

The background of the entire slide is a photograph of a vast, rugged mountain range covered in snow. In the foreground, a small orange tent is pitched on a grassy slope. The sky is clear and blue.

WRi

WILDLAND
RESEARCH
INSTITUTE

MAPPING WILDERNESS IN EUROPE AND BEYOND

STEVE CARVER
& MARK FISHER

Outline

- EP Resolution on Wilderness in Europe (Feb 2009) and the *Message from Prague* (May 2009)
- Need for wilderness guidelines (definition), register and coordinated mapping
- Focus on EU, Europe and immediate neighbours
- Wilderness quality mapping
 - Connected landscapes: Cores, Corridors and Carnivores
 - Trans-boundary connectivity
 - Protecting what's left and creating more

Wilderness in Europe

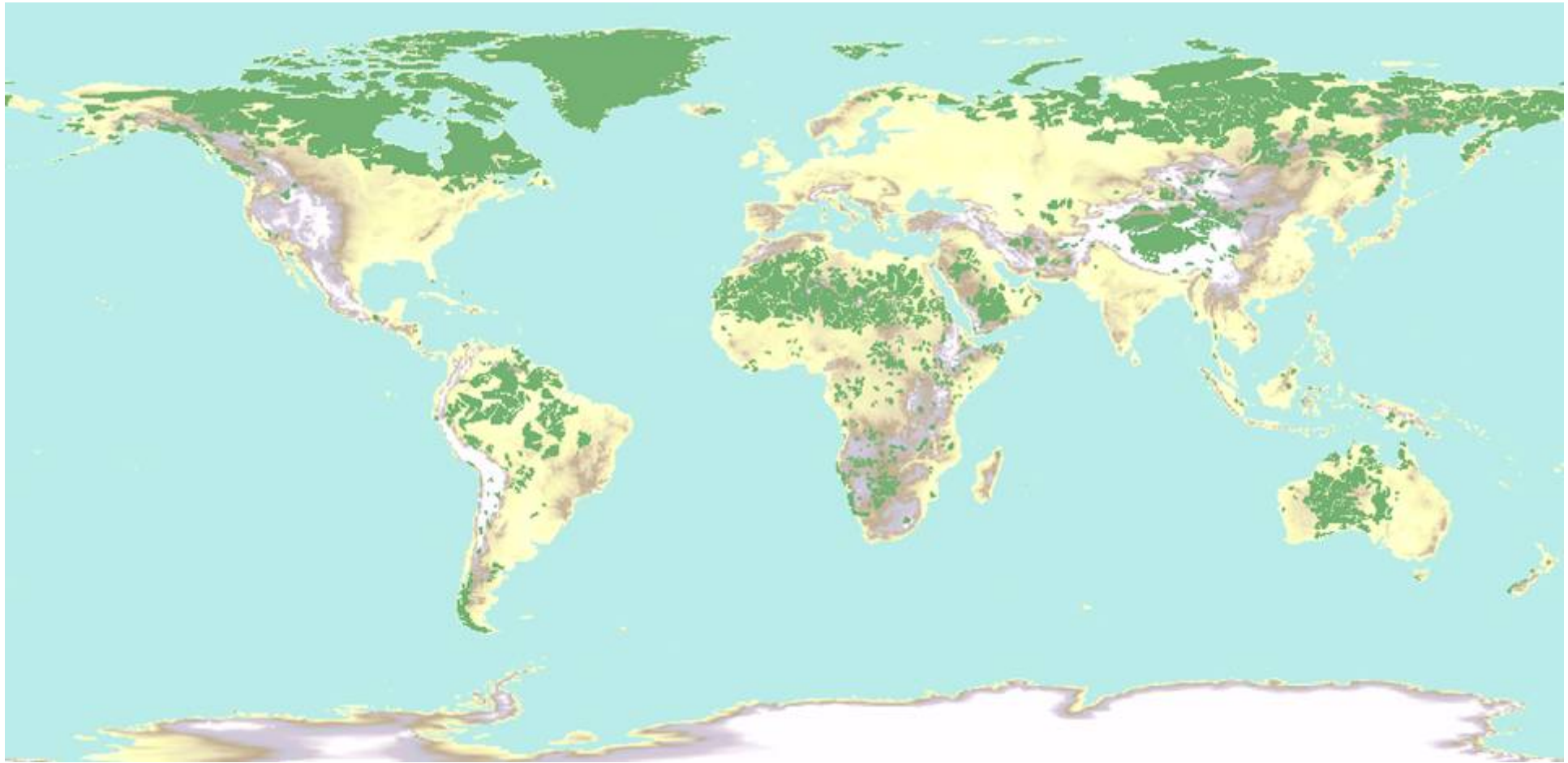
- Feb 2009 European Parliament Resolution 2008/2210(INI) 528 votes for and only 19 against
 - call for improved protection for wilderness areas through mapping, research and awareness raising
- May 2009 Conference on *Wilderness and Large Natural Habitat Areas*, Prague.
 - an Agenda for Europe's Wild Areas "*Poselství from Prague*"
 - important because of their indirect and direct economic, health, social, research and cultural values
 - mapping wilderness in Europe using appropriate definitional and habitat criteria and level of scale to support plans for protecting and monitoring

Wilderness Mapping

- Wild(er)ness is an understanding of what came before modern humans moved out of Africa:
 - based on remnant areas of low human modification as well areas of ecological restoration where human influence has been withdrawn
 - subject to individual perception, social and cultural background, and personal experience...
 - an idea... or an ideal... as much as it has a scientific basis... a place that exists in the mind as much as it does on a map!

“One man’s wilderness is another’s roadside picnic ground.” (Nash, 1982)

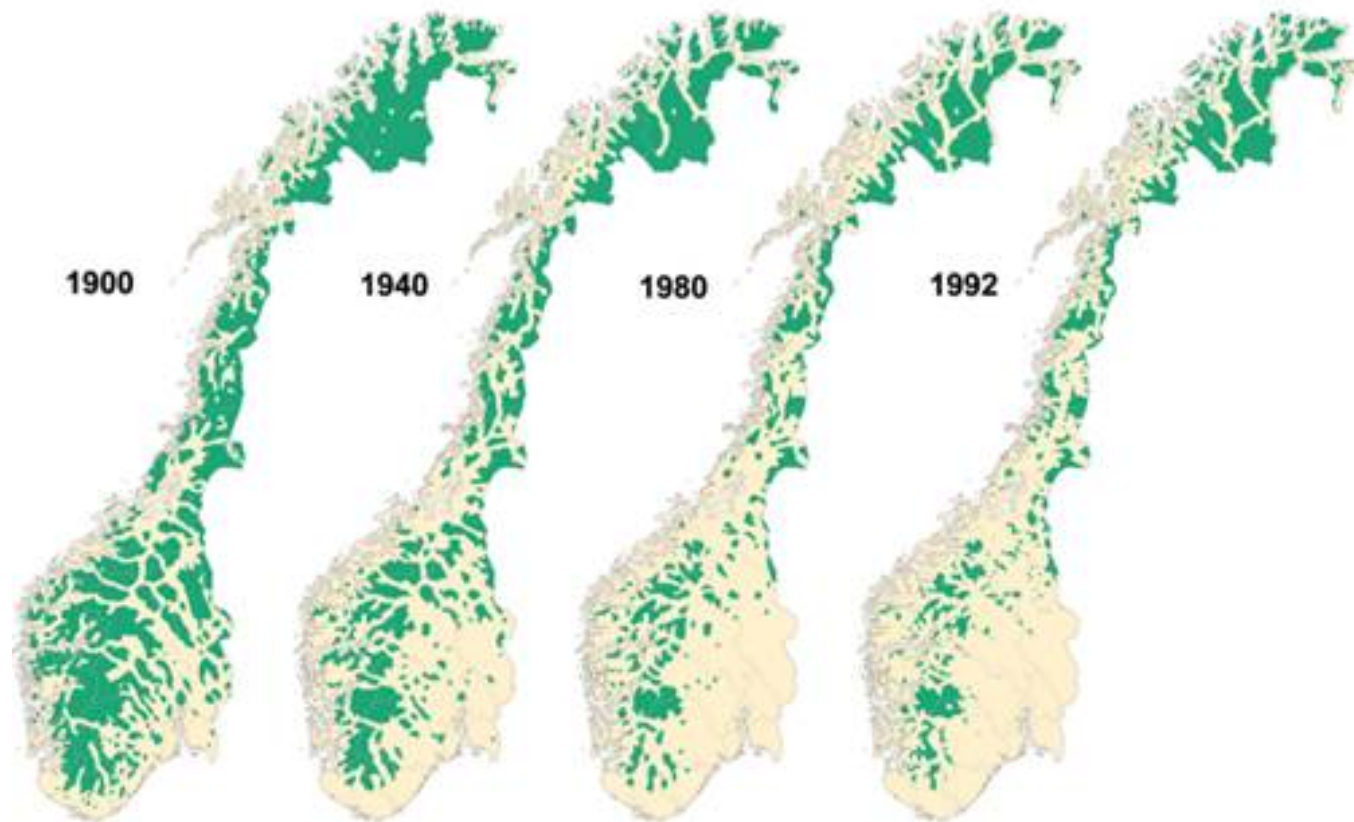




World wilderness distribution (After McCloskey and Spalding, 1989)

- areas greater than 1 million acres (404,700ha)
- essentially roadless
- unaffected by permanent habitation or structures
- based on DCW 1:5 million scale digital map data

URØRT NATUR 1900 - 1992



Kilde: Brun, M. NOU-1986/GRID Arendal 1992. Redaksjonell bearbeiding og grafisk produksjon: GRID Arendal 1995.
Kartet viser områder mer enn 5 km fra veier, jernbanelinjer eller kraftlinjer.

The shrinking wilderness (After Brun, 1992)

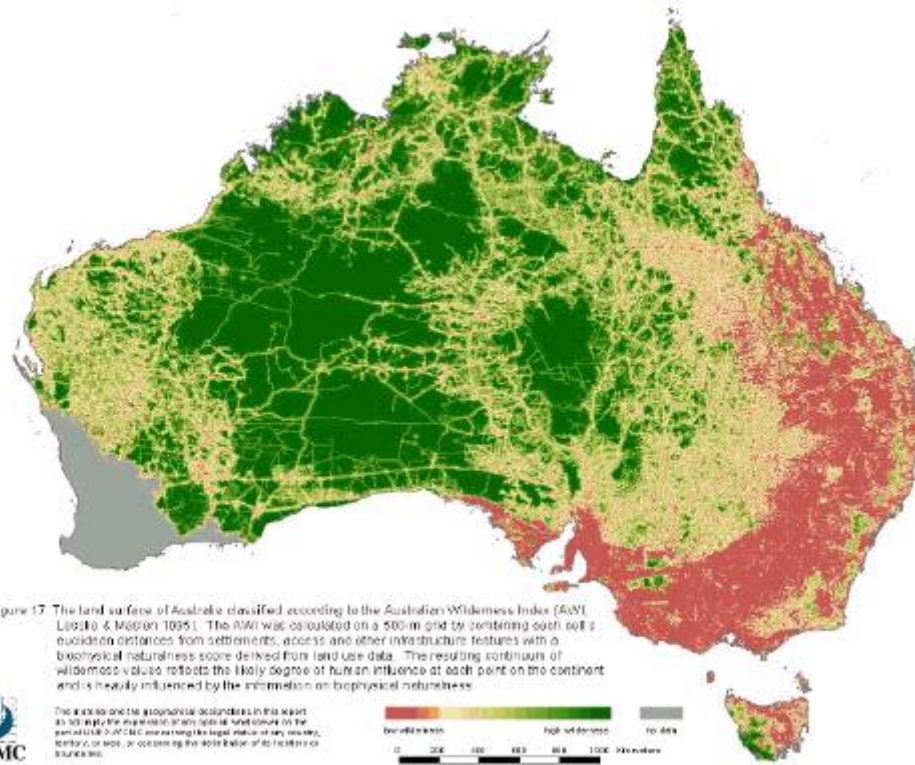
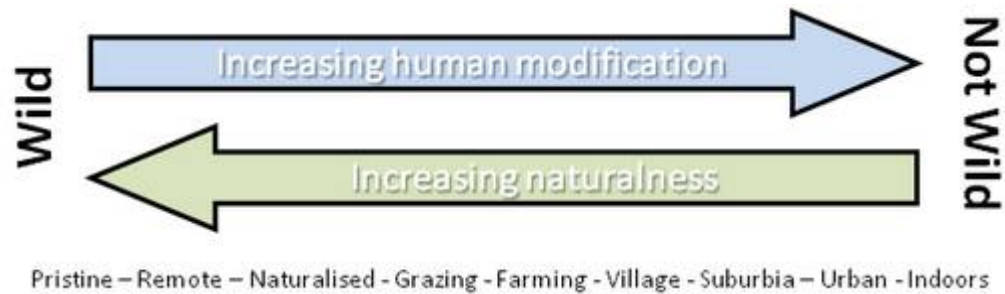
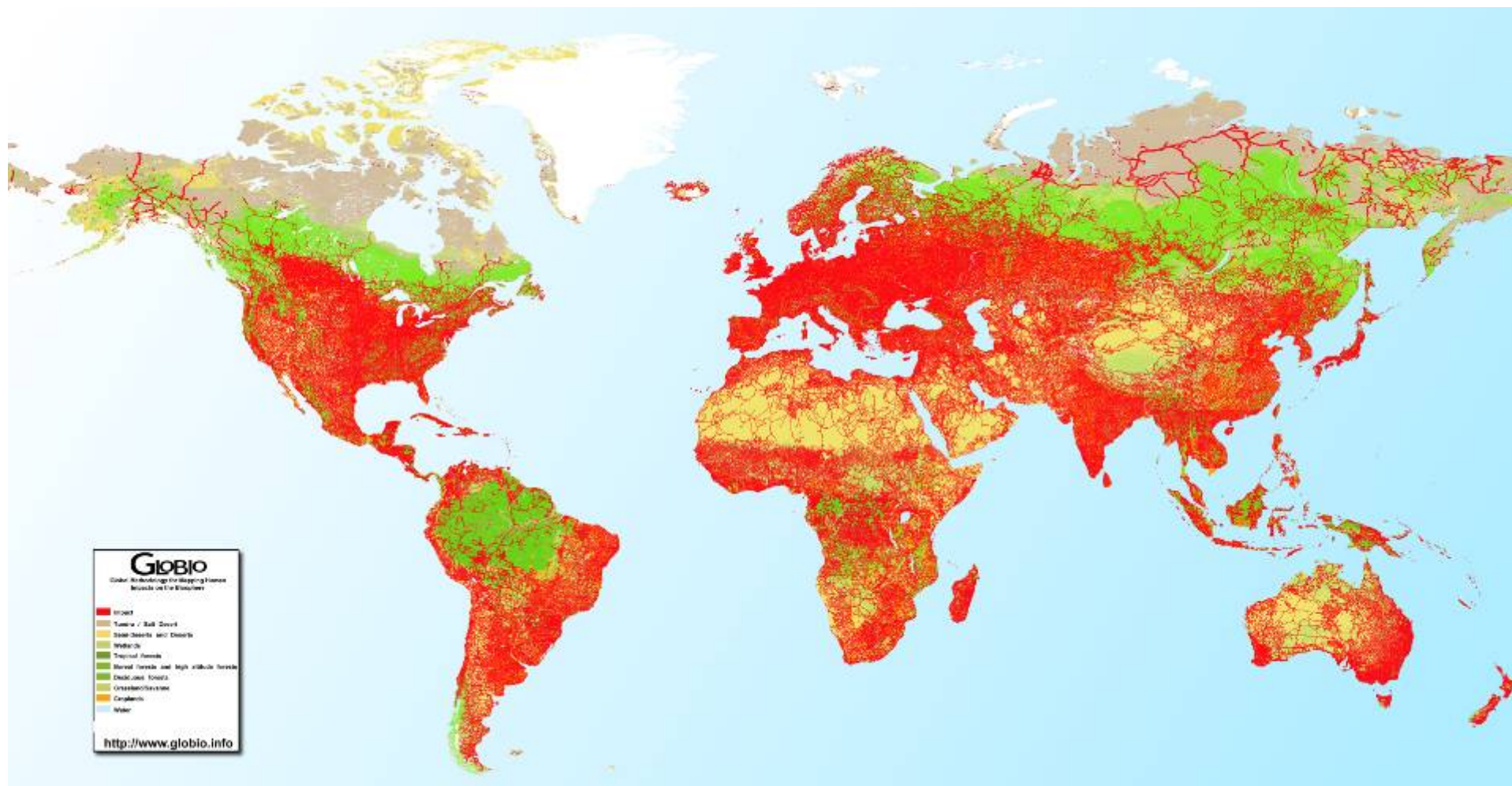


Figure 17 The land surface of Australia classified according to the Australian Wilderness Index (AWI) (Leslie & Maslen 1995). The AWI was calculated on a 500-m grid by combining each cell's exclusion distances from settlements, access and other infrastructure features with a biophysical naturalness score derived from land use data. The resulting continuum of wilderness values reflects the likely degree of human influence at each point on the continent and is heavily influenced by the information on biophysical naturalness.

