Consiglio Nazionale delle Ricerche
Istituto sull'Inquinamento Atmosferico

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in collaborazione con il Segretariato Generale della Presidenza della Repubblica

THE ECOPOTENTIAL VIRTUAL LABORATORY

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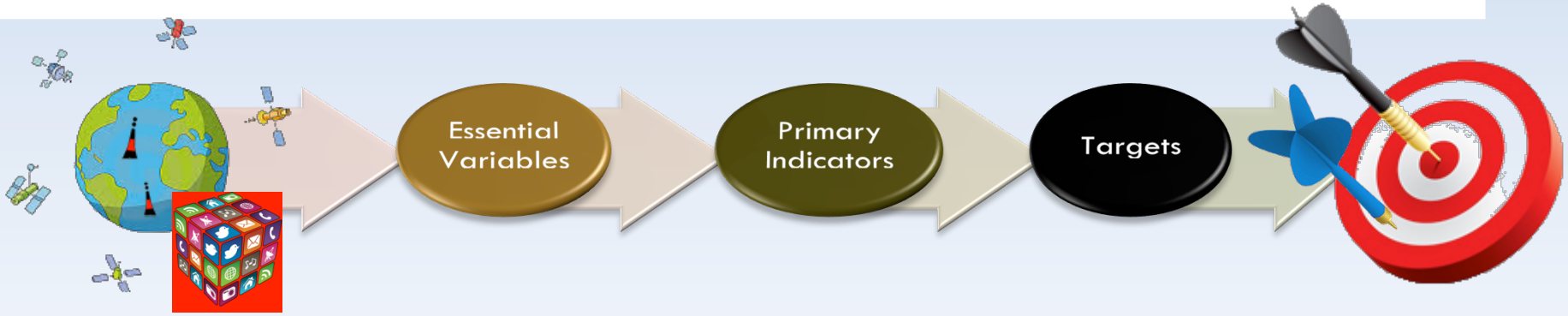
Consiglio Nazionale delle Ricerche
Istituto sull'Inquinamento Atmosferico

SPECIAL THANKS TO:
- IOANNIS MANAKOS (CERTH)

RATIONALE: FROM DATA TO KNOWLEDGE

EO & Socio-economic Data

Policy Goals (UN SDG, International treaties, …)



Data → **Information** → **Knowledge** → **Wisdom**

Essential Variables creation

Indicators generation

Target Assessment

Business Processes execution

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ECOPOTENTIAL

- ECOPOTENTIAL aims at creating a unified framework for ecosystem studies and management of protected areas (PA).
  - Focus on internationally recognized PAs in Europe and beyond in a wide range of biogeographic regions
  - Best use of Earth Observation (EO) and monitoring data through new EO ecosystem data services
  - Support of modelling approaches including information from EO data
  - Open and interoperable access to data and knowledge through a GEO Ecosystem Virtual Laboratory Platform, fully integrated in GEOSS.

ECOPOTENTIAL

Improving Future Ecosystem Benefits through Earth Observations

- **Funding programme:** EC H2020
- **H2020 Topic:** Societal Challenges - Climate action, environment, resource efficiency and raw materials
- **Call topic:** Making Earth Observation and Monitoring Data usable for ecosystem modelling and Services
- **Duration:** 2015-06-01 / 2019-05-31
- **Number of partners:** 47
- **Estimated cost:** 15,993,931.25 EUR

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THE ECOPOTENTIAL VIRTUAL LABORATORY

- The ECOPOTENTIAL Virtual Laboratory is a *knowledge generation platform supporting the activities of the ecosystem science Community of Practice*

From Science to Policy

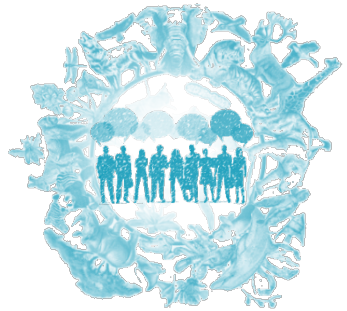
Generated knowledge targeted to policy-makers (e.g. PA managers)
Integration with global efforts for Science-Based Environmental Policy

