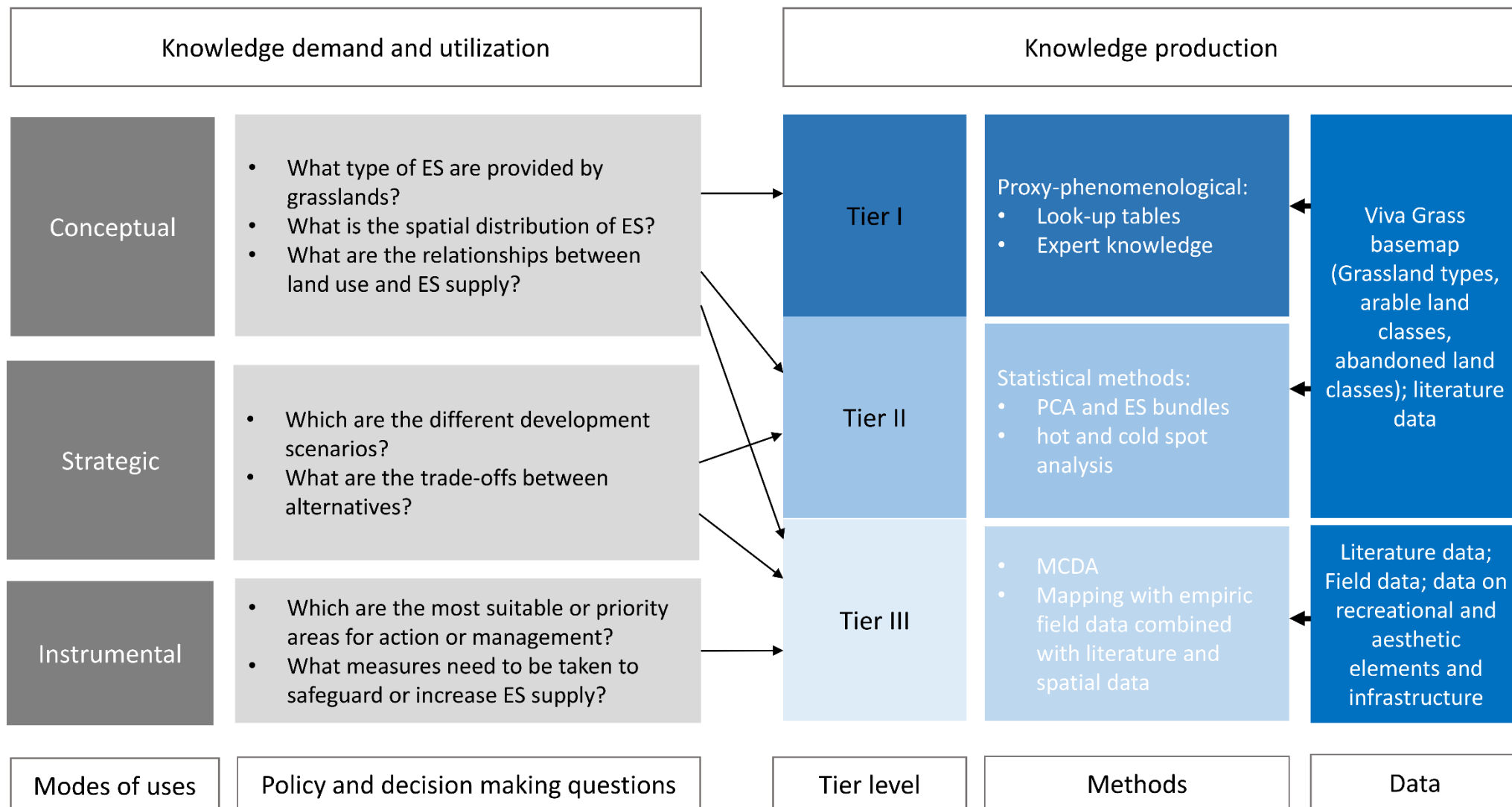


Viva Grass Base Map

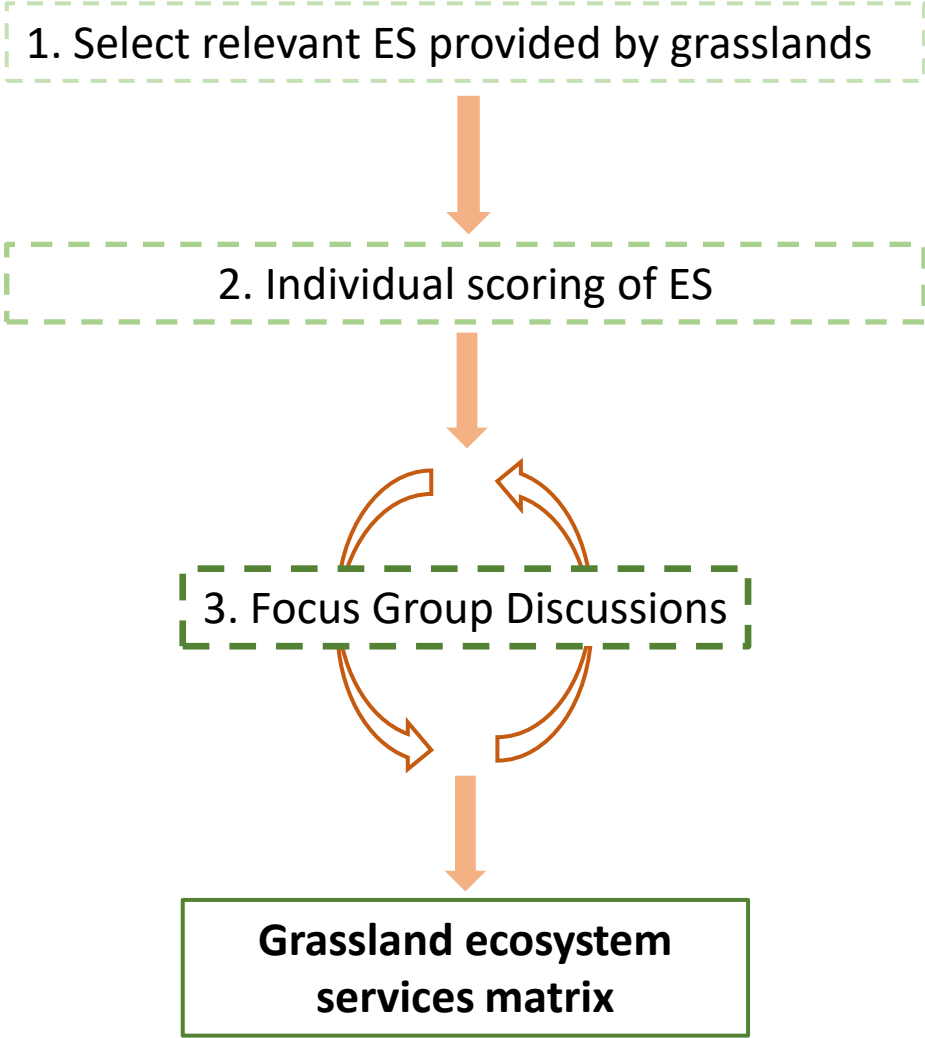


Layers	Source	
Grasslands' spatial configuration and boundaries	Land Parcel Identification System (LPIS)	Definition of SPAs
Management regime	LPIS	Definition of grassland classes
Land quality	National Soil Maps (1:10000)	
Slope	DEM (National Land Boards)	
Map algebra, GIS processing		
Viva Grass basemap	{ 30 grassland classes 10 arable land classes 10 abandoned land classes	

Tiered approach



1st Tier – Expert based assessments of ES



Grassland classes	Provisioning					Regulation & Maintenance							
	Cultivated crops	Reared animals and their outputs	Fodder	Biomass-based energy sources	Herbs for medicine	Bio-remediation by micro-organisms, plants and animals	Filtration/storage/accumulation by ecosystems	Control of (water) erosion rates	Pollination and seed dispersal	Maintaining habitats for plant and animal nursery and reproduction	Weathering processes/soil fertility	Chemical condition of freshwaters	Global climate regulation
21. Semi-natural grassland on plain relief, low soil fertility	0	1	1	1	5	4	2	0	5	5	2	3	4
22. Semi-natural grassland on plain relief, medium soil fertility	0	2	2	2	4	5	3	0	5	4	3	4	4
23. Semi-natural grassland on plain relief, high soil fertility	0	3	3	3	3	5	4	0	5	3	4	5	4
24. Semi-natural grassland on plain relief, organic soils	0	3	3	3	4	5	4	0	5	4	0	3	5
25. Semi-natural grassland on gentle slope, low soil fertility	0	1	1	1	5	4	2	4	5	5	2	3	4
26. Semi-natural grassland on gentle slope, medium soil fertility	0	2	2	2	4	5	3	4	5	4	3	4	4
27. Semi-natural grassland on gentle slope, high soil fertility	0	3	3	3	3	5	4	4	5	3	4	5	4
28. Semi-natural grassland on gentle slope, organic soils	0	3	3	3	4	5	4	0	5	4	0	3	5
29. Semi-natural grassland on steep slope, low soil fertility	0	1	1	1	5	4	2	5	5	5	2	3	4
30. Semi-natural grassland on steep slope, medium soil fertility	0	2	2	2	4	5	3	5	5	4	2	4	4

