...enabling us to live with opportunities offered by nature

GREEN INFRASTRUCTURE AND CONNECTIVITY ASSESSMENT ON LANDSCAPE OR MUNICIPAL LEVEL

green infrastructure
networks of nature

ConnectGREEN
29/09/2021. Visegrád

Interreg
Danube Transnational Programme

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SZÉCHENYI 2020

HUNGARIAN GOVERNMENT

European Union
European Regional Development Fund

INVESTING IN YOUR FUTURE

THE PROJECT

A national programme of state nature conservation

Strategic Assessments supporting the long term conservation of natural values of community interest as well as the national implementation of the EU Biodiversity Strategy to 2020

KEHOP-4.3.0-VEKOP-15-2016-00001 project

Beneficiary: Ministry of Agriculture

Partners:

- Centre for Ecological Research of the Hungarian Academy of Sciences
- Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research of the Hungarian Academy of Sciences
- Research Institute for Agricultural Economics
- Department of Geodesy, Remote Sensing and Land Offices under the Government Office of the Capital City Budapest
- Hortobágy National Park Directorate
- Kiskunság National Park Directorate

colourful green
my nature

Timeframe: Oct. 2016 – Oct. 2017, project preparation
Nov. 2017 – Dec. 2020, implementation

Budget: HUF 1,07 billion (EUR 3,45 million)

Funding: 85% ERDF + 15% national

BACKGROUND

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- **Our life insurance, our natural capital: an EU biodiversity strategy to 2020**
  Target 2 incorporates the global target agreed by EU Member States and the EU in Nagoya to restore 15% of degraded ecosystems by 2020.
  Target 2 focuses on maintaining and enhancing ecosystem services and restoring degraded ecosystems by incorporating green infrastructure in spatial planning.

- **EU Biodiversity Strategy for 2030 - Bringing nature back into our lives**
  At least 10% of agricultural area is under high-diversity landscape features.
  At least 25% of agricultural land is under organic farming management, and the uptake of agro-ecological practices is significantly increased.
  In Hungary the 10% reduction would mean 427,000 ha of arable land alone being taken out of production.

  Legally protect a minimum of 30% of the EU's land area and 30% of the EU's sea area and integrate ecological corridors, as part of a true Trans-European Nature Network.
  Natura 2000 and protected areas in Hungary: 21,4%, Missing: 7.8% protected area.

  Cities with at least 20,000 inhabitants have an ambitious Urban Greening Plan.
  Area: 962 thousand ha. This is 81 municipalities, 10.3% of the country's area.

SCALES OF GI RESEARCH

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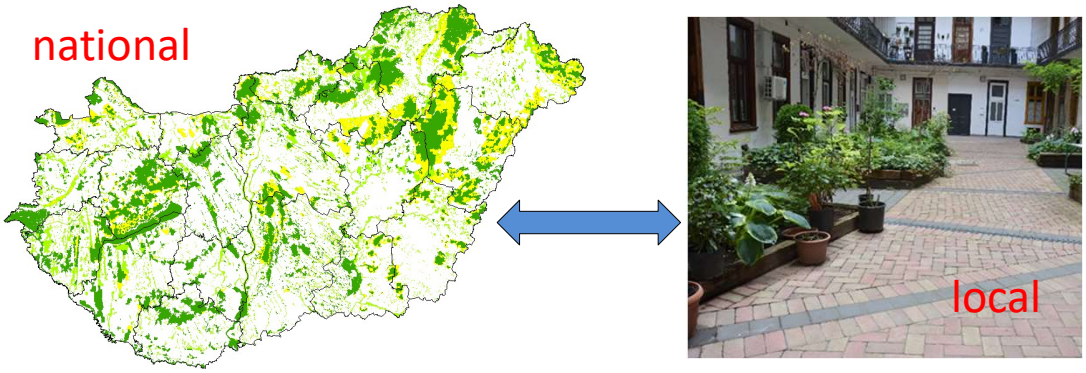
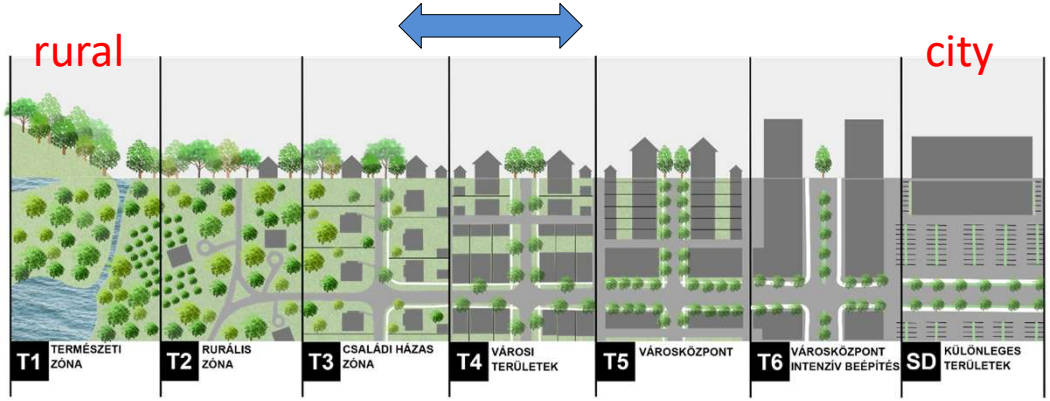
1) Vertically, from national to local scale



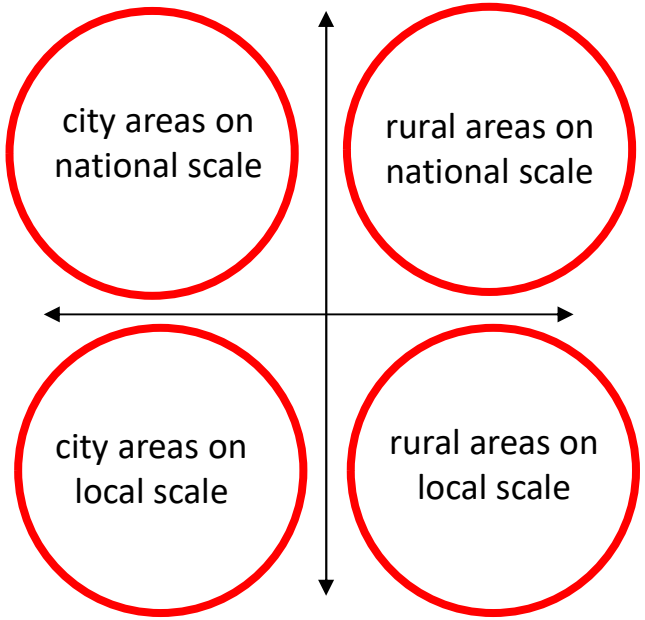
Ecological networks, forest, pastures, agricultural areas, waterways

Open space, alleys, public parks, gardens, greenbelt, geen roof and wall etc.

2.) Horizontally, from the countryside to the city



Green infrastructure is a **very wide term** covering from ecological network to green roof in cities everything.



METHODOLOGY ON MUNICIPAL OR LANDSCAPE LEVEL

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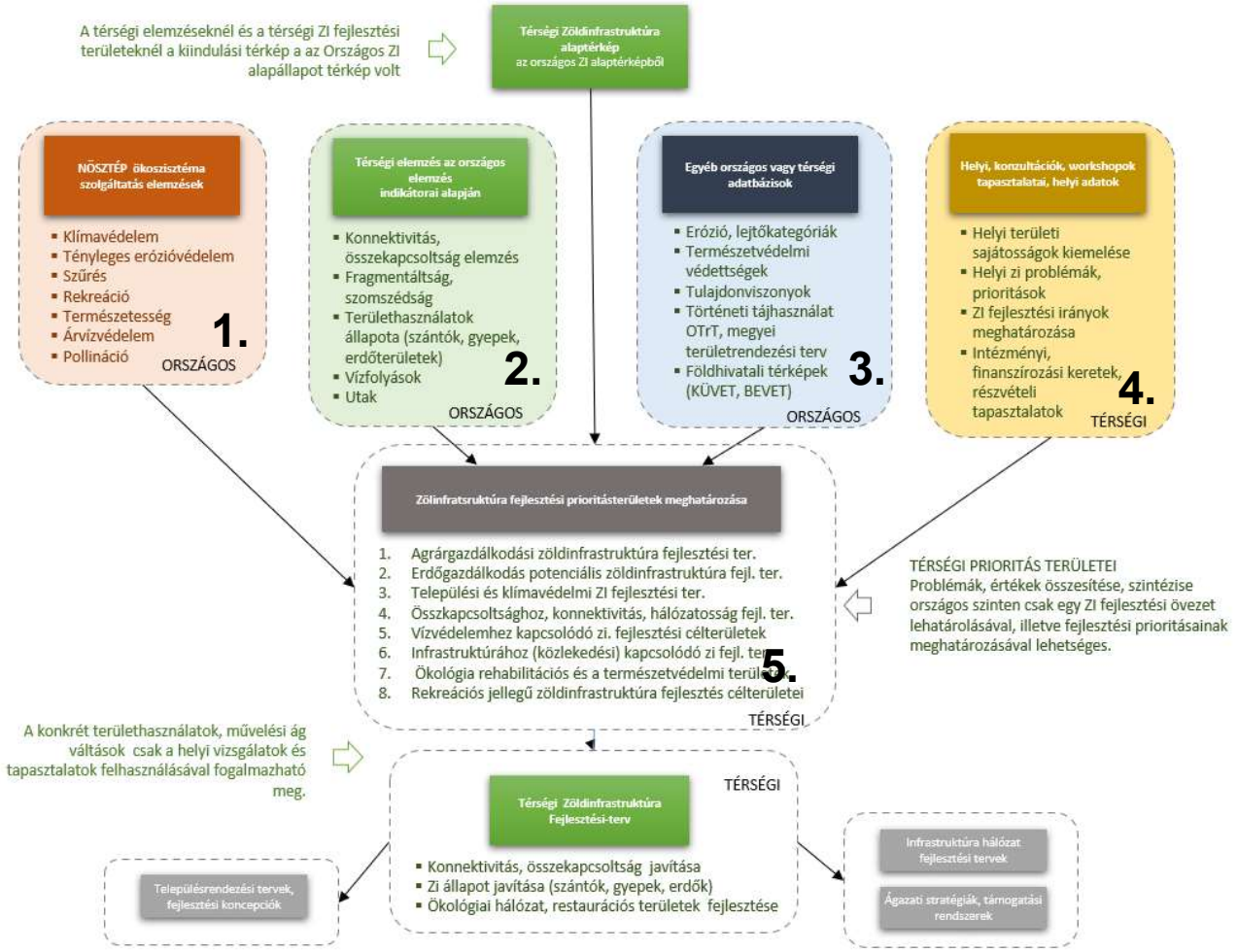
For planning at landscape scale, in addition to ecosystem service maps **(1.)** a number of indicators or conflict maps have been produced **(2.)** to help delineate green infrastructure areas. In addition historical maps, ownership maps, nature conseravtion maps are also available for planners **(3.)**.
Local, site survey are also extremely important data source **(4.)**



THE GREEN INFRASTRUCTURE BASE MAP

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The analyses were based on the national ecosystem basemap, which was complemented with a number of other databases (Copernicus data, OSM, data, water network etc.).
Tiny hedgerows and small wody elements are also well represented.

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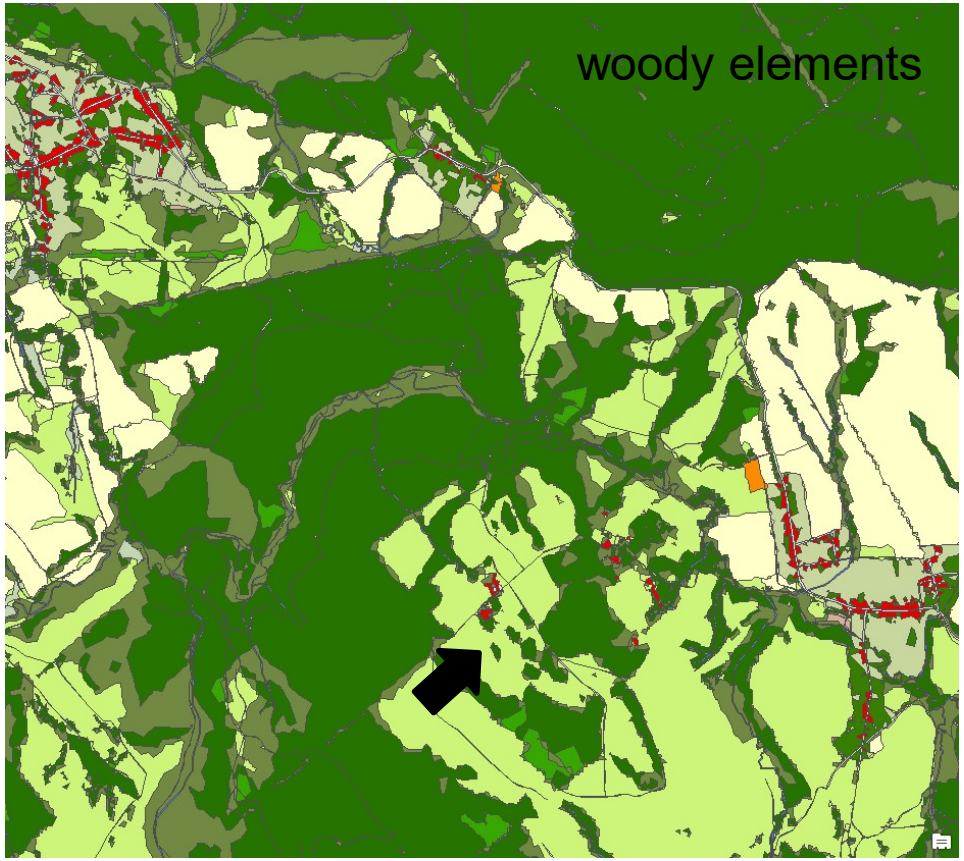

