

LANDSCAPE RELATED THEMES IN SPATIAL PLANNING – VALUABLE CULTURAL LANDSCAPES AND GREEN INFRASTRUCTURE

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***Seasonal School: “Actual Problems of Landscape
Sciences: Environment, Society, Politics”***

FRAMEWORK FOR LANDSCAPE PLANNING AND MANAGEMENT

- How should the landscape be described?
- How does the landscape operate?
- Is the landscape working well?
- How might the landscape be altered?
- What differences might the changes caused?
- Should the landscape be changed? How is the decision to be made?

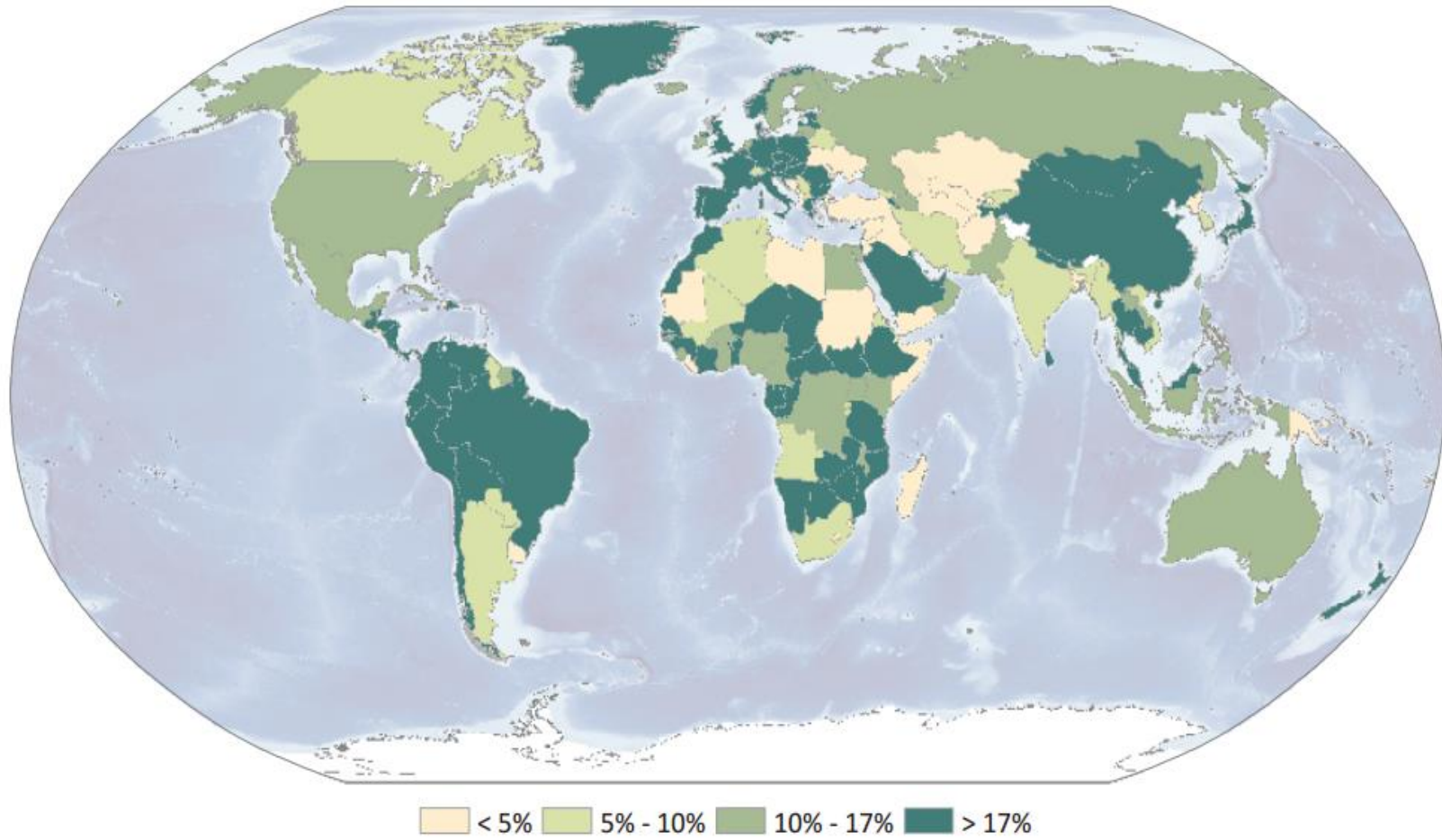
LANDSCAPE WITH A BIRD'S-EYE VIEW



INTERNATIONAL UNION FOR CONSERVATION OF NATURE



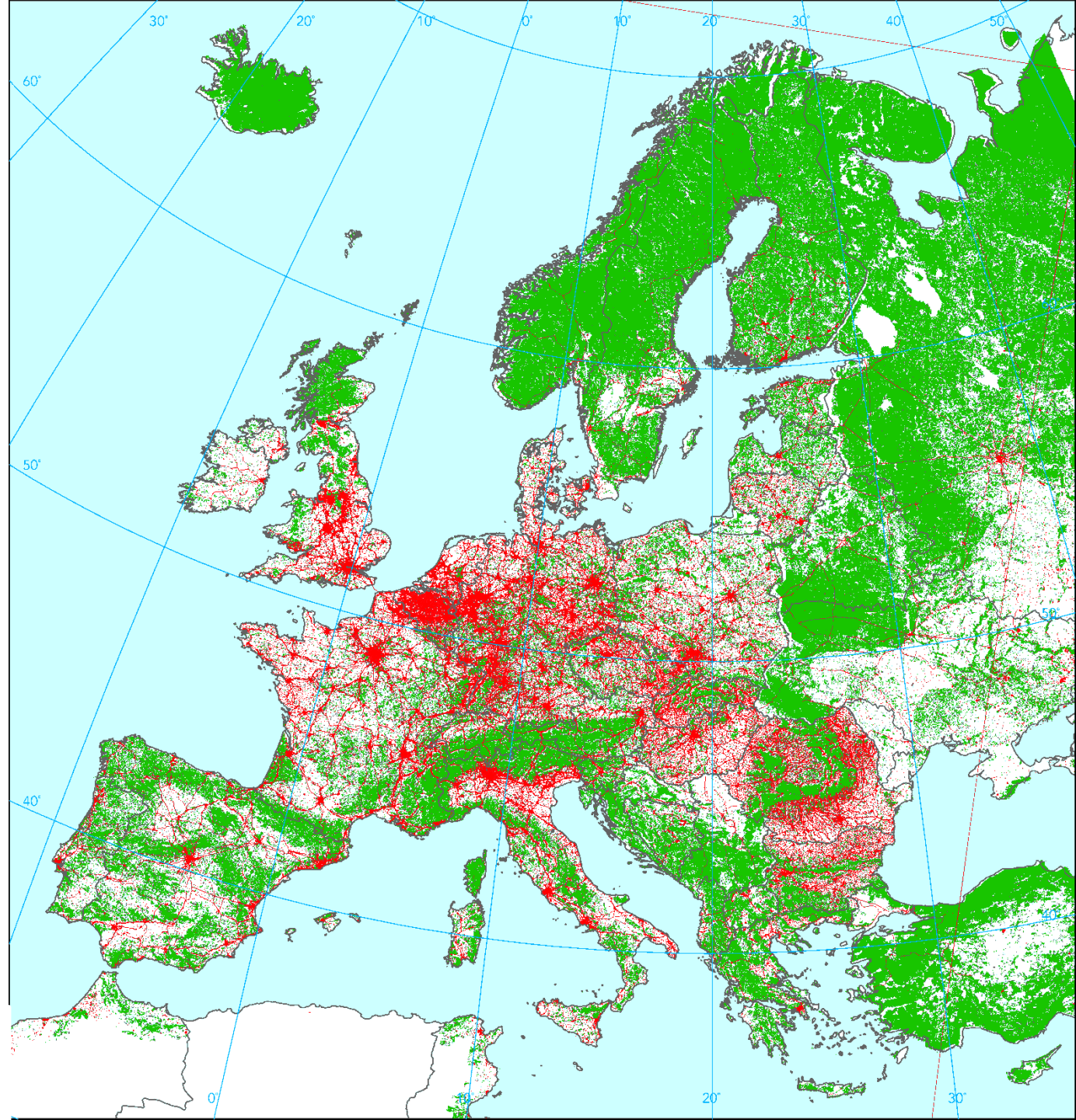
PROPORTION OF PROTECTED AREAS

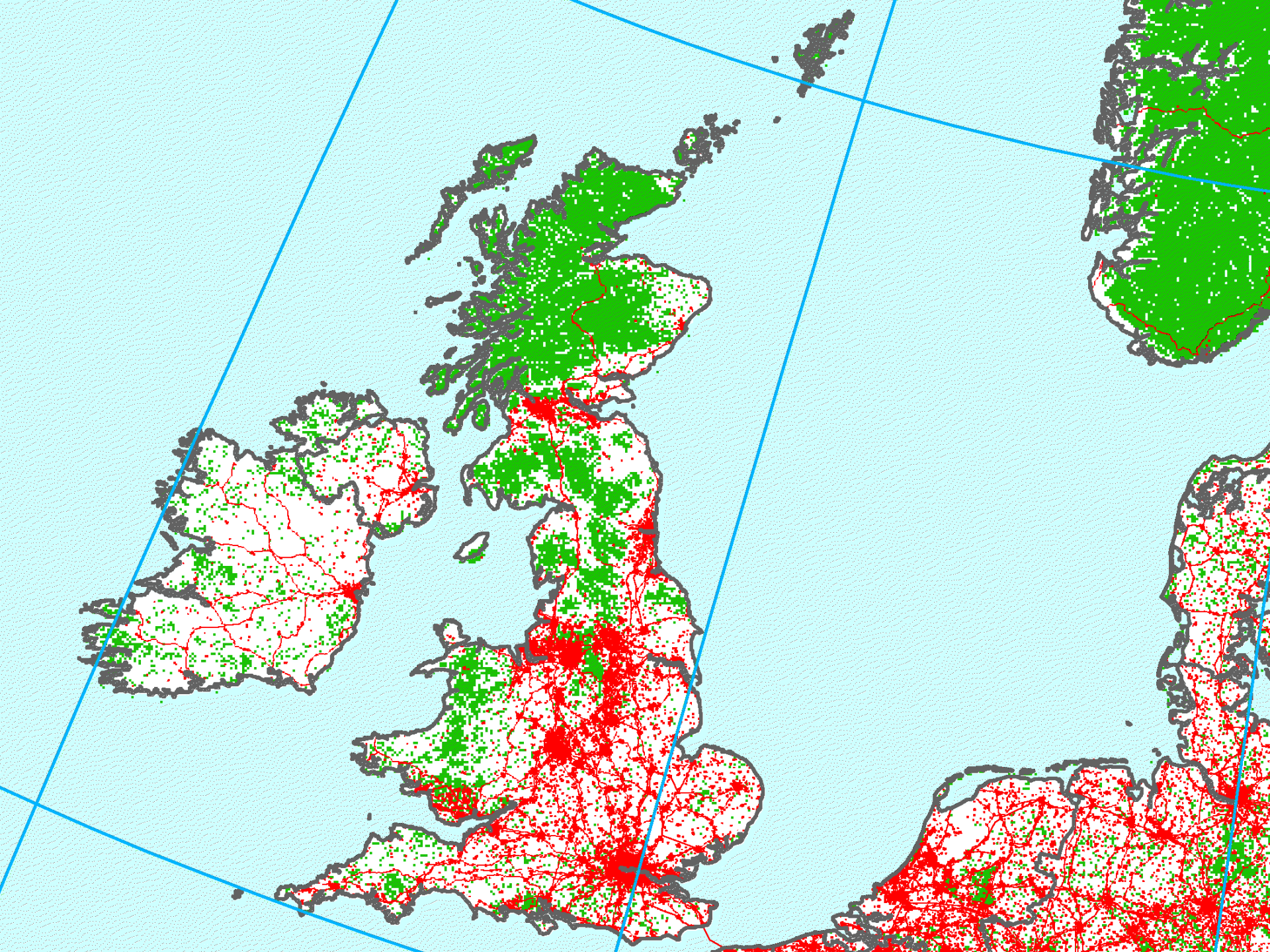


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- How does Europe look like at present?
- Strongly urbanised, big differences between urban and rural



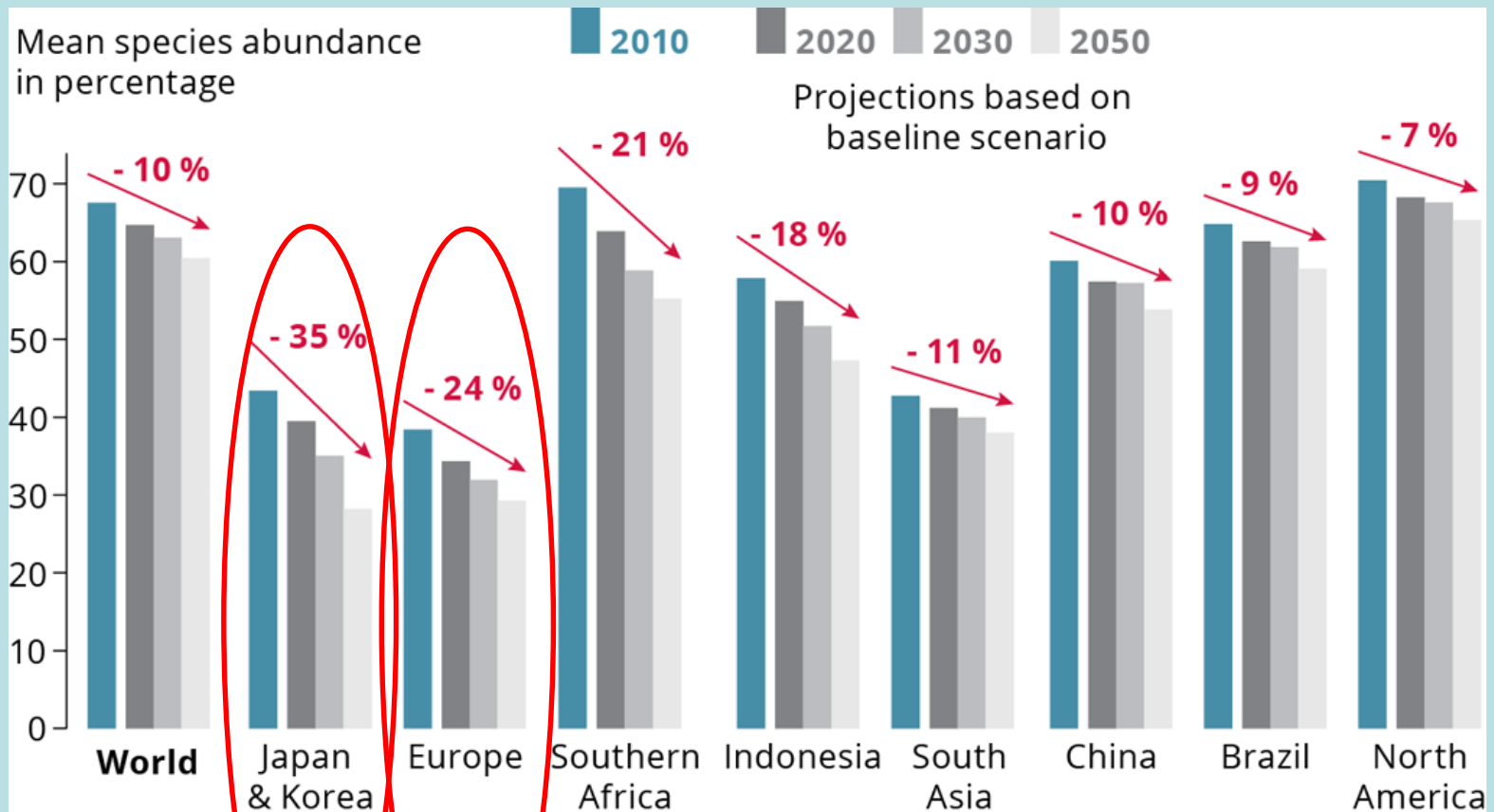


MAJOR THREATS TO GLOBAL BIODIVERSITY

- Destruction of habitats
- Habitats fragmentation
- Pollution of habitats
- Global climate change
- Over-exploitation of species for human consumption
- Invasive alien species