1st Tier – Expert based assessments of ES

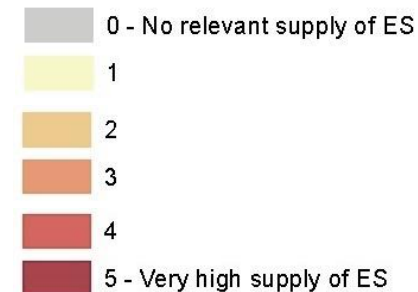
Expert based assessment:

- » 17 ES (5 prov., 8 reg., 4 cult.)
- » Qualitative assessment (5 experts per country) of the **potential supply** of ES – Spreadsheet method

Within the Tool...

- » ES consulting and summarizing capabilities
- » Estimate the supply of grassland ecosystem services in a particular plot, farm or region

ES supply capacity map



1st Tier – Expert based assessments of ES

Table 1.

ES indicators and factors determining ES potential. The list of indicators was provided in order to build a common understanding of the ES under assessment.

**in case of drained soils the value shall be lowered by 1 unit.*

Ecosystem service	Indicator	Factors determining ES potential
Provisioning services		
Cultivated crops	yield (t/ha per year)	Only arable land + soil fertility
Reared animals and their outputs	Number of Livestock Unit (LU/ha)	Land use + soil fertility
Fodder	dry weight of grass biomass	Land use + soil fertility
Biomass-based energy sources	dry weight of grass biomass	Land use + soil fertility
Herbs for medicine	Number of species and abundance	Land use + soil fertility
Regulating services		
Bio-remediation	-	Land use + soil fertility
Filtration/storage/accumulation	Soil capacity to store/accumulate nutrients (Kg ha ⁻¹) *	Land use + soil fertility
Control of (water) erosion rates	Amount of soil retained (kg/ha per year)	Land use + soil fertility + relief
Pollination and seed dispersal	Diversity and occurrence of insects- pollinators (number of species and number of individuals/ha)	Land use
Maintaining habitats	Number of species per 1 m ² (except invasive species)	Land use + soil fertility
Weathering processes/	Nutrients available for plant uptake by most important soil	Land use + soil fertility +
Ecosystem service	Indicator	Factors determining ES potential
Chemical condition of freshwaters	Absorption of nutrients	Land use + soil fertility
Global climate regulation	Carbon sequestration in vegetation and soils	Land use + soil fertility

Table 2.

List of cultural ES and their evaluation criteria.

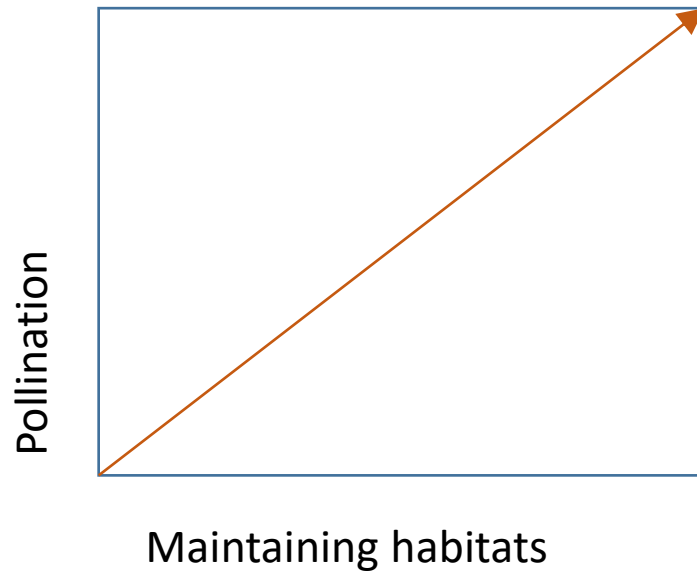
Ecosystem services	Landscape features	Buffering distance
1. Physical and experiential interactions (recreational)	Rural recreational enterprises	3 km
	Watching towers	300 m
	Tourist trails	100 m
	Area of hunting clubs	0 m
	Camping sites	300 m
	Social gathering sites	300 m
2. Educational	Educational trails	100 m
	Educational sites	100 m
3. Cultural heritage	Monuments	100 m
	Farmsteads before and in 19th century	100 m
	Traditional land use (Wooded meadow)	300 m
4. Aesthetics	Water bodies, streams	300 m
	Naturalness of surroundings	100 m
	Naturalness of grassland itself	from attributes of base map
	Linear elements	300 m / from 1:10000 map hedgerows, stone walls.
	Relief	STD of topography=10 as threshold in 5x5 km cells
	Openness	country specific density of forest in 5x5 km