Australian Wilderness Inventory (After Lesslie and Maslen, 1995)



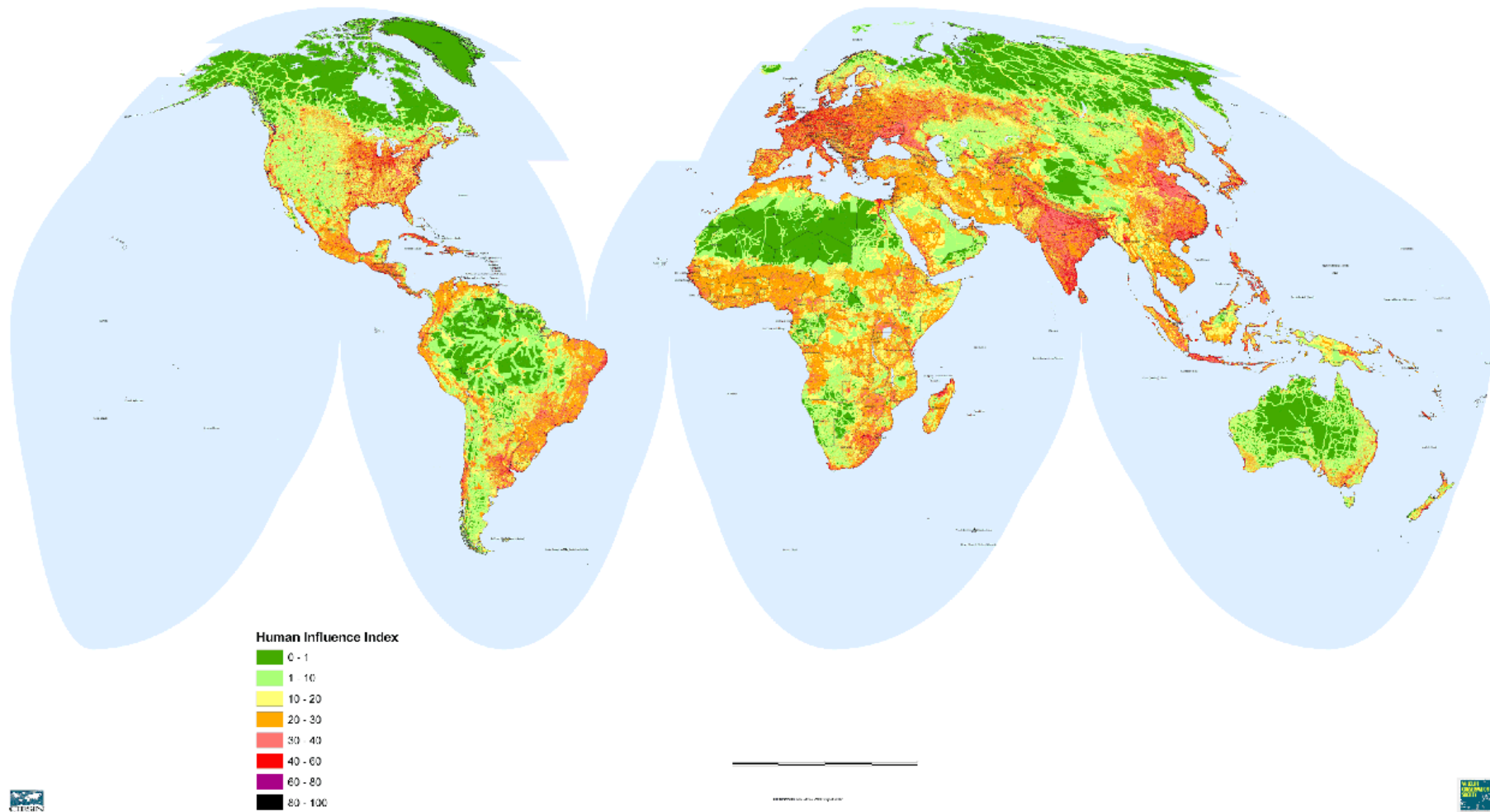
Wilderness Continuum Concept



Global human impacts (After Globio/UNEP, 2002)

The probability of impact is a function of the distance from:


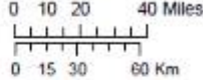
- power lines or pipelines
- roads
- settlements, cabin resorts, or construction-related facilities

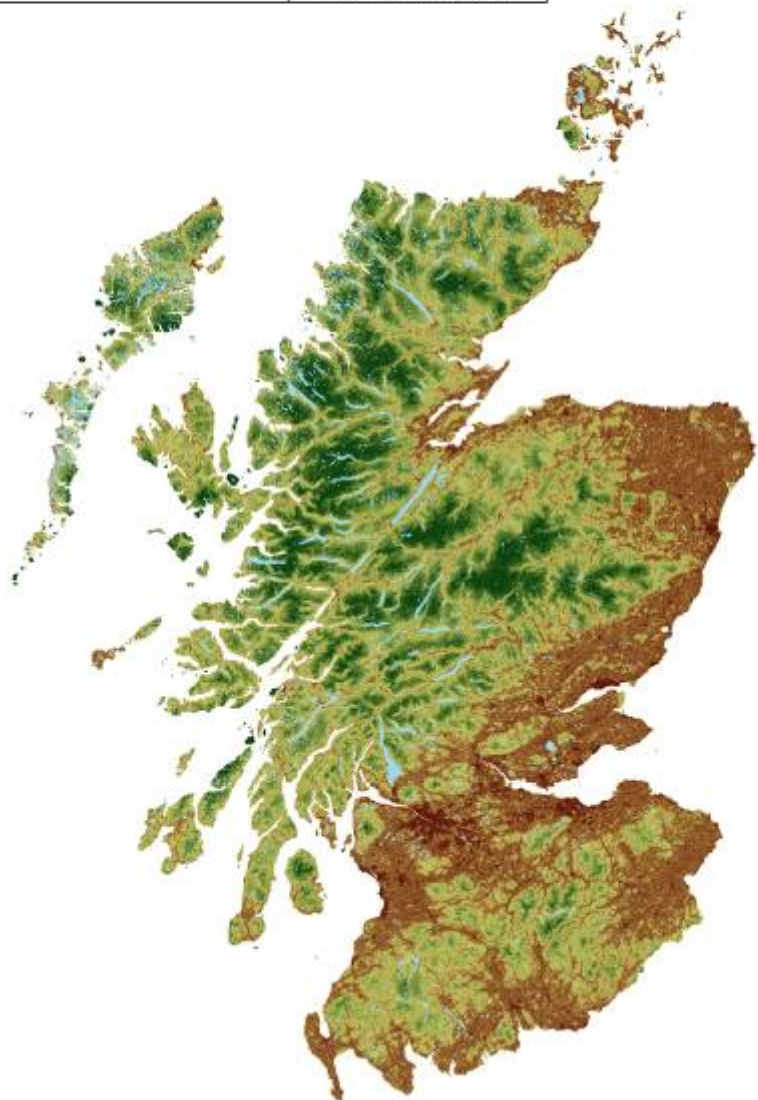


The Human Footprint (After Sanderson et al., 2002)

Uses four types of data as proxies for human influence:

- population density
- land transformation
- accessibility
- electrical power infrastructure

Mapping Scotland's Wildness Wildness Map	
Level of wildness 	
The four component layers have been given equal weighting.	Cell resolution: 25 metres
Date: 10 January 2012	Produced by: Geographic Information Group
Version 2: Interim Phase 1 map	© Crown copyright and database right 2012. All rights reserved. Ordnance Survey Licence number 100017305. Interim's HEATMap.



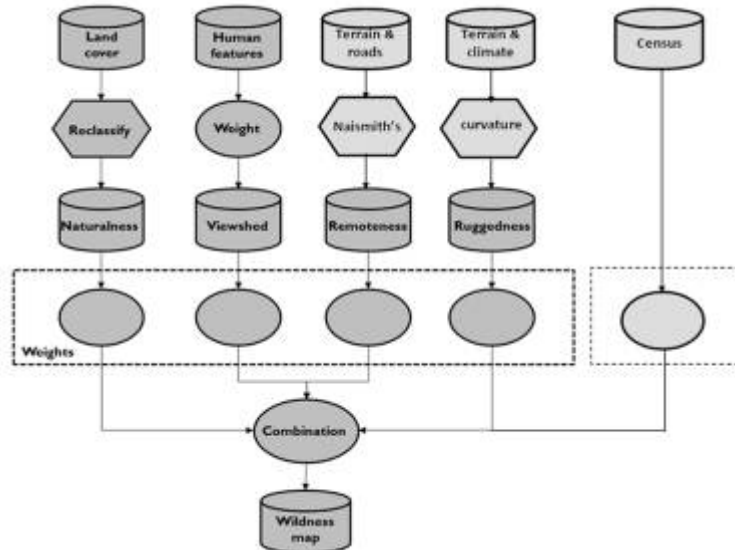
“Uninhabited and often relatively inaccessible countryside where the influence of human activity on the character and quality of the environment has been minimal.”

(NPPG 14, 1998)

“There are parts of Scotland where the wild character of the landscape, its related recreational value and potential for nature are such that these areas should be safeguarded against inappropriate development or land-use change.”

(SNH, July 2002)

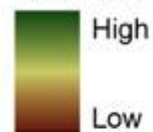
<http://www.snh.org.uk/pdfs/polstat/pd-wsc.pdf>



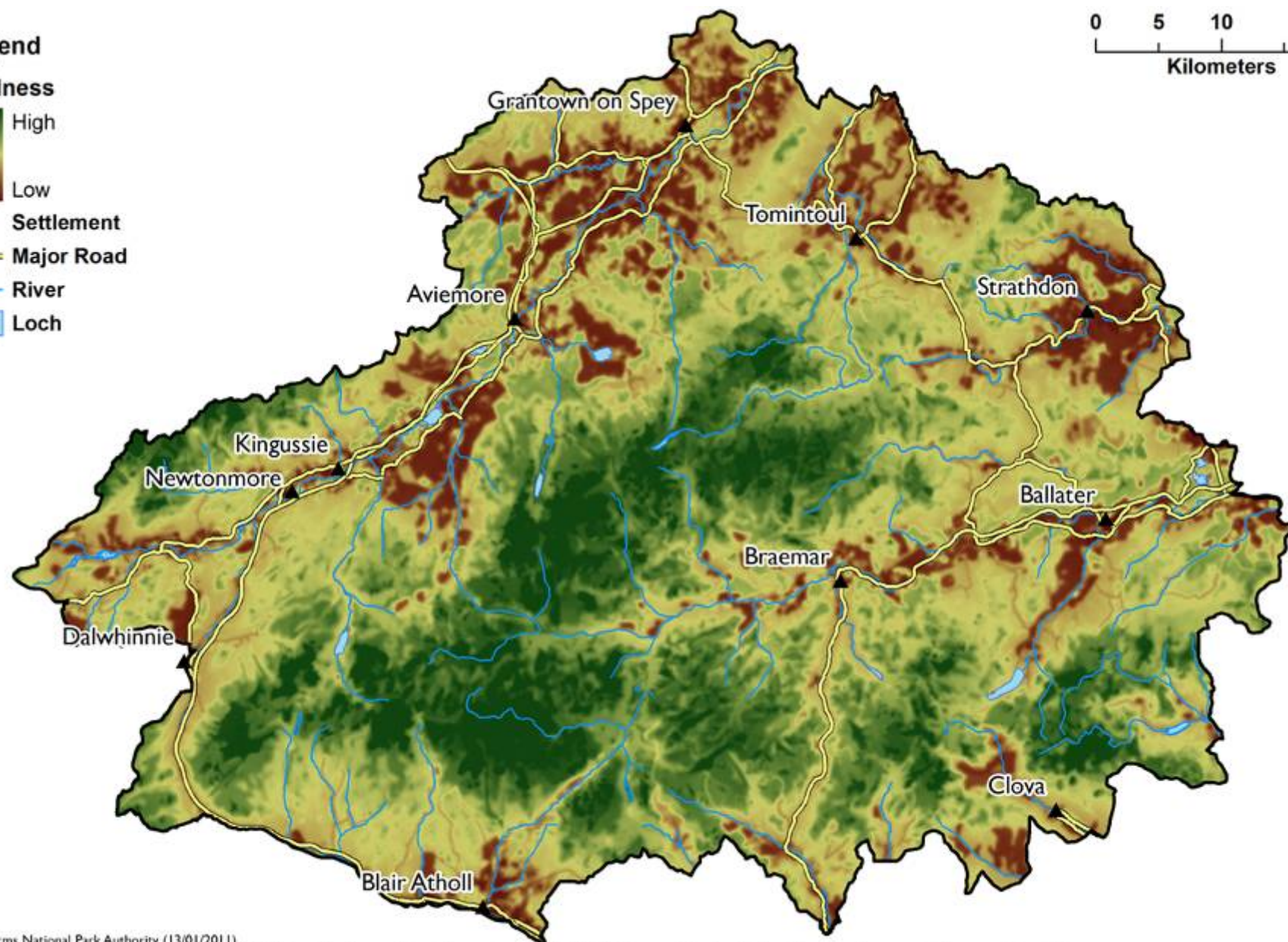
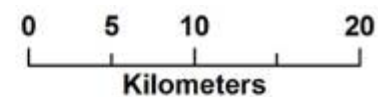
"Conservation values are rarely black and white – more often than not they are a shade of gray"
 (Stokes and Morrison, 2003)

Legend

Wildness



- ▲ Settlement
- Major Road
- River
- Loch



© Cairngorms National Park Authority (13/01/2011)

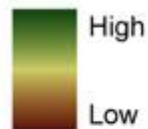
The representation of features or boundaries in which CNPA or others have an interest does not necessarily imply their true positions. For further information please contact the appropriate authority.

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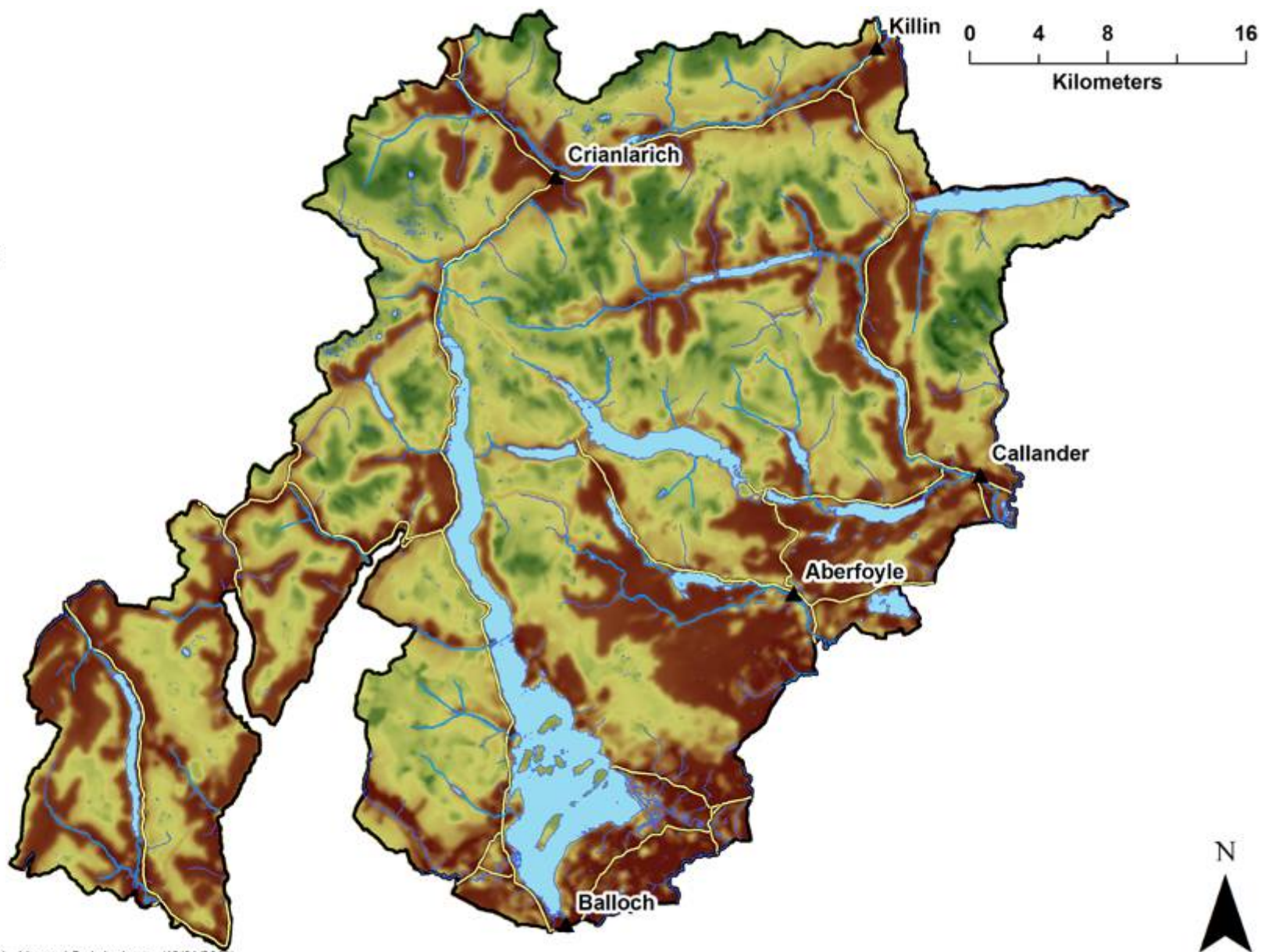
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Legend