THE GREEN INFRASTRUCTURE BASE MAP

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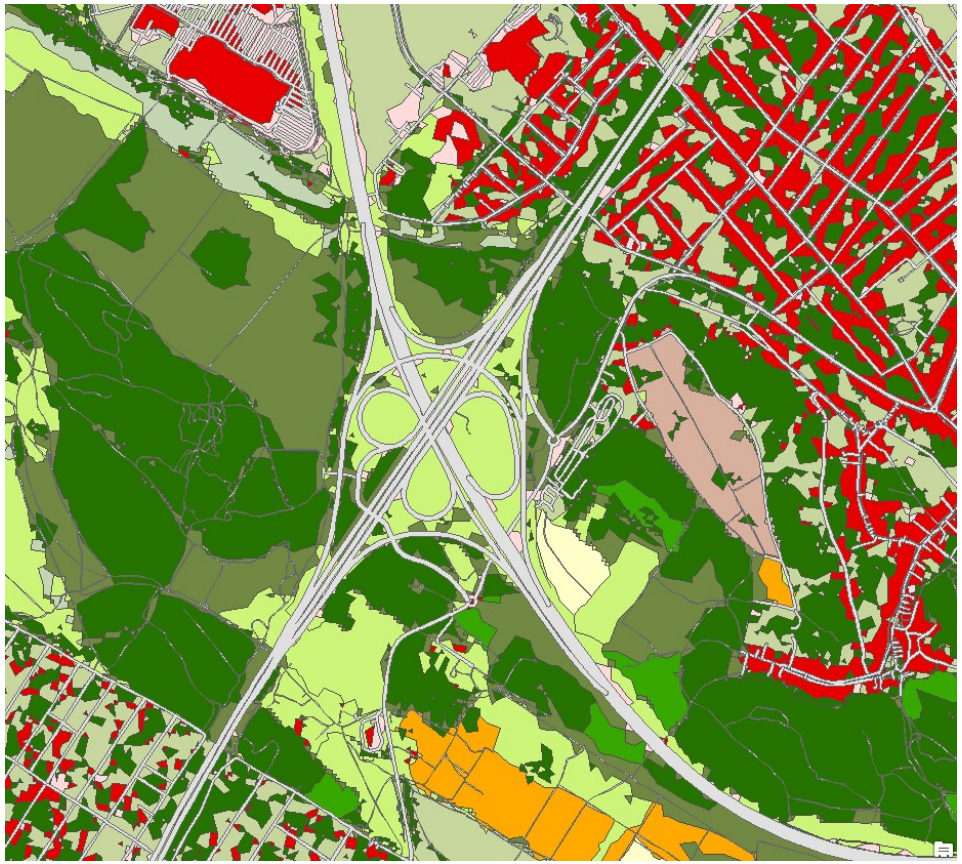
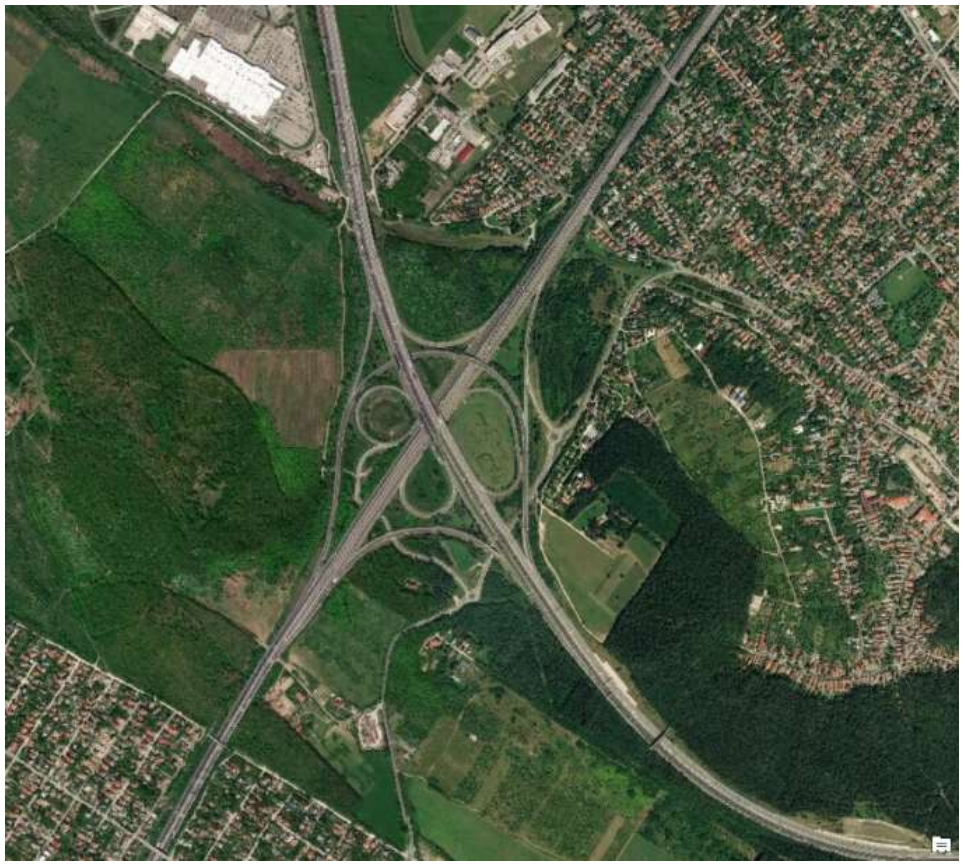
The map was enhanced with national road network and the OSM road network.





BIOLOGICAL ACTIVITY VALUE INDICATOR

FOR URBAN PLANNING

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Already in 2007, the indicator of the **biological activity value indicator** (BA) was introduced into the Hungarian town planning practice and legislation to prevent the quick land use intensification and degradation.

original plan

new spatial plan

The net value of the BA must not be reduced as a result of the design.

difference

More „red” areas and more „greens”, but the net amount of the BA indicator is 9,7 % higher on the new plan.

BIOLOGICAL ACTIVITY VALUE INDICATOR

FOR URBAN PLANNING

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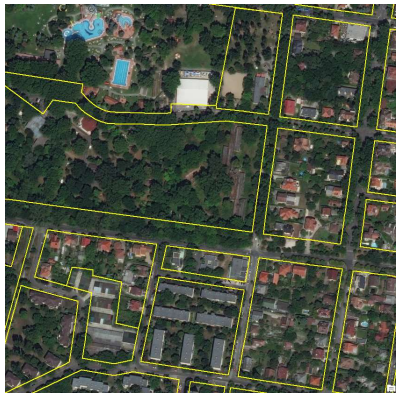
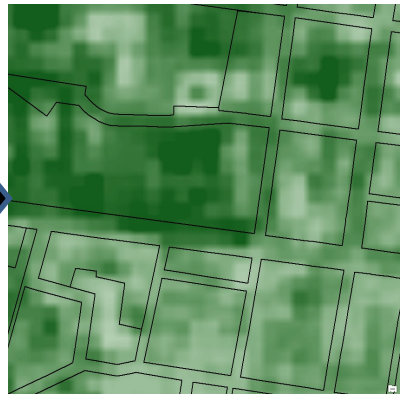
In the framework of the project, the BA value has been recalculated on the basis of NDVI and LAI values derived from modern satellite imagery, and now reflects the real biomass amount.

Land Use (Level 1)	Land Use (Level 2)	new BA Indicator (according to NDVI)
Wetland		69
Forests	Forests under water impact	84
	Natural riparian galleries	90
	Forests that are not dependent on excess water	85
	Tree plantation	85
	Woody vegetation	78
Grassland	Closed grassland in hill and mountainous areas	66
	Open rock grass	56
	Saline grassland	64
	Sandy grassland	59
Orchard, vineyard		61
Plow land		43
Green space in the settlement		66
Roads, areas along railways		52
Built-in urban areas		34

Vegetation type



NDVI counting by land use type



Biological activity indicator

GREEN INFRASTRUCTURE INDICATORS
FOR URBAN PLANNING

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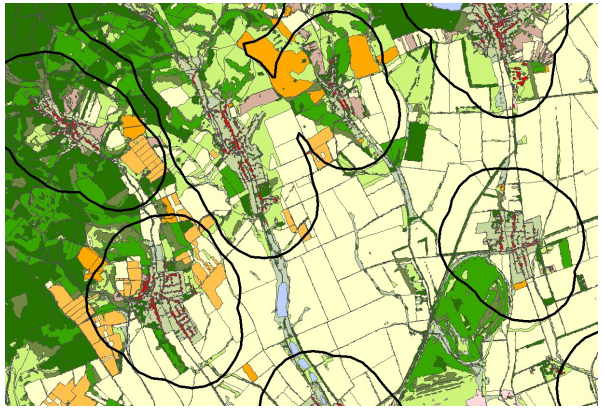
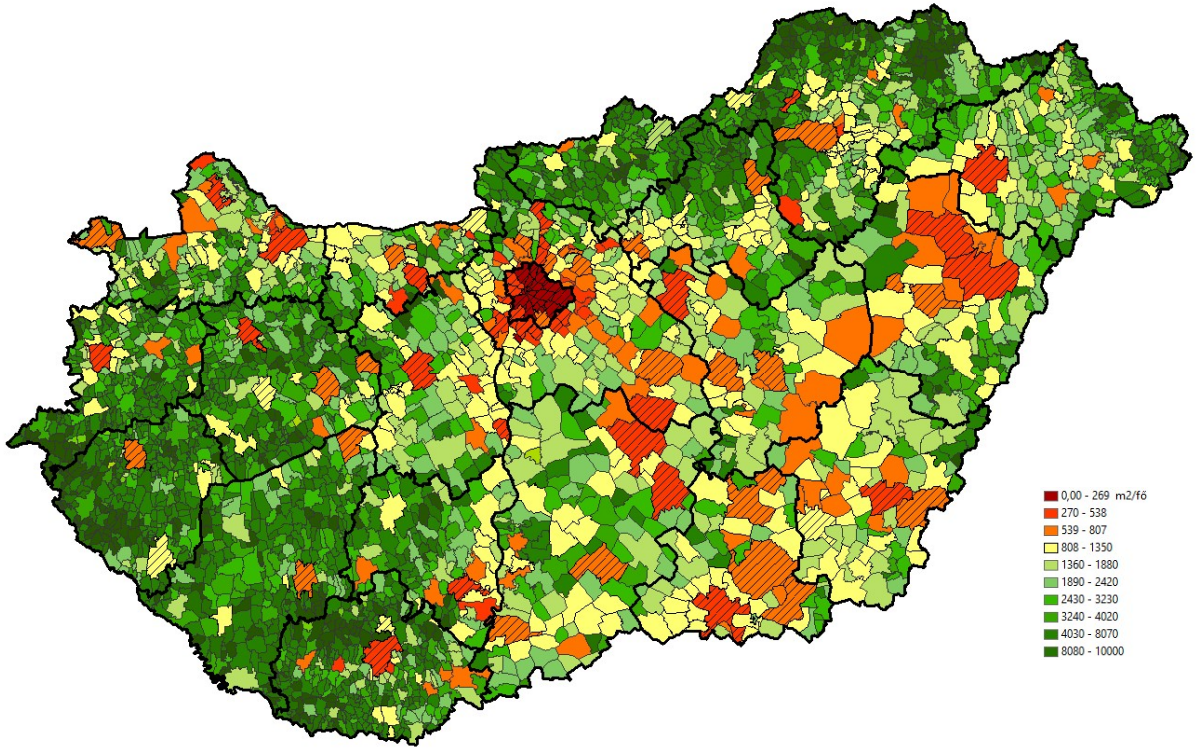
Do we have enough green according to WHO?

The World Health Organization (WHO) recommends that every settlement should have at least 9 m2 of green space per person and that green spaces should be at least a 15-minute walk away. The recommended value is 50 m2 per person.





green infrastructure
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GREEN INFRASTRUCTURE INDICATORS

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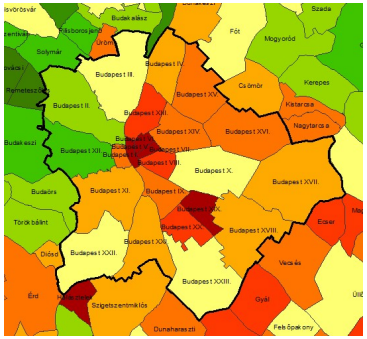
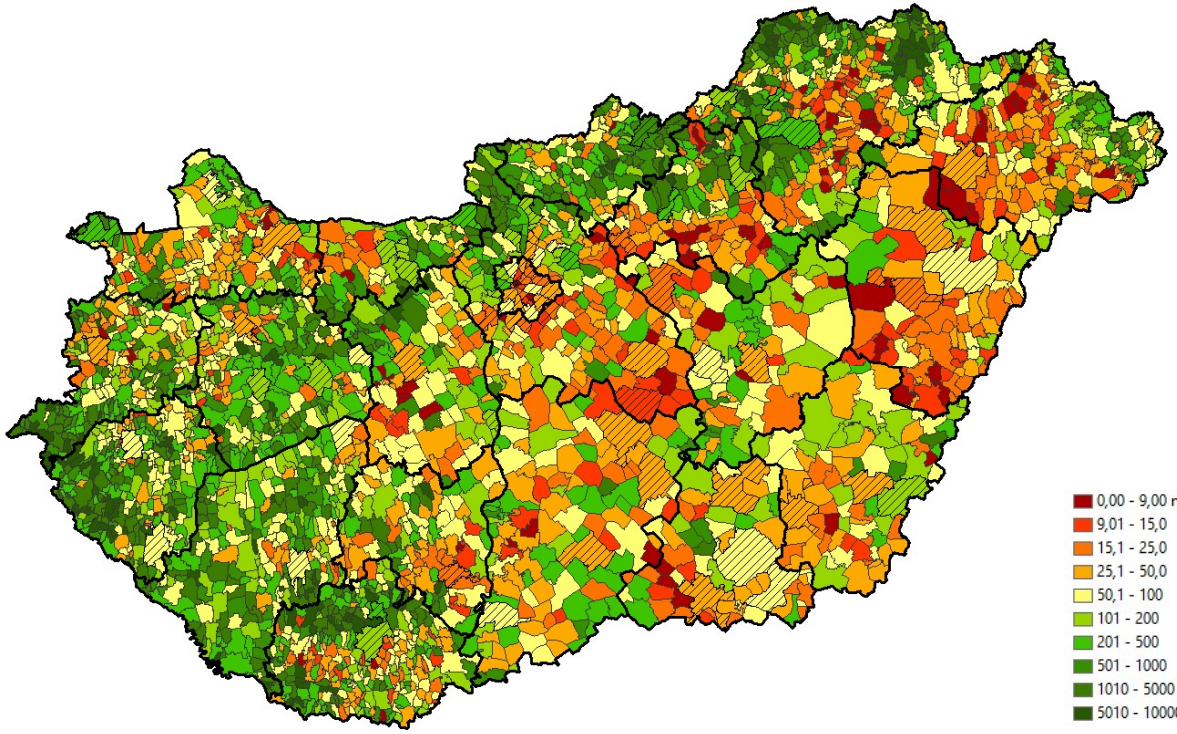
Area of public land covered with trees (m2/person) in municipalities