2nd Tier – Synergies & tradeoffs

- ES are not provided in isolation
- ES interact with each other (interaction enhanced by management)

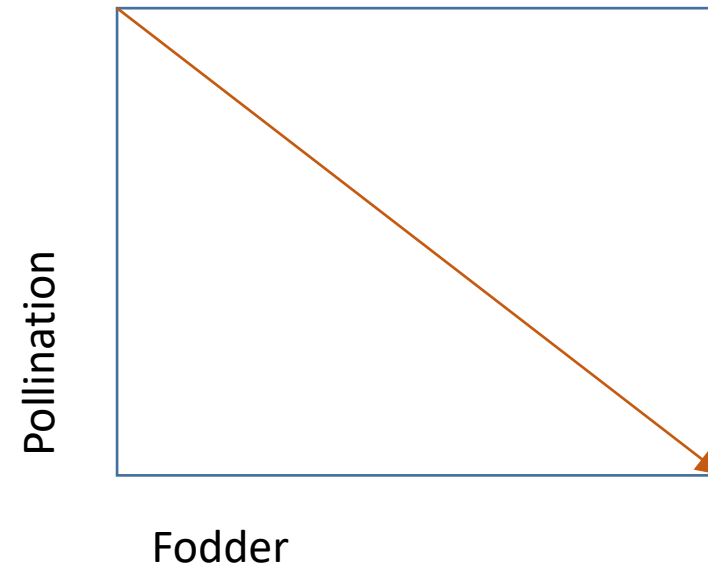
ES Synergies

“The use of one ES directly **increases** the benefits supplied by another”



ES Trade-offs

“The use of one ES directly **decreases** the benefits supplied by another”



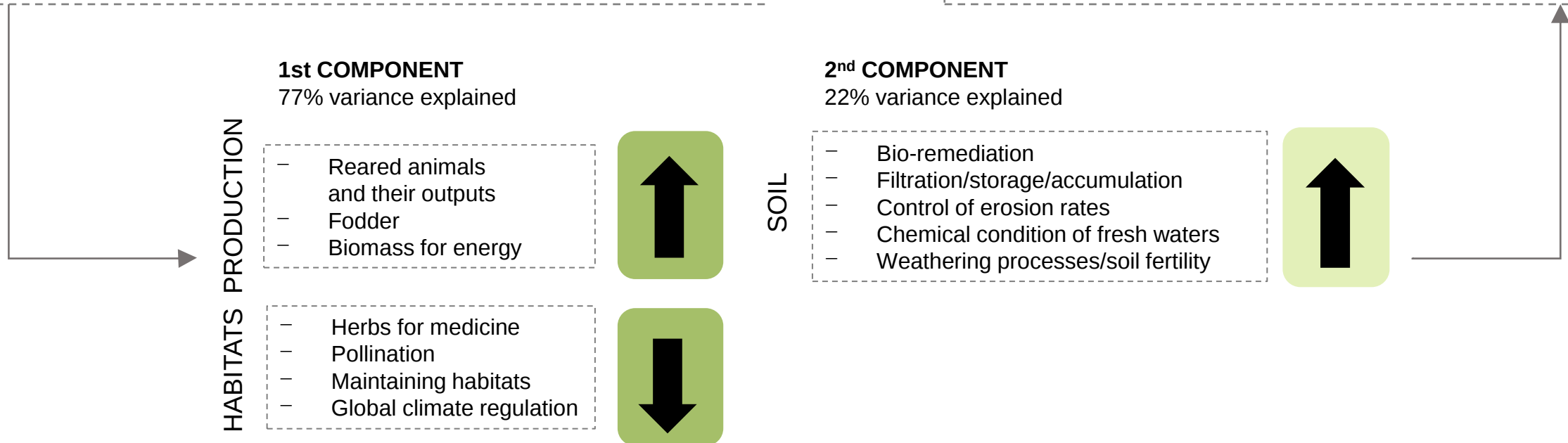
2nd Tier – Synergies & tradeoffs

Synergies & tradeoffs:

- » **Principal Components Analysis** on the basis of the experts assessment.
- » Two main components which correspond to three synergies and one trade-off.

