

Geodiversity: the backbone of *Biodiversity* for a living *Planet*

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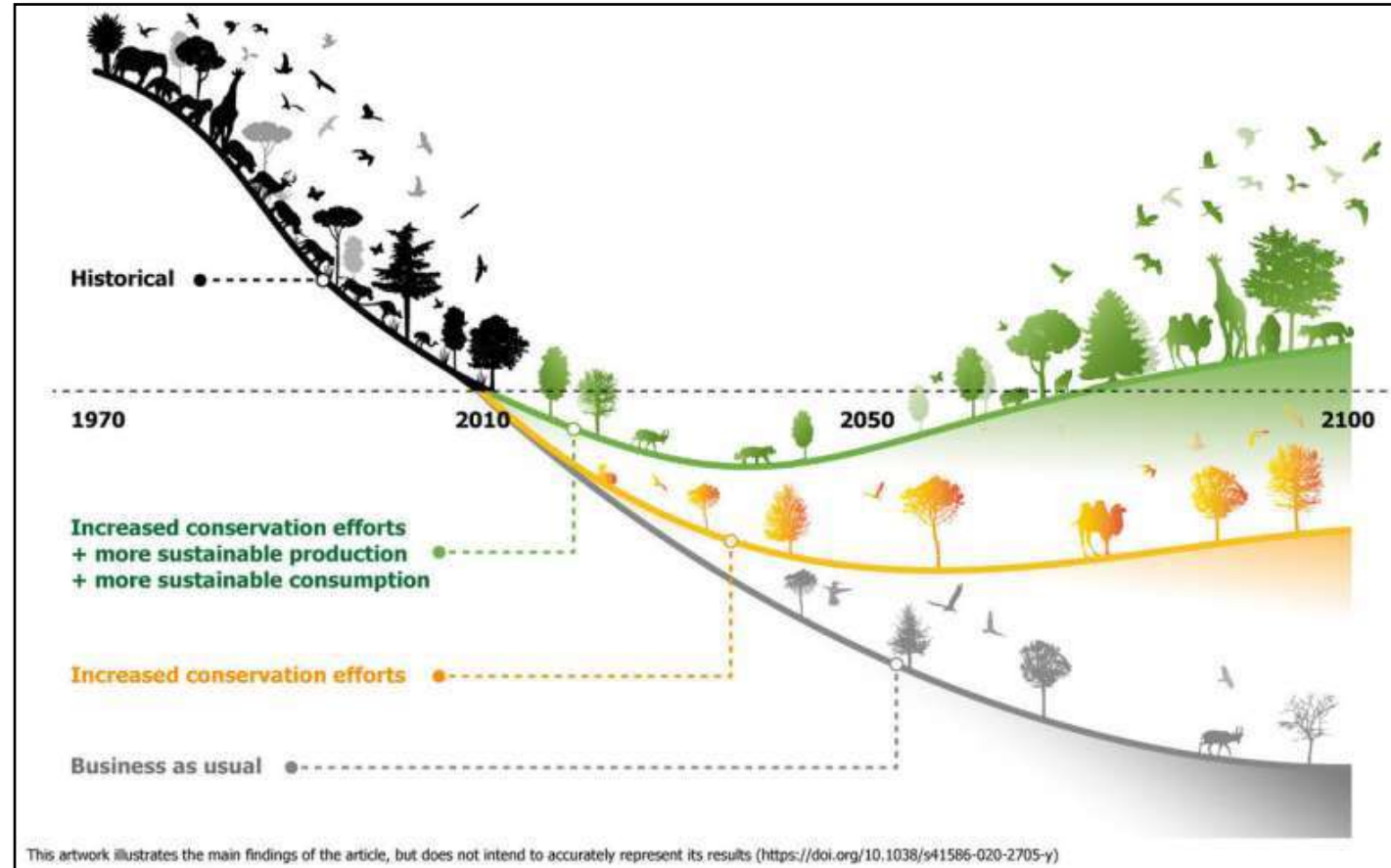
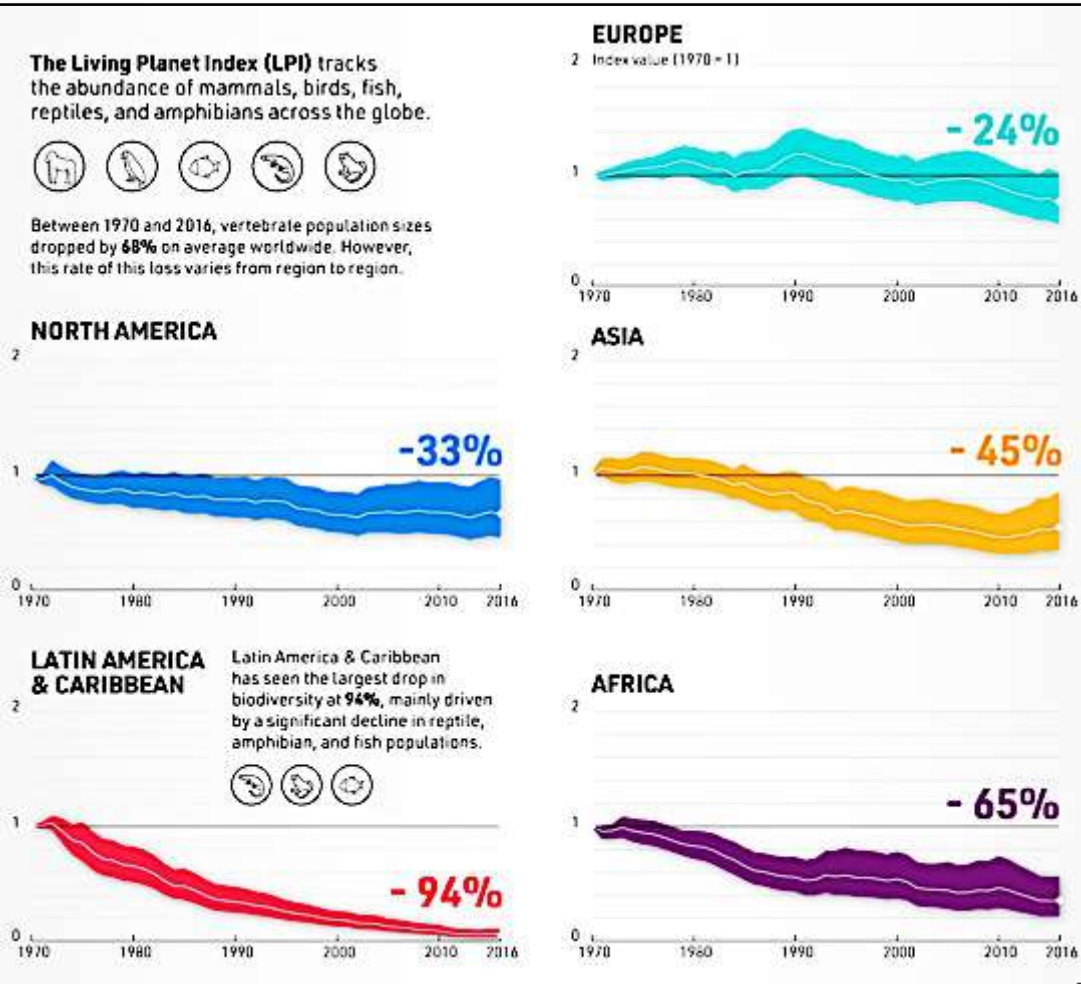
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United Nations **SUSTAINABLE DEVELOPMENT GOALS**



Starting points

1. Biodiversity loss



What does Geology have to do with it?

