ECOPOTENTIAL: Improving future ecosystem benefits through Earth Observations

Antonello Provenzale – IGG-CNR
Palma Blonda- – IIA-CNR
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Carmela Marangi – IAC-CNR

47 partners, 2015-2019

Coordination: CNR

www.ecopotential-project.eu

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ECOPOTENTIAL in a nutshell:

Make best use of Earth Observations to characterize the state and changes of ecosystems and improve management and conservation in Protected Areas and beyond

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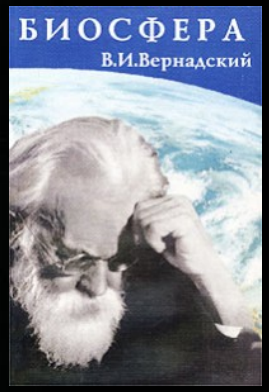
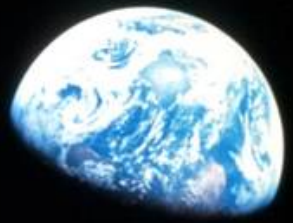
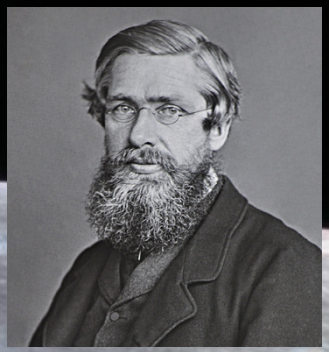
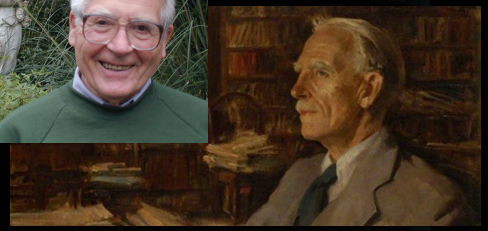
Ecosystems as an integrating concept: “one physical system” with their environment







Planet Earth as “One Grand Organic Whole”



“Earthrise”, Apollo 8, 24 December 1968, photo B. Anders, NASA

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Integration between Remote Sensing and field measurements

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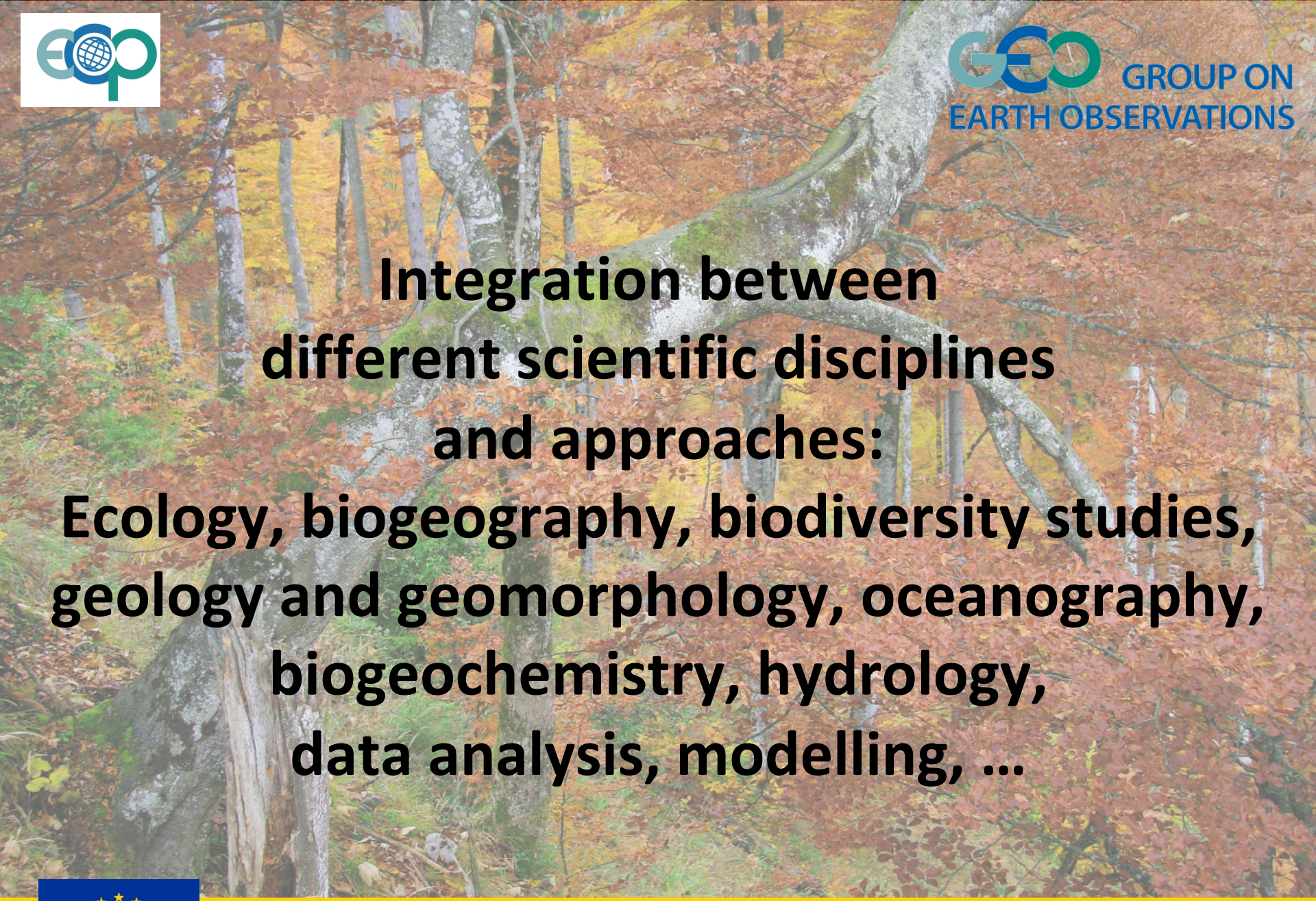

Integration between different scientific disciplines and approaches: Ecology, biogeography, biodiversity studies, geology and geomorphology, oceanography, biogeochemistry, hydrology, data analysis, modelling, …

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GROUP ON EARTH OBSERVATIONS

Integration of scientists views with PA staff needs

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Integration between different programmes and initiatives: GEO ECO, GEO GNOME, GEO BON, EuroGEOSS, eLTER, LifeWatch

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ECOPOTENTIAL

Working in partnership with Protected Areas in Europe and beyond

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This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641762

ECOPOTENTIAL

LTER

This project is funded by the European Union

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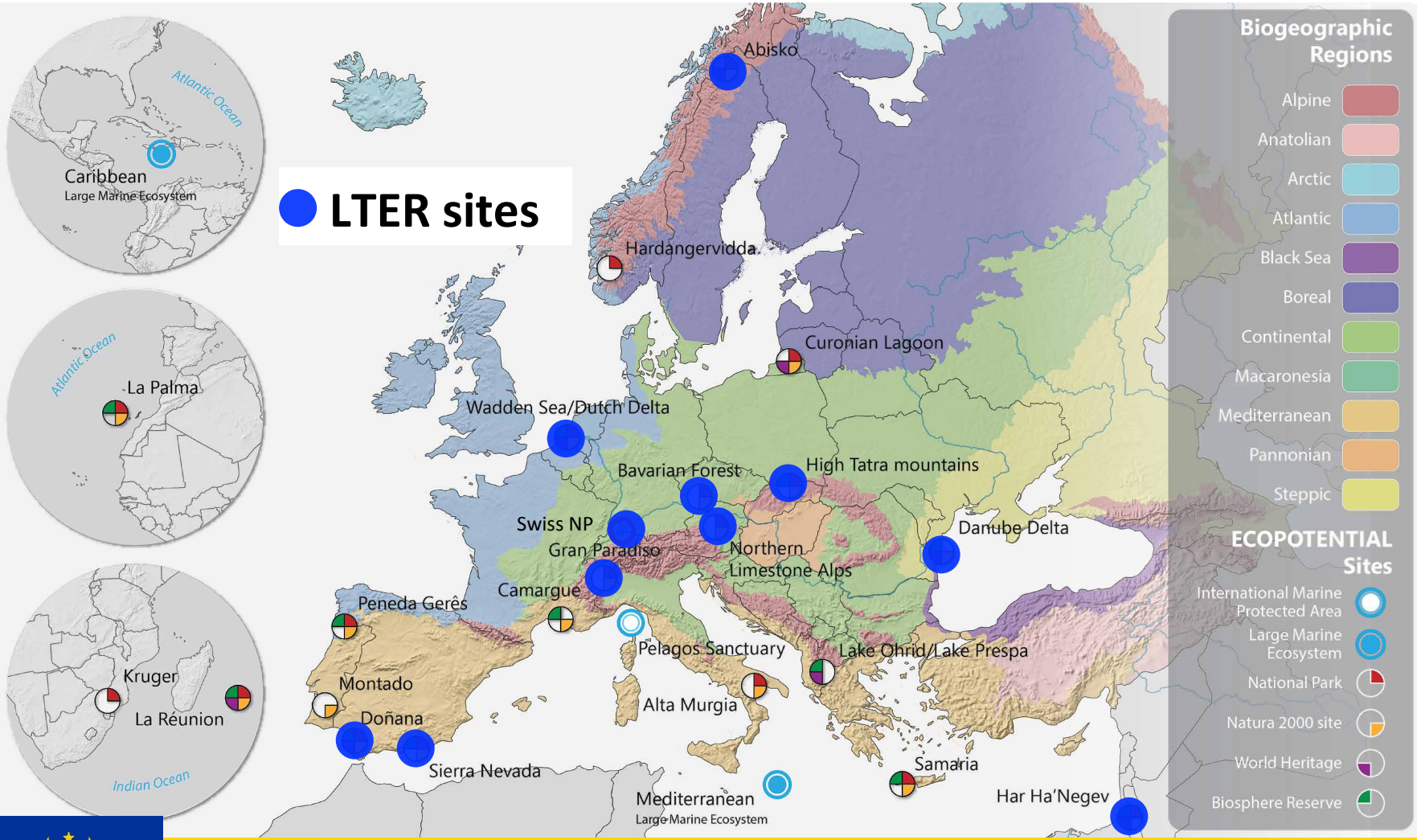
Working in partnership with Protected Areas in Europe and beyond