Wildness



- ▲ Settlement
- Major Road
- River
- Loch



© Loch Lomond and The Trossachs National Park Authority (13/01/2011)

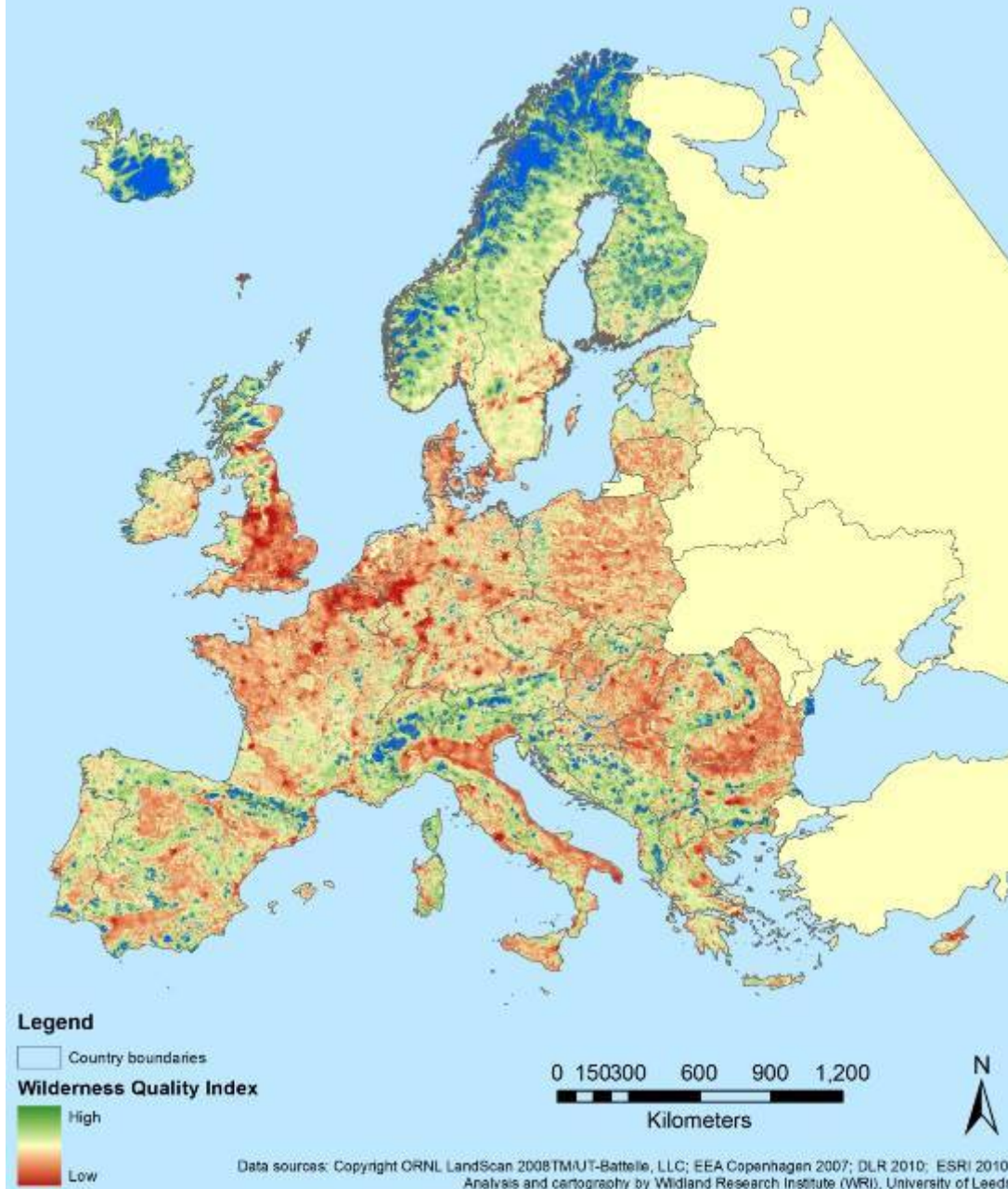
The representation of features or boundaries in which LLTNPA or others have an interest does not necessarily imply their true positions. For further information please contact the appropriate authority.

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Wilderness in Europe

Wilderness Quality Index showing top 10% by area



Wilderness Quality Index (WQI)

based on:

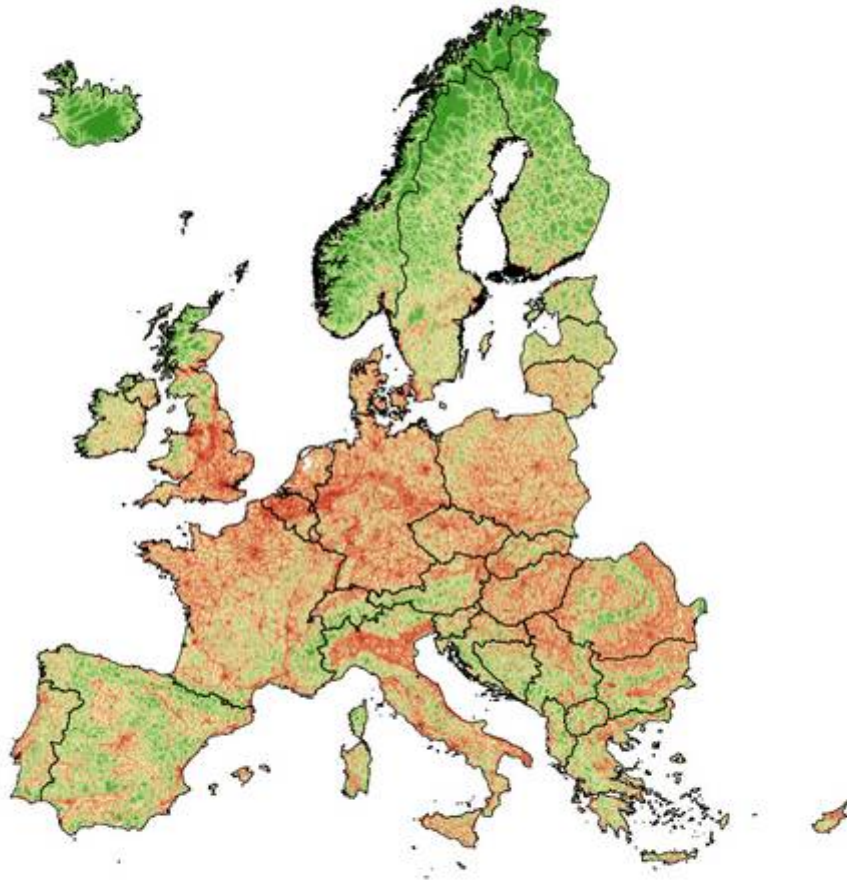
- Distance from nearest road/railway
- Population density
- Land use
- Terrain ruggedness

Top 10% wildest areas highlighted in blue

- Shows marked altitudinal and latitudinal trend (plus lowland wetland e.g. Danube Delta, Sooma, etc.)

Wilderness Quality in Europe

Case #23



0 200 400 800 1,200 1,600
Kilometers

Legend

Country borders

Wilderness Quality Index

High : 153

Low : 0.4

Map produced by Wildland Research Institute, University of Leeds.
Data sources: Digital Chart of the World, 1992; ORNL, 2010; EEA, 2000; NASA, 2010

Wilderness areas in Europe

(based on combination of top 10% wildest areas from 23 experts)



0 175 350 700 1,050 1,400
Kilometers

Legend

Country borders

Wildest areas

Wild

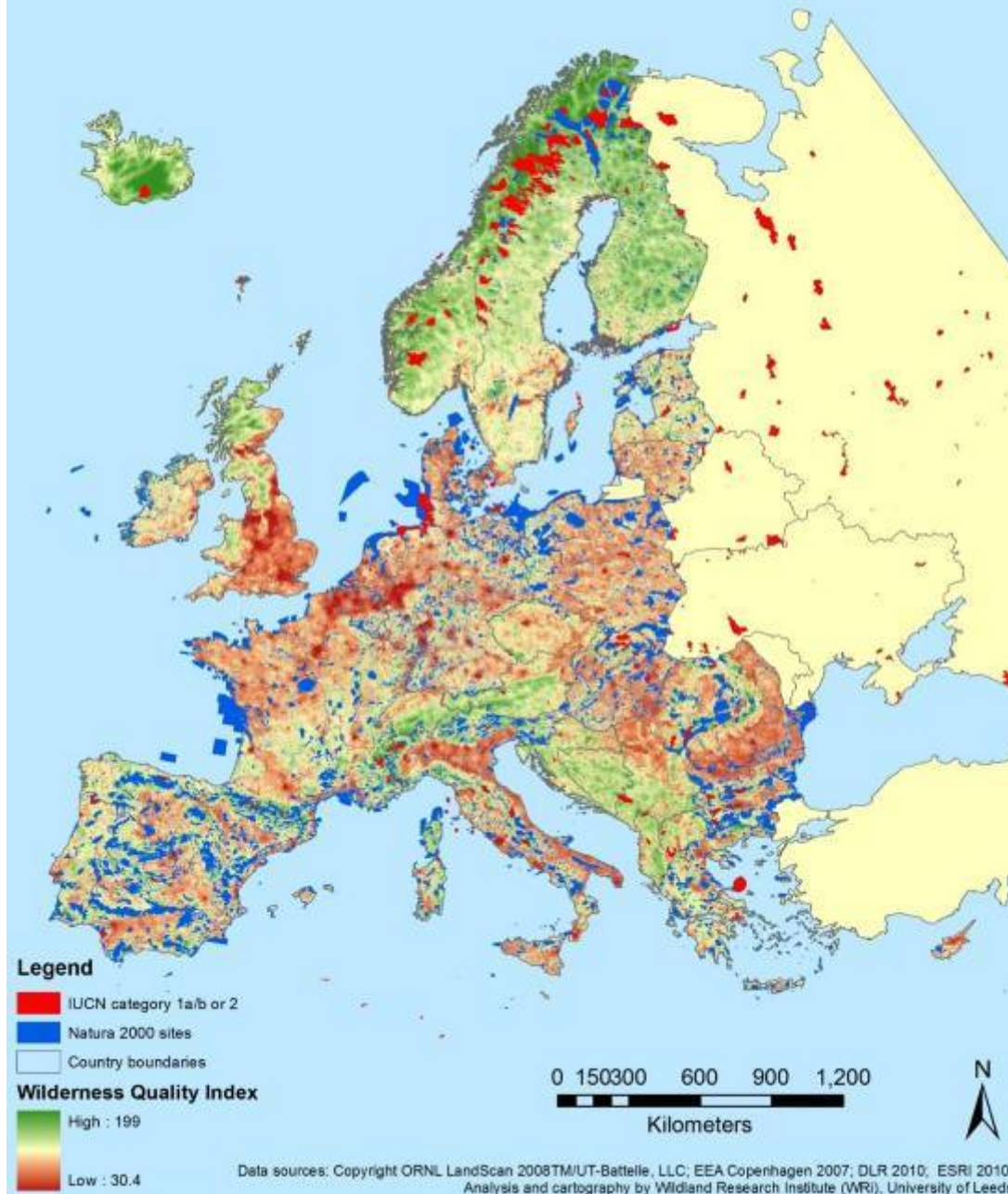
Not wild

Map produced by Wildland Research Institute, University of Leeds.
Data sources: Digital Chart of the World, 1992; ORNL, 2010; EEA, 2000; NASA, 2010

Effects of personal/expert weightings

Wilderness in Europe

IUCN sites (category 1a/b and 2)



Correspondence with existing protected area networks

- IUCN Cat 1a/b & 2 - red
- Natura 2000 - blue

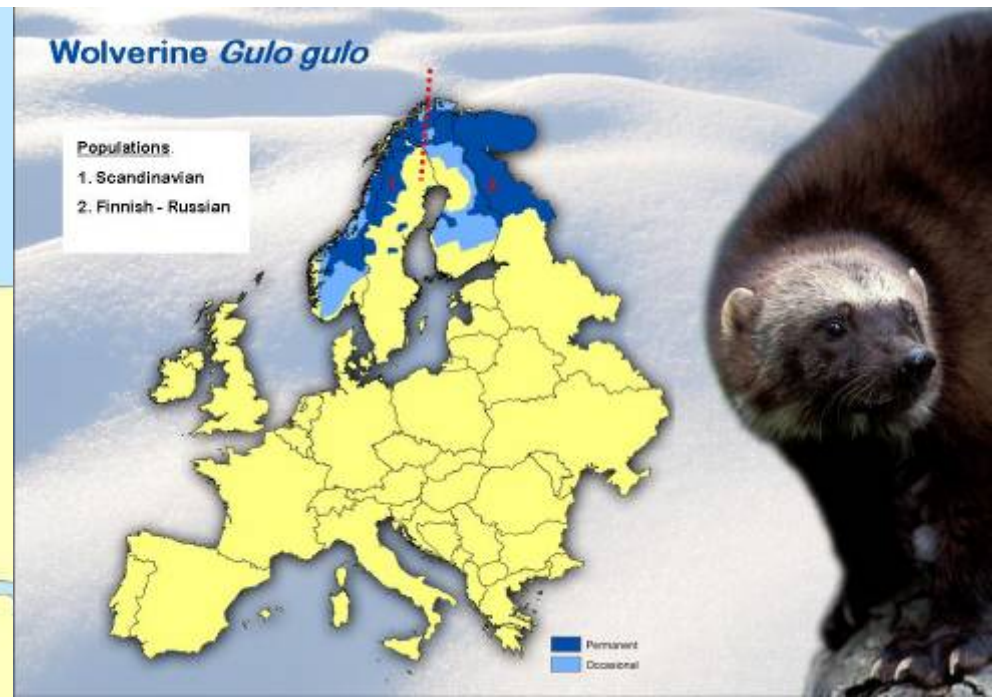
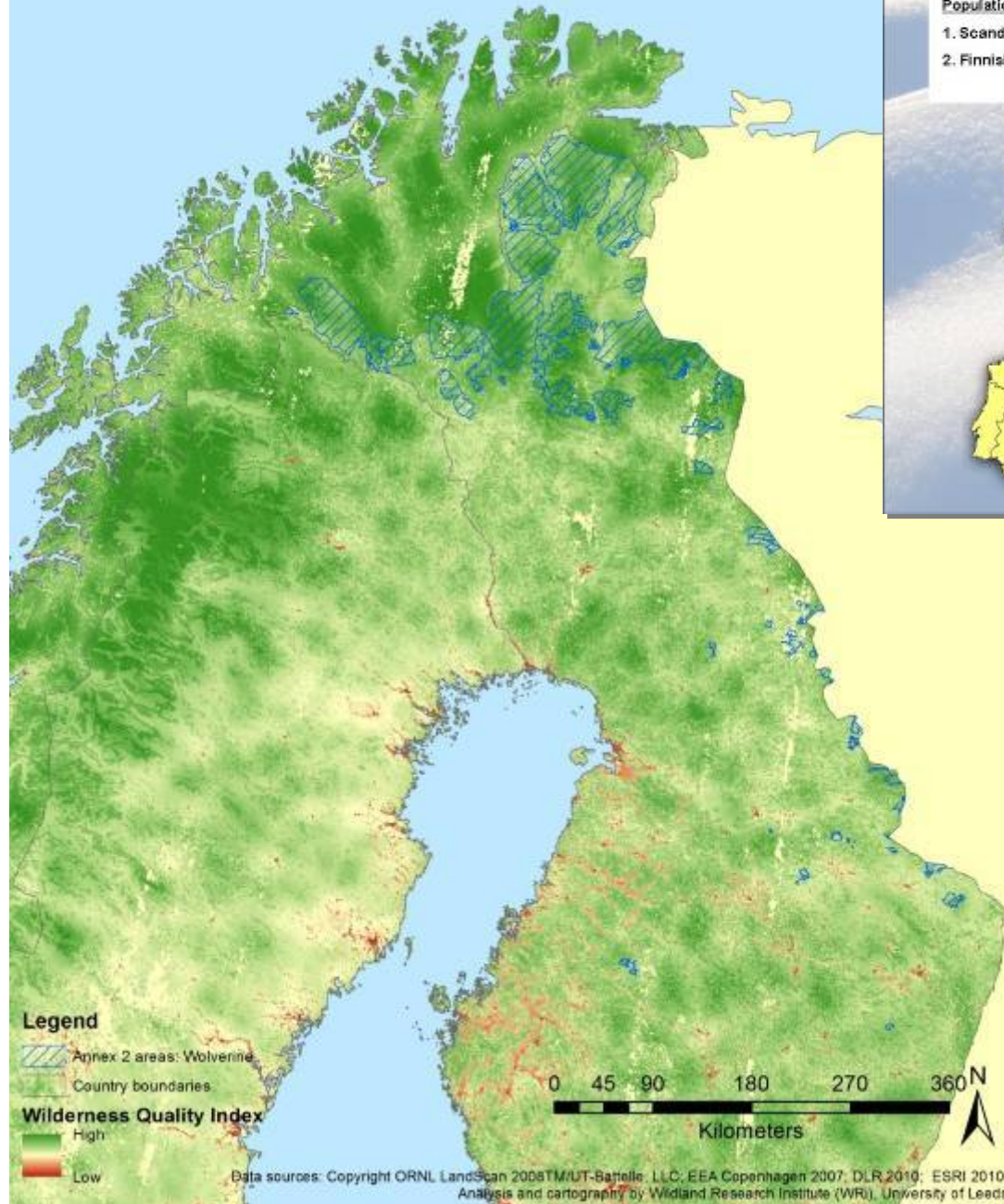
- Poor correlation with Natura 2000
- Better correlation with IUCN 1 & 2

- Indicates “wisdom” in the location of stricter IUCN protected areas

Other potential correlates with WQI
- “wilderness dependent” species in Annex 2 of Habitats Directive?