GLOBAL MEGATREND: Rising pressure on ecosystems

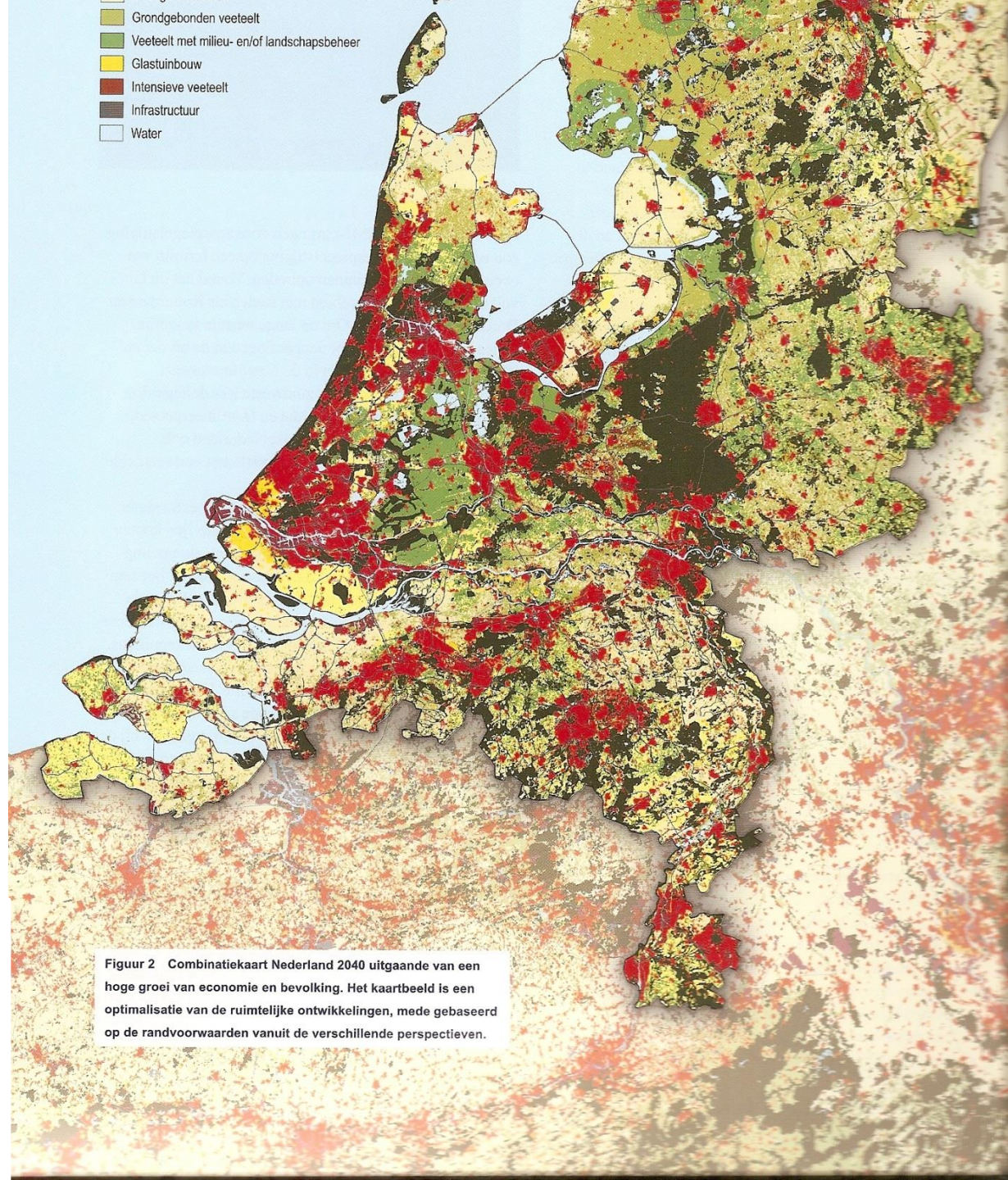


Population:	7,3 mlrd	178 mln	742 mln	?	252 mln	?	1,3 mlrd	204 mln	565 mln
Density (inh/km ²):	54	>400	116	?	132	?	142	24	>20

Human society creates barriers of all kind



- At the regional scale:
- Urbanisation means barriers, but it does not mean that there is no nature or landscape



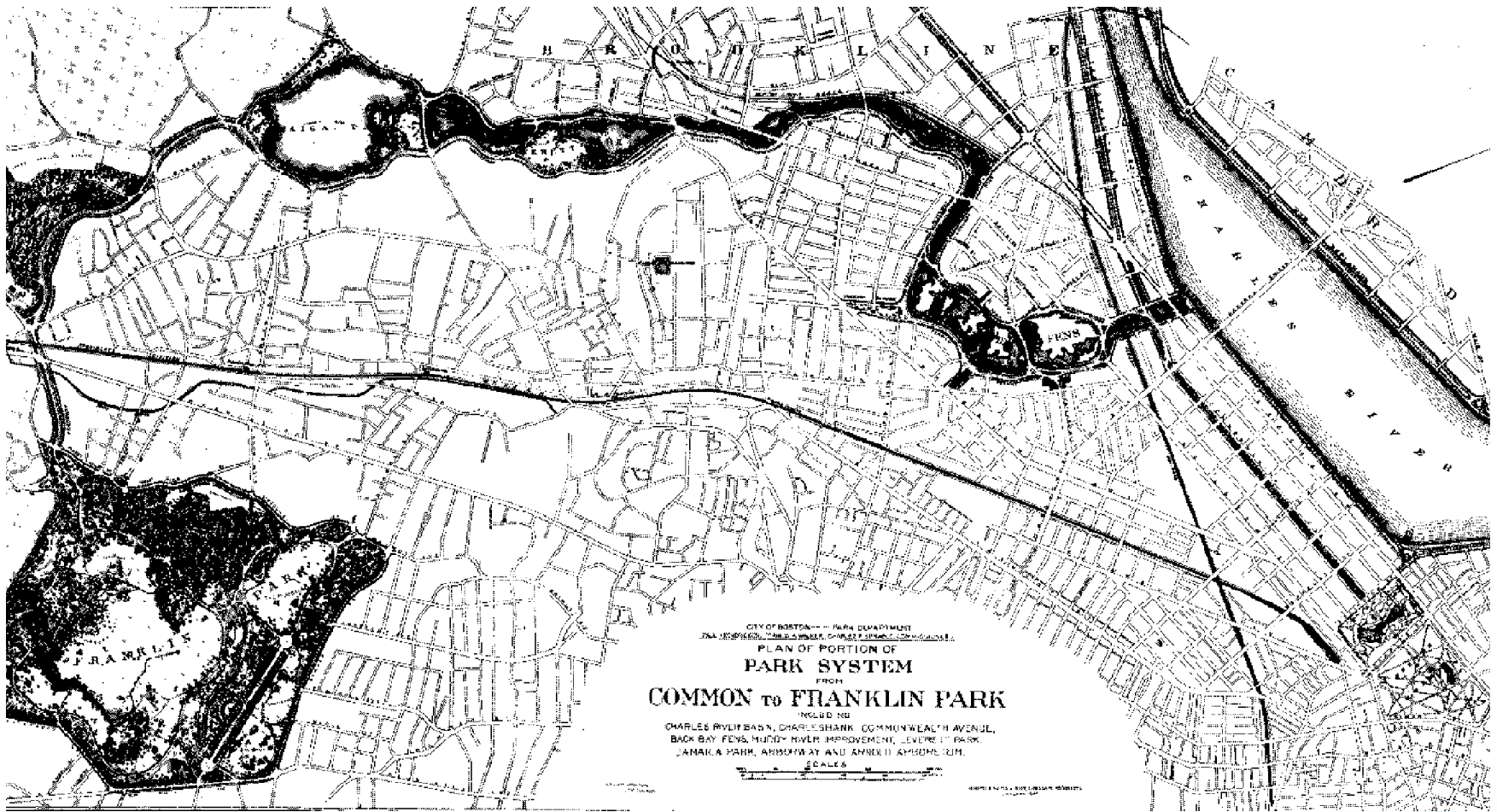
Is the Green Infrastructure a new
concept?

What we can learn from our previous
experiences?

GREENWAYS, ECOLOGICAL NETWORKS AND GREEN INFRASTRUCTURE IN A SHORT HISTORY

- **Parkways:** Landscape Architectural concept of Frederick Law Olmstead (19th century): connected systems of parks and greenways being more beneficial than isolated green spaces.
- **Green infrastructure:** Edward T. McMahon (The US Conservation Fund): ". . . an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for people."
- European Commission: ... is addressing the **spatial structure of natural and semi-natural areas** but also other environmental features which enable citizens to benefit from its multiple services.

THE EMERALD NECKLACE, BOSTON (USA)



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BACKGROUND: HISTORY

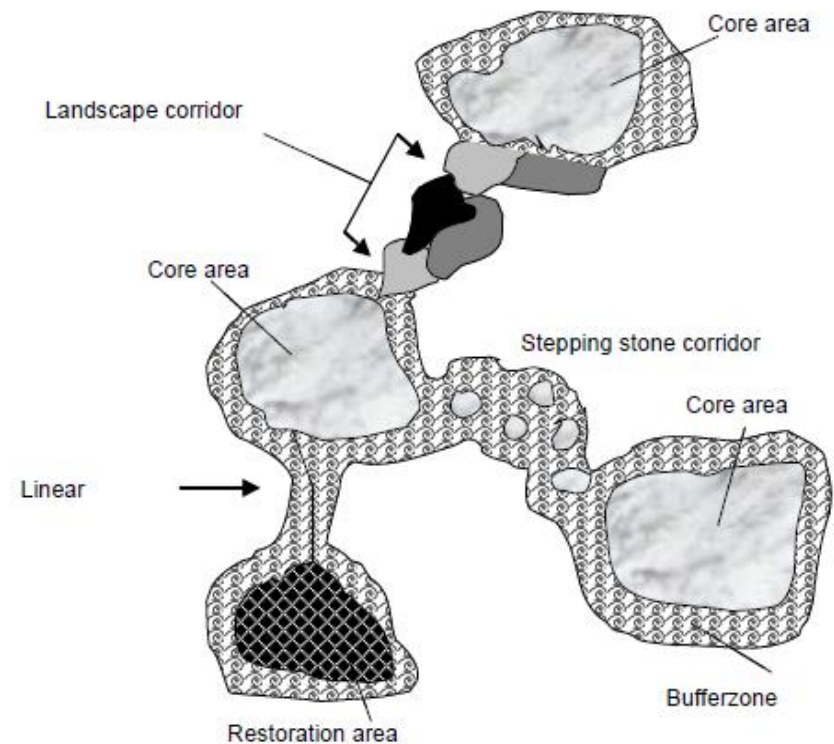
- The concept of ecological networks is not new; the model has developed over the **past 35-40 years**.
- Beginning in the 1970s and 1980s in countries where **a strong land use planning tradition** had created the institutional environment for allocating functions at the landscape scale in the context of increasingly fragmented European landscapes.
- The **concept** is the translation of ecological knowledge on fragmentation processes in the landscapes of Europe and its consequences for populations of natural specie.

WHY? BACKGROUND - POLITICAL

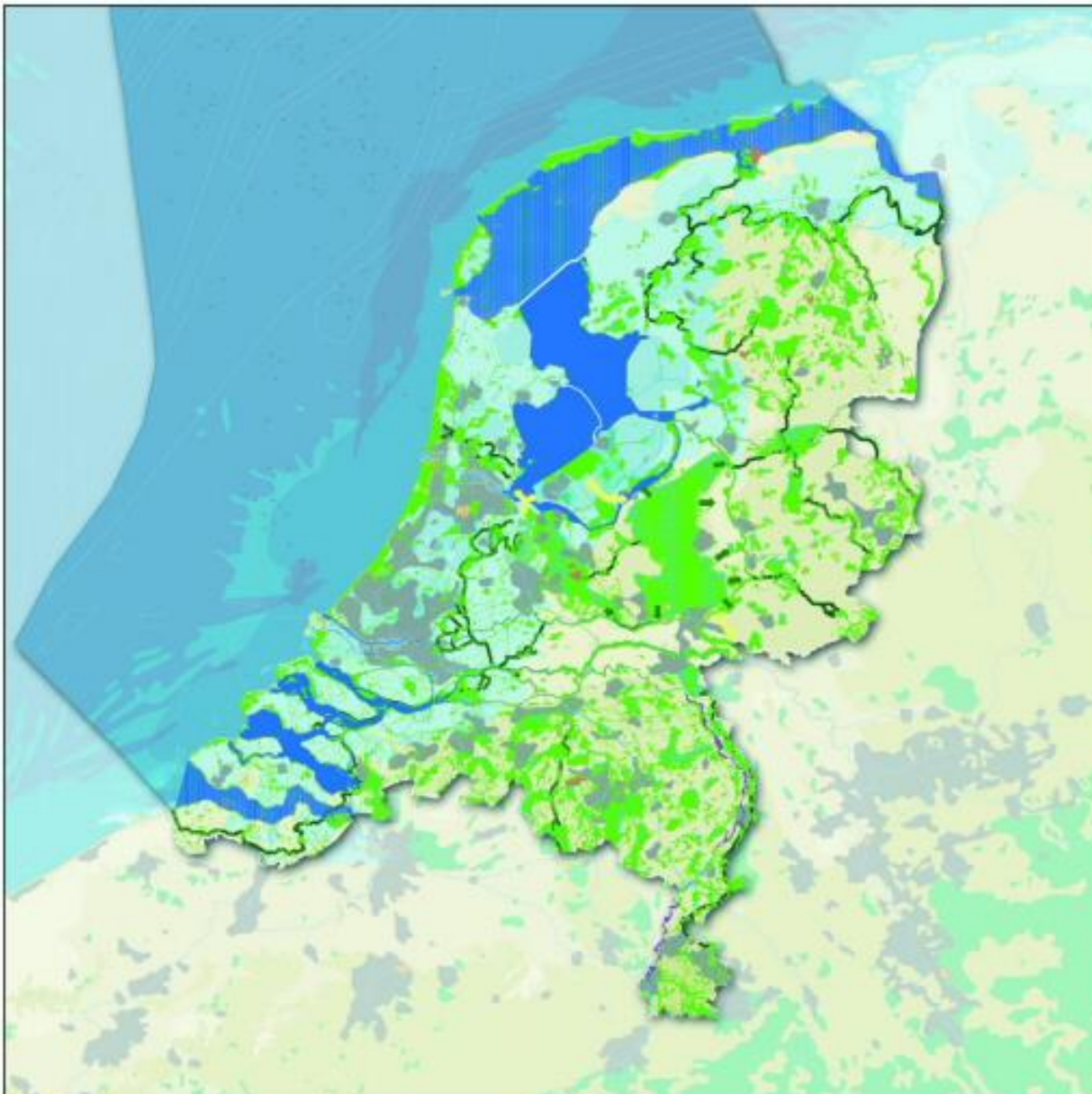
- By adopting the [Pan-European Biological and Landscape Diversity Strategy](#) in [1995](#), the development of ecological networks (the Pan-European Ecological Network) became the priority nature conservation strategy in Europe.
- The [Sixth Ministerial Conference "Environment for Europe"](#) in Belgrade in [2007](#) represented a watershed for the development of a Pan-European Ecological Network - [Green infrastructure since then](#).
- Developing [ecological connectivity](#) is one of the recommendations of the [CBD Conference of the Parties](#) in Nagoya in October 2010.

BACKGROUND: THE ECOLOGICAL NETWORKS CONCEPT

- Ecological networks' main goal is to conserve biodiversity by **maintaining** and **strengthening** the **integrity** of ecological and environmental processes.
- Ecological networks are based around the idea of **core areas**, **ecological corridors**, **buffer zones** and restoration areas.
- They are designed and managed in such a way as to preserve biological diversity and to **maintain or restore ecosystem** services through the interconnectivity of its physical elements within the landscape.



THE DUTCH NATIONAL ECOLOGICAL NETWORK



PKB - kaart 5: Ecologische Hoofdstructuur

- begrensd Ecologische Hoofdstructuur
- begrensd Ecologische Hoofdstructuur grote wateren
- zoekgebied Ecologische Hoofdstructuur
- intensief gebruikte militaire terreinen (buiten de EHS)



■ begrensd Ecologische Hoofdstructuur Noordzee

- robuuste verbinding
- ➡ indicatieve robuuste verbinding (poort)
- nader uit te werken en bestuurlijk af te stemmen robuuste verbinding

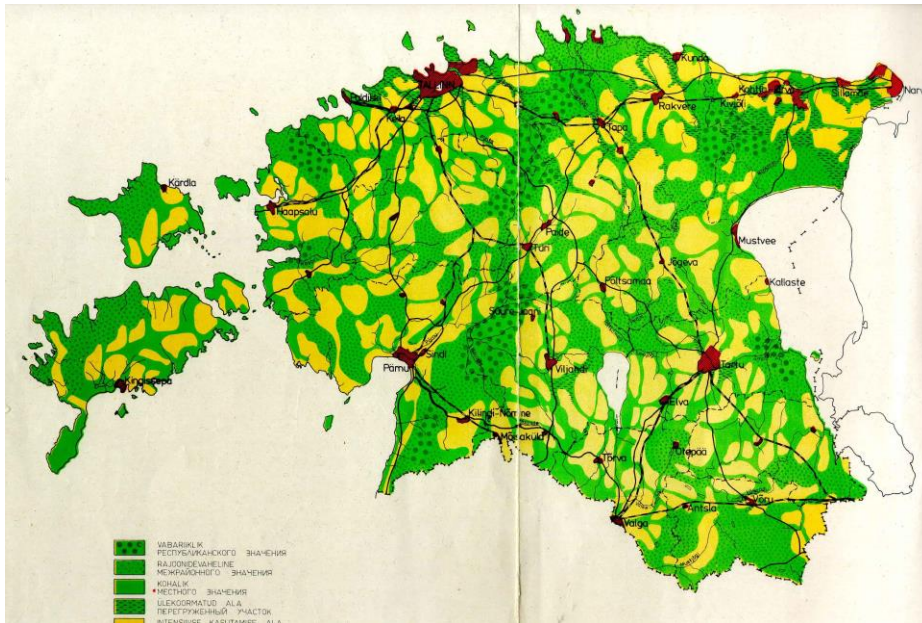
ondergrond

- vereenvoudigde topografie (exclusief hoofdinfrastructuur)
- grens Exclusieve Economische Zone (EEZ) en 12-mijlszone



(1:1.500.000)

SPATIAL PLANNING, 1983, NETWORK OF COMPENSATING AREAS AT SCALE 1: 200 000

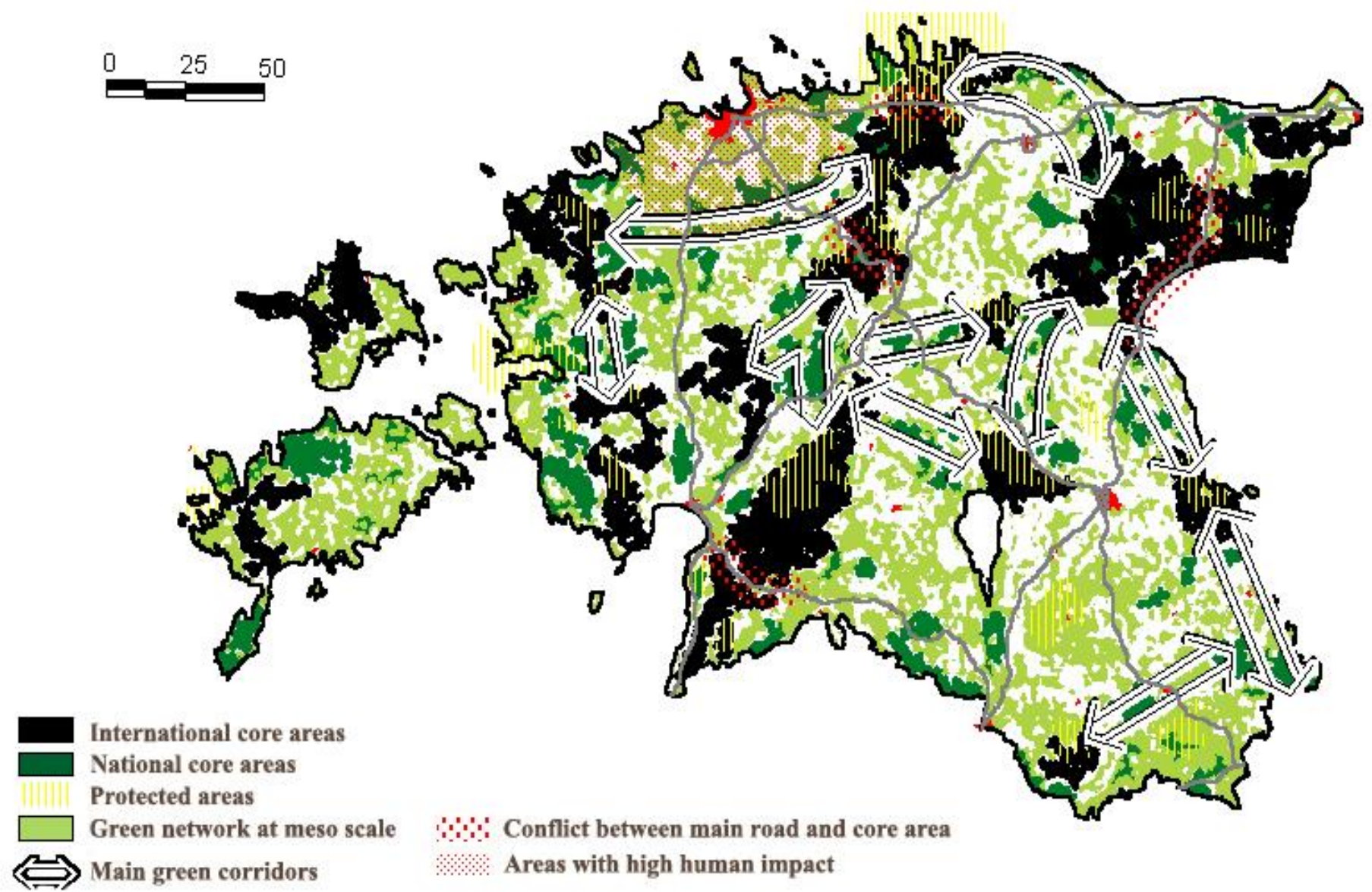


GREEN NETWORK IN ESTONIA

- Since the mid of 1990s we have a legislative and political support for ecological network applications (Act on Building and Planning, 1995, Act on Planning, 2002).
 - State level
 - County level
 - Municipality level
- The long-term National spatial strategy “Estonia – Vision 2010” included the “Green Network” chapter and also Vision 2030 will include themes related to Green Infrastructure.