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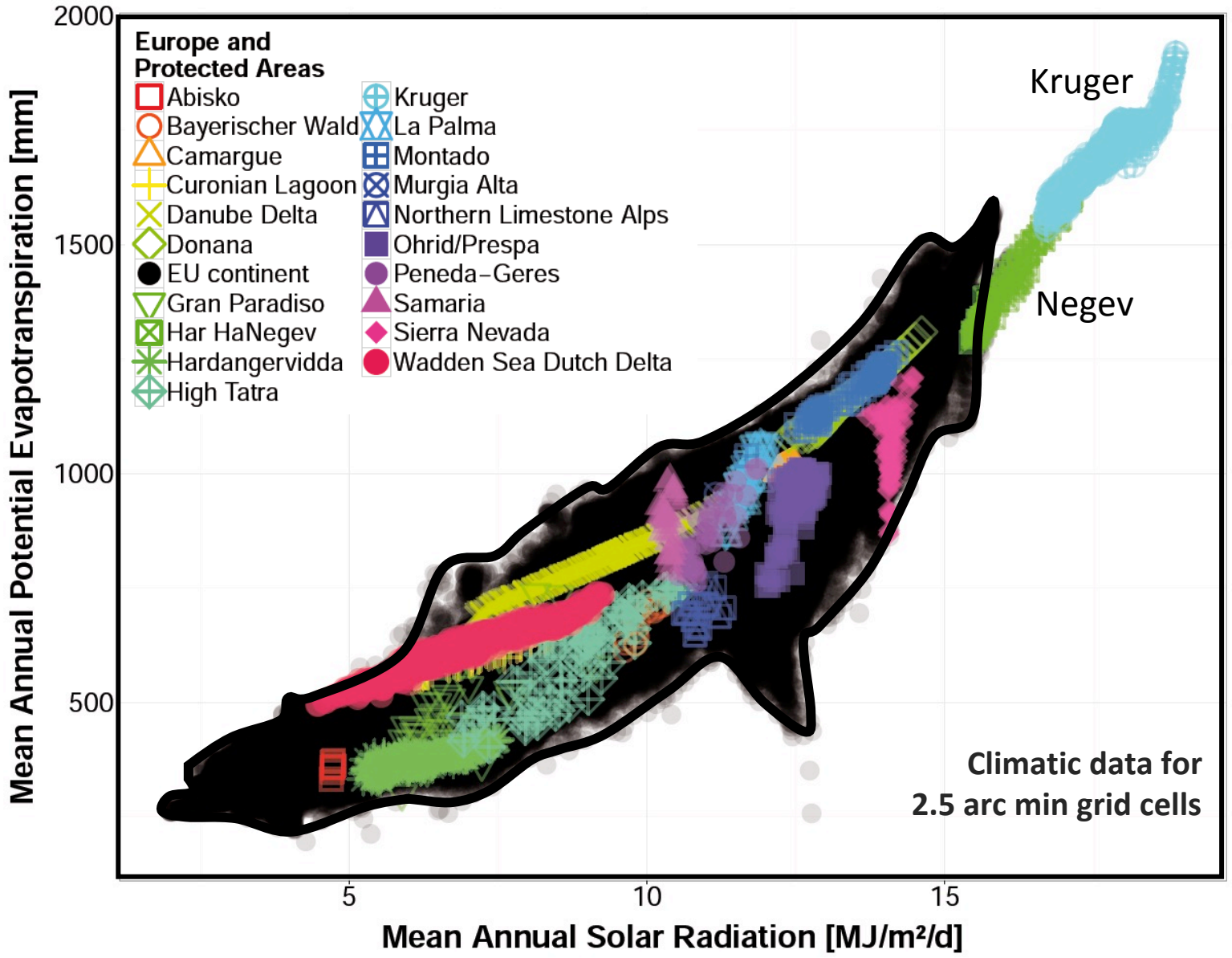
ECOPOTENTIAL PAs and climate

Hoffmann et al, 2017, 2018



What do we study in the ECOPOTENTIAL Protected Areas:

Current state of Protected Areas from Remote Sensing and field data

Ongoing and future changes in the ecosystems and the environment

Narratives related to Protected Area needs: The Storylines

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641762

Integrated approach with PA Staff:
The ECOPOTENTIAL storylines

- **An example of co-design by part of scientists and PA staff**
- **Focus on given Protected Area(s) and identify the main Ecosystem Services of interest and the functions/processes supporting them, the threats and the conservation/management issues.**
- **Co-design a strategy to address the issues, identify the data needed to provide the required information, the models, and consider the policy implications.**
- **Cross-WP threads and the circulatory system of the project**

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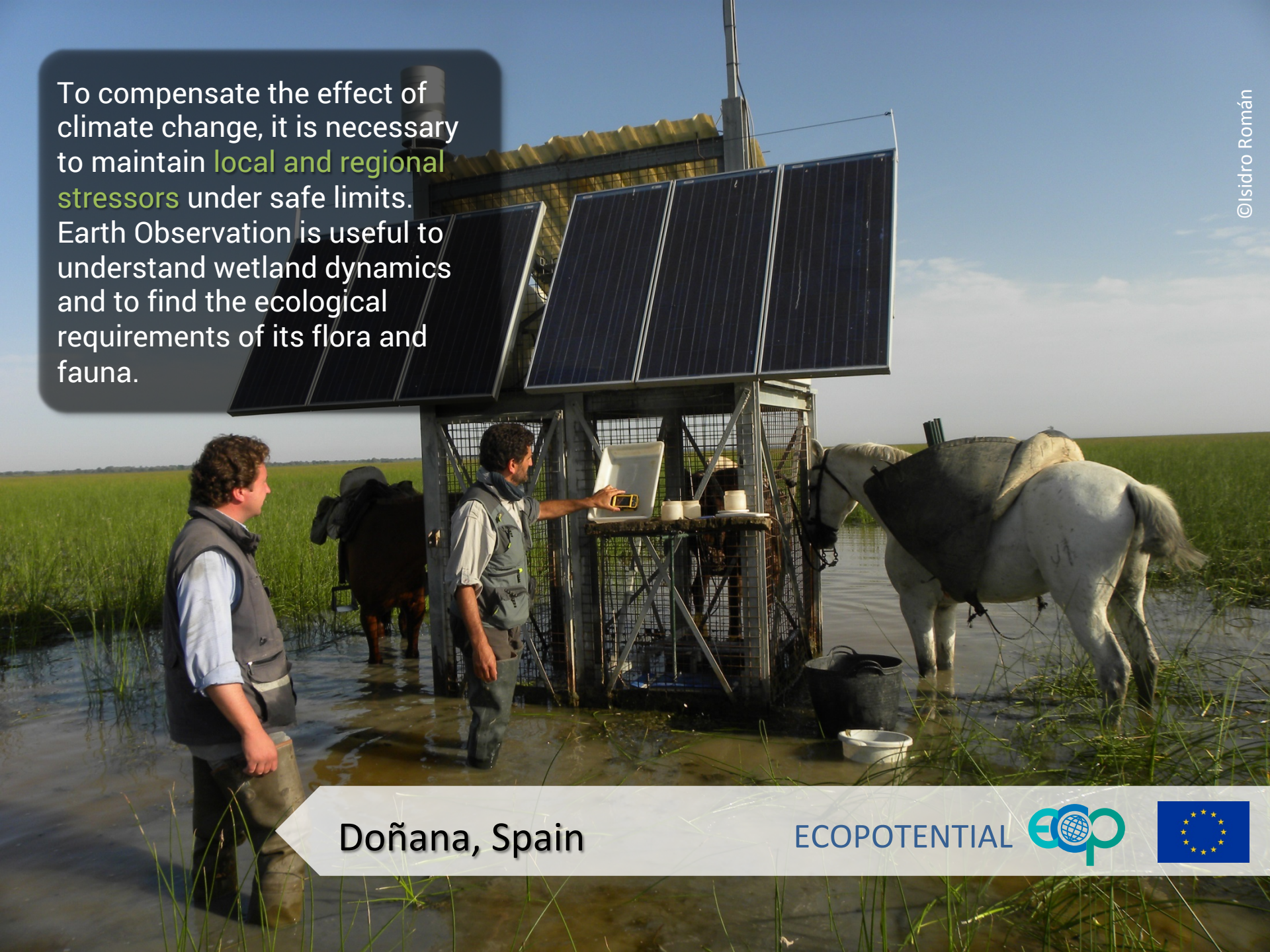
The Doñana National Park was established in the 1960's for the protection of waterbirds.
©Rubén Rodríguez-Olivares
Doñana, Spain
ECOPOTENTIAL

