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Green Infrastructure Decision Support Mapping Approach for Ecosystem Services

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PROGRESS

Sharing solutions for better regional policies

13th June 2022

The action

The Pilot Action involved **the transfer of the SITxell Territorial Information System,** which was identified as a Good Practice during the first thematic semester of the PROGRESS project.

Aimed to **develop and test a mapping approach for decision-making on Green Infrastructure in the DLR County,** to provide information and criteria for supporting local administrations land planning and management tasks

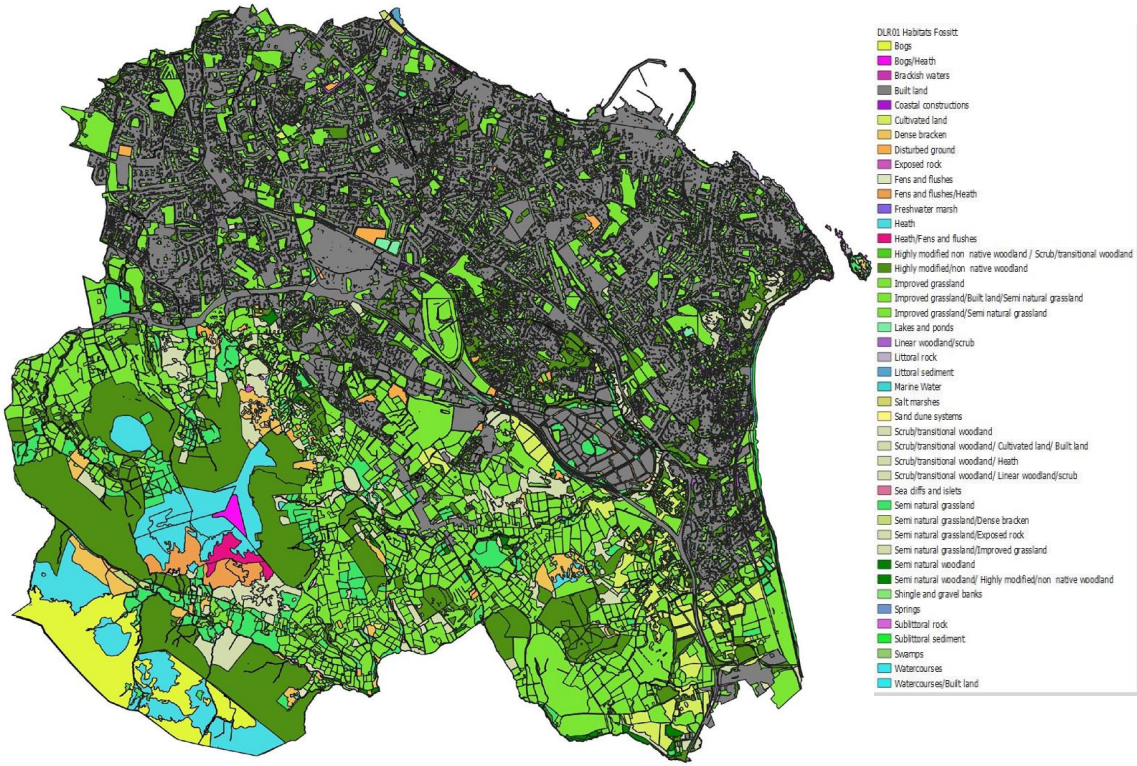
In practice

- To set up **a first information system of the Dún Laoghaire Rathdown County**, i.e. a set of spatially coherent GIS layers on selected indicators for biodiversity conservation and land planning
- To do **a first analysis** of the synergies and trade-offs of the most relevant indicators to identify the areas maximizing the sum and the diversity of values.

The basic land cover map

The Habitat Map of Dún Laoghaire Rathdown using Fossitt Classification (2020)

Updated with the Cherrywood Strategic Development Zone (SDZ)

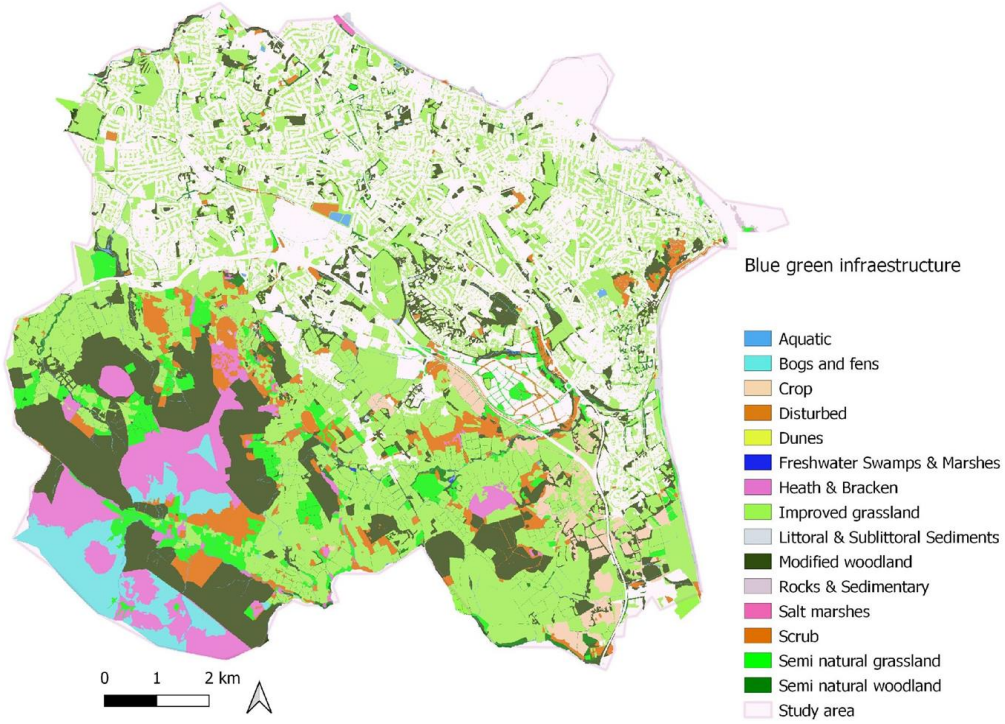


The Blue-Green infrastructure

A classification in general habitat types

Essential for the calculation of connectivity

Useful for other purposes



Three contrasting perspectives

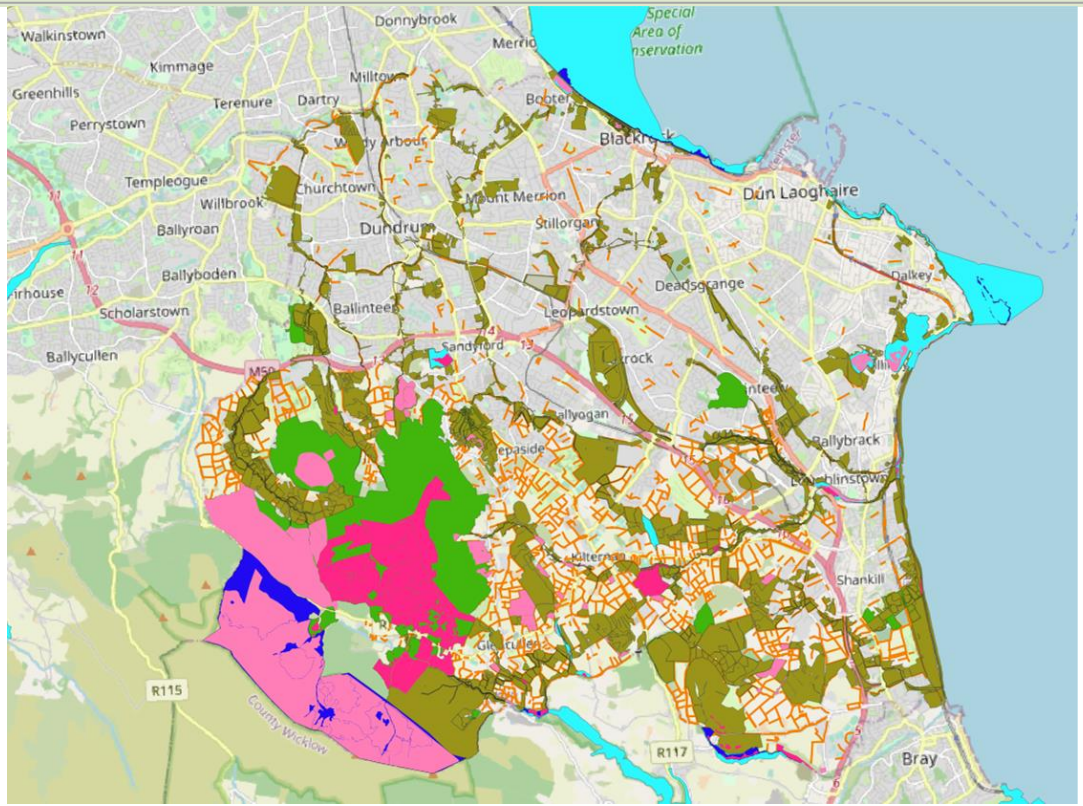
Following the SITxell example, ecosystem services will be mapped for DLR based on:

1) Intrinsic (biodiversity)value
2) Functional value
3) Leisure/Cultural value

1. Intrinsic biodiversity value

Based on the DLR information:

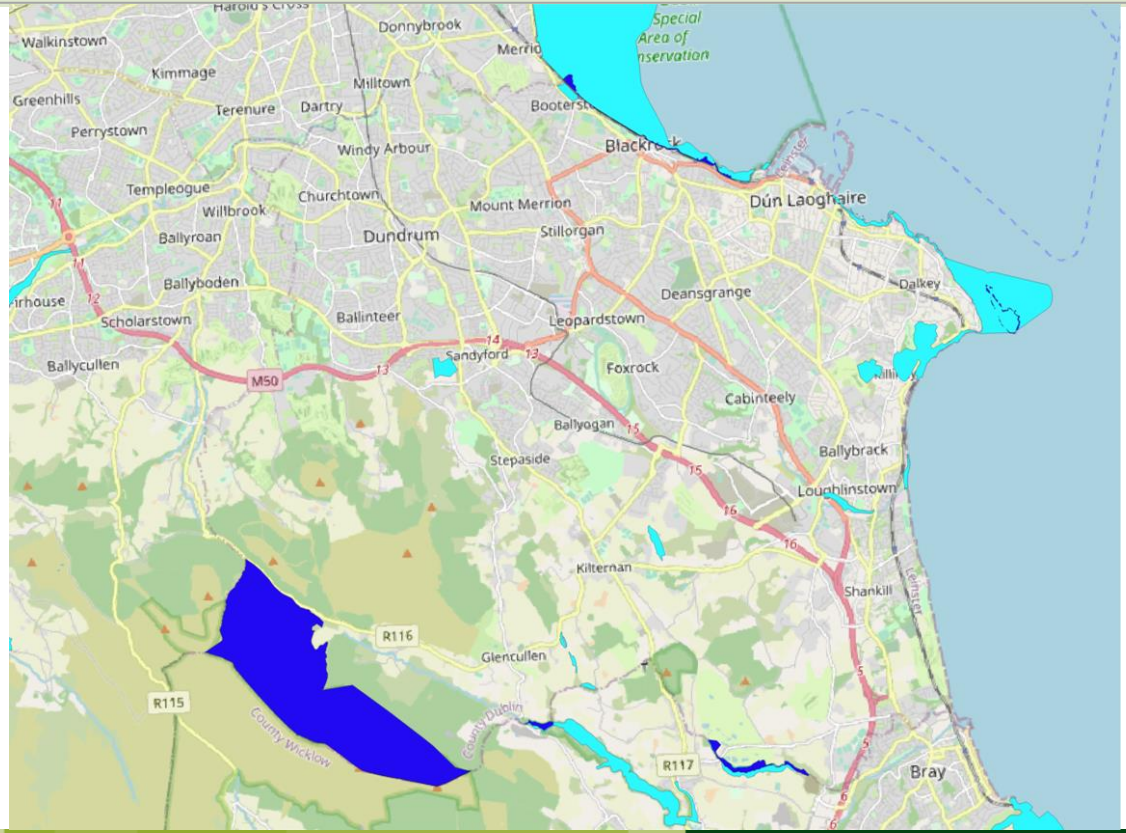
- EU and national areas of most conservation concern
- Important local areas for biodiversity (incl. wildlife corridors, hedgerows, other).
- EU Annex Habitats of conservation / potential conservation concern.



1. Intrinsic biodiversity value

EU- and National areas of most conservation concern

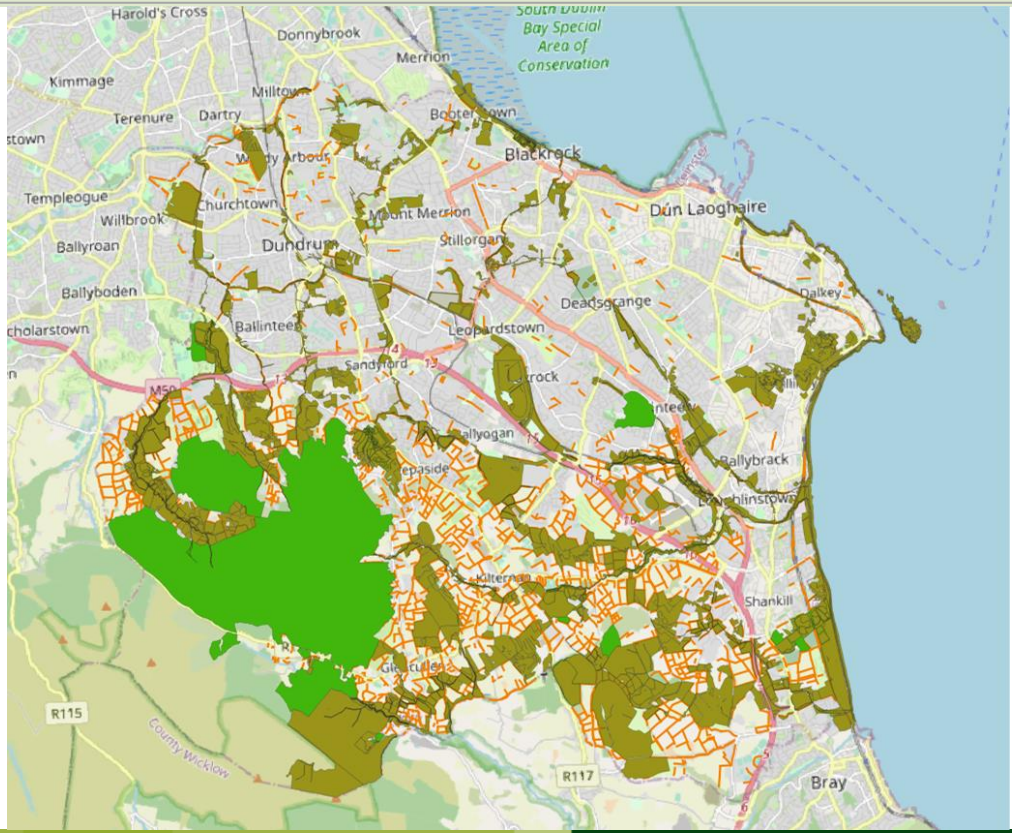
- SAC (Special Areas of Conservation) : dark blue
- NHA (National Heritage Areas): light blue



1. Intrinsic biodiversity value

Important local areas for biodiversity

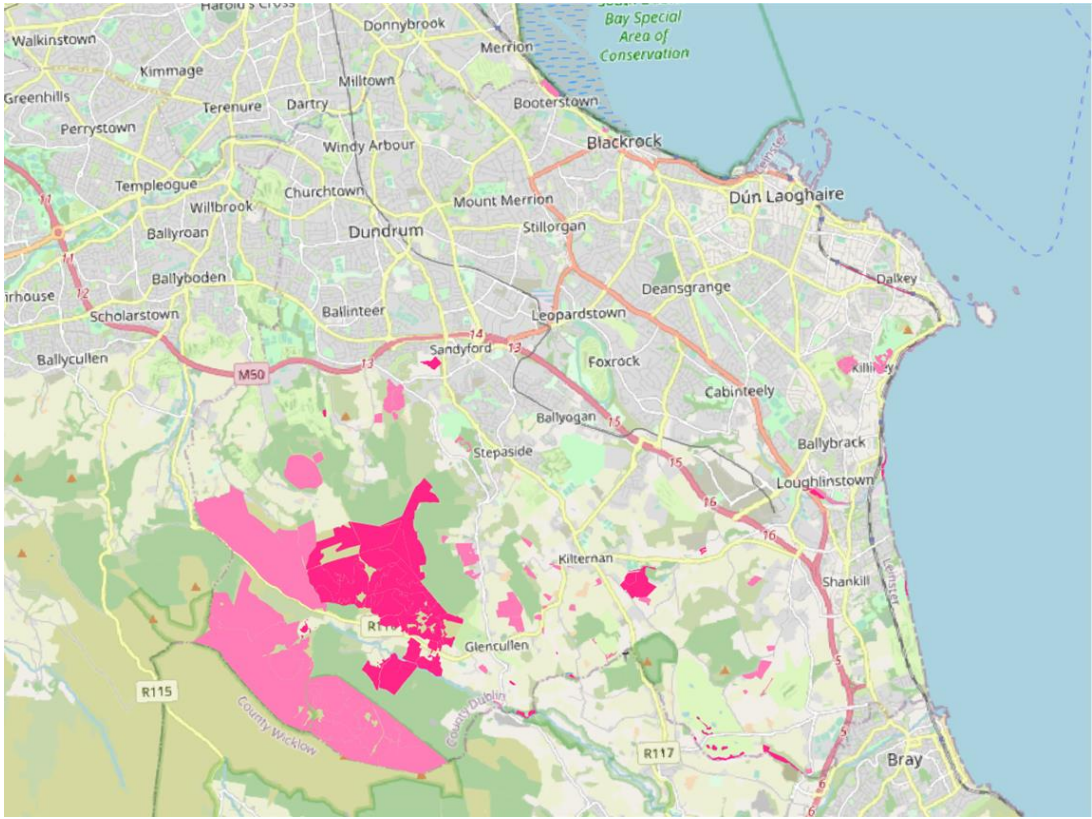
- LIBS (Local Important Biodiversity Sites): green
- Wildlife corridors: green-brown
- Hedgerows: orange



