H2020 Project ECOPOTENTIAL: Improving future ecosystem benefits through Earth Observations

Starting date: 1st June 2015, Duration: 4 years

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47 ECOPOTENTIAL Partners



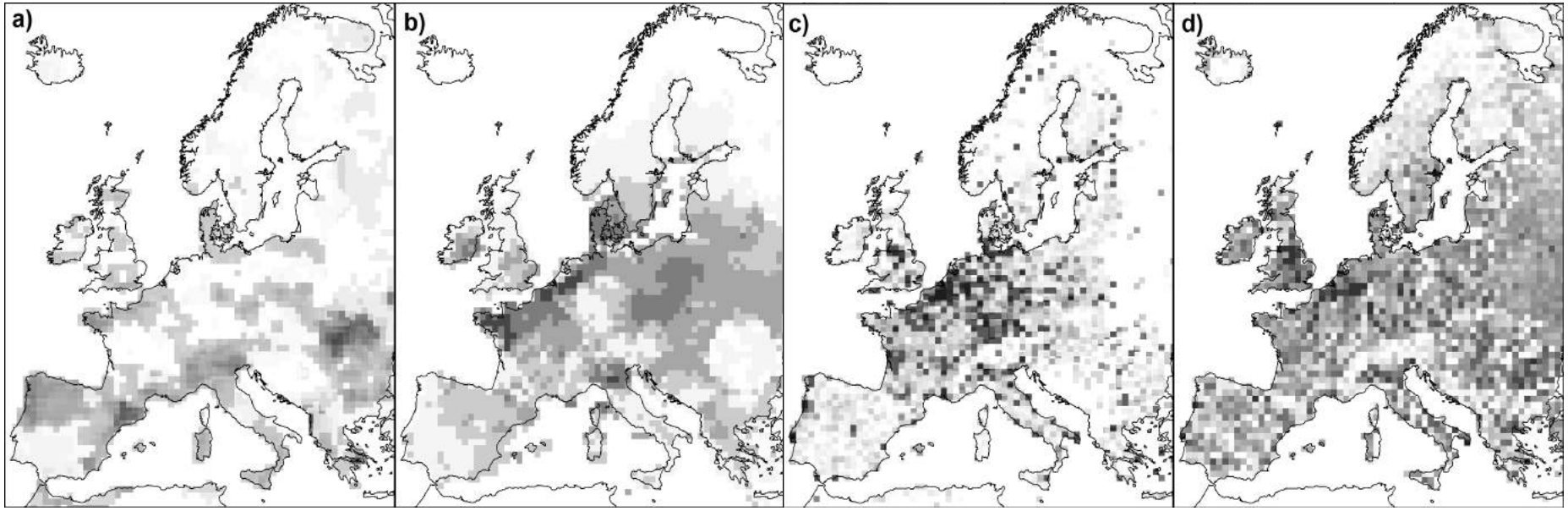






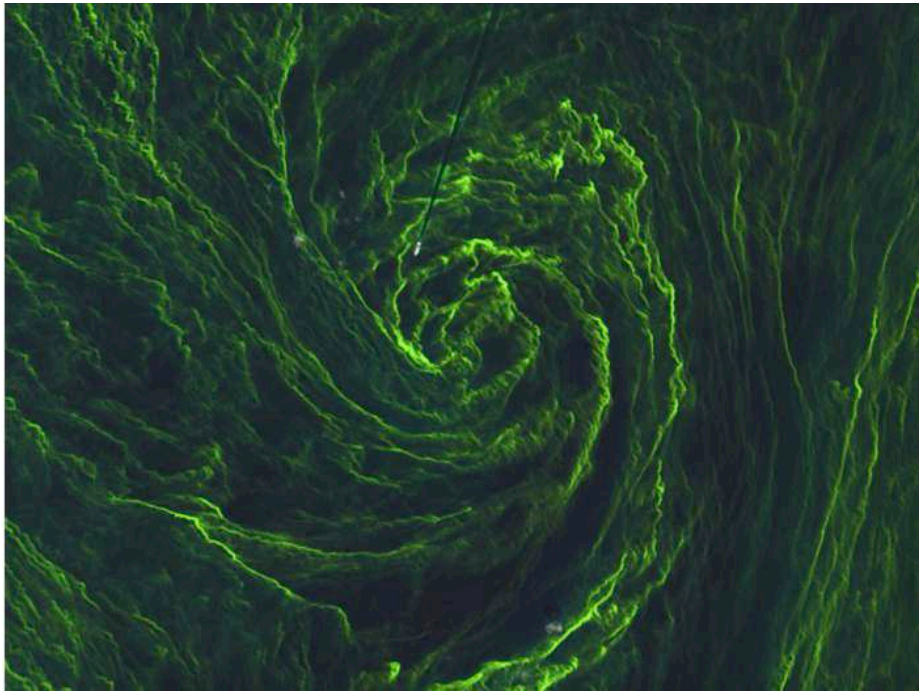
Loss of Ecosystem Services: a major issue of the Anthropocene