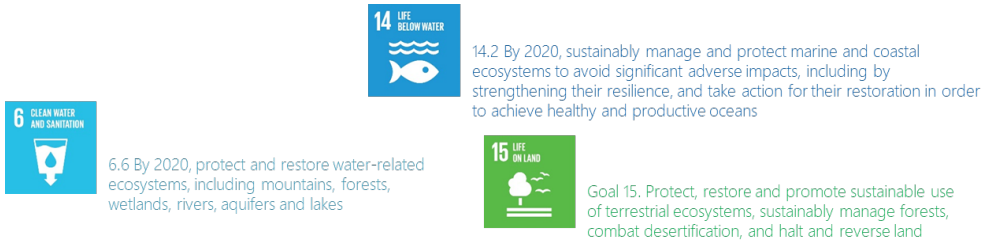
From Data to Knowledge

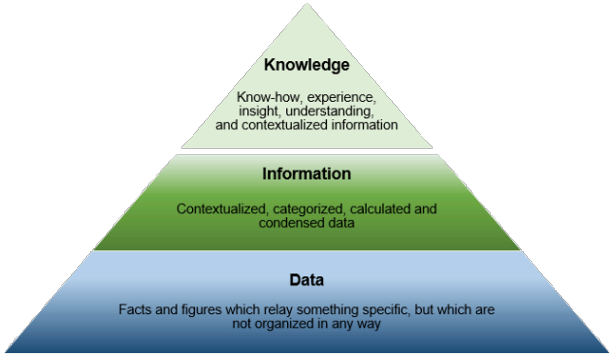
Generation of Essential Variables, Indicators and Indices from data

From Open Data to Open Science

Sharing of knowledge (ontologies), procedures (scientific business process), algorithms (source code) for reusability, reproducibility, etc.







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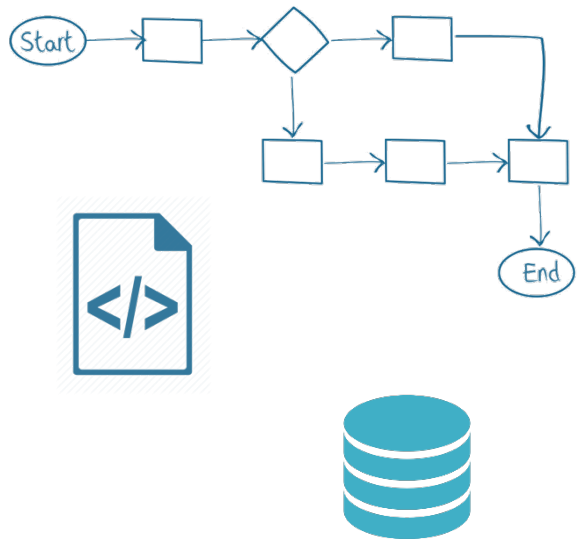
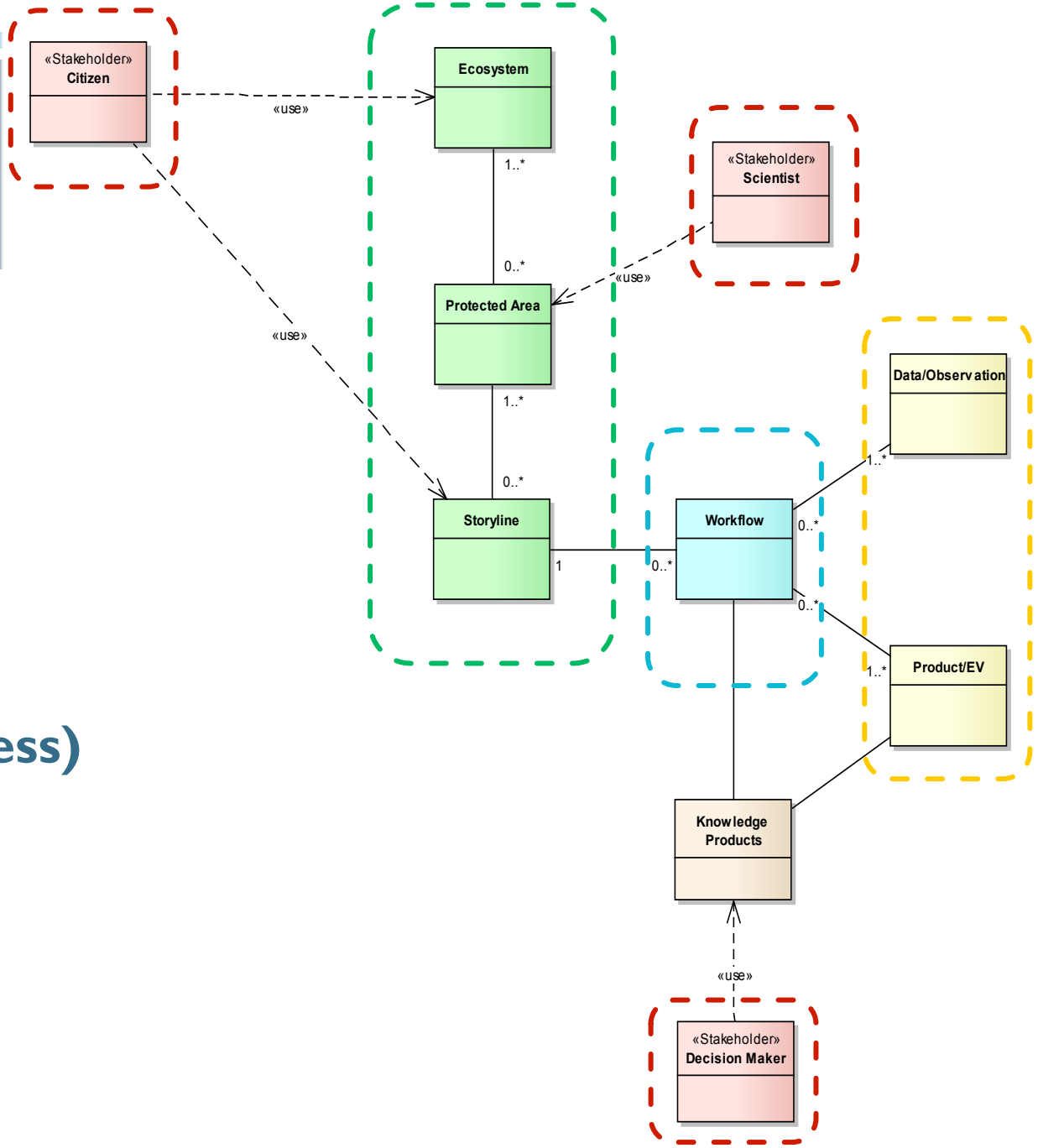
THE ECOPOTENTIAL VIRTUAL LABORATORY