1. Intrinsic biodiversity value

EU-Annex I habitats

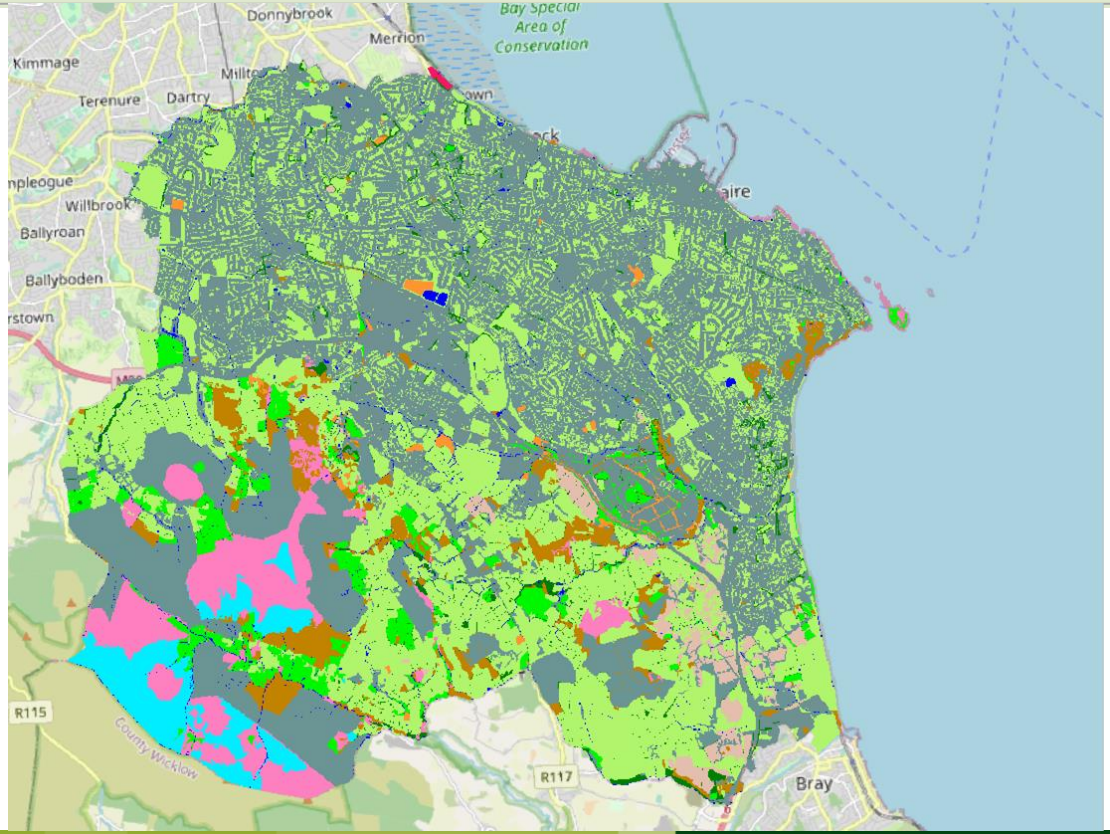
- Actual (dark pink)
- Potential (light pink)



2. Functional value

Based on the SITxell experience:

- Habitat naturalness
- Landscape diversity
- Landscape connectivity

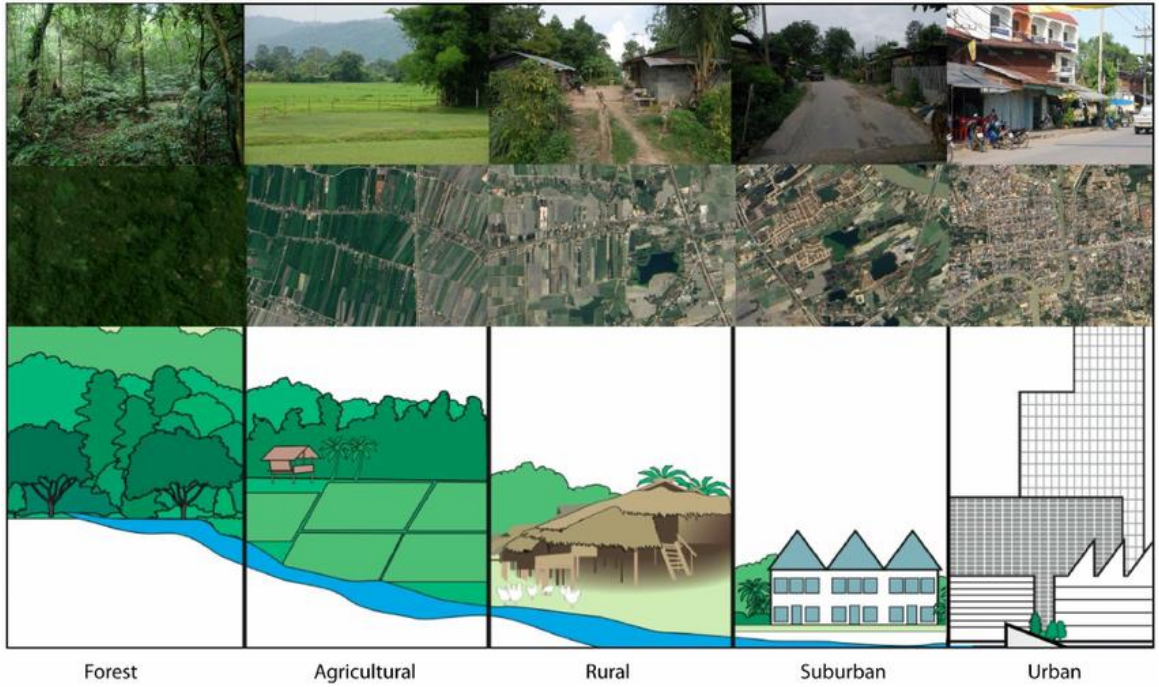


2. Functional value

Habitat naturalness

Opposite to human intervention

(i.e. habitat alteration)



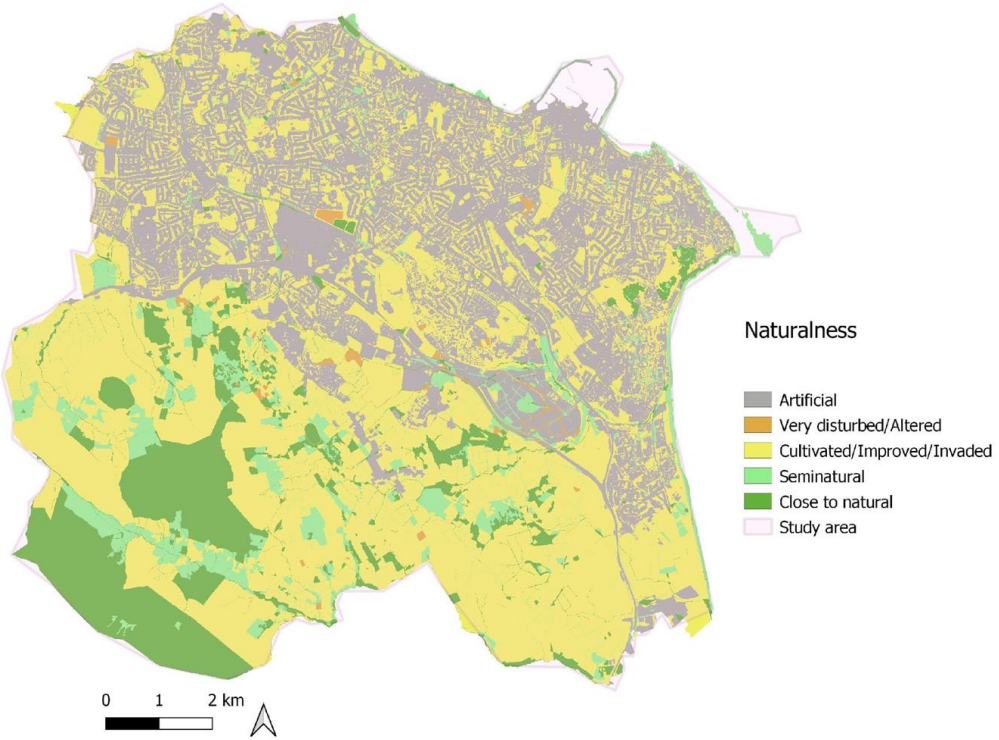
2. Functional value

Habitat naturalness

Based on the basic land cover map

Opposite to human intervention (i.e. habitat alteration)