Loss of ES: a problem at continental scale with local modulation and multiple drivers



Climate Change Pollution Land Cover Change Biodiversity Response

Need for high-res monitoring and modelling of ecosystem processes (supporting services) that underpin Ecosystem Services



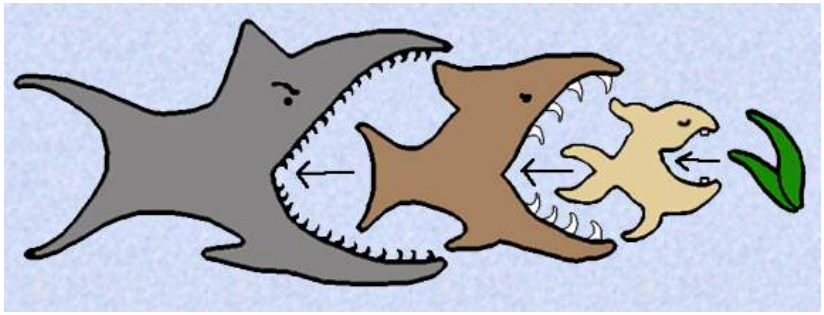
Algal bloom in the Baltic Sea
ESA, Sentinel-2 image – 10 m resolution
http://www.esa.int/spaceinimages/Images/2015/09/Eye_of_an_algal_storm

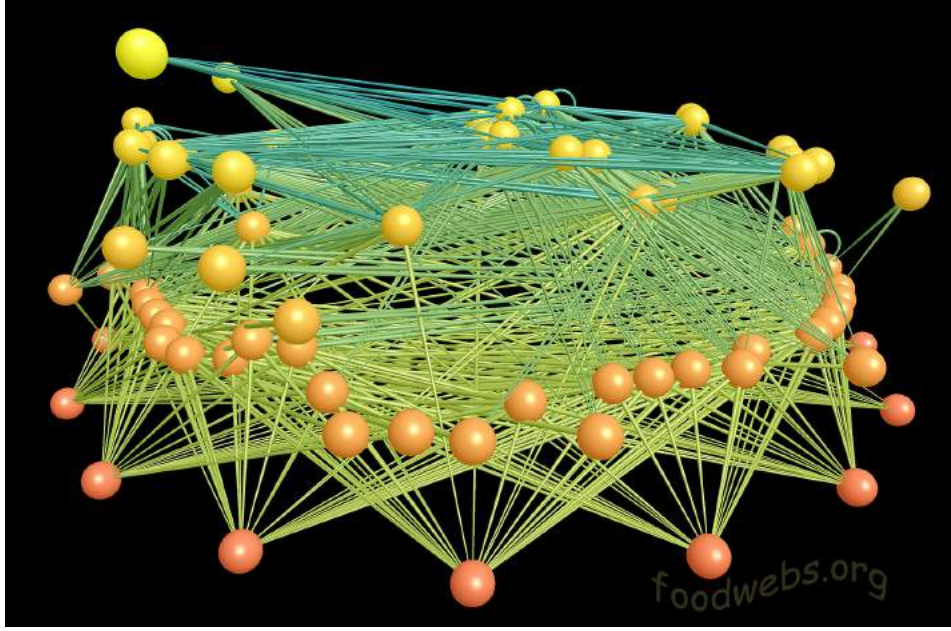
Ecosystem monitoring – LTER
Lake Leynir, Gran Paradiso National Park
2747 m a.m.s.l.