- Main functionalities:
  - Handling of different kind of resources: datasets, algorithms, workflows,…
    - publishing, harmonized discovery, access and visualization
  - Running workflows implementing scientific business processes
  - Interaction through GUI (Portal) and APIs



THE ECOPOTENTIAL ONTOLOGY

- Main concepts:
  - **Ecosystem**
  - **Protected Area**
  - **Storyline (scenario)**
  - **Workflow (scientific business process)**
  - **Data/Observation**
  - **Product / Essential Variable**
  - **Users**



THE ECOPOTENTIAL VLAB CONCEPT

Ecosystem Expert

Knowledge

Models, ontologies

ECOPOTENTIAL VLAB

Information

EO/in-situ data and products

VLab Portal and apps

Knowledge For Informed Decision-Making

Indicators

Environmental/Ecological Decision-maker, Policy-maker

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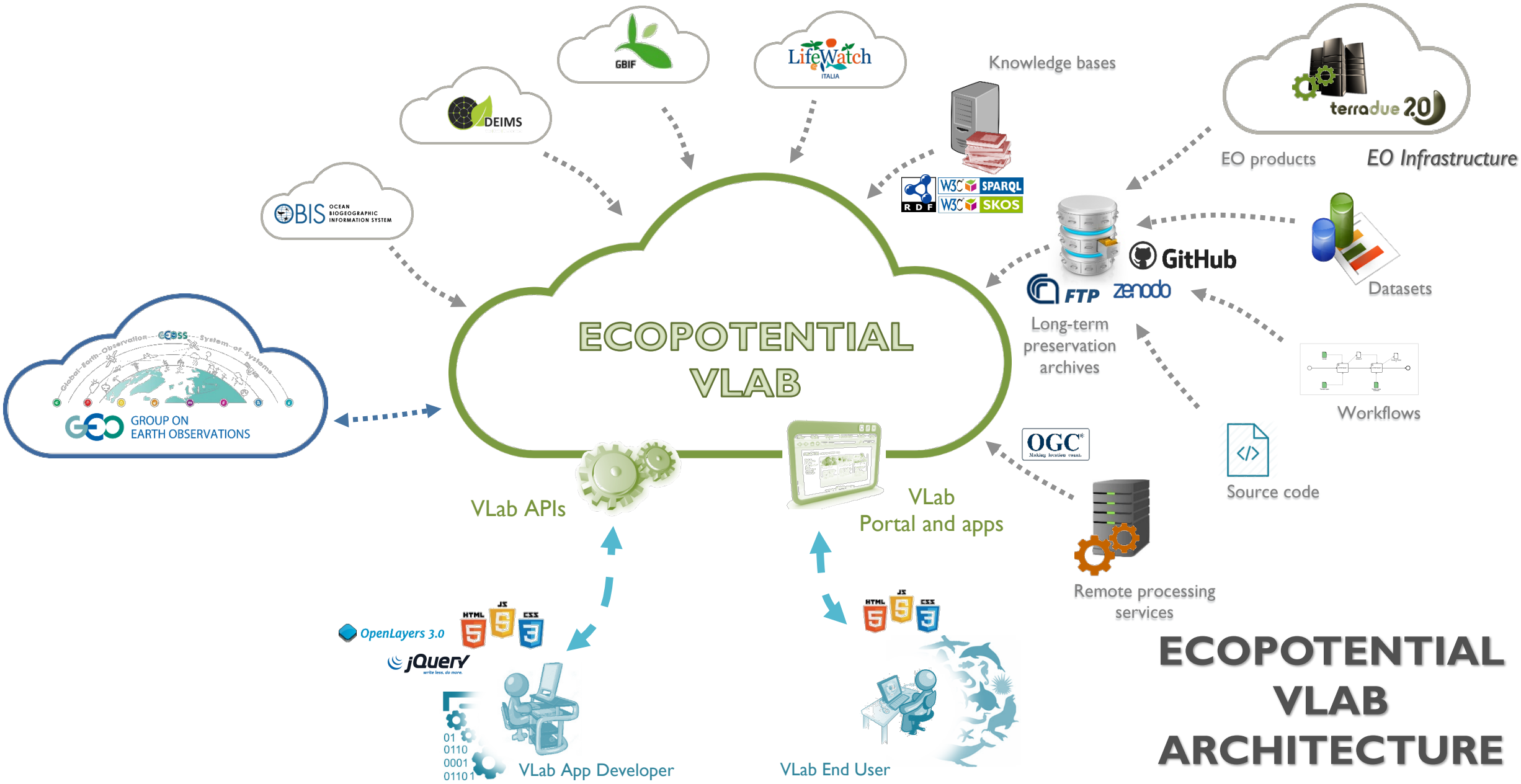