The worst-off 96 municipalities do not meet the WHO minimum requirement (9 m2 per capita) and around 290 municipalities are below the EU average (18 m2 per capita).





green infrastructure

networks of nature

GREEN INFRASTRUCTURE INDICATORS
FOR URBAN PLANNING

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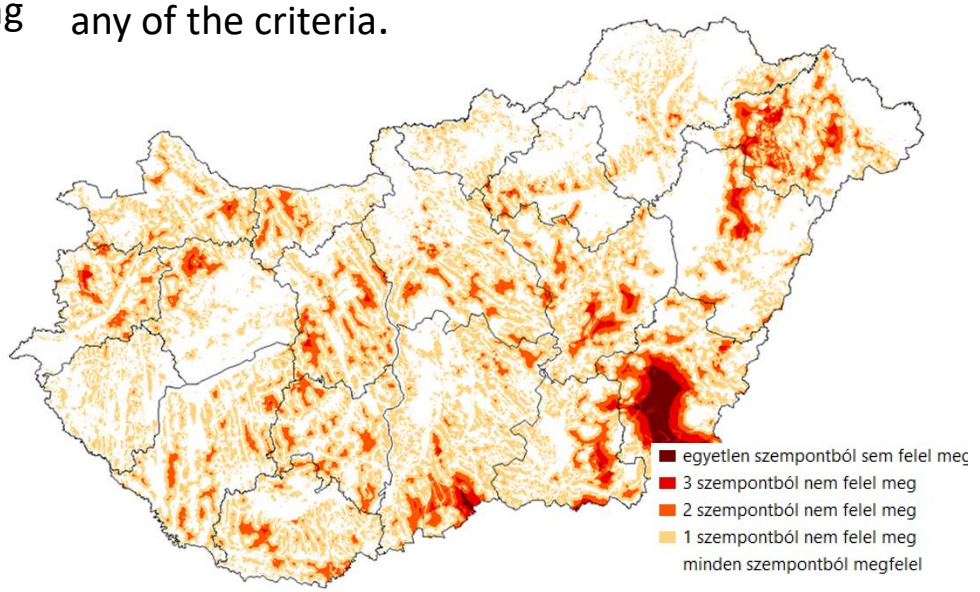
Accessible Natural Greenspace Standard (ANGSt)

1. min. 2 ha within 300 m (5 min walk)
2. min. 20 ha within 2 km
3. min. 100 ha within 5 km
4. min. 500 ha within 10 km
5. minimum 1 ha/1000 inhabitants green area

(Condition 1)
2 ha of green space within 300 m of the remaining white areas is NOT available.

Aggregate green infrastructure access index.
Municipalities in dark maroon areas do not meet any of the criteria.



GREEN INFRASTRUCTURE INDICATORS
FOR URBAN PLANNING

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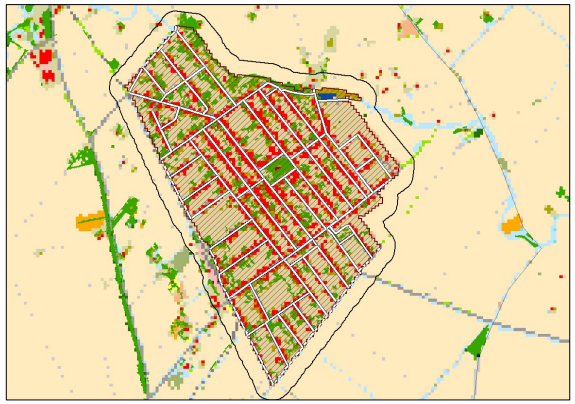
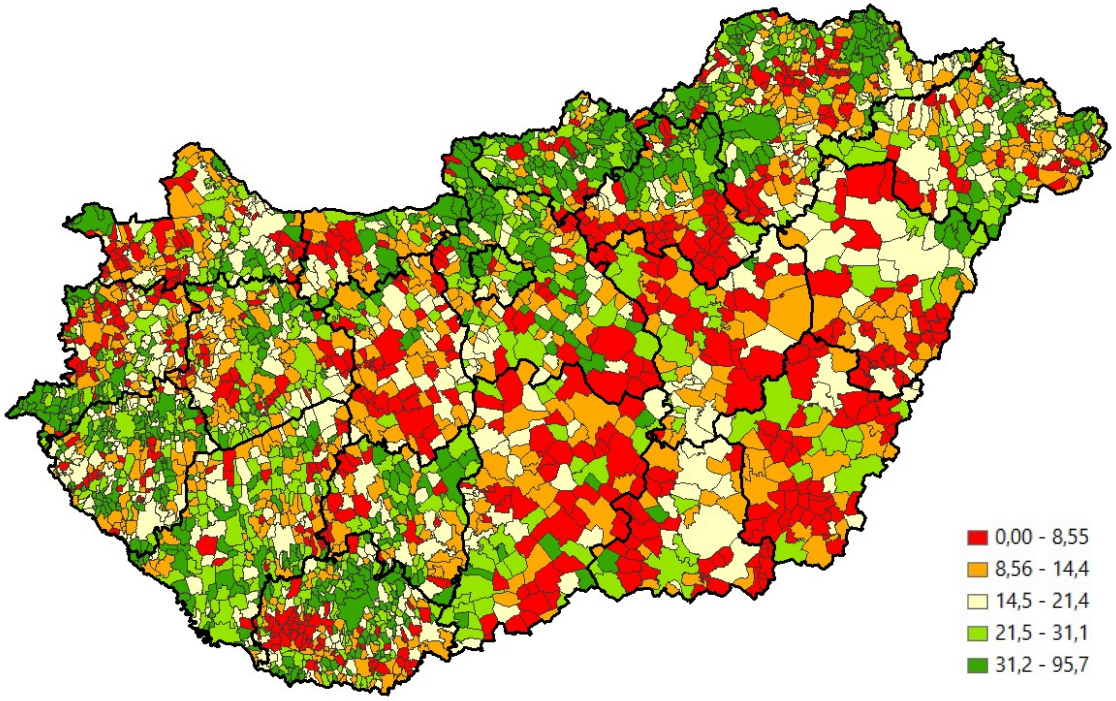
Afforestation on settlement edges

The national average afforestation rate is 20.7%, which means that only one fifth of the peripheral of the settlements border are forested area.





ROAD AFFORESTATION AS CONNECTIVITY INDICATOR

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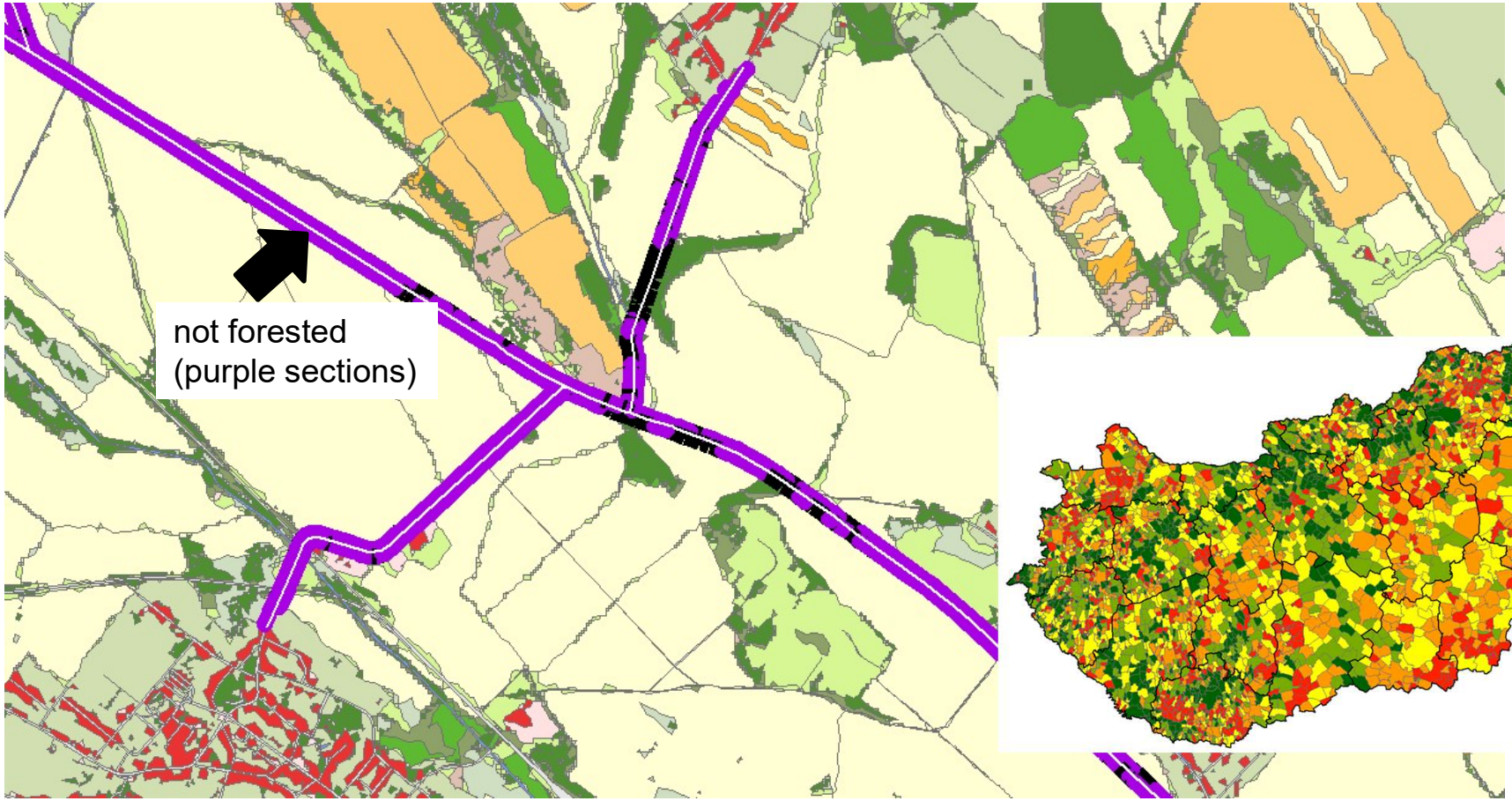
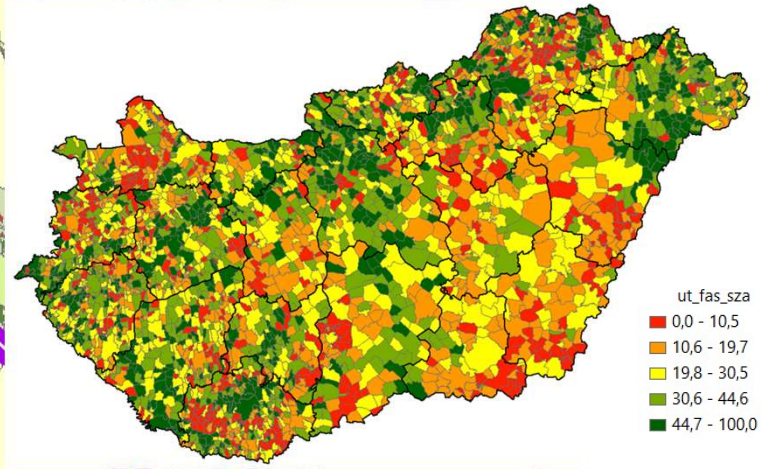
Roadside **green verges** are an important element of connectivity. The national analysis shows that the level of **road afforestation is low**. The average is only **28.4%**, which effectively means that only slightly more than a quarter of the potential 100% theoretical afforestation is being used.





PROXIMITY ANALYSIS AS CONNECTIVITY INDICATOR

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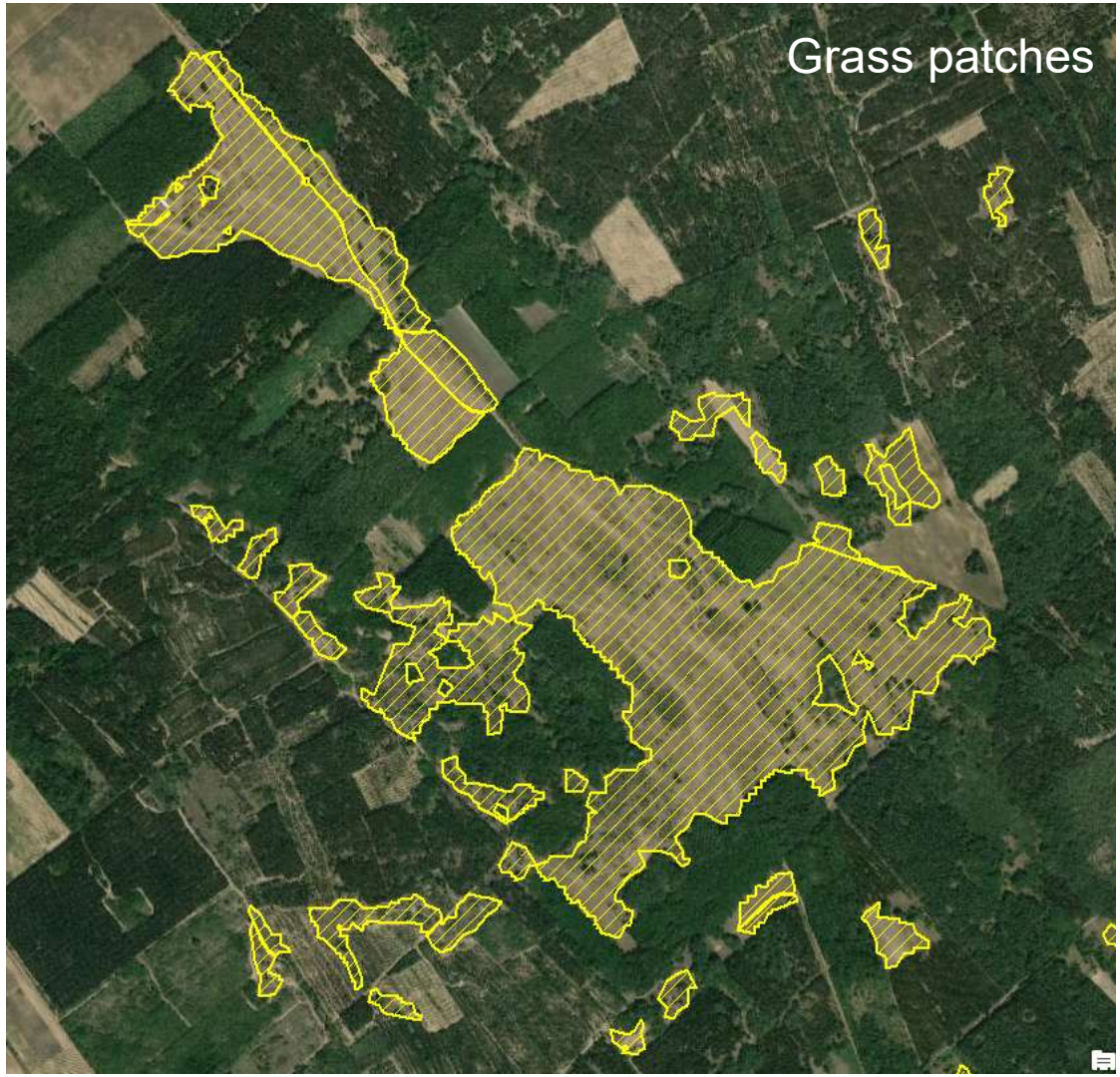
Where are there isolated areas? How to measure which of these habitat islands are in the worst situation, where connectivity should be improved?

