

TAKING
COOPERATION
FORWARD

Which data sources were used and what were the tools for analysing GI data?

Assessing the Functionality and Ecosystem Services of Green Infrastructure

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AGENDA

Data Acquisition -
Transnational &
Regional GI data

Stefan Fuchs | UniVie

Data Analysis -
Connectivity &
Functionality of GI

Field Mapping -
Local GI Assessment

Territorial System
of Ecological
Stability

Hana Skokanová | VUKOZ

MaGICLandscapes Final Conference
6th October 2020



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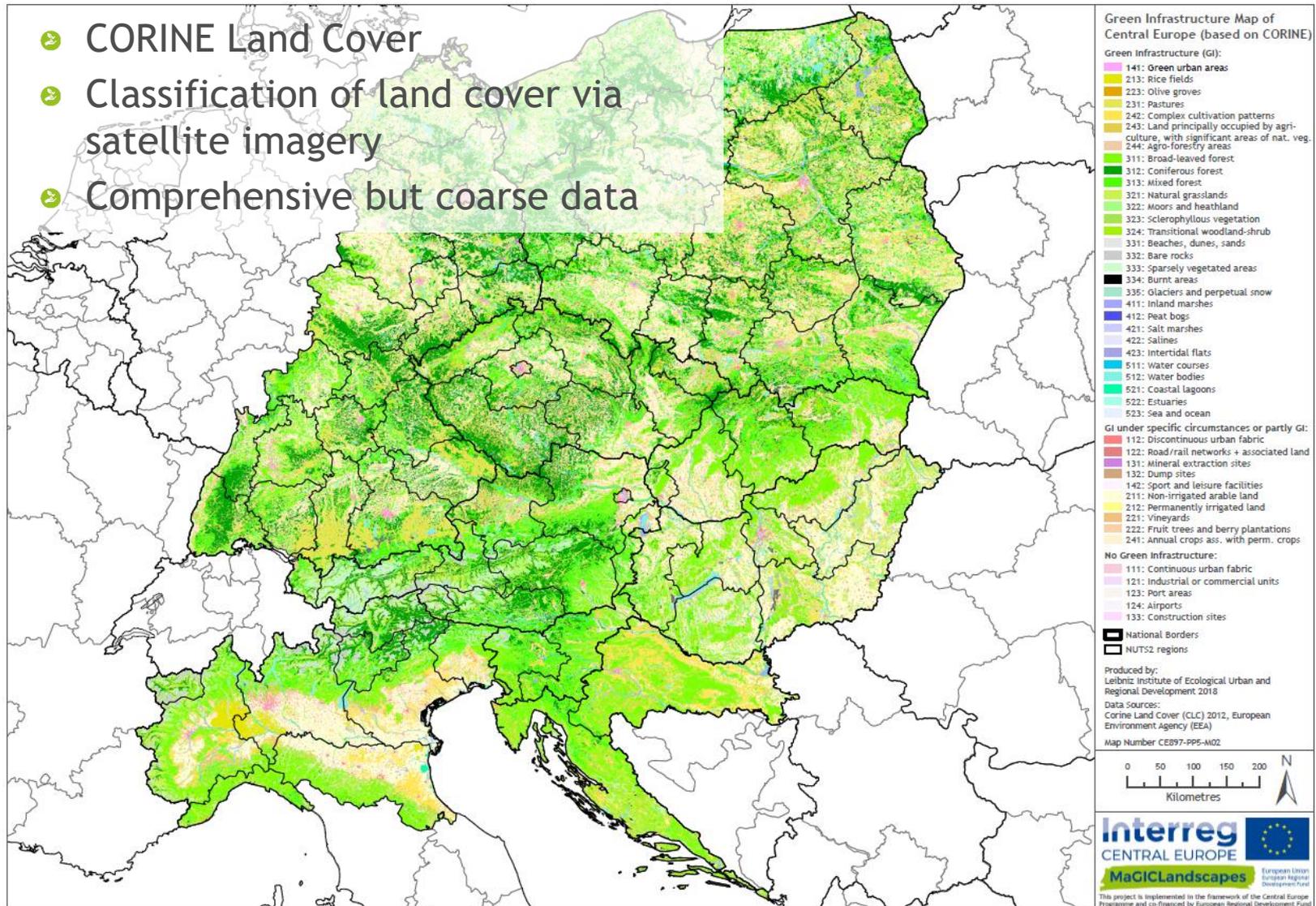
Territorial System
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GREEN INFRASTRUCTURE - TRANSNATIONAL SCALE

- CORINE Land Cover
- Classification of land cover via satellite imagery
- Comprehensive but coarse data



GREEN INFRASTRUCTURE - TRANSNATIONAL SCALE

Where to find Green Infrastructure?

Green Infrastructure (GI):

- 141: Green urban areas
- 213: Rice fields
- 223: Olive groves
- 231: Pastures
- 242: Complex cultivation patterns
- 243: Land principally occupied by agriculture, with significant areas of nat. veg.
- 244: Agro-forestry areas
- 311: Broad-leaved forest
- 312: Coniferous forest
- 313: Mixed forest
- 321: Natural grasslands
- 322: Moors and heathland
- 323: Sclerophyllous vegetation
- 324: Transitional woodland-shrub
- 331: Beaches, dunes, sands
- 332: Bare rocks
- 333: Sparsely vegetated areas
- 334: Burnt areas
- 335: Glaciers and perpetual snow
- 411: Inland marshes
- 412: Peat bogs
- 421: Salt marshes
- 422: Salines
- 423: Intertidal flats
- 511: Water courses
- 512: Water bodies
- 521: Coastal lagoons
- 522: Estuaries
- 523: Sea and ocean

GI under specific circumstances or partly GI:

- 112: Discontinuous urban fabric
- 122: Road/rail networks + associated land
- 131: Mineral extraction sites
- 132: Dump sites
- 142: Sport and leisure facilities
- 211: Non-irrigated arable land
- 212: Permanently irrigated land
- 221: Vineyards
- 222: Fruit trees and berry plantations
- 241: Annual crops ass. with perm. crops

No Green Infrastructure:

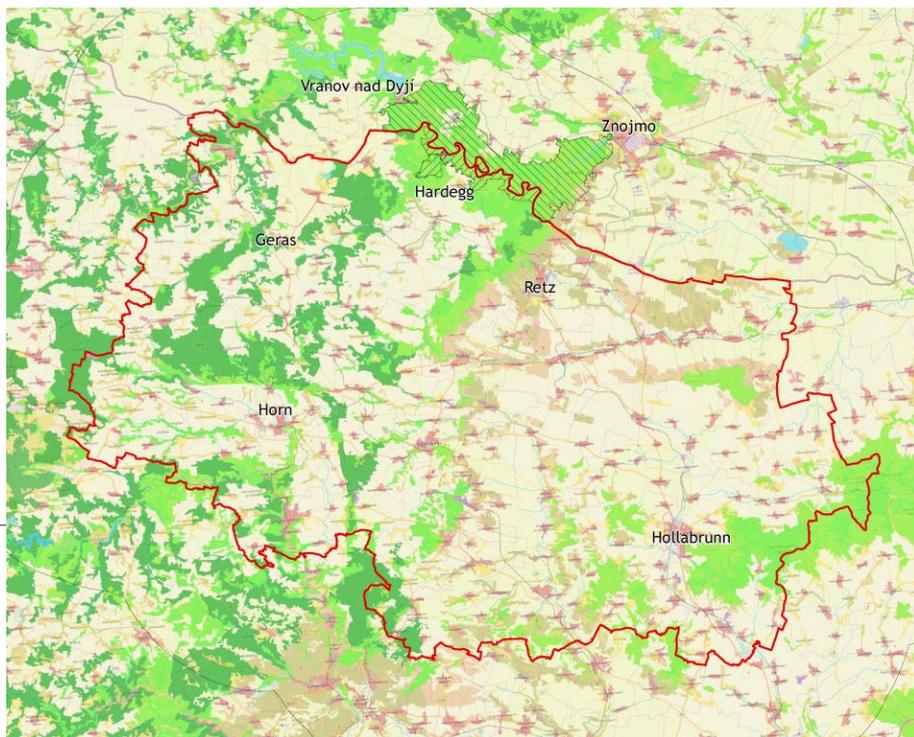
- 111: Continuous urban fabric
- 121: Industrial or commercial units
- 123: Port areas
- 124: Airports
- 133: Construction sites

- useful on the transnational scale
- but lack of detail for regional/local implementation!

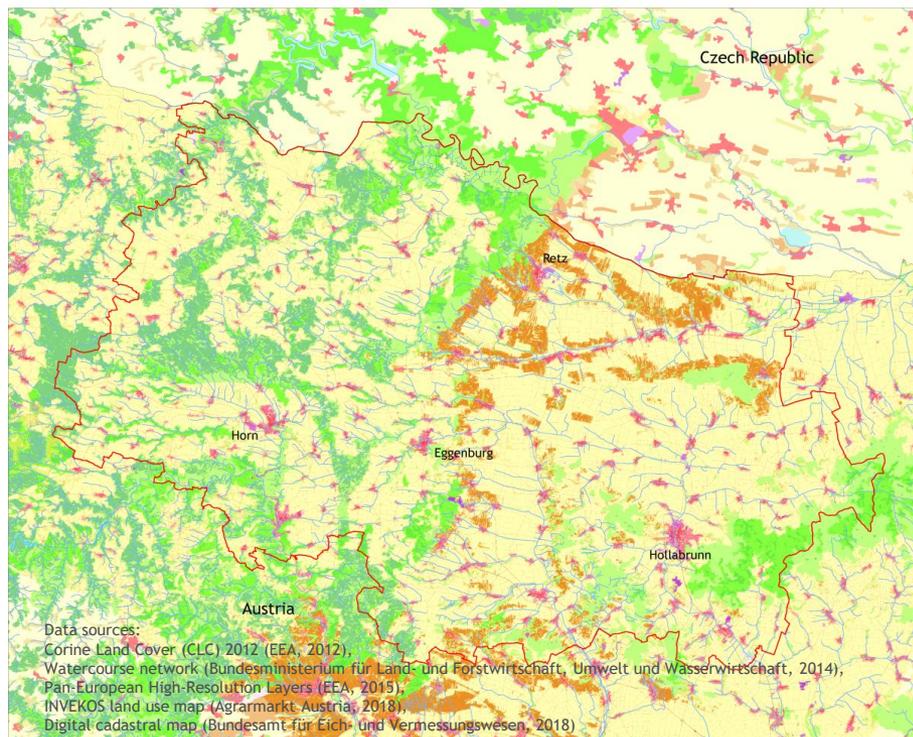
GREEN INFRASTRUCTURE - REGIONAL SCALE

- Extension of the CLC database
- Compilation of various regional geodata to map GI
- Using data of e.g. digital cadasters, agricultural plots, forest inventories, waterways, etc.