Within the Tool...

- » **Tradeoffs & synergies** visualization capabilities



Hot/Coldspots:

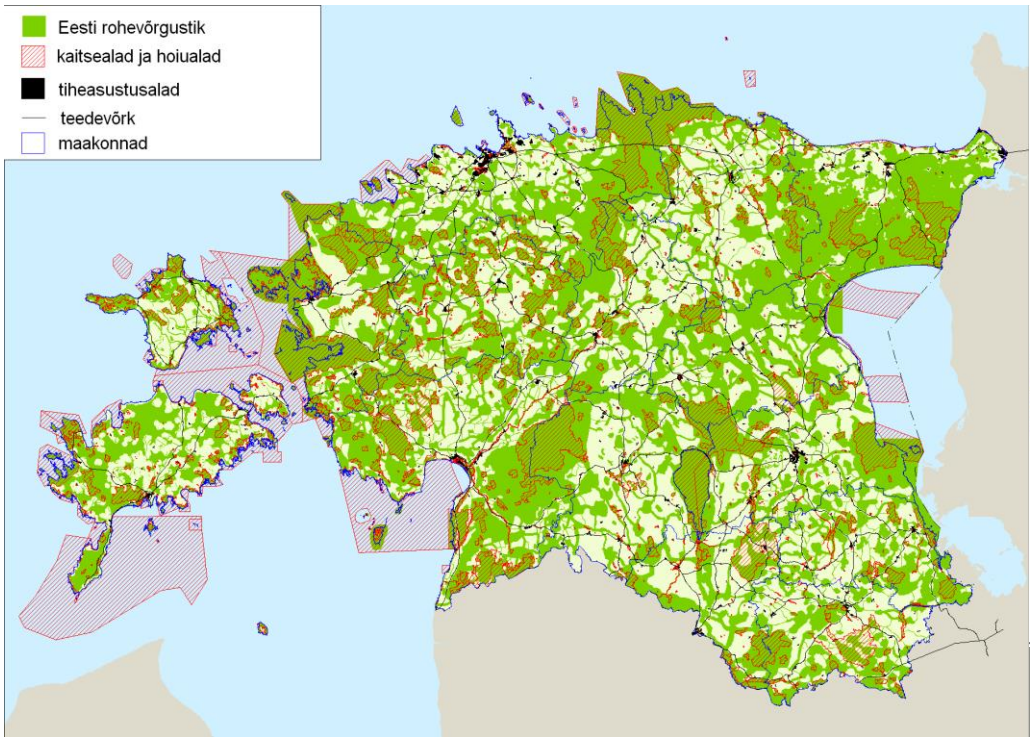
- » **Ecosystem service 'hotspot'** – territories delivering great number of ES at high value
- » **Ecosystem service 'coldspot'** – territories delivering great number of ES at low value

- ## Within the Tool...
- » **ES 'hotspot'** – indicates progress towards greater multifunctionality and sustainability
 - » **ES 'coldspot'** – indicates inclining towards monofunctionality ecosystem vulnerability