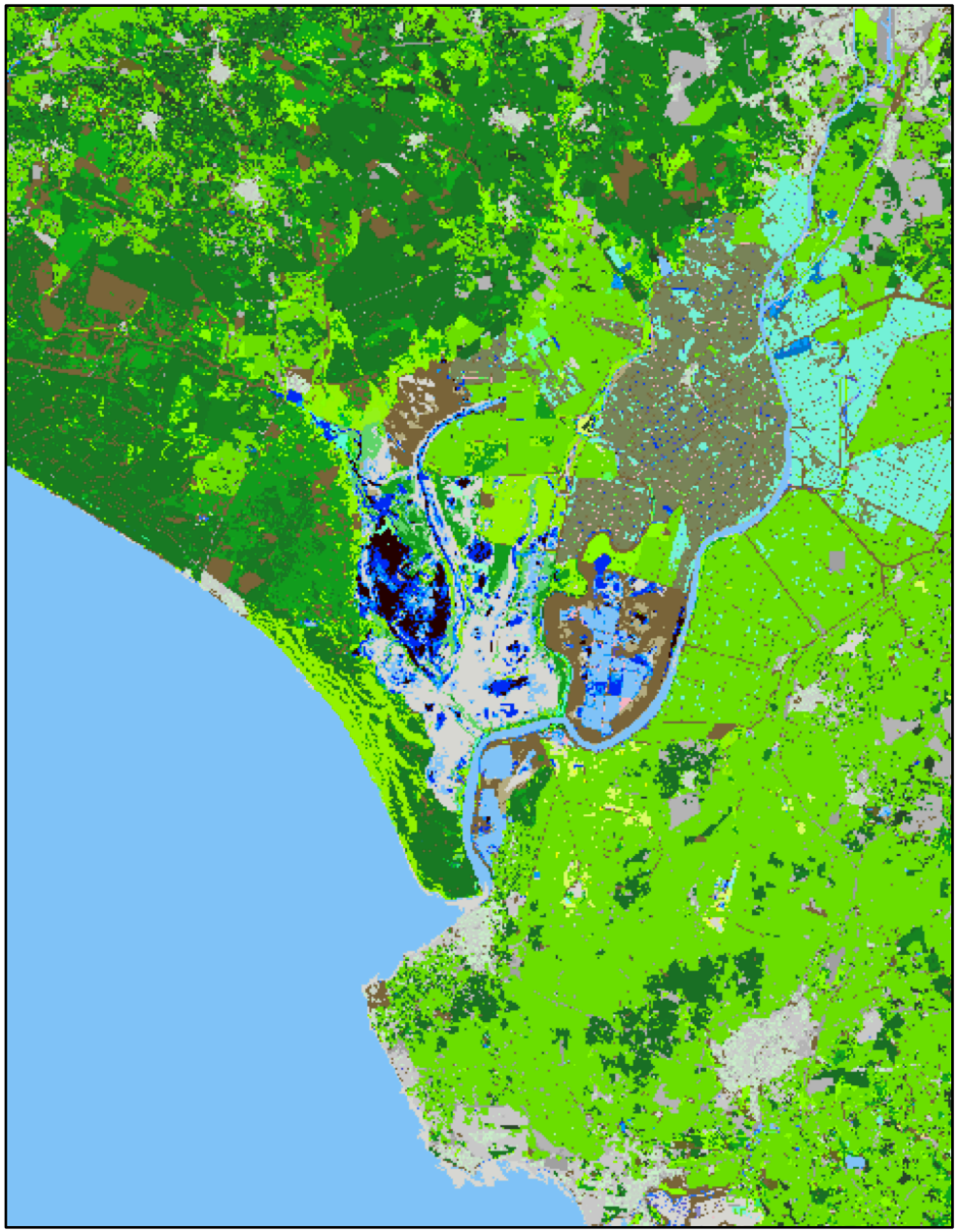

Global (climate change), regional (water extraction, eutrophication) and local (modification of hydrological and grazing regimes) stressors could act in synergy and can push the ecosystem to undesirable states.
Doñana, Spain
ECOPOTENTIAL


To compensate the effect of climate change, it is necessary to maintain local and regional stressors under safe limits. Earth Observation is useful to understand wetland dynamics and to find the ecological requirements of its flora and fauna.
©Isidro Román
Doñana, Spain
ECOPOTENTIAL

OVERVIEW OF CHANGES IN PROTECTED AREAS

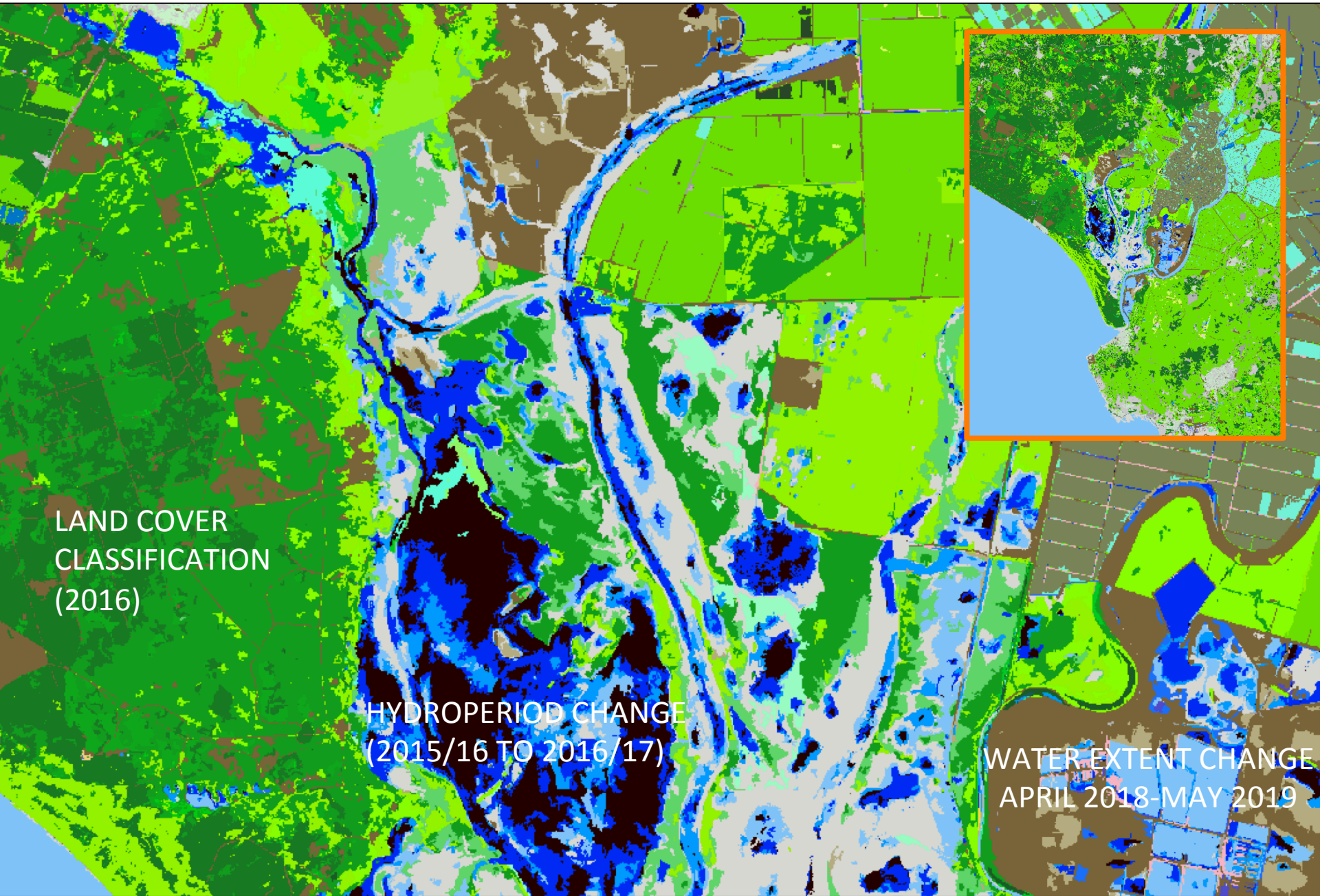
- Changes in protected areas
  - Spatial scales and temporal frequencies
- Analysis of dense time series of satellite sensor data.
  - Detecting change events and processes
- Cross Correlation Analysis
  - Detecting change from existing Copernicus Services.
- The Earth Observation Data for Ecosystem Monitoring (EODESM) and Virtual Laboratory
  - Comparison of land cover classes and environmental variables over variable time-separated periods
  - Evidence-based change detection and description.
- Data mining for land cover and change classification

