



Use of geodiversity index maps improves conservation in different types of protected areas: case examples from the Pyrenees

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GEODIVERSITY

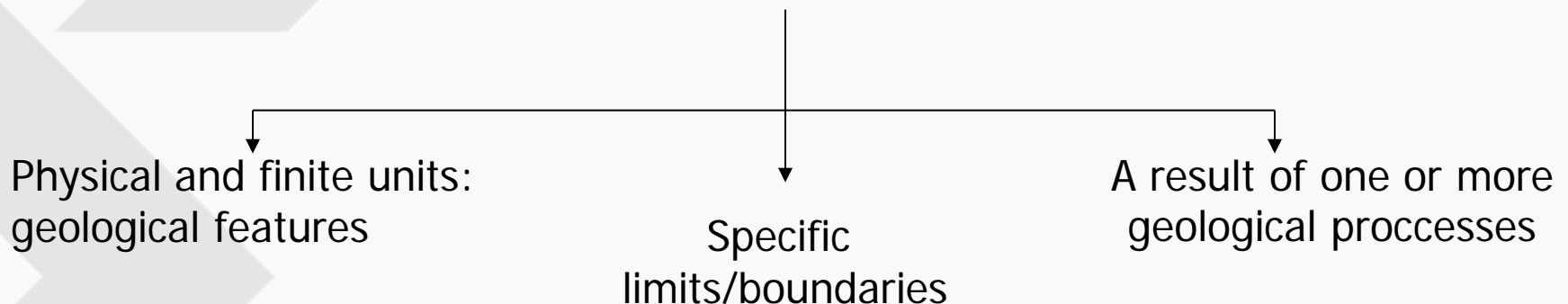
- Recent concept (early 90s).
- Born as a result of analogy with biodiversity.
- Currently, the use of the term geodiversity is less widespread than biodiversity, but is increasing.

"the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (land form, physical processes) and soil features. It includes their assemblages, relationships, properties, interpretations and systems" (Gray, 2004).

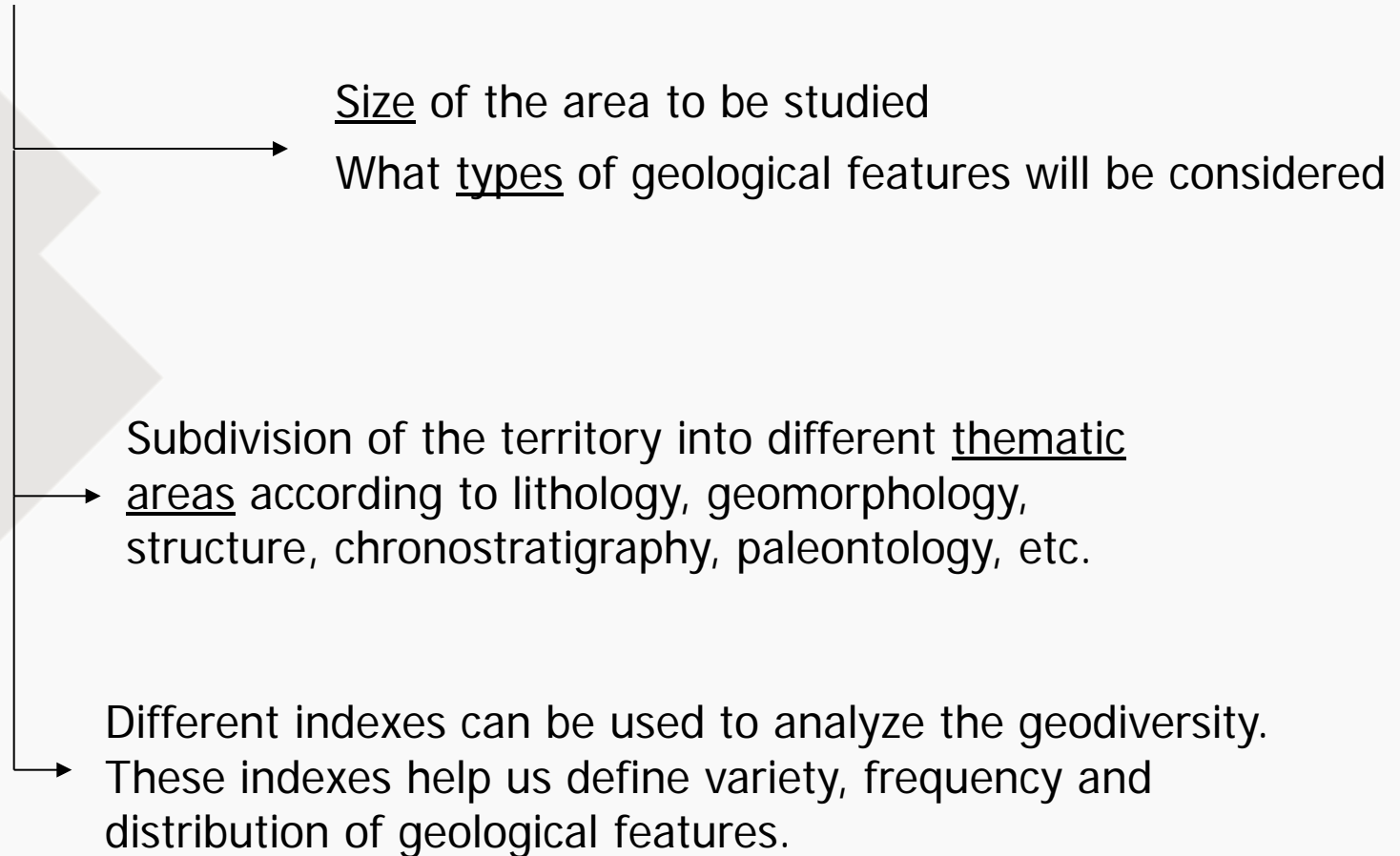
"the variety of geological features, including rocks, minerals, fossils, soils, landforms, landscapes, geological formations and units, that are the product and the record of Earth's evolution" (Natural Heritage Act, Spain, 2007).