Fragmentation causes habitat degradation. As habitat size decreases and the distance between habitat patches increases, metapopulation processes become less and less effective.
The **proximity indicator** takes into account the size and distance of adjacent patches weighted by distance.



PROXIMITY ANALYSIS AS CONNECTIVITY INDICATOR

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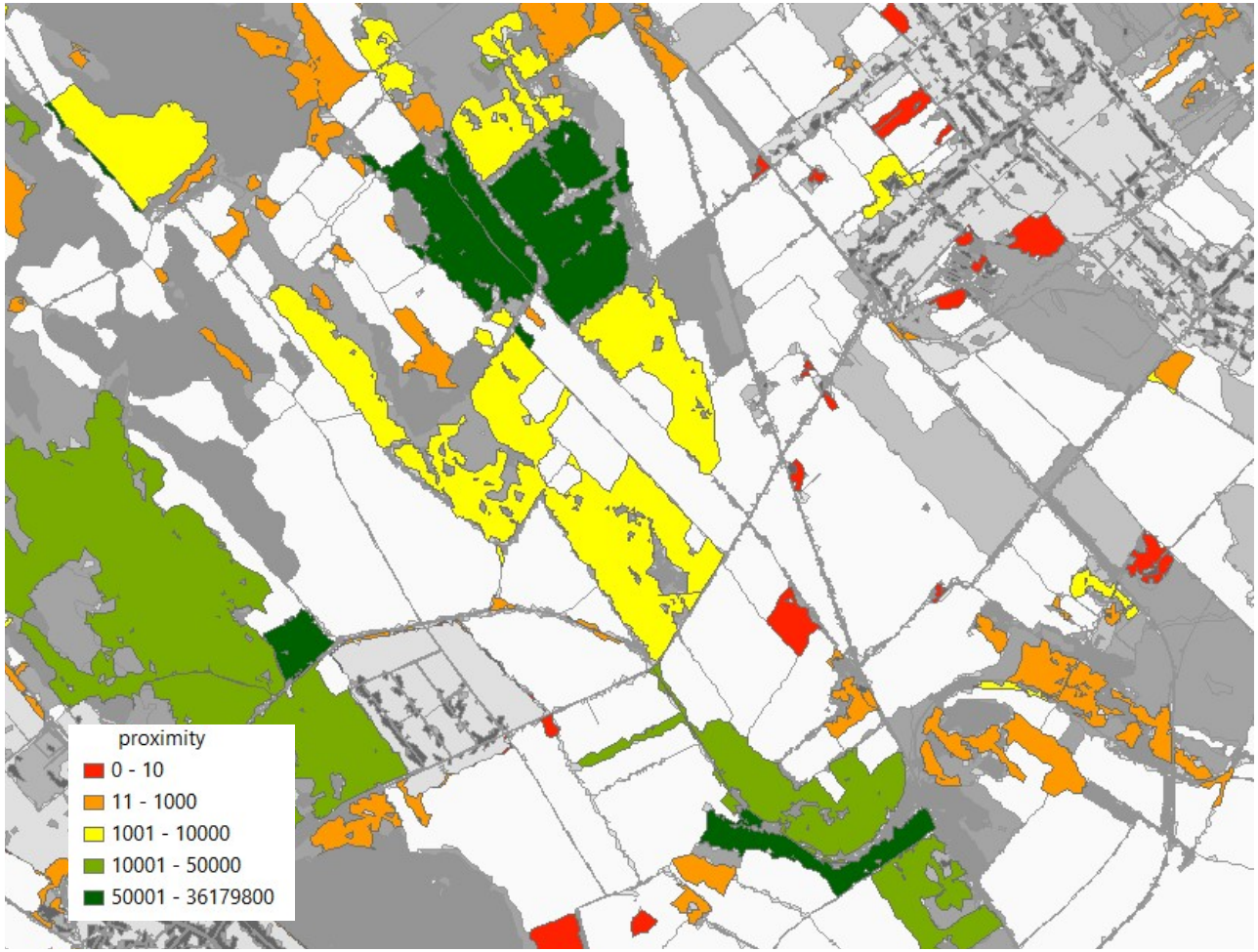
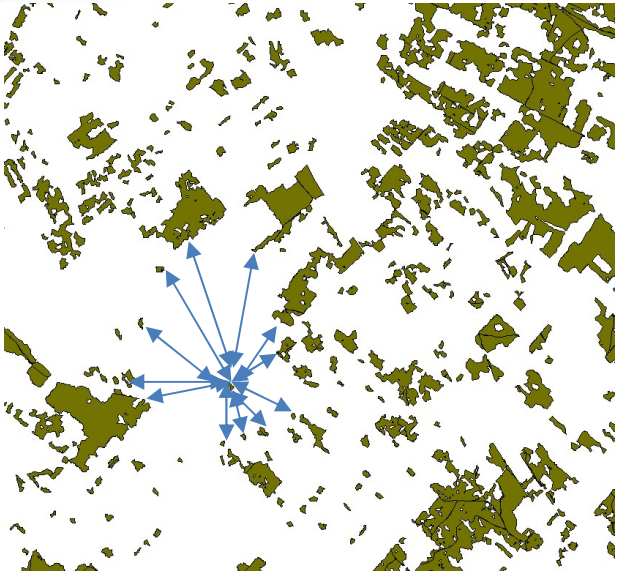
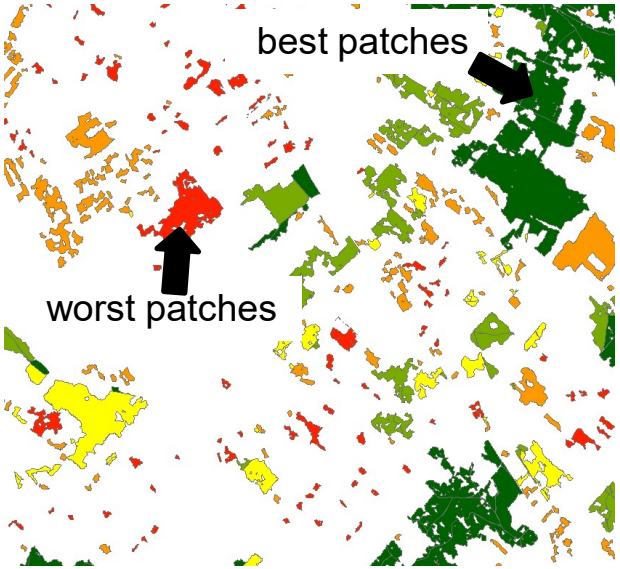
At the local level, **proximity analysis** can be a good tool to measure the connectivity of individual green infrastructure patches.





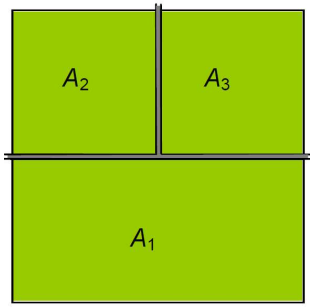


EFFECTIVE MESH SIZE INDICATOR

FOR MEASURING FRAGMENTATION IN MUNICIPALS

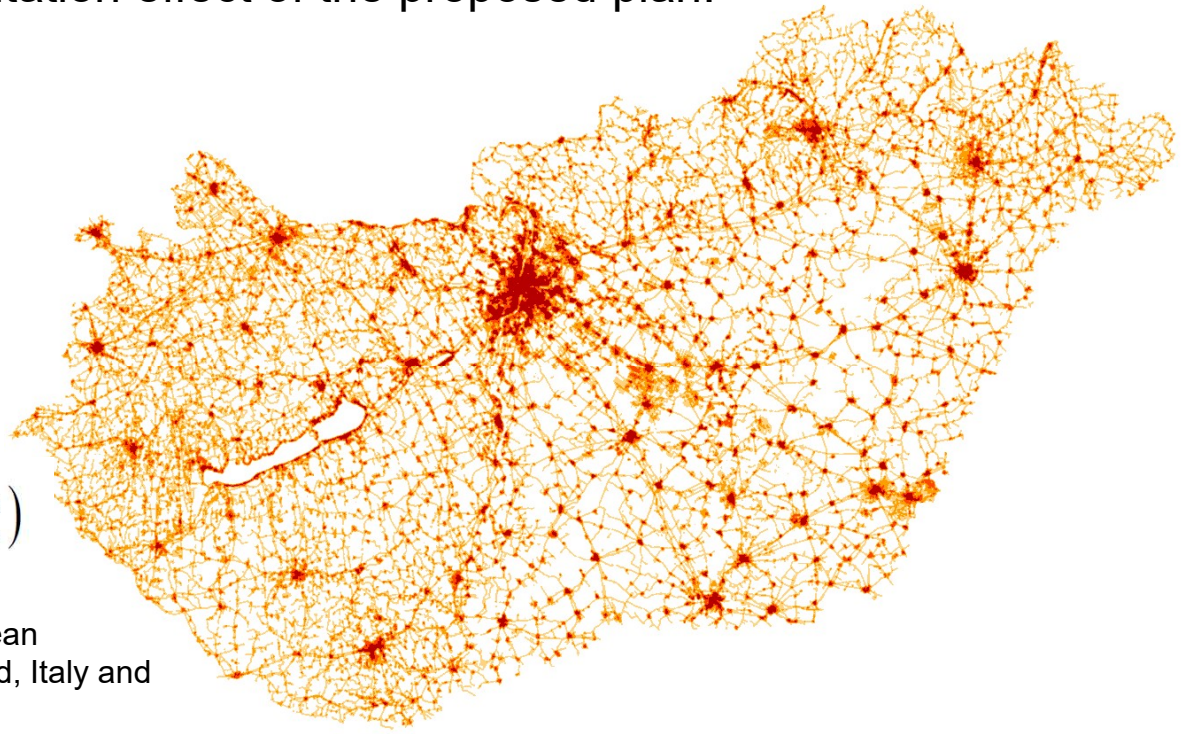
The **effective mesh size** is based on the probability of two points chosen randomly in a region will be connected. The more barriers in the landscape, the lower the probability that the two points will be connected, and the lower the effective mesh size.

The EM indicator is calculating the patch sizes (habitat size) instead of line length (infrastructure line length). The indicator is widely used in urban planning in Western Europe to monitor the fragmentation effect of the proposed plan.



$$m_{\text{eff}} = \frac{1}{A_{\text{total}}}\left(A_1^2 + A_2^2 + \ldots + A_i^2 + \ldots + A_n^2\right)$$

The me_{ff} method has been used by the European Environmental Agency in Germany, Switzerland, Italy and Canada.



