H2020 Project ECOPOTENTIAL: Improving future ecosystem benefits through Earth Observations

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ECOPOTENTIAL Partners







Why are we doing it:

Terrestrial and marine ecosystems provide essential goods and services to human societies. In the last decades, however, **anthropogenic pressures caused serious threats to ecosystem integrity, functions and processes**, potentially leading the **loss of essential ecosystem services**.

Knowledge-based conservation and management policies are needed. Fundamental to all these is **effective monitoring of the state and trends in ecosystems, fully accounting for the wide spectrum of interactions between the geosphere, ecosystems and climate and making best use of the available Earth Observation data**.

What are we doing and key outputs:

- Focus on ecosystem functions/processes that support specific ecosystem services
- Make best use of EO data (satellite and in situ)
- Build data products and make them widely available
- Build models capable of including EO data
- Assess the current state and estimate the future evolution of ecosystems (processes/functions/services)
- Define policy options and the requirements of future protected areas
- Develop capacity building strategies
- Make all results available to the community, contributing to GEO and GEOSS (Virtual Laboratory)

What are the key users:

- Scientific community
- Park managers and conservation experts
- Environmental policy makers
- International entities
- Local communities
- GEO communities

Goal: Create a GEO Ecosystem Community of Practice able to make best use of the project outputs

Sites: crucial role of Protected Areas:

Areas of natural ecosystems in a matrix of heavily anthropically modified environments

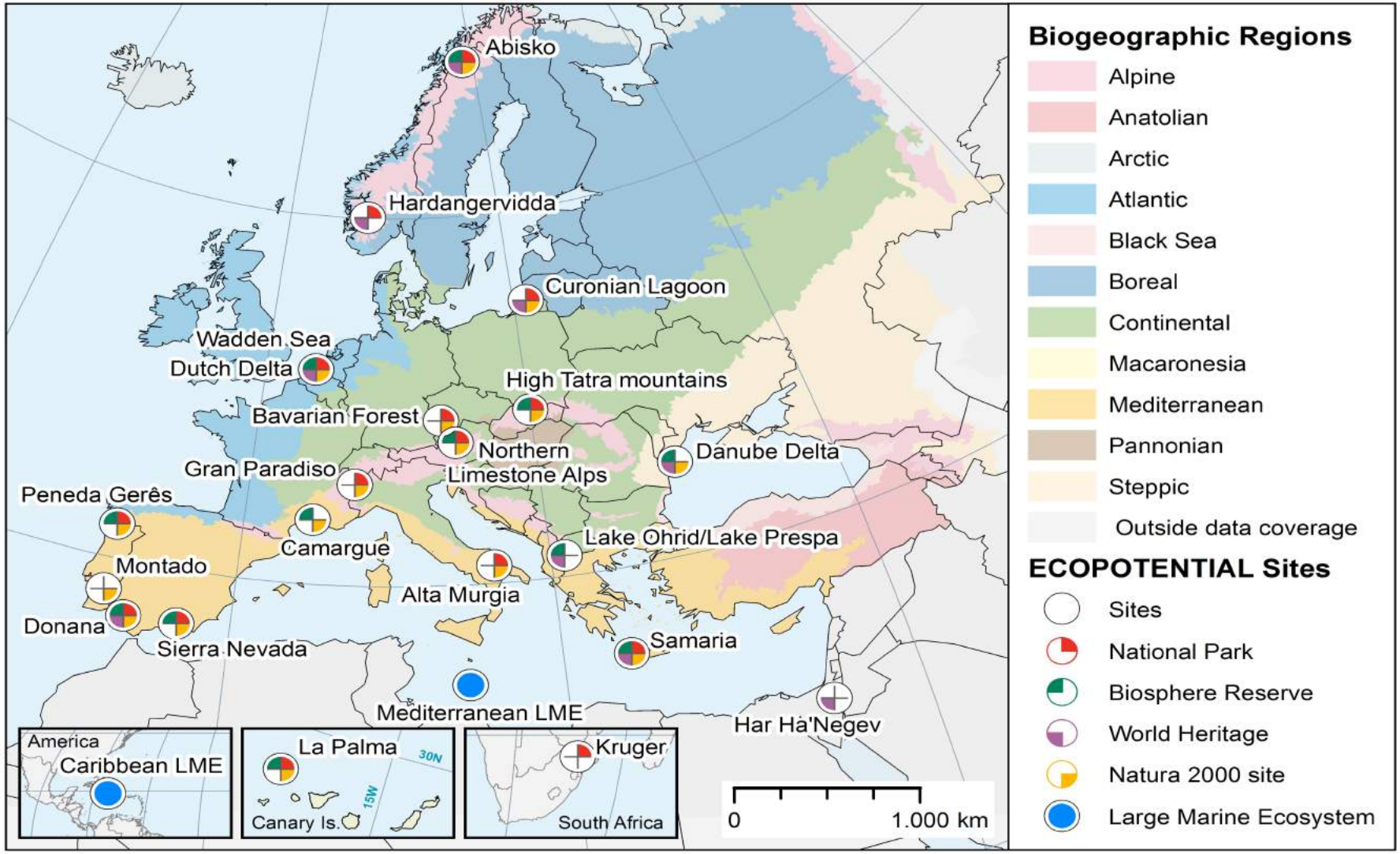
Providers of ES that are specific of weakly anthropized / natural environments

Treasure chests of biodiversity and ecosystem functions

Source / refuge areas for the surrounding environments

Areas with large amounts of quantitative data (eg, Lont-Term Ecological Research sites)

Location and protection status of the PAs in ECOPOTENTIAL and European biogeographic regions



ECOPOTENTIAL: The storylines (as an ITERATIVE process!)