Richard Lucas + Ioannis Manakos



Multi-temporal and multi-scale classifications
Donãna NP, Spain

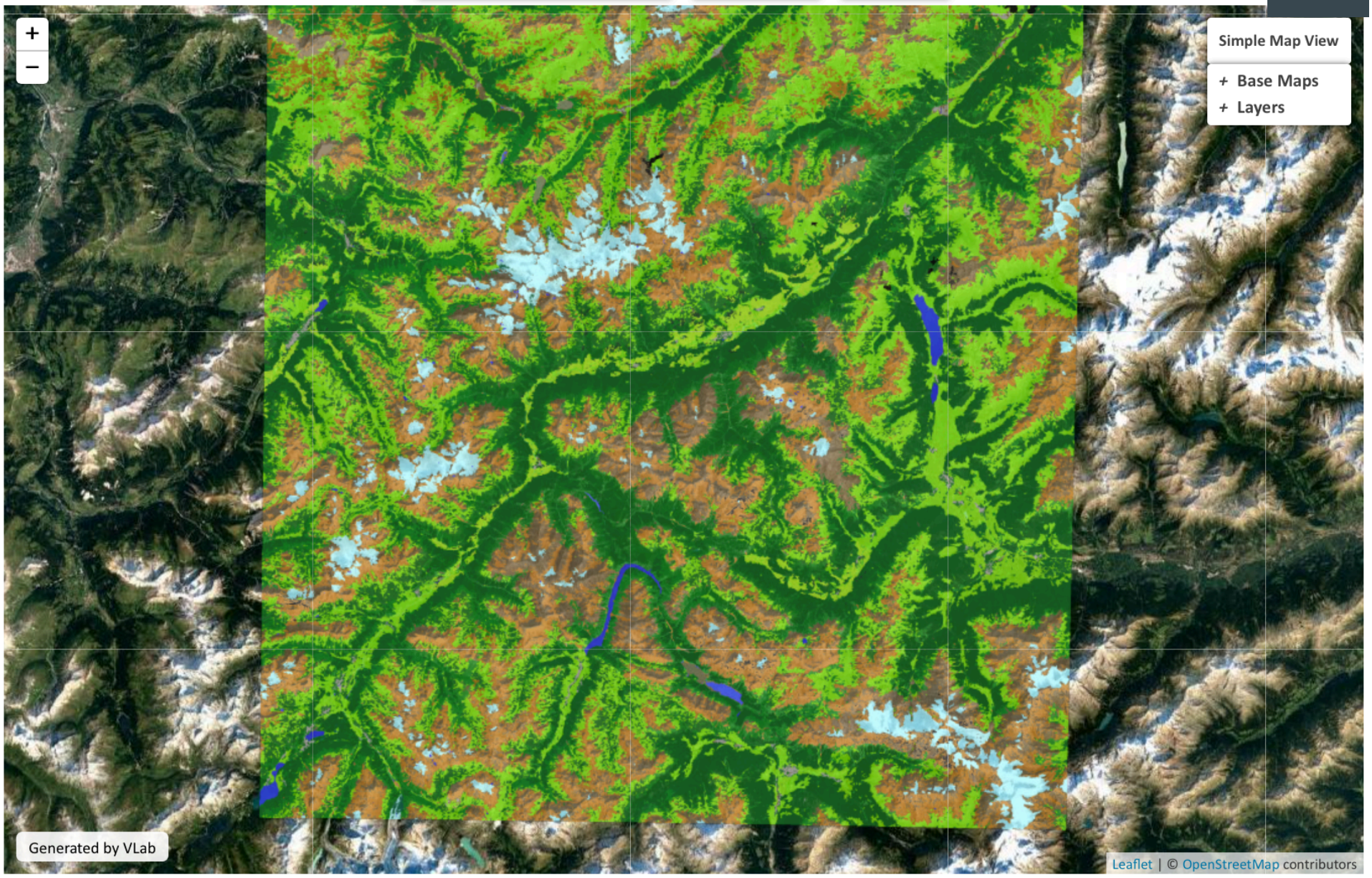
COMPREHENSIVE DETECTION OF CHANGE OVER MULTIPLE TIME SERIES: EXAMPLE FROM DONANA NATIONAL PARK, SPAIN, USING SENTINEL-2



THE EARTH OBSERVATION DATA FOR ECOSYSTEM MONITORING (EODESM) AND THE VIRTUAL LAB

Show Output (available after processing completed successfully)

RASTER ATTRIBUTE TABLE | SHAPE/TEXT | HIDE



Estimating Invasion Success by Non-Native Trees in a National Park Combining WorldView-2 Very High Resolution Satellite Data and Species Distribution Models (Diversity)

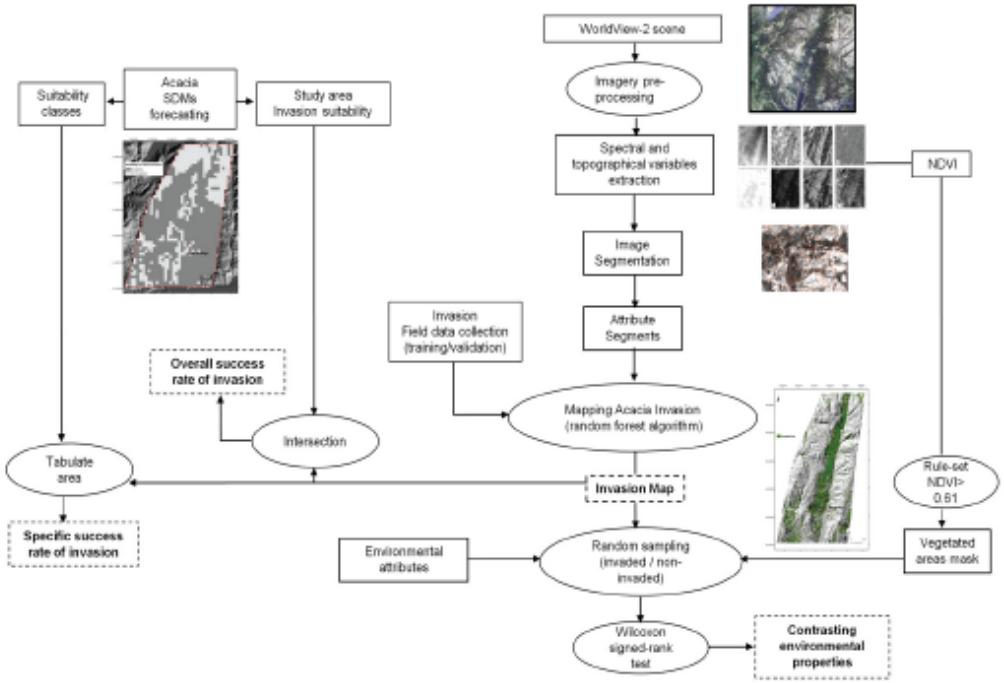
diversity

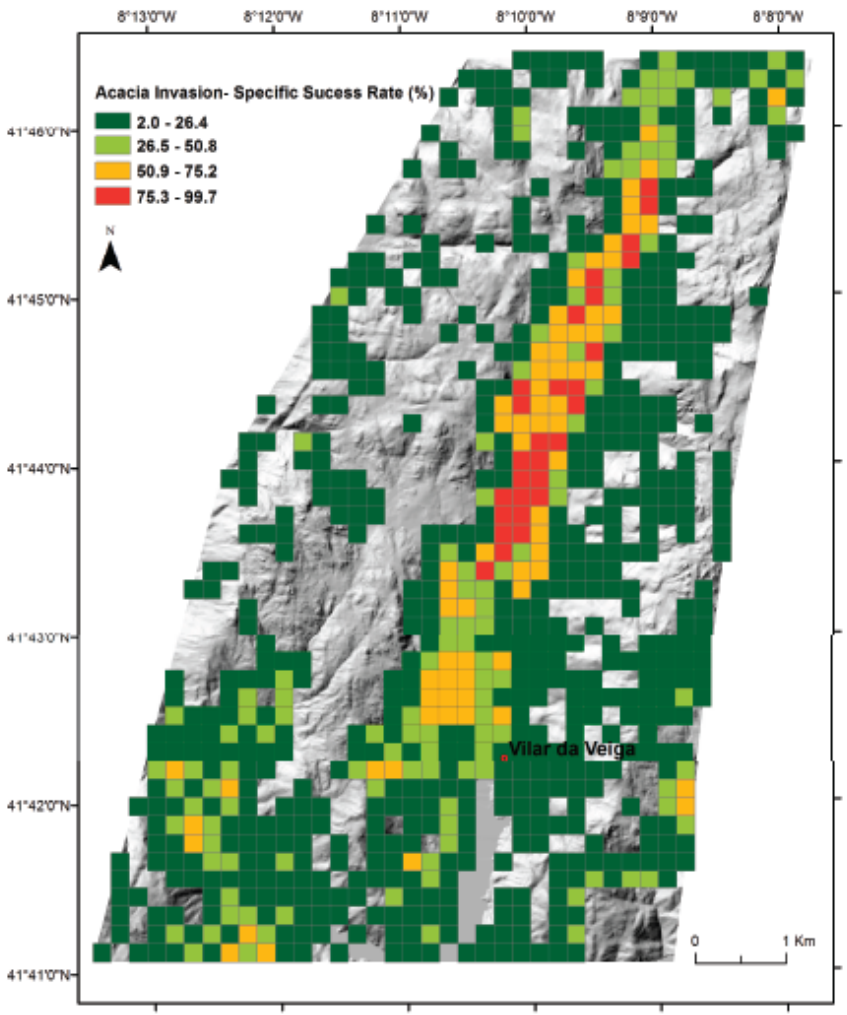
MDPI

Article

Estimating Invasion Success by Non-Native Trees in a National Park Combining WorldView-2 Very High Resolution Satellite Data and Species Distribution Models