Geodiversity = geological diversity of a region

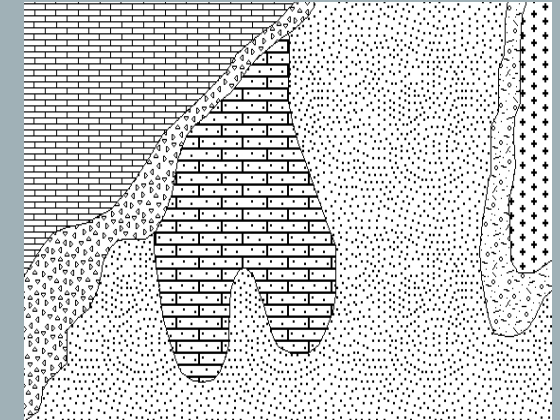
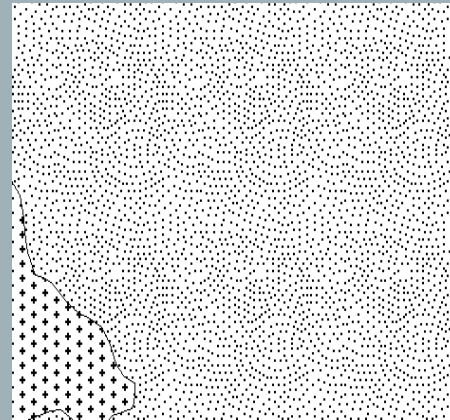
Geodiversity considers the presence and distribution of geological features, and how they represent the geological evolution of a region. The study of geodiversity considers all abiotic elements, including soils and geomorphology, but not any result of human activity.