Agreed with DLR managers



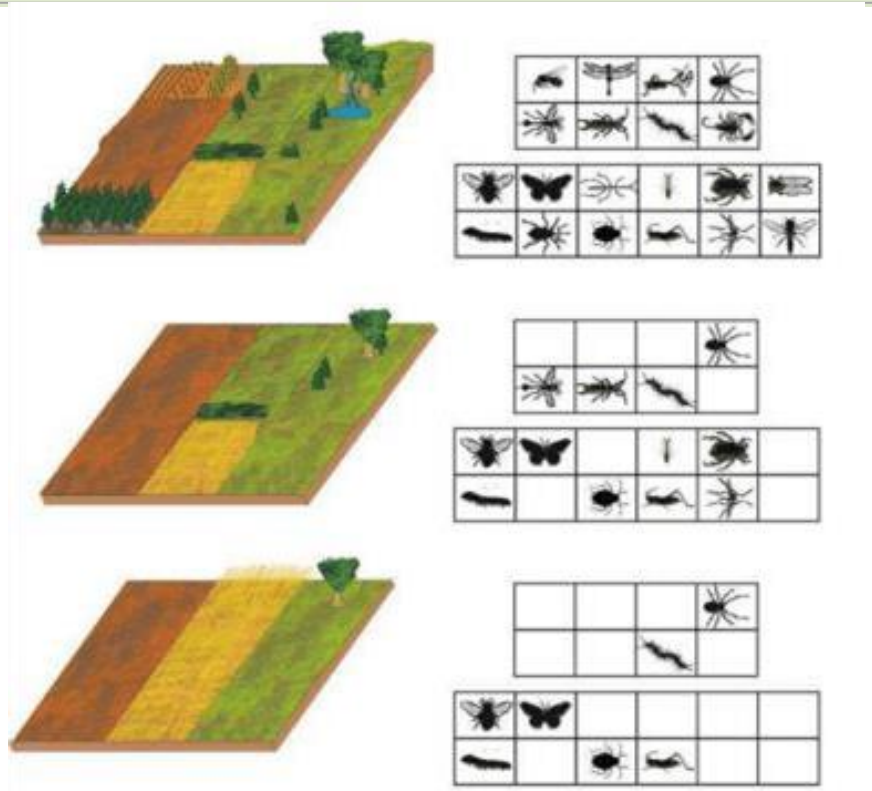
2. Functional value

Habitat Diversity in the landscape

Indicative for landscape capacity of housing habitats and species

Shannon diversity index integrates:

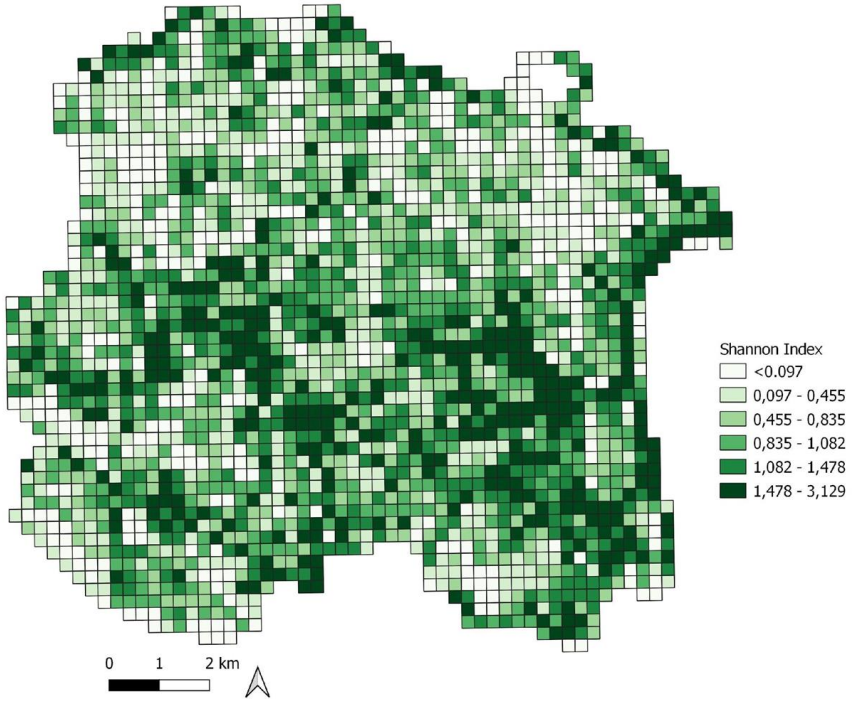
- Habitat number (richness)
- Habitat equifrequency (evenness)



2. Functional value

Habitat Diversity in the landscape

- Shannon Diversity Index calculated for three scales (landscape sizes), using in the Fossit-Cherrywood map
- Considering / Not considering built-up categories



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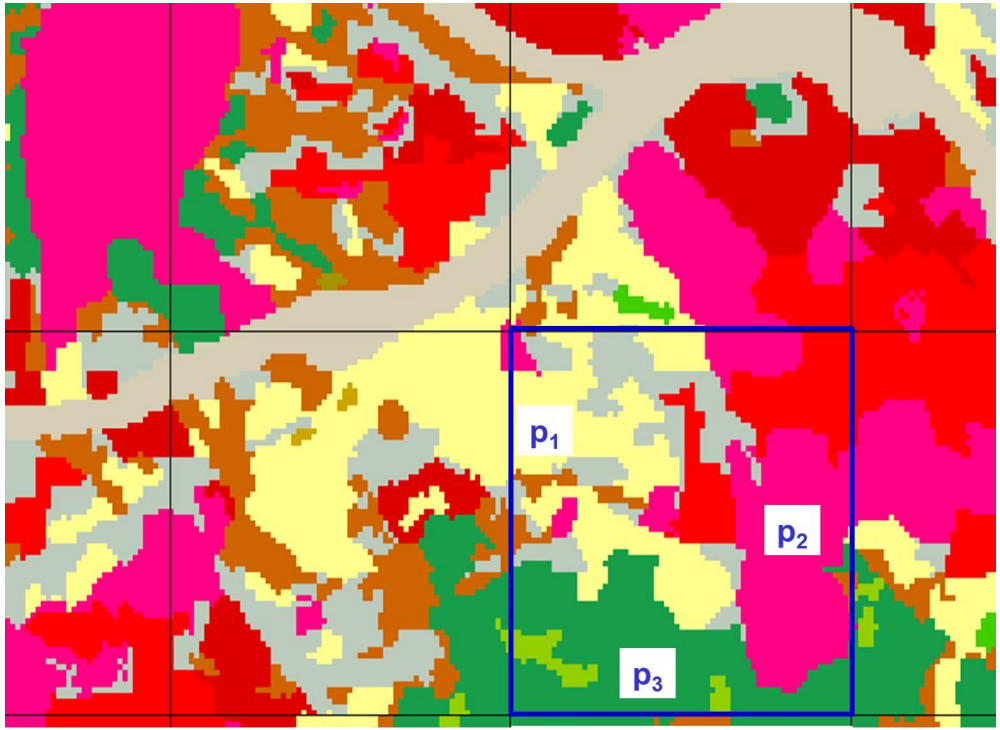
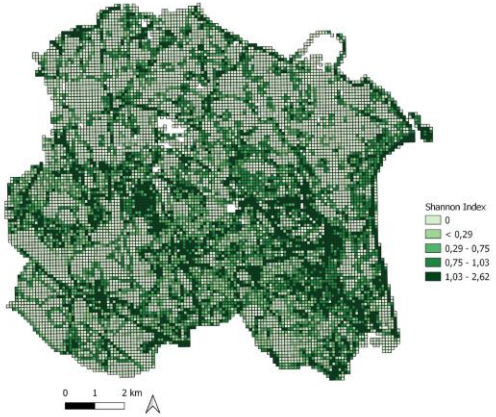
Calculation of Shannon index for each landscape using the basic land cover map