Antonio T. Monteiro [1,*], João Gonçalves [1], Rui F. Fernandes [2], Susana Alves [3], Bruno Marcos [1], Richard Lucas [4], Ana Claúdia Teodoro [3,5] and João P. Honrado [1]





Claudia Carvalho

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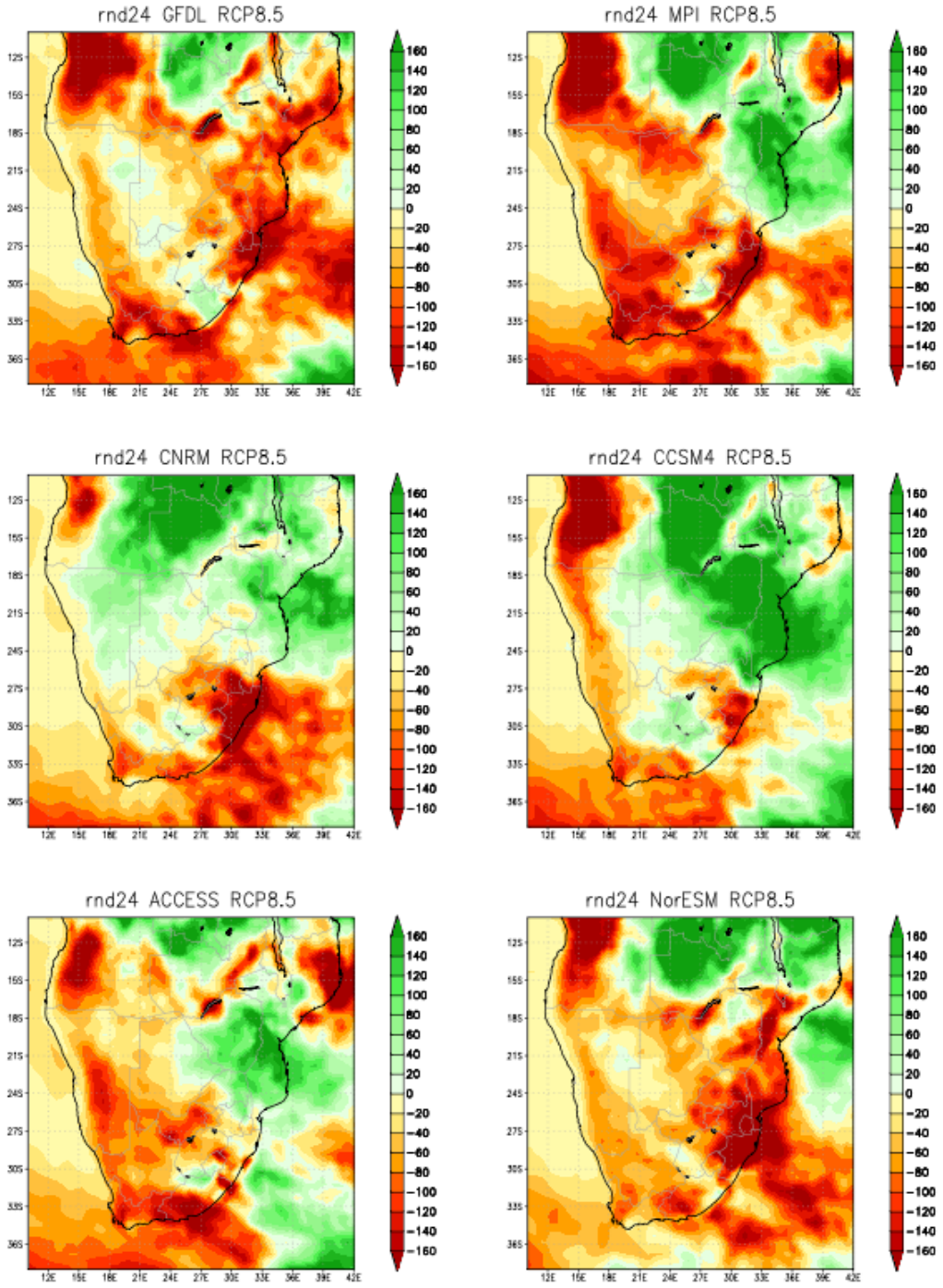
GA – Matalascañas, Spain
18-22 June 2018



Projections of changing annual rainfall over southern Africa for the period 2070-2099 relative to 1961-1990

CSIR-CHPC

Abel Ramoelo et al.

Spatial-temporal dynamics of savanna ecosystems in and around Kruger National Park (A. Ramoelo et al, CSIR)

SoE	Indicator	Method [reference] (type)*
Distribution of grazing and browsing resources in the semi-arid environments	amount of grass per unit area (biomass)	empirical techniques [Ramoelo et al. 2015] (M)
	percentage of nutrients in dry matter (leaf N (%))	empirical techniques [Ramoelo et al. 2012; 2015] (M)
	percentage of tree cover per unit area (%)	field, LiDAR and SAR empirical techniques [Mathieu et al. 2013, Naidoo et al. 2014, Urbazaev et al. 2015] (M)
	above ground woody biomass per unit area (ha) & woody volume as biomass proxy	field, LiDAR and SAR empirical techniques [Mathieu et al. 2013, Naidoo et al. 2014] (M)

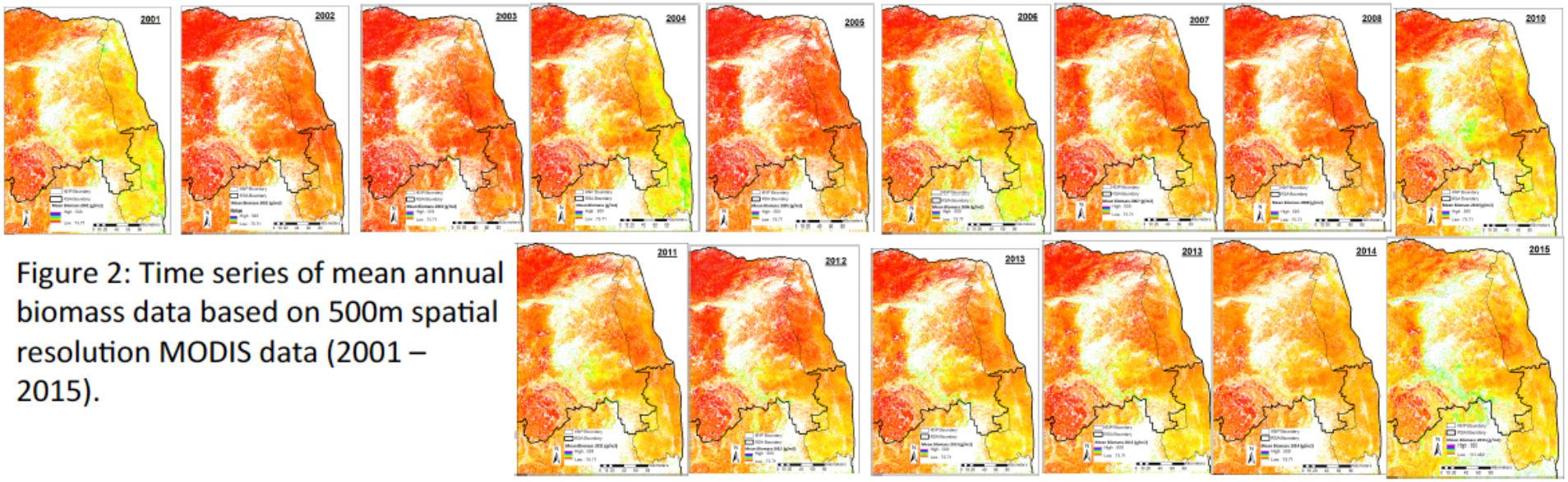


Figure 2: Time series of mean annual biomass data based on 500m spatial resolution MODIS data (2001 – 2015).