ECOPOTENTIAL VLAB ARCHITECTURE

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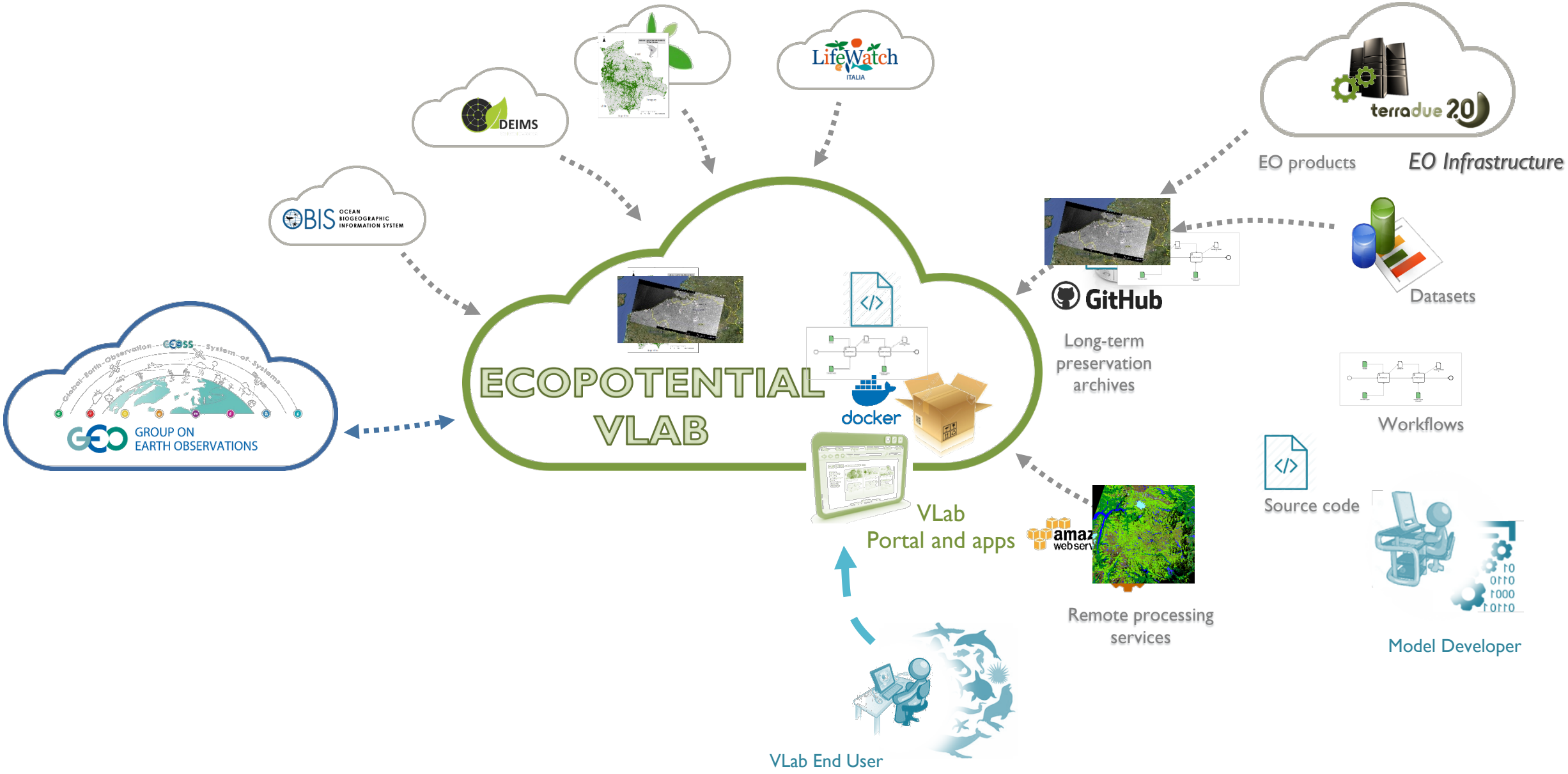