$$H=-\sum p_i \text{Log}_2 p_i$$

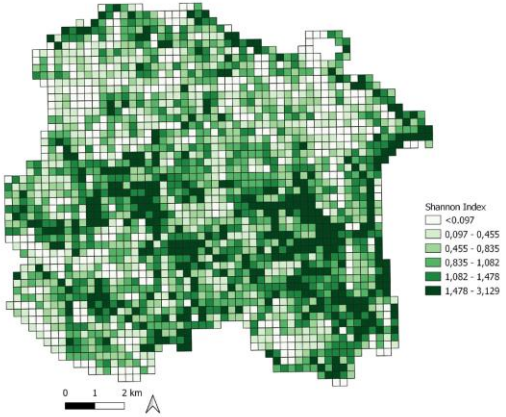
p_i=habitat proportion



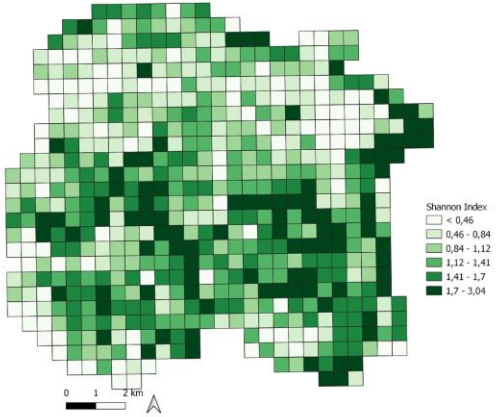
Contrasting landscape sizes
and considering/non considering built-up habitats



100 m



250 m



500 m

2. Functional value

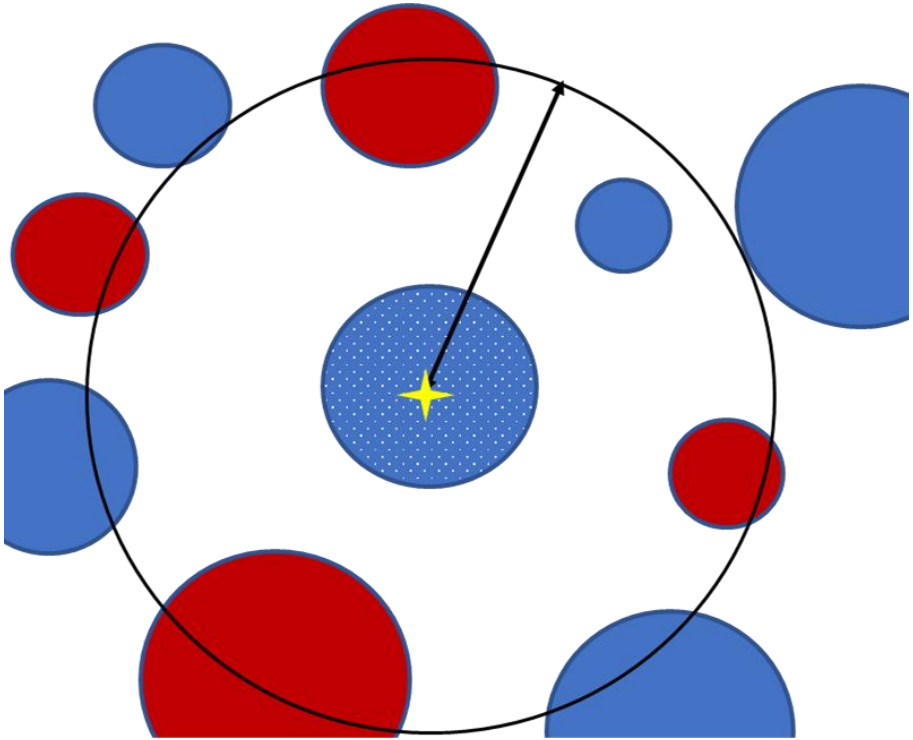
Connectivity

- A basic landscape property for preserving species and ecological processes
- Calculated considering the ecological requirements and the mobility of a medium-sized terrestrial species

2. Functional value

Connectivity

- Hanski's metapopulational concept of connectivity
- Calculated for a set of habitats, considering the pieces of the focal habitat and of similar ones , and their cost distances to each focal point
- Weight of similar habitats determined by their affinity to the focal habitat



The connectivity Index

$$ICT_i = \sum a_i A_p e^{-\alpha \delta i}$$

Calculated for 10 main habitats and for >12000 points regularly distributed across the DLR Council

Final maps obtained by interpolation of these point data

A_p: pixel area

α: average dispersion coefficient

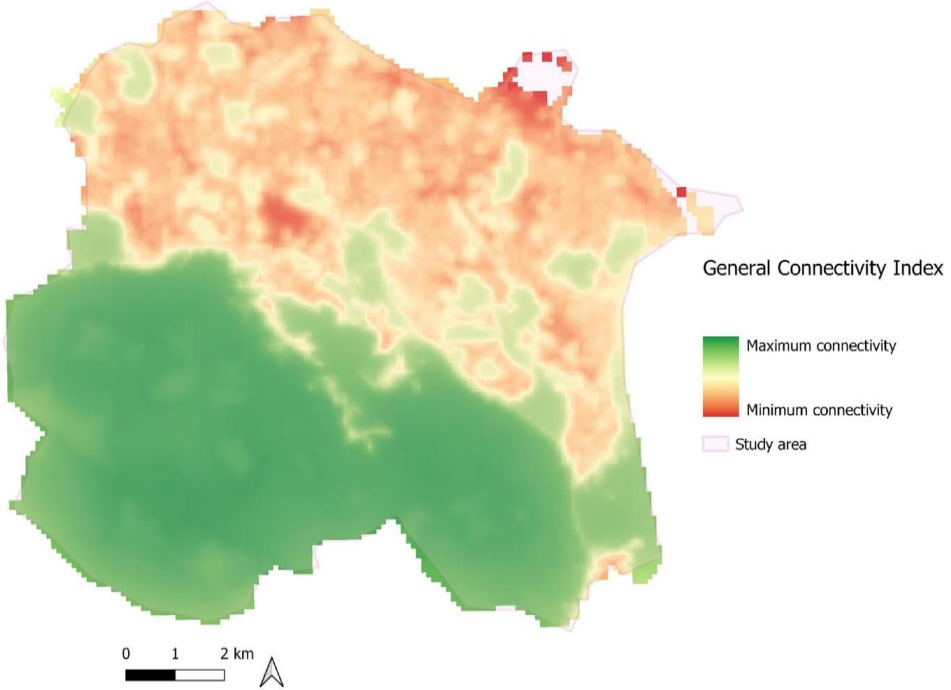
A_i: affinity of each habitat type with the focal habitat

δ_i: cost distance from each focal point to each habitat

2. Functional value

Connectivity: results

A main Terrestrial Connectivity Index (TCI) calculated on the Blue-Green Infrastructure map

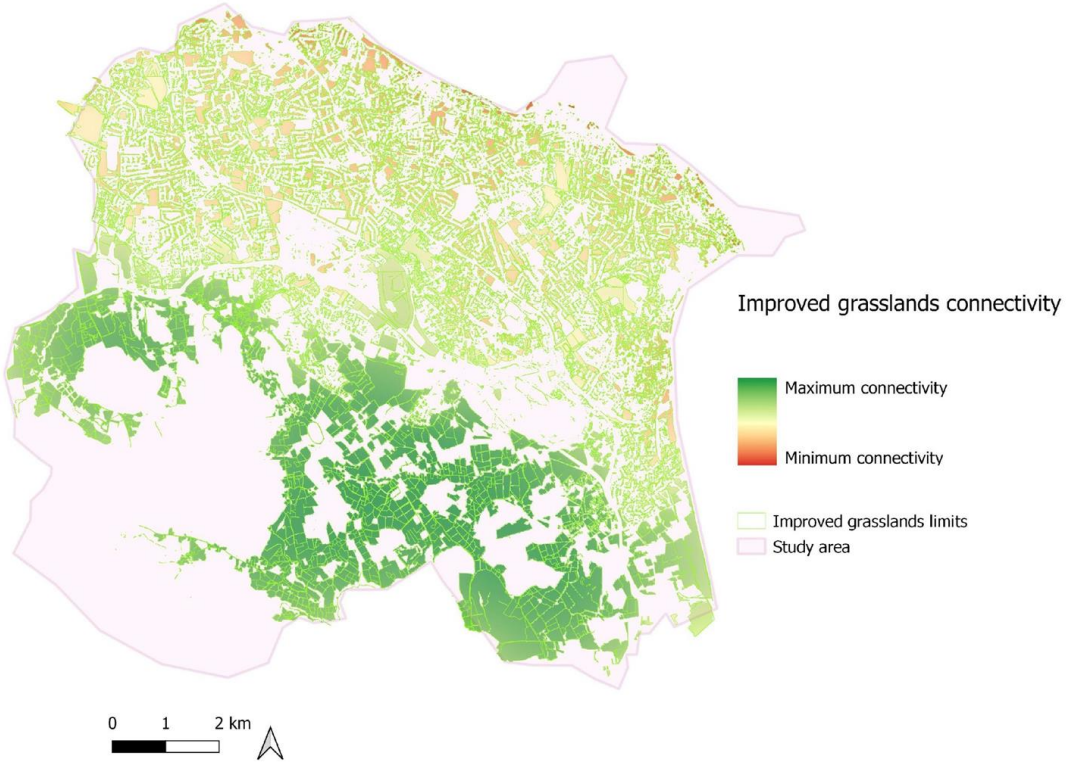


2. Functional value

Connectivity: results

Specific TCI for each main habitat

Improved grasslands (32.3%)