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A list of storylines and their results

Storyline	Title	PA	Presentations at	Publications
M1	Dynamics of high-altitude environments as a life-support system to wild herbivores: carbon and moisture cycling, biodiversity and landscape modification	Gran Paradiso	3 presentations; 2 posters	2 (1 submitted, 1 in preparation)
M1	Dynamics of high-altitude environments as a life-support system to wild herbivores: carbon and moisture cycling, biodiversity and landscape modification	Hardangervidda	2 presentations; 1 poster	2 (1 in preparation, 1 published in 2017)
M2	Managing mountain forests undergoing changing disease / disturbance dynamics	Kalkalpen National Park	6 presentations	6 (2 published in 2017, 1 published in 2018, 2 in preparation)
M3	Interaction between climate change driven bark beetle outbreaks	Bavarian Forest	No	No
M4	Mountain biodiversity as a sentinel of environmental change	Gran Paradiso	3 presentations	3 papers in preparation
M5	Ecosystem services and biodiversity crisis across mountain lakes	Ohrid/Prespa	3 presentations; 2 posters	2 (1 published in 2017, 1 in preparation)
M6	Comparing ecosystem services provided by protected areas with non-protected areas in mountainous areas of Europe using EO	Swiss National Park, Landschaft Davos	1 presentation	1 submitted
M7	Vegetation Dynamics as a Proxy of Socio-ecological Transitions and Future Societal Benefits in Mountain Pas	Peneda-Gerês	5 presentations	10 (4 published in 2017, 2 submitted, 4 in preparation)
M9	Temporal evolution of ecosystem services in Sierra Nevada	Sierra Nevada	1 poster	4 in preparation
M12	Mountain biodiversity as a sentinel of environmental change	Samaria	1 presentation	1 in preparation

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A list of storylines and their results

Storyline	Title	PA	Presentations at conferences	Publications
O1	Improving coastal lagoon benefits under multiple pressures	Wadden Sea	10 presentations	6 (2 published in 2017; 2 under review; 2 in preparation)
O2	Ecosystem services provided by cetaceans in the Mediterranean	Mediterranean LME (PELAGOS)	1 presentation	1 published in 2017
O3	Conserving dynamic wetlands under combined global, regional and local stressors	Doñana		
O4	The impact of aquatic ecosystems provisioning services on tourism	Danube Delta	3 presentations	7 papers published, 1 submitted
O5	Evolution of wetland functions and services in the Camargue	Camargue	6 presentations	2 (1 published in 2017, 1 accepted)
O7	Invasive species impacting the functioning and services of island protected areas through losses of endemic species	La Palma	2 presentations	5 (2 published in 2017; 1 under review; 2 in preparation)
A1	Impact of residential settlements on the life supporting capacity of Har HaNegev arid environment	Har HaNegev	5 presentations	5 (4 in preparation, 1 submitted)
A2	Spatial-temporal dynamics of savanna ecosystems in and around Kruger National Park	Kruger	8 presentations, 2 posters	2 (1 published in 2017, 1 in 2018)
A4	Mediterranean wood-pasture for people and nature	Alentejo Natura 2000 sites	no	submitted

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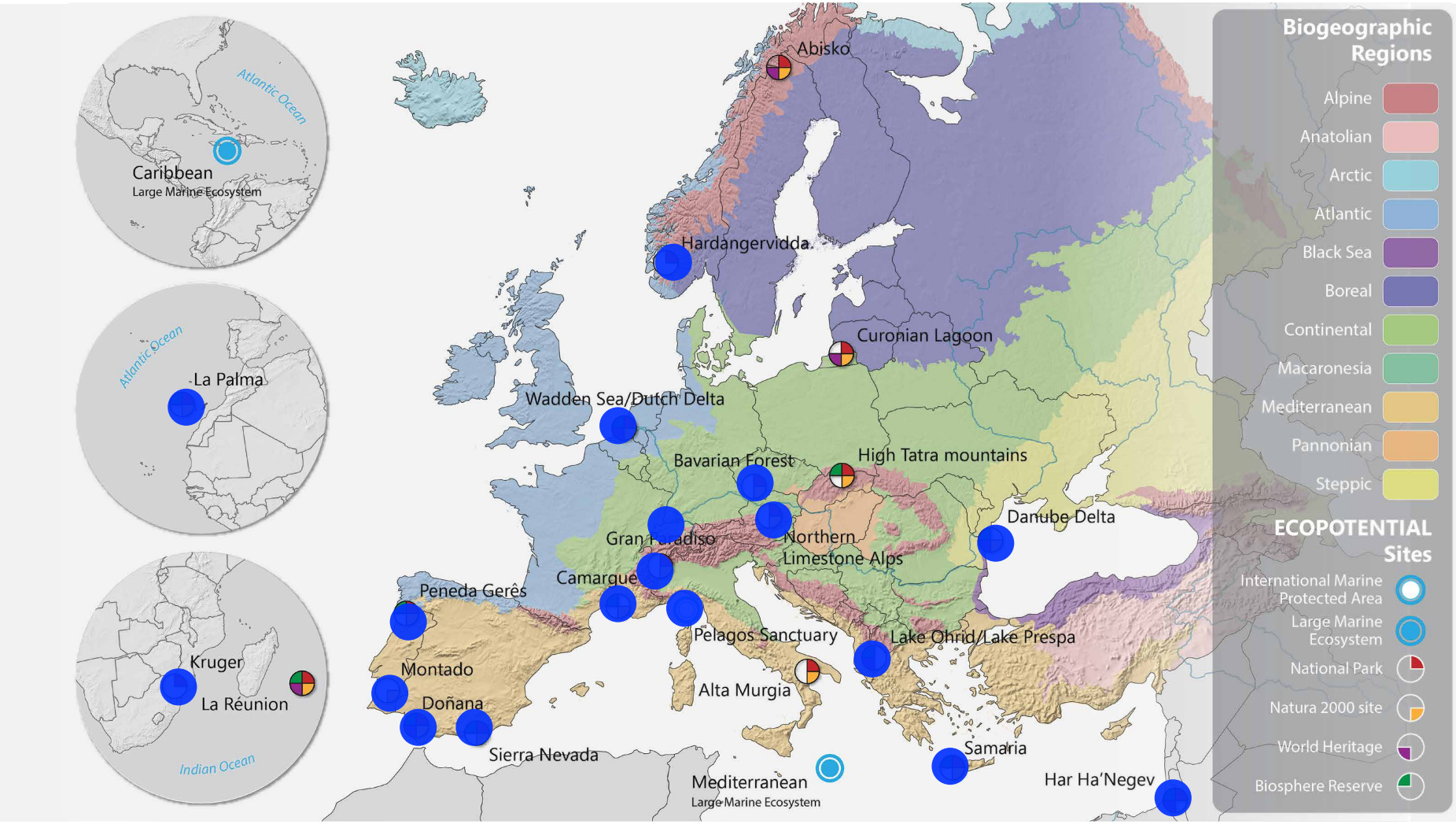
The PAs involved in the Storylines



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The ECOPOTENTIAL Community of Practice:

A community of information and data users and producers whose role changes depending upon context and works towards common goals

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GEO GROUP ON EARTH OBSERVATIONS

- Questionnaires to PA staff mediated by partners, 2015-2016
- Co-design of Storylines, 2015-2016
- First PA Pisa meeting, May 2017
- Intensive interviews with PA staff, 2017
- Pisa Training Week, February 2018
- GPNP EODESM training course, September 2018