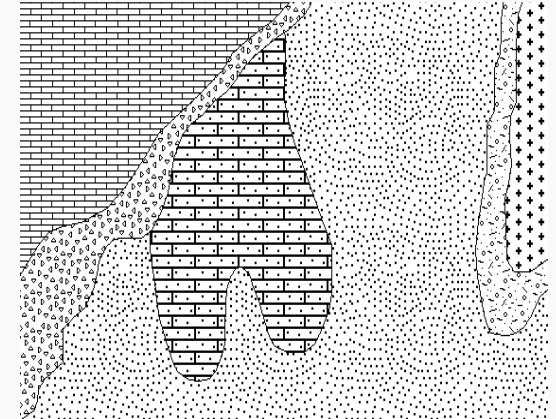
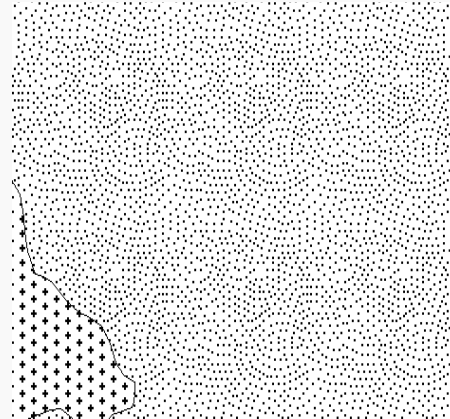
Methodology for the characterization of geodiversity:



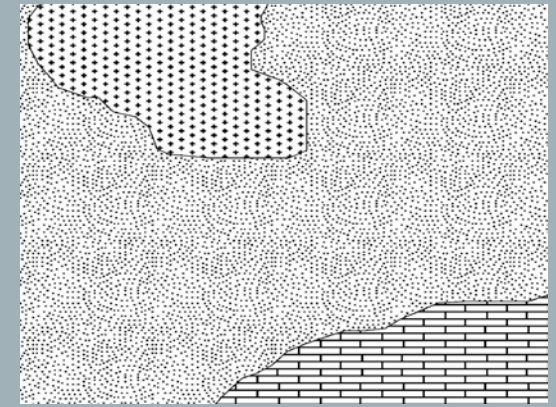
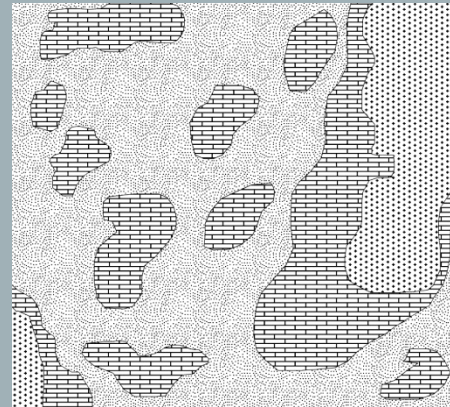
Variety (number of
different classes)



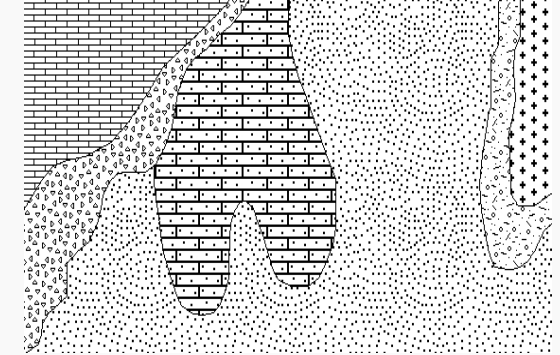
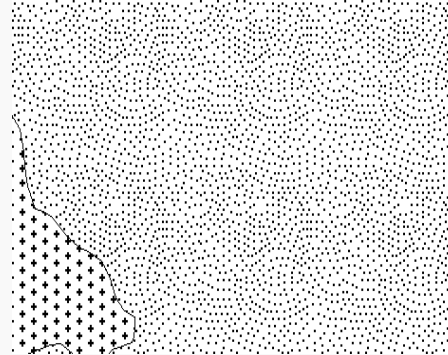
Variety (number of
different classes)



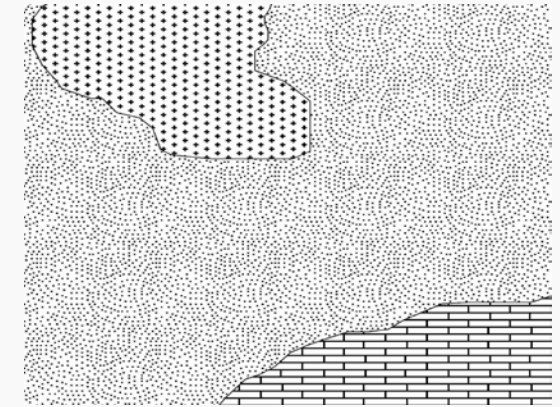
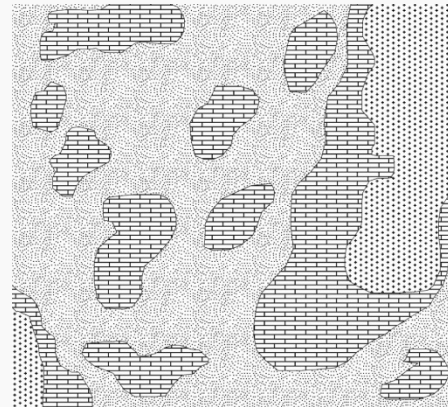
Frequency (number of
times each class is present)