ESTONIAN "GREEN NETWORK" ACCORDING TO "ESTONIA - VISION 2010"

ESTONIA 2010 GREEN NETWORK



LEGISLATION AND ADMINISTRATION

- 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, then Mol, and now MoFinance.
- We have a detailed [methodology](#) for defining green network at county level (Jagomägi, Sepp 2002).

PURPOSES OF DESIGNING OF GREEN NETWORK

- The objective of planning the green network on the county level is not to define a large-scale 'green surface' and leave it out of use, but, first and foremost, to guarantee the naturally, environmentally, socio-economically grounded space structure, based on the location of different infrastructures and needs analysis of society.
- To complete functionality of the network of protected areas, connecting them into a complete system with natural areas.

THE FOLLOWING MAIN PURPOSES WERE STATED

- To **shape the spatial structure of natural areas** in the most reasonable way considering the ecological, environmental protection, economic and social aspects.
- **To complete functionally** the network of protected areas, connecting them into a complete system with natural areas.
- To protect valuable natural habitats and preserve the migration routes of wild animals, and valuable landscapes.
- **To soften**, compensate, and forestall the **anthropogenic impact** on nature, to contribute to sustainable development strategy.
- To offer the possibility of nature-friendly management, living styles and recreation by ensuring spatial accessibility to natural areas.

THE FOLLOWING MAIN PURPOSES WERE STATED

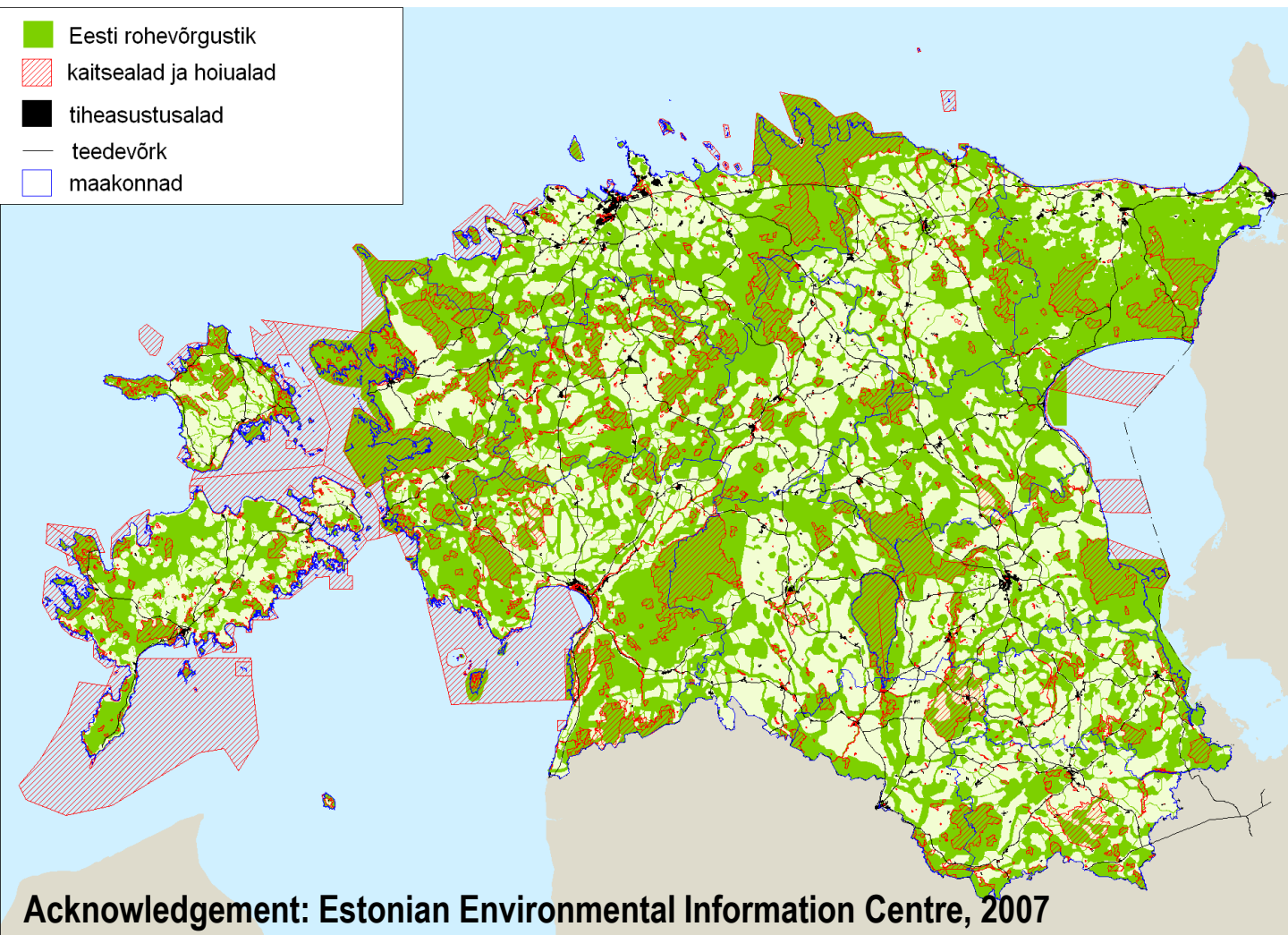
- To promote nature conservation outside protected areas.
- To minimise future conflicts of interest incorporating different sectors (forestry, agriculture, transport, recreation) through spatial planning.
- To guide development of settlement and land use structure.
- To preserve the natural self-regulation ability of the environment.
- To support international and transboundary co-operation.

METHODOLOGY

Criteria for designation structural elements

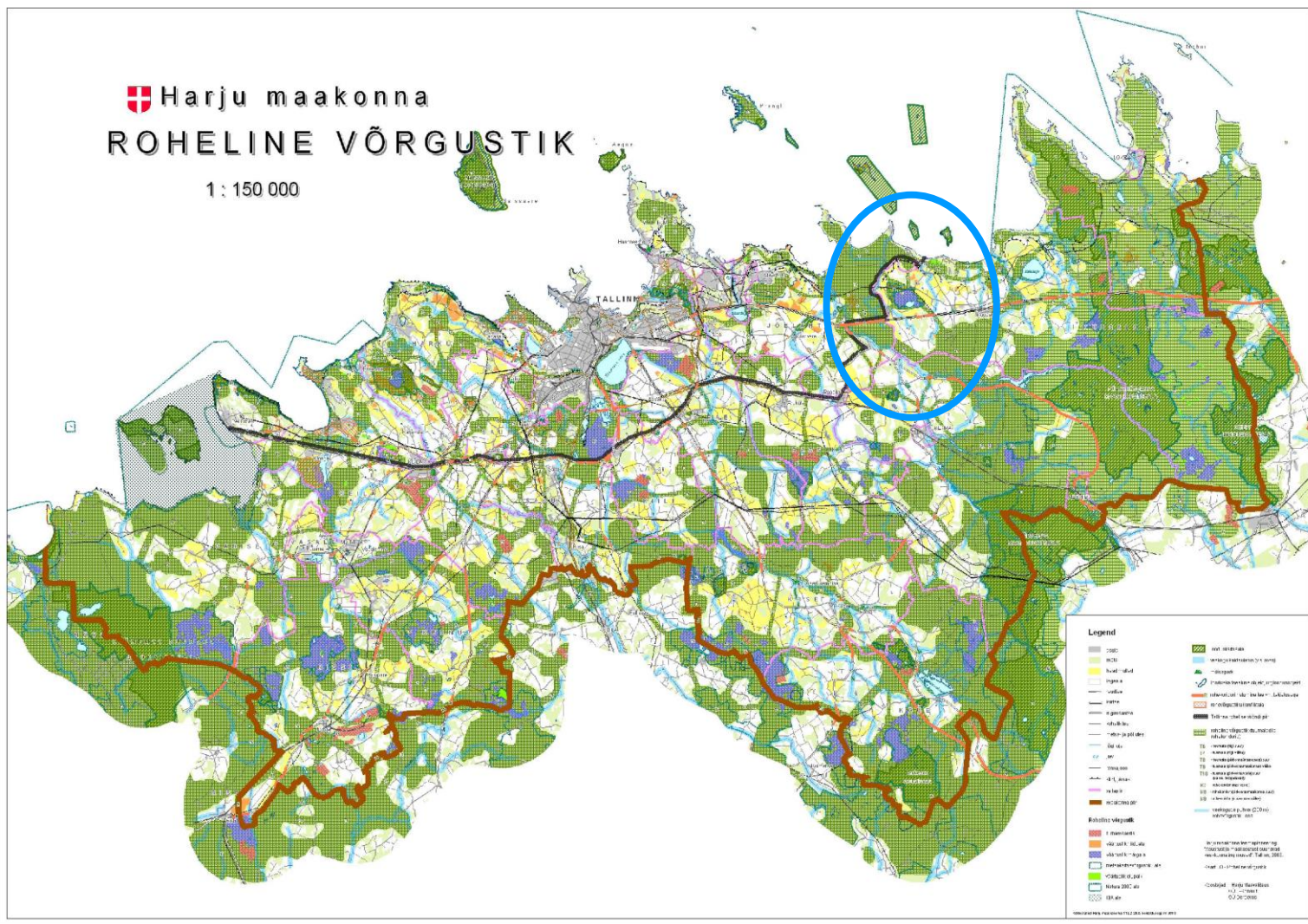
- Nature conservation and environmental protection **values**, threats, conflicts.
- **Morphometrical parameters** of the elements
 - core areas – territorial extent
 - corridors – wideness
- Ecological, environmental, socio-economic **landscape peculiarities**.
- Distribution of **species** and their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

ECOLOGICAL NETWORK



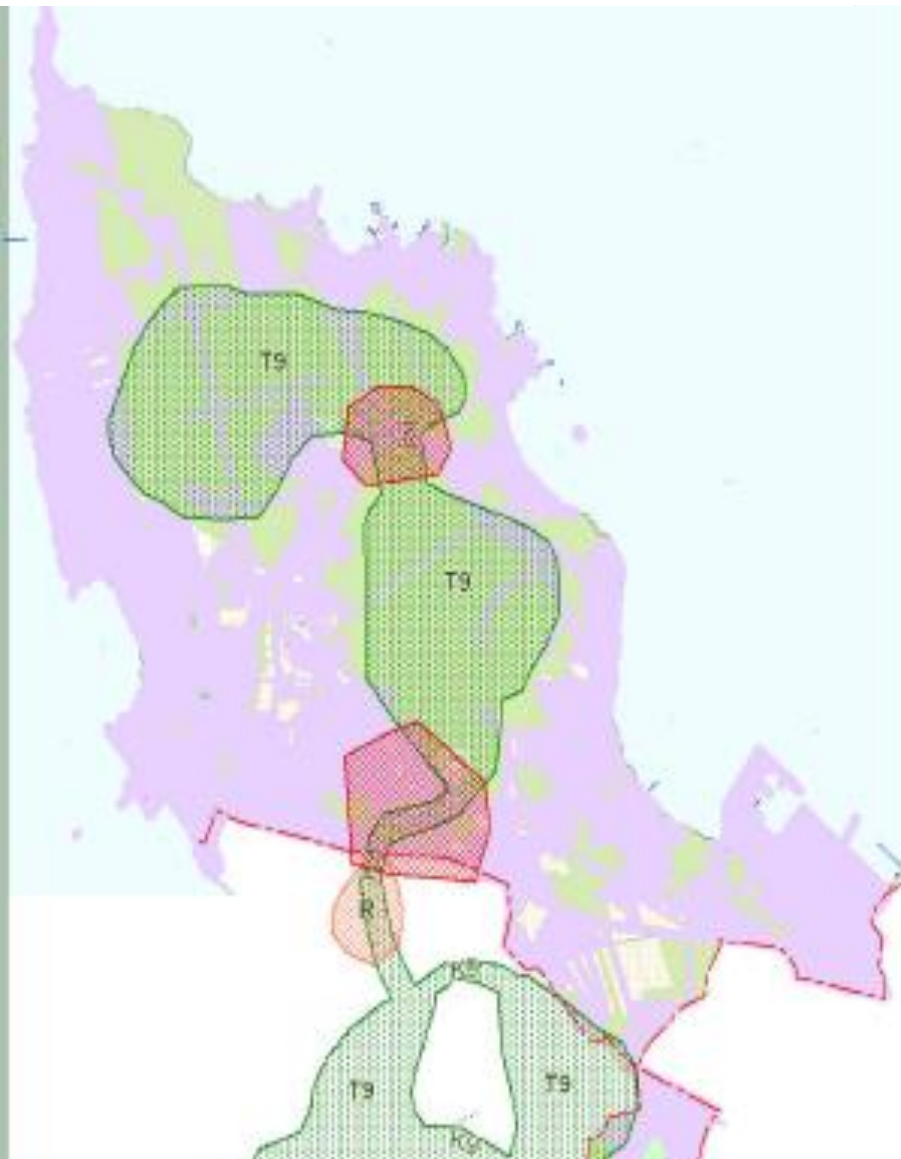
The “legal network”: ecological network compiled from 15 Green Network plans prepared at county level (2001-2007)

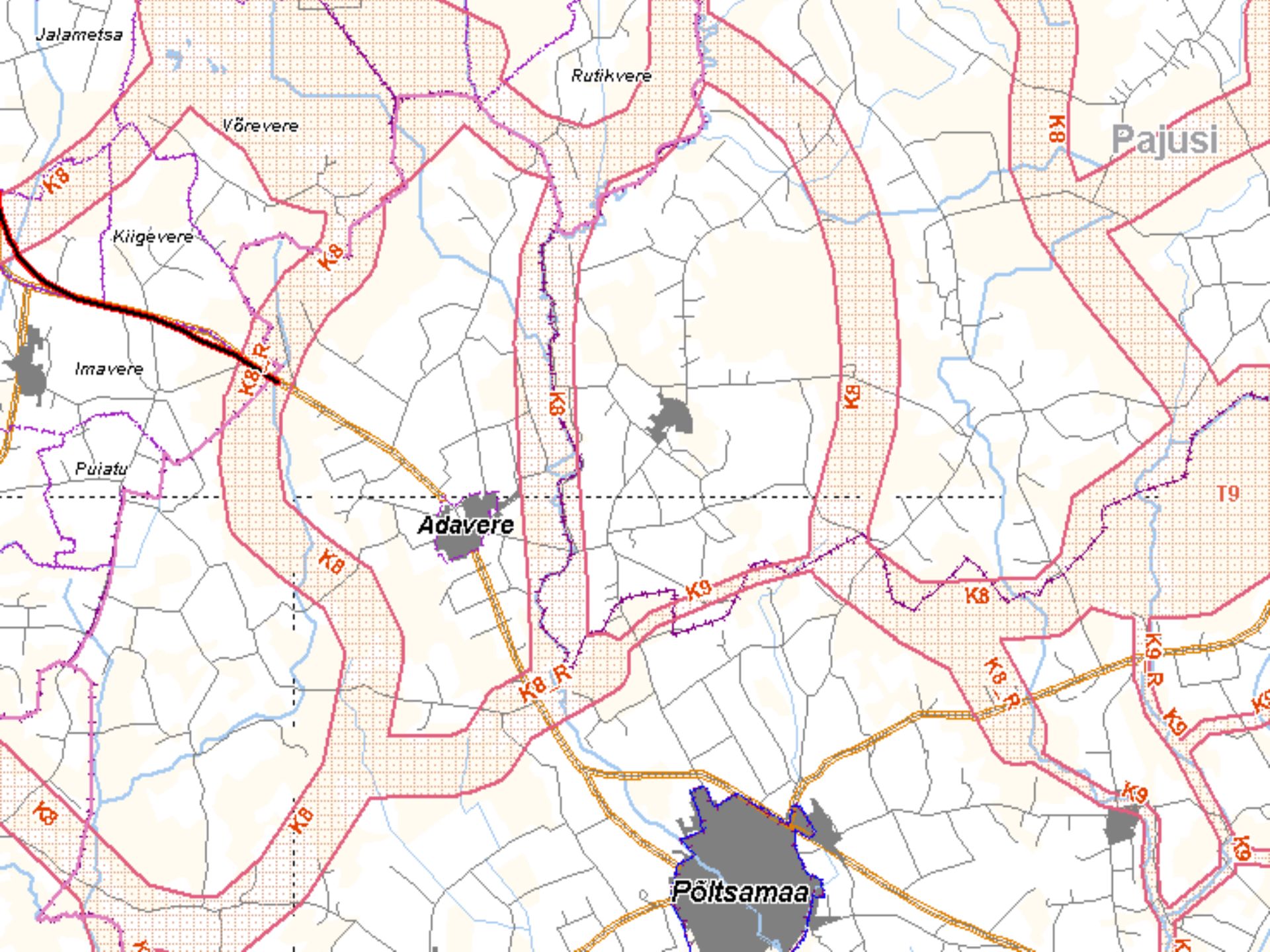
GREEN NETWORK PLAN AT COUNTY LEVEL



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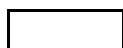
GREEN NETWORK OF “COUNTY LEVEL” SEEN FROM “COMMUNITY LEVEL”