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MAIN REQUIREMENTS

- Lowering entry barriers for end-users
  - Decision-makers should be able to easily run scientific models for the generation of indicators
- Lowering entry barriers for modelists
  - Modelists should be able to easily make their scientific models available to end-users
- Lowering entry barriers for application developers
  - App developers should be able to easily develop desktop and mobile applications for end-users

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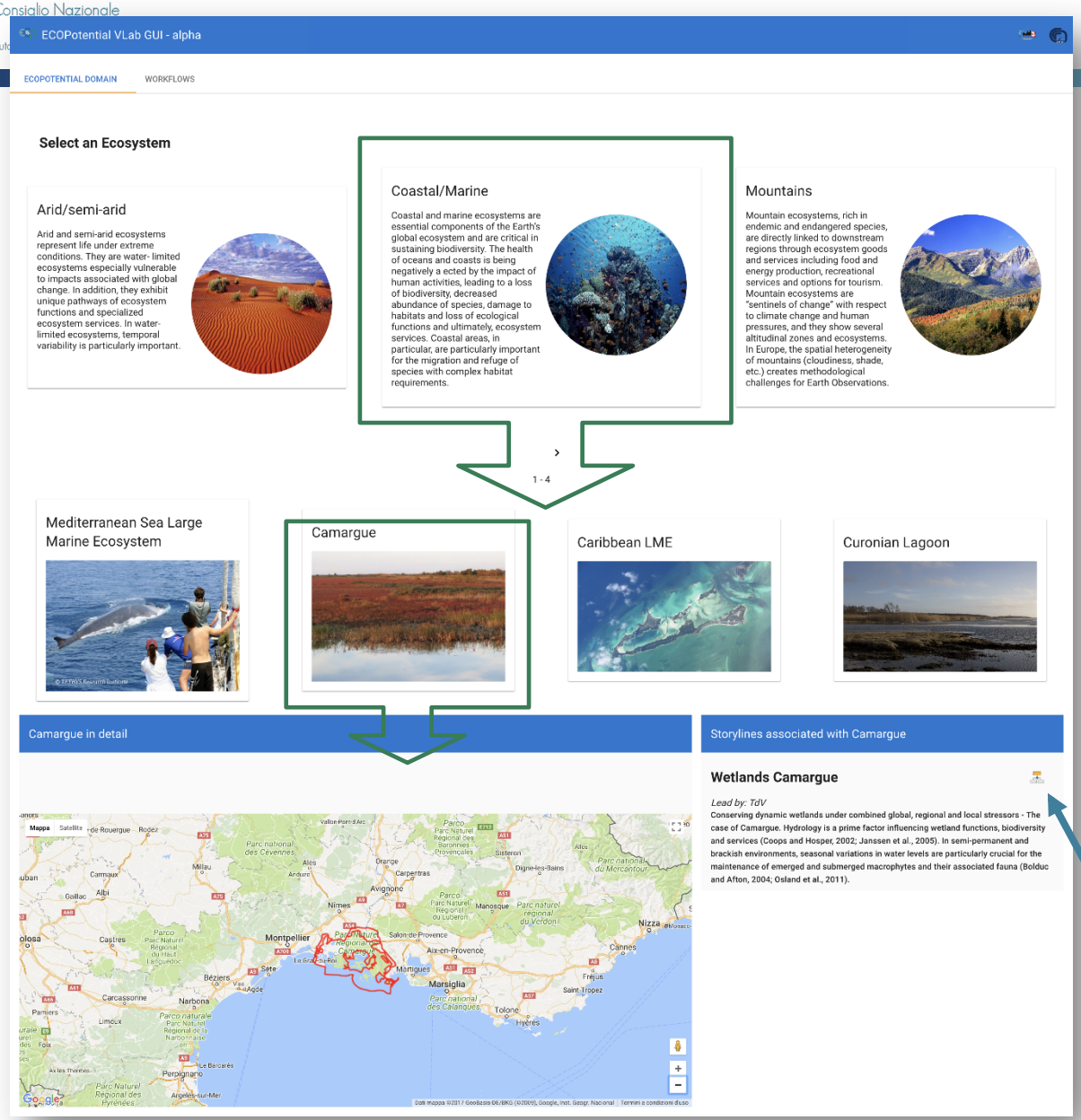

Ecosystems

Protected Areas

Storylines (scenarios)

Workflow (scientific business process)