Transnational scale



Database



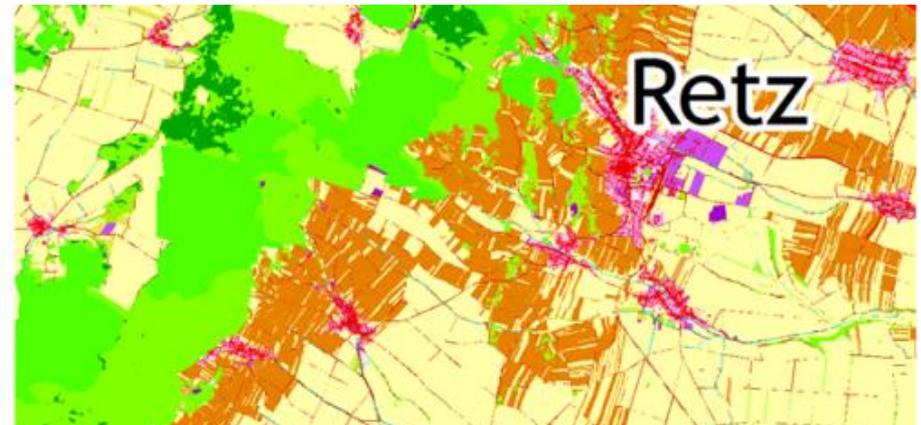
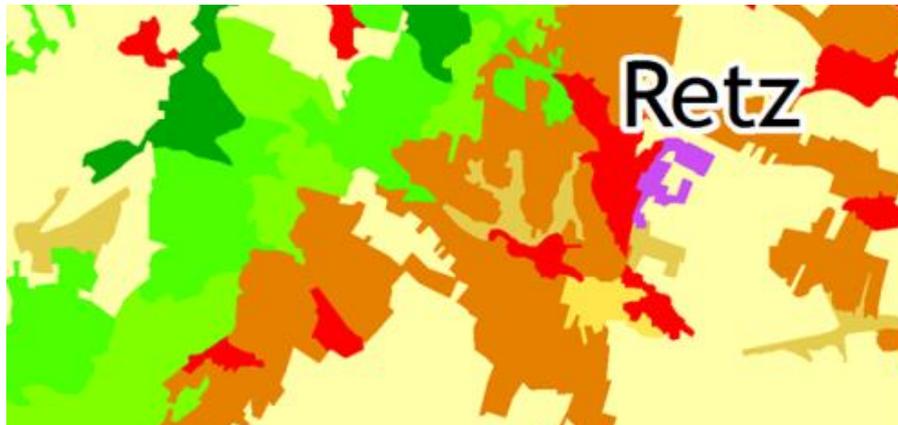
GREEN INFRASTRUCTURE - REGIONAL SCALE

- Regional data reveals differences in the realistic representation of GI
- Classification and generalization of transnational data
 - underrepresents fragmentation of GI (e.g. woodland, vineyards)
 - underrates provision of GI (e.g. arable land, urban fabric)

Transnational scale

Database

Regional scale



- ➔ High degree of detail on regional scale
- ➔ enhanced mapping quality of GI for all types of landscapes
- ➔ precondition to develop stakeholder-based strategies and action plans
- ➔ precise identification of the local GI network for land managers, policy makers and communities.

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ANALYSIS OF CONNECTIVITY

GuidosToolbox

- free software package by the Joint Research Centre (JRC) of the European Commission
- Data input: binary raster image (GI or partly GI = 2, no GI = 1)
 - **Morphological Spatial Pattern Analysis (MSPA)**
 - universal pattern analysis framework provided by a sequence of morphological operators
 - performs a segmentation to identify and localize mutually exclusive morphometric features
 - ➔ describes the *geometry, connectivity and spatial arrangement of image components*
 - **Euclidean Distance**
 - creates map of objects of interest showing the influence zones inside and outside those objects
 - derive the pairwise proximity between neighboring objects
 - ➔ measures the *degree of intactness, shape and spatial arrangement of image components*



<https://forest.jrc.ec.europa.eu/en/activities/lpa/gtb/>

ANALYSIS OF CONNECTIVITY - MSPA

- Foreground (all GI) is partitioned into 7 MSPA classes

input (MSPA: FGConnectivity=8 EdgeWidth=1 Transition=On Intext=On)

File General Tools Image Analysis Help

IMAGE/DISP

Direction/Data

Flip Vertical

Normalized

Autostretch

MSPA SETTINGS

FGConn [8/4]

EdgeWidth [pixels] 1

Transition [On/Off]

Intext [On/Off]

MSPA statistics

	FG/data[%]	Frequency
CORE(s)-green	5.92/ 2.54	1161
CORE(m)-green	7.83/ 3.36	19
CORE(l)-green	61.34/26.29	16
ISLET-brown	3.26/ 1.40	2429
PERF-blue	2.01/ 0.86	570
EDGE-black	12.35/ 5.29	2404
LOOP-yellow	1.14/ 0.49	750
BRIDGE-red	2.22/ 0.95	863
BRANCH-orange	3.93/ 1.68	4685
Backg-grey	— /57.14	1170
Miss-white	0.03	51

X: 419 Y: 748 Value: 18 (byte) MSPA class: CORE (large, external)

Divide MSPA-Core pixels: small < 1000 medium 4600 > large

European Commission

- Core
- Edge
- Perforation
- Bridge
- Loop
- Branch
- Islet
- Background
- No data

<http://forest.jrc.ec.europa.eu/download/software/guidos/>

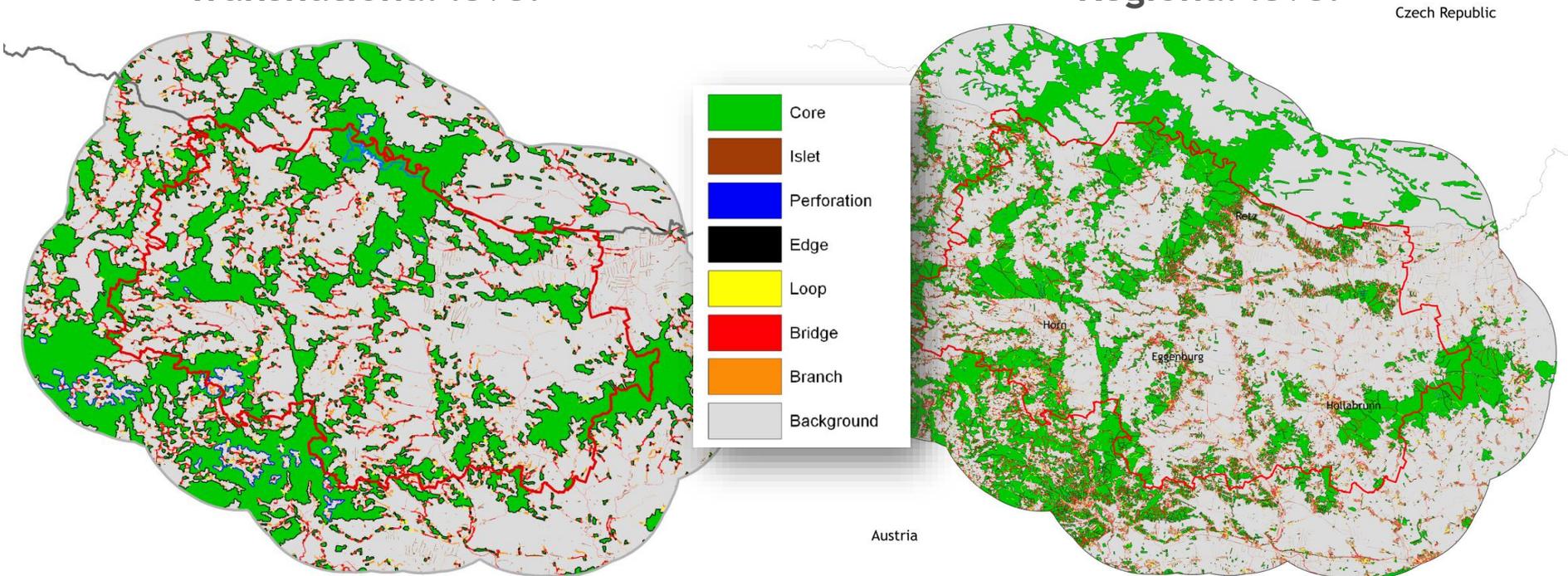
GDAL

ANALYSIS OF CONNECTIVITY - MSPA

- Foreground (all GI) is partitioned into 7 MSPA classes
- targeting individual GI priorities (e.g. forests) is also possible