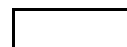


Supporting objects of green network

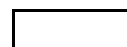
Protected stones



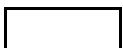
Threatened plant species



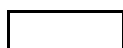
Spring



Objects of virgin nature



sites protected under heritage



Cultural objects



Areas of water preservation



Playground of capercaille 2



Areas of virgin nature



Objects of virgin nature, buffer zone 120m



puhvriga 120m

Objects of virgin nature, buffer zone 60m



Strictly protected areas



Limited management zone



Special management zone



Corine lbroadleaved forests



Playground of capercaille 1



Protected trees



Protected parks



RAMSAR sites



Important Bird Area (IBA)



Protected areas



Corine Biotopes



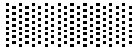
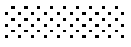
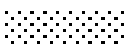
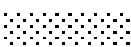
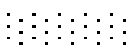
Key biotope

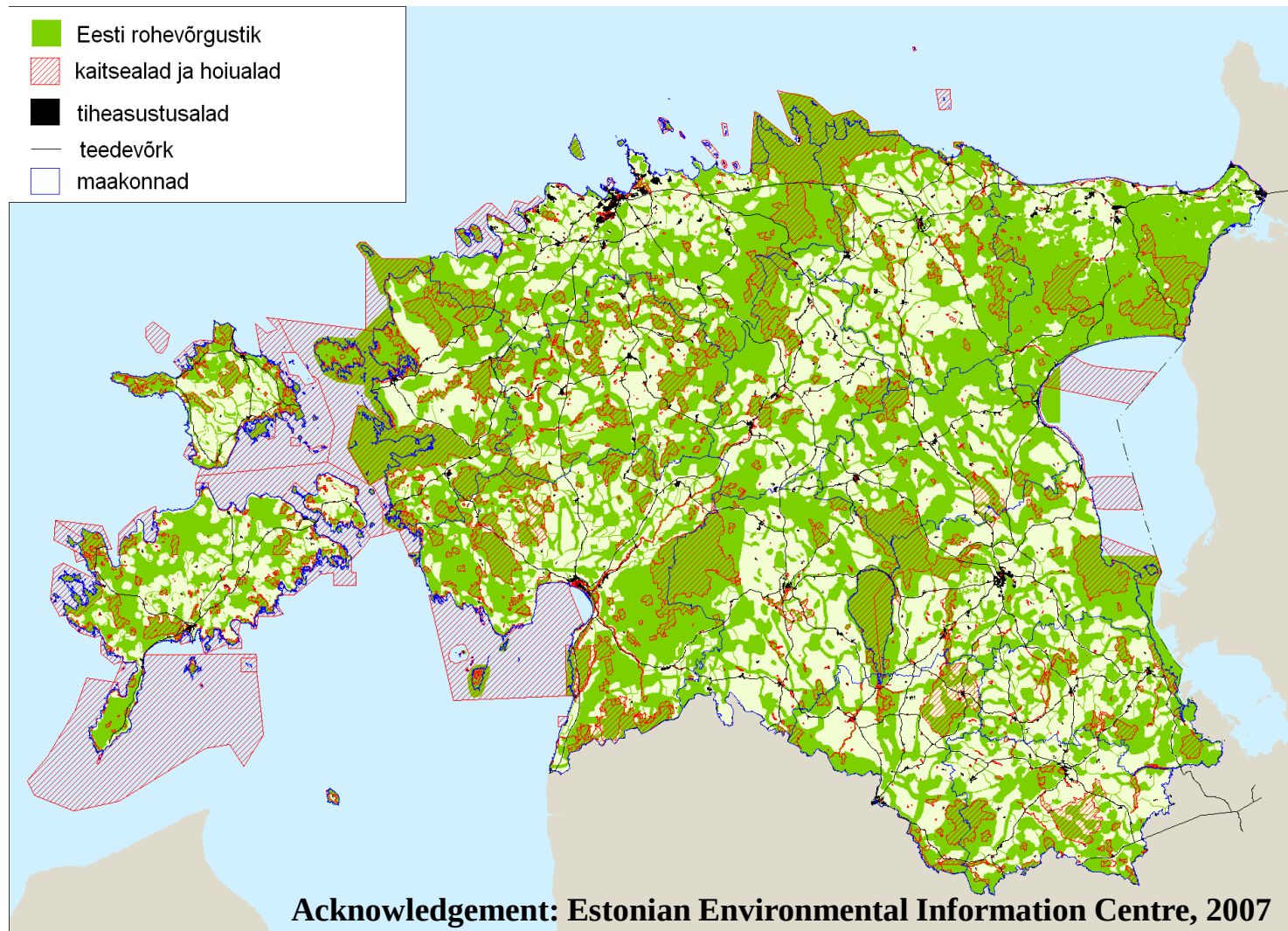


Valuable wetlands



Objects which preclude the green network

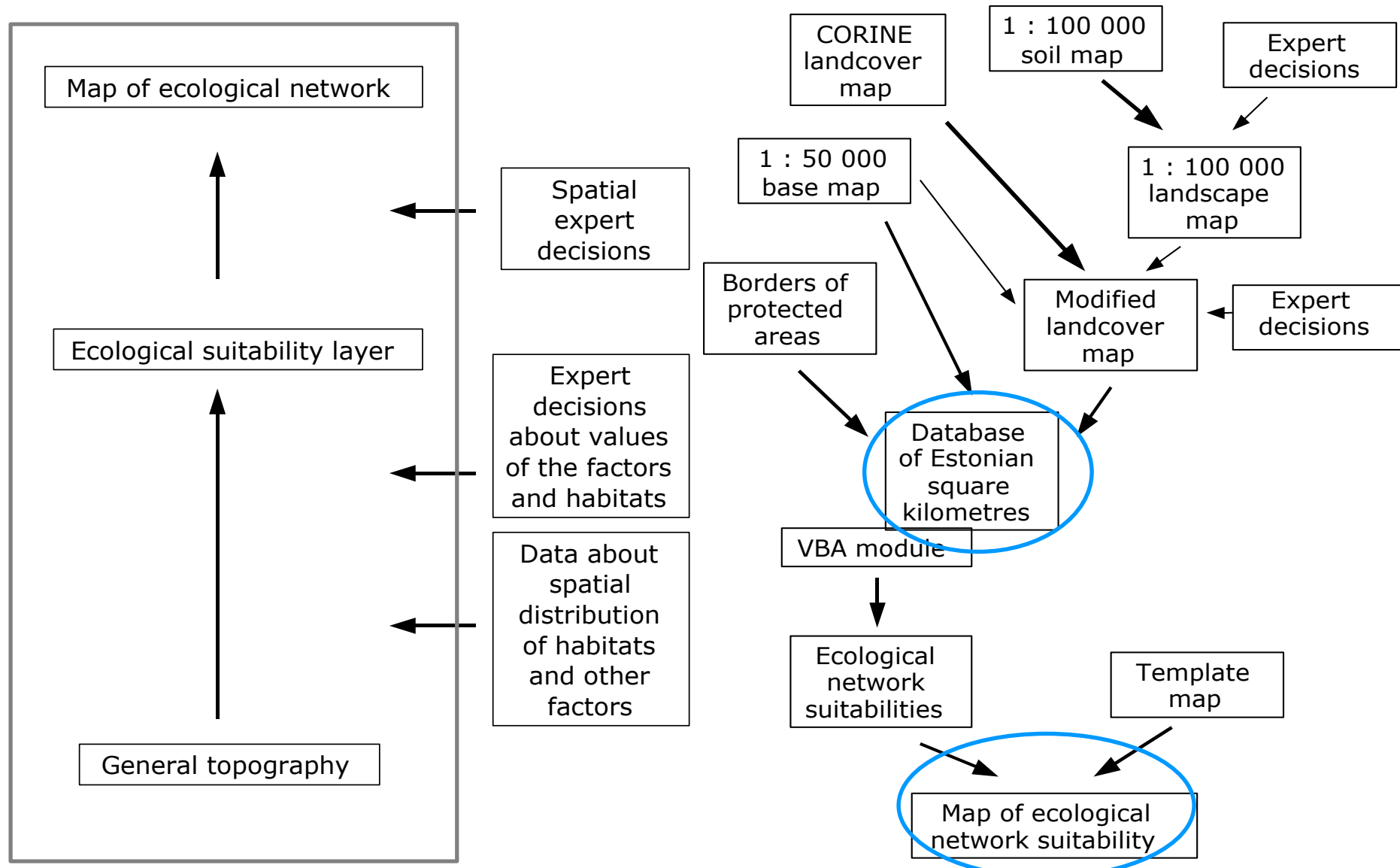
Pipe or line 	Urban areas and settlements 	
<u>Roads</u> and railway 	Basic road, buffer 50m 	Basic road, buffer 300m 
Peat extraction area 	Peat extraction area, buffer 50m 	Peat extraction area, buffer 300m 
New dump sites 	New dump sites, buffer 50m 	New dump sites, buffer 300m 
Corine dump sites 	Corine dump sites, buffer 50m 	Corine dump sites, buffer 300m 
Corine aerodrome 	Corine aerodrome, buffer 50m 	Corine aerodrome, buffer 300m 
Corine opencast pit 	Corine opencast pit, buffer 50m 	Corine opencast pit, buffer 300m 



The “legal network”: ecological network compiled from 14 Green Network plans prepared at county level (2001-2007)

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**PRINCIPAL LAYERS OF A NETWORK MAP (LEFT) AND
SOURCE DATA FOR CALCULATING ECOLOGICAL SUITABILITY LAYER OF THE MAP OF
ESTONIAN ECOLOGICAL NETWORK** (VBA – MicroSoft Visual Basic for Applications)



ECOLOGICAL NETWORK VALUES OF HABITATS (LANDCOVER CLASSES) IN ESTONIA

• Constructions	0.01
• Peat extraction sites	0.05
• Suburban areas	0.1
• Fields	0.2
• Complex cultivation	0.3
• Plantations	0.4
• Wooded agricultural land	0.6
• Scrubs	0.9
• Sparse vegetation	1.0
• Inland water bodies	1.2
• Coniferous forest on peat	1.3
• Heath	1.4
• Other grasslands	1.5
• Broad leaved and mixed forests on peat	1.8

• Coastal lagoons	1.9
• Coniferous forests on mineral soil	2.0
• Salt marshes	2.2
• Bogs	2.4
• Moist grasslands	2.6
• Broad-leaved and mixed forests on mineral soil	3.0
• Wooded fens and bogs	3.4
• Riparian zones	3.5
• Littoral marshes	3.6
• Fens	4.0
• Coastal dunes	4.5
• Inland dunes	5.0
• Boreal coastal meadows	6.0

ECOLOGICAL NETWORK VALUES OF THE DENSITY OF LINEAR FEATURES

• Seacoast	1.6
• Landcover borders	1.5
• Coastline of larger [$>1\text{km}^2$] inland water bodies (<i>incl.</i> rivers wider than 100m)	1.4
• Contour lines [recalculated to $\Delta h=20\text{m}$]	1.3
• Watercourses	1.2
• Roads	0.5

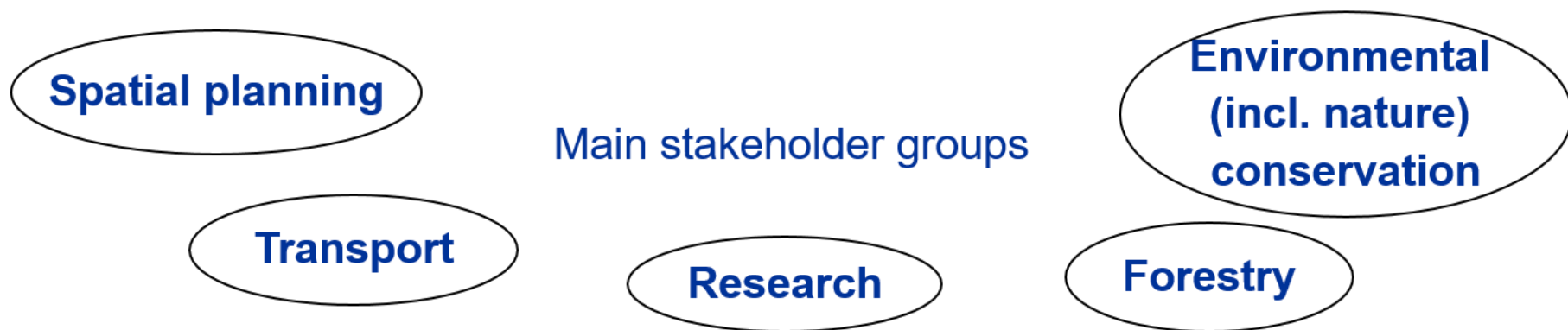
SUITABILITY AREAS FOR THE ECOLOGICAL NETWORK IN ESTONIA



SPATIAL PLANNING AT NATIONAL AND COUNTY LEVEL

- Necessary **land use conditions and limitations** were set on core areas and corridors (restrictions, codes of practice, environmental measures, regimes etc.).
- It is important to **determine and reach agreement** on the list of land use conditions which apply.

Stakeholder involvement



Their public/private affiliations:

Governmental stakeholders

- Ministry of Interior
- Ministry of Environment
- State Nature Conservation Centre
- State Forest Management Centre
- Road Administration
- and their regional departments

Business

- Spatial planning companies (representing experts of a variety of specialities)

Civil society

- Environmental NGO-s
- Resource user groups
- Landowners
- Local people

RESULTS

- All 15 counties in Estonia have defined and approved green networks at **county level**.
- Local authorities have started to define and several (ca 90) have approved the green network at **commune level**. (including towns Tallinn, Tartu, Pärnu – thematic planning)
- By 2016 the Green Network had been addressed in 87 comprehensive plans; ca 40% of municipalities

GREEN NETWORK IN ESTONIAN SPATIAL PLANS

- 1999 National Plan. Estonia 2010. Green Network
- 2003-2007. Green Networks at County level (15 Counties)
- 2013 National Plan. Estonia 2030+. Green Network
- 2000-2017. Green Networks at municipality level (ca 90 municipalities)
- 2016-2018. Green Network at County level



GREEN NETWORK IN ESTONIA. FUNCTIONALITY ANALYSES

Functionality

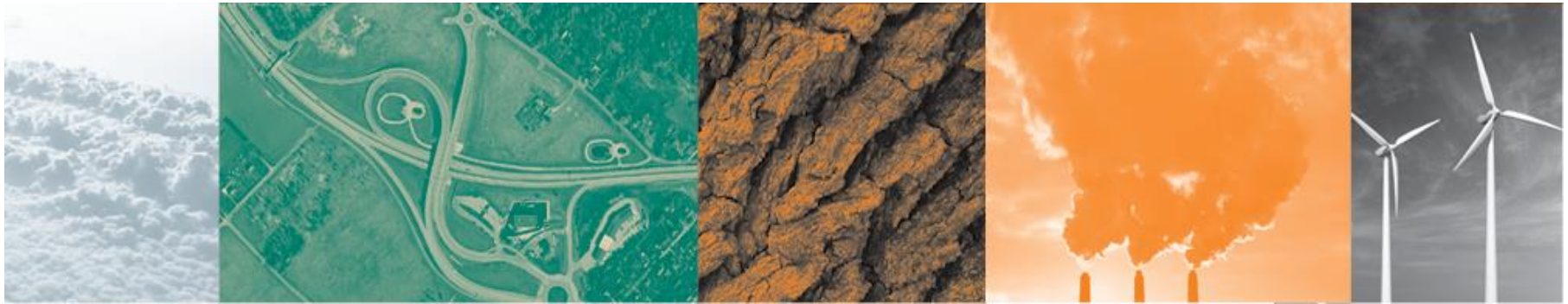
- In terms of landscape connectivity, species, habitat quality etc
- Accessibility for inhabitants (Access to green areas in radius of 300 m, 1200, 5km)
- Analyses of existing spatial plans at county and municipality level