AGRICULTURAL AREAS AS AN EXAMPLE

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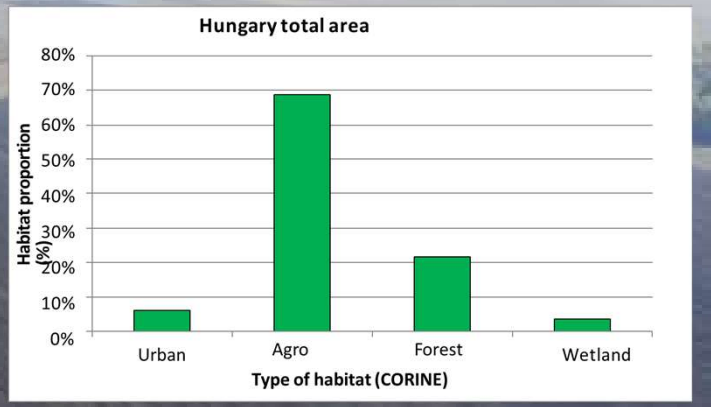

Land use rates in Hungary comparing to EU

	Hungary	EU-15	OECD	World
agricultural land	54,5	27,9	13,3	11,1
pasture	12,4	18,6	25,3	26
forest	19,1	36,3	33,5	31,7

LARGE AGRICULTURAL FIELDS

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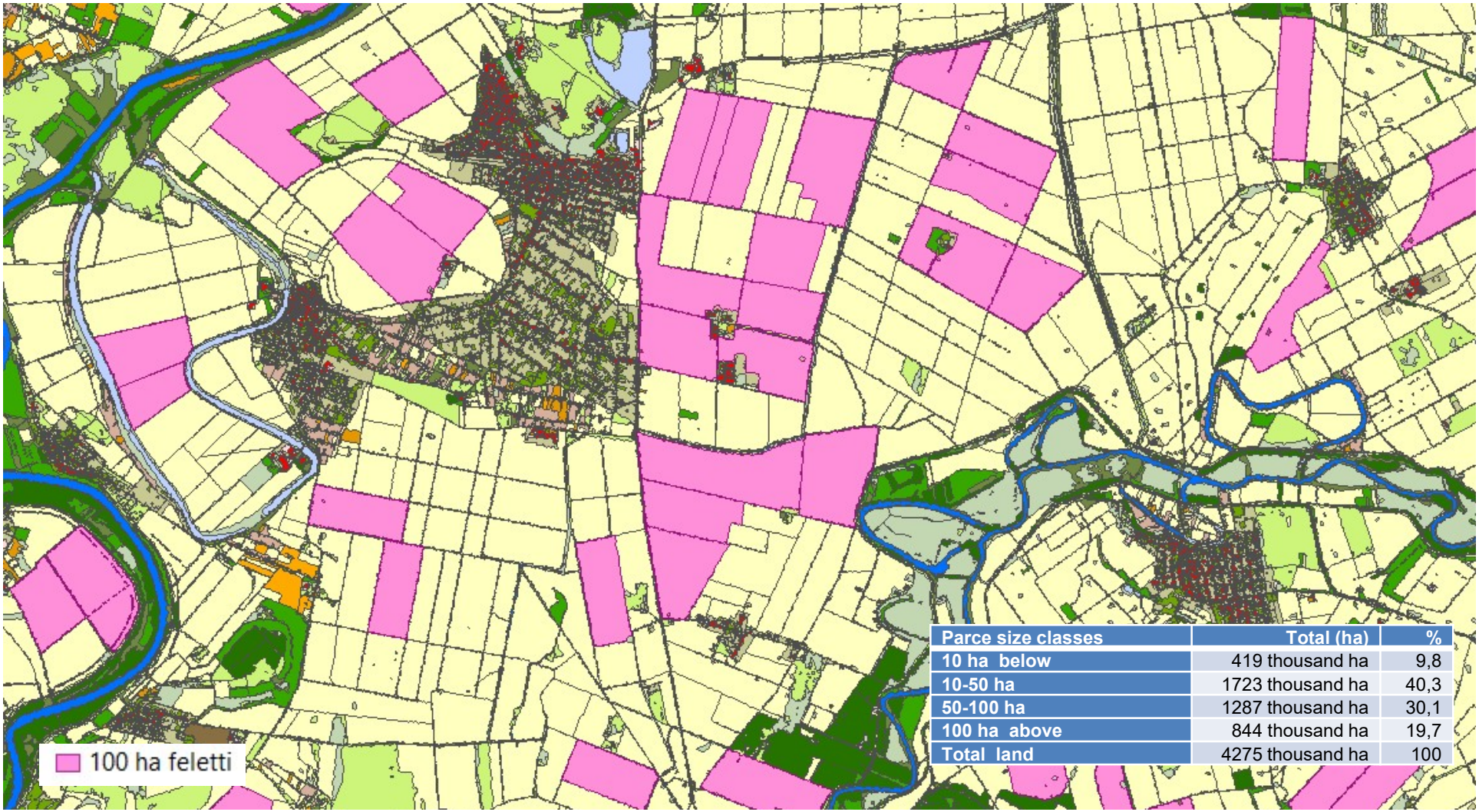
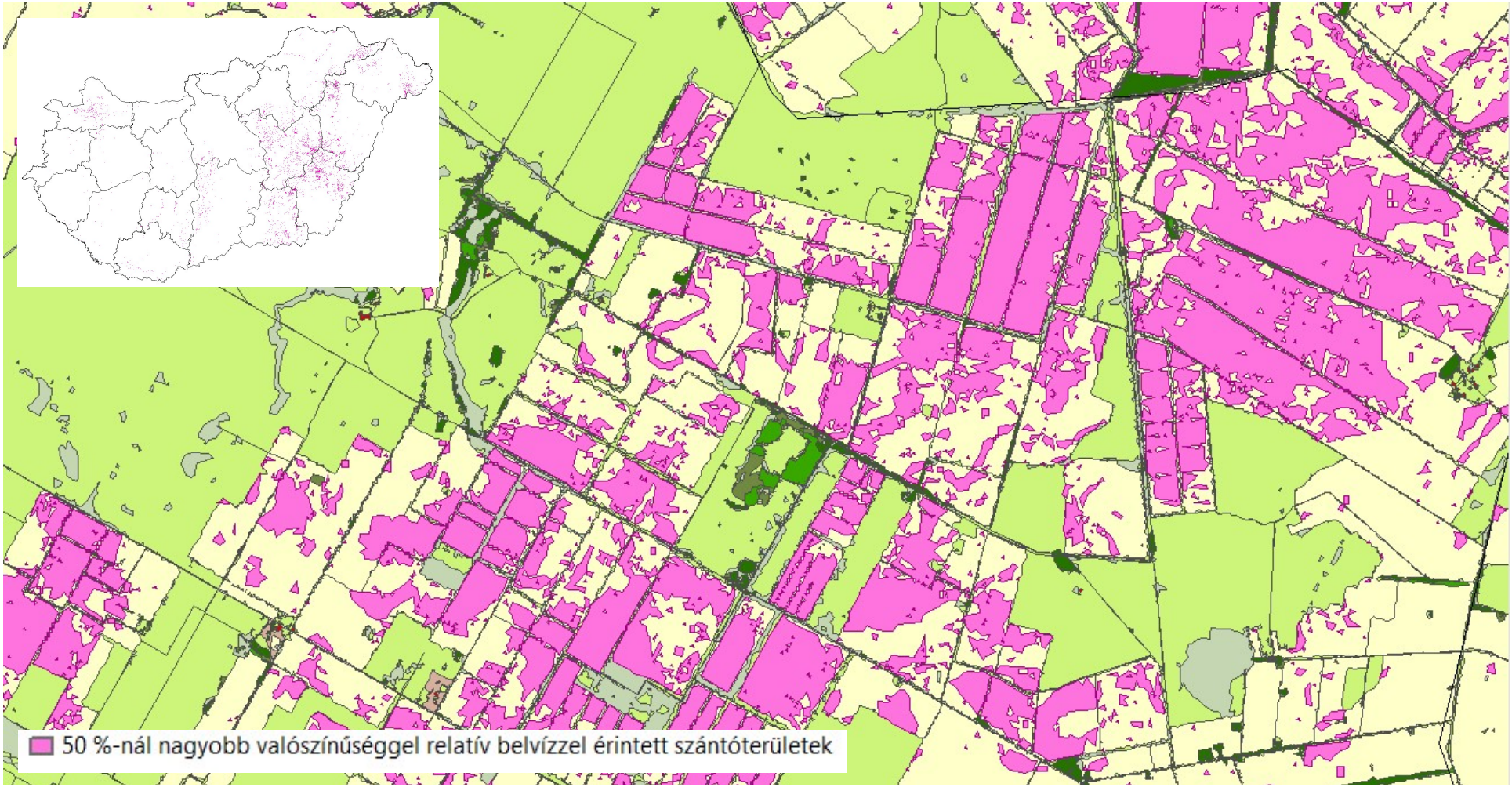
Large agricultural field sizes over 100 ha account for **almost 20% of total arable land**



Parce size classes	Total (ha)	%
10 ha below	419 thousand ha	9,8
10-50 ha	1723 thousand ha	40,3
50-100 ha	1287 thousand ha	30,1
100 ha above	844 thousand ha	19,7
Total land	4275 thousand ha	100

INLAND WATER VULNERABLE PLOUGHLAND

56 thousand ha of arable land at risk of inland water or flooding. Good target area of green infrastructure developments.



AGRICULTURAL GREEN VERGES

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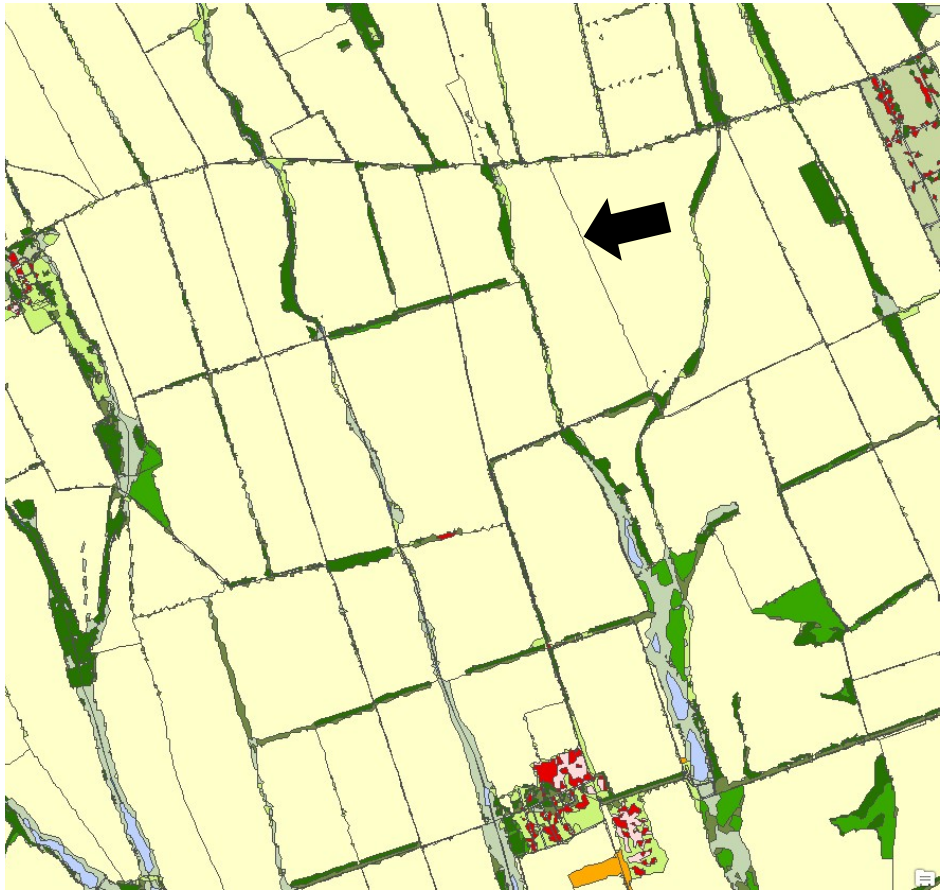
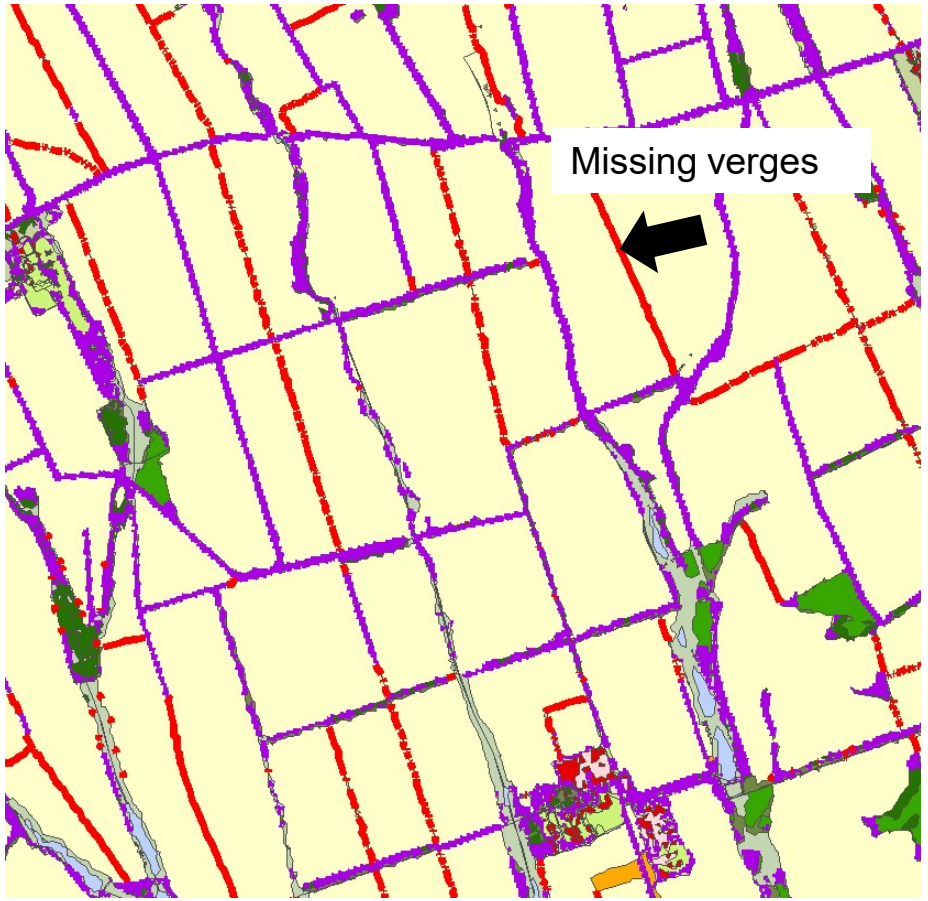
Restoring former field margins can greatly help to increase green infrastructure areas and strengthen connectivity. Within the framework of the research, the **missing field edges** and forest strips were also identified on a large scale.
This can be of great help for town and country planning.





MISSING CONNECTIVITY, MISSING LINEAR GREEN INFRASTRUCTURE LINKS

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The field boundaries have disappeared (purple = missing field boundary). The parcels are merged, the landscape is homogenised and connectivity is reduced.

NON-CULTIVATED FIELD MARGINS

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A field edge is a 5-10 m wide ecological strip called "*non-cultivated field margins*" or "*buffer strips*". These buffer strips are roughly 250-300 thousand ha in widths of 20 m nationwide.

According to the CAP greening in Hungary, a maximum width of **10 m** outside arable land can be accounted for if it is at least 50% wooded and a maximum width of **20 m** if it is a grassed field with at least 50% grass cover. In both cases, areas outside the field and within the block boundary are taken into account.