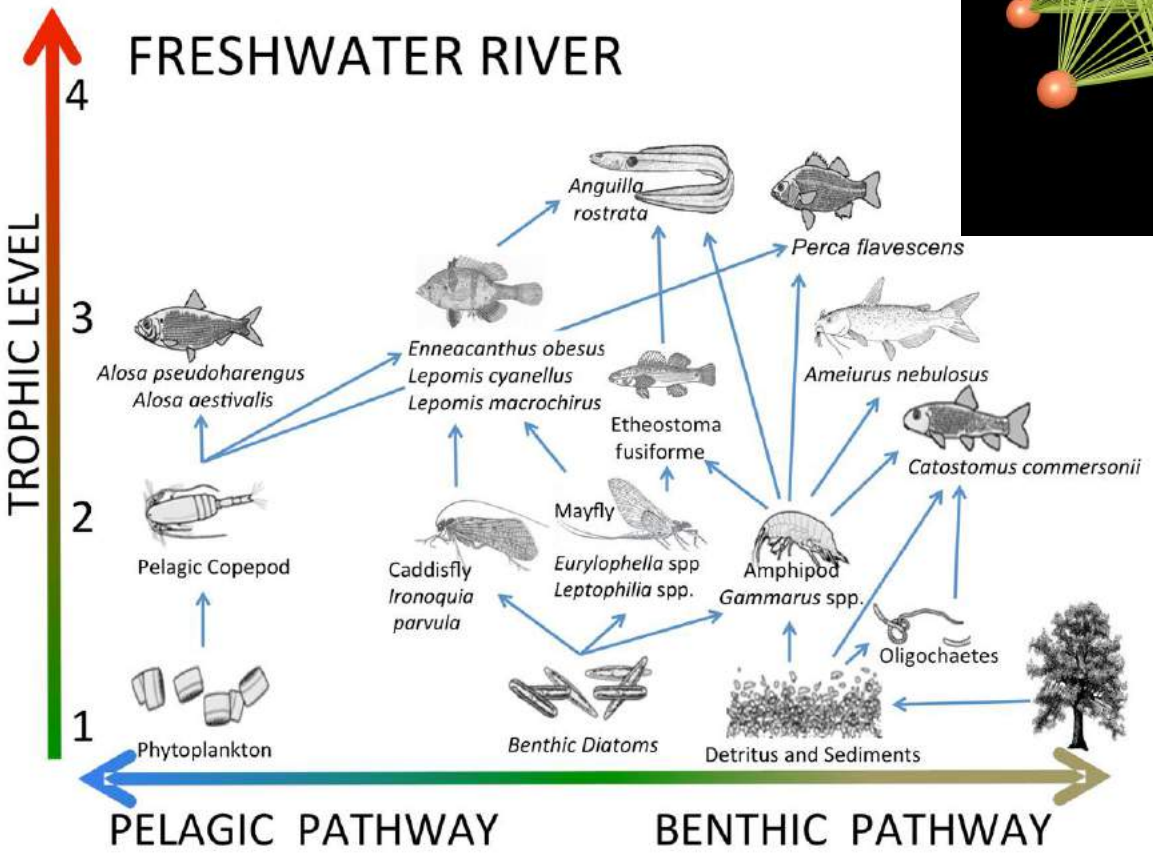
What are we doing and key outputs:

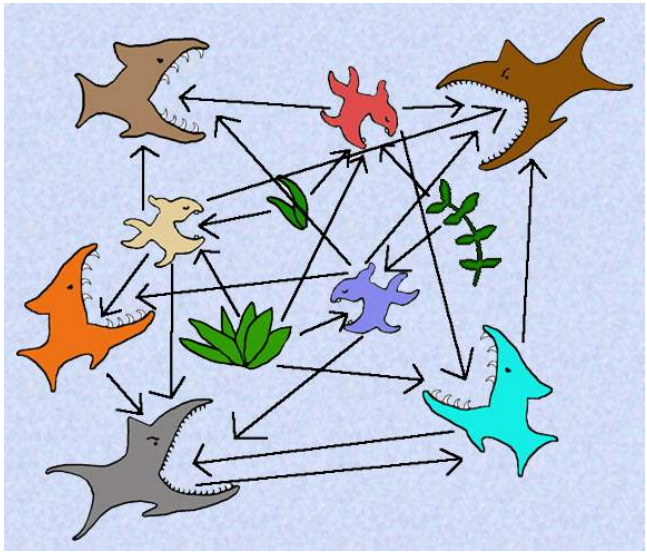
- Focus on ecosystem functions/processes that support specific ecosystem services
- Make best use of EO data (satellite and in situ)
- Build data products and make them widely available
- Build models capable of including EO data
- Assess the current state and estimate the future evolution of ecosystems (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 is an ecosystem?









Biotic components: the trophic web

Biodiversity is at the core of the biotic components of ecosystems

from D. deB. Richter and S. A. Billings,
New Phytologist, 2015

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

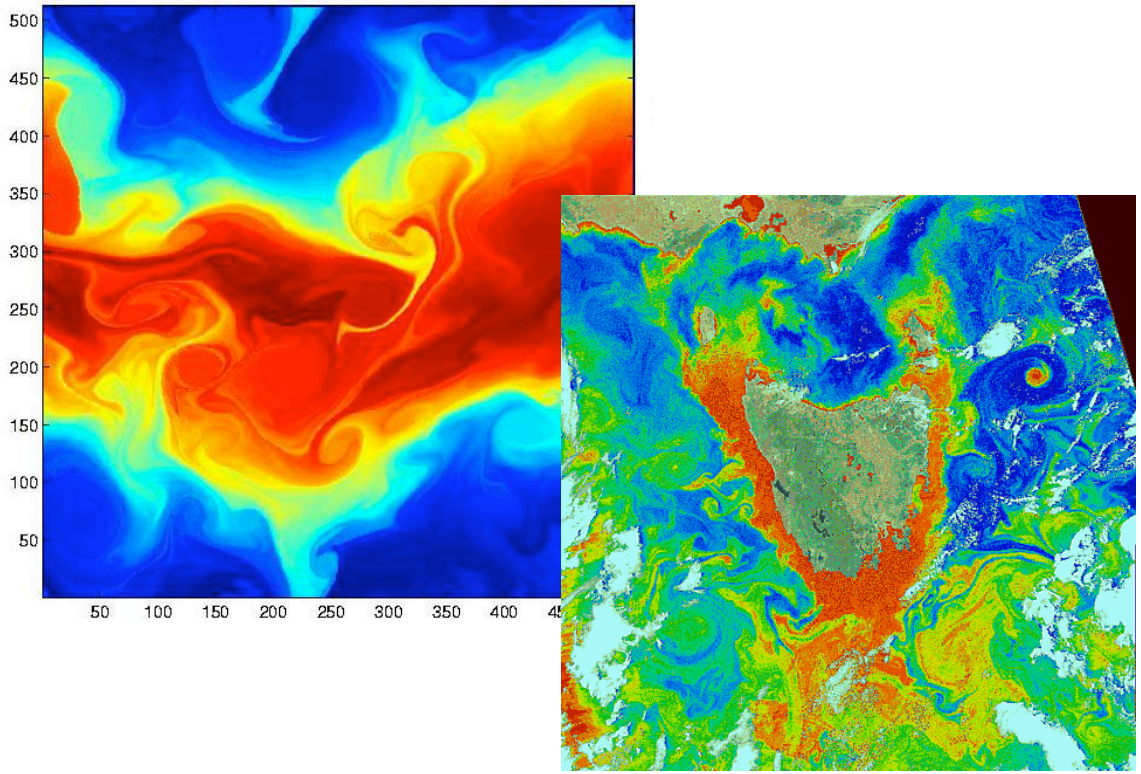
> the whole *system* (in the sense of physics), including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment of the biome – the habitat factors in the widest sense.