GREEN NETWORK IN HARJU COUNTY



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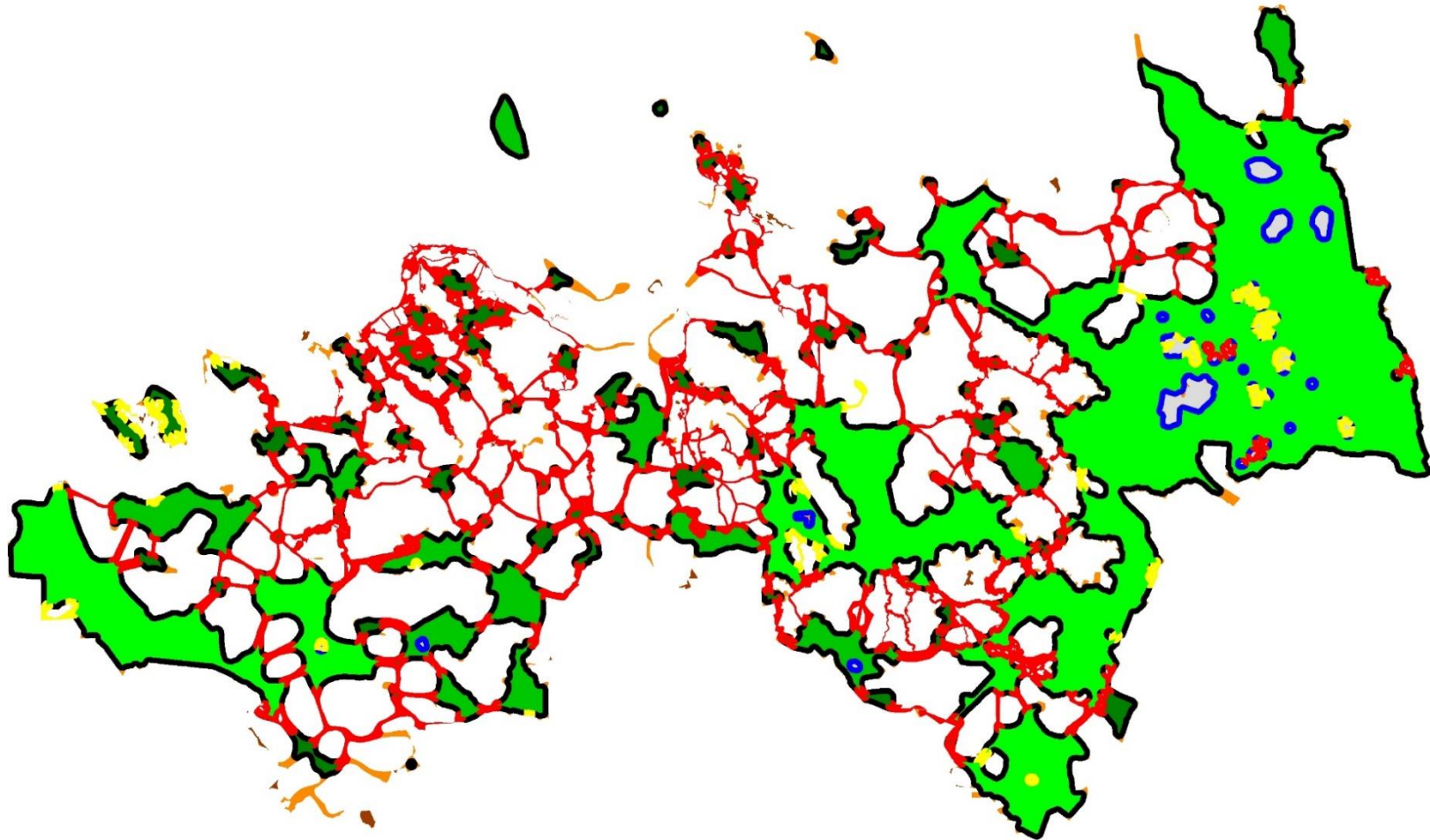


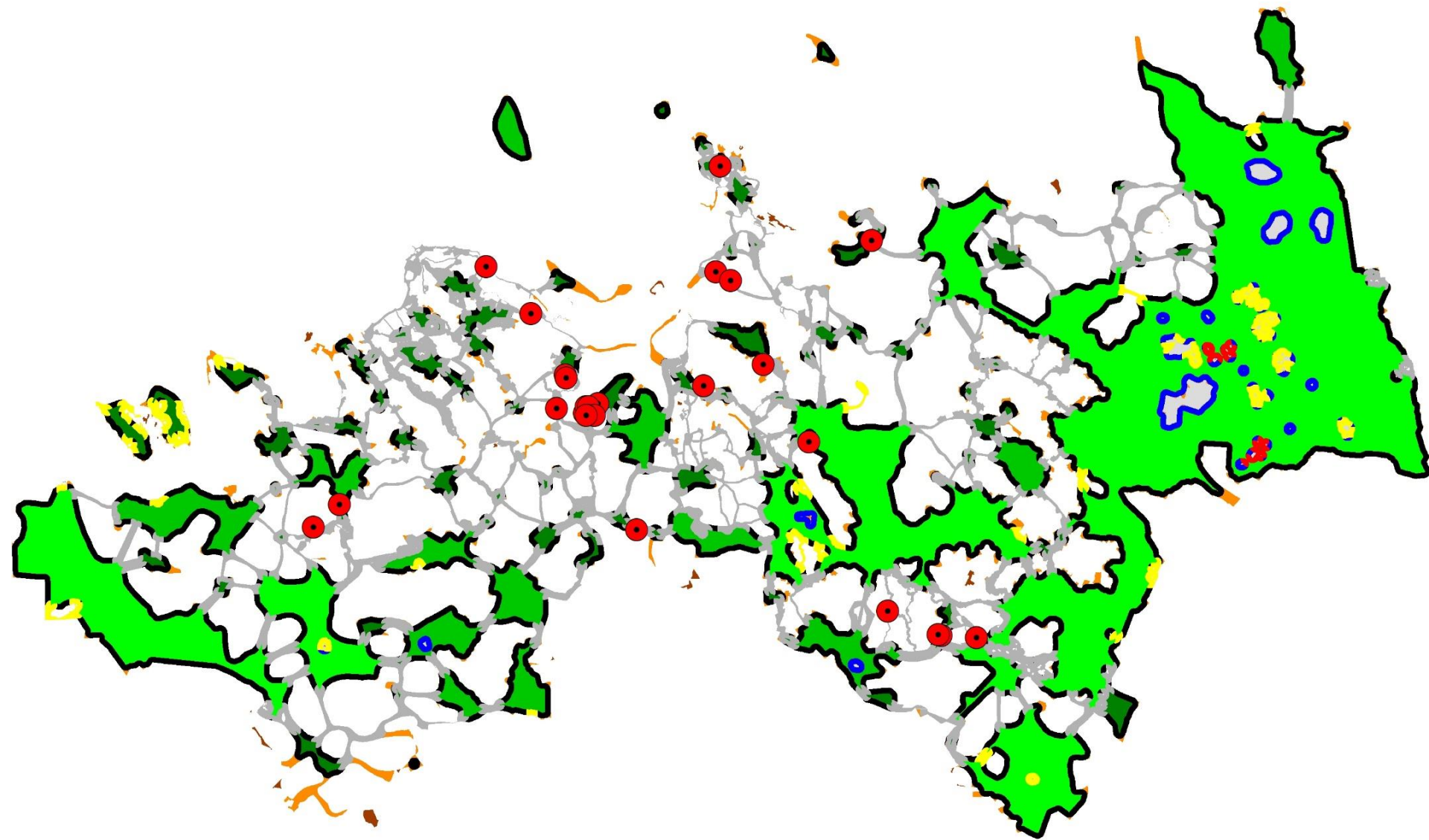


GUIDOS software

- Morphological Spatial Pattern Analysis (MSPA) GuidosToolbox (Vogt, 2016), developed by JRC (Joint Research Centre)
- Recognized by Environmental Agency Euroopa
- Tuumaalade osatähtsus (% core area);
- Servavööndi osatähtsus (% edge area);
- Häilud/augud (perforations);
- Koridorid (connectors);
- Harud (branch);
- Saared (islet);
- Sillad (loops).

Connectivity of Green Network in Harju county (buffer 500 m)





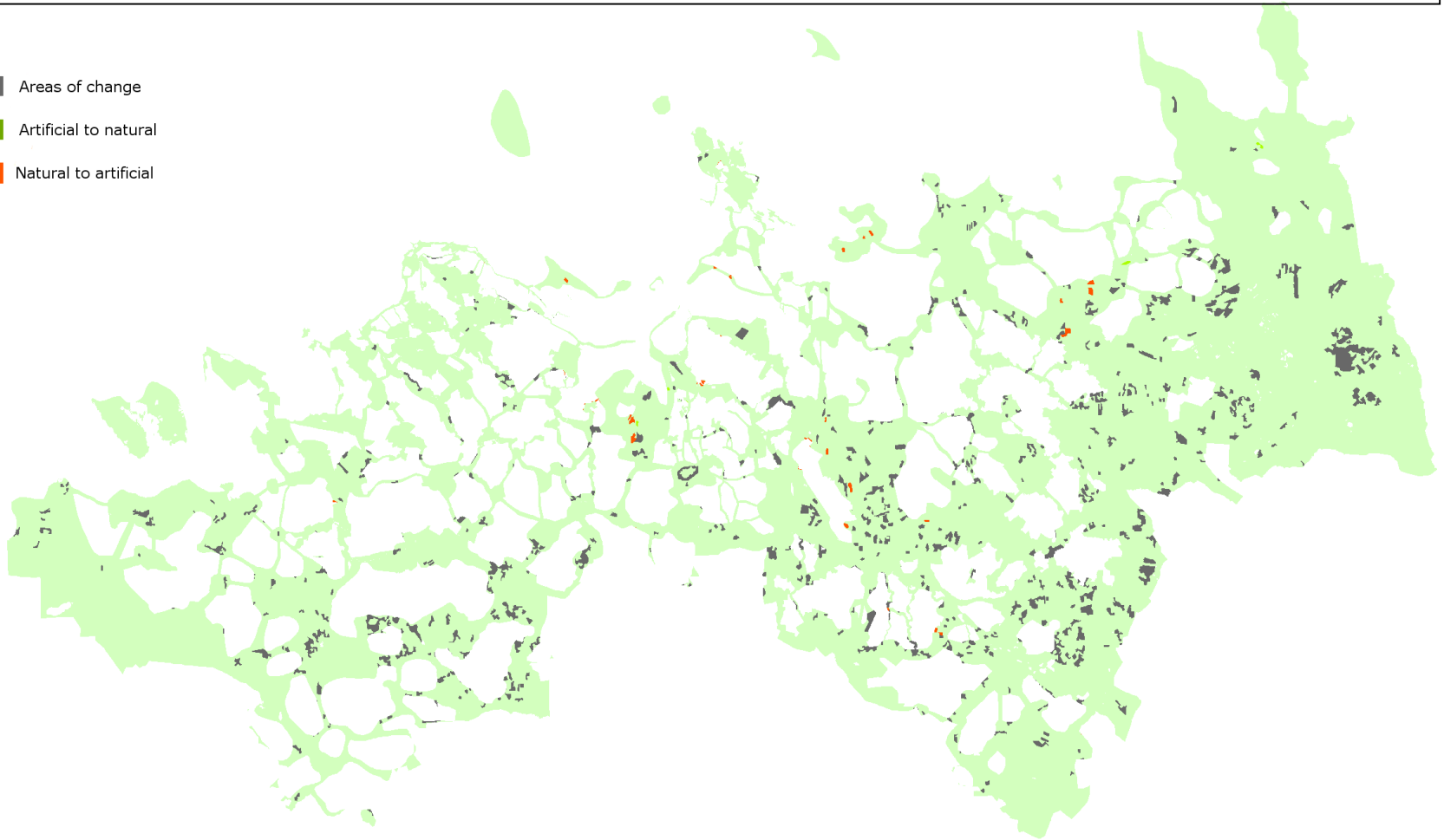
HENDRIKSON & KO

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CHANGES IN LAND COVER (2006-2012)

- Areas of change
- Artificial to natural
- Natural to artificial

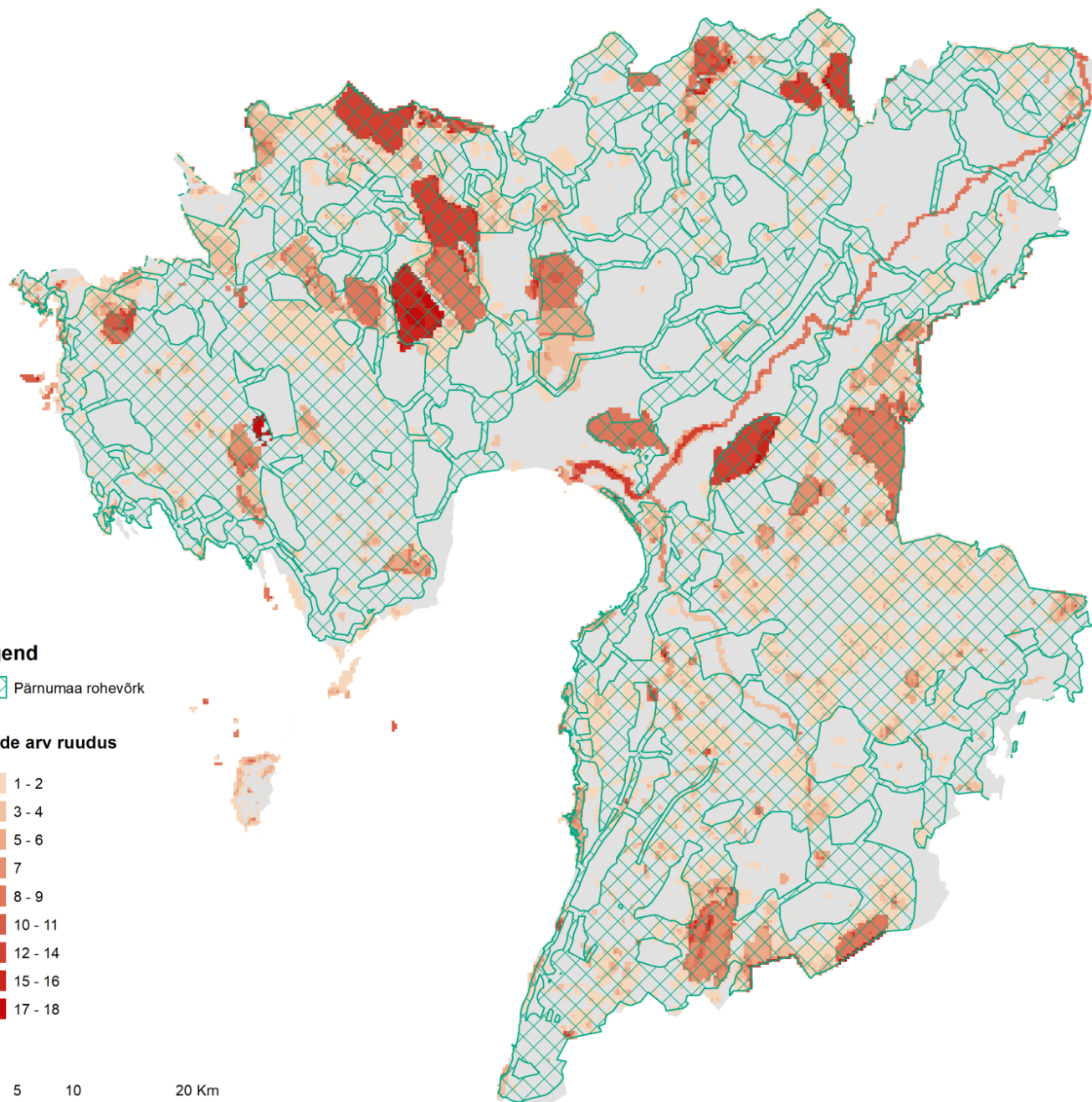


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Artificial to natural	46 ha
Natural to artificial	310 ha
Total amount of change	12010 ha

Connectivity of Green Network GUIDOS

	100 m edge	500 m edge
Size of biggest core patch	1367 km ²	862 km ²
N of cores	168	124
National core areas (>30km ²)	5	5
Regional large core areas (5-30km ²)	20	13
Regional small core areas (<5km ²)	143	106
N of perforations	161	47
N of corridors	242	71
N of branches	541	2667
(includes stray pixels)		
N of loops	62	33
N of islets	26	78



Legend

 Pärnumaa rohevõrk

Liikide arv ruudus

-  1 - 2
-  3 - 4
-  5 - 6
-  7
-  8 - 9
-  10 - 11
-  12 - 14
-  15 - 16
-  17 - 18

0 5 10 20 Km



HENDRIKSON & KO



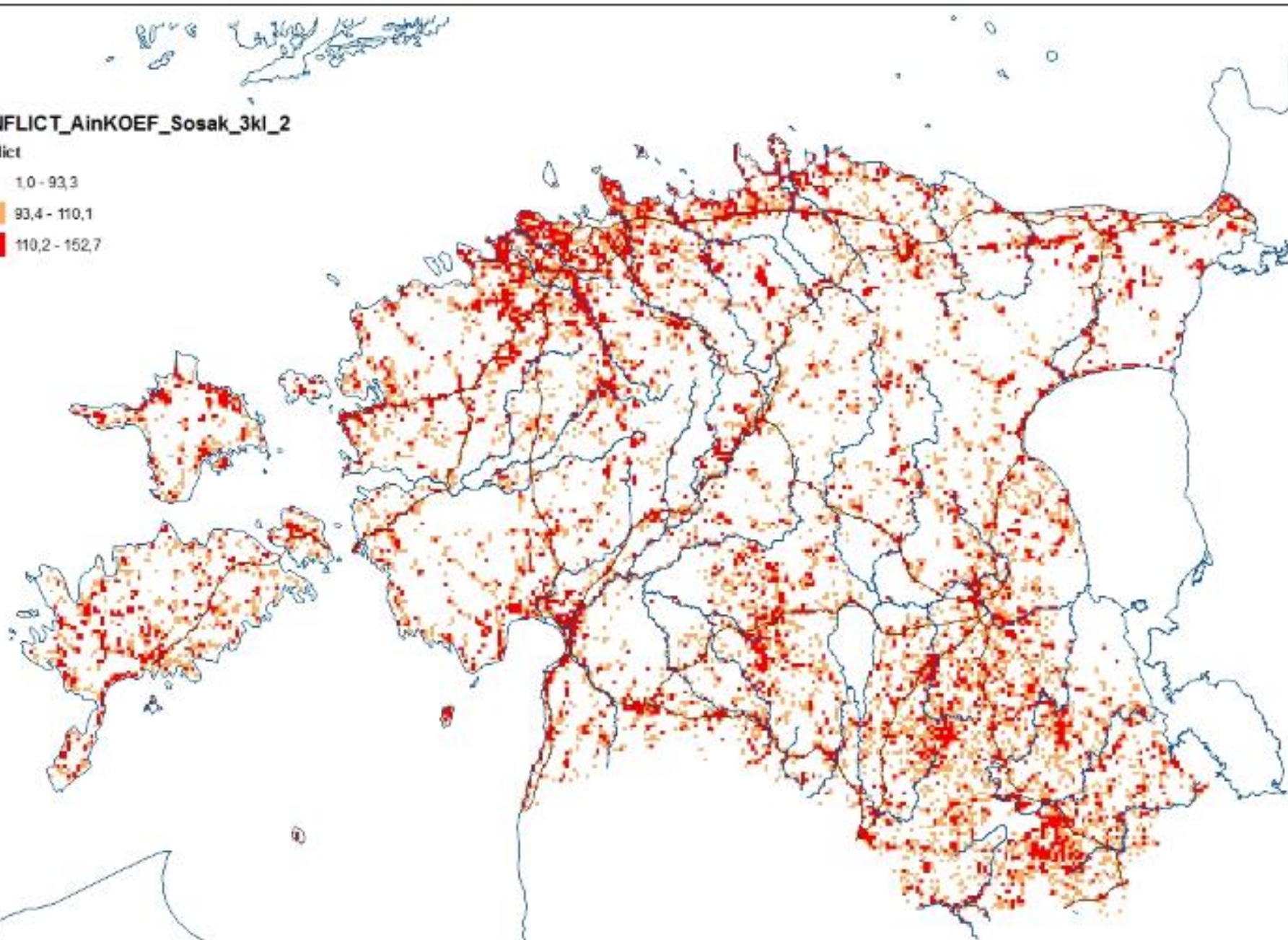
CONFLICT_AinKOEf_Sosak_3kl_2

Conflict

1,0 - 93,3

93,4 - 110,1

110,2 - 152,7



LESSONS LEARNT

- A **wide interpretation** of the concept of Ecological Networks has advantages:
 - to guarantee the naturally and environmentally grounded space structure, which should guarantee sustainable development in the whole country (Ecosystem services, maintaining ecological functions at the landscape scale).
- **Different sectors/stakeholders** (forestry, agriculture, transport, recreation) and interest groups, including local inhabitants are involved through spatial planning.
- **Implementation mechanisms** should be developed and defined in the frame of the spatial planning.
- **Green** and **Grey Infrastructure** need to be planned together – with equal priority.