Starting points

2. Biotic vs Abiotic



Weathering, soil, bio



Human well-being



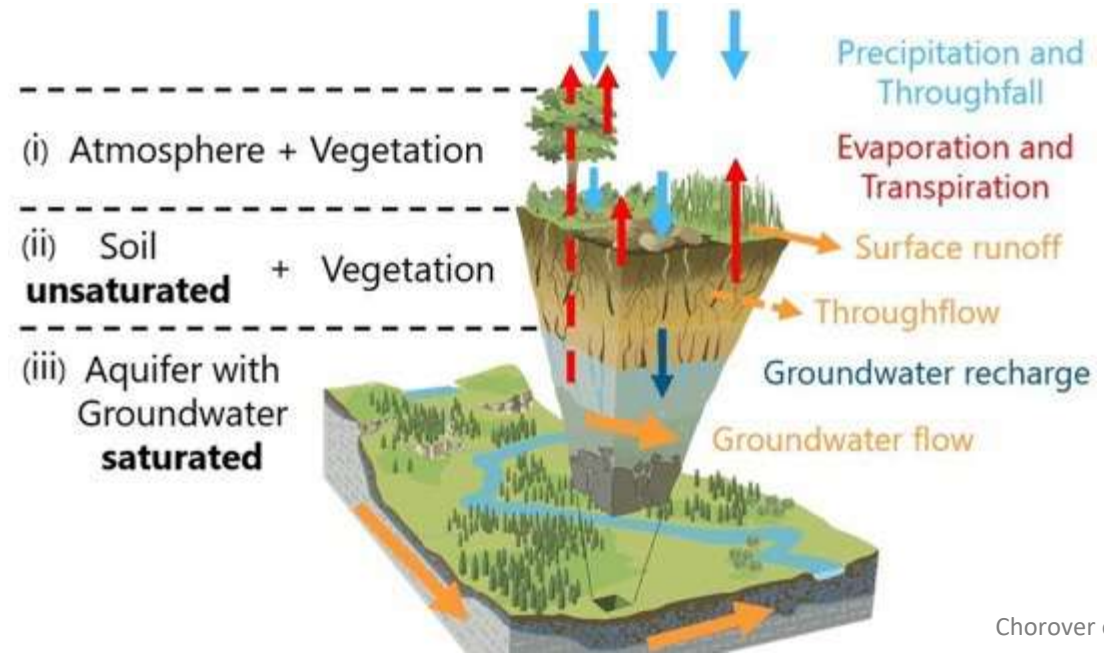
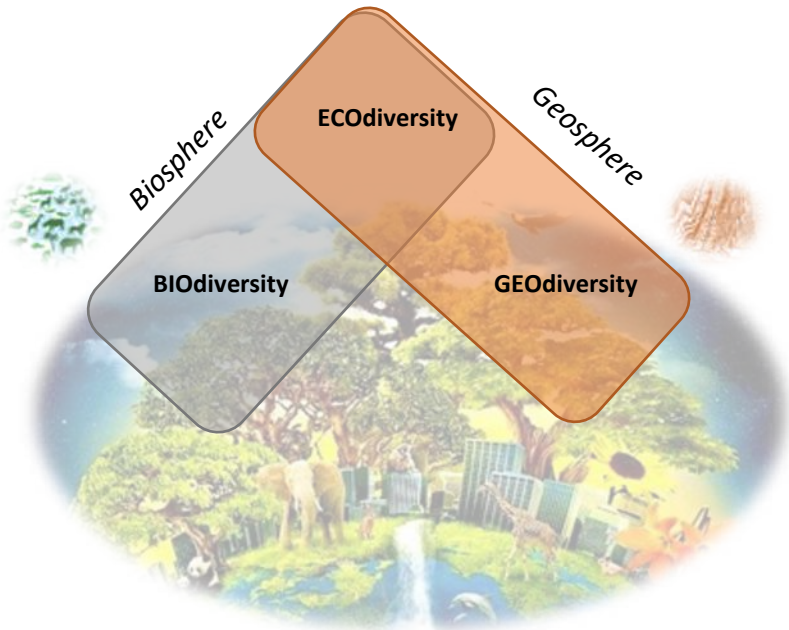
Climate past changes