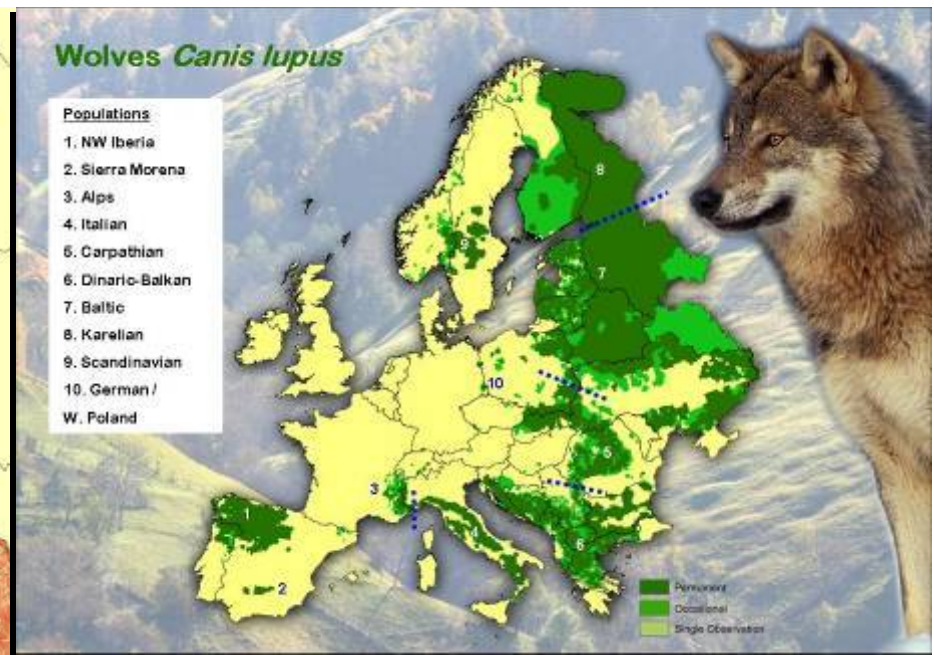
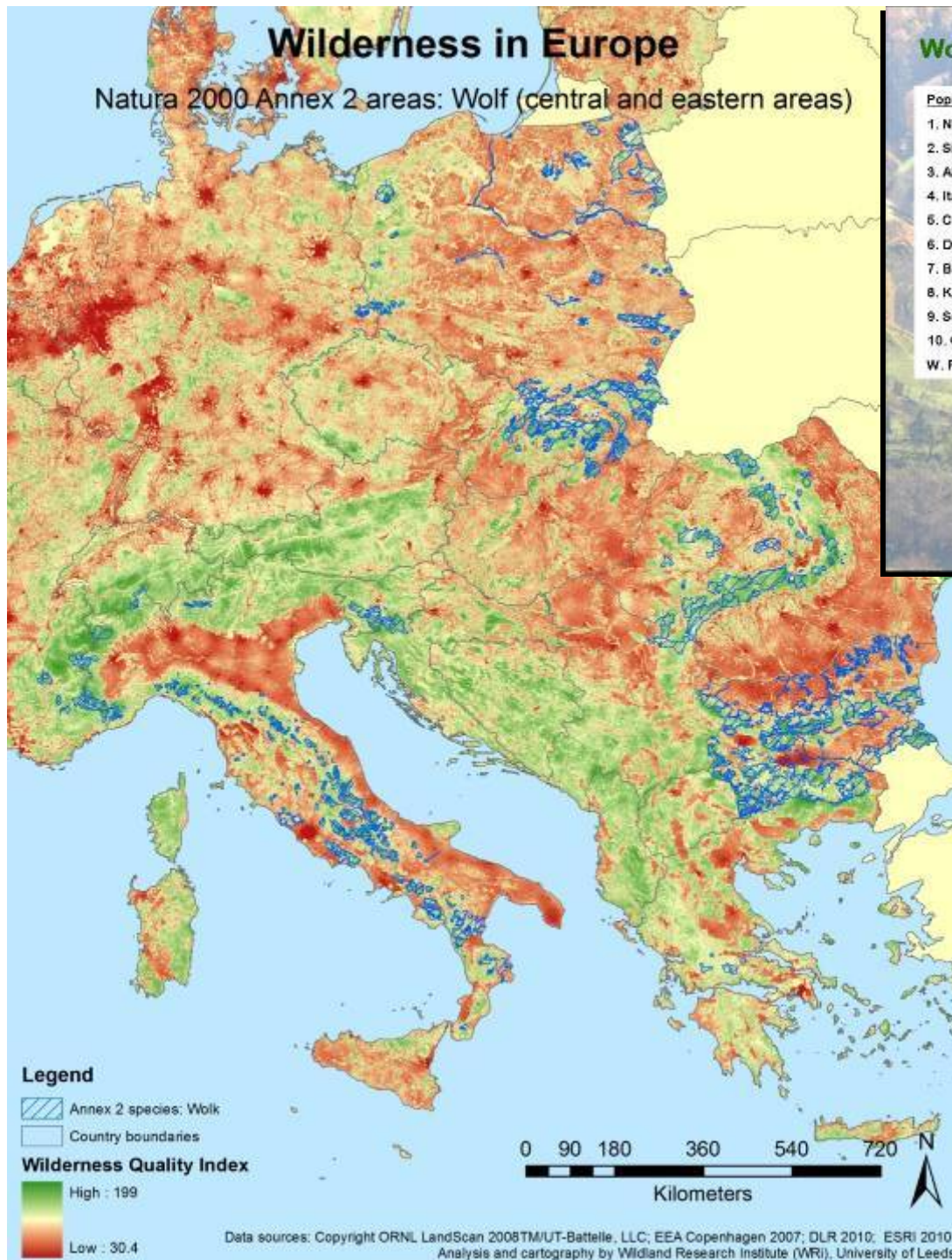
Wilderness in Europe

Natura 2000 Annex 2 areas: Wolverine



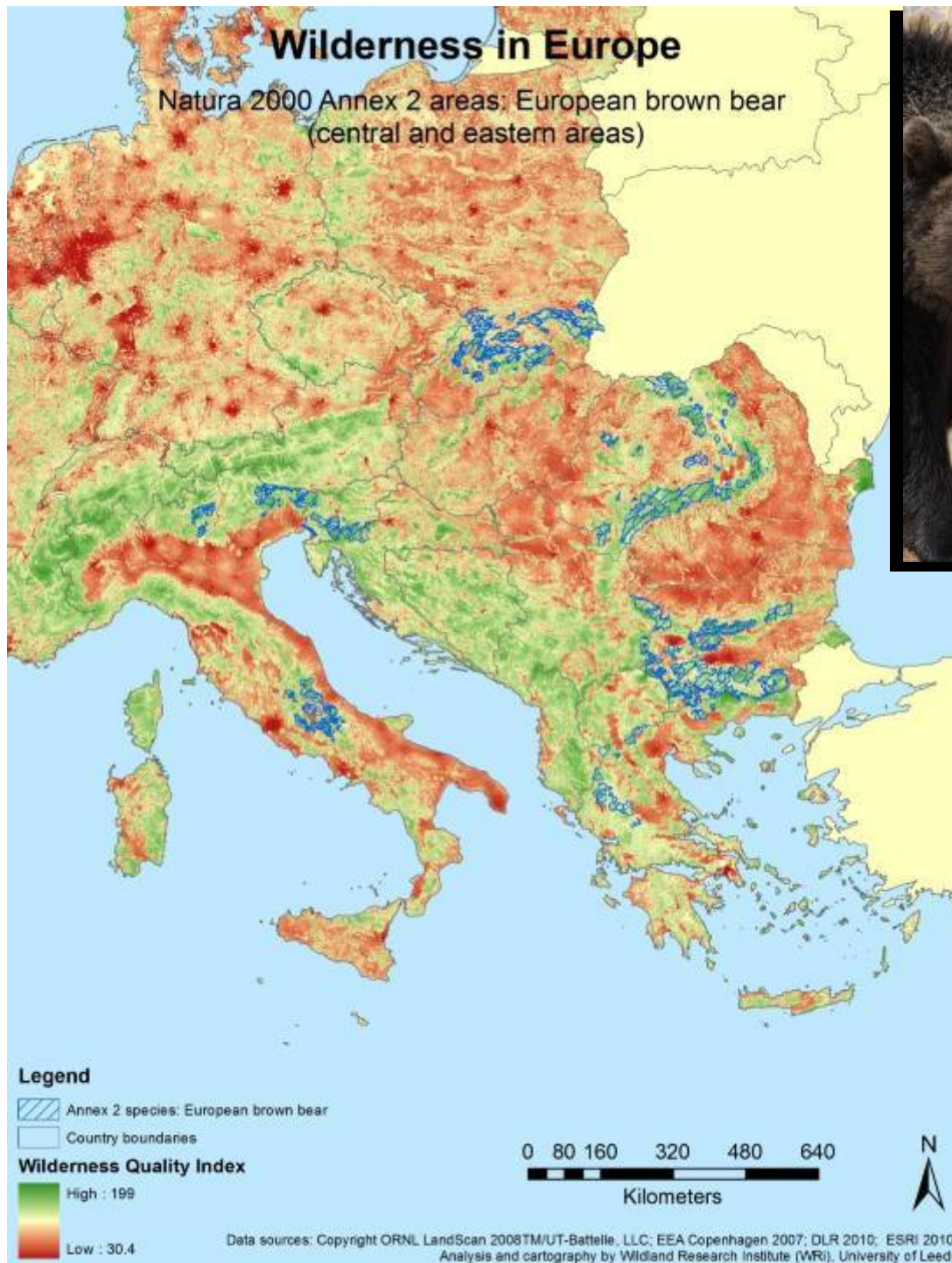
http://www.lcie.org/Docs/LCIE%20IUCN/wolverine_pop_map.jpg

- Correlation of wolverine SAC with high WQI



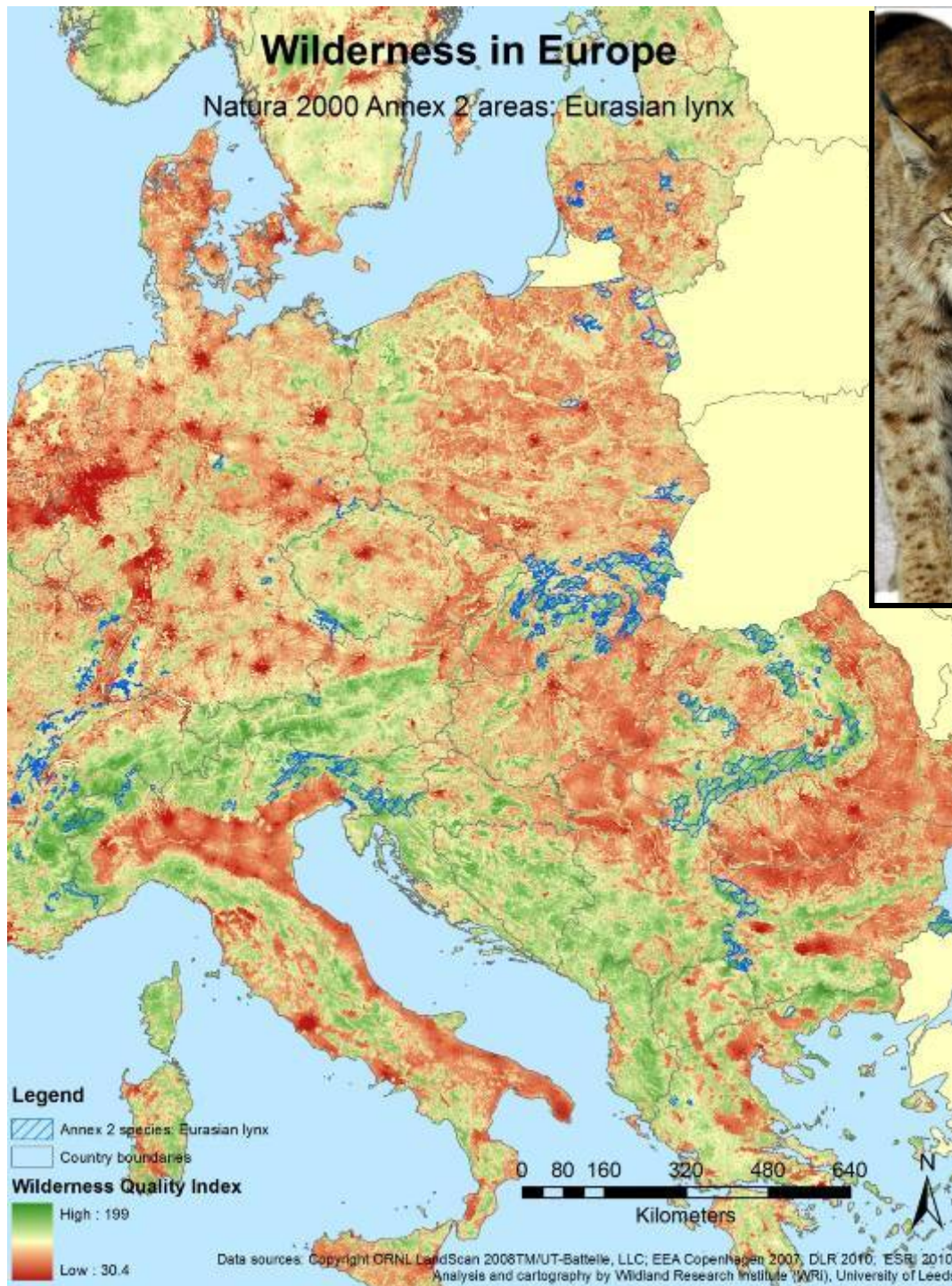
http://www.lcie.org/Docs/LCIE%20IUCN/wolf_pop_map.jpg

- Correlation of wolf SAC with high WQI



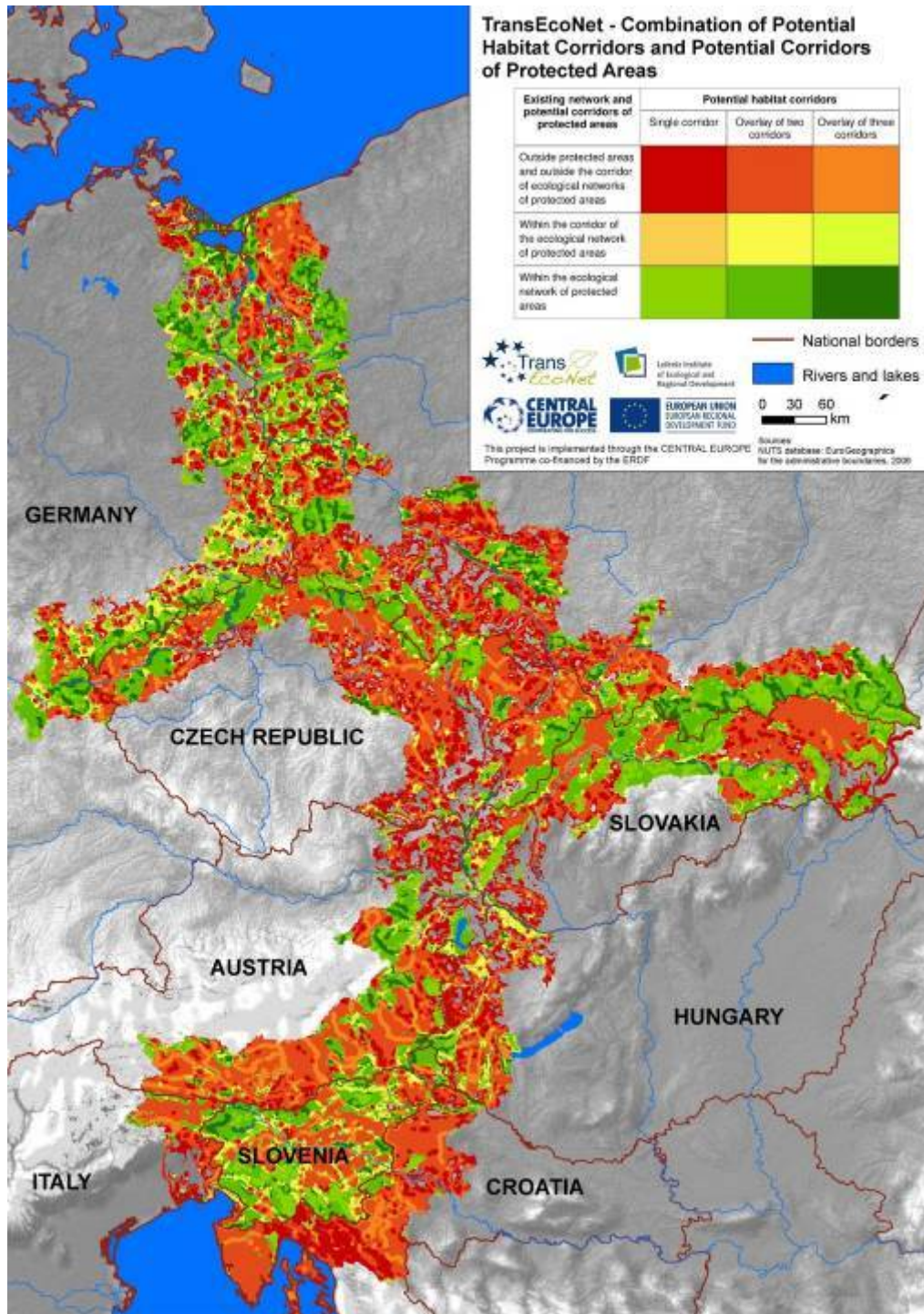
http://www.lcie.org/Docs/LCIE%20IUCN/bear_pop_map.jpg