Transnational level

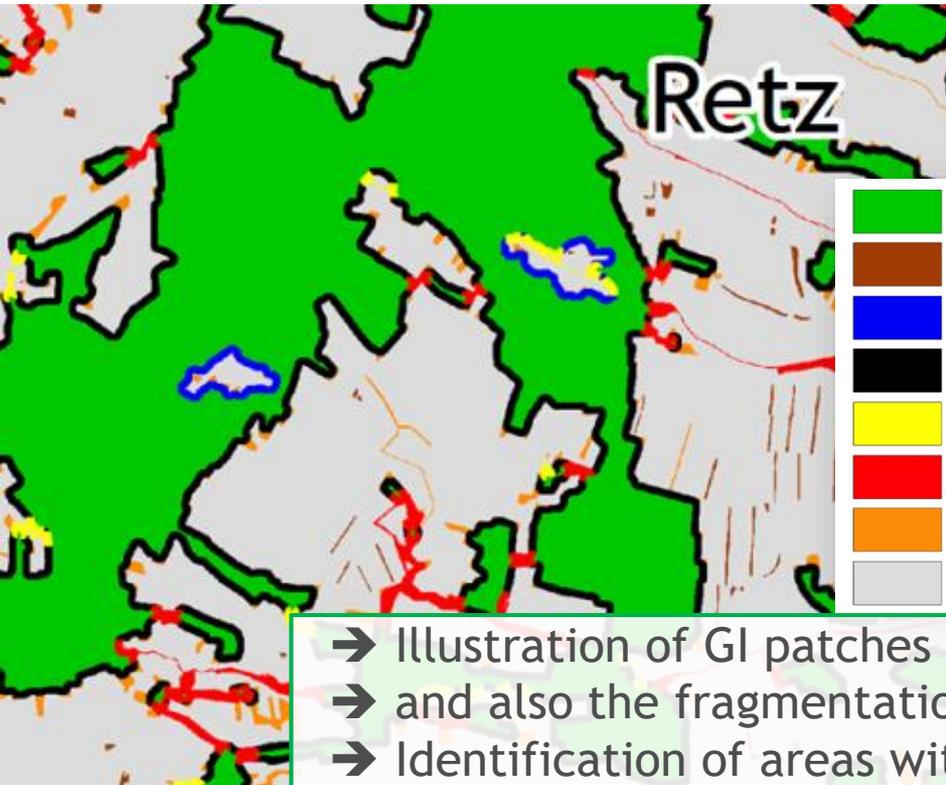
Regional level



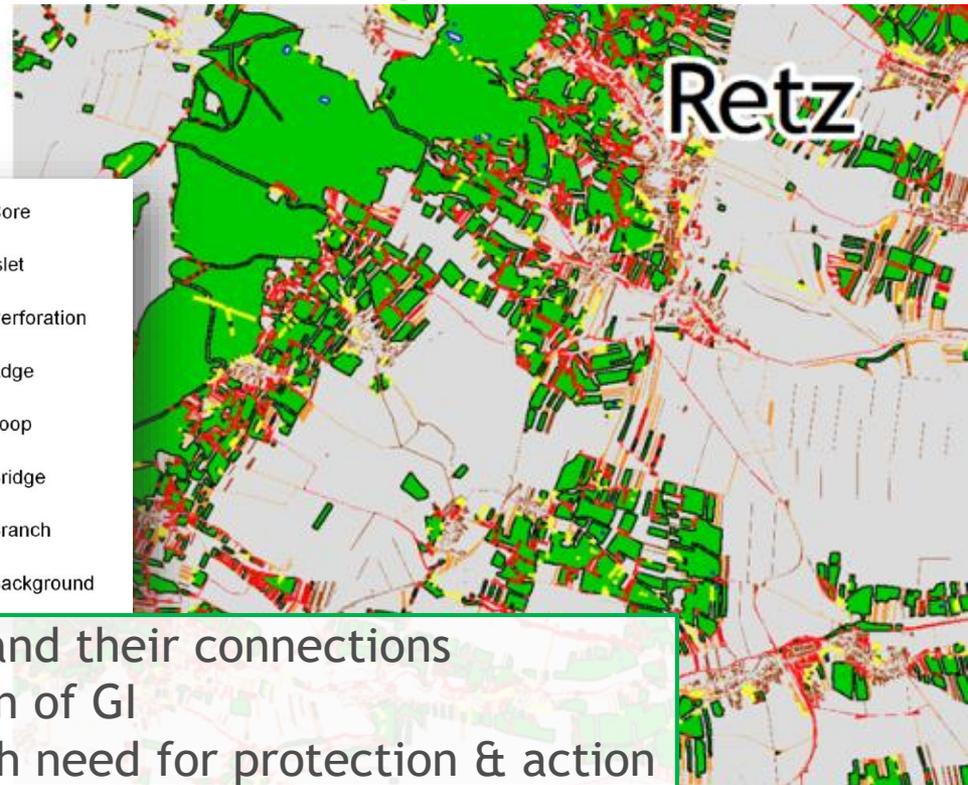
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ANALYSIS OF CONNECTIVITY - MSPA

Transnational level



Regional level



- Illustration of GI patches and their connections
- and also the fragmentation of GI
- Identification of areas with need for protection & action

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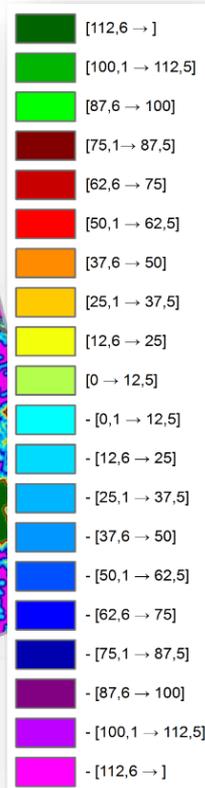
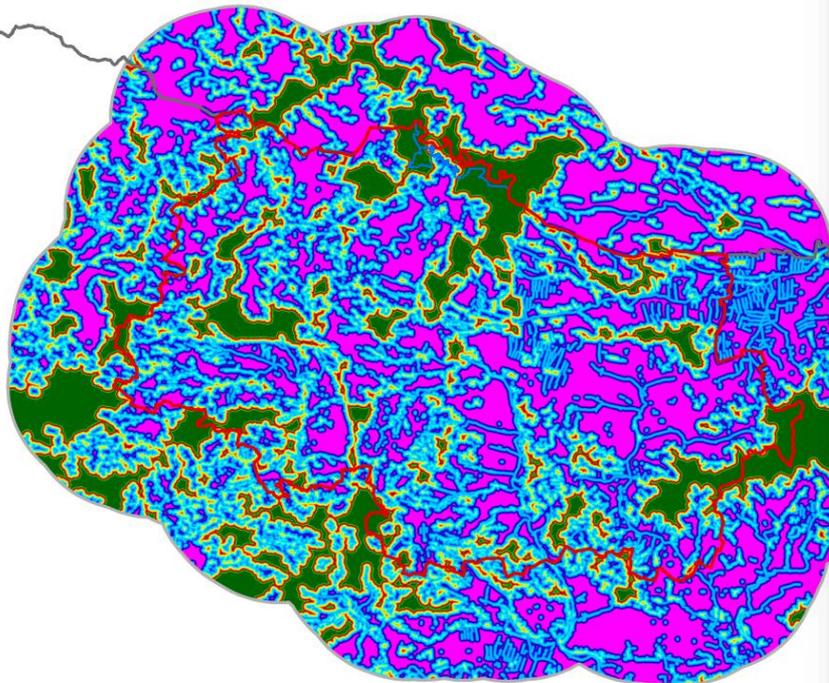


<https://forest.jrc.ec.europa.eu/en/activities/lpa/gtb/>

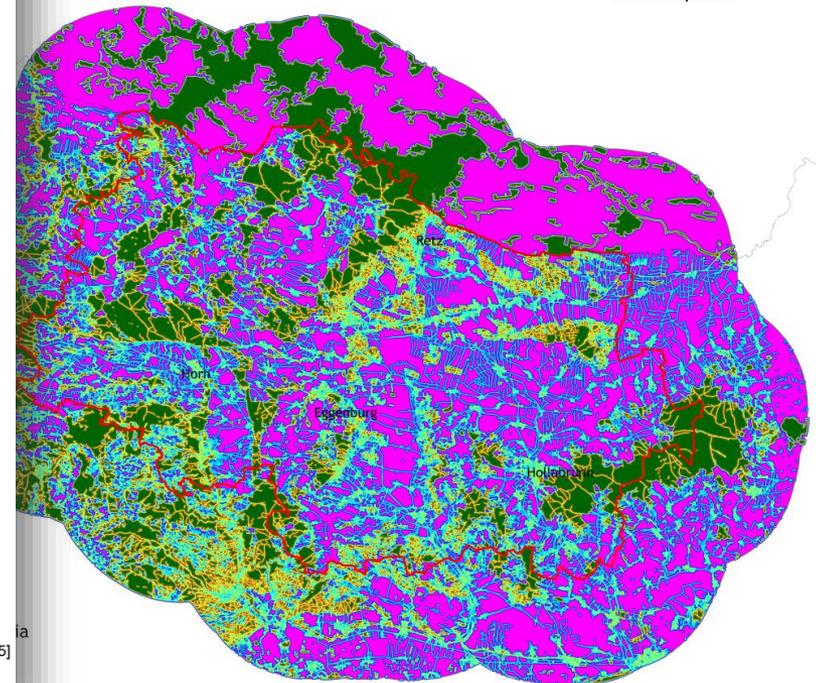
ANALYSIS OF CONNECTIVITY - EUCLIDEAN DISTANCE

- Distance ranges **inside** and **outside** of GI boundaries show the consistency and deficiencies of the GI network