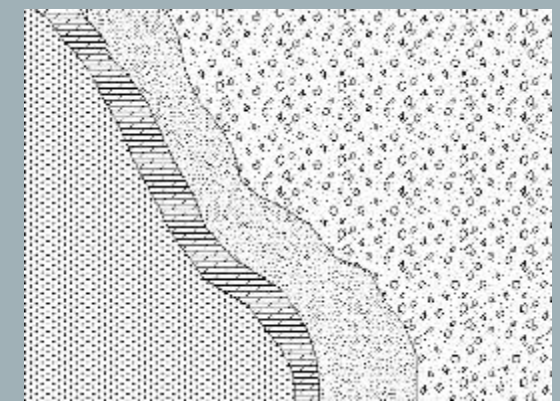
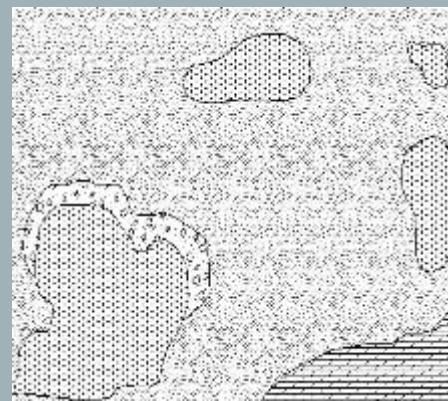
Variety (number of
different classes)



Frequency (number of
times each class is present)



Distribution (geometry
and position of each class)



- **Some people confuse the terms geological elements, geodiversity and geoheritage, and choose to use the term geodiversity to refer to all**
- **BUT they are all different concepts :**
 - **All territories have geological elements**
 - **Territories with important geoheritage may have very low geodiversity.**
 - **Territories with high geodiversity may have no important geoheritage.**
 - **Territories with low geodiversity may have more geoheritage than others with high geodiversity.**

For example, a place with an international stratotype (IUGS) may have very low geodiversity, but is an outstanding geoheritage site with very high scientific interest.



Geodiversity is an intrinsic property of a territory. An area with very high geodiversity values may be considered geoheritage deserving conservation measures.

Geoheritage
(interest of sites)

Rarity, uniqueness, scientific value,
educational value, vulnerability, etc.

Value assessment

Geodiversity
(diversity of an area)

Diversity of geological features,
regardless of their value

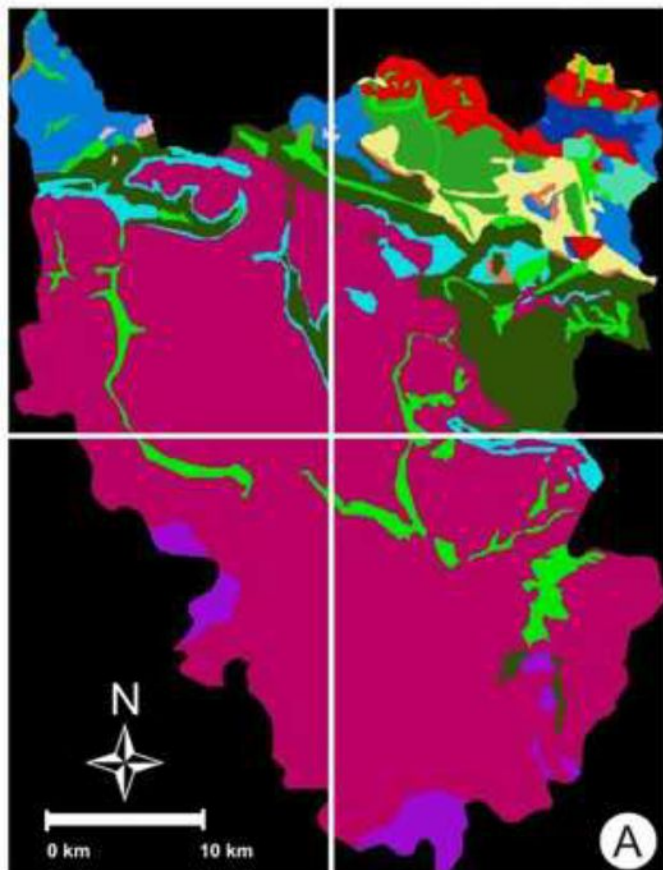
Variety, frequency and
distribution assessment