Risk disaster prevention

- the variation in Earth's abiotic processes and features

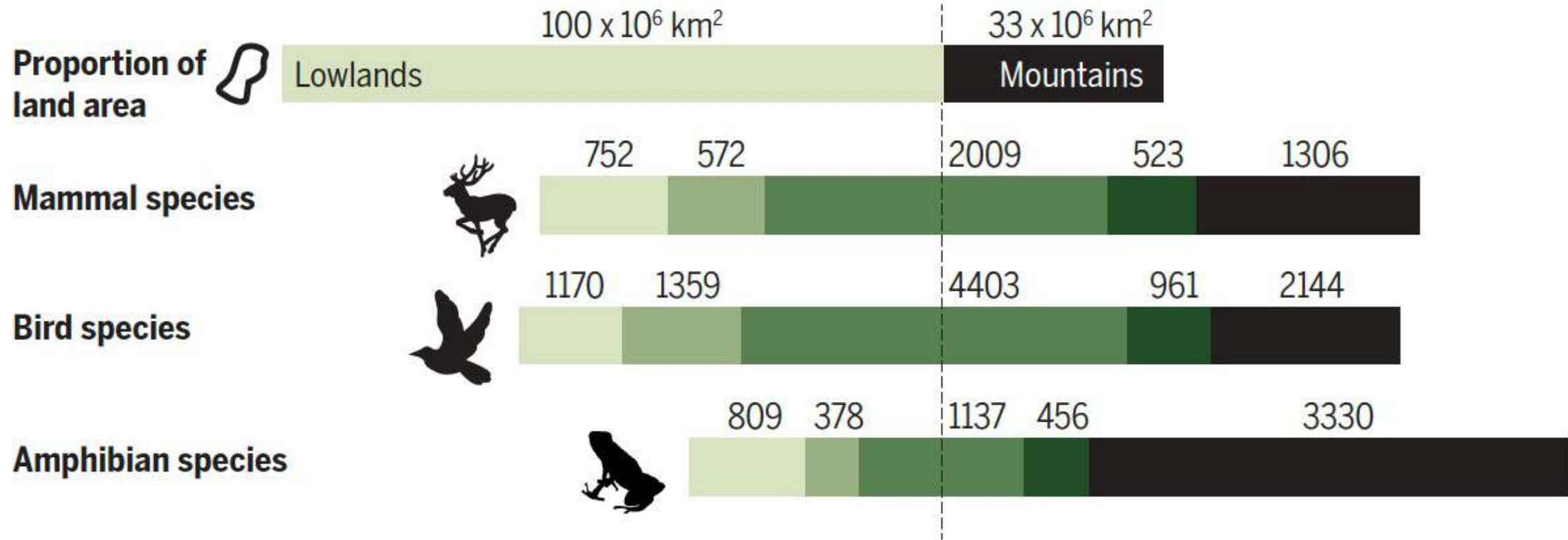
Zarnetske et al., 2018



Chorover et al., 2007, modified

Starting points

2. Biotic vs Abiotic



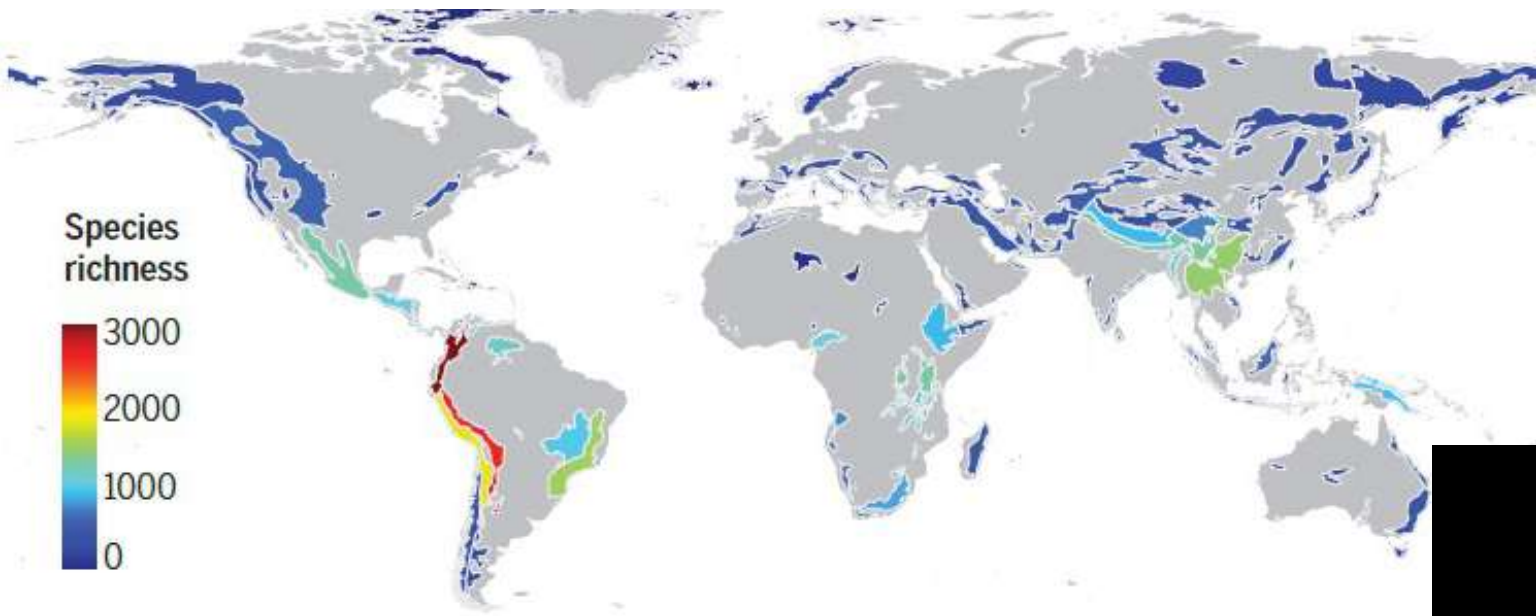
Proportion of species' range in mountains and lowlands:

● ≥ 90% lowlands
 ● ≥ 75% lowlands
 ● Both
 ● ≥ 75% mountains
 ● ≥ 90% mountains

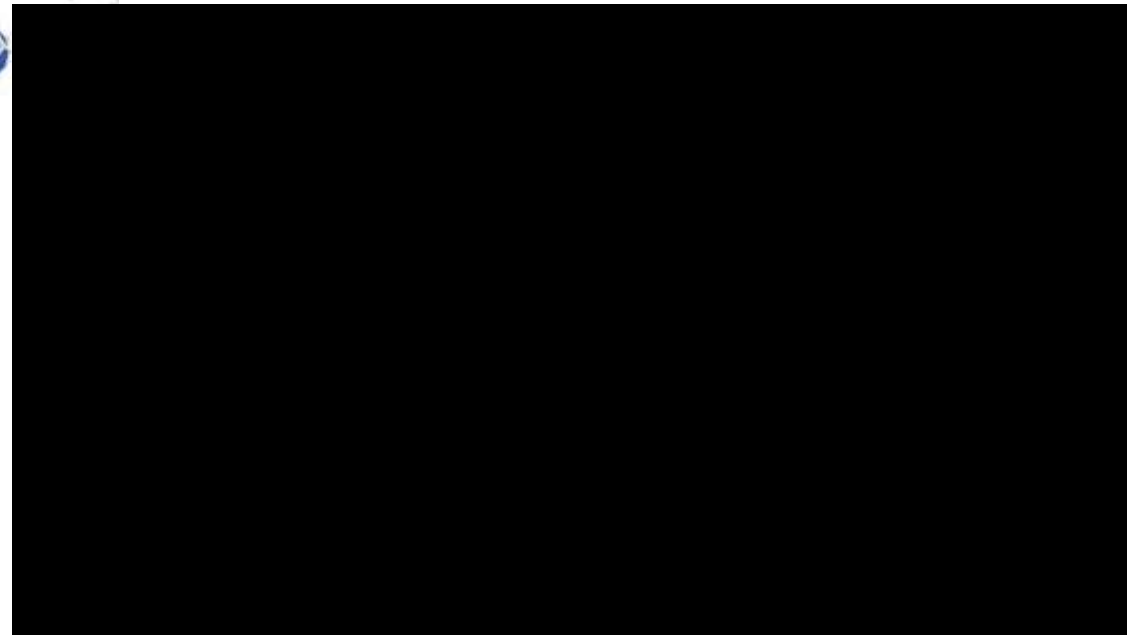
Rahbek, C., et al. (2019). Humboldt's enigma: What causes global patterns of mountain biodiversity?. *Science*, 365(6458), 1108-1113.

