



# NaturaConnect and the Building of a Coherent Trans-European Nature Network

Jeremy Dertien, Ph.D.

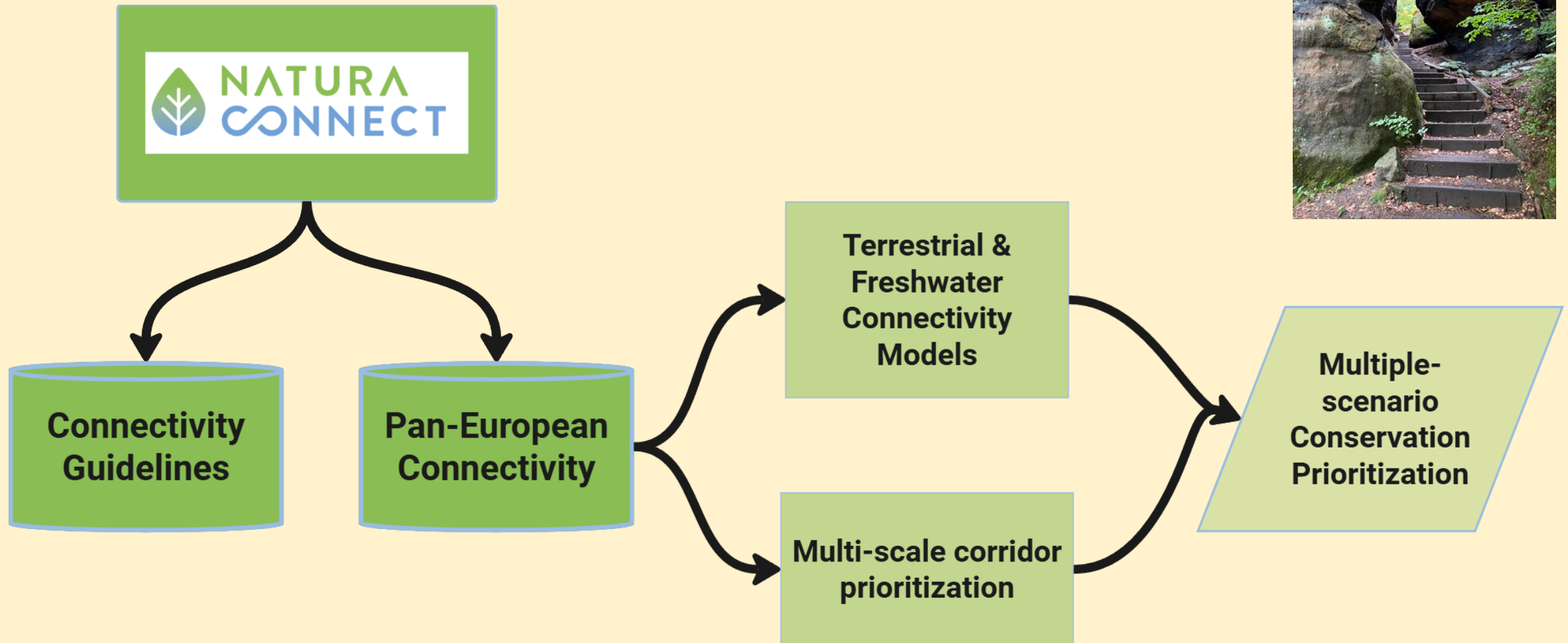
German Centre for Integrative Biodiversity Research (iDiv)

[jeremy.dertien@idiv.de](mailto:jeremy.dertien@idiv.de)

[www.naturaconnect.eu](http://www.naturaconnect.eu)



# Connectivity Overview



# Global Attention to Connectivity

## A Core of Conservation Science

- Island biogeography
- Habitat fragmentation via human land alteration
  - Linear infrastructure
    - Roads
    - Dams
    - Giant walls
    - Railways
    - Powerlines
  - Impervious cover & unsuitable habitat



# Effects of Habitat Fragmentation

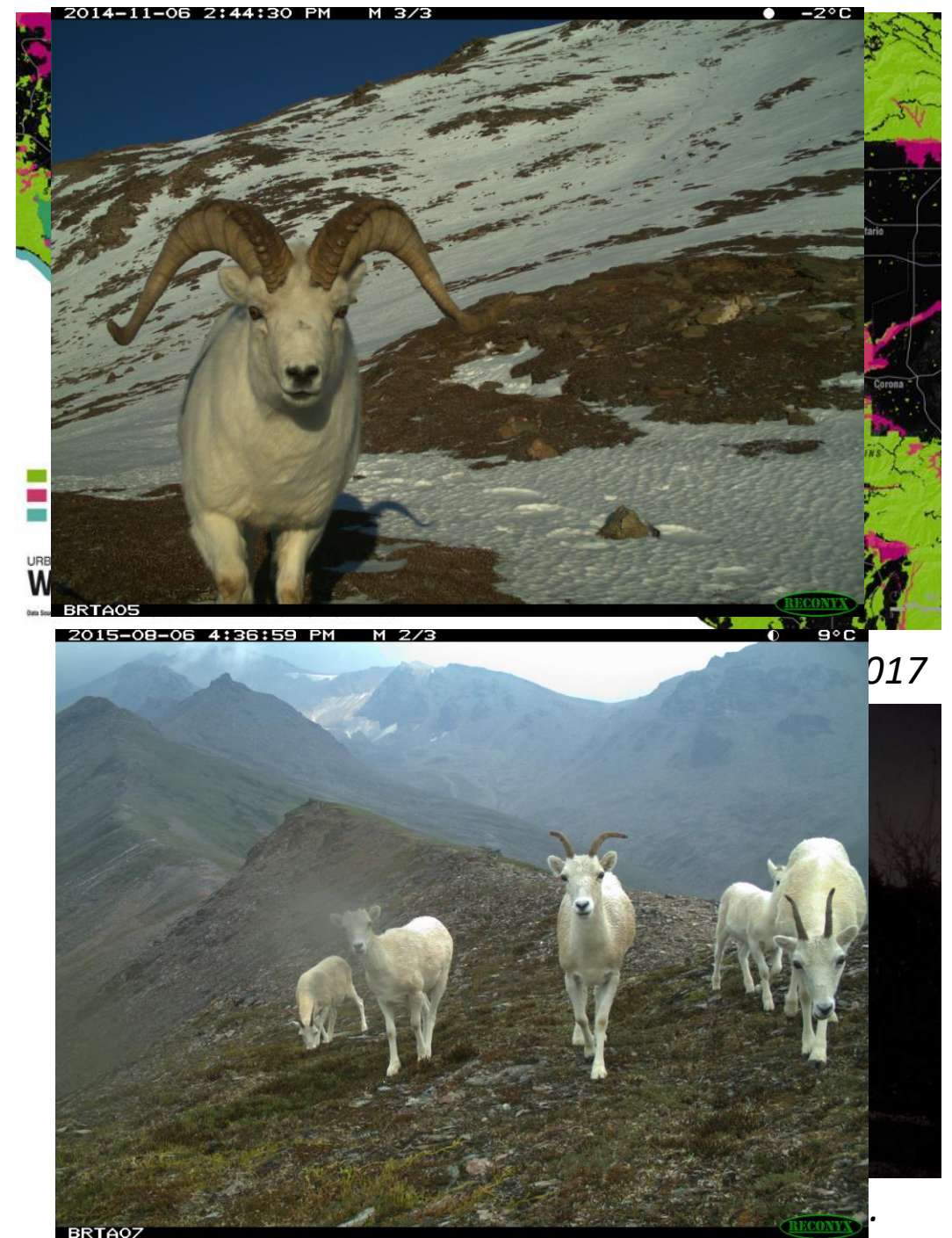
- Fragmentation can reduce:
  - *Dispersals*
  - *Genetic diversity*
  - *Species diversity*
  - *Fecundity*
  - *Abundance*
  - *Nutrient cycles, etc.*
- Wide variety of time scales
  - *Individual movement → a century of genetic flow*
  - *Climate change range shifts*





# Global Connectivity Management

- Connectivity conservation projects around the world
- Migratory populations in Africa, Asia & North America
- Potential for difficult scenarios with increasing wildlife populations or invasive species





# Connectivity and Conservation Policy

- EU Biodiversity Strategy goal to enlarge protected area (PA) network to 30% of land and ocean area.
  - Connected Trans-European Nature Network
- Connectivity a consideration in:
  - Global Biodiversity Framework
  - EU Forestry Strategy
  - Green & Blue Infrastructure Strategy
  - Water Framework Directive
  - EU Pollinators Initiative
  - EU Nature Restoration Law