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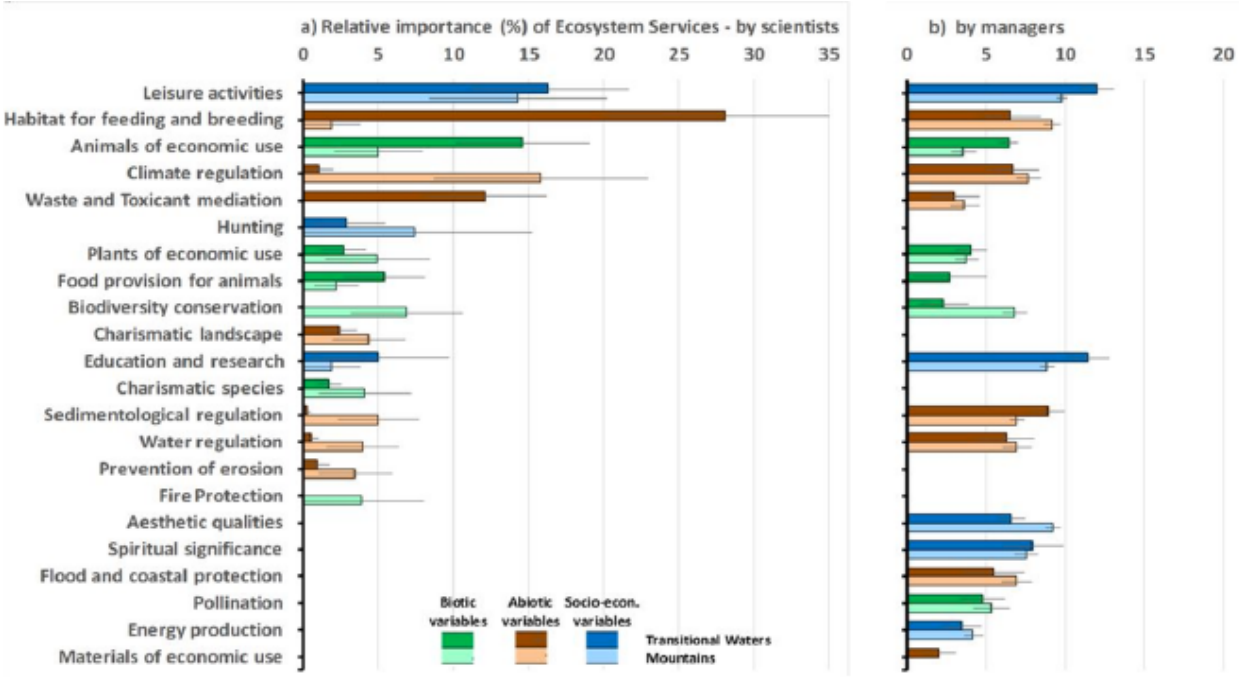
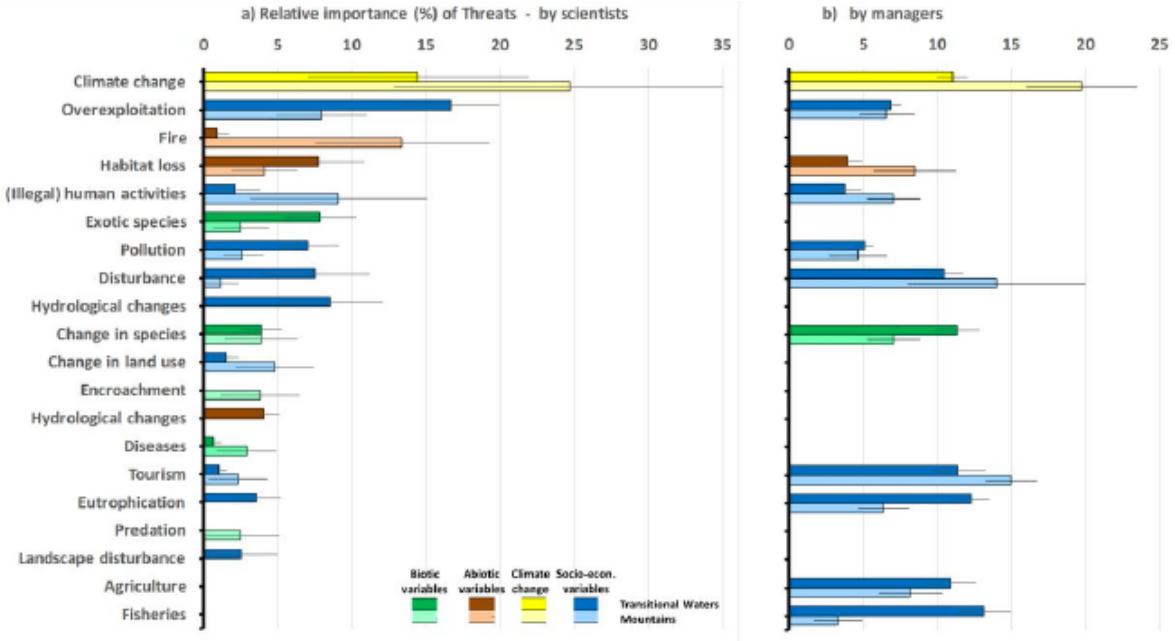
Scientists and PA staff: harmonize perspectives?





Ecosystem services in European protected areas: Ambiguity in the views of scientists and managers?

Christiaan Hummel[1,2]*, Antonello Provenzale[3], Jaap van der Meer[2,4], Sander Wijnhoven[5], Arno Nolte[6], Dimitris Poursanidis[7], Guyonne Janss[8], Matthias Jurek[9], Magnus Andresen[9], Brigitte Poulin[10], Johannes Kobler[11], Carl Beierkuhnlein[12], João Honrado[13], Arturas Razinkovas[14], Ana Stritih[15], Tessa Bargmann[16], Alex Ziemba[6], Francisco Bonet-García[17], Mihai Cristian Adamescu[18], Gerard Janssen[19], Herman Hummel[1]

Citizen science in ECOPOTENTIAL

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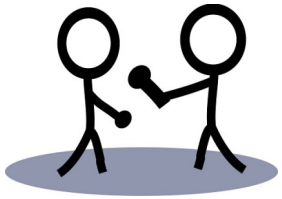
A 3-steps approach to cultural ecosystem services

Focus group (spring 2018)

Hotspots and drivers of cultural ecosystem services

Modelling (on-going)

Field survey (summer 2018)



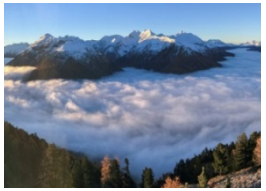
Maps of biophysical indicators / landscape features

Getting visitors' perspectives on attractive locations and landscape attributes

➔ **A focus on three mountain national parks**

Peneda-Geres National Park (Portugal)

Swiss National Park (Switzerland)



Kalkalpen National Park (Austria)

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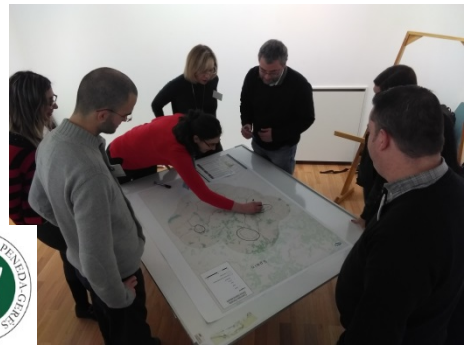
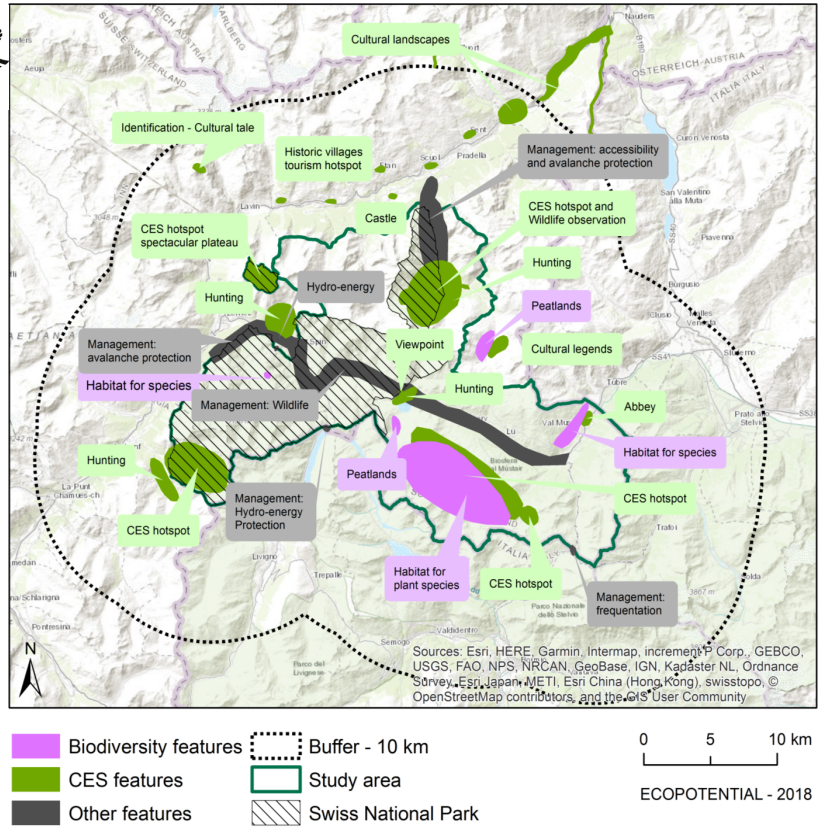
Engaging PAs teams and local experts (1/2)

- Objective: Identify **hotspots** and **drivers** of cultural ecosystem services
- Method: 1-day **workshop** gathering around 10 local experts and PA team

Individual and collective mapping of ES hotspots



Result of the collective mapping - SNP



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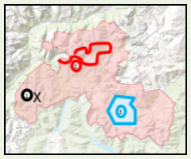
Involving citizens in the field (1/2)

- Objective: Identify **actual use** of cultural ecosystem services
- Method: field surveys with PAs' visitors (locals and tourists)

Participatory mapping



→Identify **hotspots** where people **actually benefit** from cultural ecosystem services

→**Participatory mapping** to locate activities and perception of nature by visitors

Human preference map for cultural ecosystem services

Field questionnaire

→Link **landscape features, environmental restorativeness** and **human well-being**

→**Individual surveys** to assess the diversity of visitors' perspectives

Benefits and drivers of cultural ecosystem services

The MapNat2 smartphone app

➔ A tool to ease the assessment of ES, in particular those hard to get such as cultural ES