Transnational level

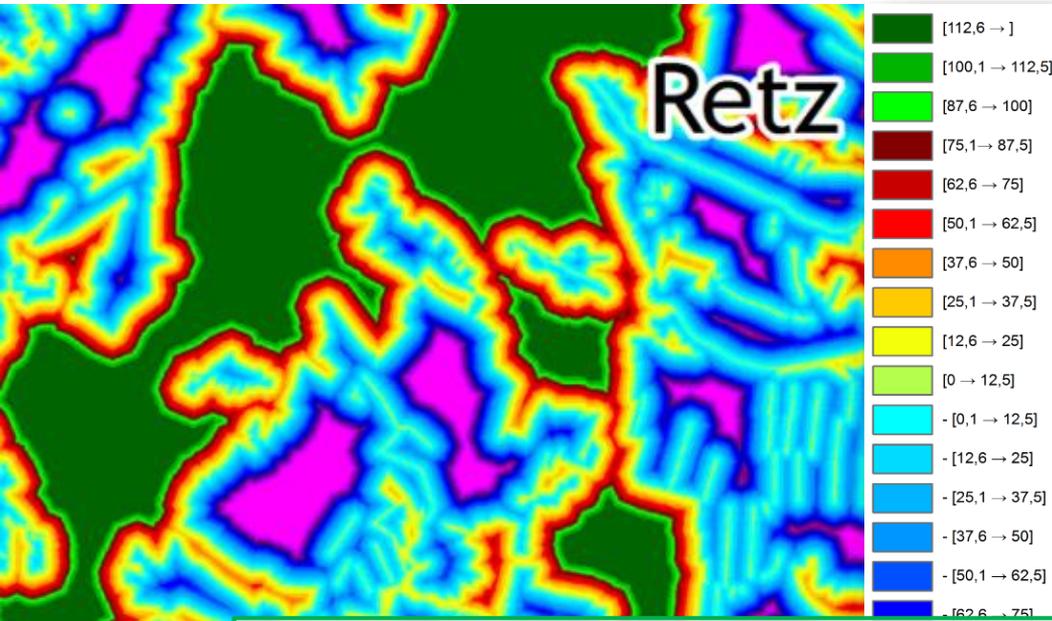


Regional level

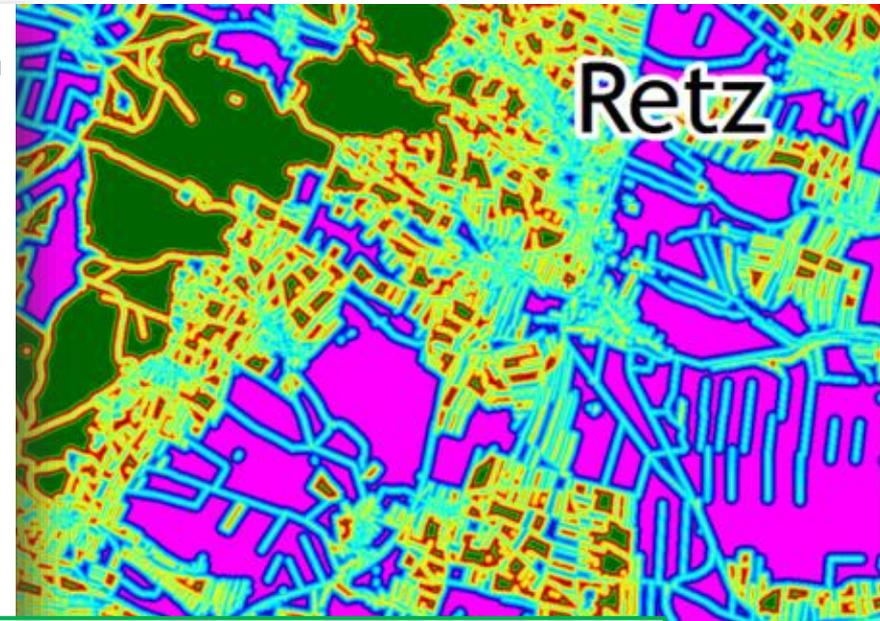


ANALYSIS OF CONNECTIVITY - EUCLIDEAN DISTANCE

Transnational level



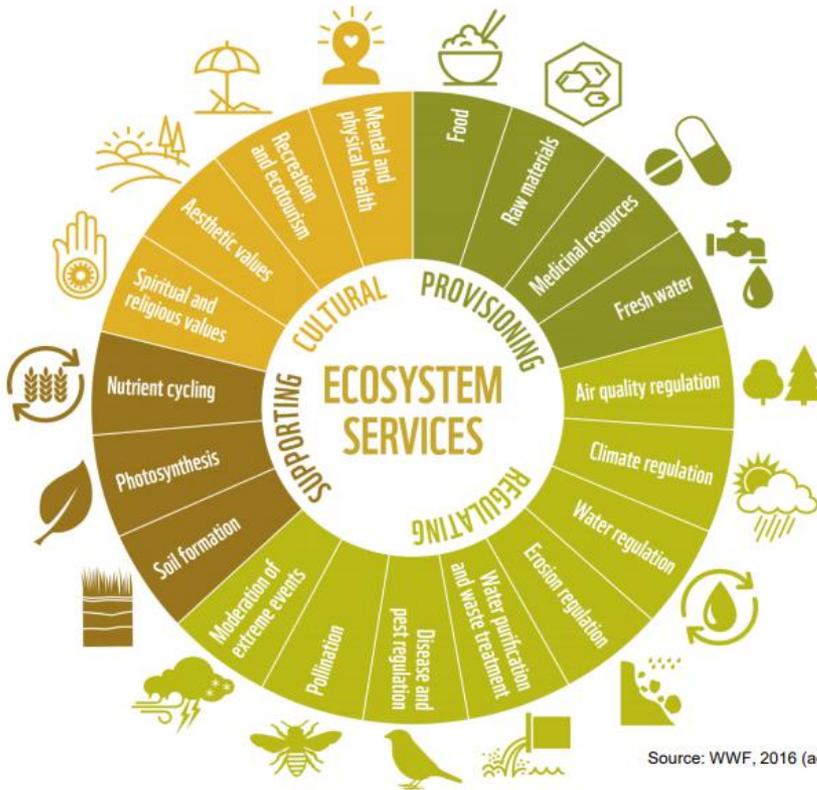
Regional level



- Emphasis of the Hot Spots & well-established GI networks
- Highlighting the Cold Spots & highly fragmented areas
- Finding cost-efficient reconnecting pathways by GI proximities

ANALYSIS OF FUNCTIONALITY

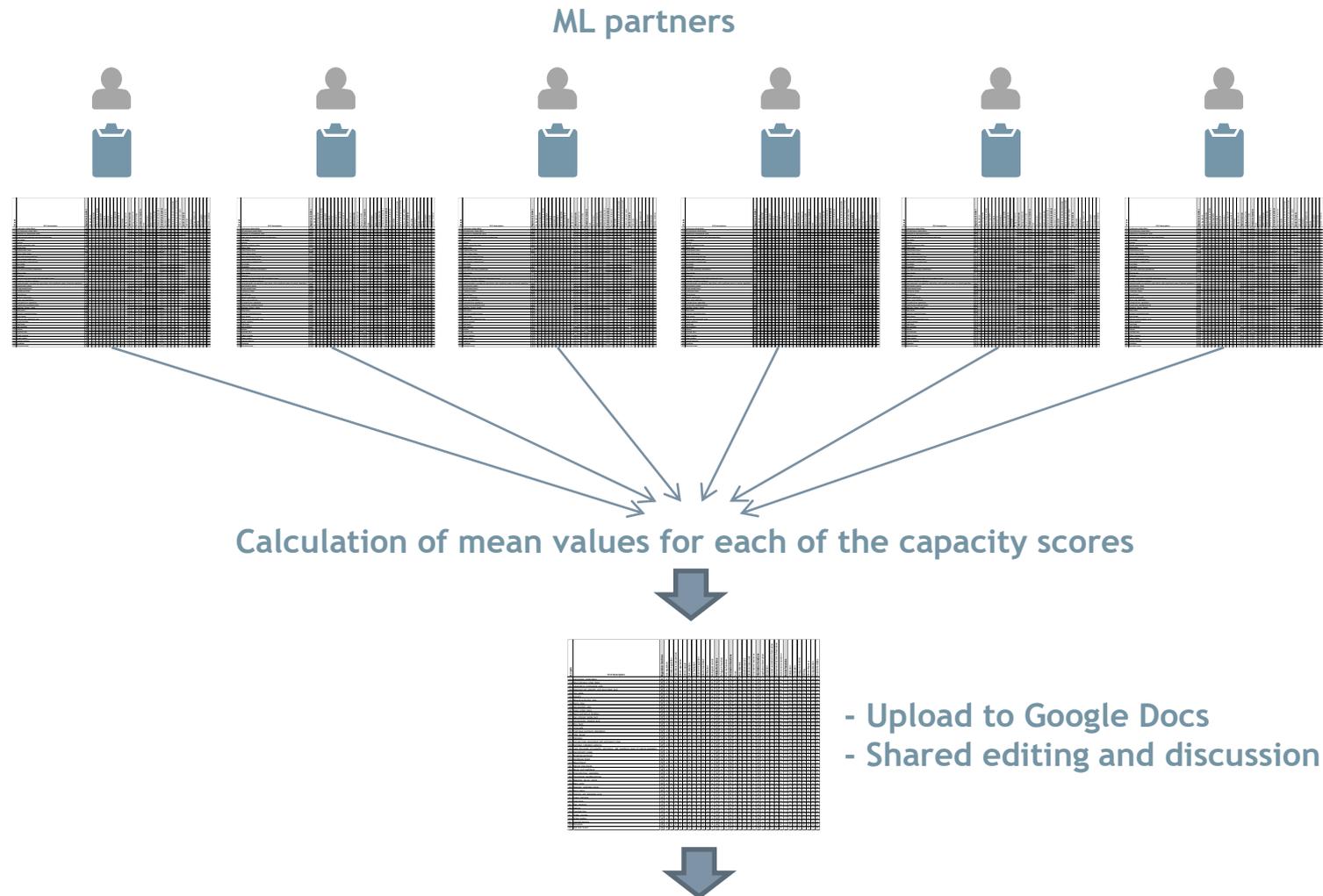
Assessment of landscape services - Where do we start?