Starting points

2. Biotic vs Abiotic



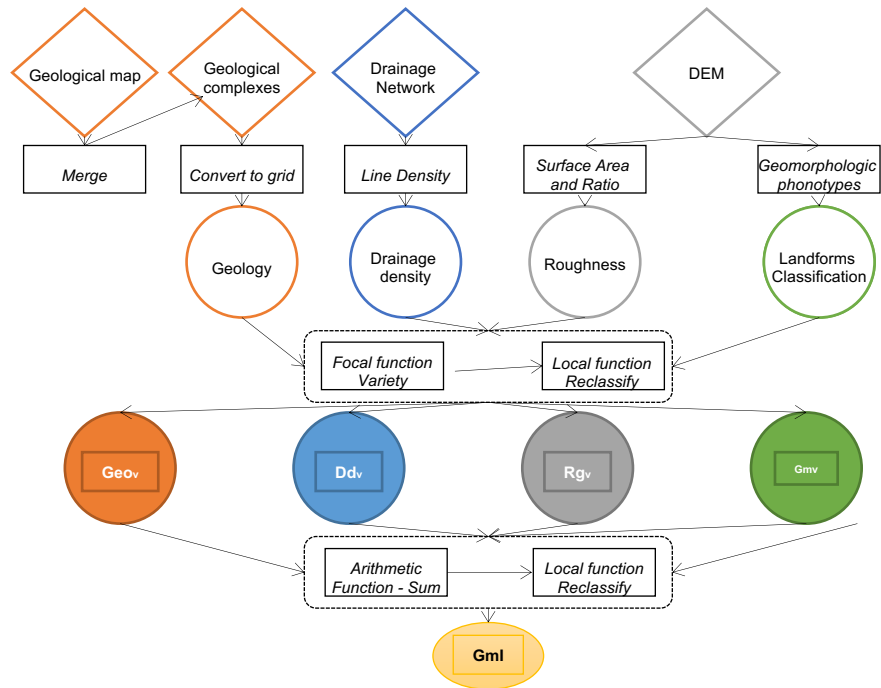
- CLIMATE
- TOPOGRAPHY



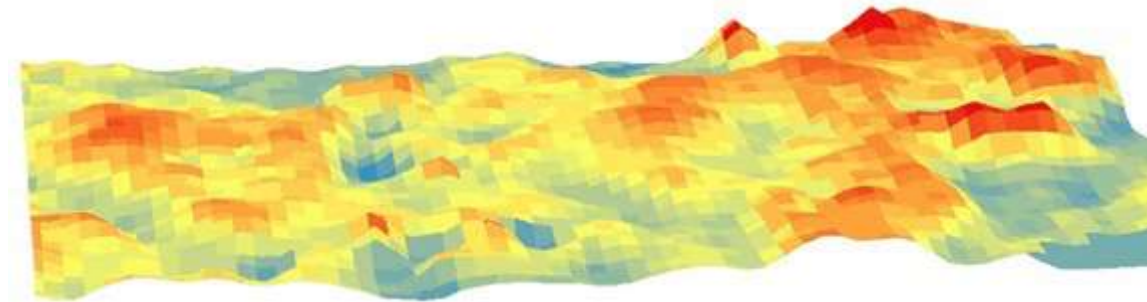
- Species richness, defined as the total number of amphibian, mammal, and bird species ranges overlapping each mountain region

Rahbek, C., et al. (2019)

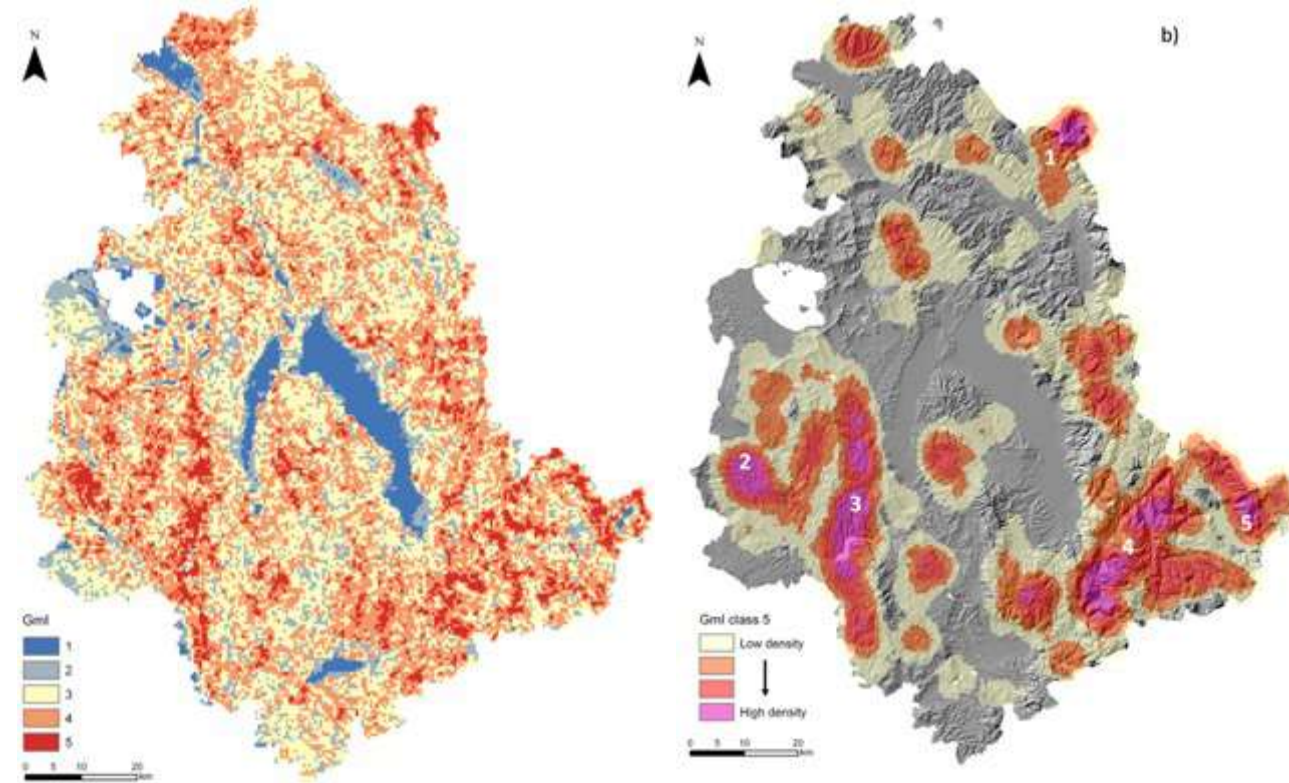
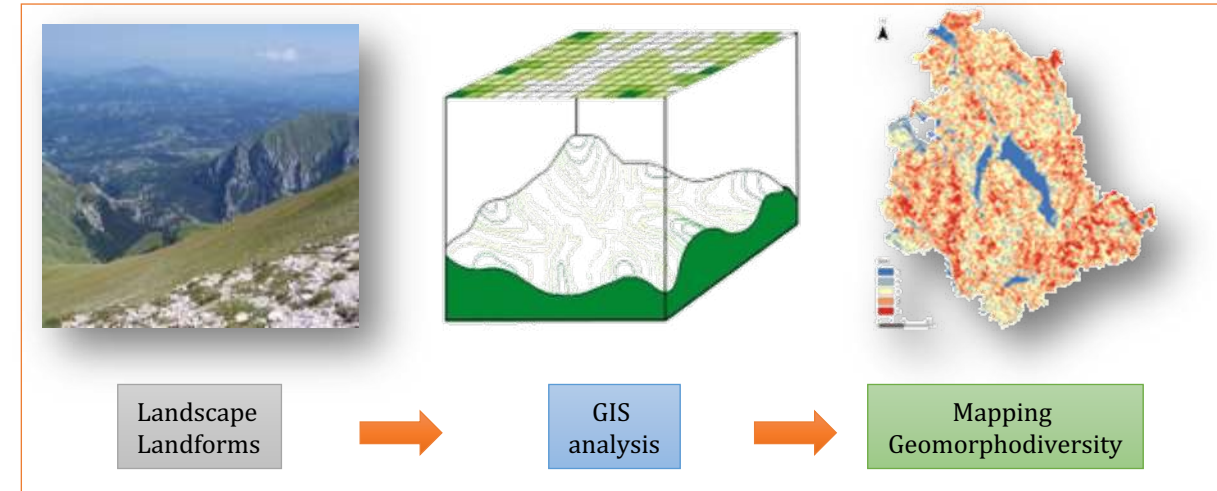
Starting points