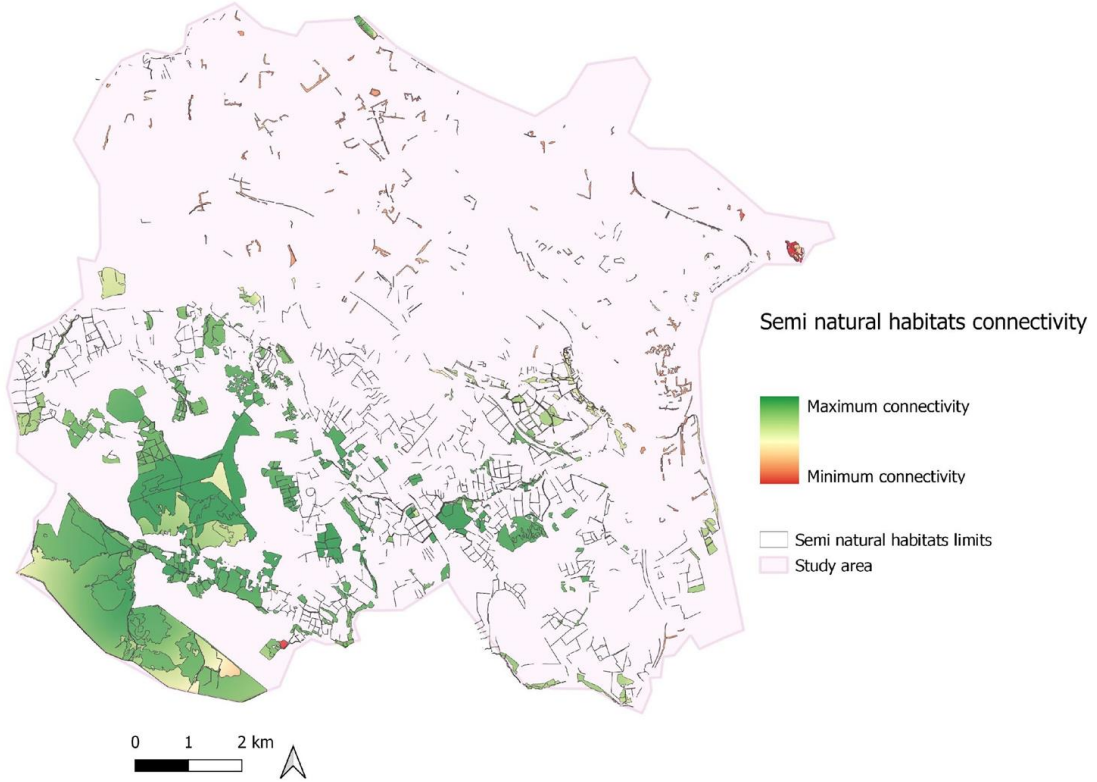


2. Functional value

Connectivity: results

Specific TCI for each main habitat

All (semi)natural habitats (17.6%) pooled together

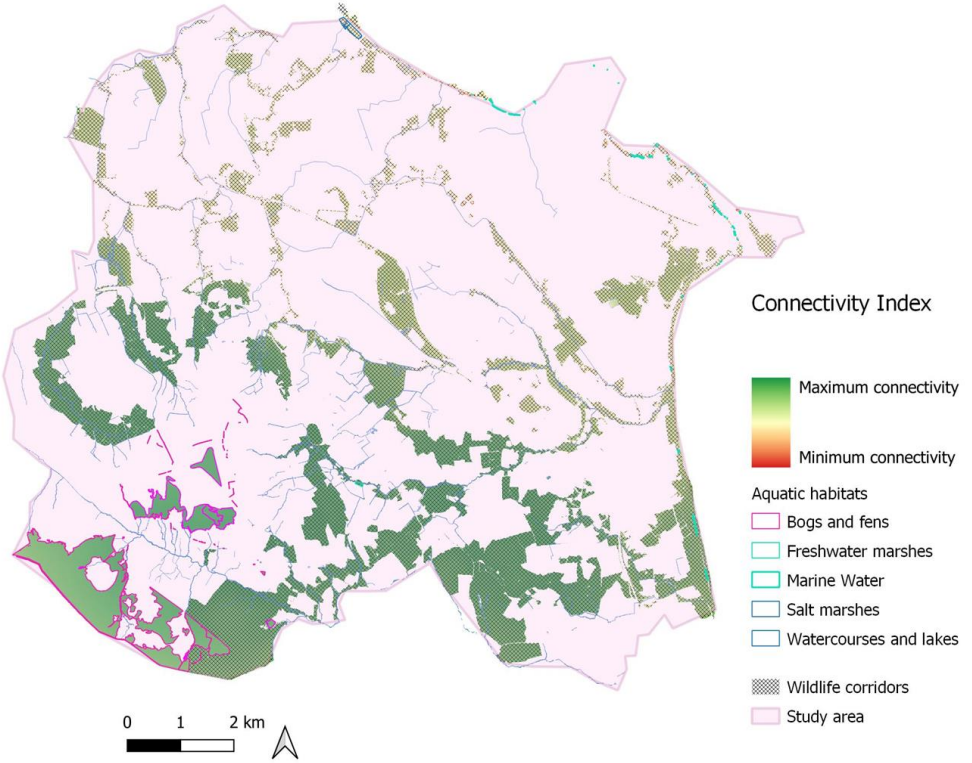


2. Functional value

Connectivity: results

Specific TCI for each main habitat

All aquatic habitats (3.76%) and Wildlife corridors



3. Recreational and cultural value

Recreational/cultural value of GI encompasses a complex set of ecosystem services, including enjoyment of sport, nature, and cultural places

Mapping and modelling these services is strongly affected by a lack of reliable data

3. Recreational and cultural value?

Population proximity to the main assets of DLR GI (as the crow flies)

≠ recreational and cultural value, but a starting point for the conversation

Sometimes in conflict with biodiversity conservation, but helping to socially accept it

Population proximity to the main assets of DLR GI

Calculated as the product of potential visitors with their proximity to the main areas of conservation concern as potential attractors:

- EU, national and local biodiversity areas
- Wildlife corridors
- Annex I habitats