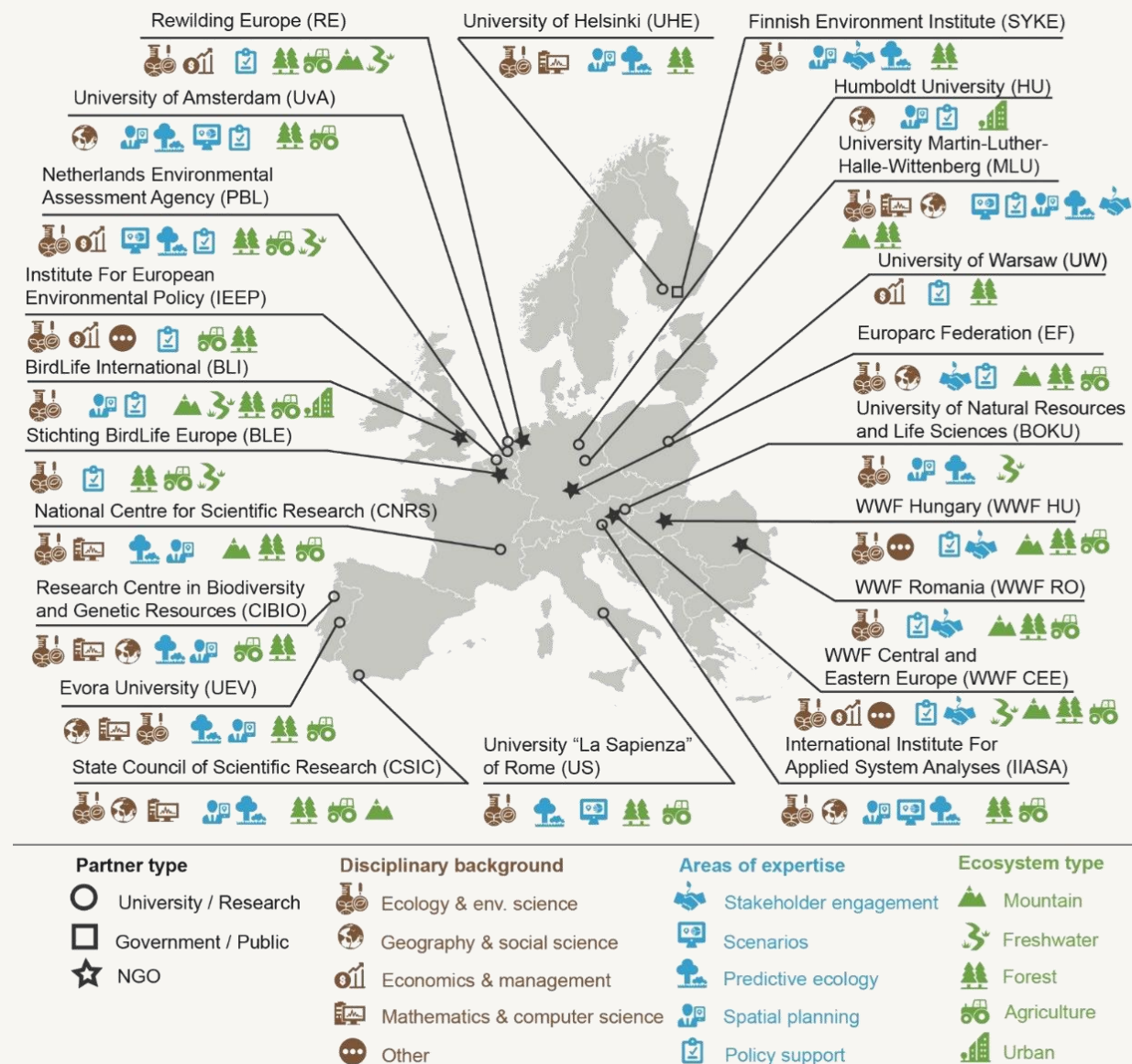


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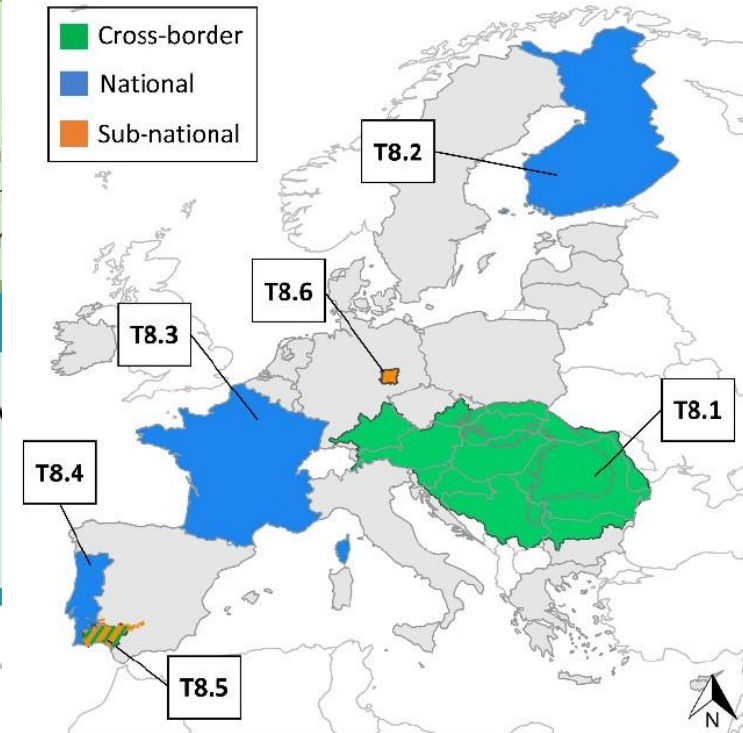
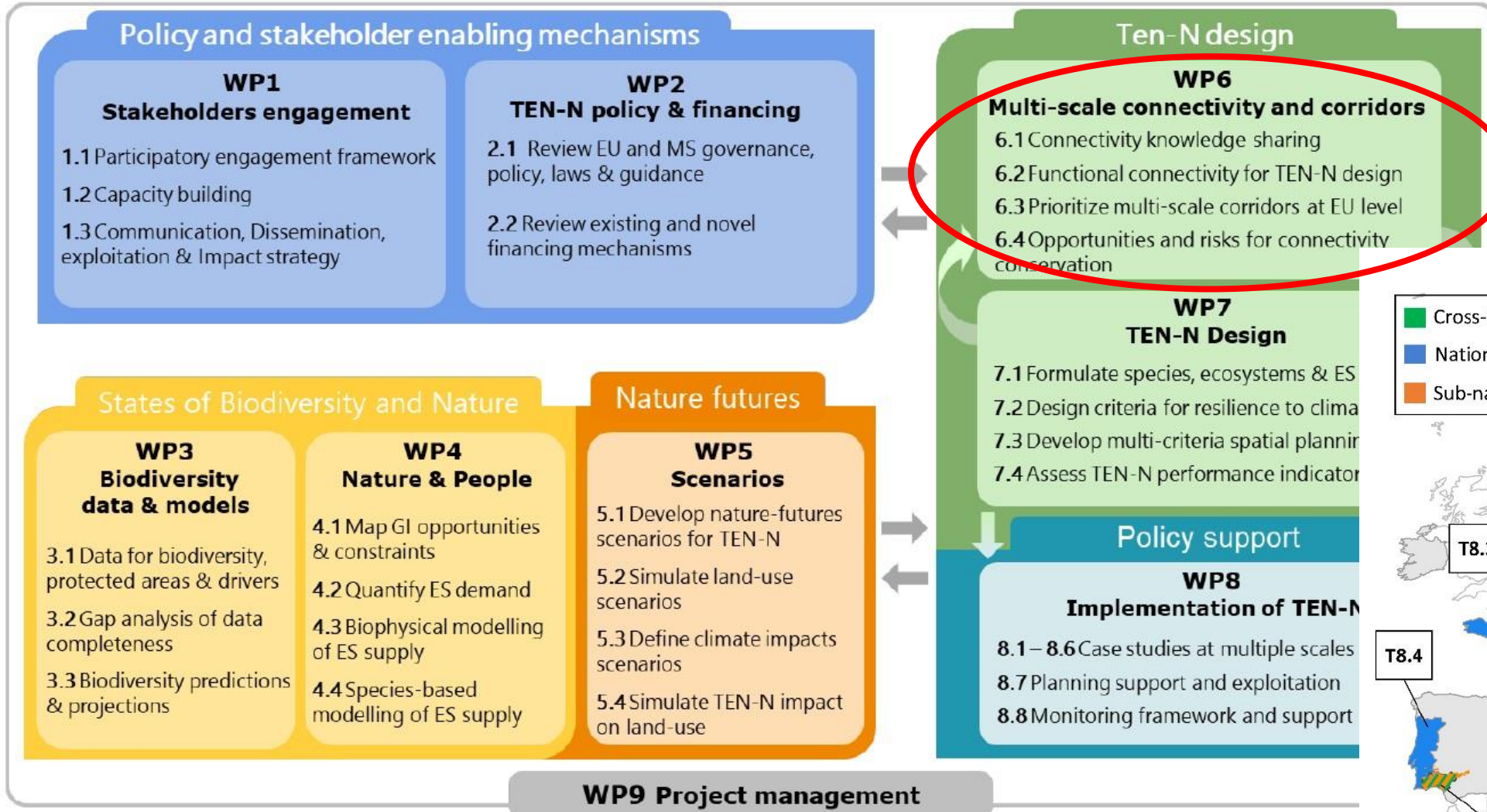


**22** partner institutions from **12** different countries

**Co-develop** knowledge, tools and capacity building to support Member States in implementing an ecologically representative, resilient and well-connected **trans-European nature network**









# WP6: Multi-scale connectivity and corridors

1. Guidelines and primer for connectivity planning in Europe
  - Survey of connectivity projects
  - Connectivity webinar
2. Pan-European connectivity models
3. Future scenario connectivity





# Guidelines and Primer for Connectivity in Europe

- **Part 1: Connectivity in Europe: Concepts, policies, & projects**
  1. Connectivity concepts and approaches
  2. Global & EU policy instruments addressing connectivity
    - EU Biodiversity, Forest, and G&B Infrastructure Strategies, GBF, etc.
  3. Connectivity projects in Europe and information needs
    - Results and repository of projects
    - Priorities, gaps and challenges





# Survey of European Connectivity Projects

- General information, location, duration
- Goals and scope
- Taxa and ecosystem types
- Policy context, target users, funding
- Approaches and outputs
- Assessments of results
- Ability to add projects

*80 projects  
35 countries*

All Projects / << Previous / Project ID 6 / Next >>

## Mainstreaming ecological connectivity in spatial planning systems of the Alpine Space

Acronym: PlanToConnect

ALPARC; Asters - Conservatoire d'espaces naturels de Haute-Savoie; E.C.O. Institute for Ecology; Eurac Research; Institute for Environmental Planning and Spatial Development (IFUPLAN); Municipality of Sondrio; Salzburger Institut für Raumordnung und Wohnen; University of Würzburg; Urban Planning Institute of the Republic of Slovenia; Veneto region

Forests Shrublands Grasslands Wetlands Rivers Agricultural areas



Country or countries of application: Austria, Switzerland, Germany, France, Italy, Slovenia, Liechtenstein

Ecological connectivity is a fundamental tool for the protection of biodiversity, yet it is currently not adequately included in Alpine spatial planning systems. The existing protected areas are created for keeping up biodiversity and ecosystem functions but, to be effective, they need to be connected among them through an ecological network. As long as it is not implemented, harmonized and managed by Alpine countries, this structure of ecological connectivity is currently threatened by the effects of human presence, anthropogenic infrastructure, and climate change. Therefore, the PlanToConnect project will foster the consideration of ecological connectivity into the spatial planning systems of the alpine countries. It will develop and test a planning strategy as well as capacity-building activities to integrate biodiversity and ecological connectivity in spatial planning tools and policies. This joint development will contribute to the enhancement of a coherent network of green and blue infrastructures in the Alps.