Digital Elevation Model



3. Geodiversity in our research



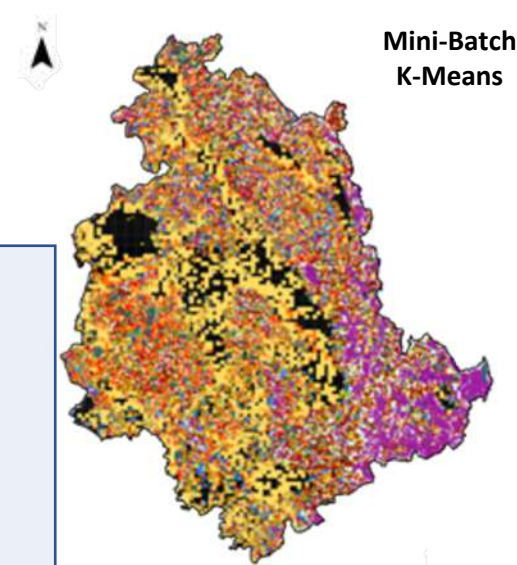
Starting points

3. Geodiversity in our research

Clustering
Partizionale

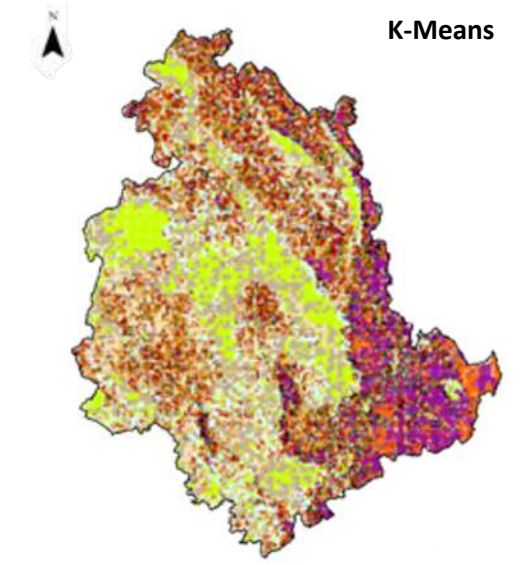


K-Means e
Mini-Batch K-
Means



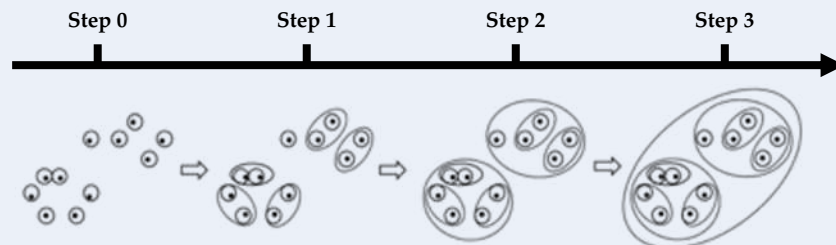
Computing time : 0.516 s

K-Means

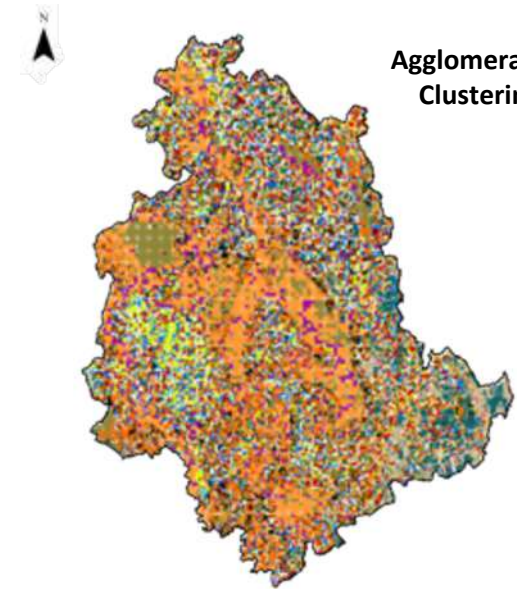


Computing time : 9.434 s

Clustering
Gerarchico



Agglomerative
clustering



Computing time : 84.298 s

Starting points

3. Urbanization in Anthropocene

2030

*60% of the world population
10% of the emerged land will be
urbanized*

2007

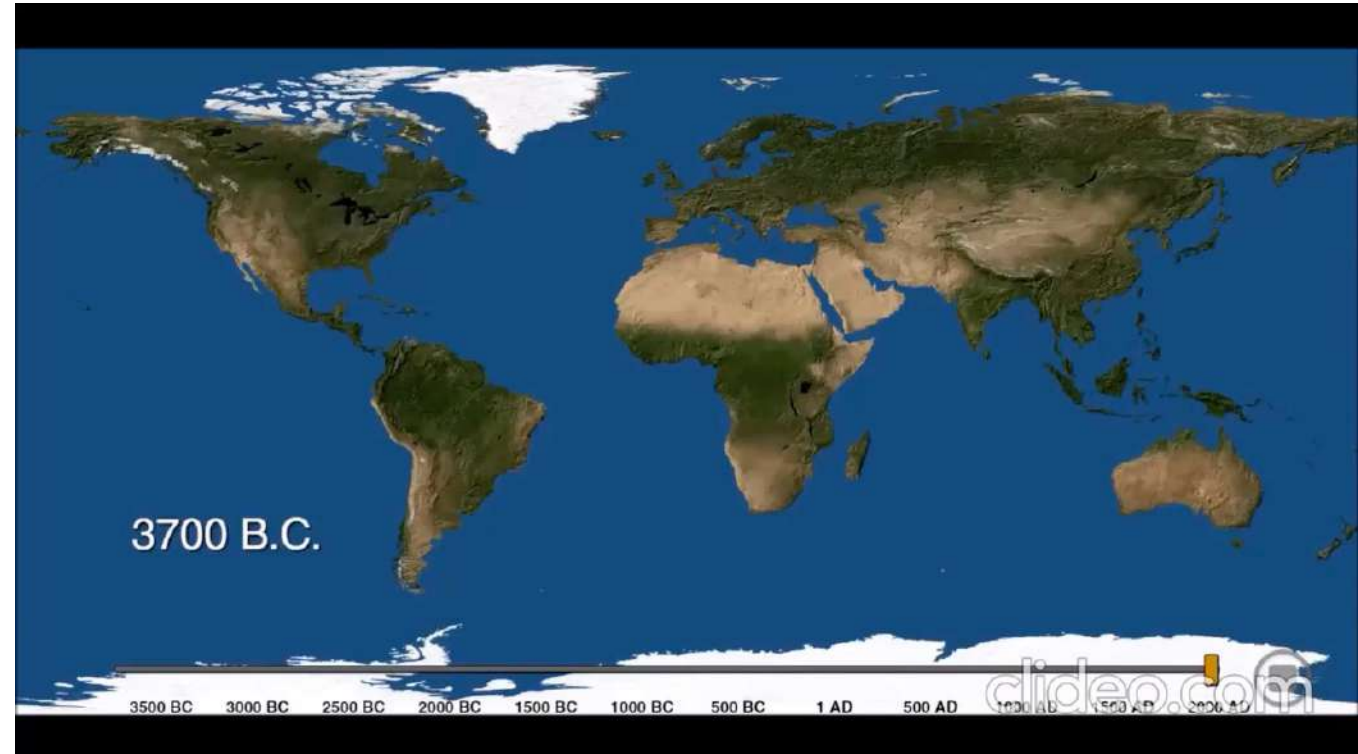
> 50% of the world population

1915

> 50% of the USA population

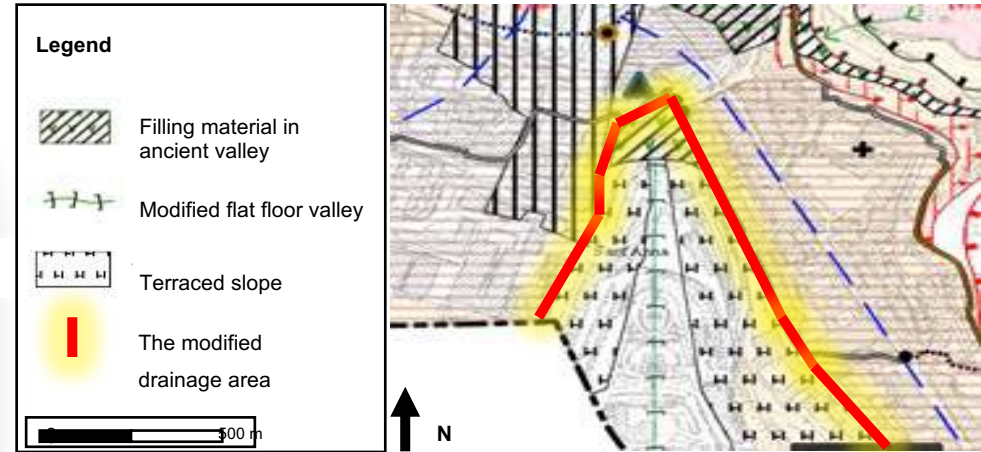
1870

> 50% of the european population



Starting points

4. Urban Geomorphology in our research



1290 UNIVERSIDADE D COIMBRA

10th IAG INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY