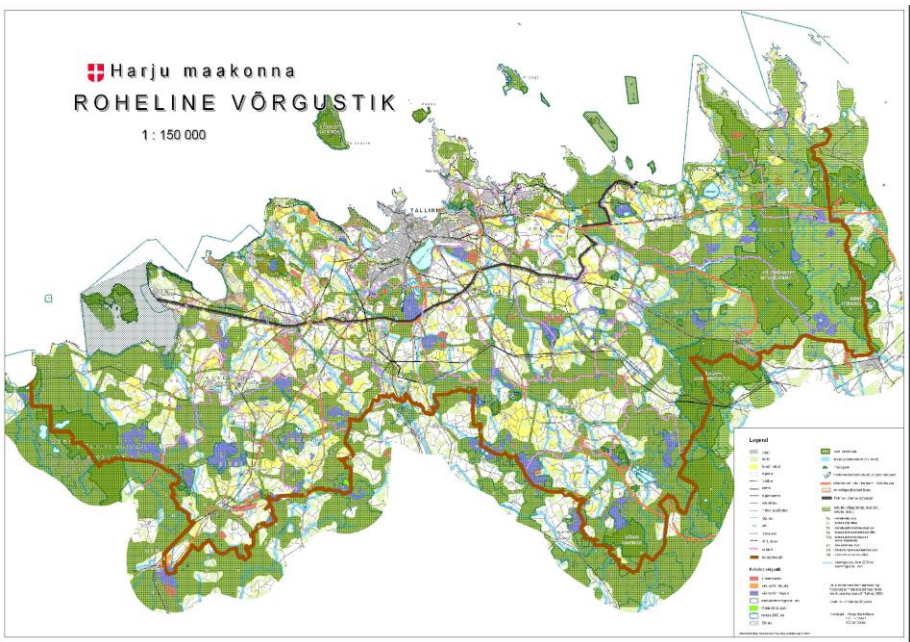
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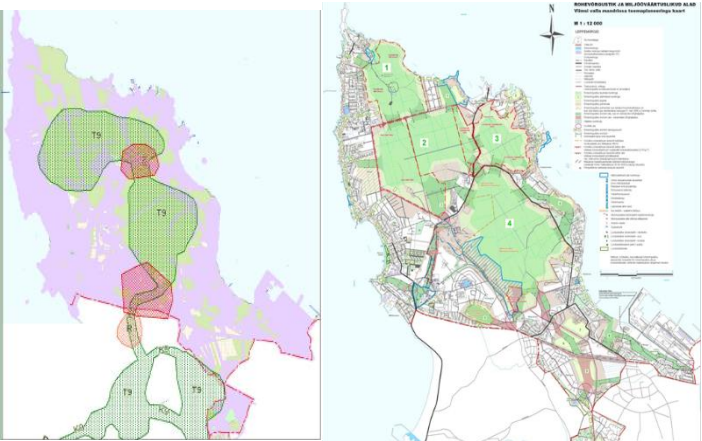
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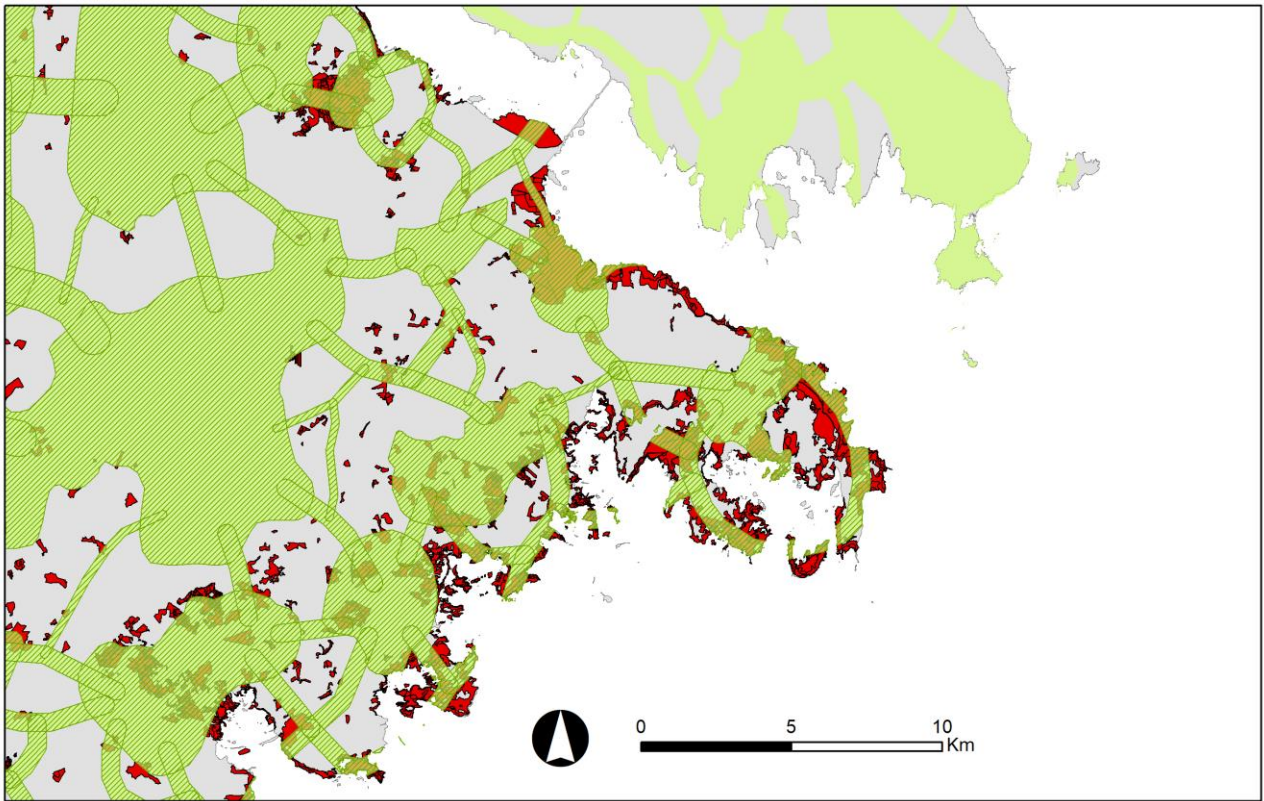
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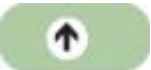
› Grasslands in the **Habitats Bundle**