Website

Temporal information ^

Start - End

2022 - 2025

Duration

3 years

Spatial information ^

Spatial scope

- Local
- Sub-national
- Transboundary

Biogeographical region

- Alpine
- Continental

Spatial information

- Locations for ecological corridors
- Locations for stepping stones
- Locations to increase permeability of linear infrastructures
- Locations for proposed protected areas

Thematic scope v

Connectivity goals v

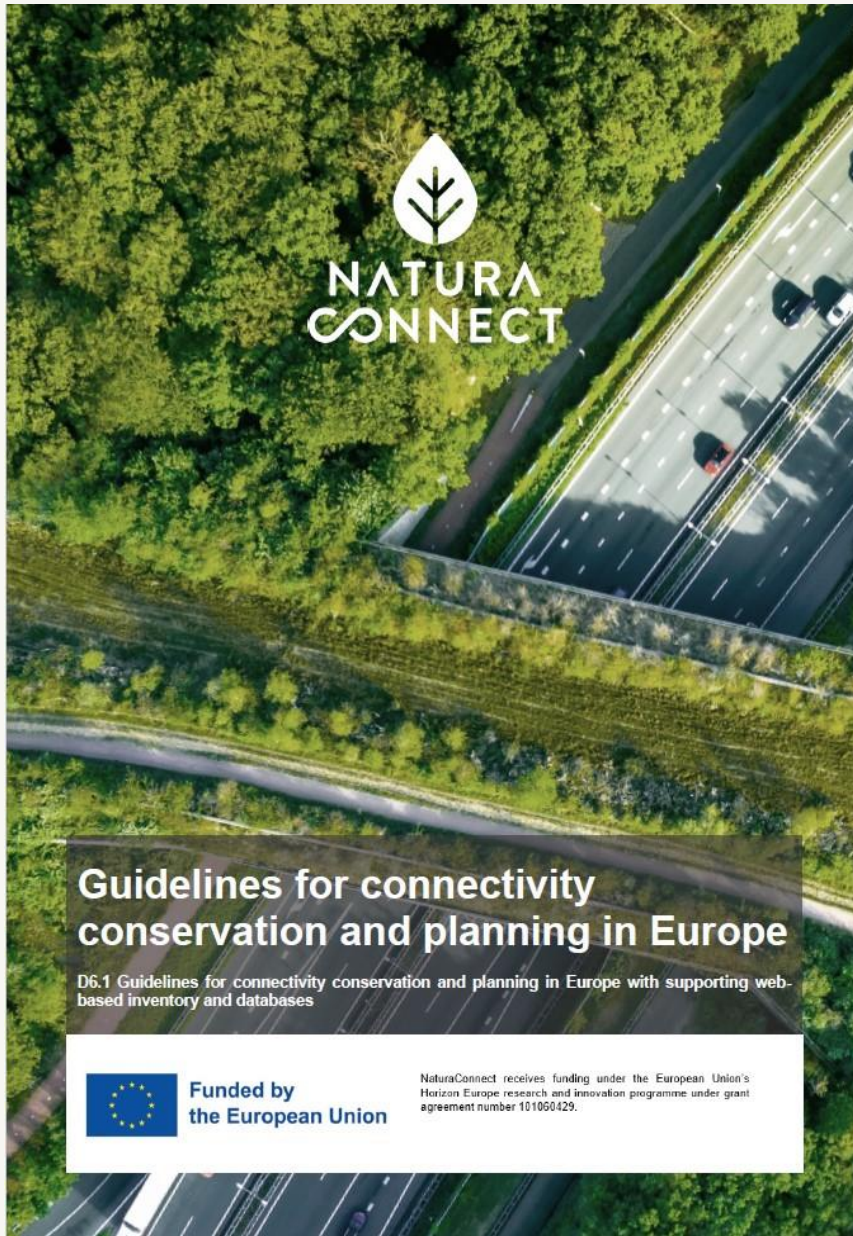
Target users of the results v

Policy support v

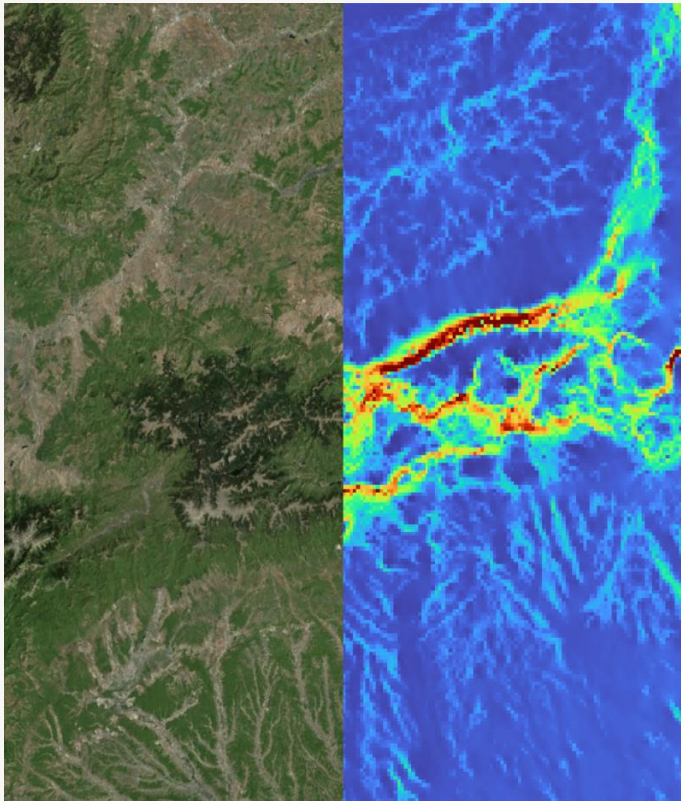


# Guidelines for Connectivity Conservation in Europe

- Part 2: Tools and guidelines for implementation of projects
  4. Tools for connectivity modelling
  5. General framework for connectivity conservation and planning



# Pan-European Connectivity Modelling



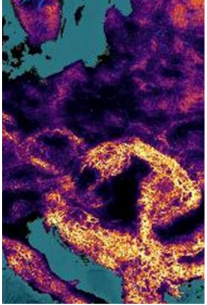
- Produce European-level terrestrial and freshwater connectivity maps
- Combining structural and functional connectivity approaches.
- Prioritize corridors between protected areas

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# Pan-European Connectivity Models

Multiple use data products



Functional models  
for terrestrial  
archetypes



Structural and  
functional freshwater  
connectivity models



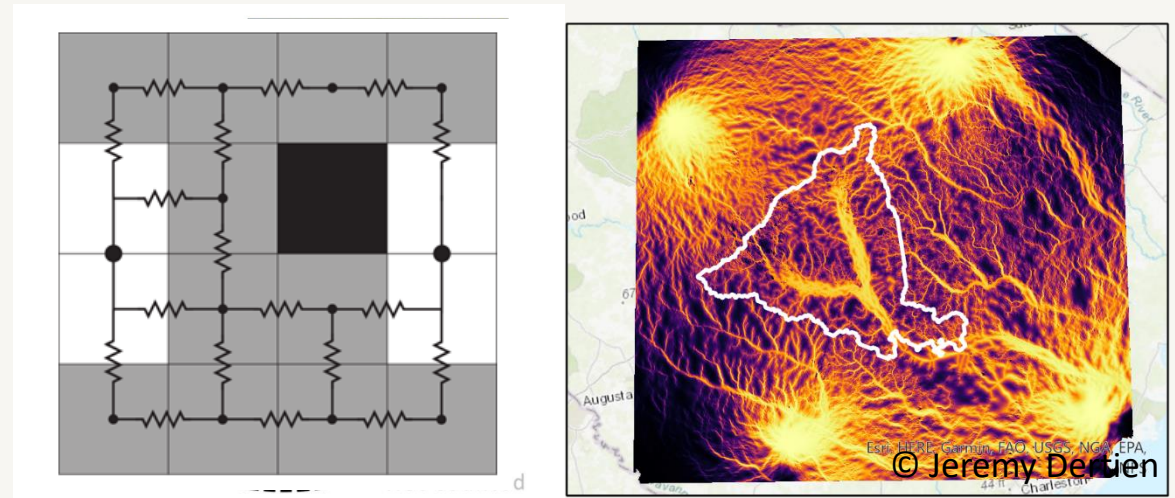
Multi-scale corridor  
prioritizations



# Pan-European Connectivity Models

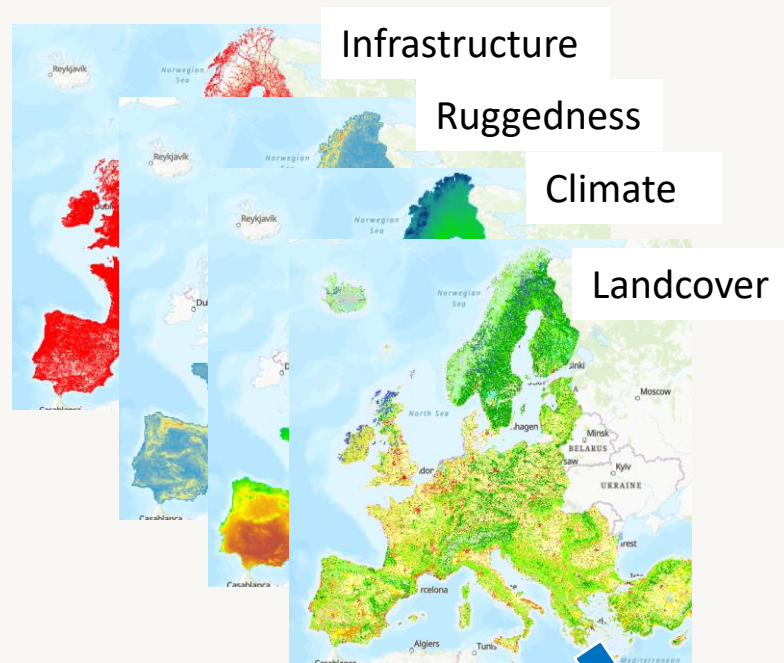
## Omniscape Modelling

- Omnidirectional electrical circuit theory connectivity models
  - Resistance and source raster
- Cumulative and normalized current densities