Heritage and diversity

GEOCONSERVATION

Application of geodiversity assessment in the planning of geoconservation strategies:

- Use of geostatistical descriptors to map geodiversity
- Use of geodiversity maps as a tool for PA management

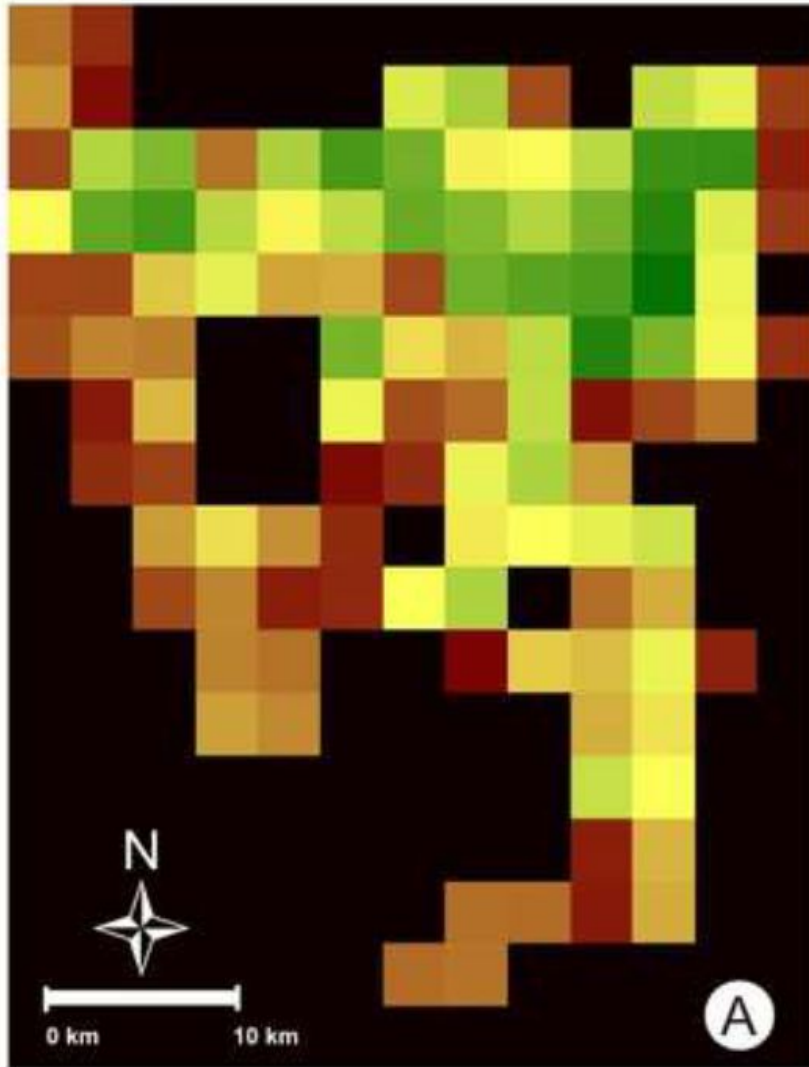


Geodiversity index based on
15 chronolithological units

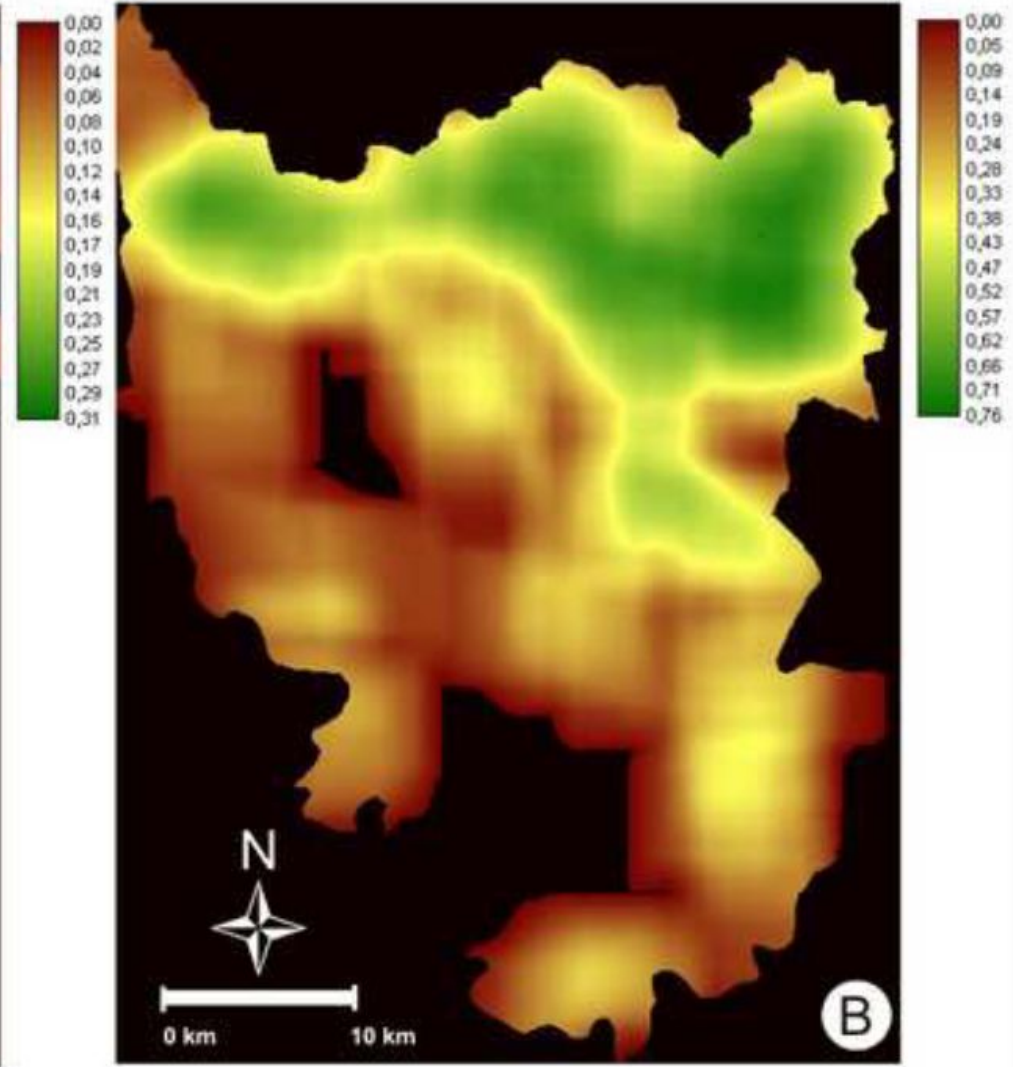
$$ISGI = \frac{1}{A} \sum_{j=1}^4 \Delta_j \sum_{i=1}^{L_j} \sum_{c=1}^C [\hat{\gamma}_c(h_{ij}) N(h_{ij})]$$