CONNECTIVITY ANALYSIS

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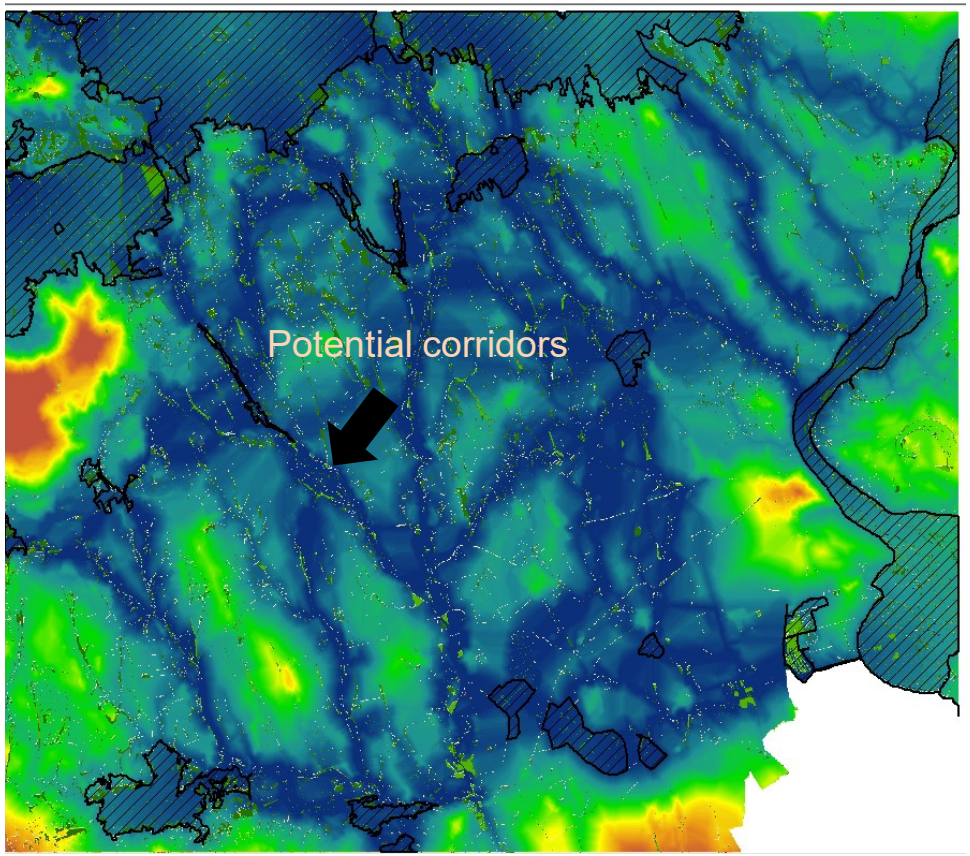
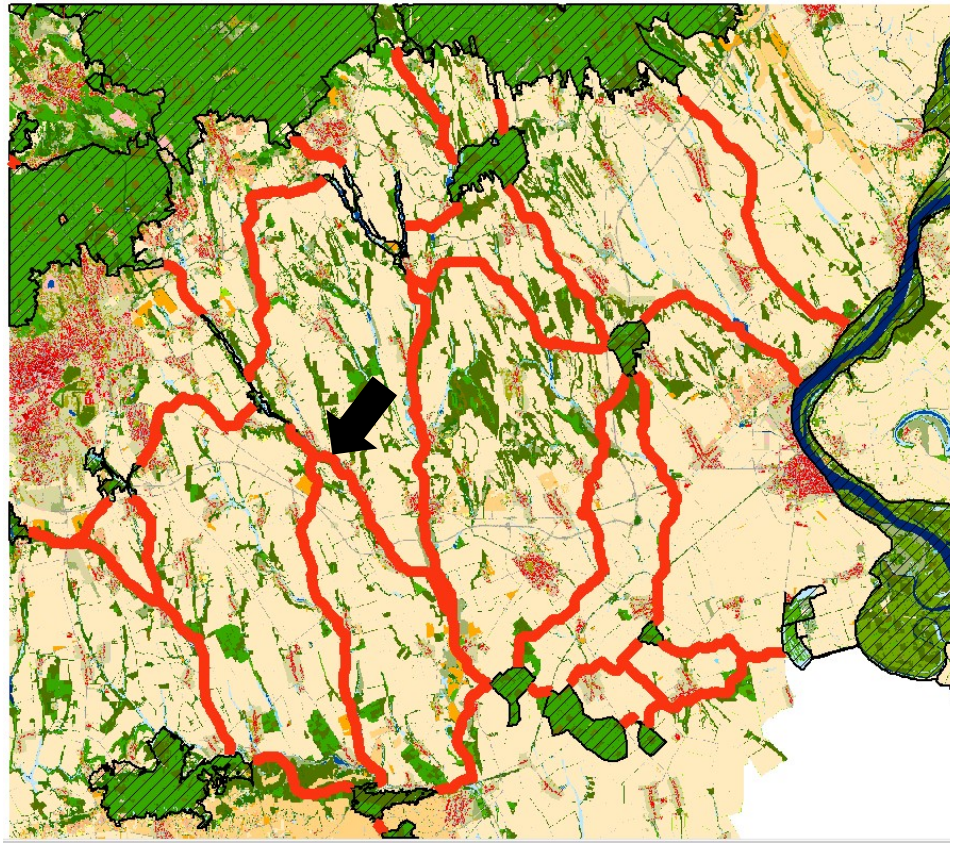
Proposed **ecological linkages** according to LinkageMapper modelling.
The modelling is based on leas-cost-path analysation.
It is understood that these corridors need to be locally validated according to real field conditions.





CONNECTIVITY ANALYSIS

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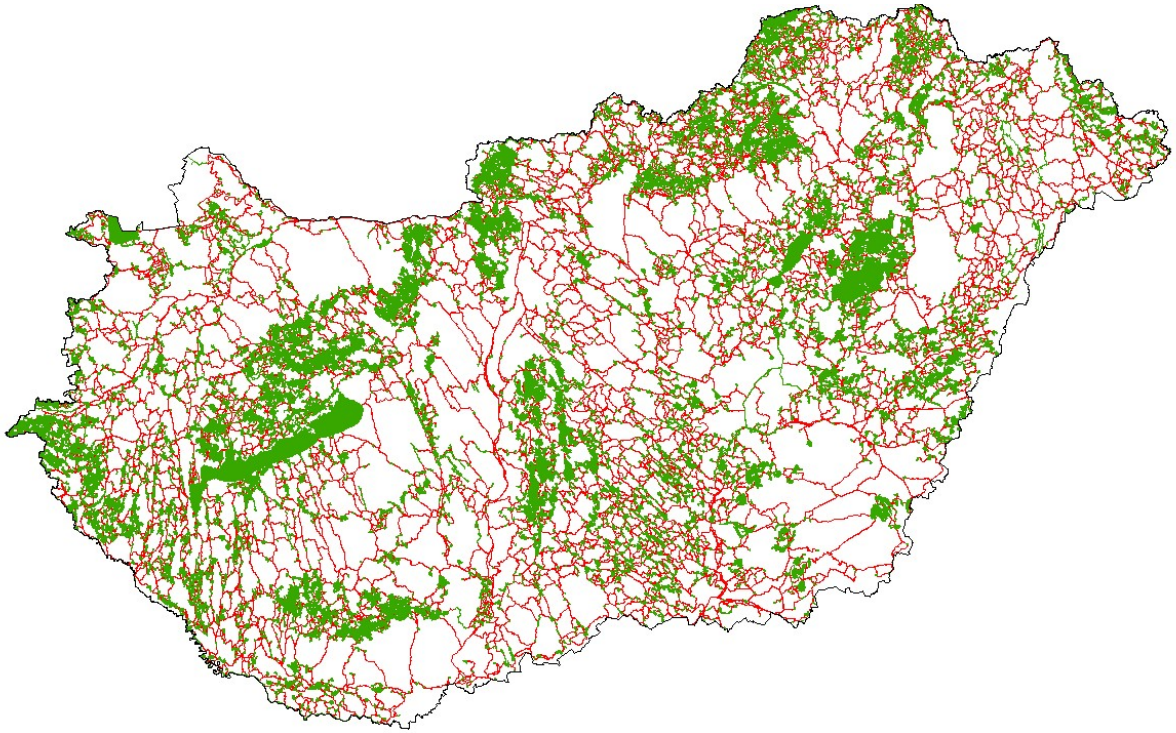
As a result of the analysis, a potential 167 thousand hectares of arable land have been identified and designated as potential eco-corridor areas.



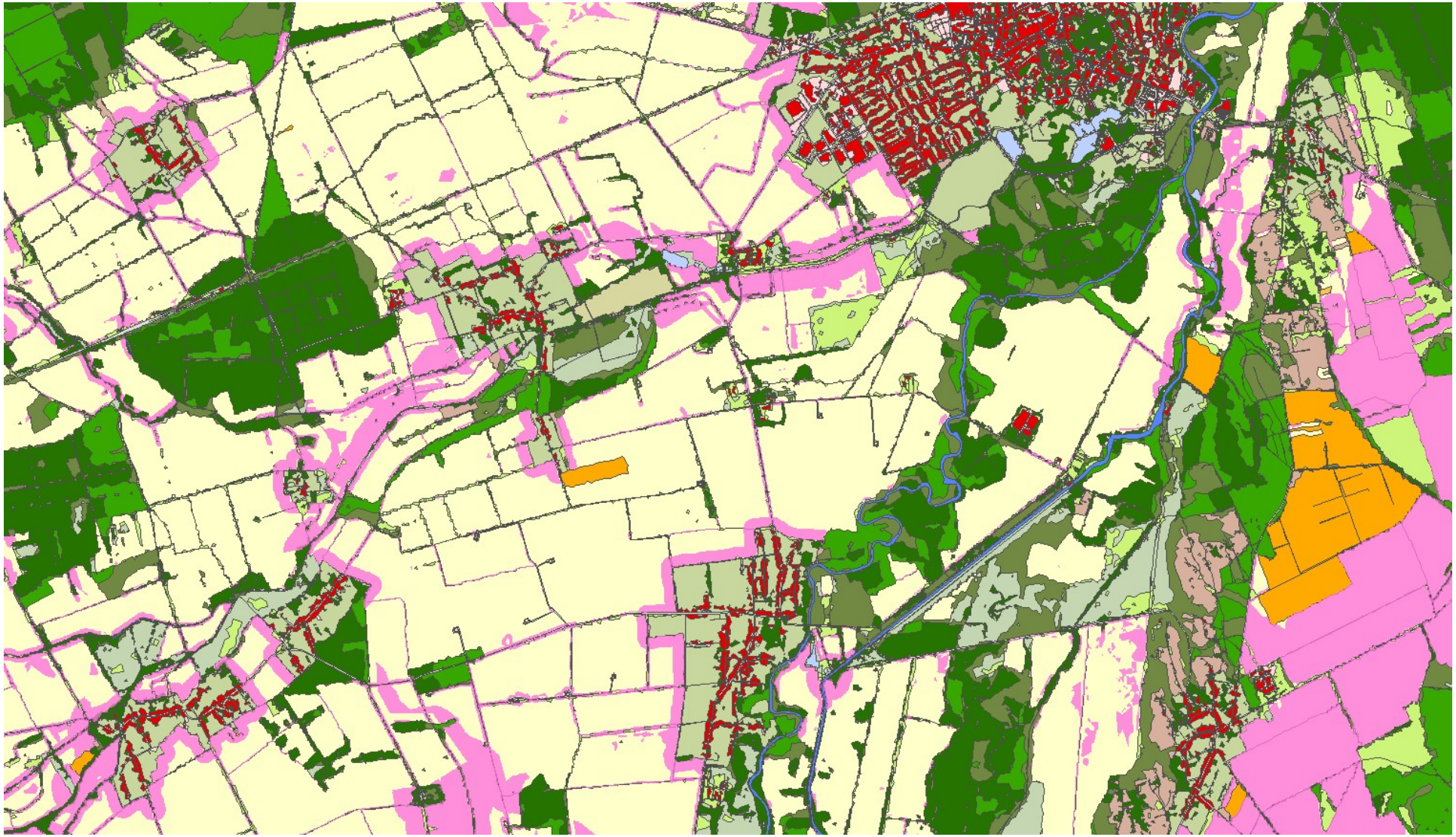
COMPOSITION OF MAPS INTO DEVELOPMENT PRIORITY MAPS

The nearly 50 primary thematic layers, indicators, or conflict maps were grouped into eight **GI development priority maps**:

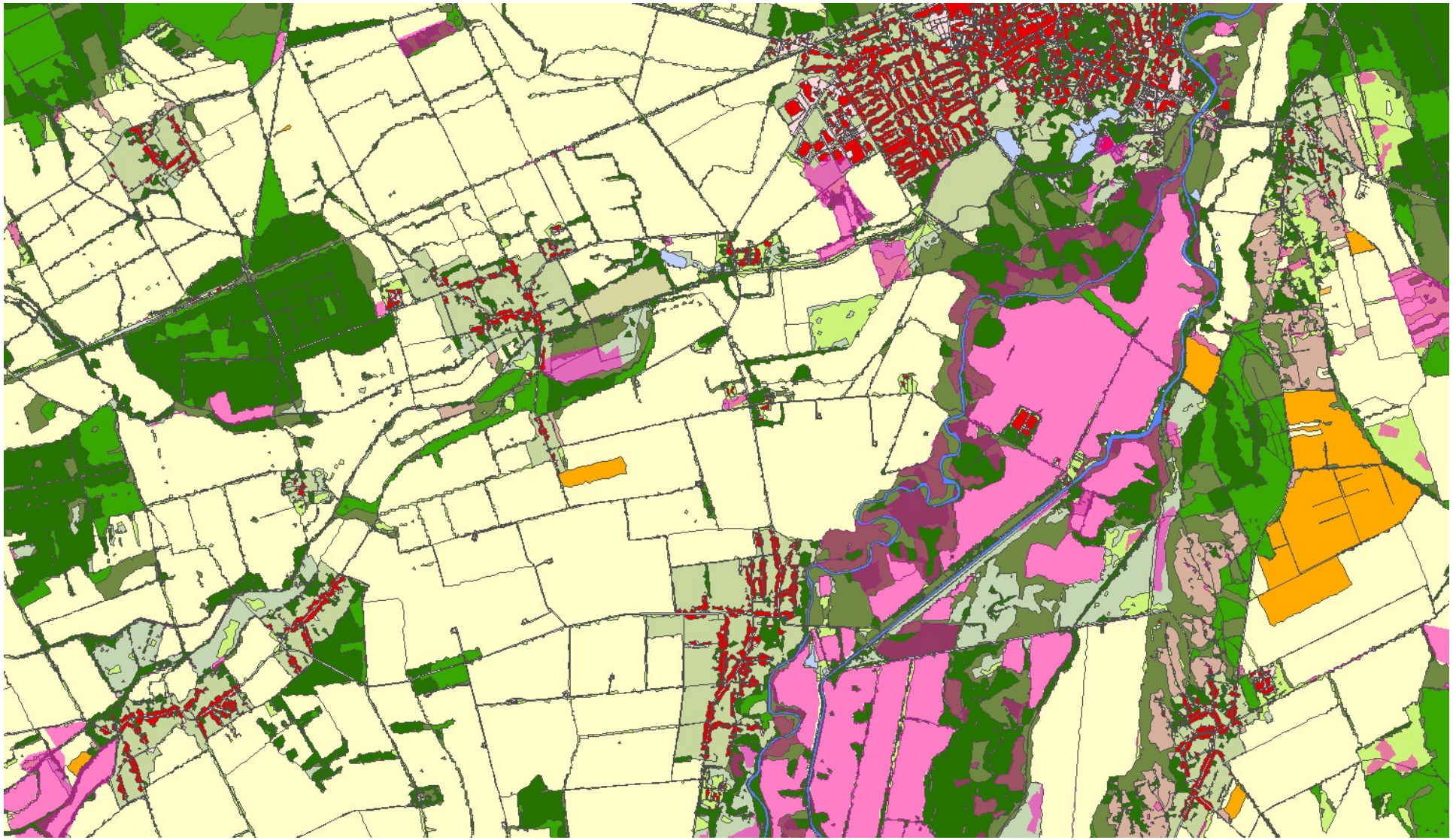
1. Agriculture dev.
2. Ecological rehabilitation and nature conservation
3. Municipal and climate protection
4. Connectivity dev.
5. Water conservation
6. Infrastructure protection
7. Forest dev.
8. Recreation