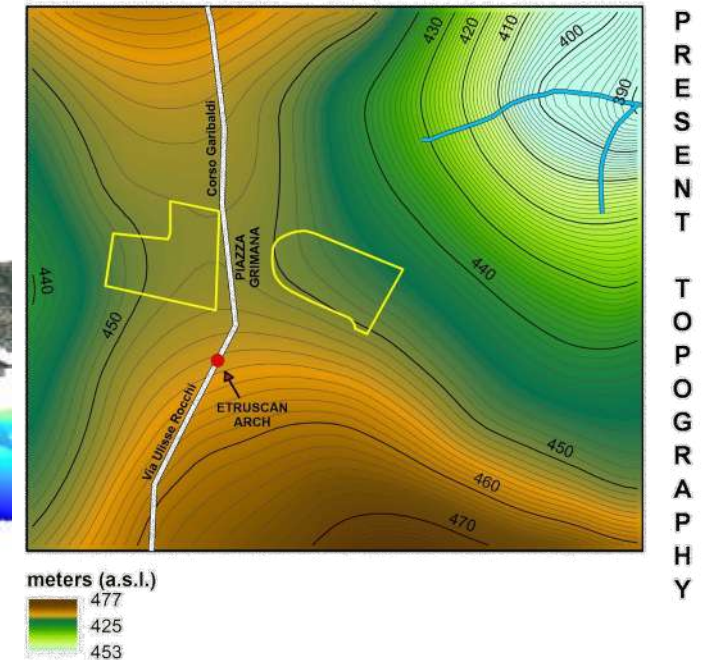
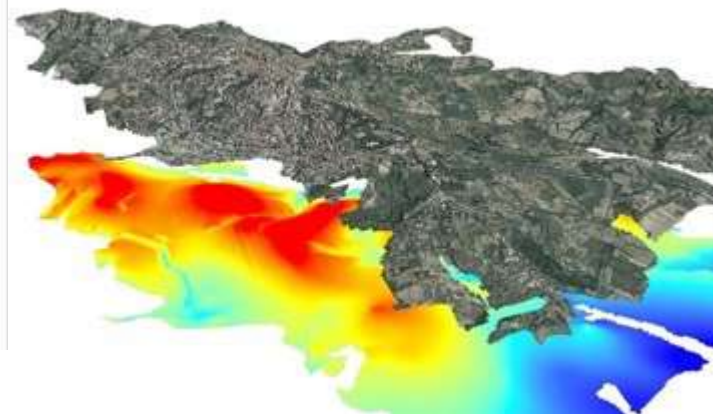
COIMBRA - PORTUGAL
6-10 September 2021

« GEOMORPHOLOGY AND GLOBAL CHANGE »

S. 20 Urban Geomorphology and Anthropogenic Landscapes



Meelli, Burnelli





Emmanuel Reynard



Alessia Pica

Unil

UNIL | Université de Lausanne



Laura Meelli



Martina Burnelli



Massimiliano Alvioli



Francesca Vergari



Istituto di Ricerca per la Protezione Idrogeologica



SAPIENZA
UNIVERSITÀ DI ROMA



Maurizio Del Monte

TERRA
*geodiversiTy and biodivERsity
in uRban Areas*

THE URBAN ECOSYSTEM

Differences with rural areas

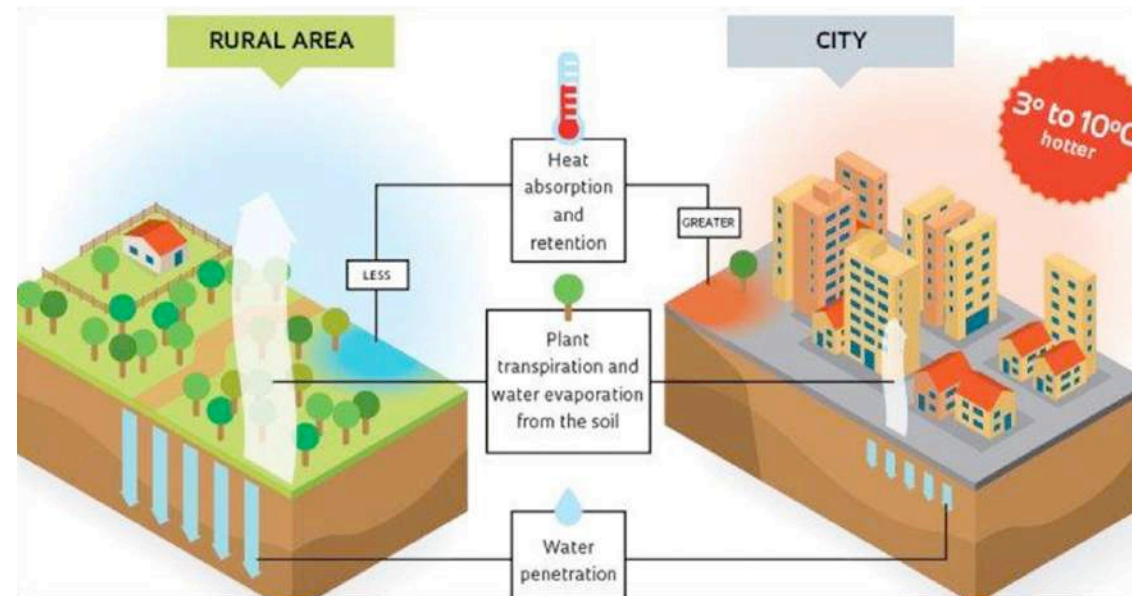
Precipitations > 5-10%

Temperature > 1-3°C

Emissions of PM_i

Humidity < 5-8%

Noise



CO₂ Emissions

Air Ventilation <20%

TERRA project

Gml Italy

Natural cities

CNR IRPI PG

Urban Gml

Bio index

*Dip. Sc. Agrarie, Alimentari, Ambientali UniPG
Dip. Ingegneria Civile e Ambientale UniPG*