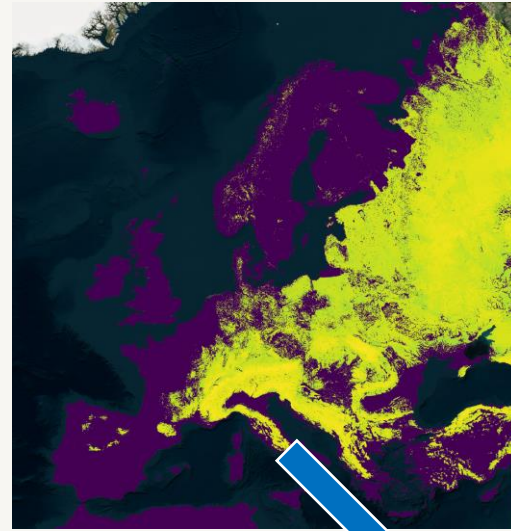




# Omniscape Modeling



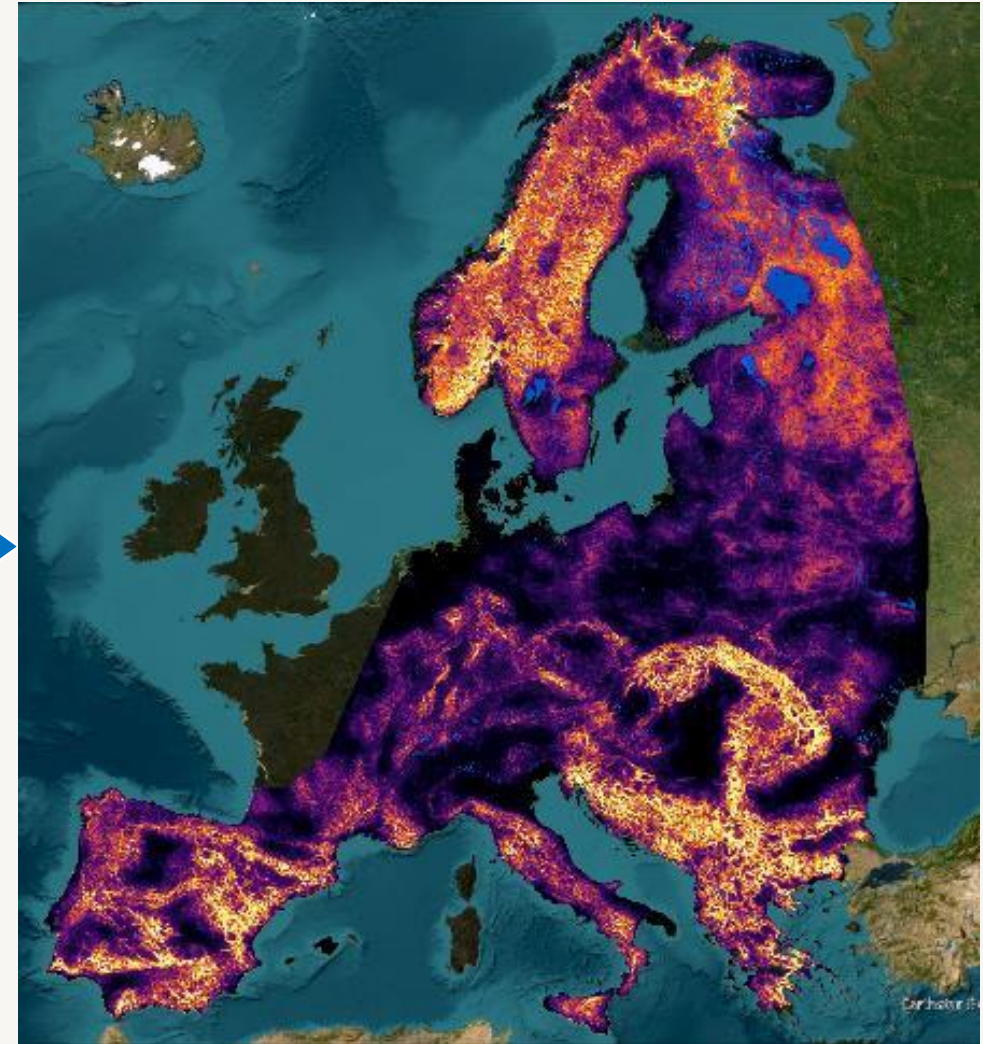
Source Raster



Omniscape.jl

- Species Dist. Models
- Inverted and neg. exp. transformation

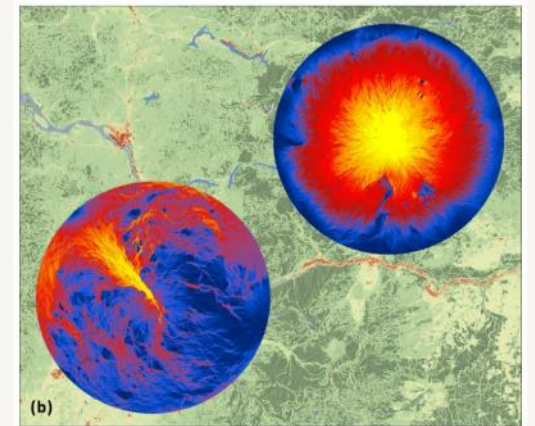
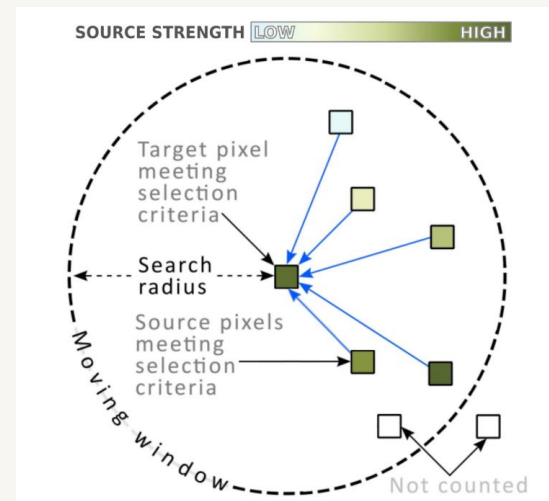
Resistance Raster



# Pan-European Connectivity Models

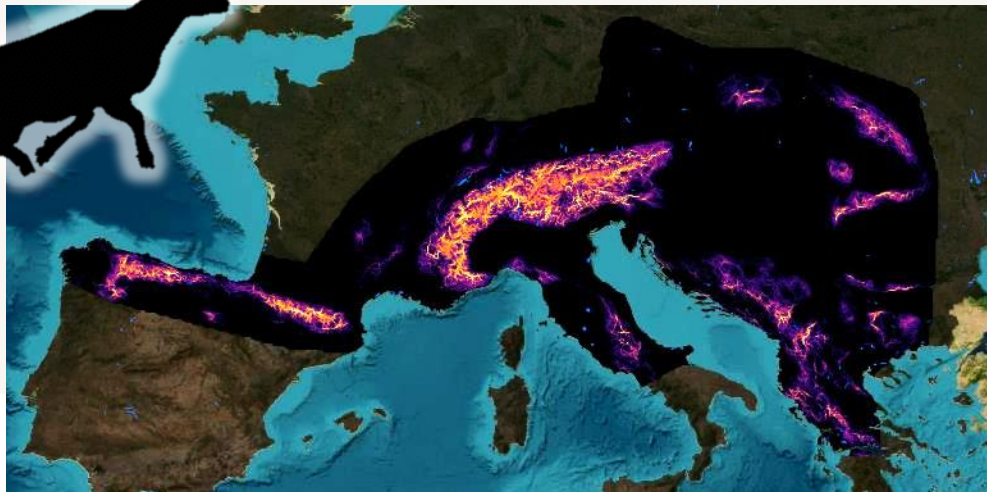
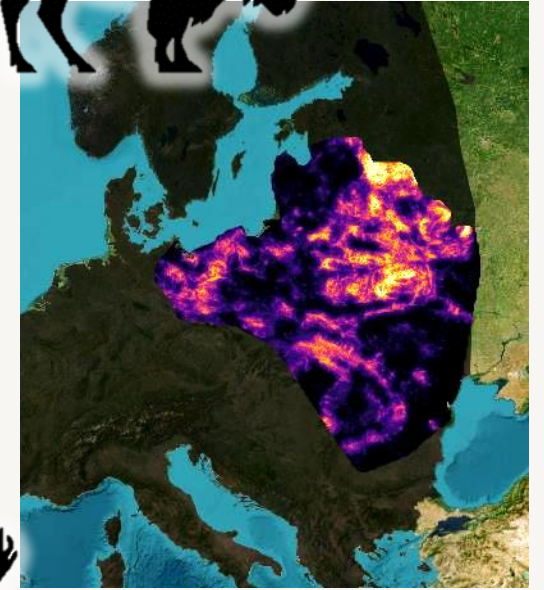
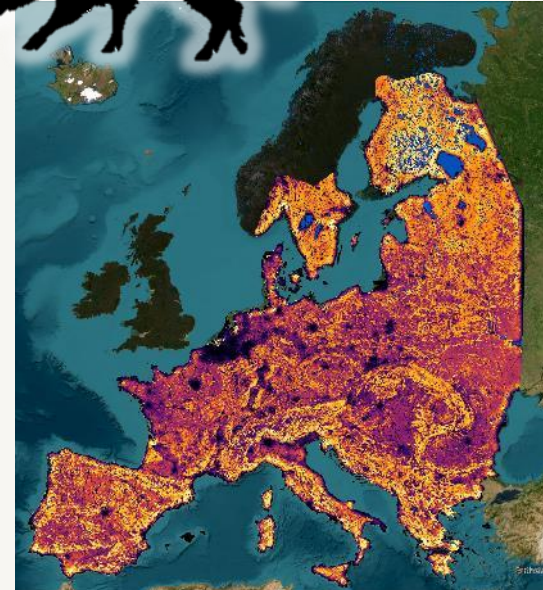
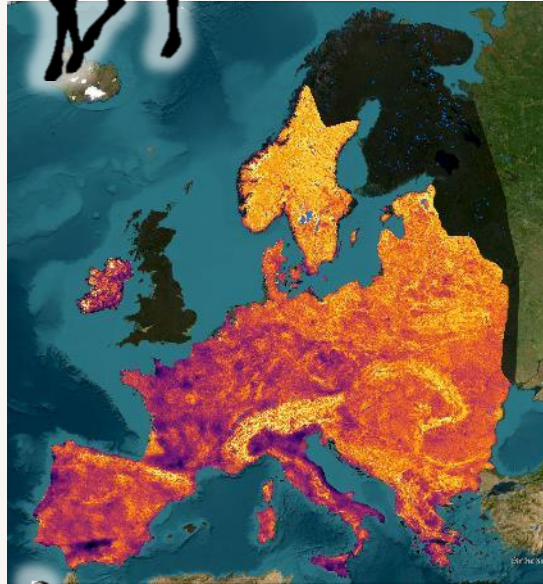
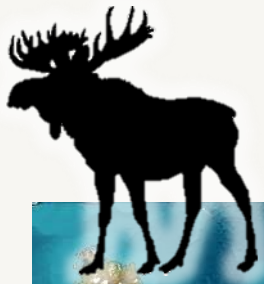
## Omniscape Modelling