- Correlation of bear SAC with high WQI



http://www.lcie.org/Docs/LCIE%20IUCN/lynx_pop_map.jpg

- Correlation of lynx SAC with high WQI

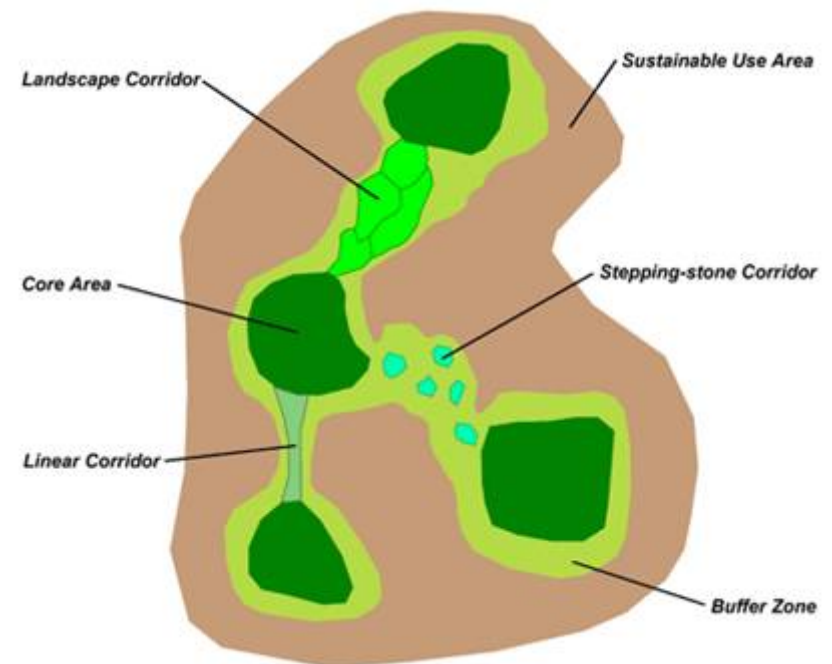


Connectivity and habitat networks

CCC (Cores-Corridors-Carnivores)

Examples in Europe:

- EHS (Netherlands)
- PEEN
- MAK-NEN
- Etc.



Overview over existing transboundary ecological network initiatives in the study area

Project team: Dr. M. Leberich, J. Harst
Geodata: ESRI ArcMap 2009, GIK, Maco 2005, Map: J. Harst, S. Wilschke 2009





GIS tools and information for designing wildlife corridors

Our goal is to transfer everything we've learned about designing wildlife corridors to the general public to facilitate better conservation, science, and dialogue.



Learn about corridors

Learn the important conceptual & technical steps for designing wildlife corridors

Download GIS tools

Download CorridorDesigner, a suite of ArcGIS tools for designing and evaluating corridors

Linkage Designs

Download reports and GIS data for linkage designs created throughout Arizona

Corridor Design Blog

Aug 02 2011

[Do wildlife corridors work? Here's how to suggest a corridor site](#)

Faúl Bear and Andy Gregory of Northern Arizona University are looking for reactive wildlife corridors, and will pay a \$250 finder's fee if your suggested site is used in their upcoming study.

Apr 11 2011

[Linkage Mapper GIS tool now available](#)

Linkage Mapper, a GIS tool developed to support regional wildlife habitat connectivity analysis for the Washington Connected Landscapes Project, is now available for free download to use elsewhere.

Dec 08 2010

[CorridorDesigner tools now work with ArcGIS 10](#)

The CorridorDesigner evaluation tools can now be used in ArcGIS 10.

Dec 07 2010

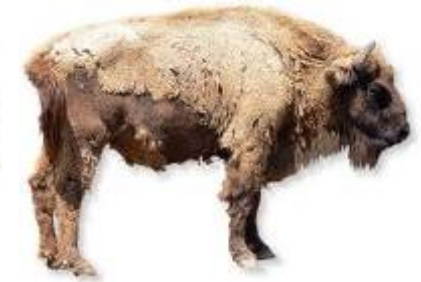
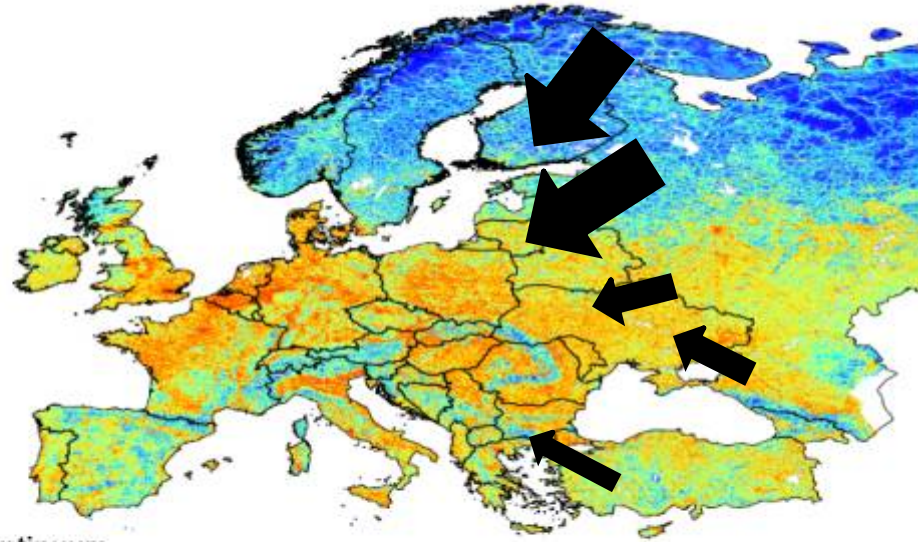
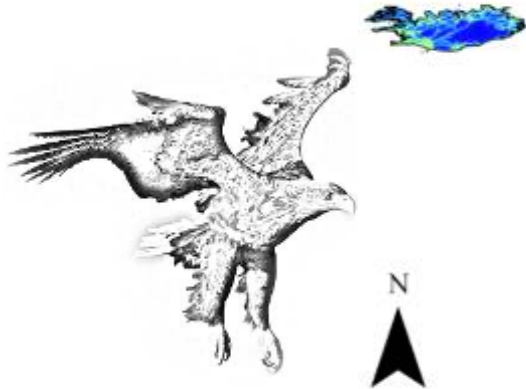
[Common ArcToolbox Errors](#)

Article covers 3 common errors occurred when using the CorridorDesigner toolset, and how to fix them.



Wilderness continuum for Europe

Criteria: naturalness of land cover, population density and remoteness from road/rail access

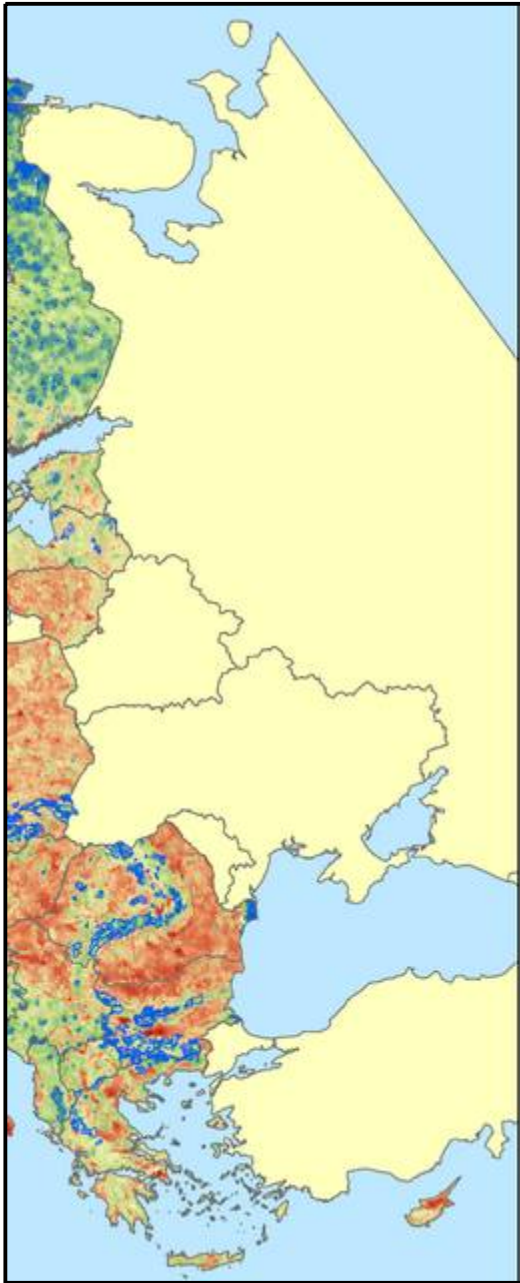


Legend
Wilderness continuum



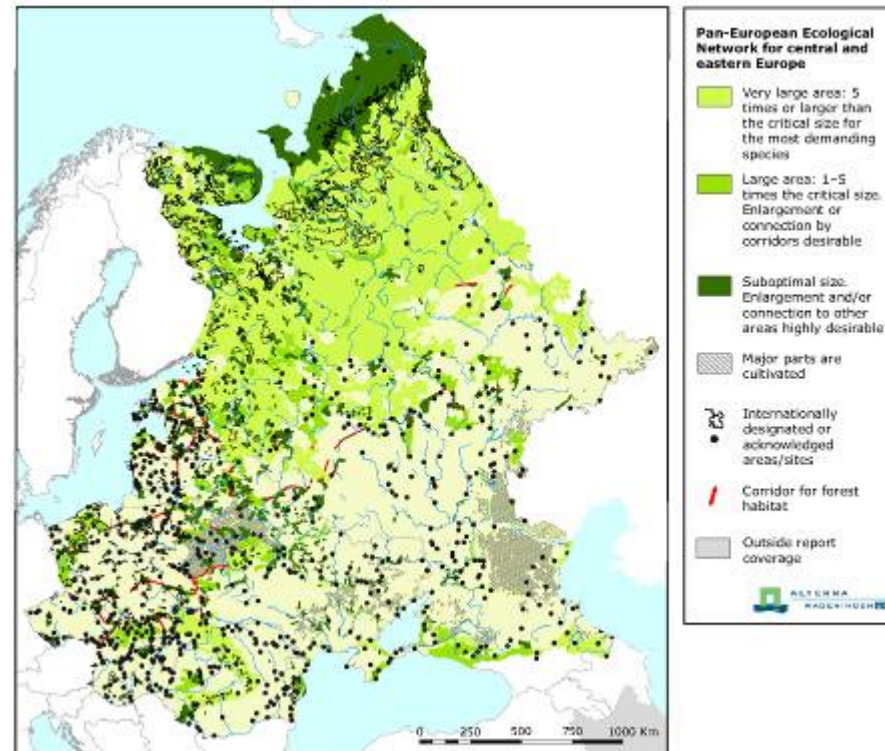
Data sources: GLCF Land Cover Classification; SEDAC/CIESIN Gridded Population of the World v.3; Digital Chart of the World





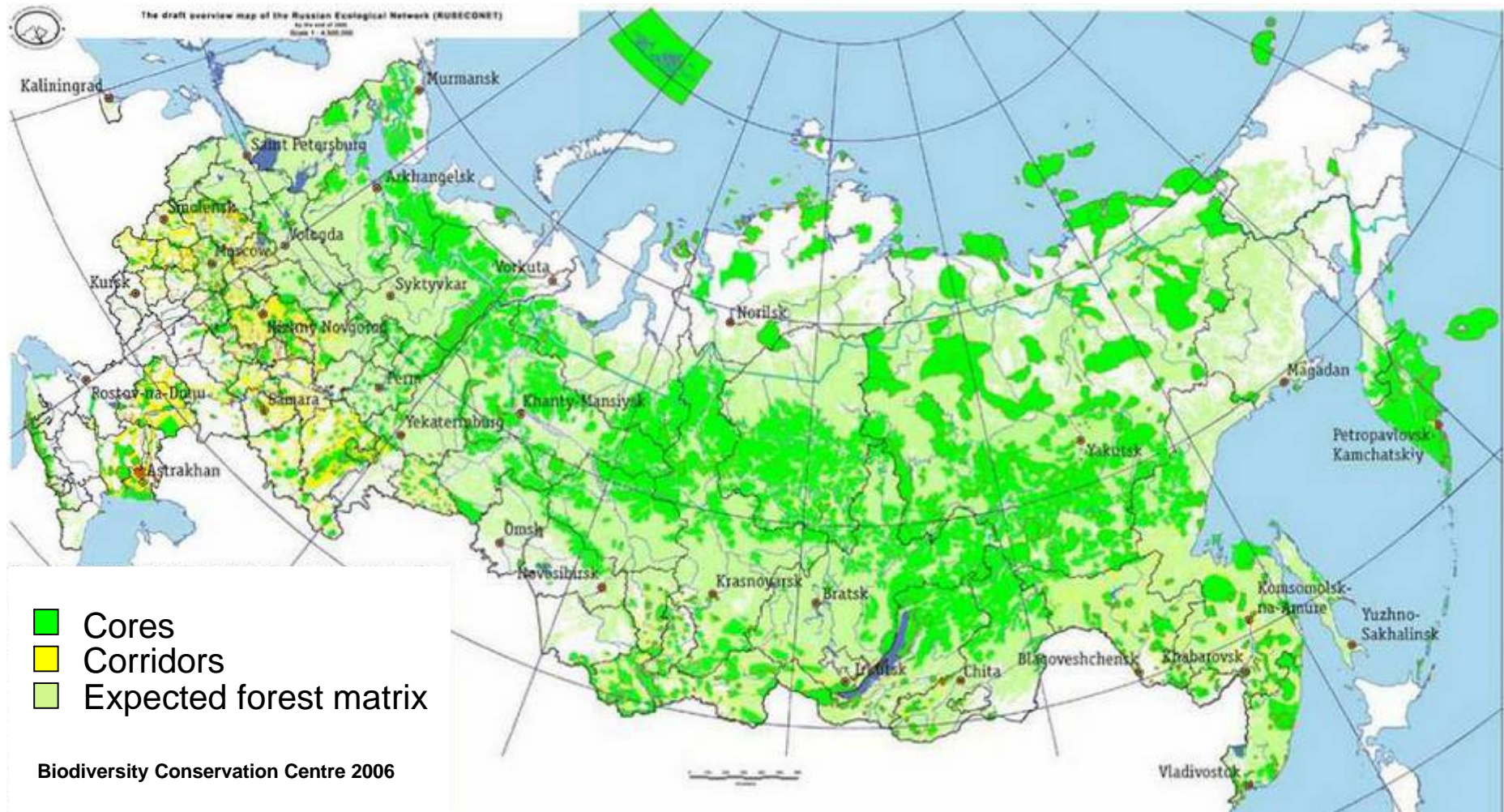
Mapping frontiers – too much yellow!!!!!!!

- Need for consistent and comprehensive data sets across all of Continental Europe
- speculative mapping on networks is a start eg.