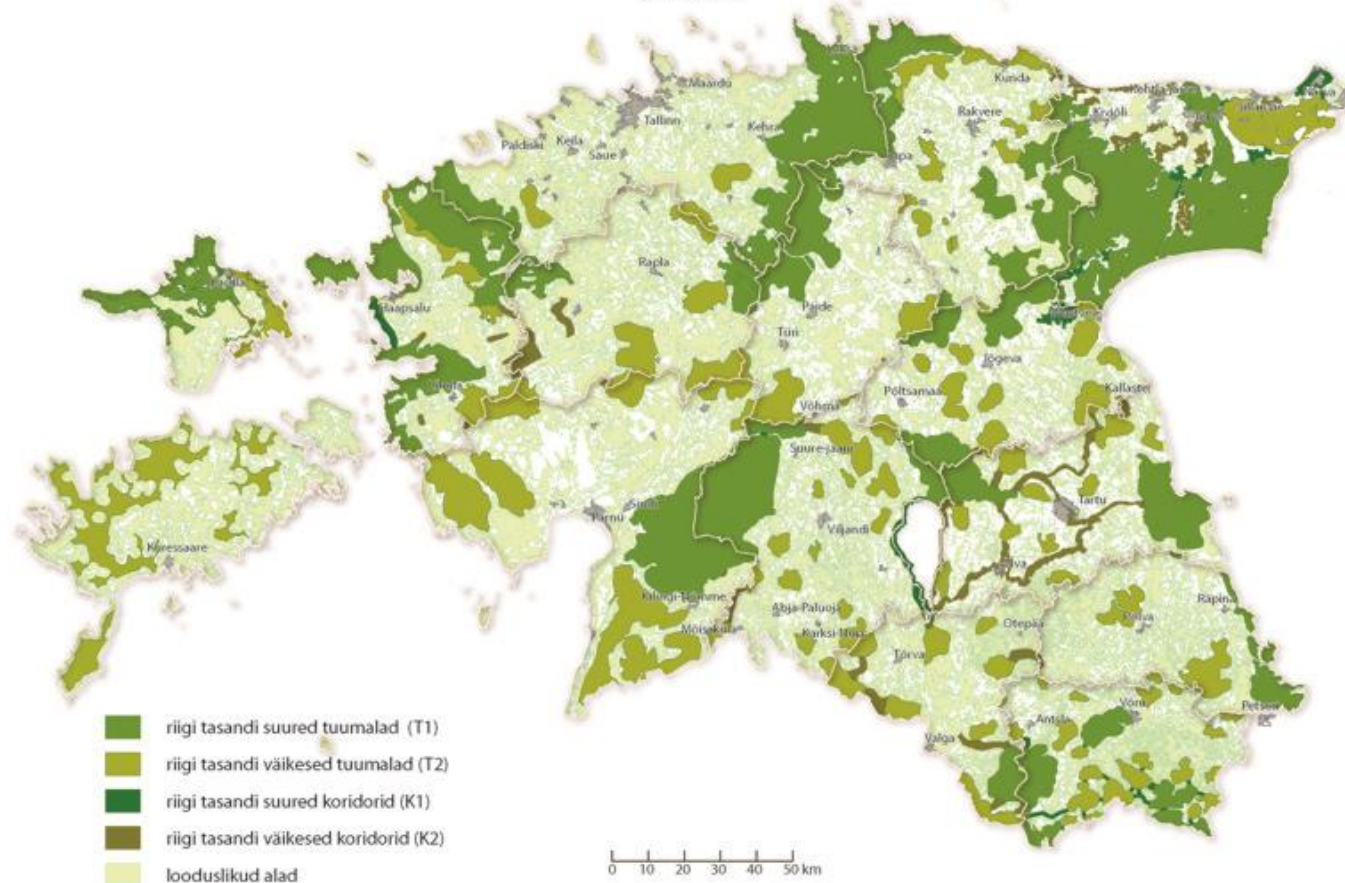
LESSONS LEARNT

- The practice shows that the actual implementation of the requirements has been very different among the cases. **Many implemented measures are weak. Mapism!**
- We should **enhance existing methodologies** (municipality level) in defining green (ecological) networks.
- We need criteria for evaluating functioning of Ecological network. **Monitoring!**
- There is a need for practical advice on implementation and for **involving stakeholders**, supported by direct, open and flexible communication.

ESTONIA 2030 – GREEN INFRASTRUCTURE

(SEPP. JAGOMÄGI 2011)

Eesti rohelse võrgustiku tuumalad ja koridorid
1:1500 000



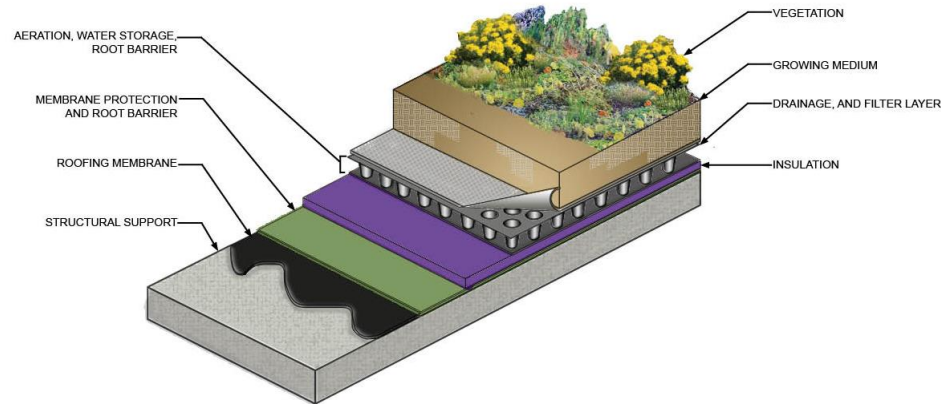
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WHY A GREEN INFRASTRUCTURE?

- The [Sixth Ministerial Conference](#) "Environment for Europe" in Belgrade in [2007](#) represented a watershed for the development of a Pan-European Ecological Network - [Green infrastructure](#) since then.
- [Loss](#) of landscape [connectivity](#): a new serious threat to further survival of many wildlife species.
- Changes in nature conservation approaches: Species protection ➤➤➤ Habitat conservation ➤➤➤ [Managing the connectivity](#) (agricultural landscape, forest, rtc)
- Multi-functionality of the Green Infrastructure: [climate change](#), [ecosystem services](#) etc
- [Greening](#) urban planning, road constructions etc.

WHY A GREEN INFRASTRUCTURE?



In Urban areas Green infrastructure reduces....

- Flooding
- Erosion
- Stormwater runoff volume
- Stormwater pollutant loadings
- Gray infrastructure operation, maintenance, energy and treatment costs

WHAT IS GREEN INFRASTRUCTURE?

Green Infrastructure is about maintaining, strengthening and restoring ecosystems – investments that often provide multiple benefits.

It should explicitly serve the following purposes:

(1) Strengthening the **functionality** of ecosystems for continued delivery of goods and services.

This includes increasing the resilience and restoration of ecosystems and the maintenance of water and carbon cycles.

(2) Combating biodiversity loss by increasing spatial and functional **connectivity** between existing natural areas and improving landscape permeability.

GREEN INFRASTRUCTURE COMPONENTS

- a) **Healthy ecosystems** inside and outside a coherent network of protected areas (Natura 2000) with their buffer zones; such as floodplain areas, wetlands, extensive grasslands, coastal areas, natural forests etc.;
- b) **Multifunctional zones** where the way land is used helps maintaining or **restoring** healthy ecosystems.
- c) Natural **landscape features** such as small water courses, forest patches, hedgerows which can act as eco-corridors or stepping stones for wildlife.



GREEN INFRASTRUCTURE COMPONENTS

- e) **Artificial features** such as eco-ducts or eco-bridges, or permeable soil covers that are designed to assist species movement across insurmountable barriers (such as motorways or paved areas).
- g) Areas where measures are implemented to improve the general ecological quality and **permeability** of the landscape.
- h) **Urban elements** such as biodiversity-rich parks, permeable soil's cover, green walls and green roofs, hosting biodiversity and allowing for ecosystems to function and deliver their services. This should also connect urban, peri-urban and rural areas.



EU actions:

- GI integration into EU policies and implementation
- GI integration into EU funding mechanisms and access to alternative funding
- Research on value of biodiversity and ecosystem services
- Collection of GI initiatives – analyzing impacts, costs & benefits
- GI strategic goal and indicators
- Communication, participation, and education

- Provide and promote a GI framework and goals for stronger EU coherence
- Providing best practices, experiences and guidance.
- Communication and education
- Promoting stakeholder involvement

- Promote interregional and regional GI
- Advise on GI integration into EU funded operational programmes
- Providing best practices, experiences and guidance

- Funding of targeted local actions underpinning GI

Targeted levels:

EU

National

Interregional

Regional

Local

PRACTICAL SOLUTIONS



INTERCONNECTED NETWORK OF GI AT ALL SPATIAL SCALES



CITY GI

- Main Watercourses
- National Cycle Network
- Greenways
- Country Parks
- Flood Alleviation Schemes
- Major Historic Sites



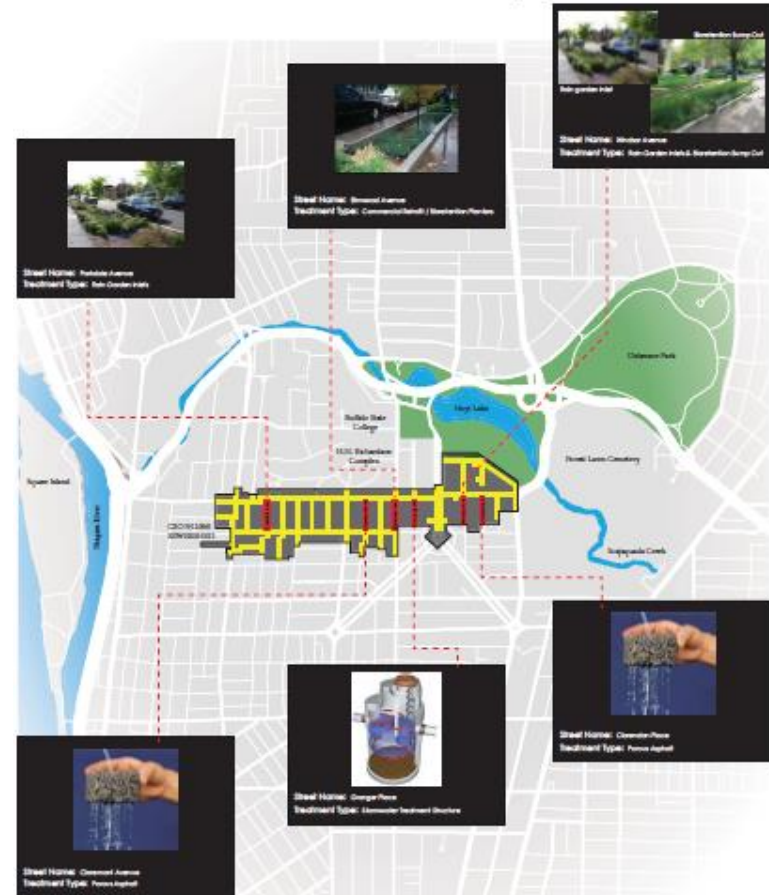
LOCAL GI

- Watercourses
- Public Parks
- Pedestrian Paths and Rights of Way
- Conservation Areas
- Road and Rail Corridors/Verges



SITE GI

- Domestic Gardens
- Footpaths
- Sustainable Drainage Systems
- Trees, Hedges and Ponds
- Allotments
- Green Roofs
- Cemeteries and Churchyards



WHAT IS GREEN INFRASTRUCTURE?

- Green Infrastructure is a strategically planned and delivered network of high-quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering a wide range of environmental and quality of life benefit local communities.
- Green Infrastructure includes forests, rivers, coastal zones, parks, eco-corridors and other natural or semi-natural features which constitute key elements for the provision of ecosystem services.

GREEN INFRASTRUCTURE

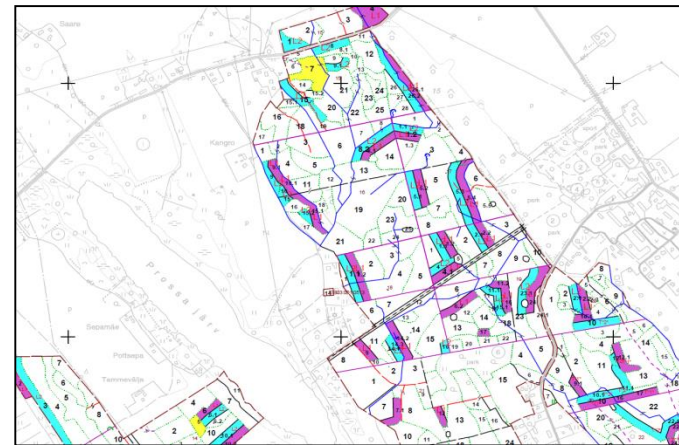
- Linking ecological networks to spatial planning at different geographical scales can therefore be seen as a key to effective delivery in the future.
- This is not only because of the obvious functional relationship between ecological networks and other forms of land use and infrastructure but also because delivering the concept through the vehicle of spatial planning is one of the main mechanisms for sectoral integration

GREEN INFRASTRUCTURE

- Green Infrastructure planning should be collaborative and interdisciplinary, combining a wide **range of skills** and **funding**
- **Green** and **Grey** Infrastructure need to be planned together – with equal priority.
- Coordinated and **integrated spatial planning** is **essential** to the success of GI.