	Indikátor név	konnektivást	településvédelmi	vízvédelmi	agrárgazdálkodási	infrastruktúra véd.	erdőgazdálkodási	rehabilitációs	rekreációs
8	Felszín alatti vízminőségvédelmi területek szántói			●	●				
9	Defláció veszélyeztetett szántók (10 ha nál nagyobb és 7,8,9,10 kategória)		●		●				
10	Természetvédelmi védettség alatt álló szántók.				●			●	
11	Vízfolyás, vizek melletti szántóterületek (50 m)	●		●	●				
50	Közút melletti szántók (2x20 m)				●	●			
12	Település melletti szántók (100 m)		●		●				
13	Állandó gyepterületek (Corine alapján)				●				
14	Időszakos gyep területek (Corine adatbázis alapján)				●			●	
51	Időszakos vizenyős gyepterületek (Corine adatbázis alapján)				●			●	
75	Kiváló szántók (OTrT szerint)				●				
52	Gyep ahol a valószínűség kisebb, mint 50% (Copernicus GRAVPI)							●	
16	Természetvédelmi védettségű gyepek, vizes élőhelyek				●				
56	Cserjésedő gyepterületek				●			●	
17	Környezeti szempontból érzékeny állandó gyepterületek (Natura2000 gyepek)							●	
21	Faültetvények területei				●		●		
22	Erdőterületek (12,13,14) természetvédelmi védettség szerinti átfedése						●	●	
24	Erdőterületek a NÖSZTÉP természetességi besorolás szerint (1, 2 kat)				●		●	●	
73	Erdőterületek a NÖSZTÉP természetességi besorolás szerint (1, 2 kat) természetvédelmi területen (NP, TK TT, Natura2000)						●	●	
74	Faültetvények területei természetvédelmi területen (NP, TK TT, Natura2000)						●	●	
27	Cserjésedő területek (mindenhol)				●		●	●	
29	Hiányzó ökotonok, átmeneti zónák				●		●	●	

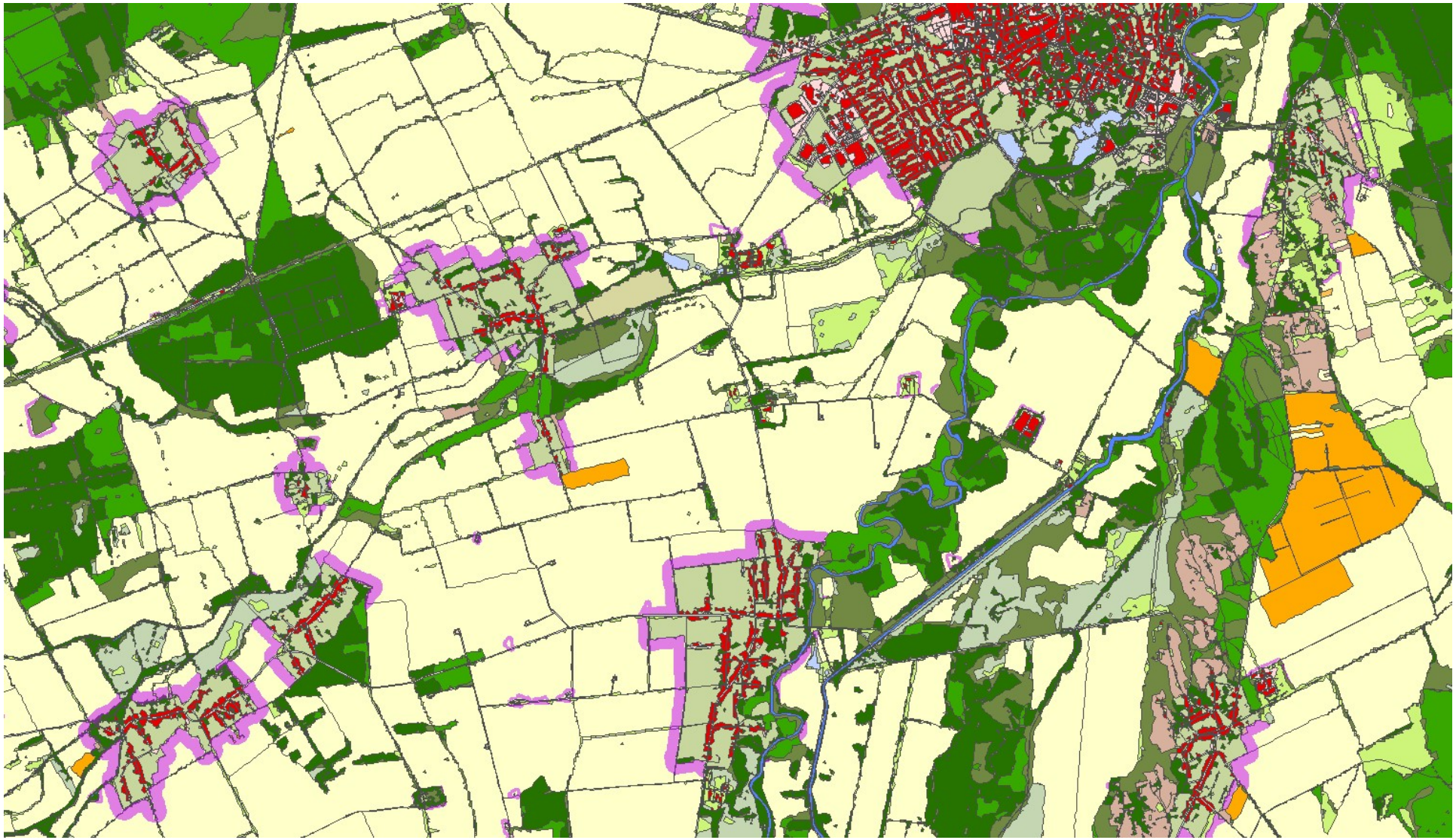
GI PRIORITY DEVELOPMENT AREAS RELATED TO AGRICULTURE AREAS



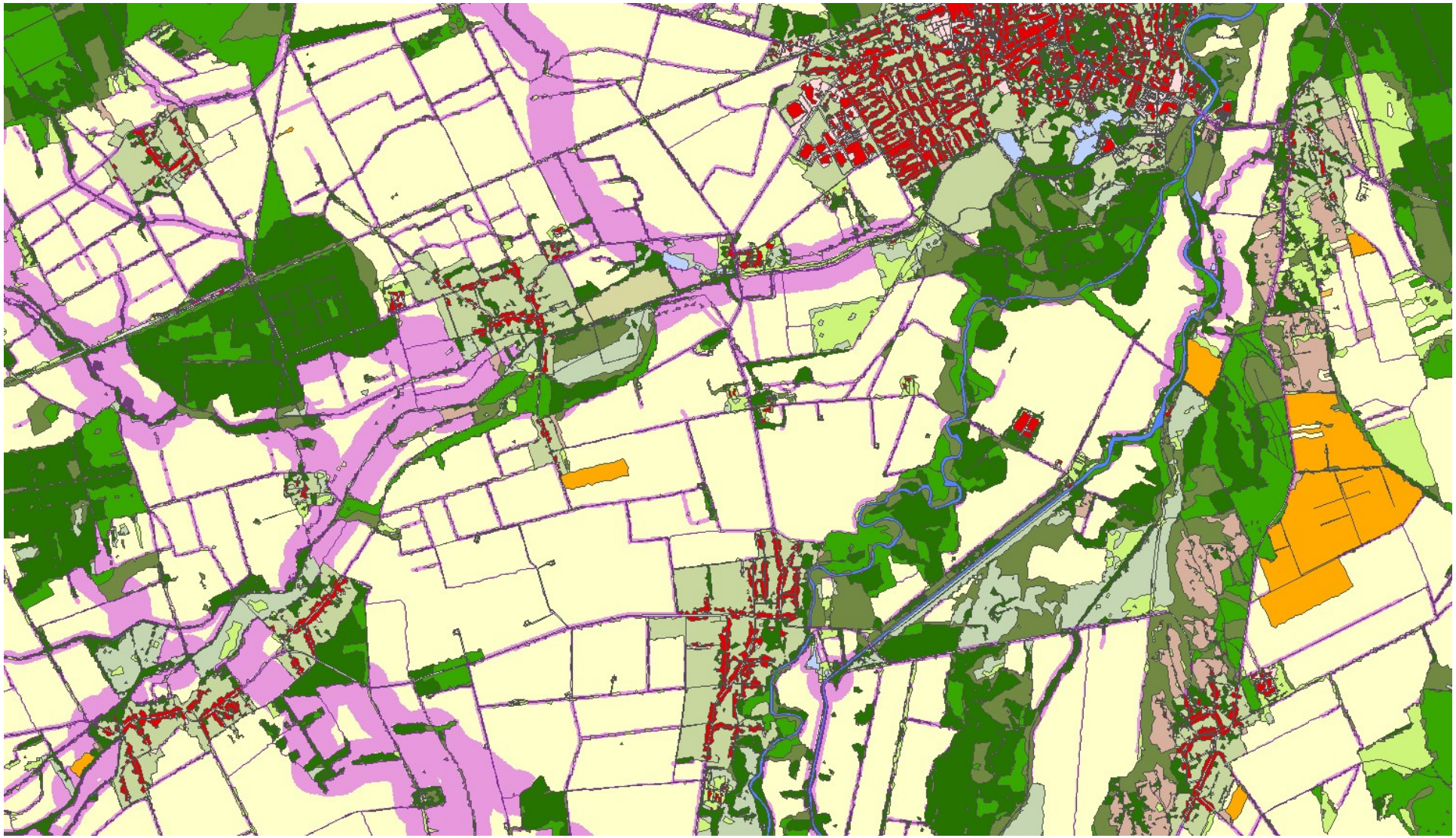
GI DEVELOPMENT AREA FOR ECOLOGICAL REHABILITATION AND DEVELOPMENT OF NATURE CONSERVATION AREAS