- Capacity matrices as a widely used tool for assessing ecosystem services
- Capacity matrix = look-up table that connect land cover types to ecosystem services or landscape services potentially provided
- **Implementation in MaGICLandscapes:** analyze the functionality by plotting LSS matrix on regional geodata sets

ANALYSIS OF FUNCTIONALITY

2.) Individual expert based revision by ML partners



ANALYSIS OF FUNCTIONALITY

3.) Joint expert based validation by ML partners

CLC code	CLC description	Regulation functions	Gas regulation	Climate regulation	Disturbance prevention	Water regulation	Water supply	Soil retention	Soil formation	Nutrient regulation	Waste treatment
111	Continuous urban fabric		0	0	0	0	0	0	0	0	0
112	Discontinuous urban fabric		0	0	0	0	0	0	0	0	0
121	Industrial or commercial units		0	0	0	0	0	0	0	0	0
122	Road and rail networks and associated structures		0	0	0	0	0	0	0	0	0
123	Port areas		0	0	0	0	0	0	0	0	0
124	Airports		0	0	0	0	0	0	0	0	0
131	Mineral extraction sites		0	0	0	0	0	0	0	0	0
132	Dump sites		0	0	0	0	0	0	0	0	0
133	Construction sites		0	0	0	0	0	0	0	0	0
141	Green urban areas		0	0	0	0	0	0	0	0	0
142	Sport and leisure facilities		0	0	0	0	0	0	0	0	0
211	Non-irrigated arable land		2	1	0	0	0	0	0	0	0
212	Permanently irrigated land		2	1	0	0	0	0	0	0	0
213	Rice fields		2	1	0	0	0	0	0	0	0
221	Vineyards		3	2	0	0	0	0	0	0	0
222	Fruit trees and berry plantations		3	2	0	0	0	0	0	0	0
223	Olive groves		2	2	0	0	0	0	0	0	0
231	Pastures		4	3	0	0	0	0	0	0	0
241	Annual crops associated with permanent pastures		4	3	0	0	0	0	0	0	0
242	Complex cultivation patterns		4	3	0	0	0	0	0	0	0
243	Land principally occupied by agriculture, with scattered non-agricultural buildings		4	3	0	0	0	0	0	0	0
244	Agro-forestry areas		4	3	0	0	0	0	0	0	0
311	Broad-leaved forest		1	1	0	0	0	0	0	0	0
312	Coniferous forest		1	1	0	0	0	0	0	0	0
313	Mixed forest		1	1	0	0	0	0	0	0	0
321	Natural grasslands		4	3	0	0	0	0	0	0	0
322	Moors and heathland		4	3	0	0	0	0	0	0	0
323	Sclerophyllous vegetation		4	3	0	0	0	0	0	0	0
324	Transitional woodland-shrub		4	3	0	0	0	0	0	0	0
331	Beaches, dunes, sands		2	1	0	0	0	0	0	0	0
332	Bare rocks		0	0	0	0	0	0	0	0	0
333	Sparsely vegetated areas		1	1	0	0	0	0	0	0	0
334	Burnt areas		0	0	0	0	0	0	0	0	0
336	Glaciers and perpetual snow		1	1	0	0	0	0	0	0	0
411	Inland marshes		4	3	0	0	0	0	0	0	0
412	Peat bogs		4	3	0	0	0	0	0	0	0
421	Salt marshes		3	2	0	0	0	0	0	0	0
422	Salt lakes		1	0	0	0	0	0	0	0	0
423	Intertidal flats		2	1	0	0	0	0	0	0	0
511	Water courses		3	2	0	0	0	0	0	0	0
512	Water bodies		3	2	0	0	0	0	0	0	0
521	Coastal lagoons		4	3	0	0	0	0	0	0	0
522	Estuaries		3	2	0	0	0	0	0	0	0
523	Sea and ocean		3	2	0	0	0	0	0	0	0

Comments from users:

- Gian Luigi Rossi: "it is important, for us, to consider the right proportions between the roles of natural uses for habitat functions and the 'residual' roles played by artificial uses"
- Anonym: "where the soil is seen as a source of erosion"
- Gian Luigi Rossi: "1 we think there is a little role for discontinuous urban fabric in refugium function"
- Anonym: "some mining sites may not have exhausted capacity"
- simonetta alberico: "green areas have not a residential use"
- Gian Luigi Rossi: "I agree with KRNAP, I propose 2"
- Gian Luigi Rossi: "3 as the other type of agricultural land"
- simonetta alberico: "4 their role in disturbance"
- Gian Luigi Rossi: "crumbling of rocks contributes to soil formation"
- Anonym: "3 as the water course"
- Gian Luigi Rossi: "5 --> 4"

ANALYSIS OF FUNCTIONALITY

Final landscape services capacity Matrix for CE

CLC code	CLC description	Regulation functions	Gas regulation	Climate regulation	Disturbance prevention	Water regulation	Water supply	Soil retention	Soil formation	Nutrient regulation	Waste treatment	Pollution	Biological control	Habitat functions	Redigum function	Nursery function	Production functions	Food	Raw materials	Genetic resources	Medicinal resources	Ornamental resources	Information functions	Aesthetic information	Recreation	Cultural and artistic information	Spiritual and historic information	Science and education	Carrier functions	Habitat	Cultivation	Energy-conversion	Mining	Waste disposal	Transportation	Tourism-facilities	Total Function Value	
111	Continuous urban fabric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	4	2	0	2	5	0	1	0	0	3	2	16	
112	Discontinuous urban fabric	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	2	3	3	4	2	0	1	4	0	1	0	0	3	2	18	
121	Industrial or commercial units	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	4	0	1	0	0	3	0	6	
122	Road and rail networks and associated land	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	5	2	8	
123	Port areas	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	1	0	0	1	0	0	0	0	5	2	8	
124	Airports	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	5	2	7	
131	Mineral extraction sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	2	0	4		
132	Dump sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	0	0	3		
133	Construction sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1		
141	Green urban areas	2	2	4	1	2	1	2	1	1	2	1	1	2	2	1	0	0	1	0	0	1	2	3	5	3	0	1	1	0	1	0	1	0	0	0	4	27
142	Sport and leisure facilities	1	1	2	0	1	1	1	1	0	2	0	1	1	2	0	0	0	0	0	0	0	1	5	1	0	0	1	0	0	0	0	0	0	0	0	5	16
211	Non-irrigated arable land	1	1	3	1	3	0	1	2	1	1	1	2	2	2	2	2	5	2	2	1	1	1	2	1	3	0	1	1	0	5	0	0	0	0	0	0	31
212	Permanently irrigated land	2	1	3	1	4	0	1	2	1	1	1	2	2	2	2	2	5	2	2	1	1	1	2	1	3	0	1	1	0	5	0	0	0	0	0	0	31
213	Rice fields	2	1	3	1	4	1	1	2	2	1	1	2	4	3	4	2	5	2	2	1	1	2	3	1	4	2	2	1	0	5	0	0	0	0	0	0	42
221	Vineyards	2	1	3	1	3	1	2	3	1	1	1	1	2	2	2	2	5	3	2	1	1	3	3	3	4	3	2	1	0	5	0	0	0	0	1	40	
222	Fruit trees and berry plantations	3	2	3	2	3	1	2	3	2	2	5	3	2	2	1	2	5	2	2	1	1	3	3	3	3	2	2	1	0	5	0	0	0	0	1	40	
223	Olive groves	2	2	4	2	3	1	3	3	2	2	2	3	3	2	3	5	2	2	2	2	4	4	3	4	4	3	1	0	5	0	0	0	0	1	48		
231	Pastures	3	1	3	1	3	1	4	4	2	3	3	3	4	4	3	3	5	2	3	3	1	3	4	4	3	1	3	1	0	5	0	0	0	0	1	51	
241	Annual crops associated with permanent crops	2	1	3	1	3	1	2	3	1	1	3	2	2	2	2	4	3	1	3	1	2	2	2	3	1	2	1	0	4	0	0	0	0	0	1	36	
242	Complex cultivation patterns	2	1	3	1	3	1	2	3	1	2	2	3	3	3	2	2	4	2	1	2	1	2	2	3	3	2	2	1	1	4	0	0	0	0	1	39	
243	Land principally occupied by agriculture, with significant areas of natural vegetation	2	2	3	1	3	2	3	3	2	2	2	3	4	3	4	3	3	2	3	3	3	3	3	3	3	3	1	0	3	1	0	0	0	2	49		
244	Agro-forestry areas	3	3	4	1	4	3	4	4	2	3	2	4	4	3	3	3	5	3	3	3	3	2	3	3	2	3	1	0	3	3	0	0	1	1	54		
311	Broad-leaved forest	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	3	5	5	5	5	5	5	5	4	5	5	1	0	1	1	0	0	0	2	79	
312	Coniferous forest	4	5	4	4	4	4	3	2	4	3	4	3	3	3	4	2	5	3	3	5	5	4	4	4	3	4	4	1	0	1	1	0	0	0	2	78	
313	Mixed forest	5	5	4	5	5	5	5	4	4	5	5	5	5	4	3	5	5	4	3	5	5	4	5	5	5	4	4	5	0	1	1	0	0	0	2	77	
321	Natural grasslands	4	3	3	3	4	4	5	5	4	3	4	4	5	5	5	3	2	1	5	3	4	5	5	5	4	4	5	0	1	0	0	0	0	0	1	67	
322	Moors and heathland	4	3	4	4	4	4	5	5	4	3	3	4	5	5	5	3	2	3	5	3	4	5	5	5	4	4	5	0	0	1	0	0	0	0	1	69	
323	Sclerophyllous vegetation	4	3	4	4	3	3	5	5	4	3	4	4	5	5	4	3	3	5	3	4	4	5	4	4	3	4	5	0	0	0	0	0	0	0	0	1	67
324	Transitional woodland-shrub	4	3	4	4	3	4	5	5	4	3	4	4	5	5	5	3	2	3	4	3	3	4	4	4	3	2	5	0	1	0	0	0	0	0	0	63	
331	Beaches, dunes, sands	2	1	2	5	5	2	2	2	1	1	1	1	5	4	5	2	0	1	4	2	3	4	5	5	2	4	4	0	0	0	1	0	0	2	52		
332	Bare rocks	0	0	0	1	1	0	0	0	0	1	0	3	4	1	2	0	0	3	2	3	3	4	4	0	5	4	0	0	0	0	0	0	0	0	0	2	33
333	Sparsely vegetated areas	1	1	1	1	2	1	1	1	1	2	1	4	4	4	2	0	0	3	2	3	3	4	3	1	4	4	0	0	0	0	0	0	0	0	0	0	40
334	Burnt areas	0	0	0	0	0	0	1	0	1	1	2	1	2	1	2	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
335	Glaciers and perpetual snow	1	1	3	0	4	5	0	0	0	0	1	2	2	2	1	0	0	2	0	3	4	5	5	1	5	4	0	0	0	0	0	0	0	2	34		
411	Inland marshes	4	4	4	4	5	5	4	5	4	5	2	1	5	5	5	3	1	2	5	4	2	4	4	4	2	4	5	0	0	0	1	0	0	1	63		
412	Peat bogs	4	4	5	3	4	4	5	4	4	1	3	5	5	4	2	0	4	4	3	1	4	4	4	4	2	4	4	1	0	0	2	2	0	0	1	60	
421	Salt marshes	3	1	3	3	4	3	4	4	3	3	2	1	5	4	5	2	1	1	4	3	2	1	4	4	3	3	4	5	0	0	0	0	0	0	0	53	
422	Salines	1	0	2	0	3	2	0	2	1	2	0	0	4	4	4	2	1	0	3	2	2	2	3	2	0	4	3	0	0	0	0	0	0	0	1	37	
423	Intertidal flats	2	0	3	5	3	0	1	1	1	3	0	2	5	5	4	2	3	0	3	2	2	4	4	2	4	4	0	0	0	0	0	0	0	1	49		
511	Water courses	3	2	4	3	4	5	2	1	3	5	0	3	5	5	5	3	3	2	5	3	4	5	5	4	5	5	1	0	0	4	0	0	3	3	70		
512	Water bodies	3	2	4	3	4	5	3	4	3	5	0	3	5	5	5	3	3	2	5	3	3	5	4	5	4	5	5	1	0	0	3	0	0	3	69		
521	Coastal lagoons	4	3	5	4	4	4	4	4	4	5	2	3	5	5	5	3	4	1	5	3	4	5	5	4	4	5	0	0	0	0	0	0	0	1	68		
522	Estuaries	3	3	5	3	4	4	3	3	3	5	0	4	5	5	5	4	4	2	5	3	4	5	5	5	4	4	5	1	0	3	1	0	0	2	70		
523	Sea and ocean	3	3	5	2	4	5	3	1	5	5	0	3	5	5	5	5	5	3	5	5	5	5	5	5	5	5	1	0	0	2	0	0	4	3	77		