Pollination and seed dispersal



Maintaining habitats



Global climate regulation



Herbs for medicine



Control of erosion rates



Chemical condition of fresh waters



Bio-remediation



Filtration/storage/accumulation



Soil fertility



Fodder



Biomass based energy sources



Reared animals and their outputs

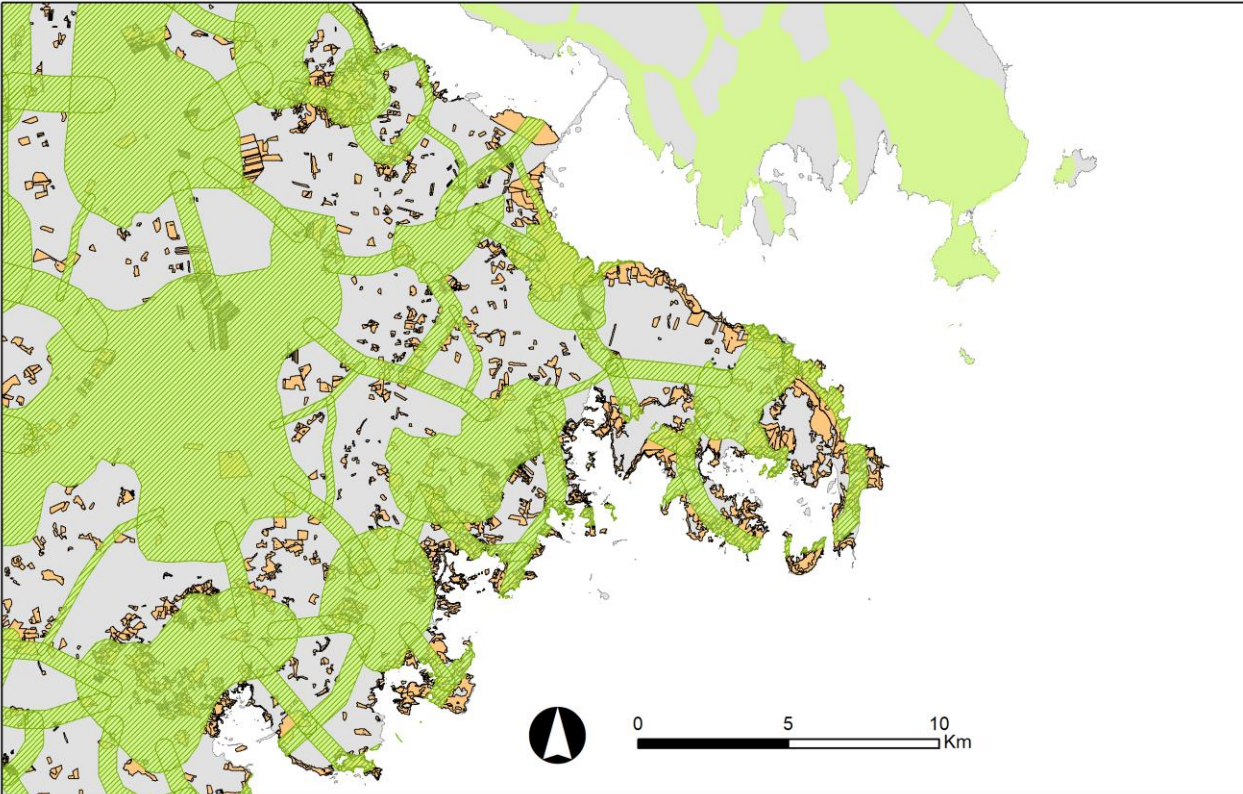


Cultivated crops



SCENARIO APPROACH – Scenario 2: Medium ecological coherence

- › Grasslands in the **Habitats Bundle**
- › Grasslands intersect **protected species areas**