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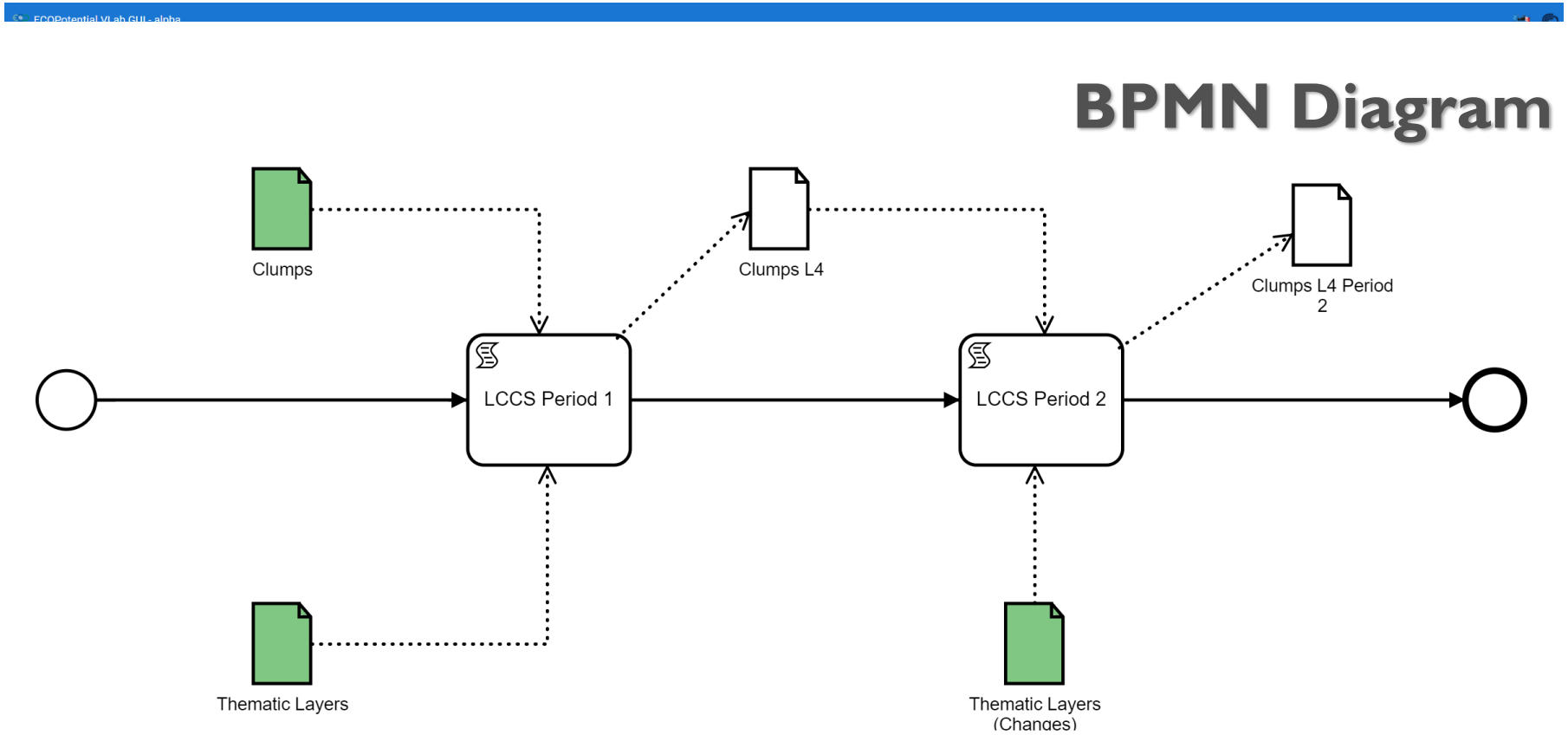
BPMN Diagram