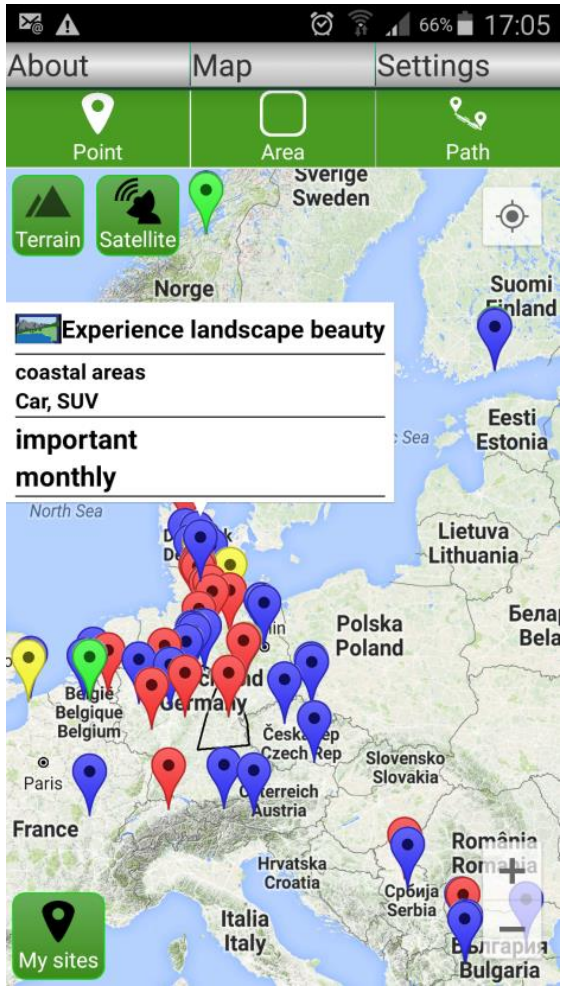
- **Simple participatory** mapping tool
- For **citizens** and / or **scientists**
- To map, value and share nature experiences
  ➔ Assess **current use** of ES

- A **non-commercial app** developed by several research partners

- Outputs are **spatially explicit**
- Data is **shared** among all users

Examples of features assessed:

- **Nature's services** such as picnicking in city parks, biking in fields or forests or bird watching in grasslands or wetlands,
- **Environmental problems** such as bad water quality, pests or plants causing allergies or hayfever



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A citizen science guide for environmental monitoring in PAs

- Focus: '*How can Citizen Science enhance environmental monitoring in protected areas in Europe?*'
- A one-day workshop coordinated with the **Italian Citizen Science conference**
- Co-organized by a **wide range of partners**

Participants to the workshop – 21/11/2017

Characterising actors of citizen science in protected areas

- Around 25 participants from **over 10 European countries**, including protected area managers and researchers.
- Building on results from the workshop, a guide is developed on **how to establish citizen science projects** for environmental monitoring in protected areas in Europe.

Further information with the UFZ/iDiv team:
Anett Richter Anett.Richter@idiv.de, Aletta Bonn Aletta.Bonn@idiv.de

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641762

Science – Policy interface

D11.1 Research Outputs, UFZ

- Based on questionnaires to all PAs
- Presenting the main research and methodological needs expressed by the PA technical staff to inform appropriate capacity building and training activities

D11.2 Synthesis Study, UNEP

- Based on questionnaires to all PAs
- Presenting the state of the integration of knowledge and understanding of ecosystem services and Earth Observation in the governance and management of PAs

MS14 Relevant Events in GEO/GEOSS/EU institutions to illustrate policy options

- Side event held at the GEOSS XIV Plenary in Washington DC, October 2017
- Policy options were presented in relation to the Sustainable Development goals and the use of Earth Observation data and tools to achieve them and to monitor progress.

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641762

Science – Policy interface

Policy Recommendations mainstreamed into the GEO/GEOSS, UNEP

- Progress made with the event at GEOSS XIV Plenary in Washington DC
- Preparations underway to develop Science-Policy briefing document based on the questionnaires, synthesis and research output studies (D11.1 and D11.2) as well as relevant findings from the other WPs
- **To be presented first at the Science-Policy briefing event at the EU Parliament**
- The briefing document will be presented at an upcoming meeting of the GEOSS

In cooperation with WP12, D12.12 – **Science-Policy Briefing at the EU Parliament**

- Briefing event to be held at EU Parliament **27 September 2018 – 09:00-11:00**
- Chaired by Ricardo Serrão Santos MEP
- In cooperation with the EU Intergroup Climate Change, Biodiversity and Sustainable Development and IUCN
- ECOPOTENTIAL provides the main scientific input for a discussion on the role of science and Earth Observation to achieve post 2020 environmental targets

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641762

Remote Sensing:
Sandbox (WP3)
PA from Space (WP4)
EODESM (WP4)
CNR Server -> updated with LifeWatch Virtual Laboratory Platform (WP10)

Field Data:
DEIMS with eLTER (WP5)

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GEO ECO

The GEO Global Ecosystem Initiative

A world-wide extension of the ECOPOTENTIAL CoP: Changes in Protected Areas Storylines for PAs (Natura2000 and beyond) Remote Sensing for Macrosystem Ecology

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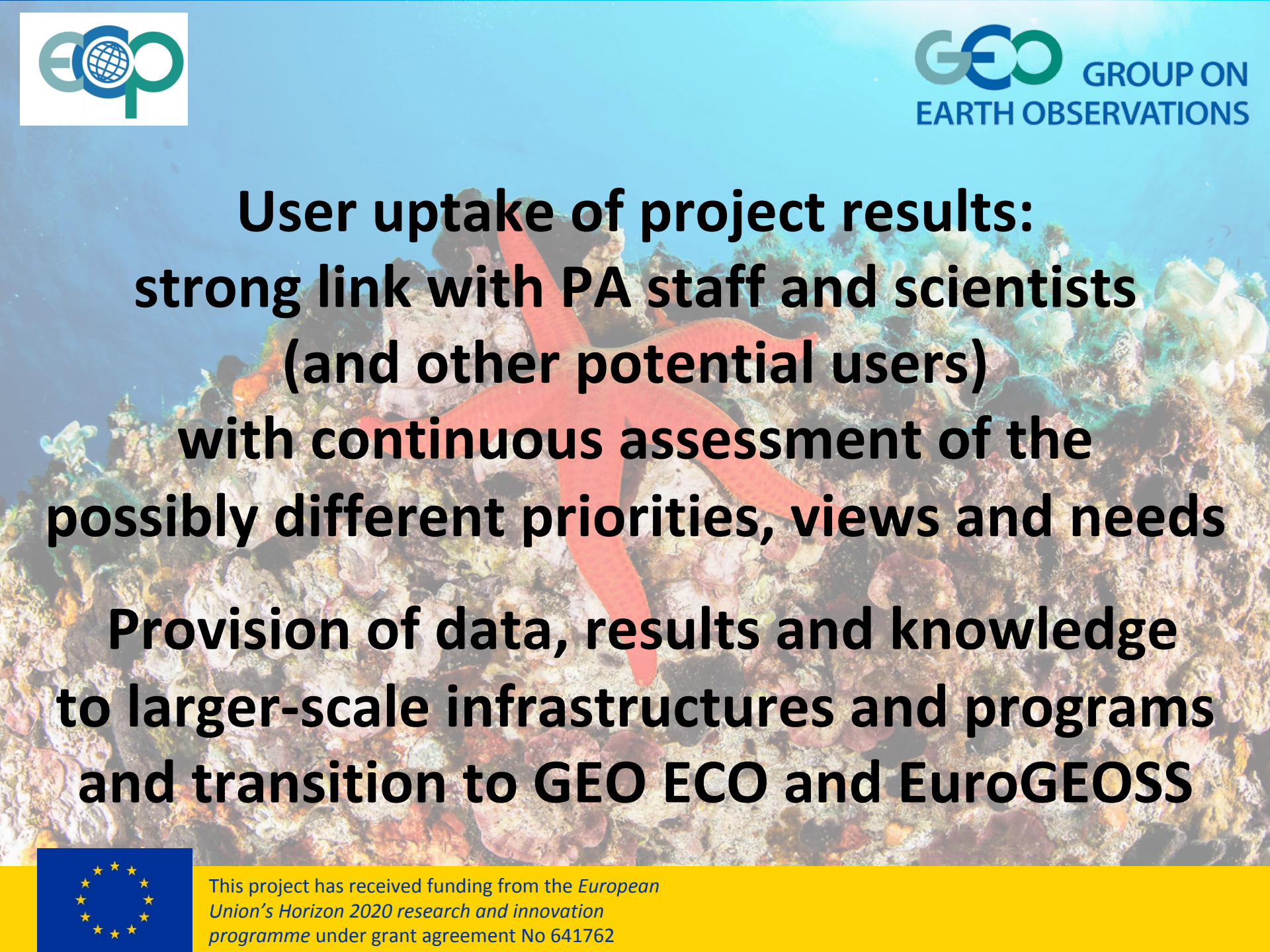

User uptake of project results: strong link with PA staff and scientists (and other potential users) with continuous assessment of the possibly different priorities, views and needs

Provision of data, results and knowledge to larger-scale infrastructures and programs and transition to GEO ECO and EuroGEOSS

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 641762

Need for fresh conceptual approaches to understanding and predicting ecosystem changes

Coupled geo-biodynamics

Ecosystem Services

Uncertainty assessments

Cross-scale interactions

Vulnerability approach ("decision scaling")

Essential Variables

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Thank you for your attention