Focus on a given Protected Area and identify the main ESs of interest

Identify main ecosystem functions/processes that are relevant for the ESs

Identify indicators for the state of the ecosystem and of ecosystem processes (DPSIR SoE)

Identify indicators for the most important (abiotic and biotic) control factors on the ecosystem

Identify indicators (either from literature review or novel) that can describe the main (human-induced) pressures (DPSIR Pressures)

Identify the most critical Ecosystem Processes

Identify indicators of the impacts on ecosystem structure, functions and services (DPSIR Impacts)

Describe societal and management responses (DPSIR Responses) and develop conservation and management policy options

Always: verify whether EO (remote sensing and in-situ) data are available to estimate the indicators

ECOPOTENTIAL
Essential Variables for Ecosystems

Essential Biodiversity Variables	Essential Climate Variables	Essential Ocean Variables	Essential Water Variables	Essential Social and Environmental Variables
Species Composition	Precipitation	Sea Surface Temperature	Runoff/streamflow/ river discharge	Population density
Functional groups traits	Temperature	Ocean acidification	Lakes/ reservoir levels	Resource use and management
Ecosystem extent & structure	Irradiance	Zooplankton composition	Glaciers front	Natural-areas accessibility

ECOPOTENTIAL thus aims to **develop widely applicable monitoring indicators for ecosystem status and trends, biodiversity change and ecosystem services** (including their socio-economic demand), creating a unified EV framework. This necessitates extending the already developed concepts of EBVs, ECVs etc. and include indicators that capture the major dimensions of ecosystem services supply and demand. Such indicators include,

A suite of remote-sensing and *in-situ* observation data will also be used to develop and define Essential Ecological and Environmental Protection Descriptors (EEPD) and the indicators of the current quality status in the PAs to be studied. To these indicators belong requirements such as: level of (bio)diversity (as being relevant for e.g. the description of the Good Environmental Status (GES) as used in the Marine Strategy Framework Directive (MSFD)), level of protection of key-species, improvement in numbers of (certain) species, habitat diversity, (minimal) size of the area, connectivity with other (protected) areas, and habitat quality. In particular, the parameters "habitat diversity", "size of the area" and "connectivity with other areas" will be mainly determined through EO data.

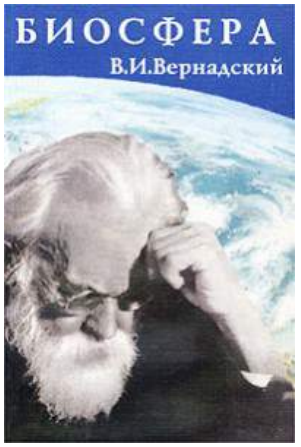
Conceptual aspects: back to the future

Arthur Tansley (1935), who briefly but substantively defined the ecosystem to be the integrated biotic–abiotic complex:

> the whole *system* (in the sense of physics), including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment of the biome – the habitat factors in the widest sense.

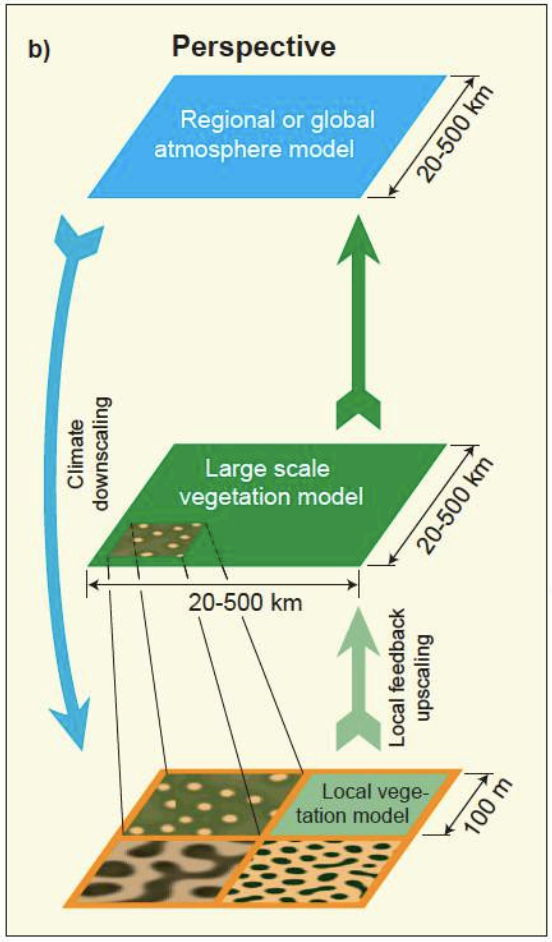
Significantly, as if to emphasize what he meant by 'the whole system', Tansley (1935) added:

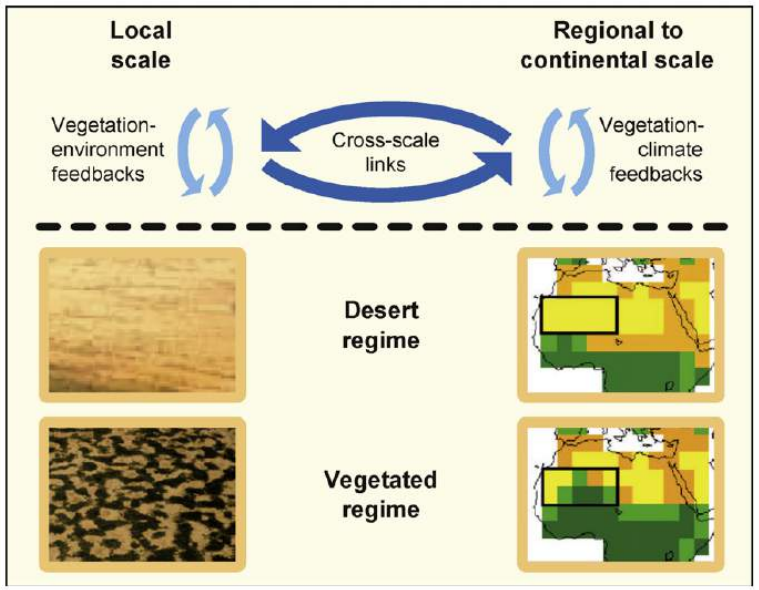
> Though (as biologists) the organisms may claim our primary interest, when we are trying to think fundamentally we cannot separate them from their special environment, with which they form *one physical system* (italics ours).

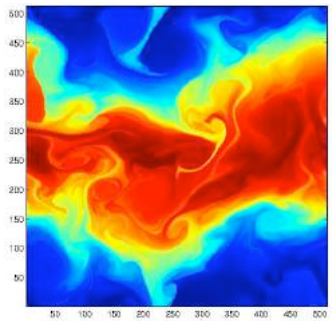


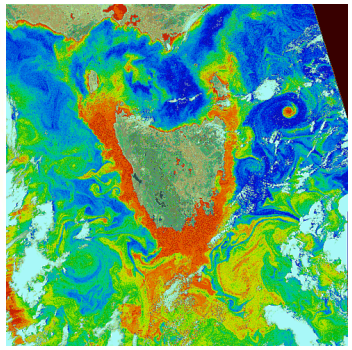
Ecosystems as complex adaptive systems with strong geosphere-biosphere interaction

A European way to Macrosystems Ecology, cross-scale interactions and Earth's Critical Zone

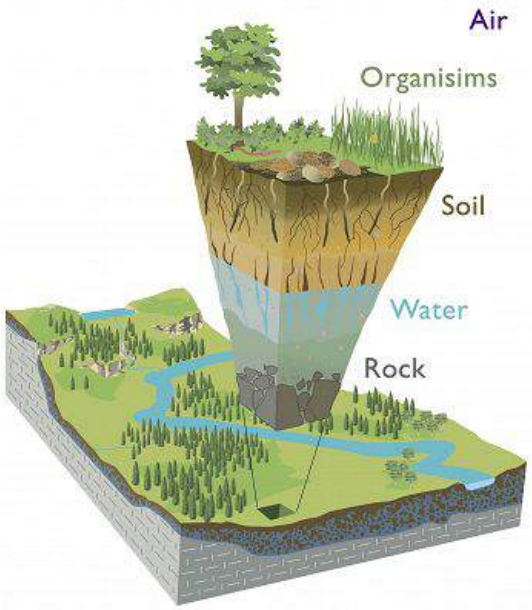








ECZ and geosphere-biosphere coupling



Cross-scale interactions

Rietkerk et al., Ecological Complexity 2011

Circulation-ecosystem interactions

Conceptual threads:

Propagation and estimate of uncertainties in future ecosystem projections

Role of changing extremes compared with changing means

A grasp on Essential Variables: essential for what questions? How many do we need?

Ecosystem Services and their conceptual role in conservation and management. Benefits and dangers of the ES approach

Links with other projects:

EU BON

SWOS
Satellite-based Wetland Observation Service

GLOBIS-B

ConnectinGEO

LifeWatch
E-Science European Infrastructure for Biodiversity and Ecosystem Research

ECOPOTENTIAL provides support to GEO and GEOSS

GROUP ON
EARTH OBSERVATIONS

www.ecopotential-project.eu

Thank you for your attention