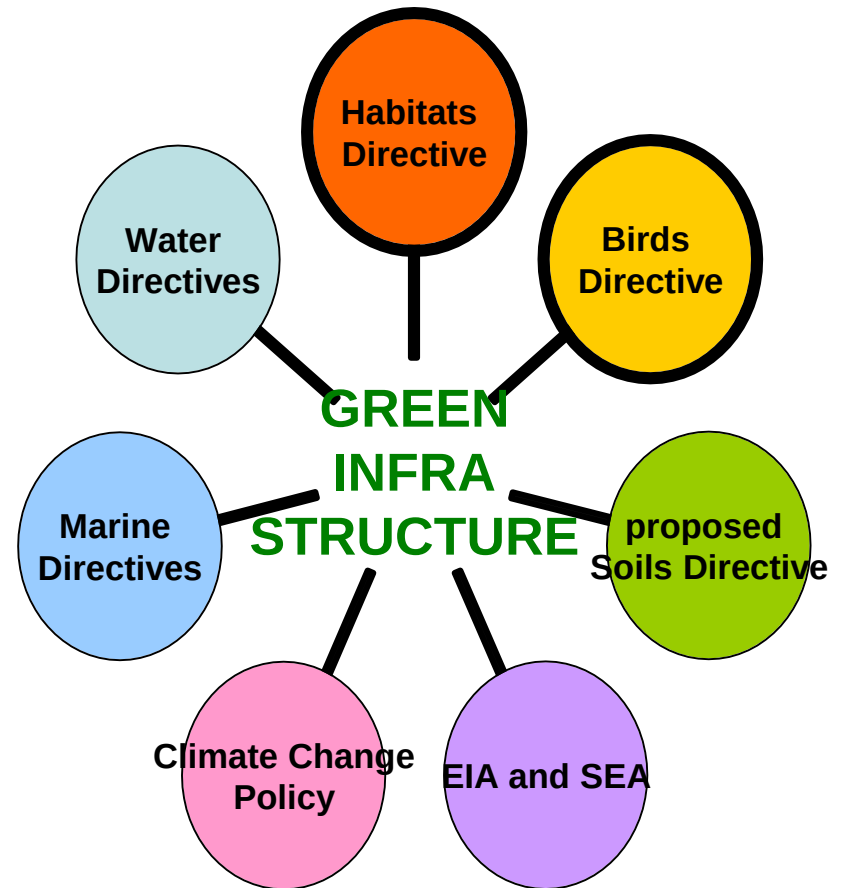
PRACTICAL SOLUTIONS

- Spatial planning
- Scales - Hierarchy
- Management measures
 - agricultural landscapes
 - forest management
 - protected areas,
 - green solutions for urban environment
 - quarries,
 - roads, rivers

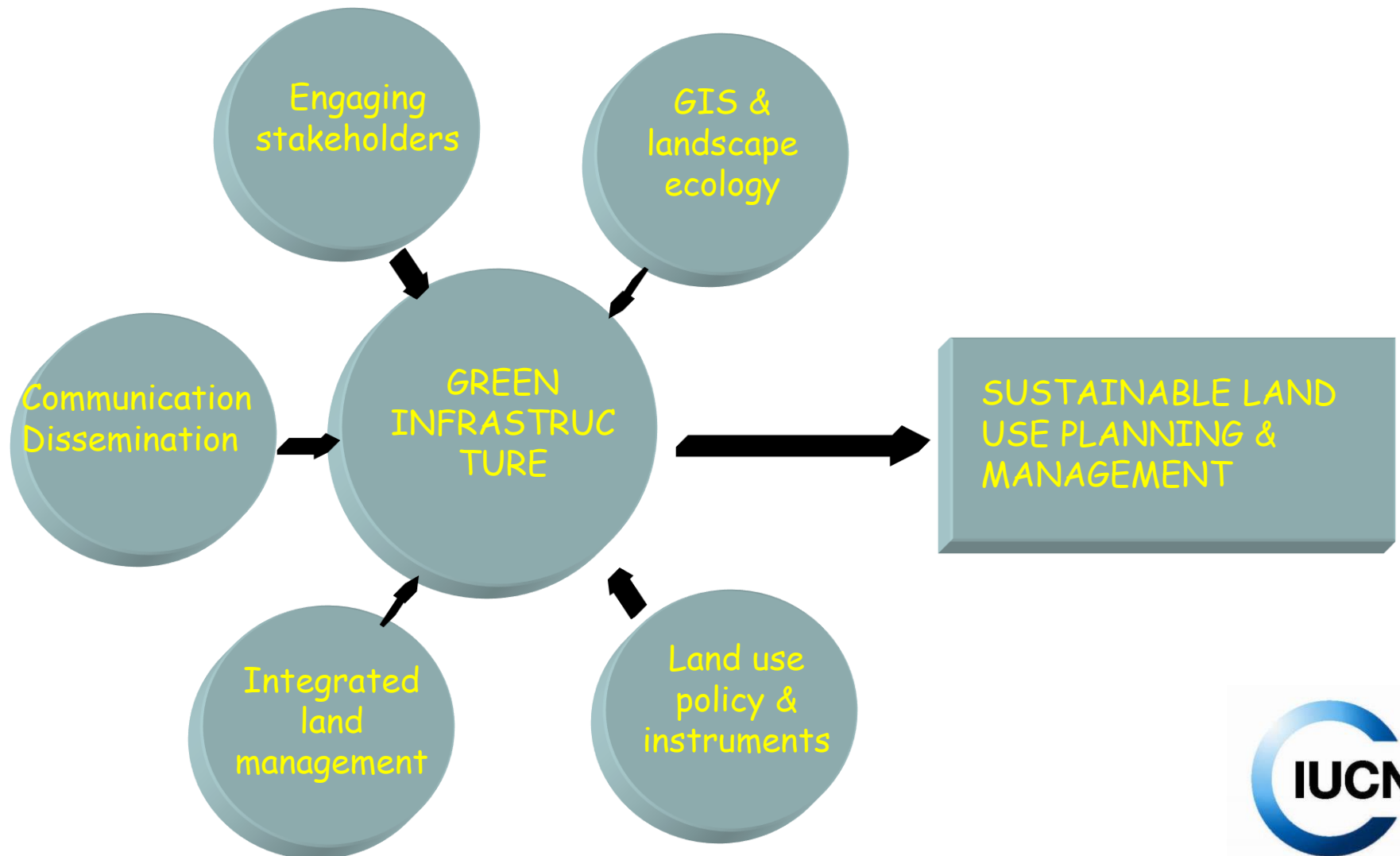


GREEN INFRASTRUCTURE

- Successful delivery of GI needs **cross-sectoral integration** into all relevant land-use policies is essential for sustainable development.
- GI is in the interest of a number of EU Commission Directorates.



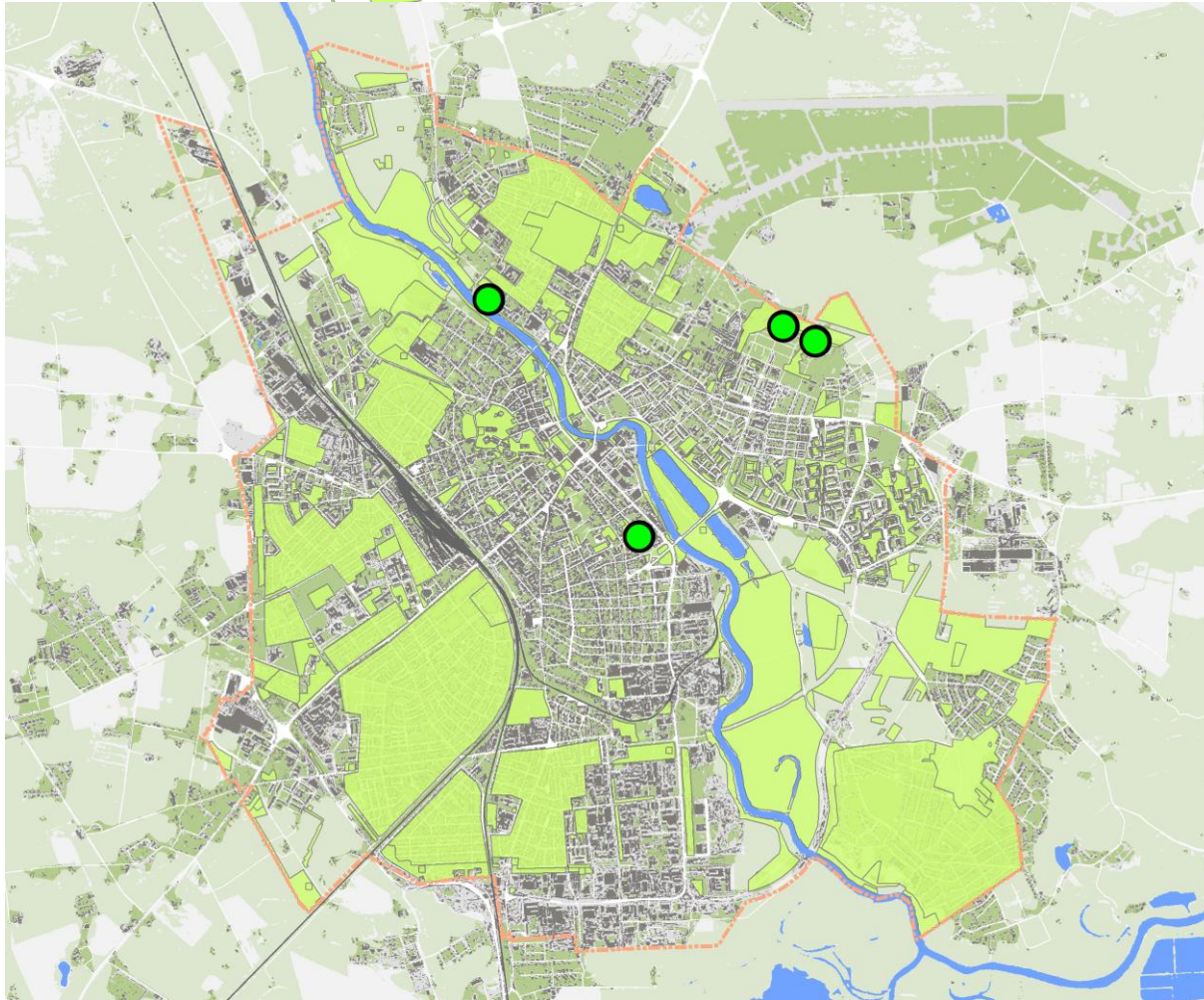
GREENWAY AND ECOLOGICAL NETWORK PLANNING: COOPERATION BETWEEN SCIENCE, POLICY AND SOCIETY



ONGOING & FUTURE ACTIONS

- EC Communication (Green Paper), 2012 **GI Strategy**.
- Improvement of the implementation of existing **legislation**, assess new legislation possibilities, integrate approach into **funding schemes** (e.g. Regional Policy for sustainable growth in Europe 2020 COM).
- **Guidance** for Green Infrastructure implementation and financing, based on experiences ("tool box").
- Step up **research** to better understand how it works
- **Communication** to targeted stakeholders and the general public (training, citizen participation, innovative financing and capacity building).
- Promoting **integrated spatial planning** as a required tool to implement Green Infrastructure.

A multifunctional perspective of urban green networks



INTERNATIONAL UNION FOR CONSERVATION OF NATURE



DYNAMIC



CONNECTED

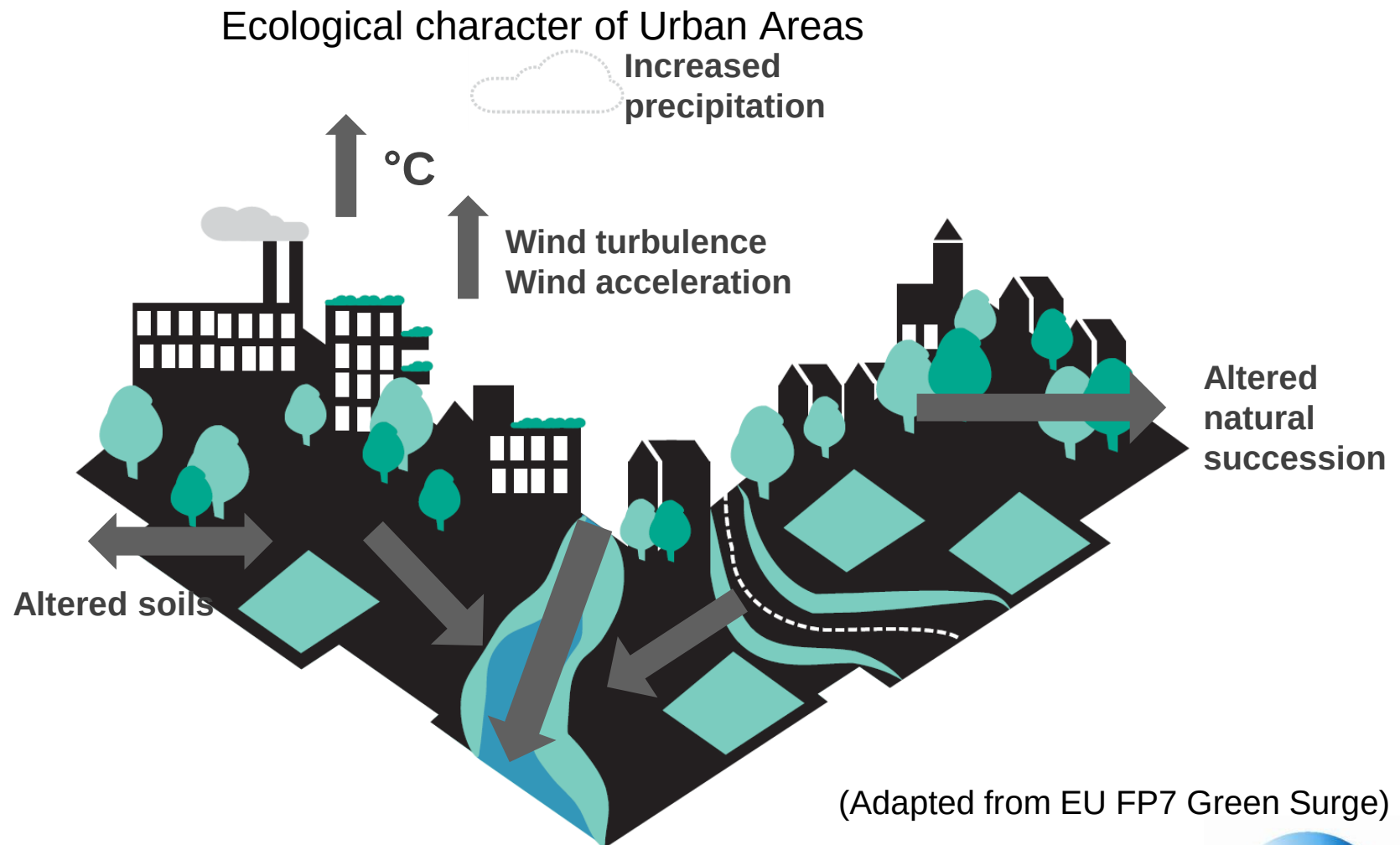


OPEN



INTERNATIONAL UNION FOR CONSERVATION OF NATURE





(Ideal) Urban Green Network Core Principles

- Green – Grey integration
 - Connectivity
 - Multifunctionality
- 



TRENDS in Ecology & Evolution

What is green?

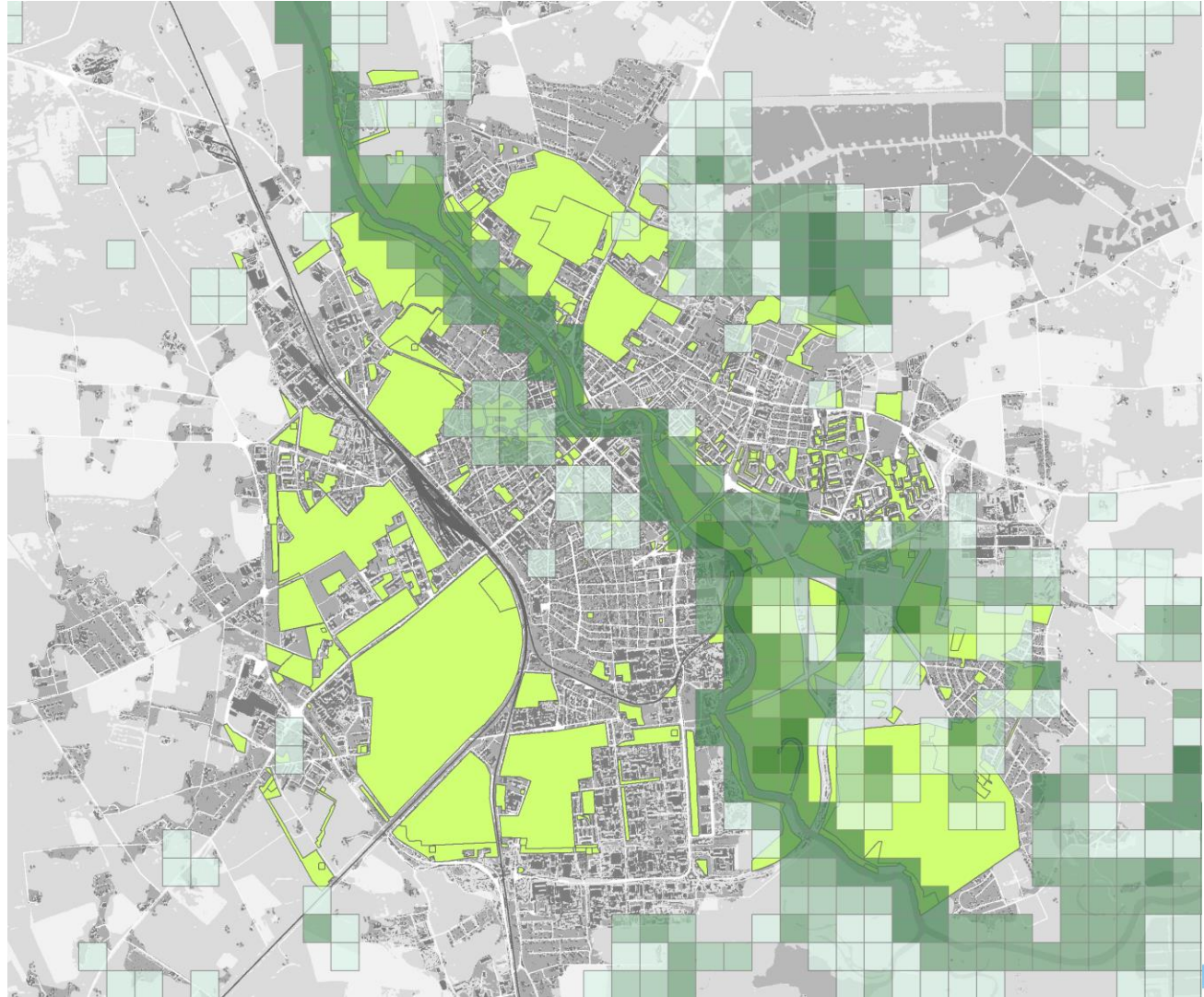
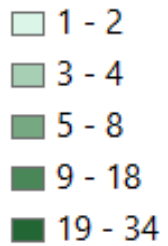


INTERNATIONAL UNION FOR CONSERVATION OF NATURE

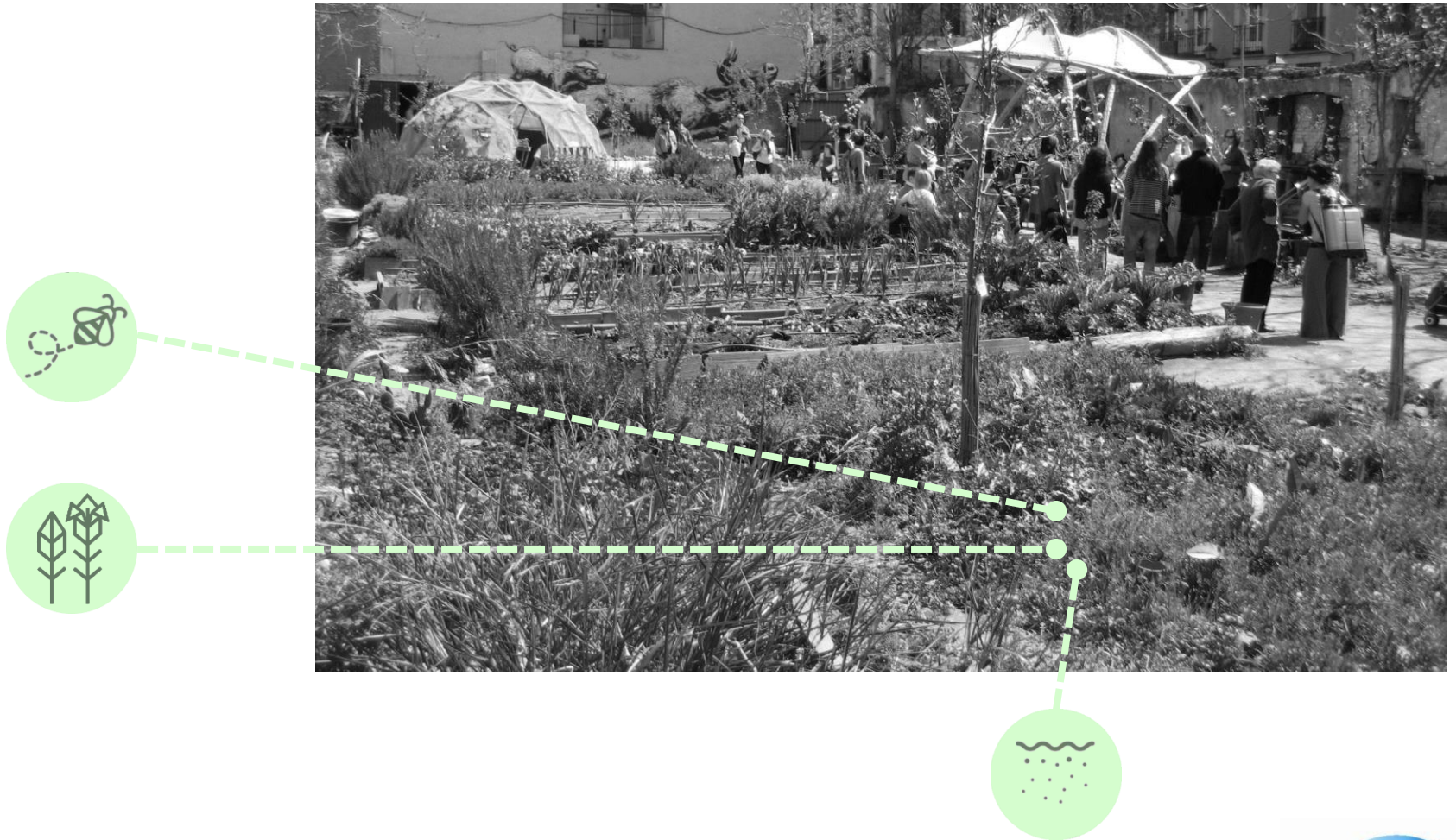


Biodiversity Anything left?