Using specific GIS layers

A= Population density . Exponential inverse of distance to GI elements

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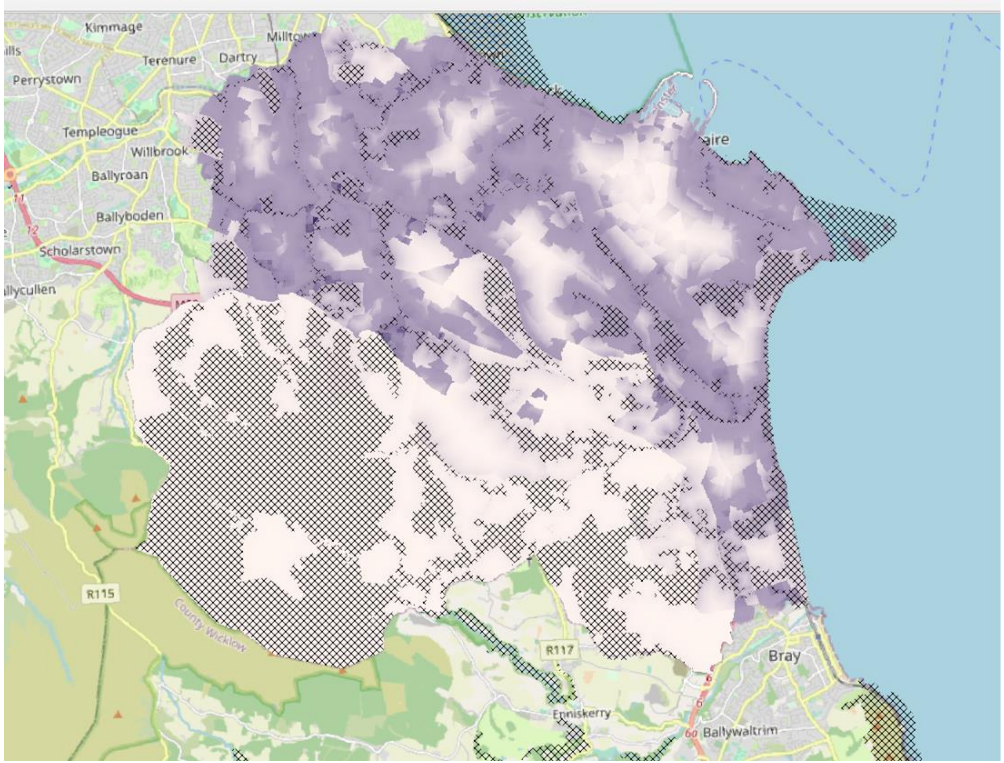
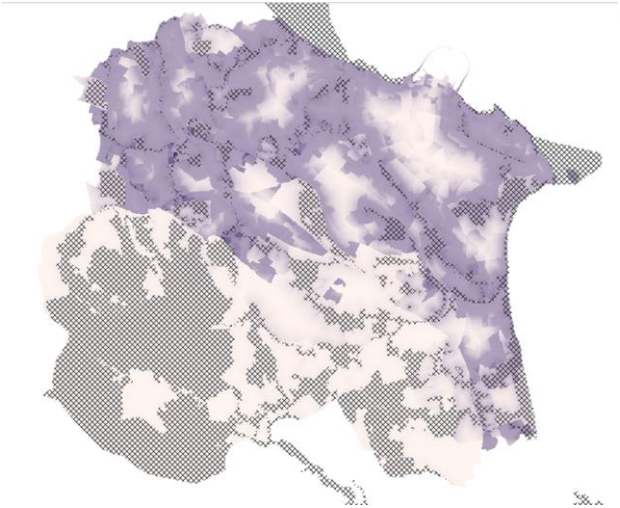
Population proximity to the main assets of the green infrastructure
(as the crow flies)

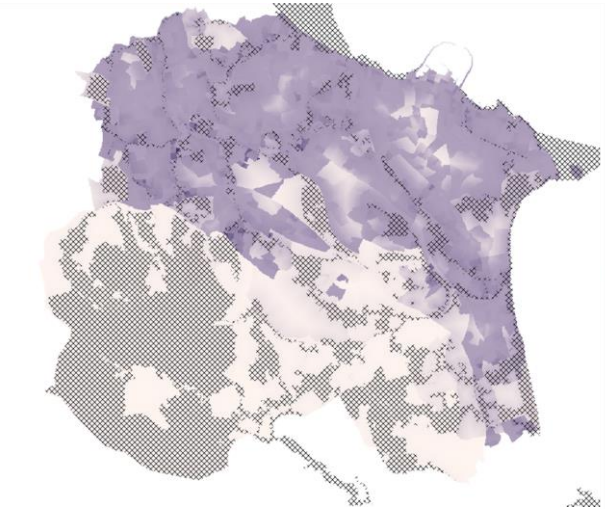
A starting point for the consideration of recreational and cultural value



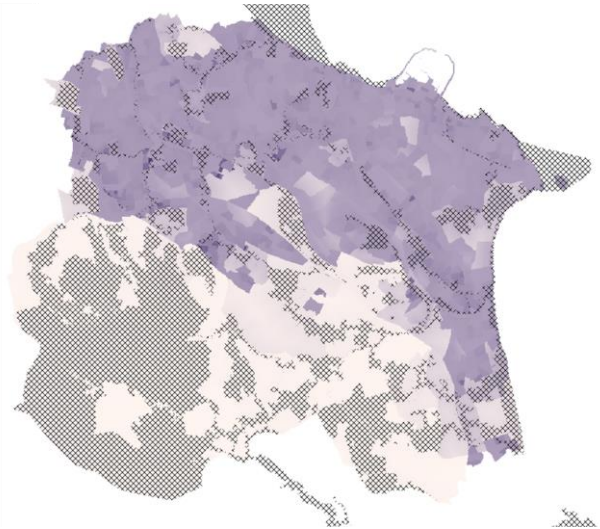
Available maps for three proximity radii and for each type of biodiversity conservation area



1000 m



2000 m



5000 m

4. Analysis of the synergies and trade-offs

Analysis of the **synergies and trade-offs** of the most relevant indicators to identify the areas maximizing the sum and the diversity of values.

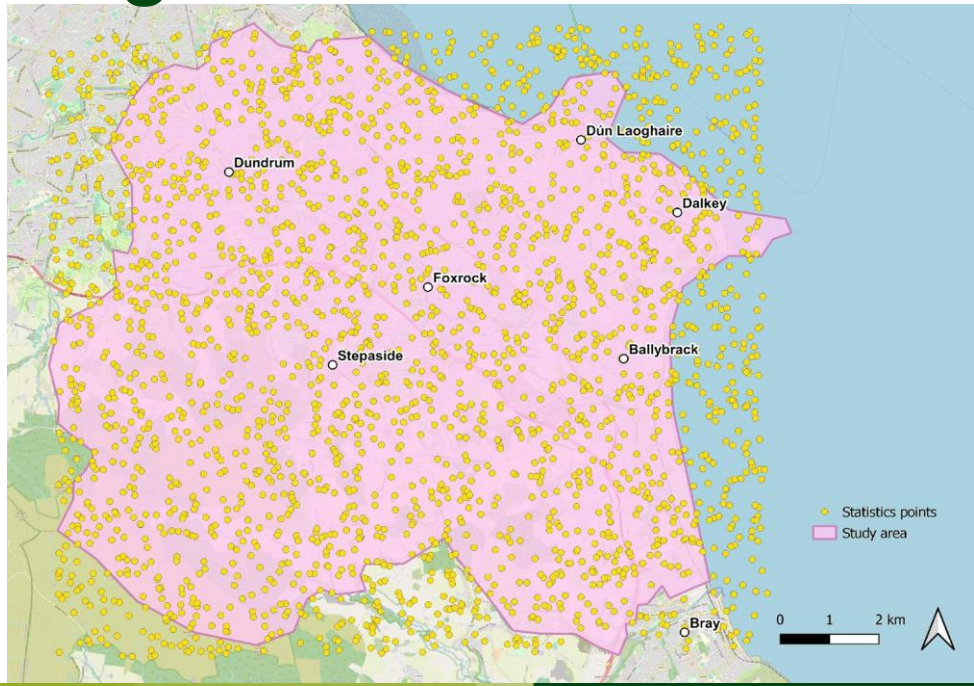
- **Correlation analyses**
- **Synthetic maps**

4. Analysis of the synergies and trade-offs

Representative indicators: Biodiversity conservation value, naturalness, connectivity, landscape diversity and population proximity.

Database of 2000 points randomly distributed.

Association between indicators through Pearson correlation matrix and PCA.



Pearson correlation matrix

High positive correlation between biodiversity conservation, naturalness and connectivity.

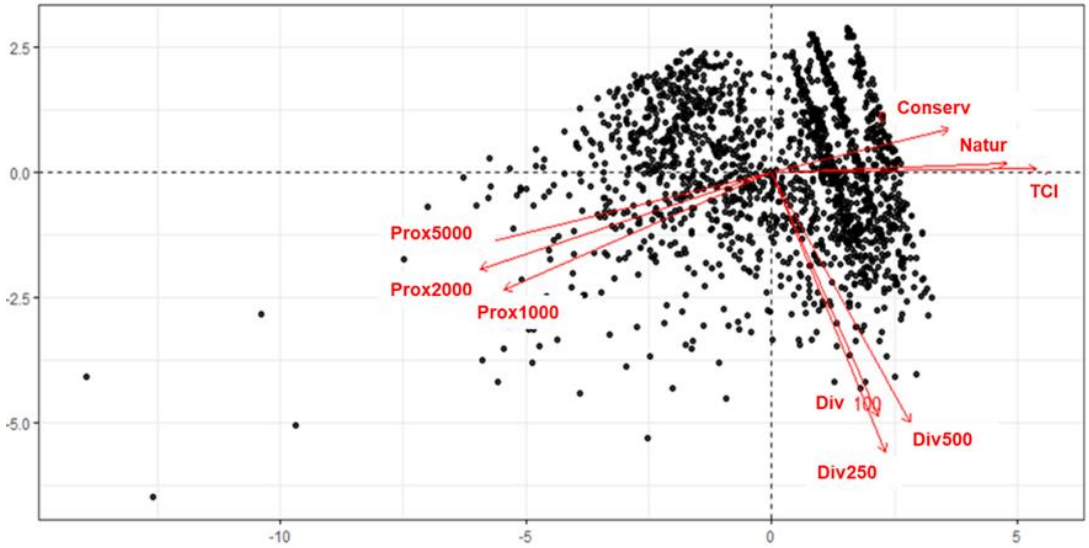
Negative correlation of these indicators with population proximity.