- Omnidirectional electrical circuit theory connectivity models
  - Resistance and source raster
- Cumulative and normalized current densities
  - Normalized = cumulative / potential flow
  - Normalized layer a first step to identify priority areas
  - Ability to divide areas (*McRae et al. 2016*):
    - Blocked (0.0 – 0.8)
    - Diffuse (0.8 – 1.2)
    - Intensified (1.2 – 1.7)
    - Channelised (> 1.7)



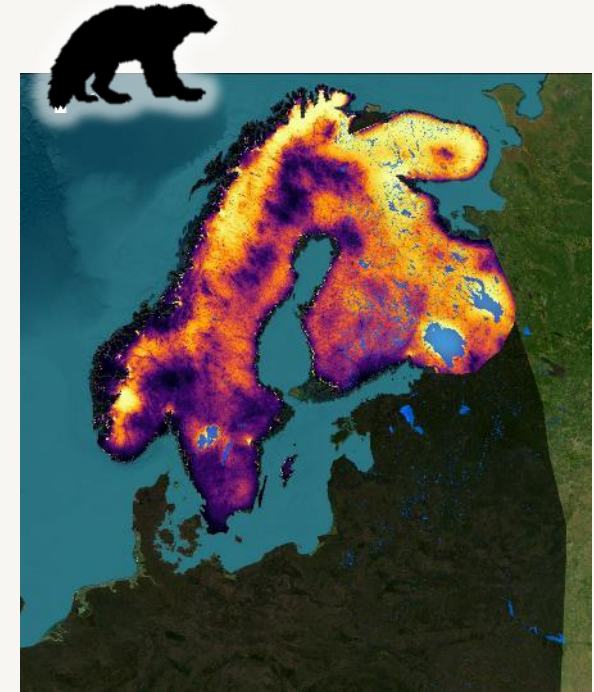
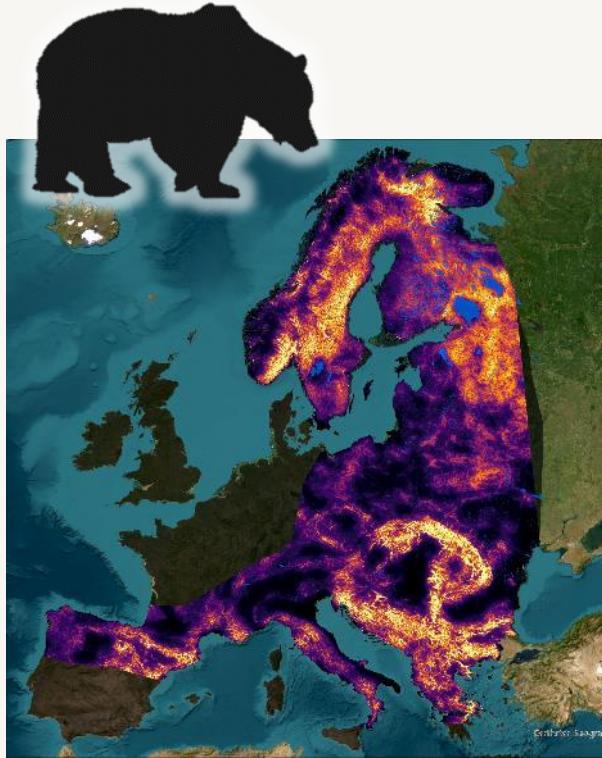


# Cumulative Current Density - Herbivores



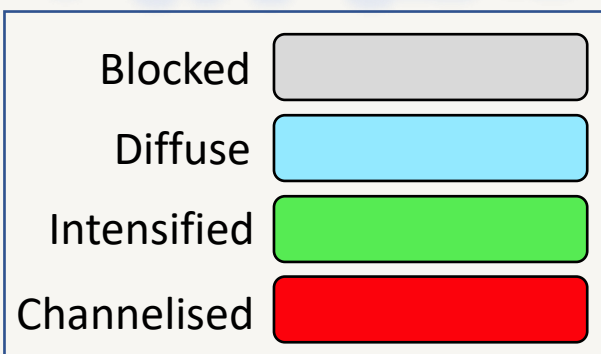
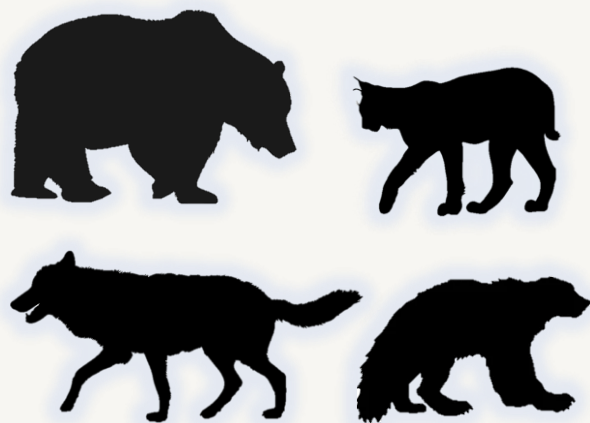


# Cumulative Current Density - Predators



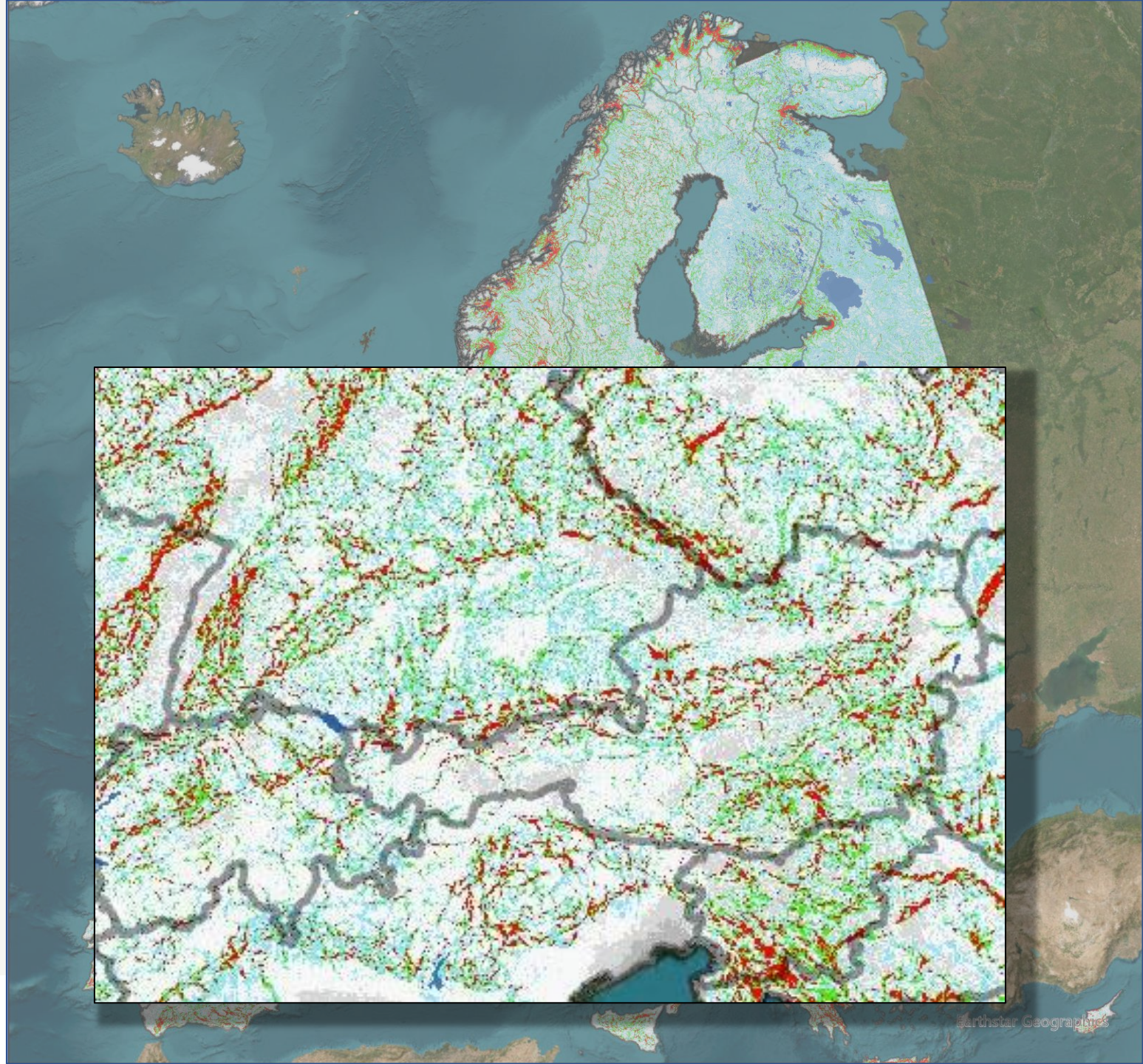
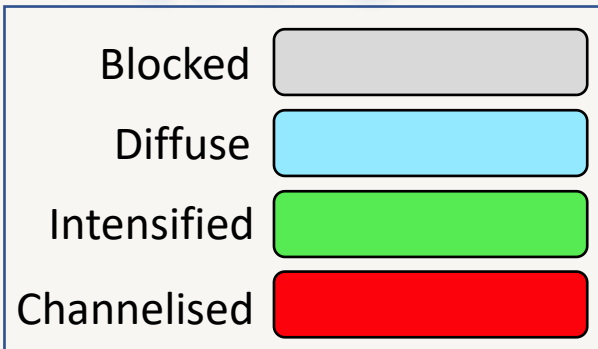
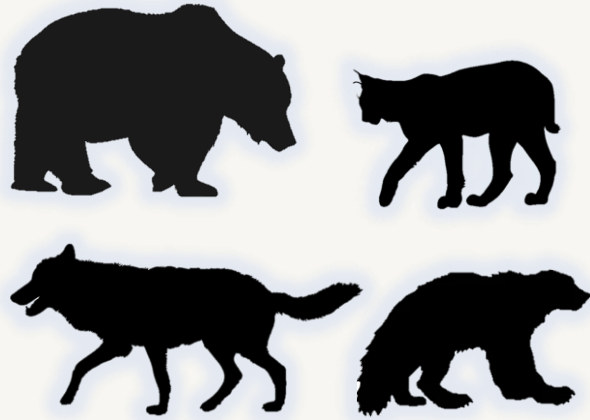