Indicative map of the Pan-European Ecological Network for central and eastern Europe

Russian Ecological Network

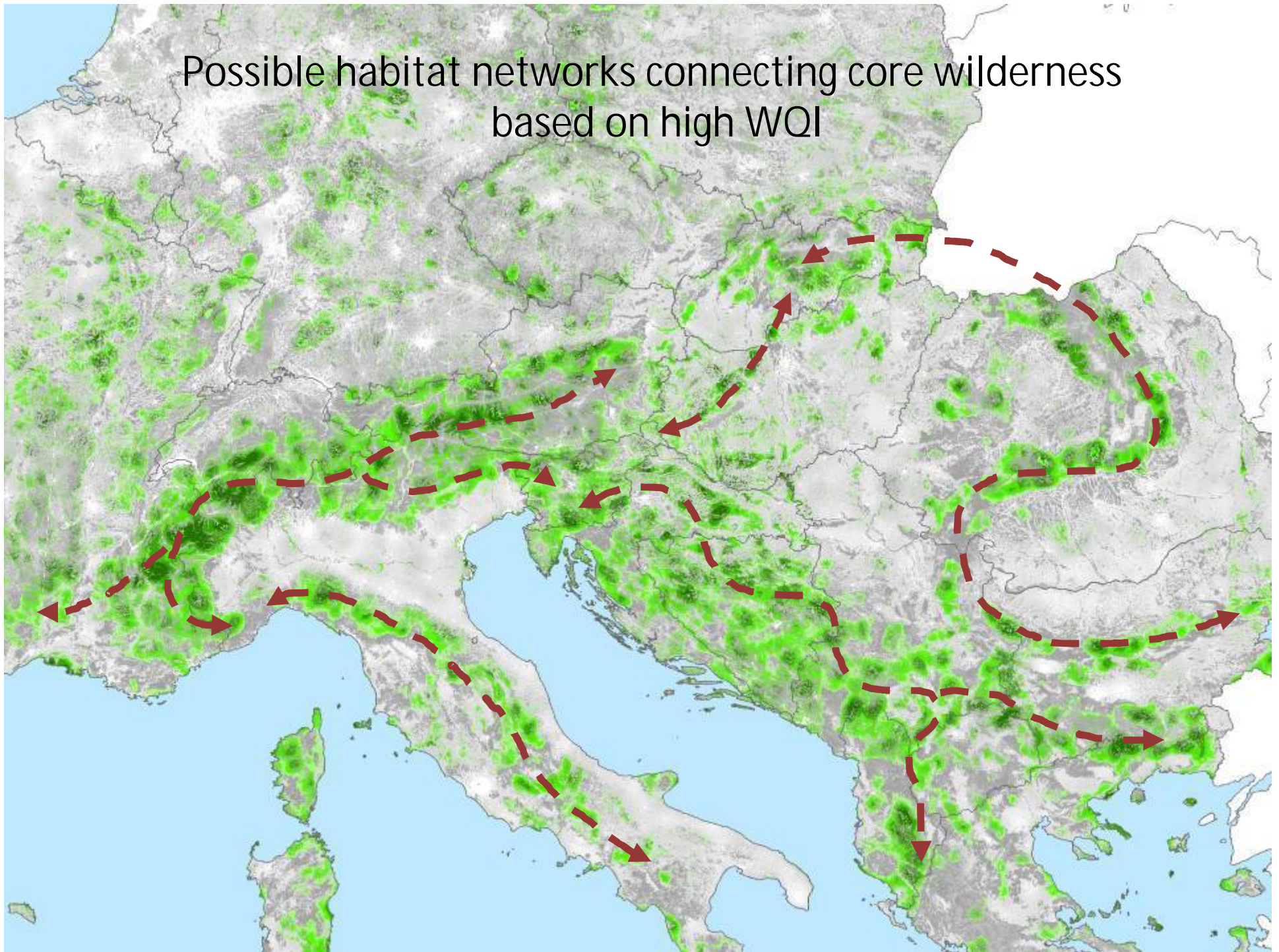


Target species to be translated into an Emerald Network

"The spatial distribution of species protected in Russia *is linked more with low disturbed natural areas* and so may be used for assessing potential ASCI's" – Nikolai Sobolev 2012

Species rich countries (i.e. with carnivores) can identify co-location areas for conservation

Possible habitat networks connecting core wilderness
based on high WQI



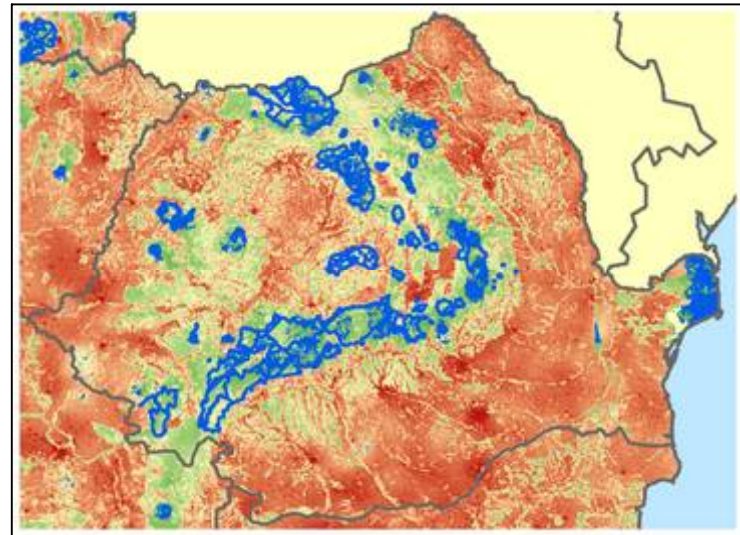
THE IMPORTANCE OF CARNIVORES REVEALED BY MAPPING

“There are opportunities for rewilding landscapes from farmland abandonment in some regions – in Europe, for example, about 200,000 square kilometers of land are expected to be freed up by 2050. Ecological restoration and reintroduction of large herbivores AND CARNIVORES will be important in creating self-sustaining ecosystems with minimal need for further human intervention”

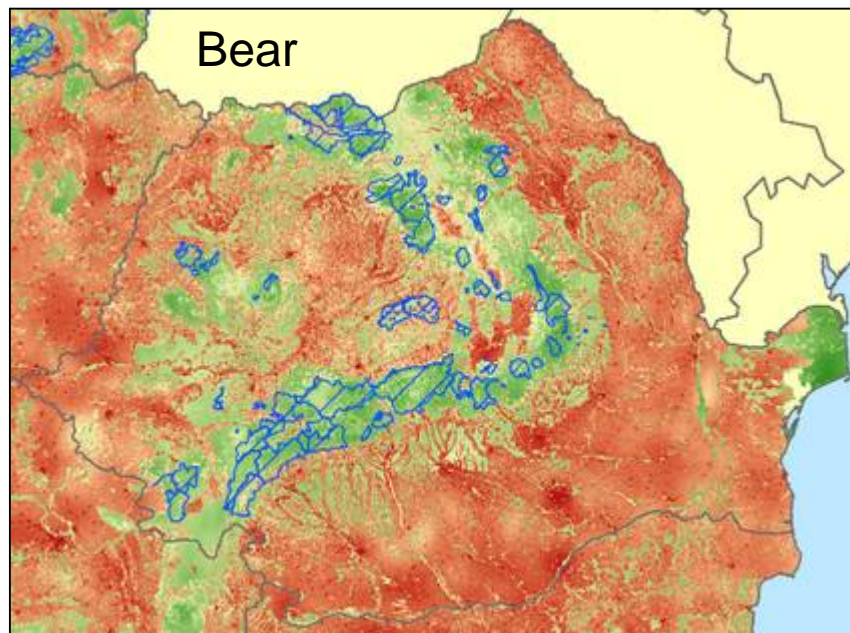
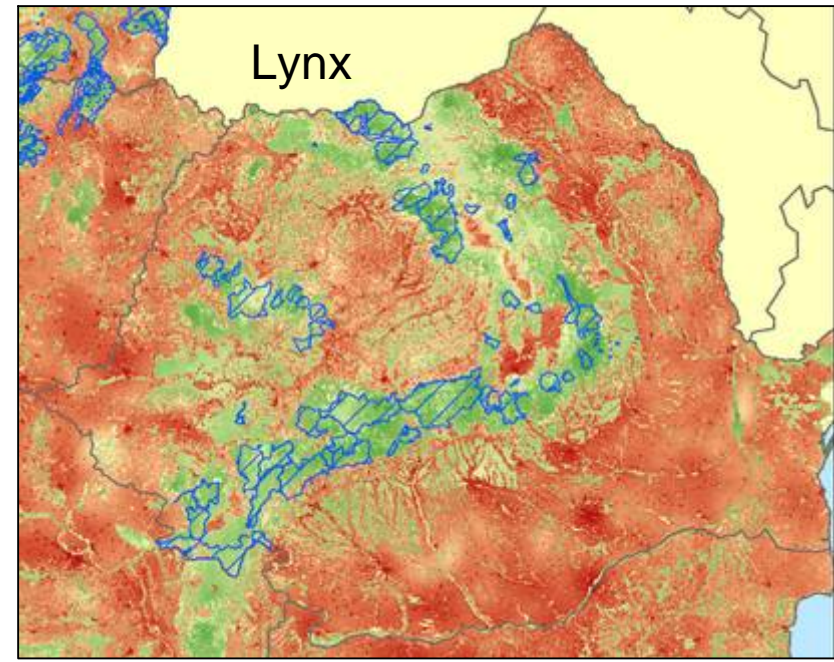
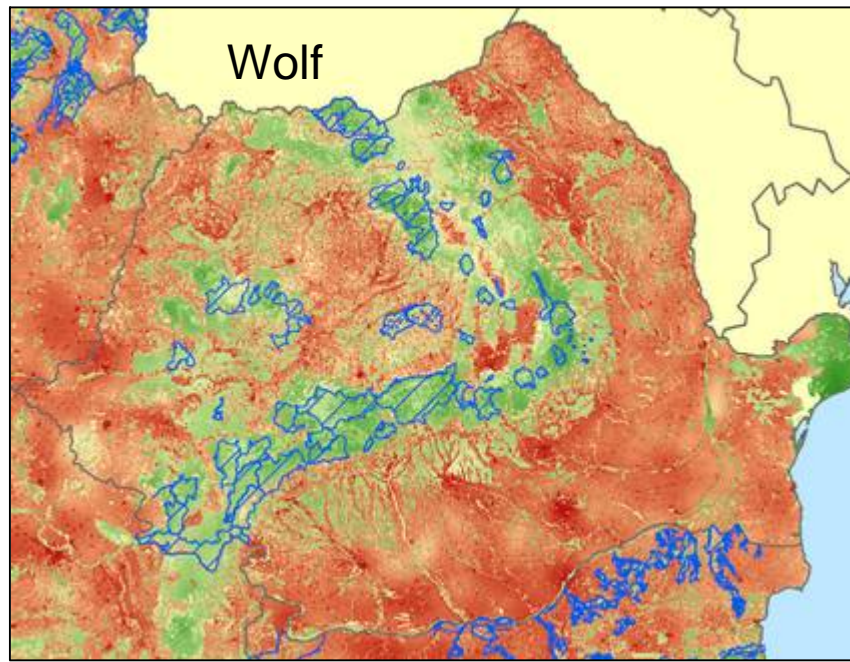
Global Biodiversity Outlook 3, 2010

- Evolution of mapping approaches in the species rich Carpathian Mountains

- Romania as an example of co-location of species of conservation concern with carnivores



Romanian Carpathians and top10% WQI

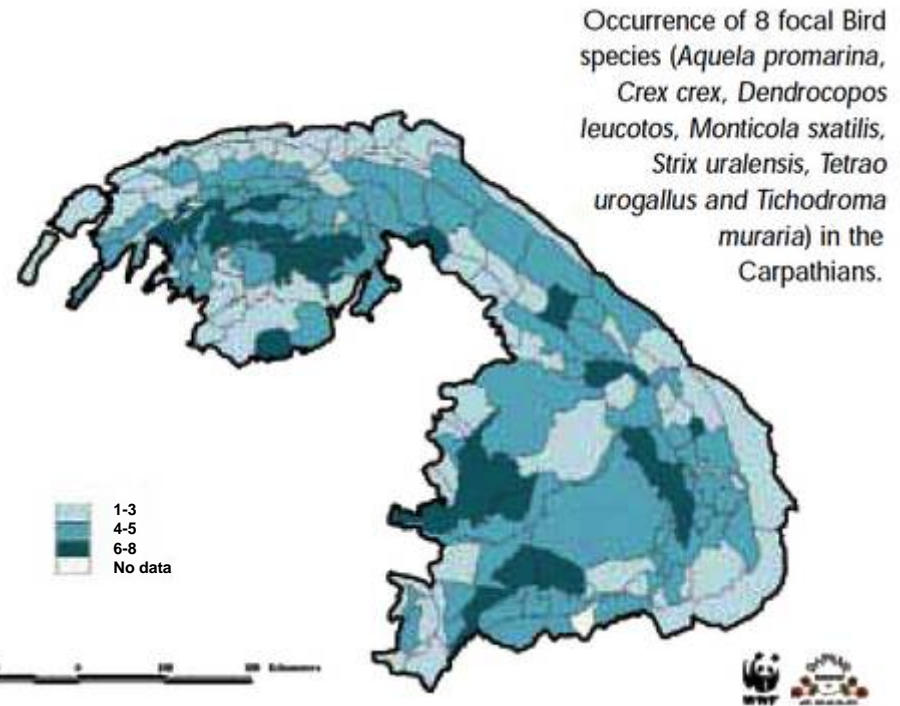
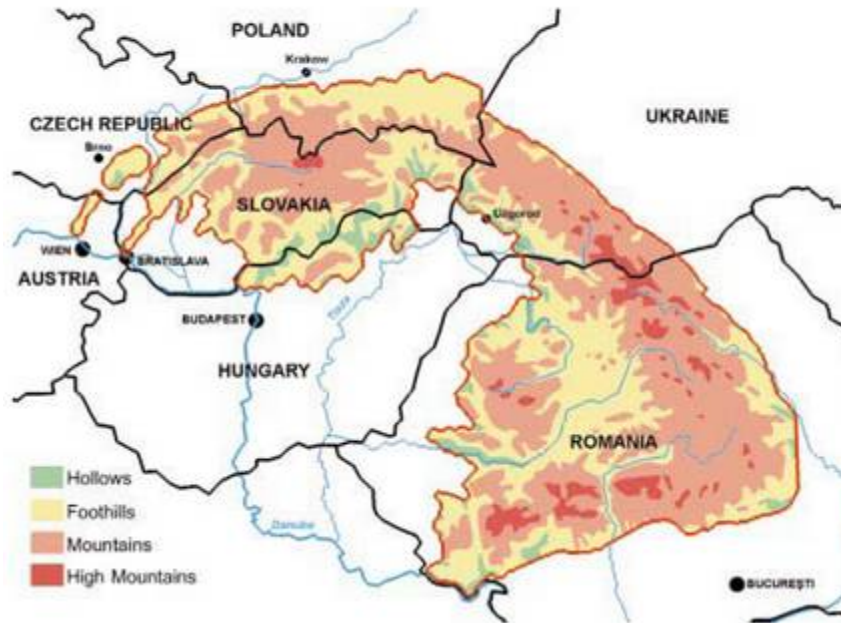


Special Areas of Conservation (SACs) for large carnivores in Romania

- Correlation with areas of high WQI
- Co-location of carnivore species
- "Wisdom" of carnivores!!