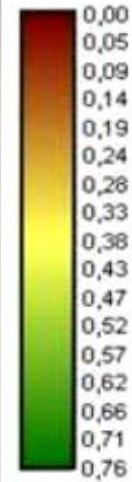
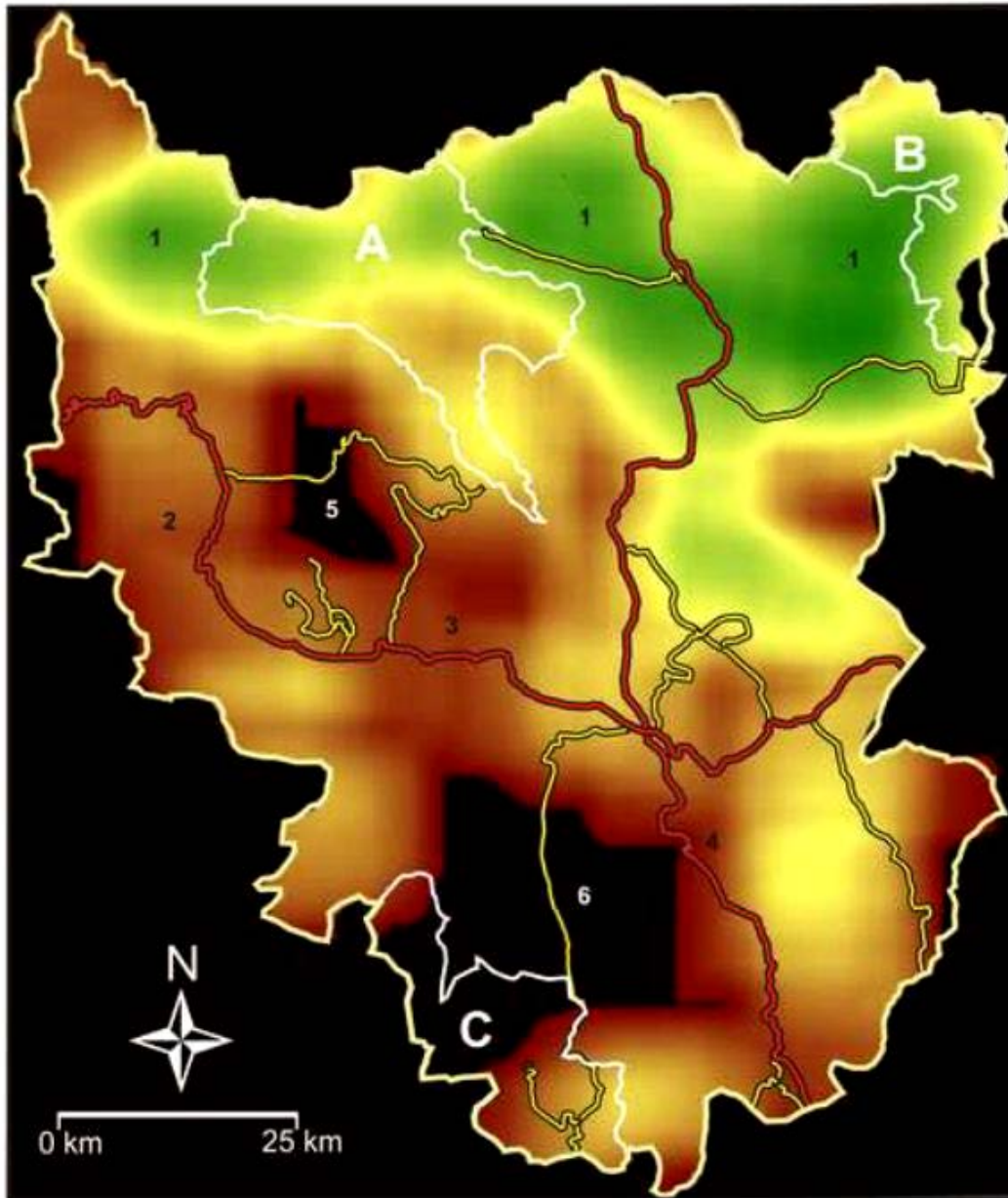
ISGI: Indicator Semivariogram
Geodiversity Index



ISGI values based on a non-overlapping division into cells (20 x 20 pixels)



ISGI values based on an overlapping moving window of 20 x 20 pixels



A former proposal of connecting corridor was rejected

A new proposal was made to extend and connect protected areas A and B

A: Ordesa y Monte Perdido National Park
B: Posets-Maladeta Natural Park
C: Guara canyons Natural Park

— Main road
— Secondary road

CONCLUSIONS

- Proper use of terms
- Use of geodiversity index maps for PA management

Questions?