

ECOPOTENTIAL: a framework to monitor ecosystem services in protected wetlands with remote sensing

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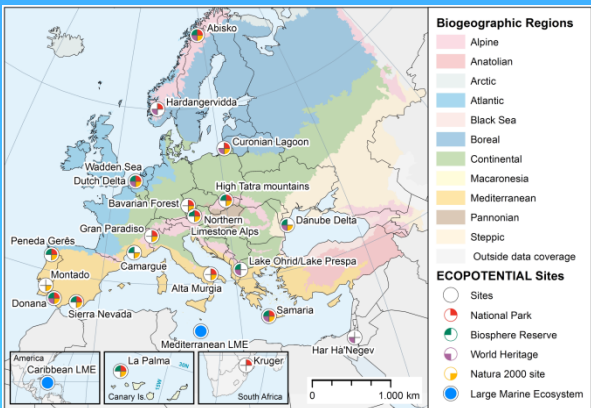
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INTRODUCTION

Terrestrial and marine ecosystems provide essential goods and services to human societies. In the last few decades, however, anthropogenic pressure has produced a loss of ecosystem services that can seriously affect human wellbeing and climate processes at a local and regional scale. In order to improve ecosystem benefits, knowledge-based conservation, management and restoration policies are urgently needed. Fundamental to all these is effective monitoring of the state and trends in ecosystem conditions and services. New monitoring methodologies are now available, combining approaches in geo- and bioscience, earth observation data, and *in situ* data.

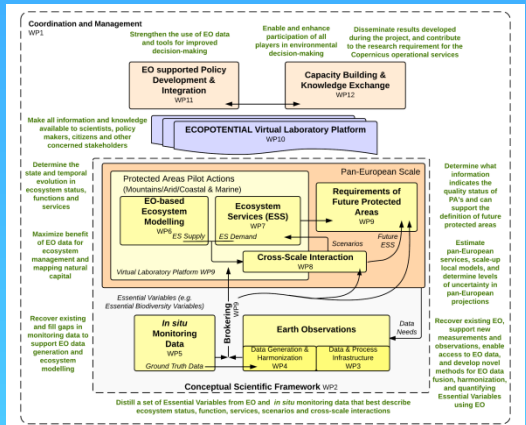
This work synthesizes the objectives and methods of the ECOPOTENTIAL project, a European Horizon 2020 project started in June 2015 (with a budget of 15 million of euros and 47 partners), which has been designed to reach achieve significant progress beyond the state of the art on ecosystem services. The project focuses its activities and pilot actions on a targeted set of internationally recognized protected areas (PA) in Europe, European Territories and beyond, over a broad range of habitats, ecosystems and landscapes, including wetlands ecosystems, among others.

STUDY AREA



Protected Areas and responsible partner	Elevation Range [m]	Köppen-Geiger climate	Key status indicators for the PA
Coastal and Marine Ecosystems			
Wadden Sea and Dutch Delta (NIOZ)	-15 - 2	Oceanic (Cfb)	Sandy tidal flat habitat; benthic biomass; bird populations.
Camargue (TdV)	-2 - 5	Hot-summer Mediterranean (Csa)	Water flows; climatic and water quality parameters; sea level; flora/ fauna abundance; changes in socio-economic and land use.
Donana (CSIC)	0 - 50	Hot-summer Medit. (Csa)	Bird populations; marsh hydroperiod; vegetation communities; endangered species populations.
Danube Delta (UB)	0 - 13	Cold semi-arid (Bsk)	Habitat cover; benthic biomass; bird populations.
Curonian Lagoon (KU)	-5 - 60	Oceanic (Cfb)	Habitat cover; bird population; maximum chlorophyll a concentrations.
LME1: Caribbean (UNESCO)	-7,500 - 0	Tropical monsoon (Am/As)	Coral cover; coral diversity; fish abundance and diversity; mangrove cover; bird populations; whale abundance and diversity.
LME2: Mediterranean (UNESCO)	-5,267 - 0	Hot-summer Medit. (Csa)	Fish abundance and diversity; habitat cover.