Urban Analysis

Perugia

Lausanne

Sion

Université de Lausanne, CH

TERRA network in urban areas

Geomorphological mapping

Sapienza, Uni Roma

Anthropic landforms

Human modified landforms

Small-scale analysis

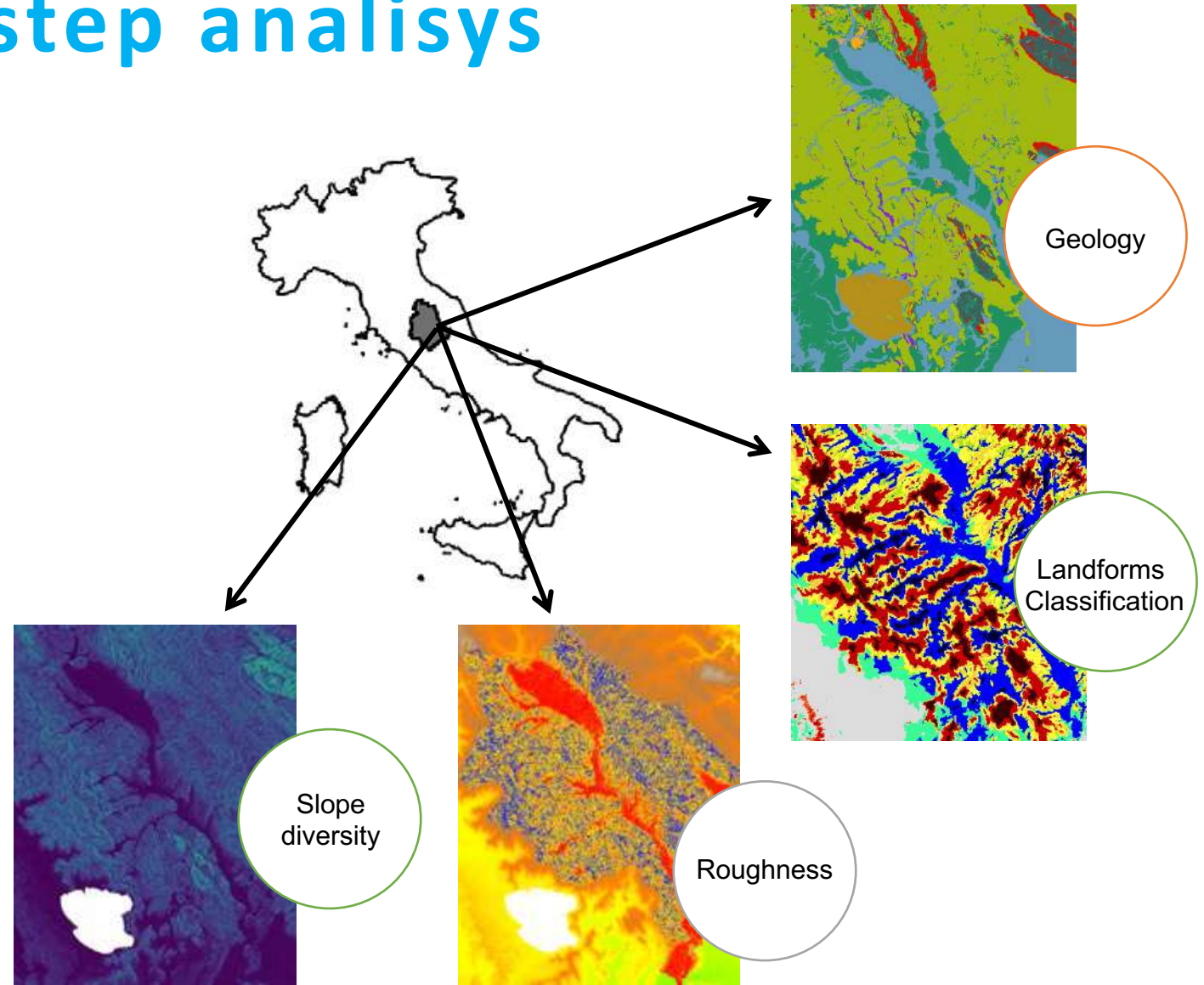
Remote sensing data

Large-scale analysis

Field data

First step analysis

Elaboration of a **quantitative method** to calculate the **Geomorphodiversity index** in a test area of the Umbria region

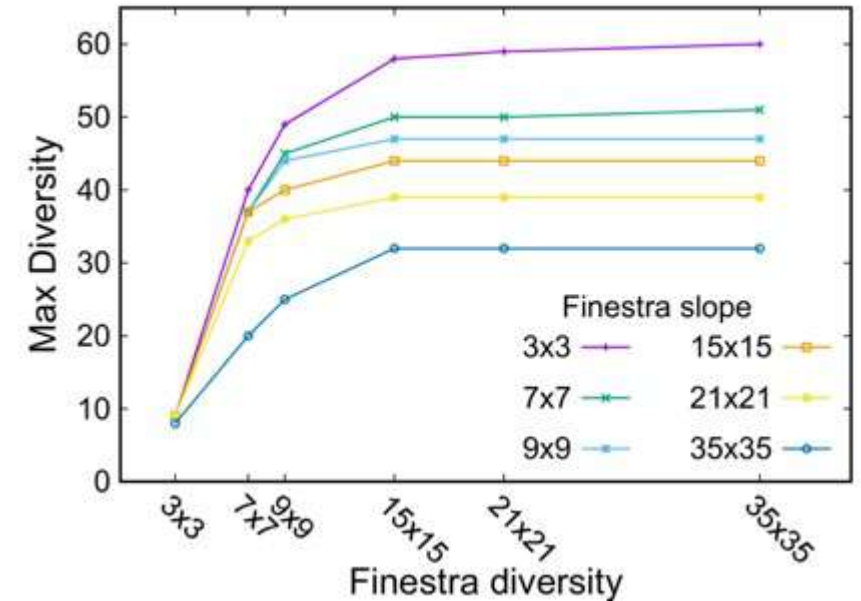
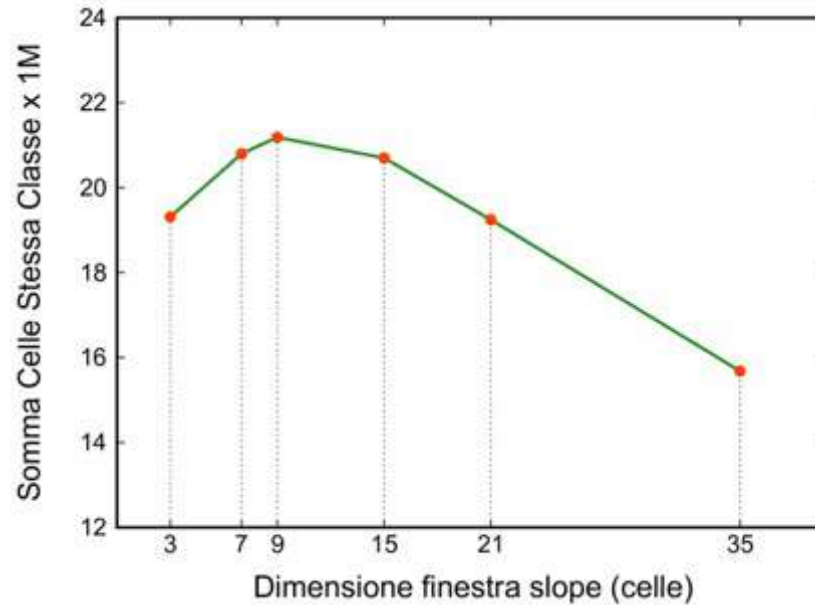


First step analysis



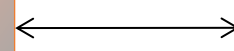
Slope diversity

Focal function *r.slope.aspect* and *r.neighbors* to find the best threshold and radius to assess the Slope diversity



Future steps & perspectives

Urban Gml



Bio index

As reported by the European Commission, the **Urban Green Infrastructures** are a strategically planned **network** of natural and semi-natural areas **designed and managed to deliver** a wide range of **ecosystem services**