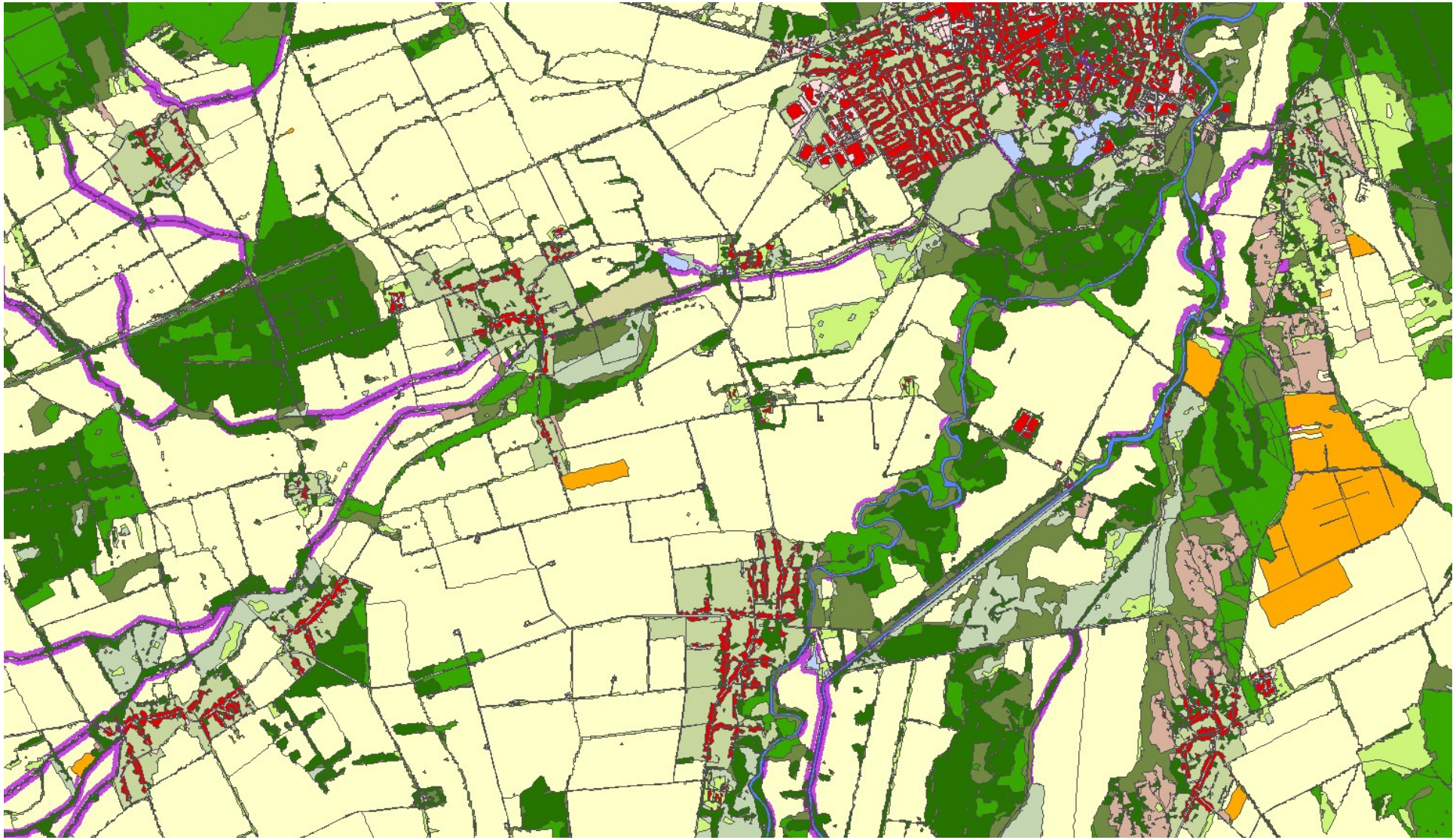
URBAN AND CLIMATE GI DEVELOPMENT AREAS



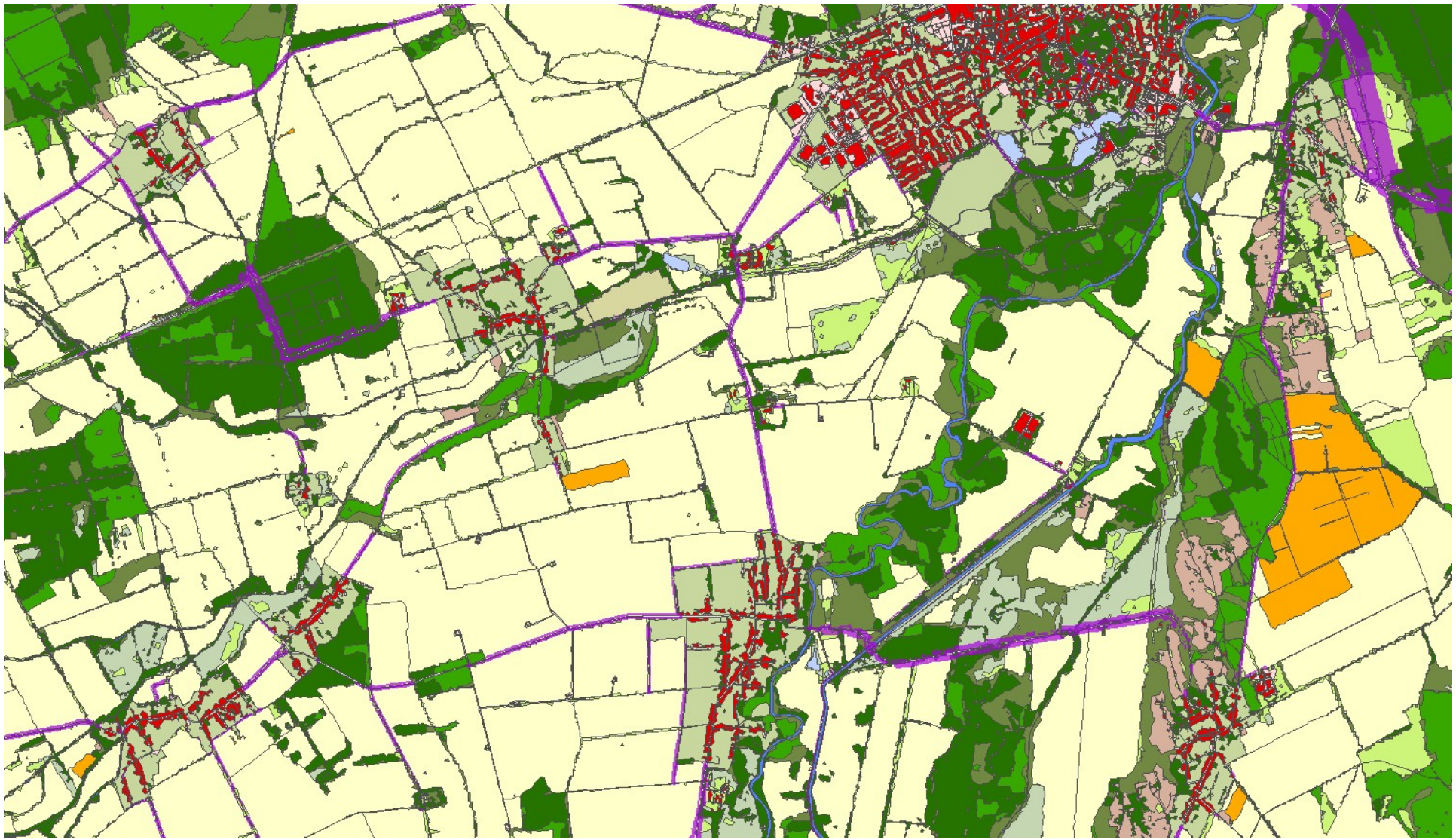
GI DEVELOPMENT AREAS RELATED TO INCREASING ECOLOGICAL CONNECTIVITY AND NETWORKING



GREEN INFRASTRUCTURE DEVELOPMENT AREAS RELATED TO WATER AND AQUIFER PROTECTION

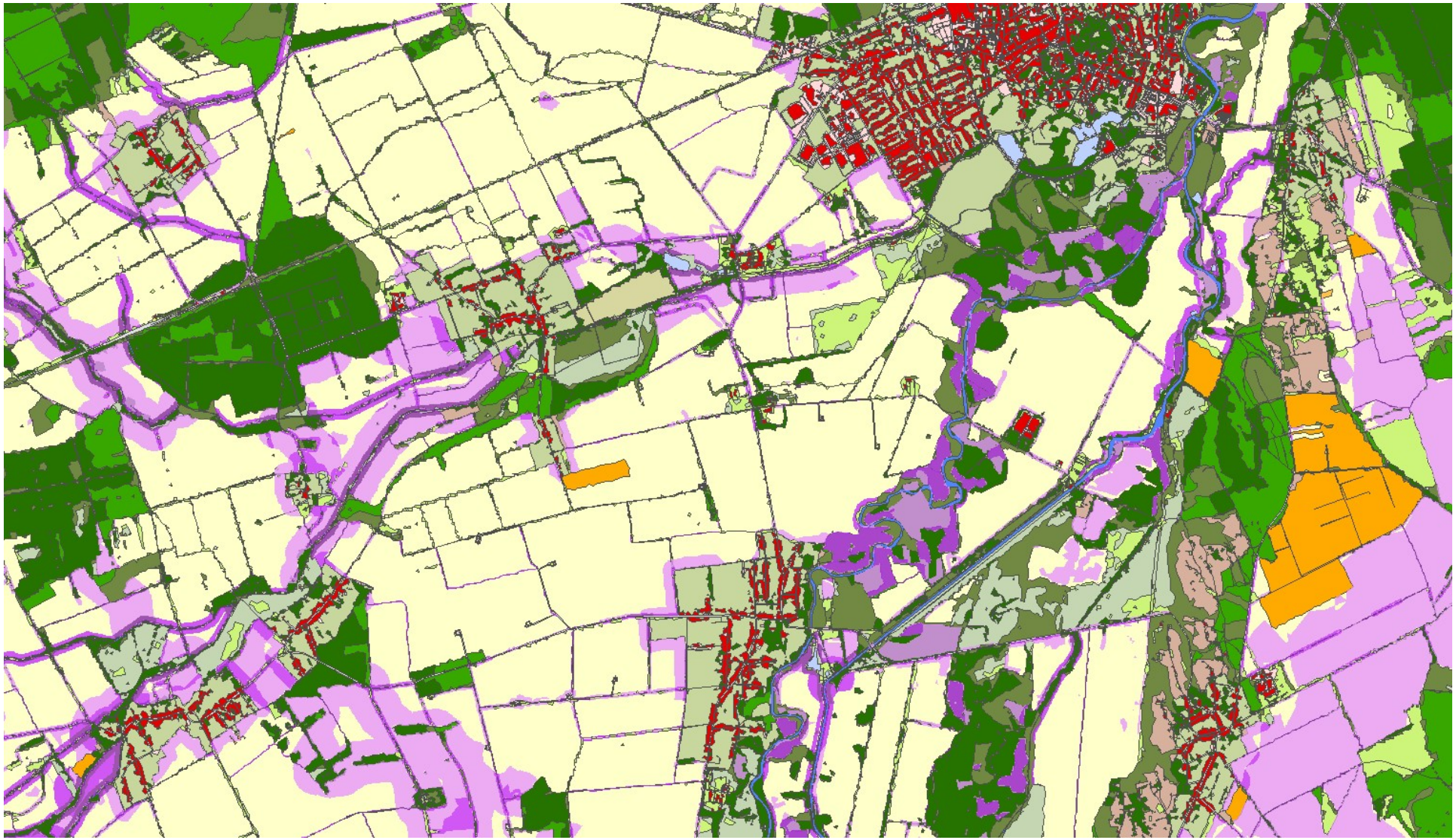


GREEN INFRASTRUCTURE DEVELOPMENT AREAS LINKED TO TRANSPORT INFRASTRUCTURE



GREEN INFRASTRUCTURE DEVELOPMENT AREAS BASED ON THE AGGREGATION OF EACH PRIORITY (COMPOSITE)

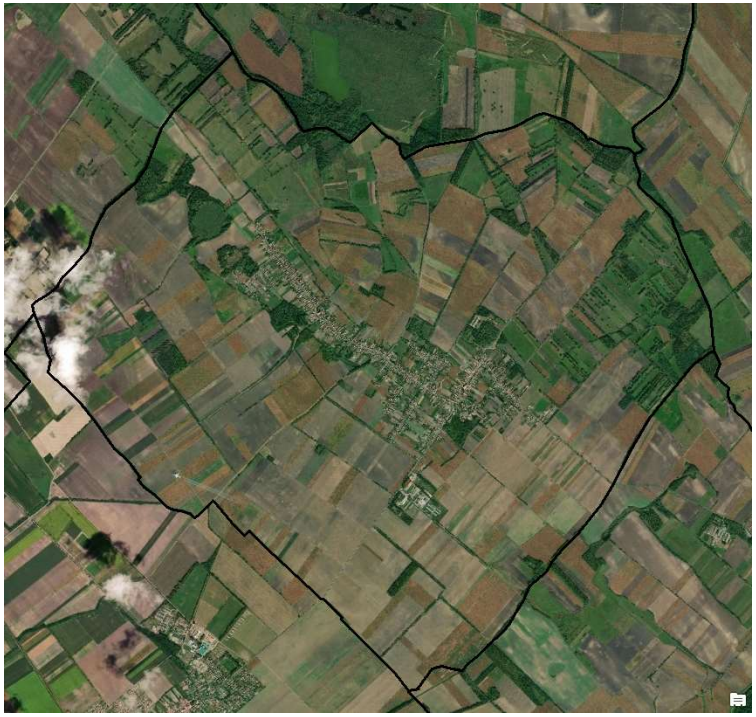
The composite map only helps the landscape or town planners to set priorities for GI.



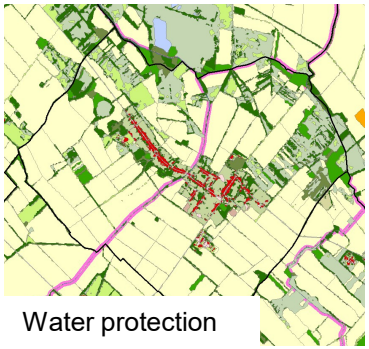
GI PRIORITIES FOR TOWN AND SPATIAL PLANNING

A national programme of state nature conservation

The plans only helps the landscape or town planner to set priorities. GI development priority setting **is not a substitute** for planning process or local site surveys, consultations by farmers, stakeholders, municipals, it helps only to scientifically background the plan and to think in a GI network and connectivity.



Connectivity enhancement



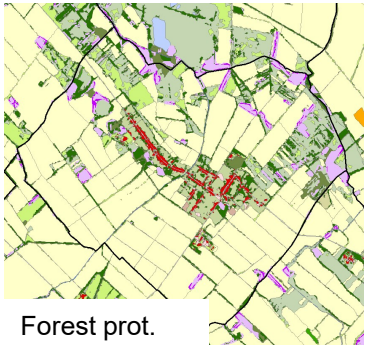
Water protection

Agro-environment prot.

Infrastructure protection

Nature conservation

Municipal and climate prot.



Forest prot.

Composite priority areas

TOOLS: NEW LEGISLATION FROM JULY 2021 …

A national programme of state nature conservation

Green infrastructure and the protection and development of the ecological network are explicitly included in **spatial and urban planning**.

„Green Infrastructure: a strategically planned network of areas, typically green or water-covered, providing a wide range of ecosystem services, identified in the municipal plan and designed to improve quality of life and protect health, the environment, nature and the landscape."

- 1997. évi LXXVIII. Törvény az épített környezet alakításáról és védelméről
  Law on the shaping and protection of the built environment

- 53/1997. (XII. 20.) Korm. Rendelet az országos településrendezési és építési követelményekről
  Ordinance on national town planning and building requirements

- 419/2021. (VII. 15.) Korm. Rendelet a településtervek tartalmáról, elkészítésének és elfogadásának rendjéről, valamint egyes településrendezési sajátos jogintézményekről
  Ordinance on the content, preparation and adoption of settlement plans and on certain specific legal measures relating to settlement planning

TOOLS: AGRO-ECOLOGICAL PROGRAMME (ECO-SCHEME) ELEMENTS NON-PRODUCTIVE INVESTMENTS

Within the framework of the **CAP intervention**, support is **available for non-productive investments** in the following target areas:

1. Planting perennial crops for biodiversity conservation
2. Establishment of **grass strips** on arable land for **erosion control**
3. Establishment of **grass and shrub strips** in arable land
4. Grassland planting on arable land
5. Non-productive investments for water protection
6. Construction and improvement of erosion
7. control facilities
8. Creation and improvement of **water protection buffer zones**
9. **Creation of wetlands** by retaining excess area
10. Installation of **agroforestry systems** for environmental or climate protection purposes

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...enabling us to live with opportunities offered by nature

THANK YOU FOR YOUR ATTENTION!

green infrastructure
networks of nature

SZÉCHENYI 2020

HUNGARIAN GOVERNMENT

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European Regional Development Fund

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