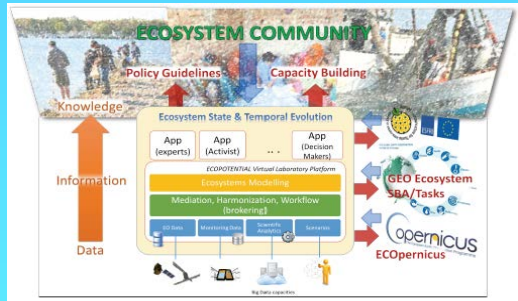
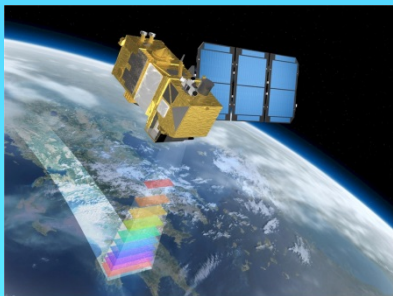
STRUCTURE



OBJECTIVES

1) Making extensive use of Earth Observation (EO) data in combination with *in situ* monitoring. Data from existing archives and new missions (in particular, Sentinel and VENμS sensors) are considered.

2) Developing an ECO system data service for COPERNICUS (ECOPERNICUS): a new open-access, smart and user-friendly geospatial data/products retrieval portal and web coverage service using a dedicated online server, will be created, coherent with the Global Earth Observation System of Systems (GEOSS) data sharing principles.



3) Creating a corpus of innovative, field-tested, peer reviewed and documented monitoring methodologies to define the ecological status of current and future protected areas, based on EO and *in situ* data.

5) Finally, estimating current and future ecosystem services and benefits, combining ecosystem functions (supply) with beneficiaries' needs (demand). Wetland ecosystems are negatively affected by the impact of human activities, leading to a loss of biodiversity, reduced abundance of species, damage to habitats and loss of ecological functions and ultimately, ecosystem services. Countering these threats is only possible through sustained monitoring and development of indicators to inform policy makers and managers.

Protected Areas and responsible partner	Major environmental pressures for the PA	Key ecosystem services currently provided by the PA
Wadden Sea and Dutch Delta (NIOZ)	Fisheries; eutrophication.	Stopover for millions of migrating birds; nursery for many fish species; sustainable tourism; coastal erosion protection.
Camargue (TdV)	Agriculture; sea level rise; water quality; increased hydroperiod of temporary marshes; peripheral urbanization; game hunting.	Food production: crops, reared animals and wild animal; pasture; irrigation water; flow maintenance; pollination and seed dispersal; nursery populations and habitats; maintenance of chemical conditions of waters; experiential use of plants, animals and land-/seascapes; importance for research and cultural heritage; spiritual.
Donana (CSIC)	Eutrophication, water extraction.	Cultivated crops (rice); reared animals; surface water for non-drinking purposes; physical use of landscape; biodiversity; climate regulation; Carbon sequestration; flood buffering; sediment and nutrient retention; wintering area for migrating birds; ecotourism, religious and spiritual services; scientific research.
Danube Delta (UBC)	Fisheries; hunting; tourism; eutrophication; water transport.	Local climate and water flow regulation; water purification; nutrient and erosion regulation; pollination; energy (biomass); fodder; livestock; fibre; timber; wood; fisheries; aquaculture; wild foods; biochemicals/medicine; freshwater; tourism; knowledge systems; religious and spiritual services; cultural/natural heritage.
Curonian Lagoon (KU)	Eutrophication; fisheries.	Provision services of fishery and reed harvesting; stopover for millions of migrating birds; nursery for many fish species; sustainable tourism; cultural heritage & diversity; flood protection; nutrient regulation (denitrification); climate regulation (Carbon sequestration).
LME1: Caribbean (UNESCO)	Habitat loss by ecosystem conversion; overfishing; sewage; nitrification; oil pollution; sedimentation; ocean acidification; sea temperature rise.	Provisioning services from fisheries; shoreline protection; tourism and recreation; charismatic species (e.g. whales); Carbon sequestration (mangroves and seagrasses).
LME2: Mediterranean (UNESCO)	Overfishing; eutrophication; invasive marine alien species.	Provisioning services from fisheries; shoreline protection; tourism and recreation; charismatic species (e.g. whales); Carbon sequestration (salt marshes and seagrasses).

4) Developing a conceptual framework guiding the integration of data, models and scenarios towards a new vision of ecosystem structure, change and services. This objective includes the concept of Essential Biodiversity Variables (EBV), EO (Ocean), ECV (Climate) and defines an overarching EV approach combining these with new EWV (Water), EGV (Geo) and ESEVs (Social and Environmental), as well as the crucial issue of cross-scale interactions in the framework of Macrosystems Ecology.

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



In short, ECOPOTENTIAL will address the data-to-information-to-decision-making process for ecosystem services, making significant progress beyond the state of the art, using novel approaches of Earth System and Natural Sciences.