# Predator Normalized Current Density





# Predator Normalized Current Density



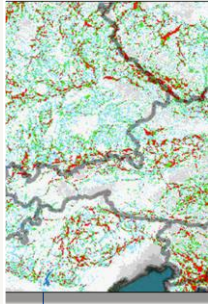






# Pan-European Connectivity Models

Multiple use data products



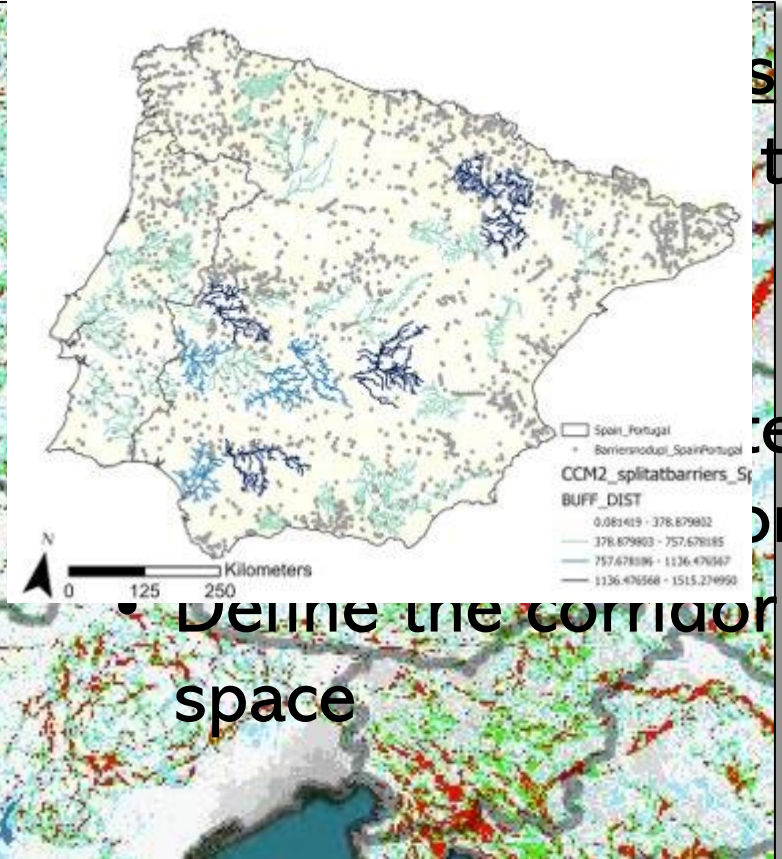
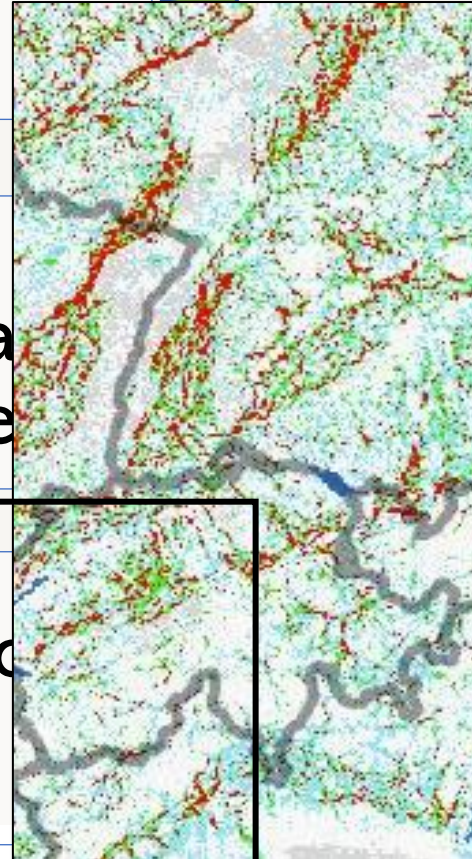
Omniscape models  
for 26 terrestrial  
archetypes



Structural and  
functional freshwater  
connectivity models



Multi-scale corridor  
prioritizations



Define the corridor  
space

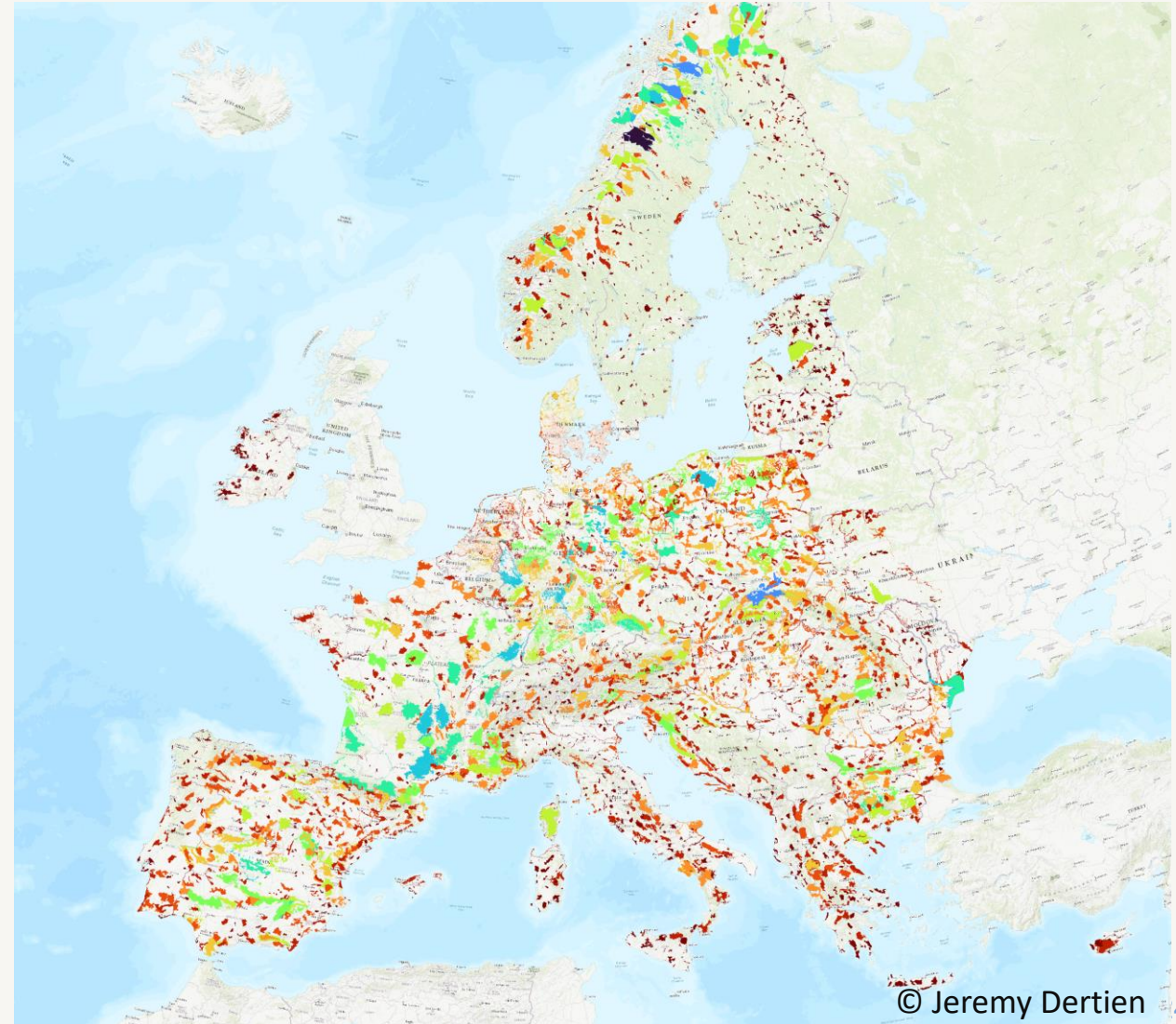
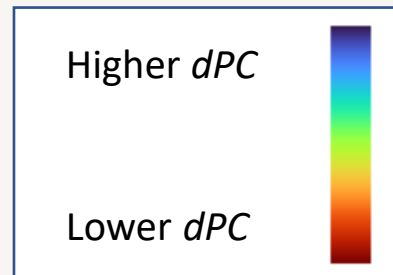