ANALYSIS OF FUNCTIONALITY

Final landscape services capacity Matrix for CE

CLC code	CLC description	Regulation functions											Habitat functions					Production functions			Information functions					Carrier functions			Total Function Value					
		Gas regulation	Climate regulation	Disturbance prevention	Water regulation	Water supply	Soil retention	Soil formation	Nutrient regulation	Waste treatment	Pollution	Biological control	Regulium function	Nursery function	Food	Raw materials	Genetic resources	Medicinal resources	Ornamental resources	Aesthetic information	Recreation	Cultural and artistic information	Spiritual and historic information	Science and education	Habitat	Cultivation	Energy-conversion	Mining		Waste disposal	Transportation	Tourism-facilities		
111	Continuous urban fabric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	4	2	0	2	5	0	1	0	0	3	2	16	
112	Discontinuous urban fabric	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	3	3	4	2	0	1	4	0	1	0	0	3	2	18	
121	Industrial or commercial units	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	4	0	1	0	0	3	0	6	
122	Road and rail networks and associated land	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	2	8	
123	Ports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	
124	Green spaces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	
125	Water bodies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	
126	Coastal lagoons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
127	Estuaries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
128	Sea and ocean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
129	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
133	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
134	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
136	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
139	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
141	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
142	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
144	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
147	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	Land use not defined	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
152	Water bodies	3	2	4	3	4	5	3	4	3	5	0	3	5	5	5	3	3	2	5	3	3	5	4	5	4	5	5	1	0	0	3	0	3
153	Coastal lagoons	4	3	5	4	4	4	4	4	4	5	2	3	5	5	5	3	4	1	5	3	4	5	5	5	4	4	5	0	0	0	0	0	1
154	Estuaries	3	3	5	3	4	4	3	3	3	5	0	4	5	5	5	4	4	2	5	3	4	5	5	5	4	4	5	1	0	3	1	0	2
155	Sea and ocean	3	3	5	2	4	5	3	1	5	5	0	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	0	0	2	0	4

TOTAL function value

= total amount of capacity of all landscape services

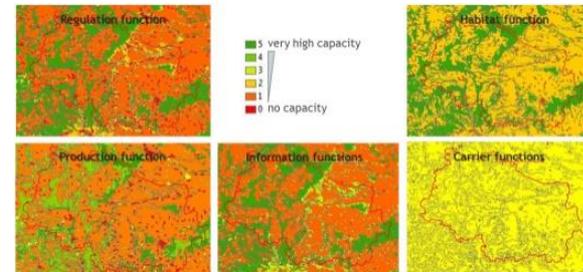
→ indicator for multifunctionality of GI and landscape elements

- Σ Regulation services
 - Σ Habitat services
 - Σ Provision services
 - Σ Information services
 - Σ Carrier services
-
- = TOTAL FUNCTION VALUE

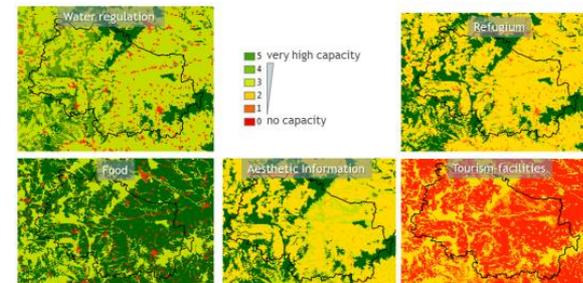
ANALYSIS OF FUNCTIONALITY

Maps demonstrating functionality

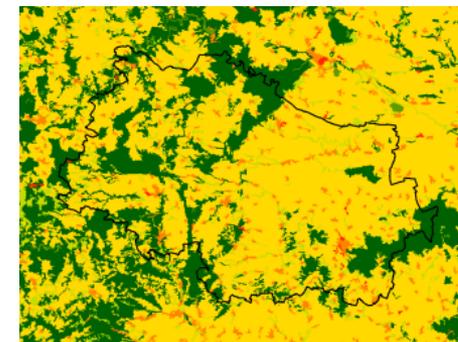
- Relevant single categories of LSS (actual values of single LSS)



- Main categories of LSS (mean values of single LSS)

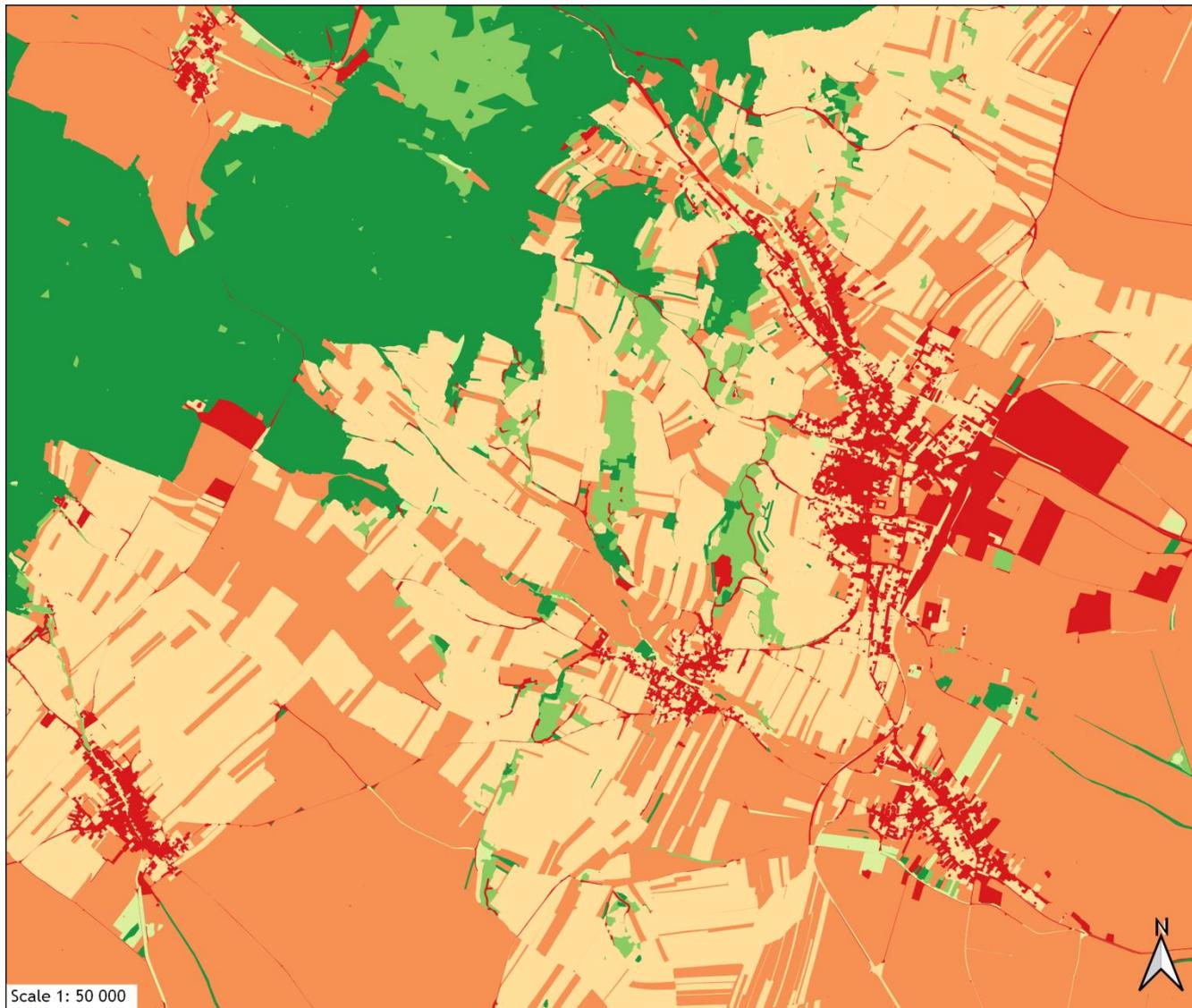


- Total function value (multifunctionality of GI)