Pollination and seed dispersal



Maintaining habitats



Global climate regulation



Herbs for medicine



Control of erosion rates



Chemical condition of fresh waters



Bio-remediation



Filtration/storage/accumulation



Soil fertility



Fodder



Biomass based energy sources



Reared animals and their outputs

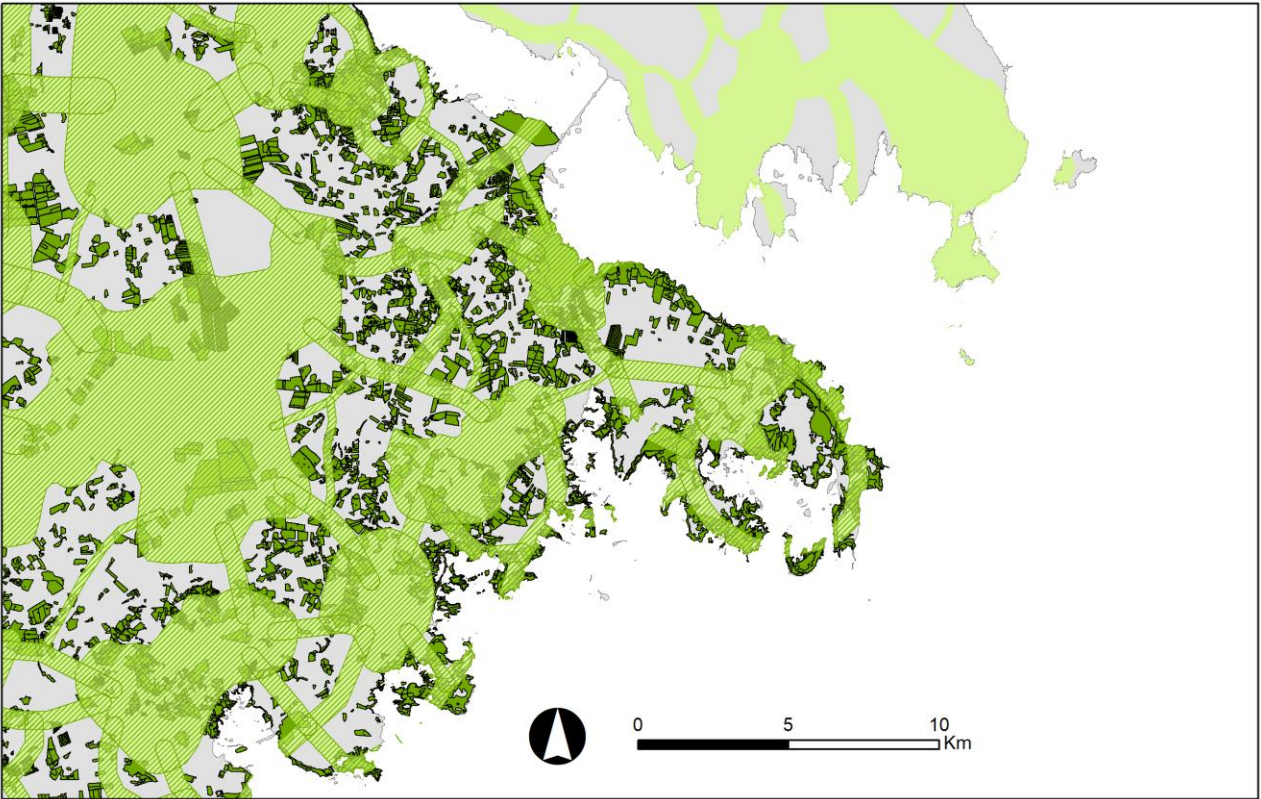


Cultivated crops



SCENARIO APPROACH – Scenario 3: High ecological coherence

- › Grasslands in the **Habitats Bundle**
- › Grasslands intersect **protected species areas**
- › Grasslands in **Soils bundle**



Pollination and seed dispersal	↑
Maintaining habitats	↑
Global climate regulation	↑
Herbs for medicine	↑
Control of erosion rates	↑
Chemical condition of fresh waters	↑
Bio-remediation	↑
Filtration/storage/accumulation	↑
Soil fertility	↑
Fodder	↑
Biomass based energy sources	↑
Reared animals and their outputs	↑
Cultivated crops	↑



1. The MCDA modules developed helps planners enhance Green Network corridors and core areas, as well as detect conflict between conservation and urban development priorities
2. Combining grassland ES expert scores and ES synergies maps together with data on habitats conservation status, biodiversity, current spatial plans and transportation network data.



Methods

A multitiered approach for grassland ecosystem services mapping and assessment: The Viva Grass tool

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