# Prioritising Ecological Corridors

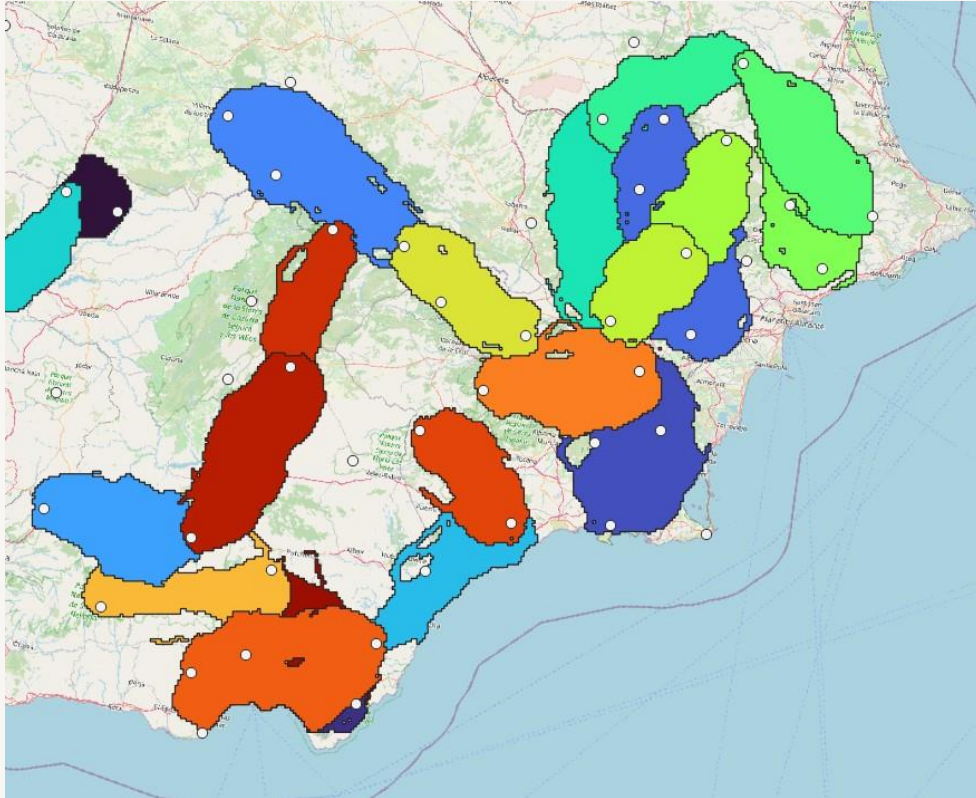
## Change in Probability of Connectivity ( $dPC$ )

- Graph-theoretical connectivity metrics
- Measure of individual PA or linkage importance
- Assist with prioritisation
- Simpler measure of connectivity

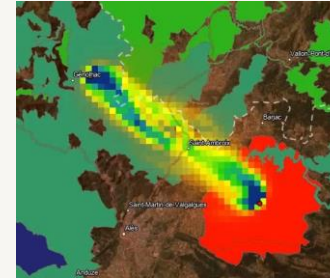
- Valuation by PA area (km<sup>2</sup>)
- Dispersal Max. 50 km



# Prioritising Ecological Corridors



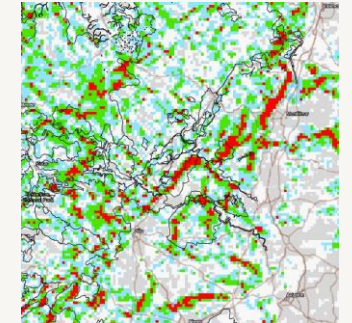
Randomized Shortest Paths to  
identify corridor space



Corridor  
importance ( $dPC$ ;  
"link removal")



Mean  $dPC$  of the  
Two Cores



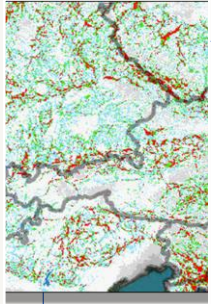
Mean or Median  
Corridor Current  
Density Value

**Corridor  
Priority Value**

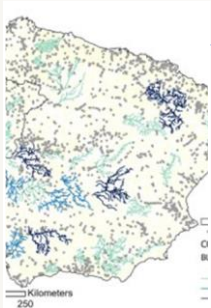


# Pan-European Connectivity Models

Multiple use data products



Omniscape models  
for 26 terrestrial  
archetypes

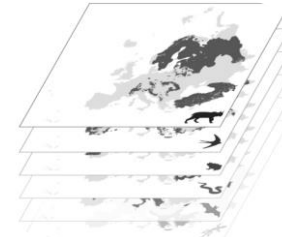


Structural and  
functional freshwater  
connectivity models

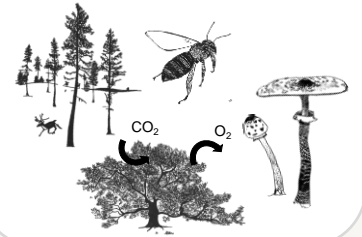


Multi-scale corridor  
prioritizations

Species & habitats  
distributions and FRV



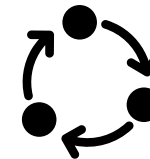
Ecosystem  
services



Climate  
change



Connectivity



Land use  
change  
scenarios



Costs



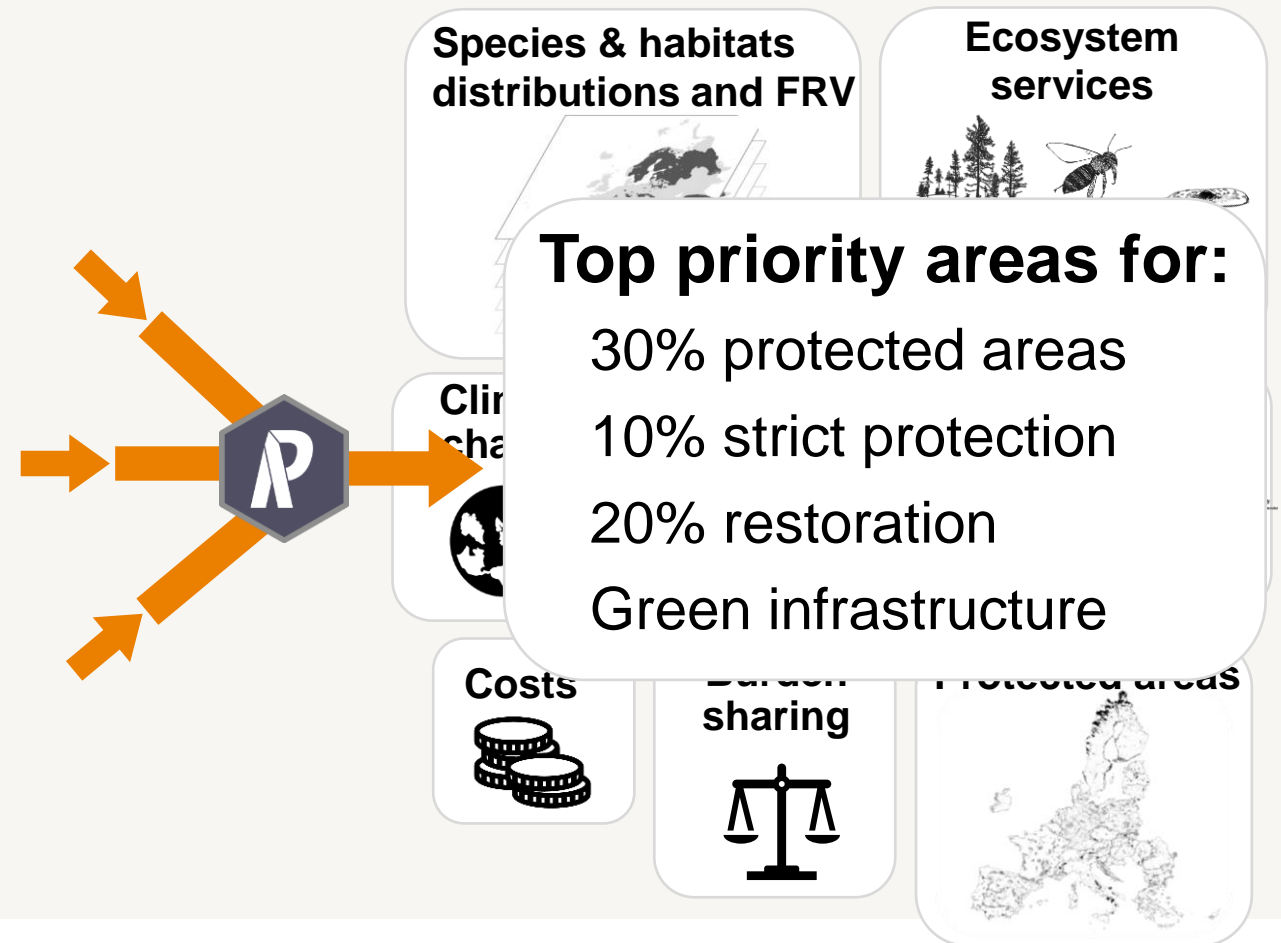
Burden  
sharing



Protected areas



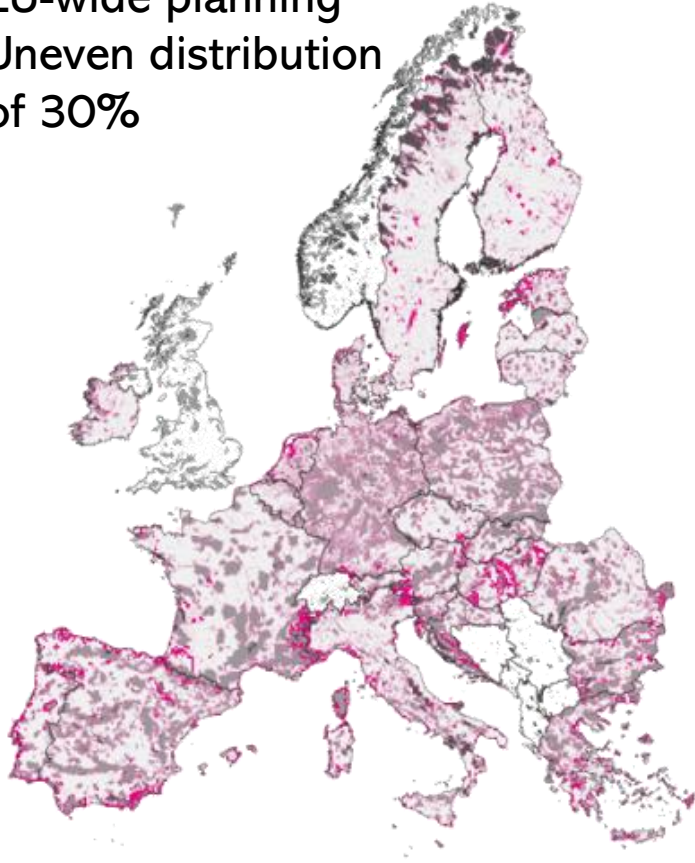
# WP7: Finding priorities for conservation, restoration and sustainable management