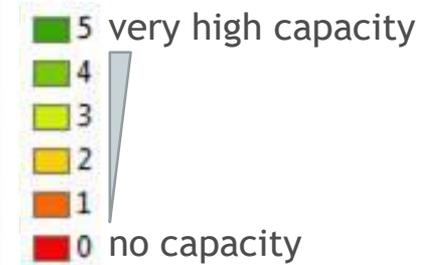
ANALYSIS OF FUNCTIONALITY

Eastern Wald- & Western Weinviertel



CORINE Land Cover Classes -
Case study Area Western Wein-
& Eastern Waldviertel, Austria

Regulation functions



Scale 1: 50 000

0 1 2 3 km

Produced by:
University of Vienna
Division of Conservation Biology, Vegetation and Landscape Ecology 2019

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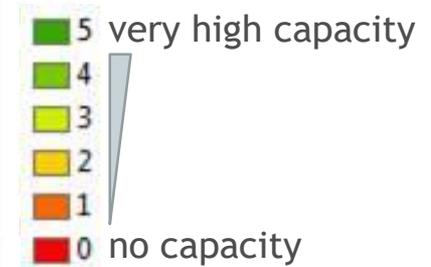
ANALYSIS OF FUNCTIONALITY

Eastern Wald- & Western Weinviertel



CORINE Land Cover Classes -
Case study Area Western Wein-
& Eastern Waldviertel, Austria

Climate regulation



- Highly detailed view on the various functional capacity of GI
- Detection of areas of interest to develop specific management strategies
- Easy communication to enhance applicability & acceptance of GI initiatives

Scale 1: 50 000

0 1 2 3 km

Produced by:
University of Vienna
Division of Conservation Biology, Vegetation and Landscape Ecology 2019

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AGENDA

Data Acquisition -
Transnational &
Regional GI data

Data Analysis -
Connectivity &
Functionality of GI

Field Mapping -
Local GI Assessment

Territorial System
of Ecological
Stability

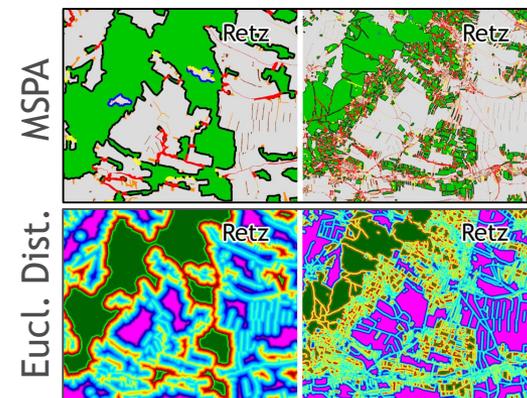
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GREEN INFRASTRUCTURE - LOCAL SCALE

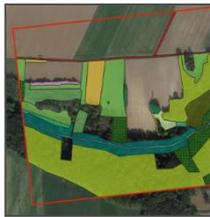
Identification of GI of interest

- Selecting appropriate sites for assessment (based on MSPA, Euclidean Distance)
- Focus on:
 - crucial areas for GI (cores, nodes, bridges,...)
 - different habitats (forest, wetlands, dry grasslands)
- Adaption of shape and size (bridge vs. node)
- Cumulative area of min. 1 km²



FIELD MAPPING

Workflow in the field



Field mapping form - Elements of Green Infrastructure (GI)

WP 2 - Green Infrastructure at European, Regional and Local Scale - Green Infrastructure Functionality Assessment

Interreg CENTRAL EUROPE
H2020Landscapes

Date: _____ Political municipality: _____
User: _____ Mapping unit: _____

Element No.	General characteristics of element	Habitat type	Barrier	Level of naturalness	Barriers
example	Religiosity of nearby church and chapel site	2A (open grassy meadows and pastures)	B1.2 (deciduous forest)	4 (deciduous for forest nature)	<input type="checkbox"/> forest <input type="checkbox"/> field <input type="checkbox"/> other
1					<input type="checkbox"/> forest <input type="checkbox"/> field <input type="checkbox"/> other

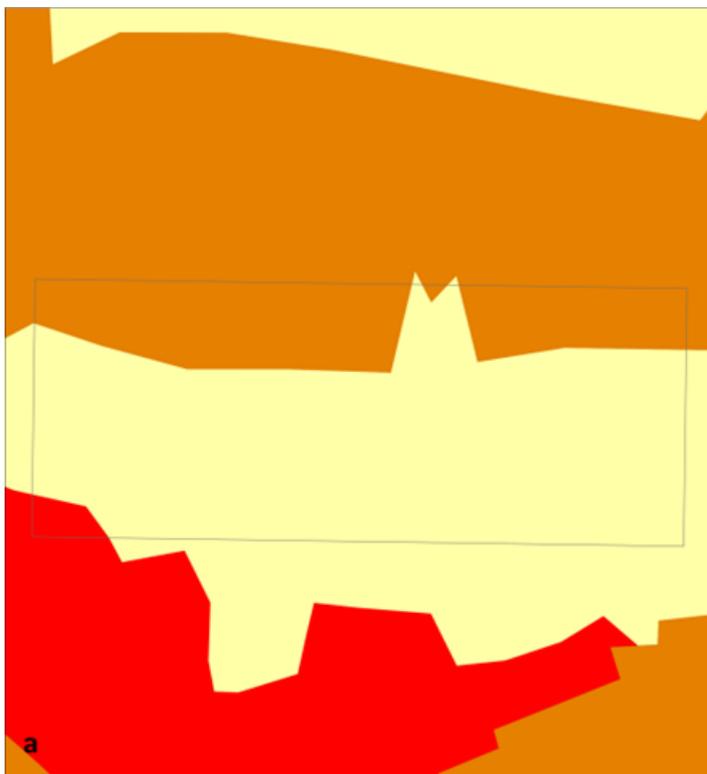
- 1 Location of homogenous GI elements
- 2 Determination of EUNIS habitat type, hemeroby, barriers, general characteristics
- 3 Marking out on aerial image
- 4 Processing spatial data in GIS
- 5 Joining shapefile with database from field mapping form



FIELD MAPPING - RESULTS

Comparison of CLC data

Transnational level



Regional level



Map of CORINE land cover, based on regional data

□ Border of study area

CLC description

- Discontinuous urban fabric
- Industrial or commercial units
- Road and rail networks and associated land
- Green urban areas
- Sport and leisure facilities
- Non-irrigated arable land
- Vineyards
- Fruit trees and berry plantations
- Pastures
- Land principally occupied by agriculture with significant areas of natural vegetation
- Agro-forestry areas
- Broad-leaved forest
- Transitional woodland-shrub
- Water courses
- Water bodies

Scale 1:9 000

Produced by:
University of Vienna
Division of Conservation Biology, Vegetation and Landscape Ecology 2019



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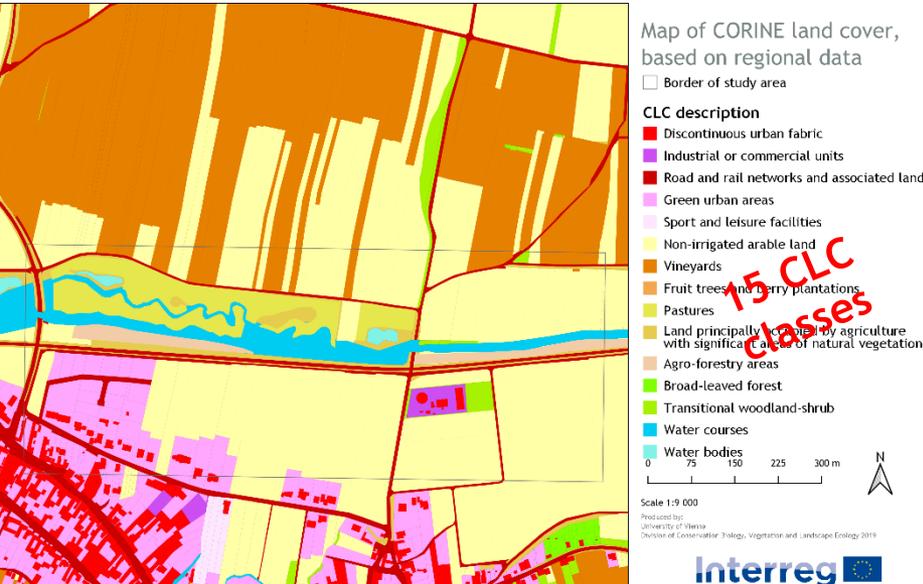
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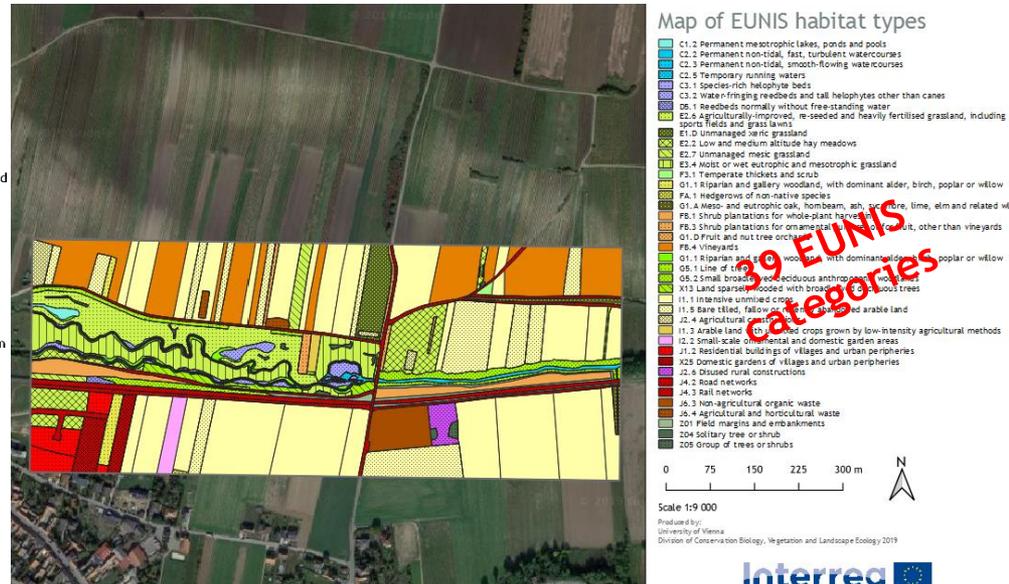
FIELD MAPPING - RESULTS