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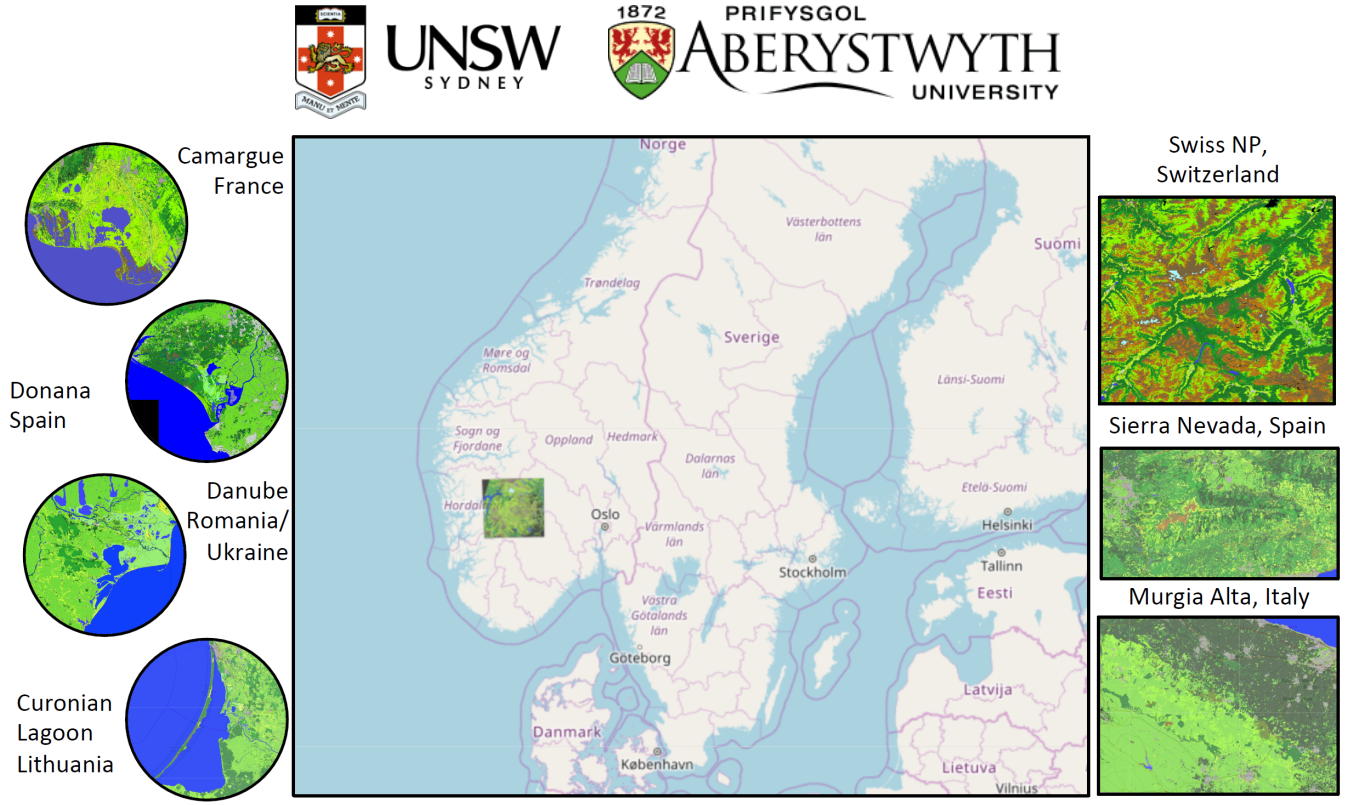
EARTH OBSERVATION DATA FOR ECOSYSTEM MONITORING (EODESM)

- The EODESM system classifies land covers according to the Food and Agricultural Organisation's (FAO's) **Land Cover Classification System (LCCS2)** taxonomy.
- The EODESM system can use, as input, any remote sensing or other spatial datasets and at any scale
- Highly detailed and relevant classifications are generated for protected areas and surrounds
- The system is designed for use by a wide range of users and is entirely open source and freely available.



CAPACITY FOR EUROPEAN CLASSIFICATION OF LAND COVER AND LAND COVER CHANGE WITHIN THE VIRTUAL LABORATORY: OUTPUTS OF THE EODESM MODEL

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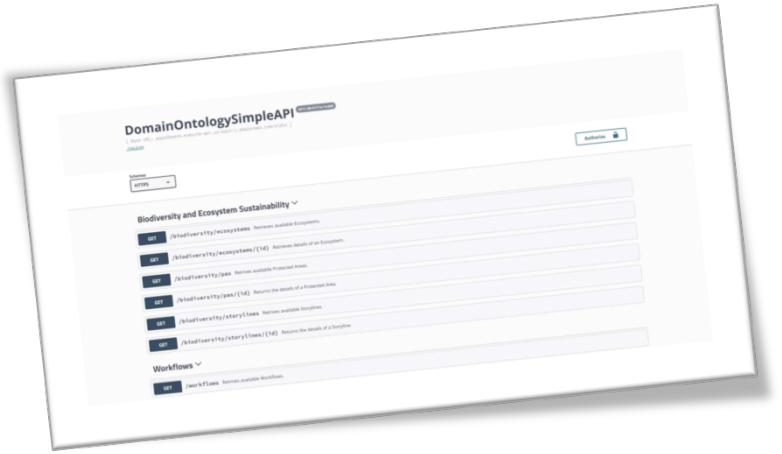
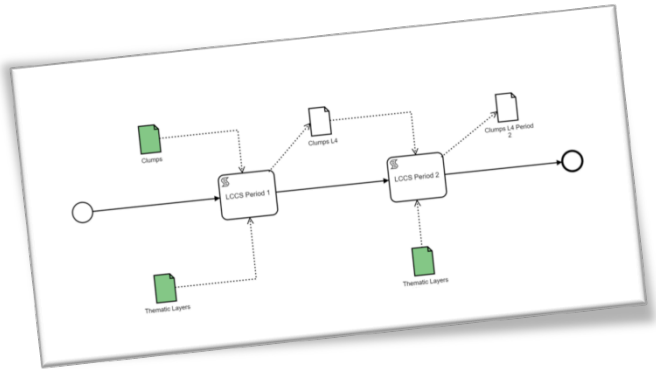
LOWERING ENTRY BARRIERS FOR MODEL DEVELOPERS