Protected species



Plant species diversity

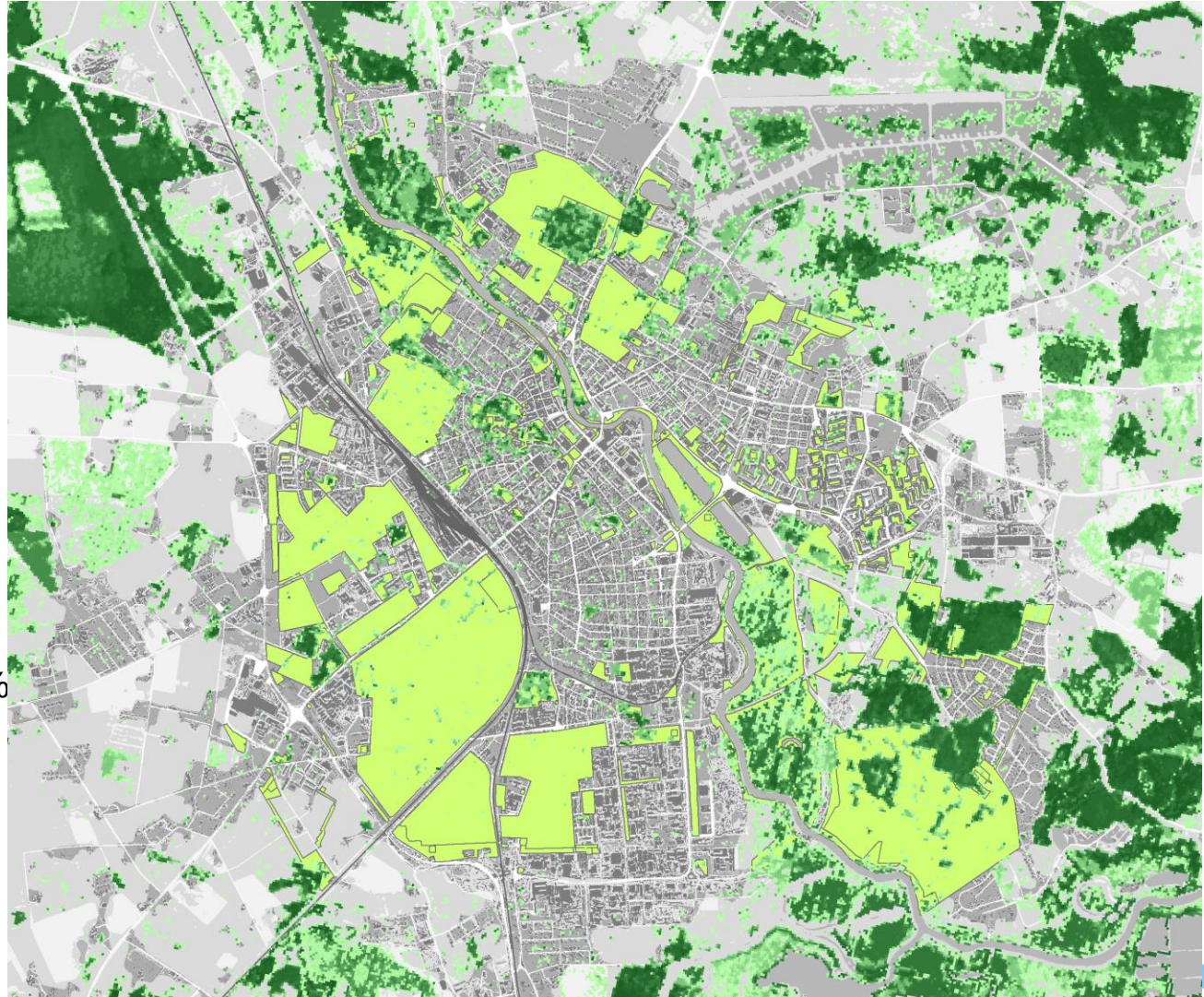
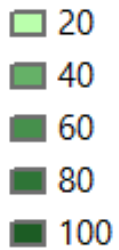


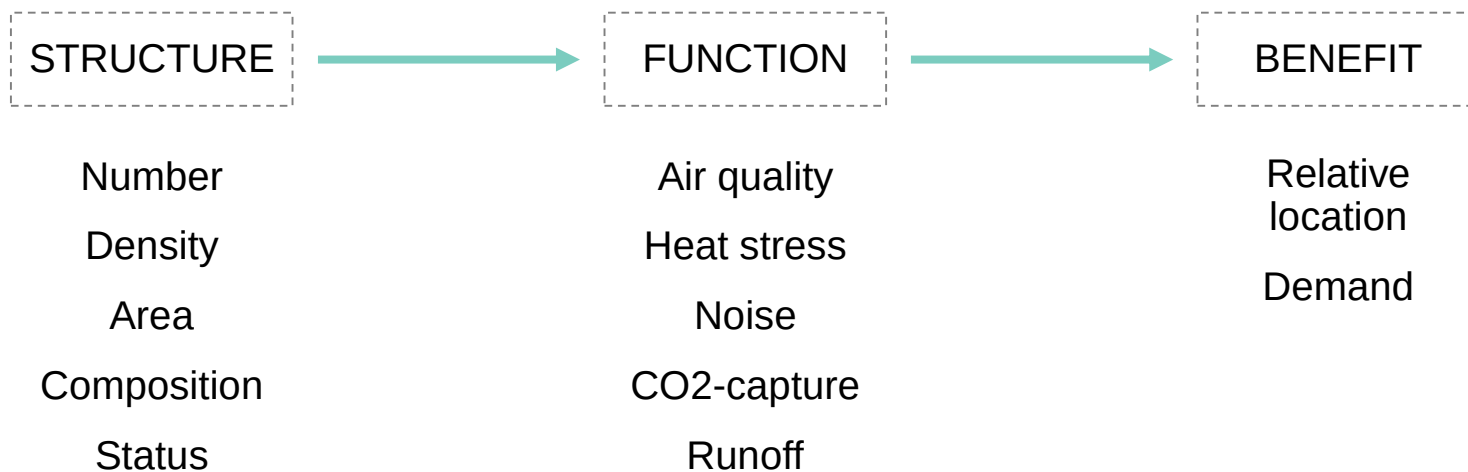
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Tree density

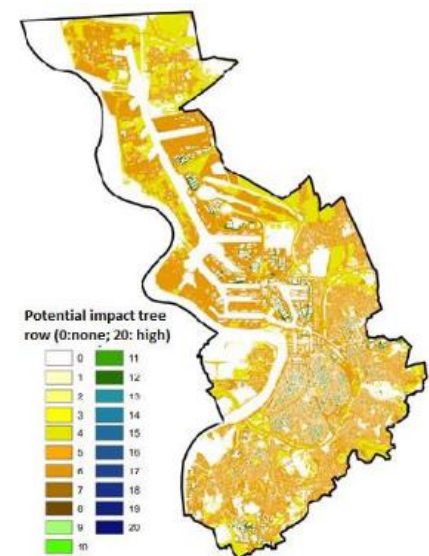
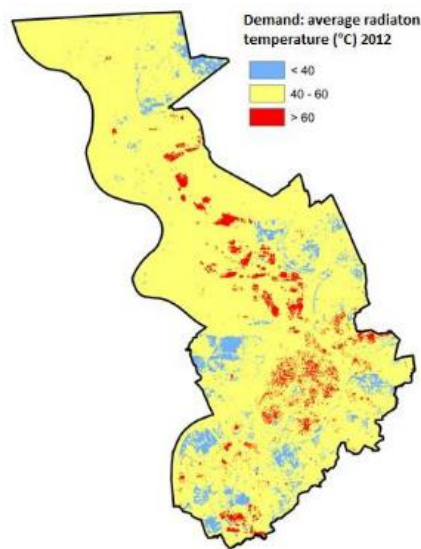
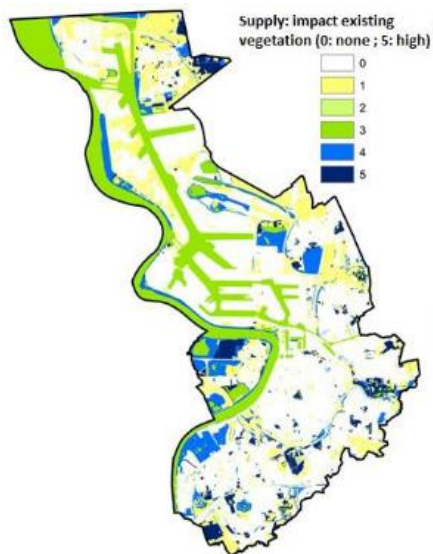
Tree cover density (%)



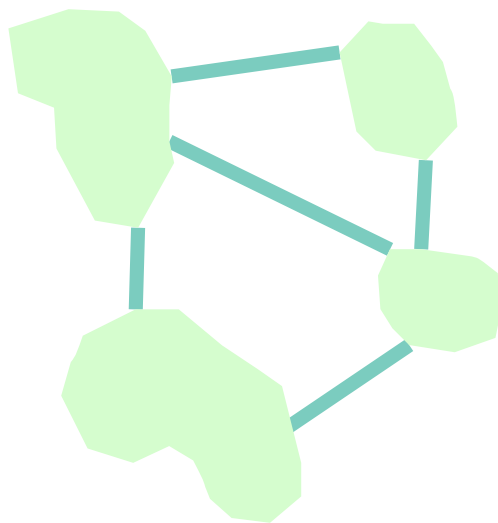


Antwerp, Belgium

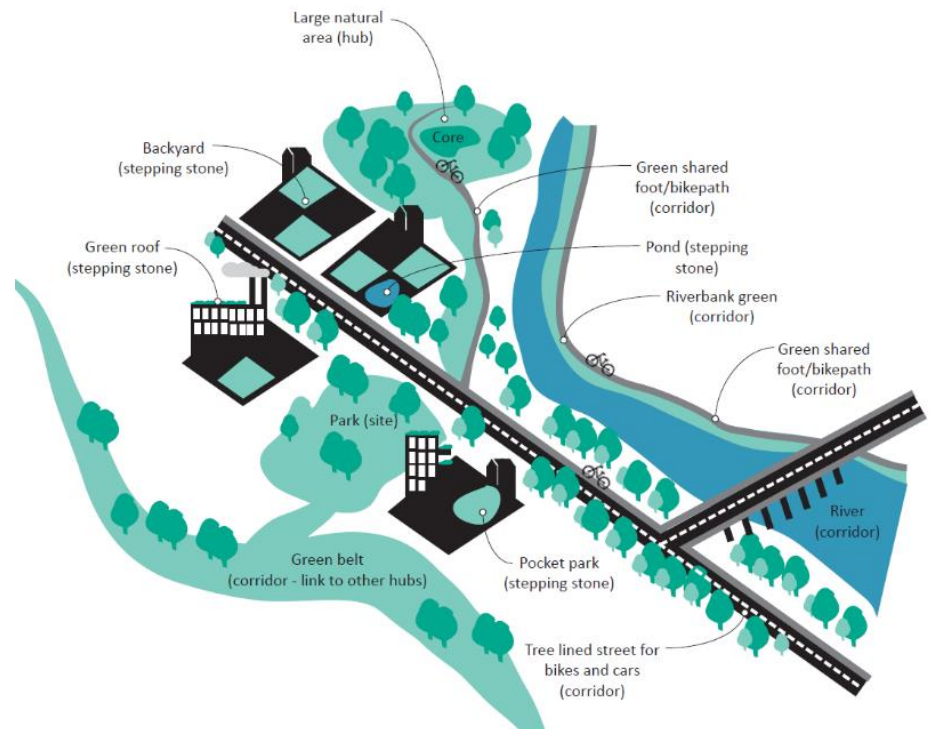
GreenTool



STRUCTURAL CONNECTIVITY



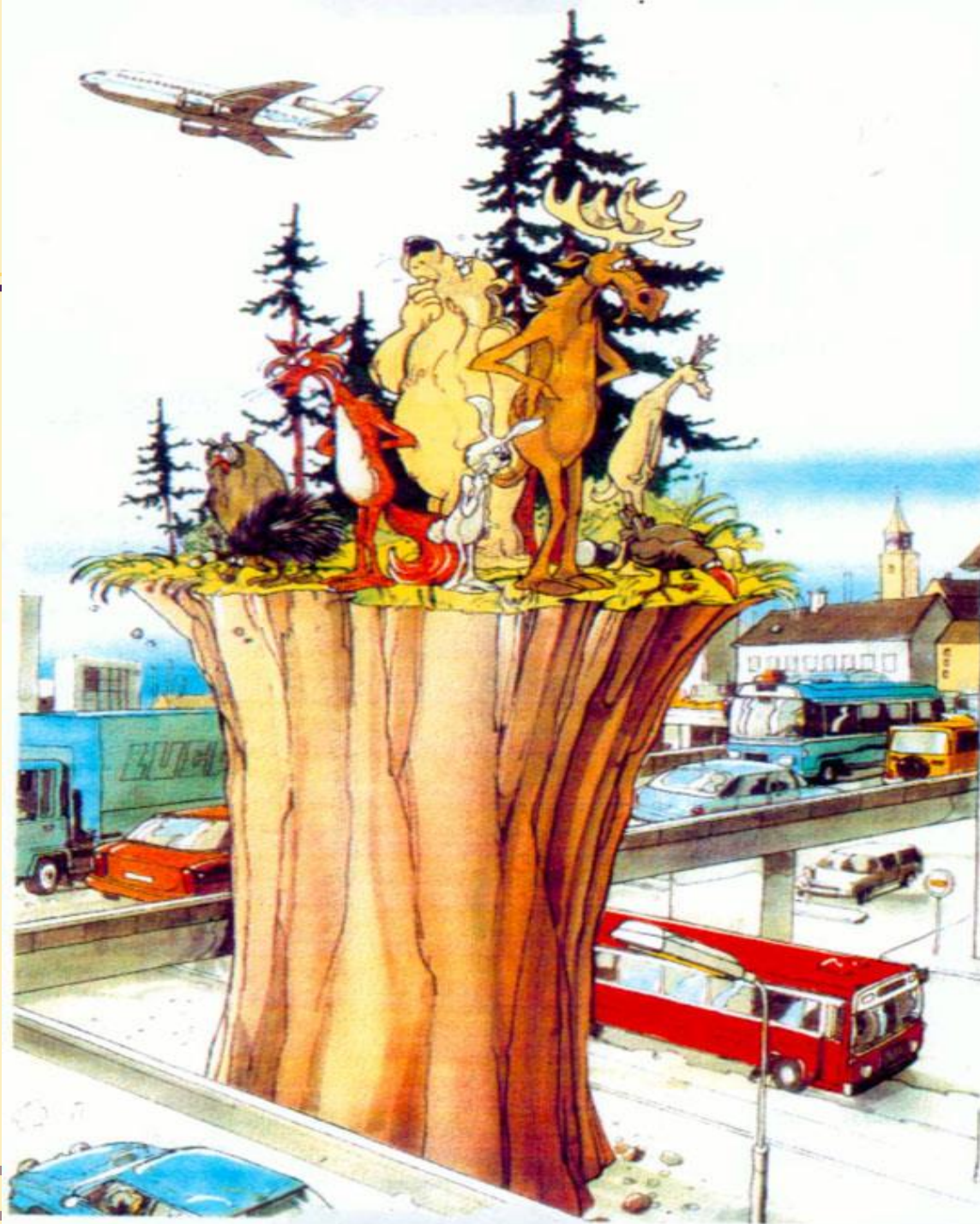
FUNCTIONAL CONNECTIVITY



(Eleanor Chapman, EU FP7 Green Surge)

CONCLUSIONS

- Land and Climate changes have a serious impact on the ecological functioning of the landscape.
- The impacts depend on the geographical position, on-going changes, characteristics of the region and the environmental conditions.
- A systematic approach looking at the whole landscape to define how the green infrastructure should be designed.
- The ecological knowledge required consists of spatio-temporal population models, quality of living environment.
- No Ecological network development without local and regional involvement and agreement, stakeholders!



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Thank You!!