CLC vs. EUNIS Habitat Types

Regional level



Local level



- Significant higher degree of detail
- Numerous biotope types, hence different management approaches
- very useful for concrete spatial planning on local scale

FIELD MAPPING - RESULTS

Level of naturalness



Map of Hemeroby

□ Border of study area

Level of naturalness

- 1 Artificial
- 2 Strange to natural
- 3 Far from natural
- 4 Relatively far from natural
- 5 Semi-natural
- 6 Natural

0 75 150 225 300 m

Scale 1:9 000



→ Localization of high-quality habitats

Vegetation and Landscape Ecology 2019



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FIELD MAPPING - RESULTS

Barriers



Map of barriers within the biotopes of the case study area

□ Border of study area

Merged_GI_Data

■ walled

■ fenced

■ partly fenced

□ none

0 75 150 225 300 m

Scale 1:9 000



→ Consideration of physical barriers with in the landscape for further planning

Vegetation and Landscape Ecology 2019

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AGENDA

Data Acquisition -
Transnational &
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Connectivity &
Functionality of GI

Local GI
Assessment

Territorial
System of
Ecological
Stability

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Functionality and connectivity of GI - regional example from the Czech Republic

Territorial System of Ecological Stability

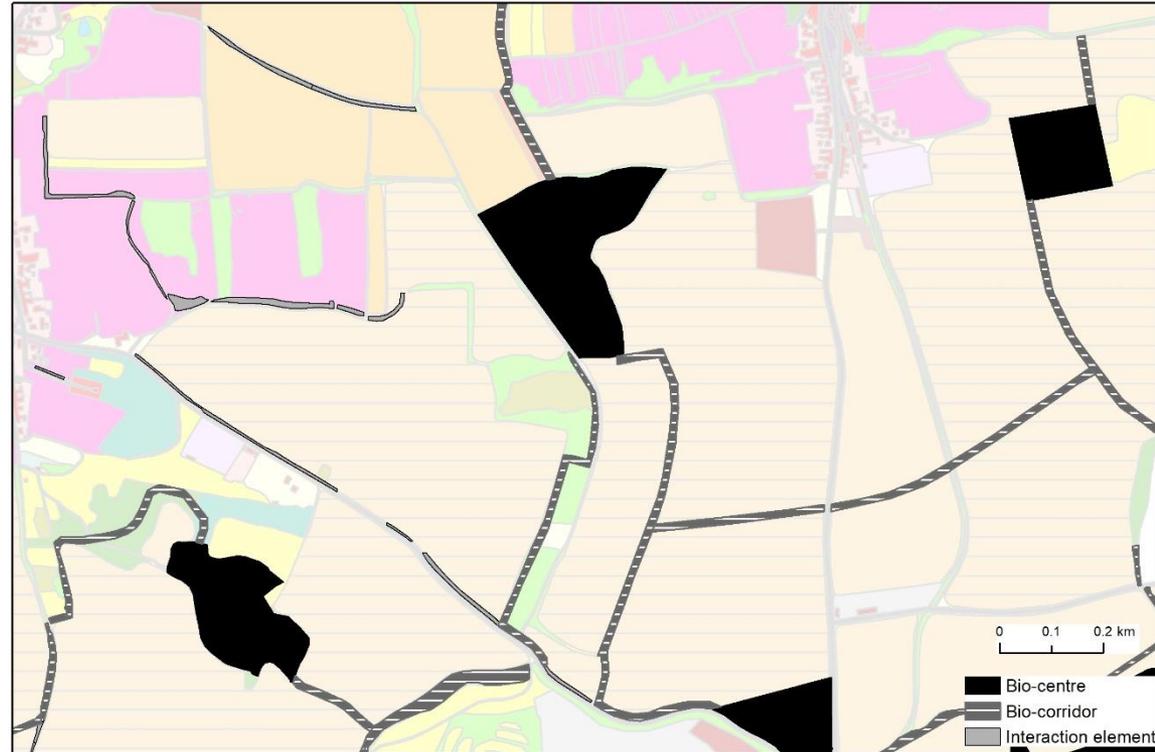
Hana Skokanová | Silva-Tarouca Research Institute for Landscape and Ornamental Gardening

TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY (TSES)

Kyjevsko



- Defined as interconnected system of natural as well as modified but semi-natural ecosystems keeping the natural balance
- Designed network, integral part of municipalities' spatial plans
- Three levels - local, regional, supra-regional - different spatial parameters
- Three types:
 - Bio-centres
 - Bio-corridors
 - Interaction elements

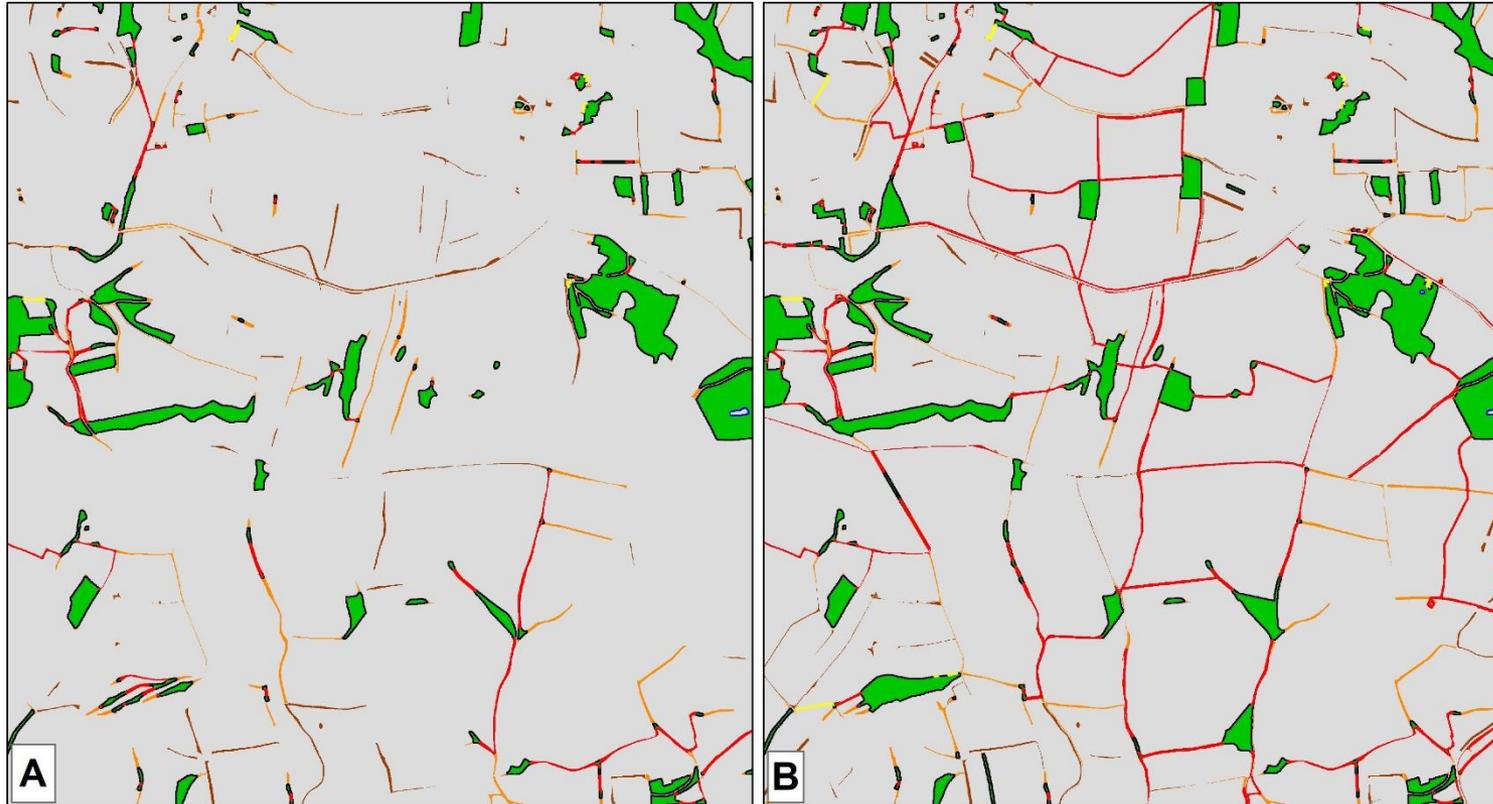


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TSES AND CONNECTIVITY

Kyjevsko



- Fully implemented can increase connectivity
- Kyjevsko - increase in equivalent connected area (ECA) from 150 ha to 1,239 ha
- Increases number of bridges & area of cores

Core Branch Bridge Loop Islet Perforation Edge Background

0 0.5 1 km

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- Part of GI
- More narrowly focused on the need to protect/create a minimum area for potential natural biota
- Increases connectivity of GI
- Strict set of rules
 - Concept easily understandable for professional background
 - Can omit other features that do not follow these rules but have a positive effect on the landscape and people (e.g. high nature value farmland, domestic gardens)
- New GI elements outside TSES easier to create with the help & agreement of landowners

CONTACTS

Kyjevsko



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Department of Landscape ecology



<https://www.vukoz.cz/index.php/en>



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