>>> COMPLEXITY
>>> ENERGY FLOWS
>>> ECOLOGICAL FUNCTIONS

Policies strategies for citizen science



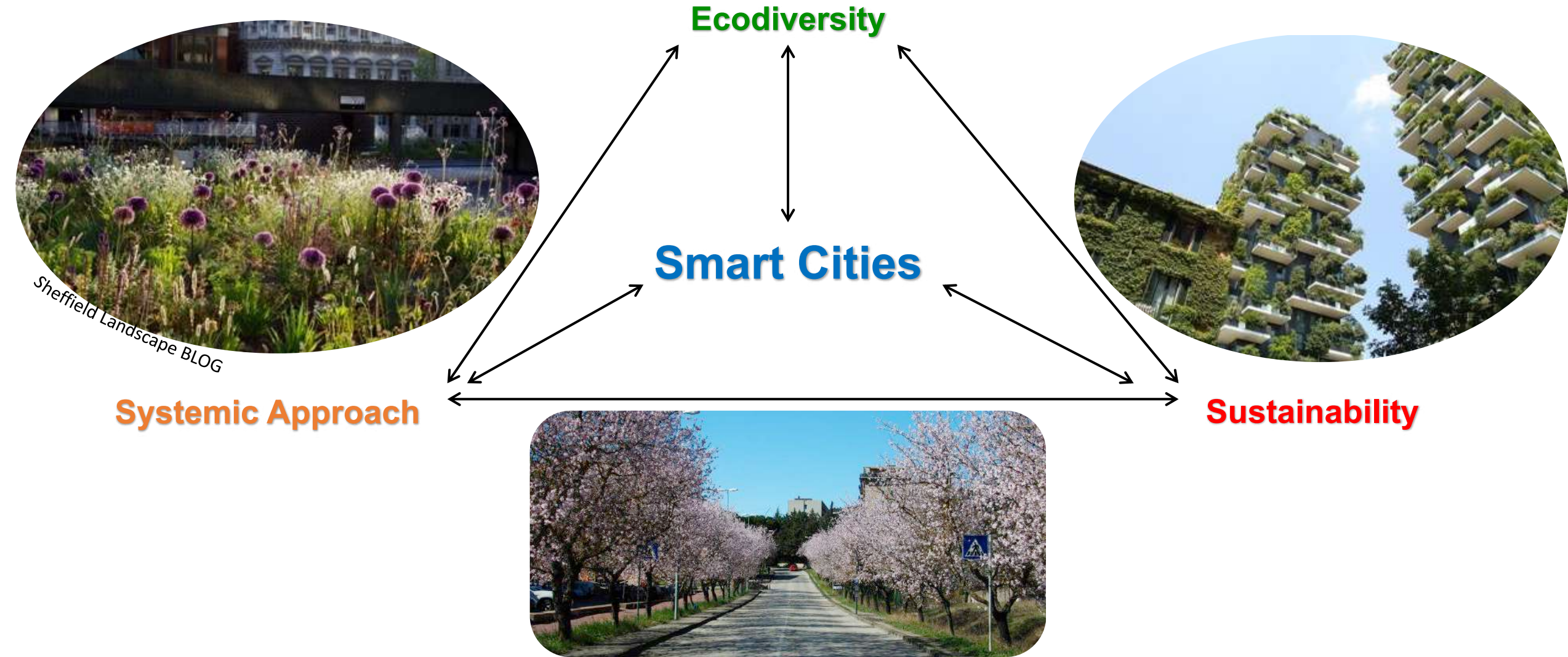
Promoting public participation

Strengthening communities

Raising awareness

**CITY GOVERNANCE
& SUSTAINABLE URBAN
PLANNING**

Policies strategies for citizen science



Foresights & Partnership

PNRR

Geoheritage e sostenibilità ambientale: il ruolo dell'Uomo tra Aree Urbane e Territori Naturali

AZIONI

- 2 - Cultura, creatività e società inclusive
 - 2.2 - Tecniche e strategie di comunicazione della conoscenza
 - 2.4 - Conoscenza, valorizzazione e conservazione del patrimonio materiale e immateriale
- 3 - Sicurezza civile per la società
 - 3.1 - Disastri e crisi complesse
- 5 - Clima, energia e mobilità
 - 5.2 - Cambiamenti climatici: consapevolezza impatto sociale, modelli scientifici e soluzioni tecnologiche
- 6 - Prodotti alimentari, bioeconomia, risorse naturali, agricoltura e ambiente
 - 6.1 - Alimentazione, ambiente, territorio e biodiversità
 - 6.2 - Stili di vita e società

AMBITI DI RICERCA DIPARTIMENTALI

Geoheritage

Partnership

Université de Lausanne
Sapienza Università di Roma
Dip. Sc. Agrarie, Alimentari, Ambientali UniPG
Dip. Ingegneria Civile e Ambientale UniPG
CNR IRPI Perugia

Expected Partnership

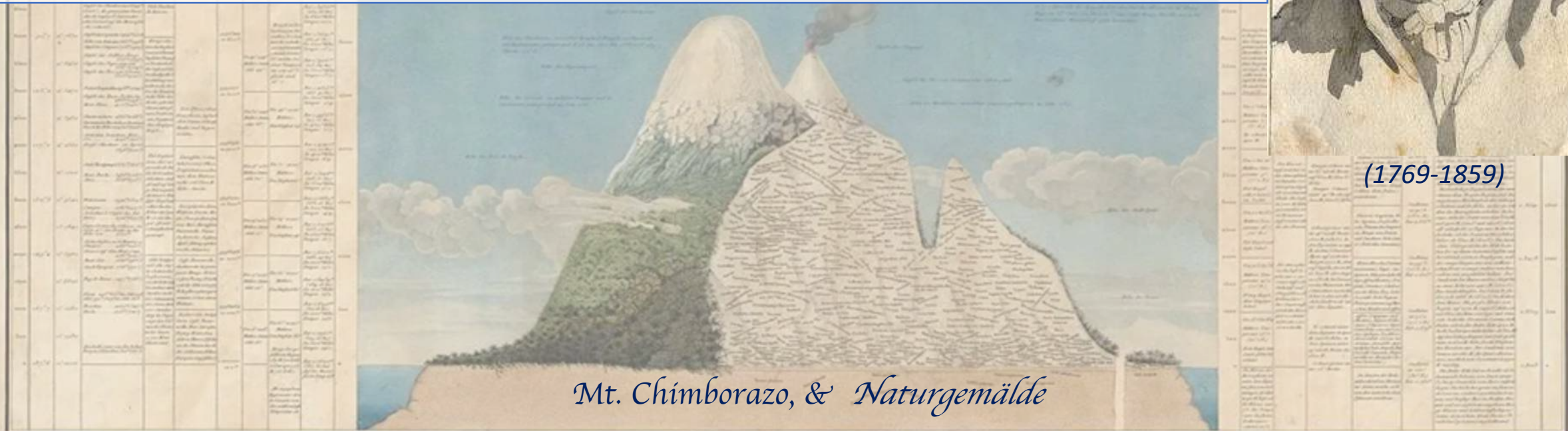
Economia
Scienze Sociali

«La natura è il regno della libertà perché l'equilibrio della natura è creato dalla diversità, che a sua volta può essere presa a modello di verità politica e morale. Ogni elemento, [...] ha il suo ruolo e, insieme, compongono il tutto. Il genere umano non ne è che una piccola parte. **È la natura in sé a essere una repubblica fondata sulla libertà»**

(A.von Humboldt)



(1769-1859)



Mt. Chimborazo, & Naturgemälde

*Geographie der Pflanzen in den Tropen-Ländern;
ein Naturgemälde der Anden,*

Grazie a tutti per l'attenzione !