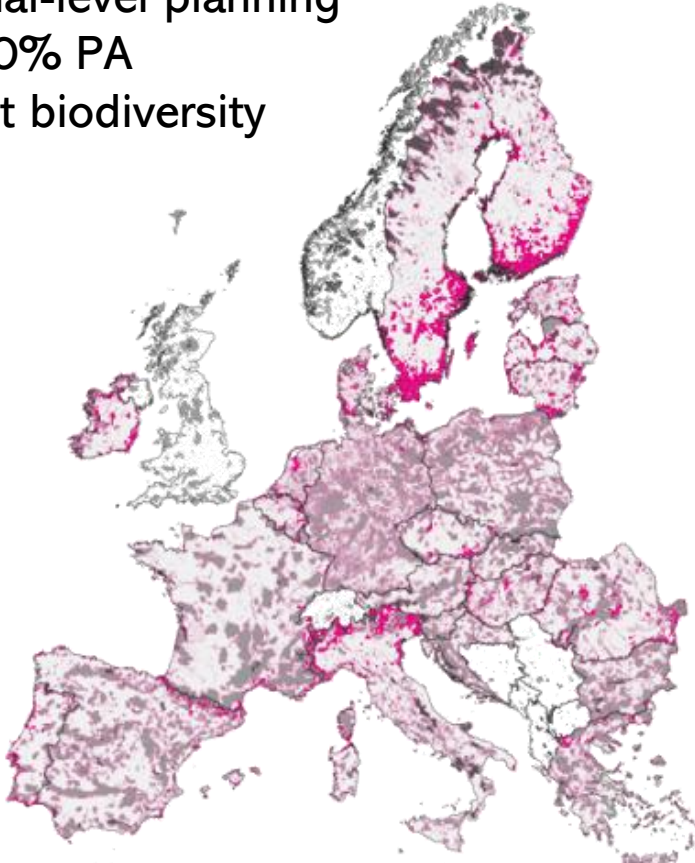


# Preliminary Conservation Prioritization Scenarios

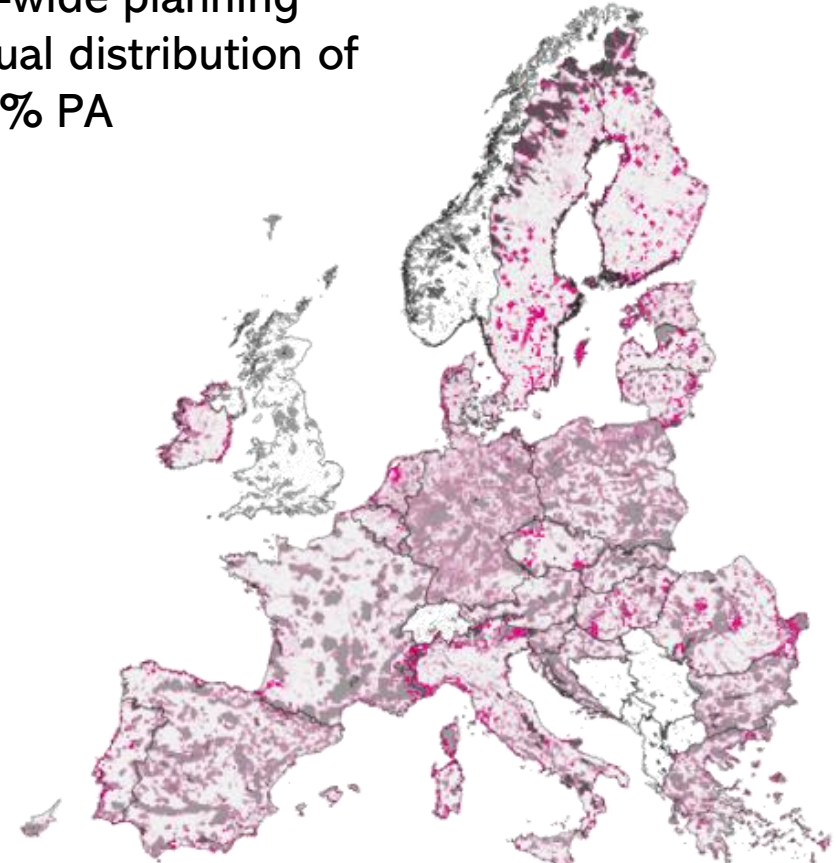
EU-wide planning  
Uneven distribution  
of 30%



National-level planning  
Still 30% PA  
Lowest biodiversity  
gains



EU-wide planning  
Equal distribution  
of 30% PA



© Louise O'Connor  
IIASA; NaturaConnect

# A Connected Multifunctional Nature Network

- Multi-faceted approach to conserve multifunctional connections
- Ideally used by conservation practitioners at local, regional, and multi-national scales
- Interactive maps of connectivity results will become available next year
- Beta testing interactive spatial planning application
- Learning Platform for spatial prioritization, connectivity modelling, etc.
  - [www.naturaconnect.eu](http://www.naturaconnect.eu)

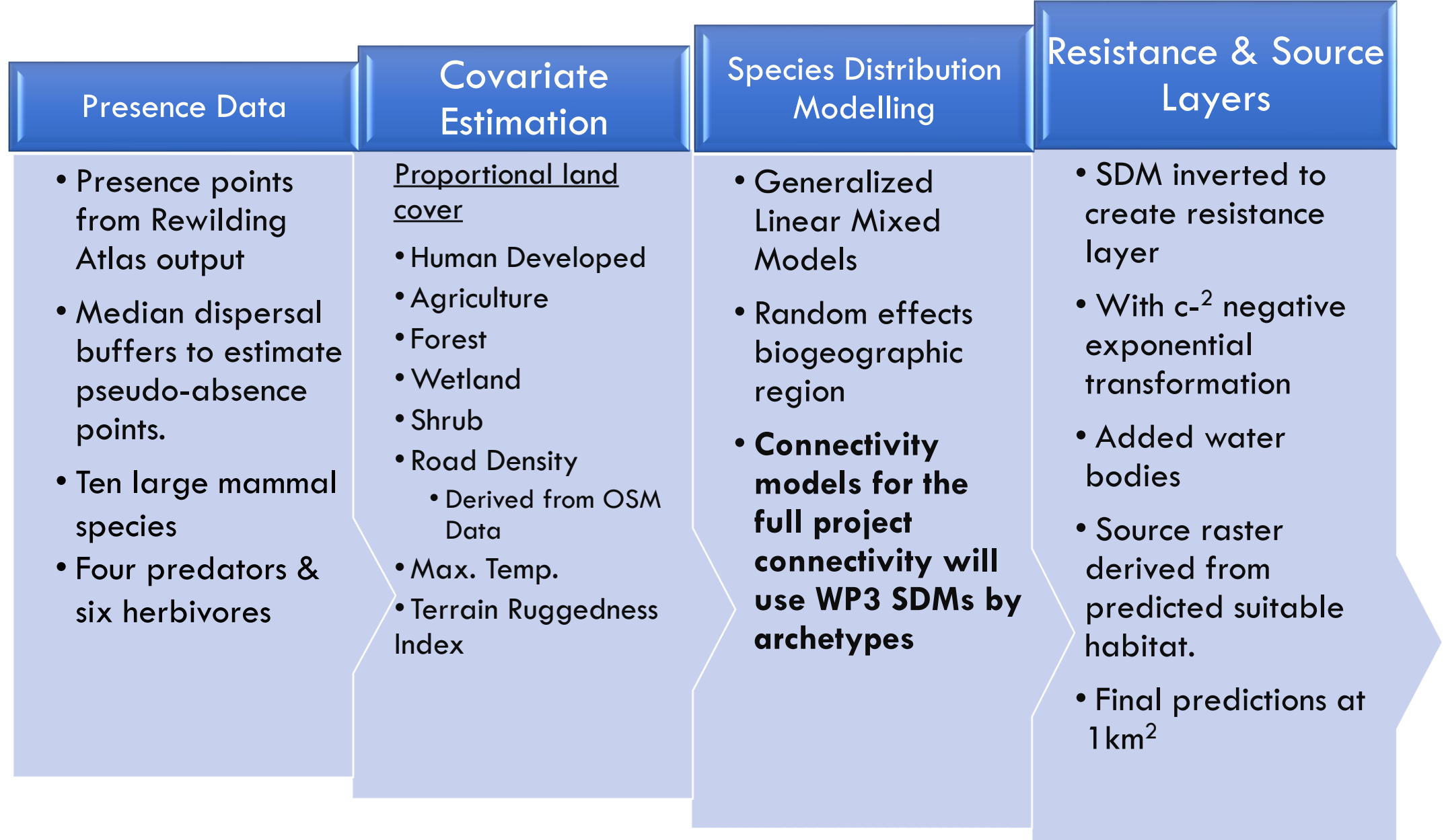




# Questions?



# Resistance & Source Layers for Omnidirectional Modelling





# Metrics and Methods

## Functional vs. Structural Connectivity

- A spectrum rather than binary difference
- Structural connectivity index and other measures of spatial congruency
  - Effective mesh size
  - Betweenness centrality
  - Distance to nearest neighbor
- Functional connectivity incorporates aspects of habitat preference and/or animal movement
  - Step selection functions from GPS data
  - Species distribution models -> Resistance surface-based graph models



# Deliverables To Date

- D1.2. NaturaConnect Learning Platform
- D1.3. Stakeholder Analysis
- D2.1. Review of Best Practices in Governance and LC policies
- D4.1. Spatial Opportunities and Constraints for GI network design
- D5.1. Scenario Framework for TEN-N
- D6.1. Guidelines for Connectivity Conservation Planning in Europe
- D7.1. Formulations, Targets and Preferences for the TEN-N



High Connectivity



Low Connectivity