Non-significant correlation of landscape diversity with the rest.

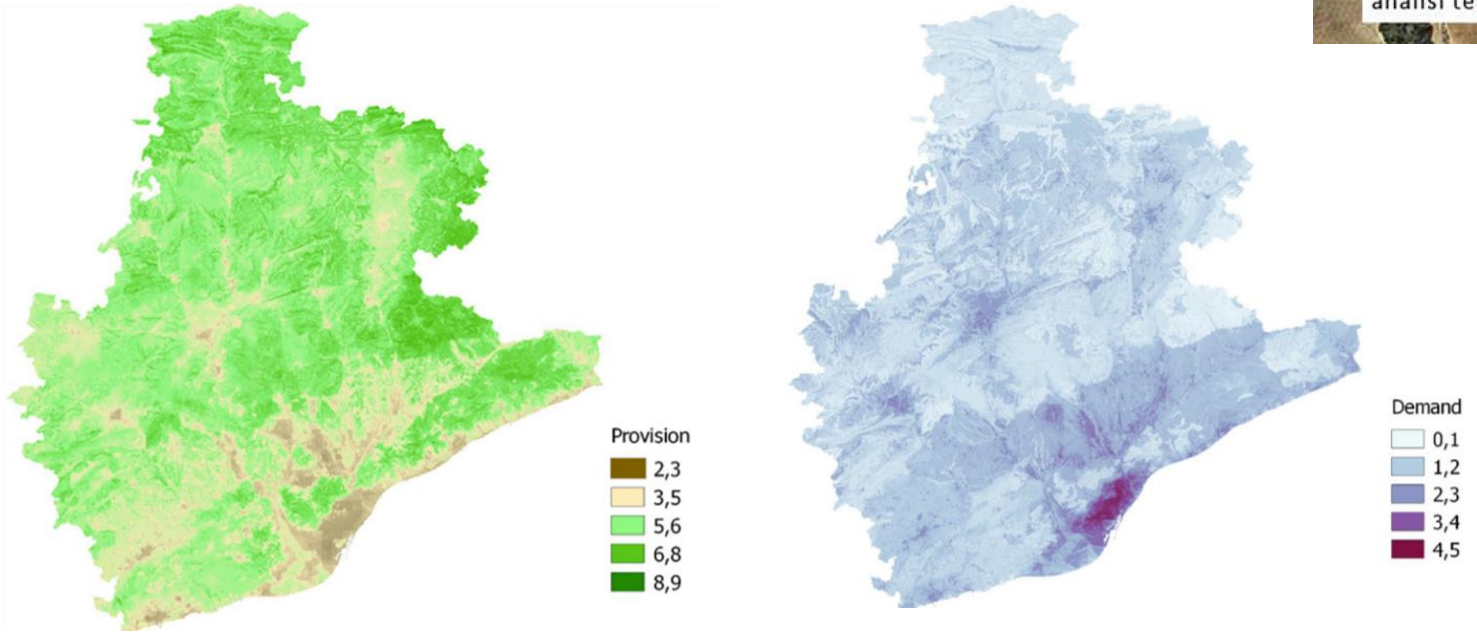
	Conserv	Natur	TCI	Div100	Div250	Div500	Pr1000	Pr2000
Conserv.								
Natur.	**0.61**							
TCI	**0.50**	**0.67**						
Div_100	**0.05**	**0.19**	**0.19**					
Div_250	**0.04**	**0.16**	**0.22**	**0.61**				
Div_500	**0.08**	**0.21**	**0.32**	**0.49**	**0.72**			
Prox1000	**-0.24**	**-0.38**	**-0.5**	**-0.05**	**-0.04**	**-0.11**		
Prox 2000	**-0.31**	**-0.45**	**-0.58**	**-0.11**	**-0.11**	**-0.18**	0.97	
Prox5000	**-0.36**	**-0.49**	**-0.64**	**-0.16**	**-0.16**	**-0.24**	0.89	0.97

Principal Component Analysis

PCA analysis corroborates the results of the Pearson correlation matrix



Example of SITxell in the Barcelona Province

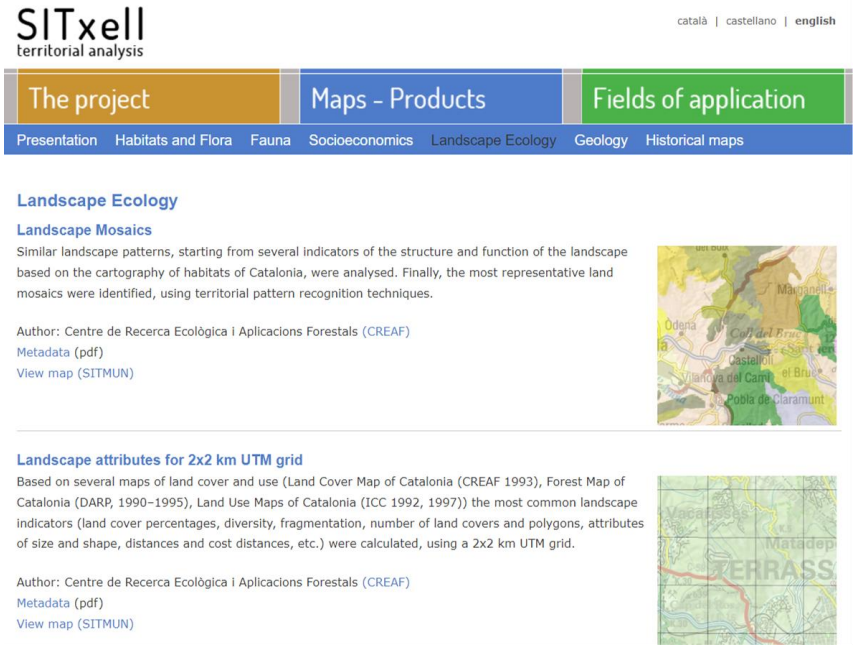


Basnou et al. 2020. Urban Forestry & Urban Greening

5. And beyond the project

- This is a demonstrative action developed under the PROGRESS project

- First assessment of the synergies and trade offs of these indicators



5. And beyond the project

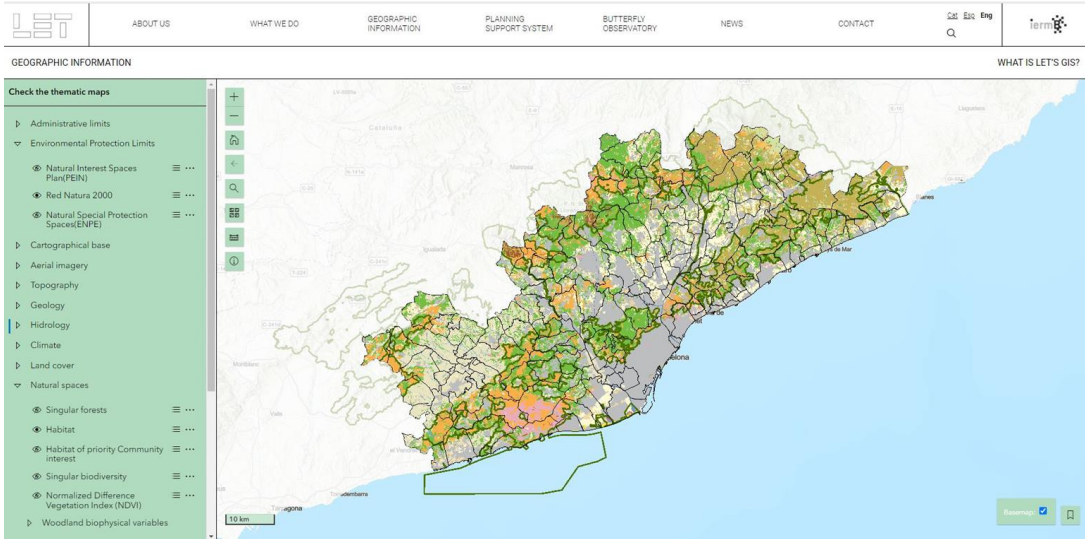
Workshops held with stakeholders revealed the need to include much wider ranging datasets and data types.

Ways, barriers and access points	Catchment data
Road network and noise	Species data
Climate risk and vulnerability	Elevation data
Zoning/planning/strategic datasets	Carbon sequestration capacity
Recreational features	Thematic census data

5. And beyond the project

How these layers will be setup and delivered to the general public?

Example of GIS tool of socio-ecological variables for the metropolitan and regional area of Barcelona.



https://iermb.uab.cat/let/en/geographic-information/

Thank you very much

for your attention

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