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 are complex adaptive systems

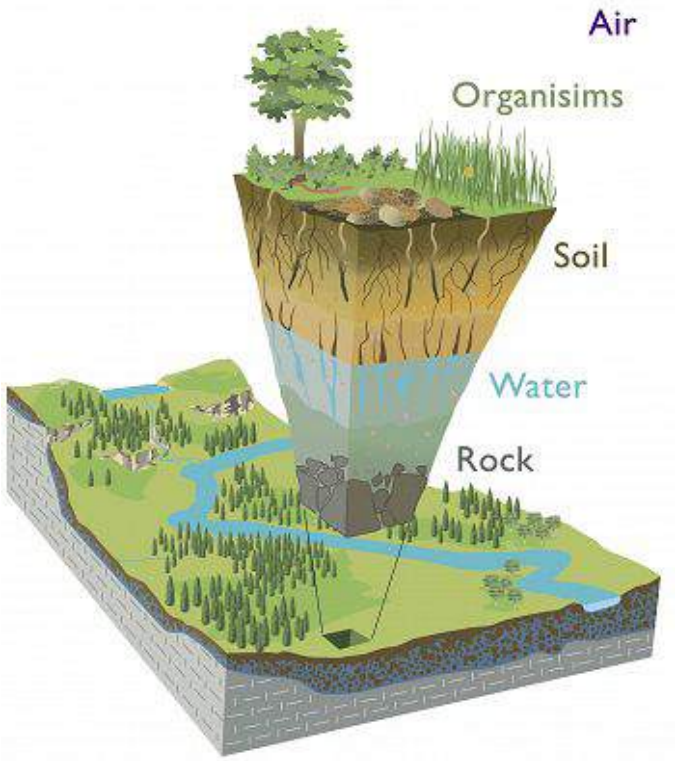
A focus on geosphere-biosphere interactions