Focal bird species in the Carpathian Mountains

The Carpathian Ecoregion

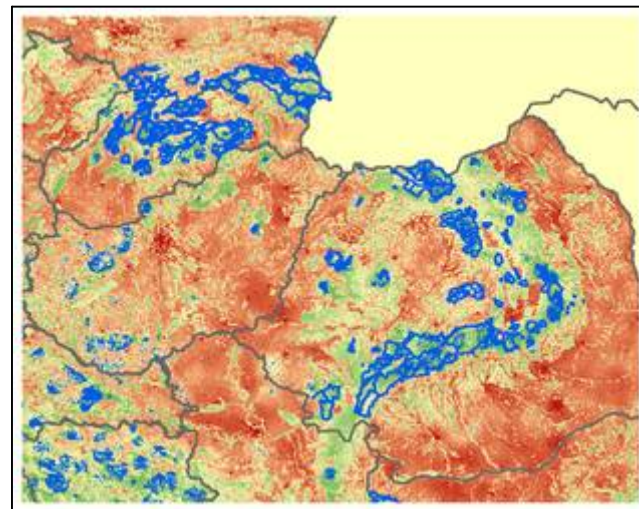


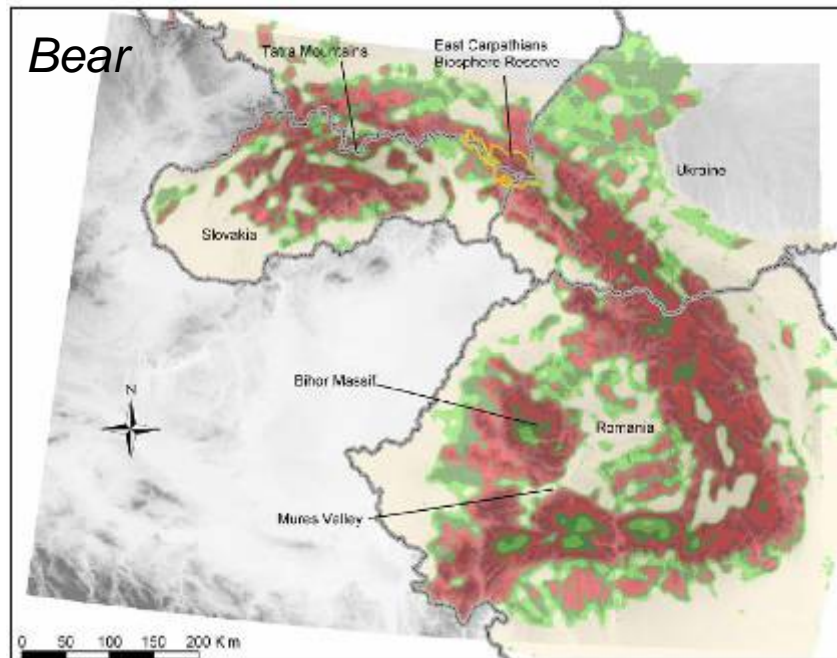
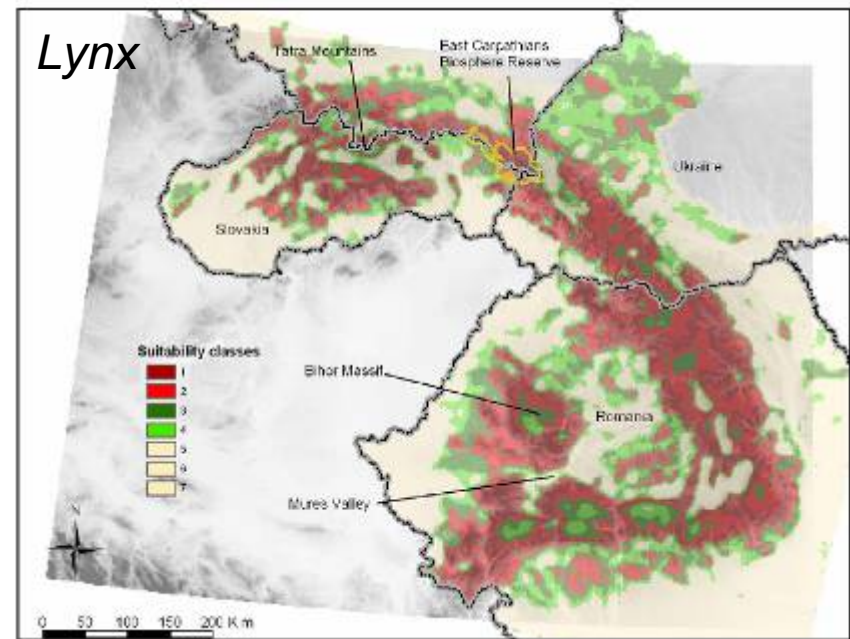
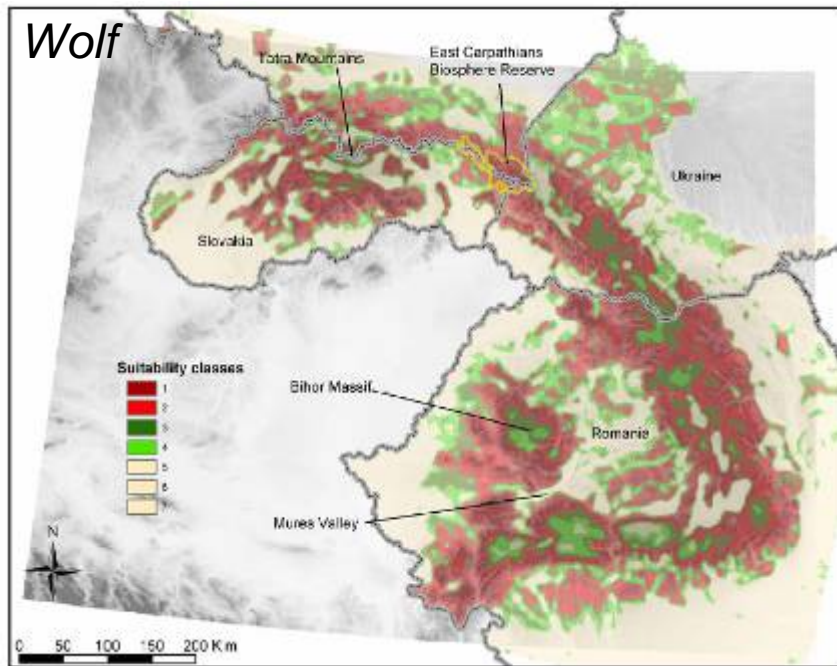
THE STATUS OF THE CARPATHIANS

Carpathian Ecoregion Initiative November 2001

<http://www.carpat.es/docs/publications/status.pdf>

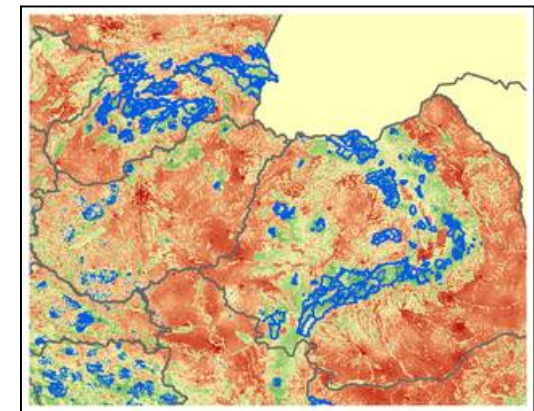
Carpathians and top 10% WQI



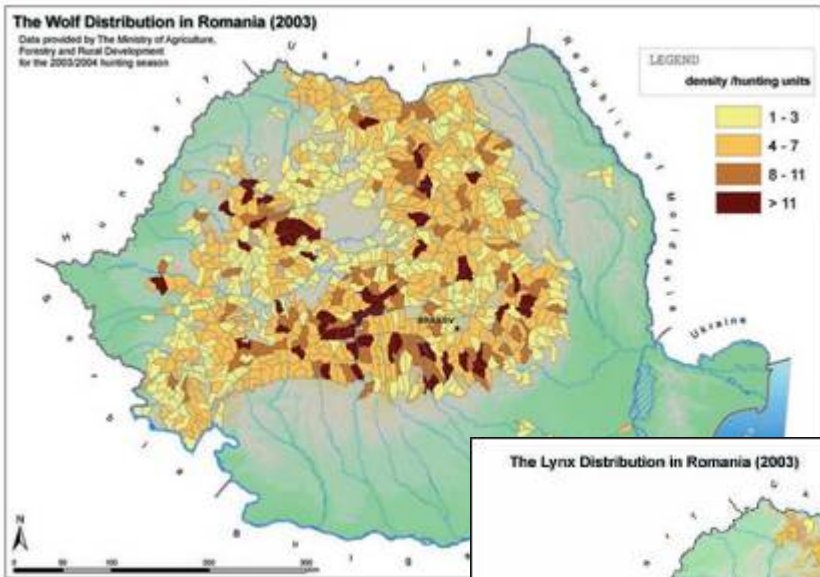


Mapping environmental suitability for large carnivores in the Carpathians, Salvatori, 2004

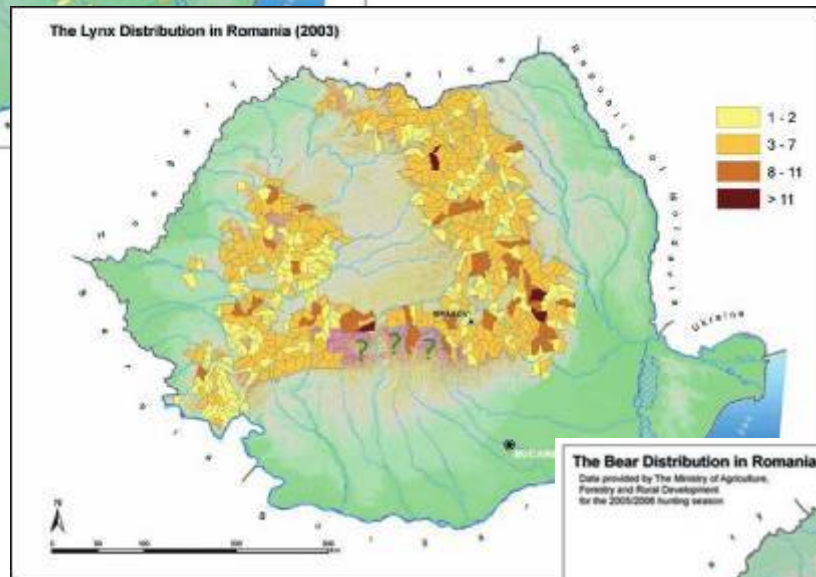
Environmental variables describing the distribution were based on information of the behaviour of carnivores from experts & published literature, refined by data from local experts on the species' presence



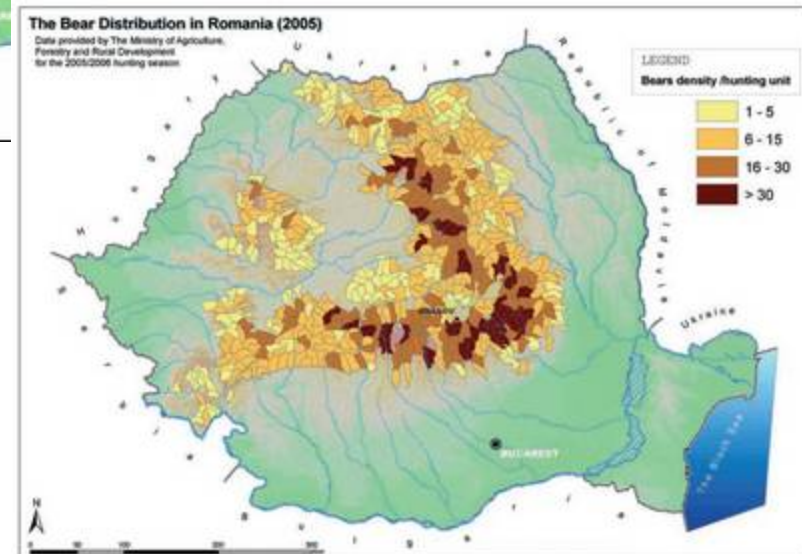
Carpathians and top10% WQI



Wolf



Lynx

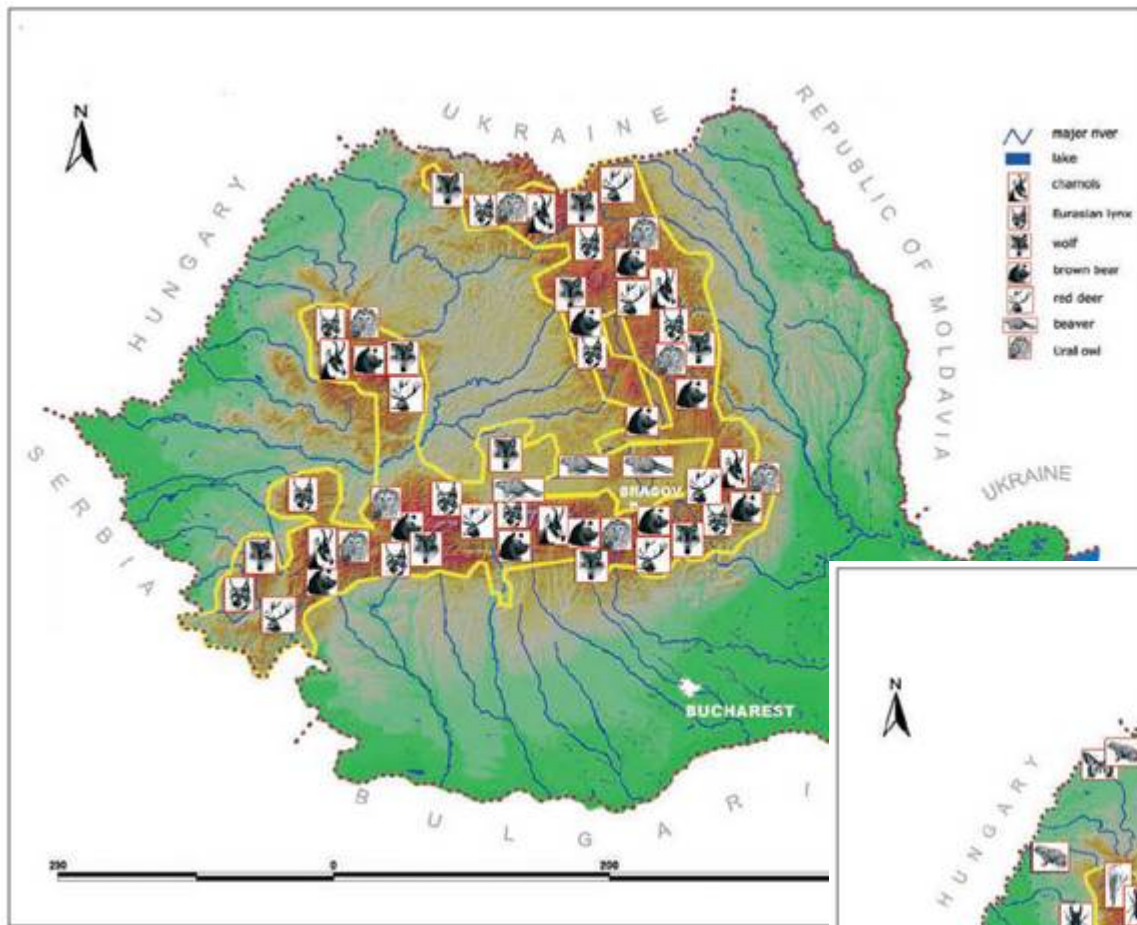


Bear

Reported numbers per hunting unit in Romania in 2005

Safeguarding the Romanian Carpathian Ecological Network. A vision for large carnivores and biodiversity in Eastern Europe 2006

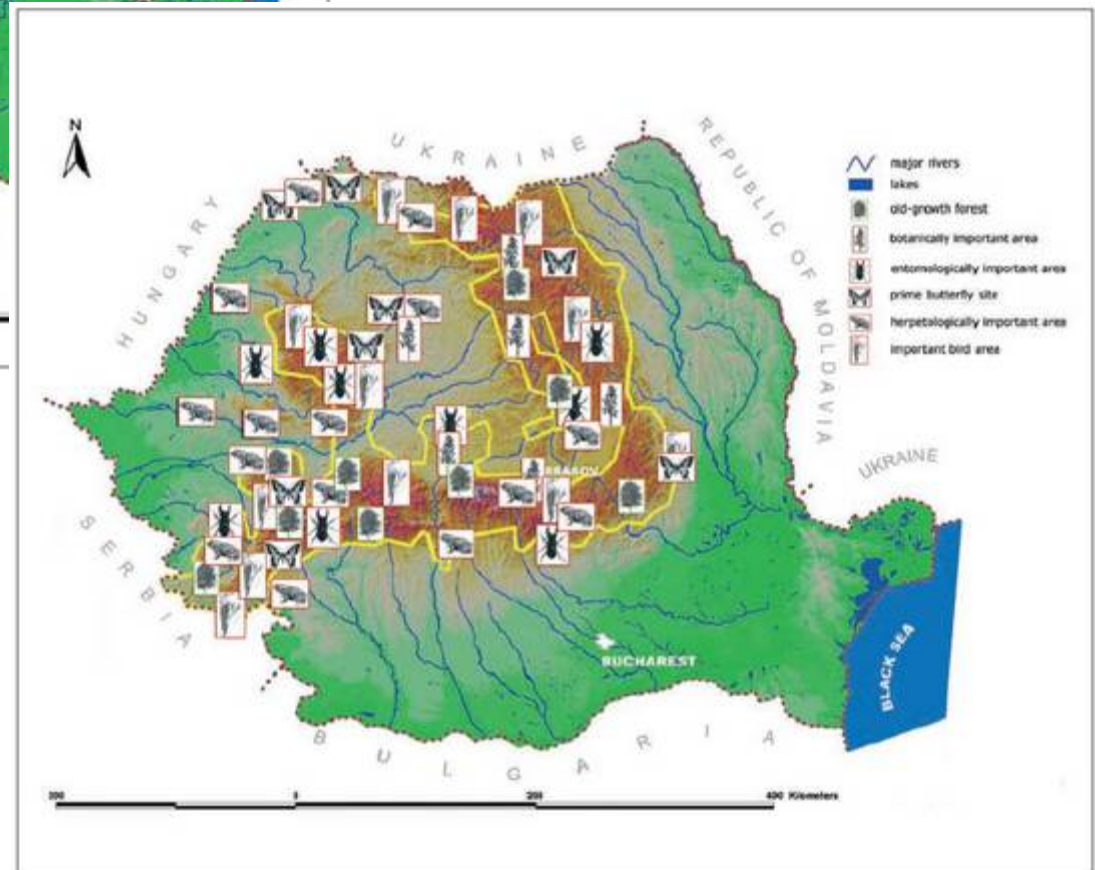
http://www.carnivoreconservation.org/files/issues/carnivores_carpathian_vision.pdf

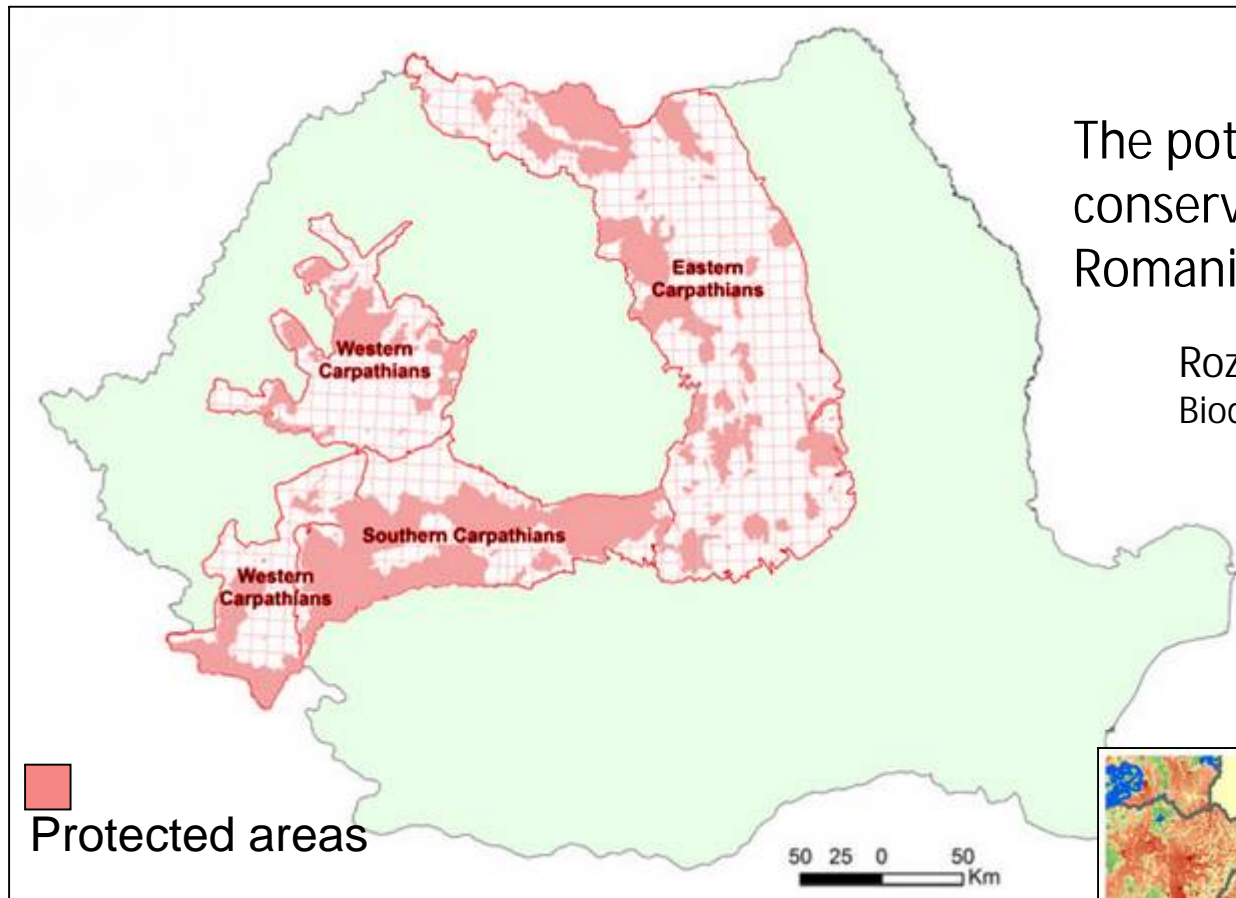


Preliminary Carpathian Ecological Network Vision Map for the safeguarding of at least 60% of the current large carnivore populations.