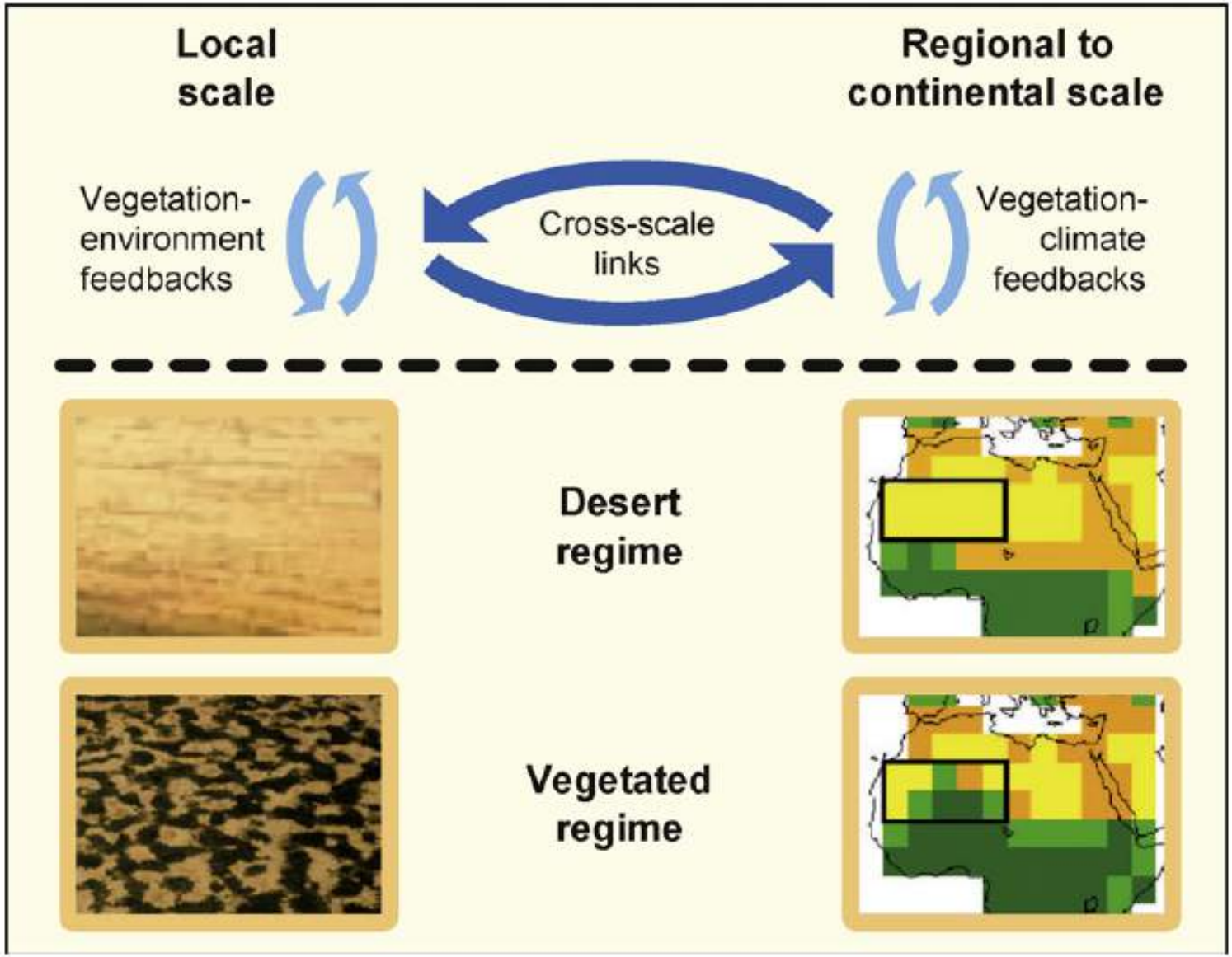
Circulation-ecosystem interactions

Biogeodynamical processes and biogeochemical cycles, fluxes and efficiencies

the **Earth's Critical Zone**

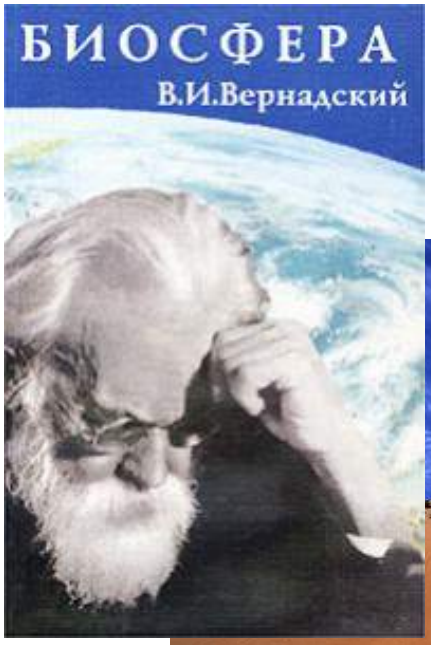


Rietkerk et al. Ecological Complexity 2011



Cross-scale interaction and scale mismatch

Two-way feedbacks between ecosystems and environment



Ecosystem engineers, niche construction, complex adaptive landscapes and global biogeochemical cycles

Crucial role of Protected Areas:

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

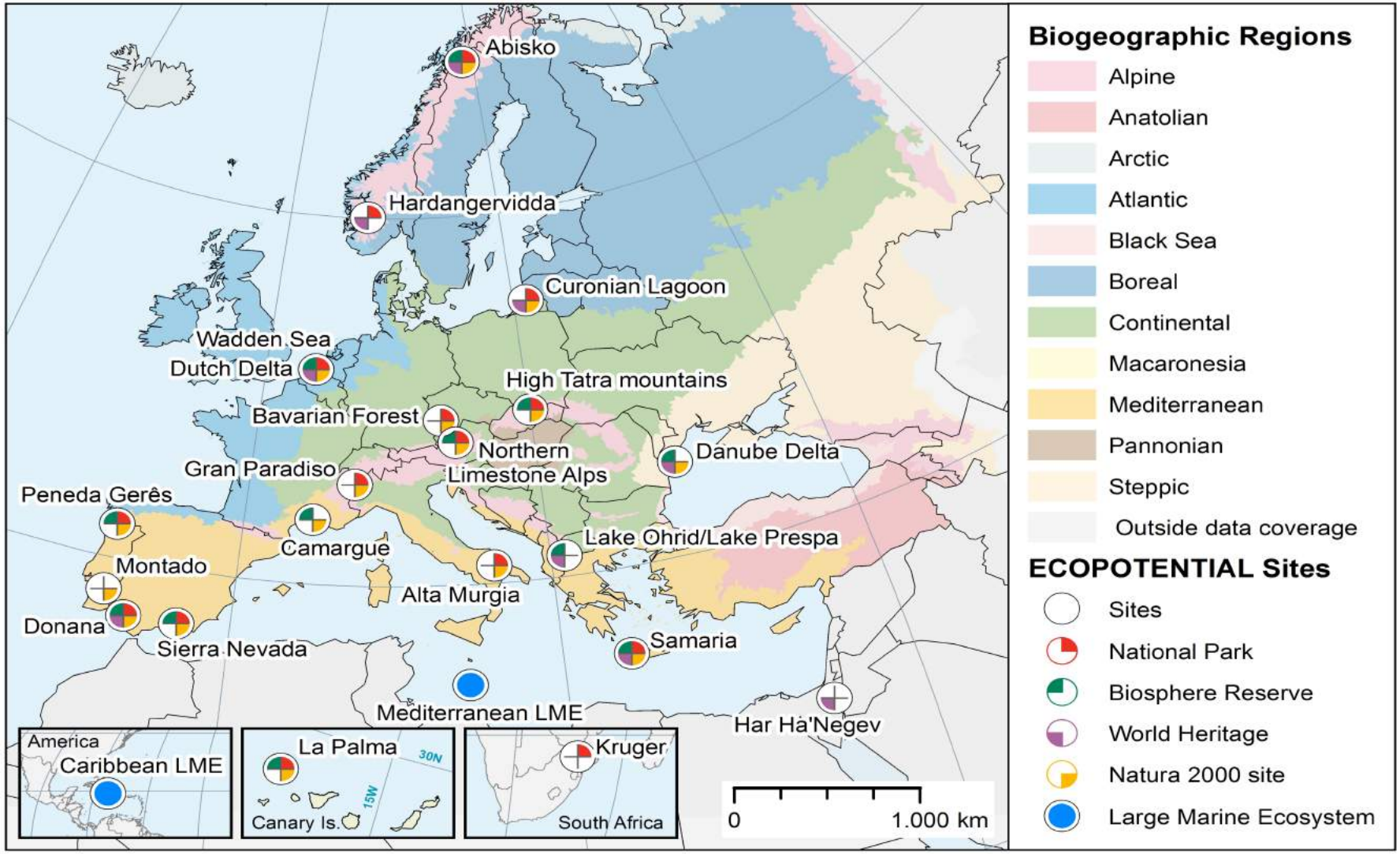
Providers of ES that are specific of weakly anthropized / natural environments

Treasure chests of biodiversity

Source / refuge areas for the surrounding environments

Areas with large amounts of quantitative data (eg, Long-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

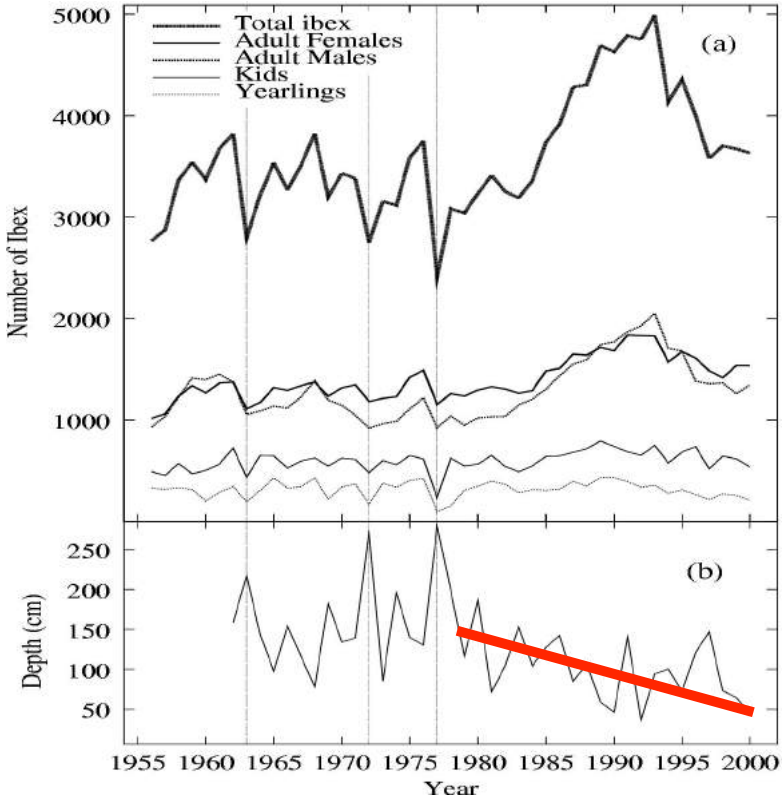
Identify indicators of the impacts on ecosystem structure, functions and services (DPSIR Impacts)

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

Example: mountain grasslands as a support system for wild and domesticated ungulates

Long-term census of ibex and chamois



Water and carbon fluxes through eddy covariance
Soil moisture and carbon content
In-situ vegetation monitoring
Remote sensing of vegetation, NDVI, snow cover
Population dynamics and vegetation modelling

Conceptual threads:

Propagation and estimate of uncertainties in future ecosystem projections

Role of changing extremes and intermittency compared with changing means

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

How are (current and future) PAs identified and selected?

A grasp on Essential Variables: essential for what questions? How many do we need? Is it useful to define Essential Ecosystem Variables? (the example of rainfall)

ALPINE SUMMER SCHOOL

www.ecopotential-project.eu Course XXIV www.to.isac.cnr.it/aosta

Cross-Scale Interactions in the Coupled Geosphere-Biosphere System

Valsavarenche (Valle d'Aosta, Italy), **15 – 24 June 2016**

Directors of the Course:

Antonello Provenzale - CNR-IGG, Italy
Carl Beierkuhnlein - University of Bayreuth, Germany

Scientific Secretary:

Ilaria Baneschi - CNR-IGG, Italy

Lecturers and Seminar Speakers:

Alberto Basset - University of Salento, Italy
Mara Baudena - Utrecht University, The Netherlands
Carl Beierkuhnlein - University of Bayreuth, Germany
Alessandro Chiarucci - University of Bologna, Italy
Francesco D'Ovidio - LOCEAN, France
Ghada El Serafy - DELTARES, The Netherlands
Elisabetta Erba - University of Milano, Italy
Klaus Fraedrich - Max-Planck-Institut für Meteorologie, Germany
Arnon Karnieli - Ben Gurion University, Israel
Tim Lenton - University of Exeter, United Kingdom
Stefano Poli - University of Milano, Italy
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Ariane Walz - University of Potsdam, Germany
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Thanks for your attention