Also contains hotspots (sizeable populations) for herbivores and other important species like the reintroduced beaver

- 'Large carnivore umbrella' protects other hotspots, including old-growth forest (primary forest), insects, butterflies, vascular plants, herpetofauna (amphibians and reptiles) and birds.



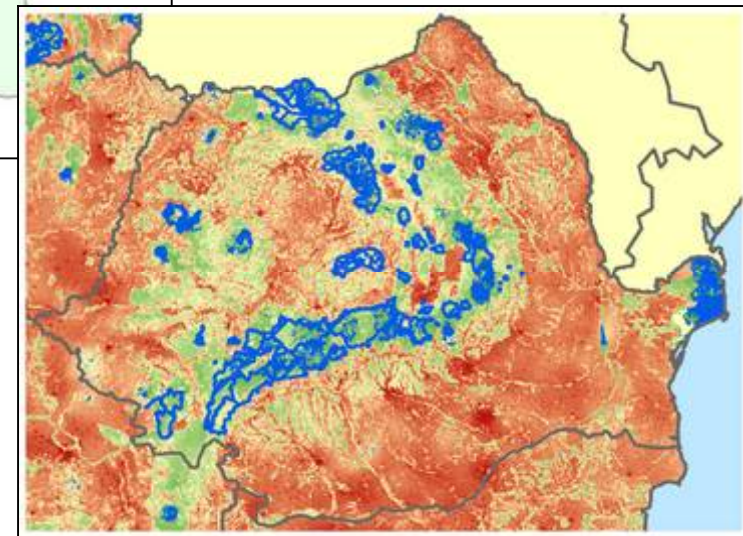


The potential of large carnivores as conservation surrogates in the Romanian Carpathians

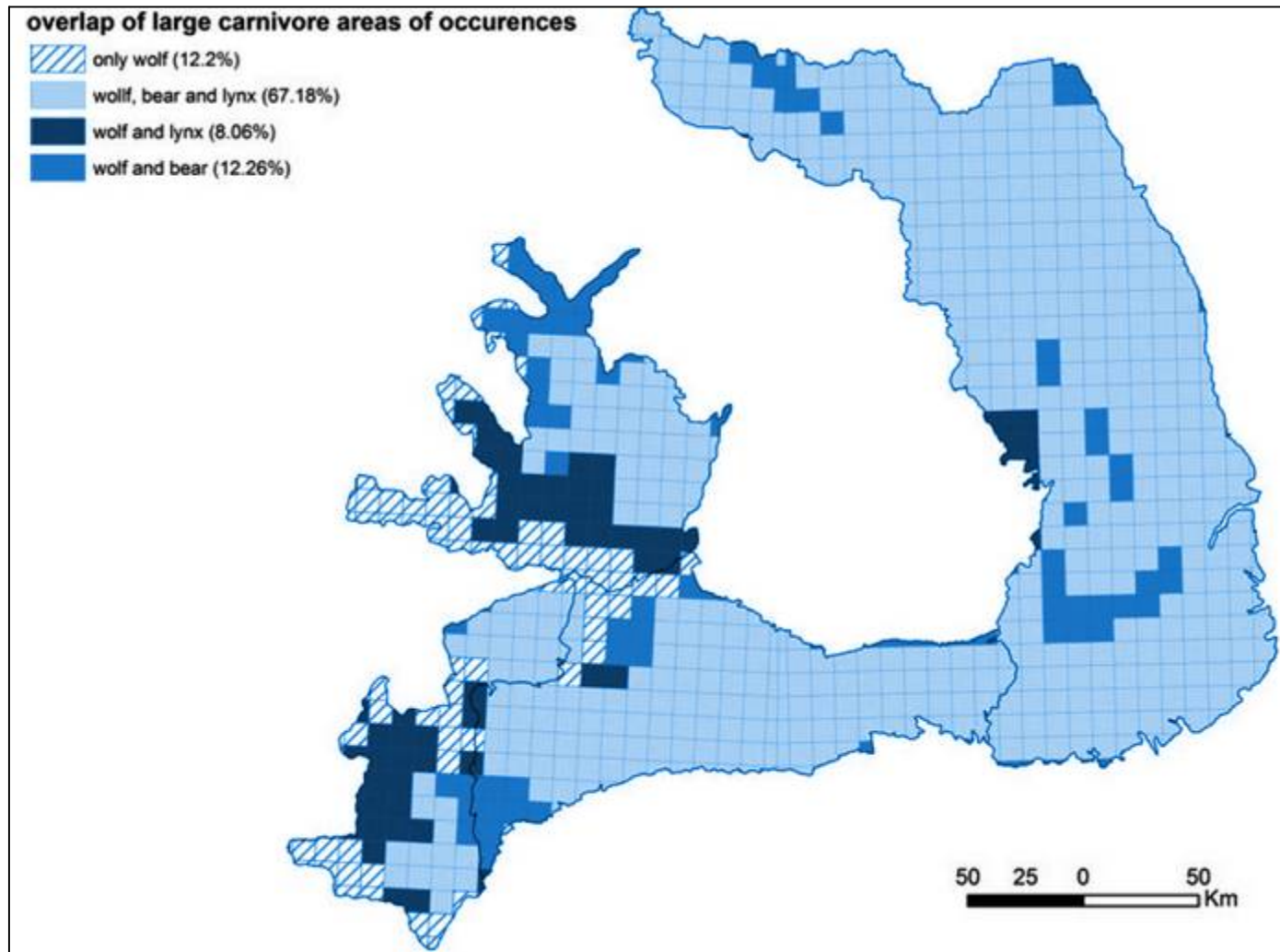
Rozyłowicz and others 2011
 Biodiversity & Conservation 20:561–579

Carpathian Mountains in Romania

Area of analysis shown as hatched



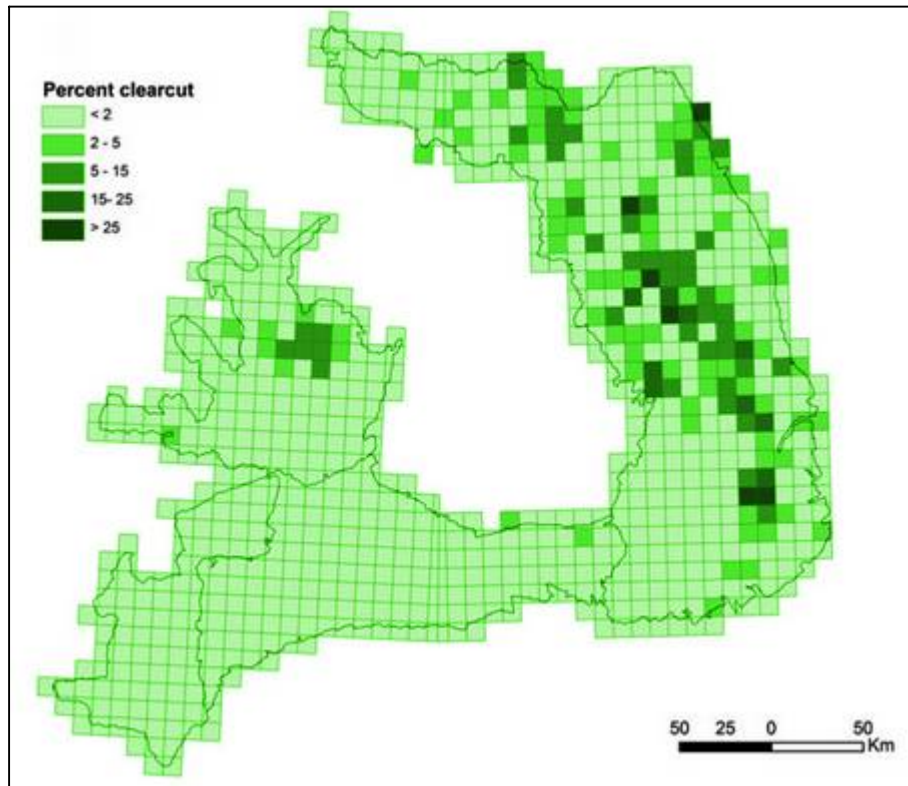
Romanian Carpathians and top10% WQI



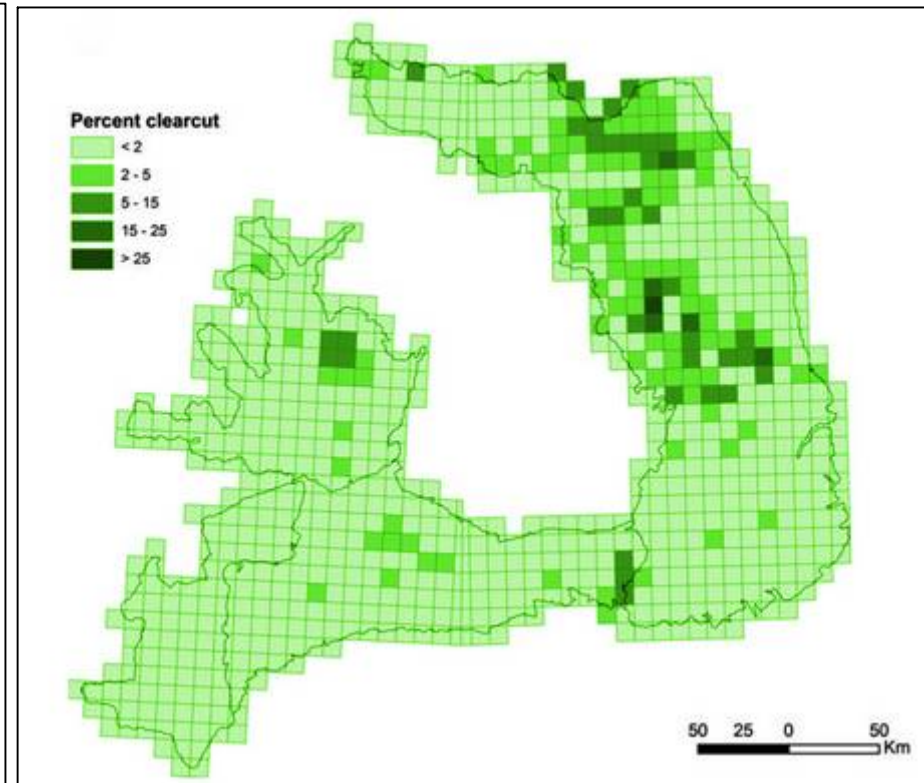
Large
carnivore
overlaps

- 67% of the area of Carpathians in Romania have all three carnivore species

Forestry operations as a disturbance factor in the Carpathians



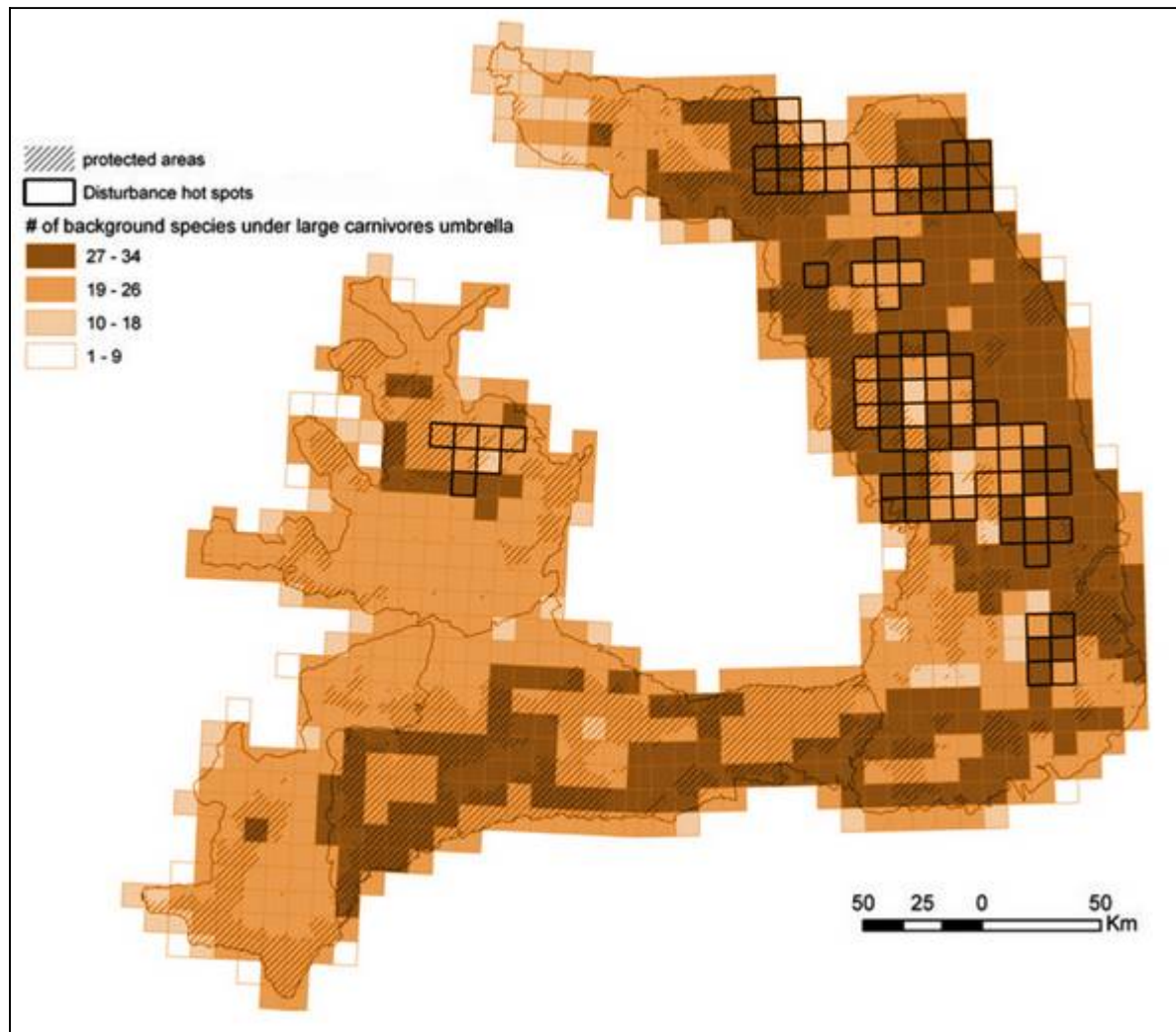
1990–2000



2000–2006

Changes in forest cover expressed as percent clearcut from start of period

- Most disturbance in Eastern Carpathians



Co-location between carnivores and 10 mammal and 55 bird species of European conservation concern - forest specialists, habitat generalists, and non-forest species.

Presence of one large carnivore species in a quadrat qualified as "umbrella species present"

- 55% of the bird and 80% of mammals species are under the carnivore umbrella
- Forestry practices are not a natural disturbance regime, but redistribute species
- New protected areas in Romania should capture high opportunity co-locations

Conclusions

- Wilderness Register (ongoing) will deliver a new, unified WQI for Europe but:
 - Needs to be extended into adjoining areas in the east
 - Only a broad brush indicator
- More opportunity mapping for PAs based on overlaps identified from multiple layers
- Importance of the “moving frontier” of carnivore distribution towards NW Europe
- Need for *mapping champions* across the whole of Continental Europe to work at national/regional/local scale using coordinated methods/data