- Source code retrieved by GitHub repository
  - Always up-to-date
- Support of Docker packaging as the only constraint
  - Support of multiple software frameworks: Python, R, etc.
  - Github ECOPOTENTIAL conventions
- Leveraging datasets harmonization by an internal data broker (DAB)
- Access through RESTful API for system integration and app development
- The workflow has an abstract (high-level) representation in BPMN
  - Targeting end-users not code developers





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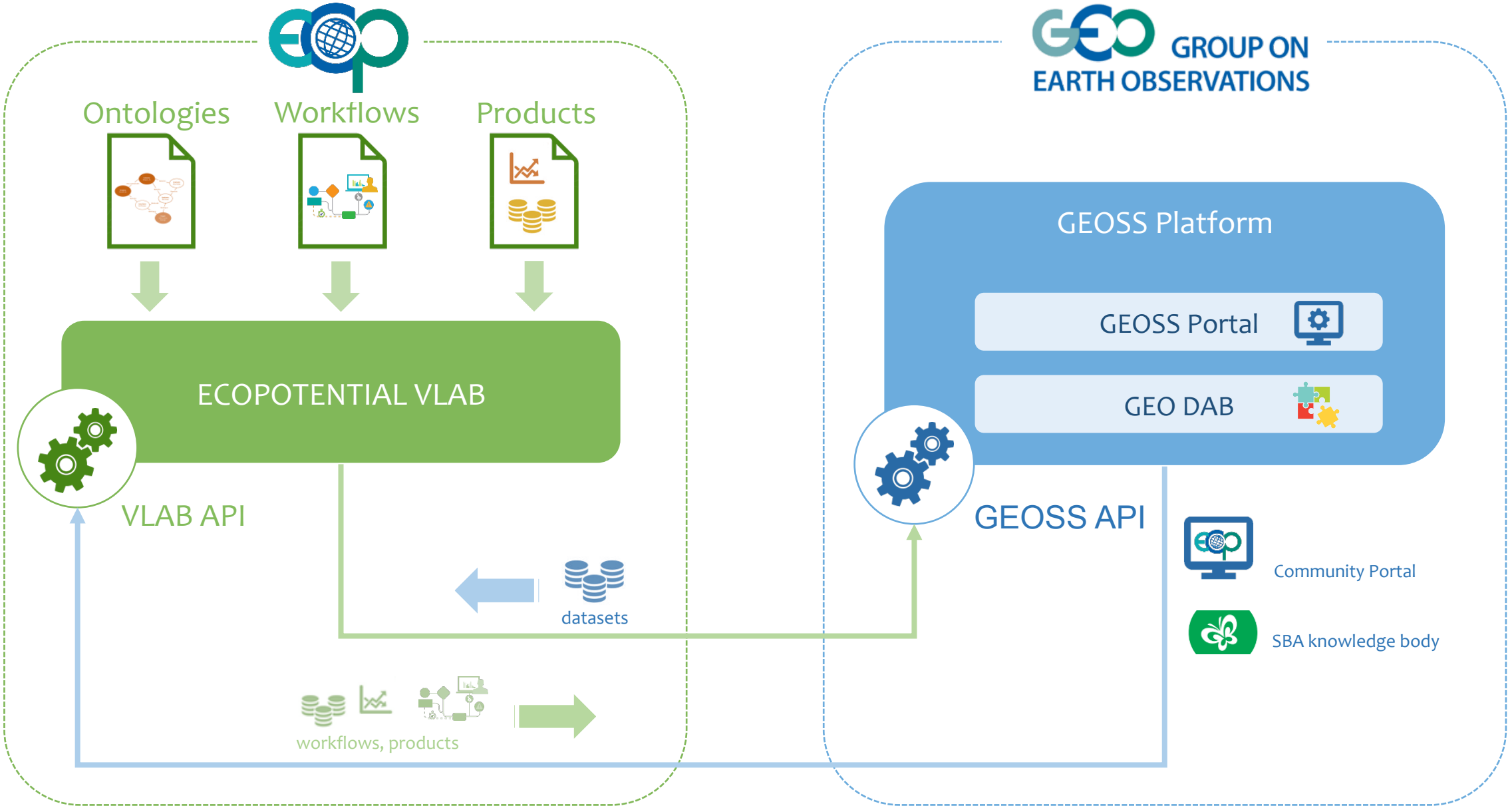
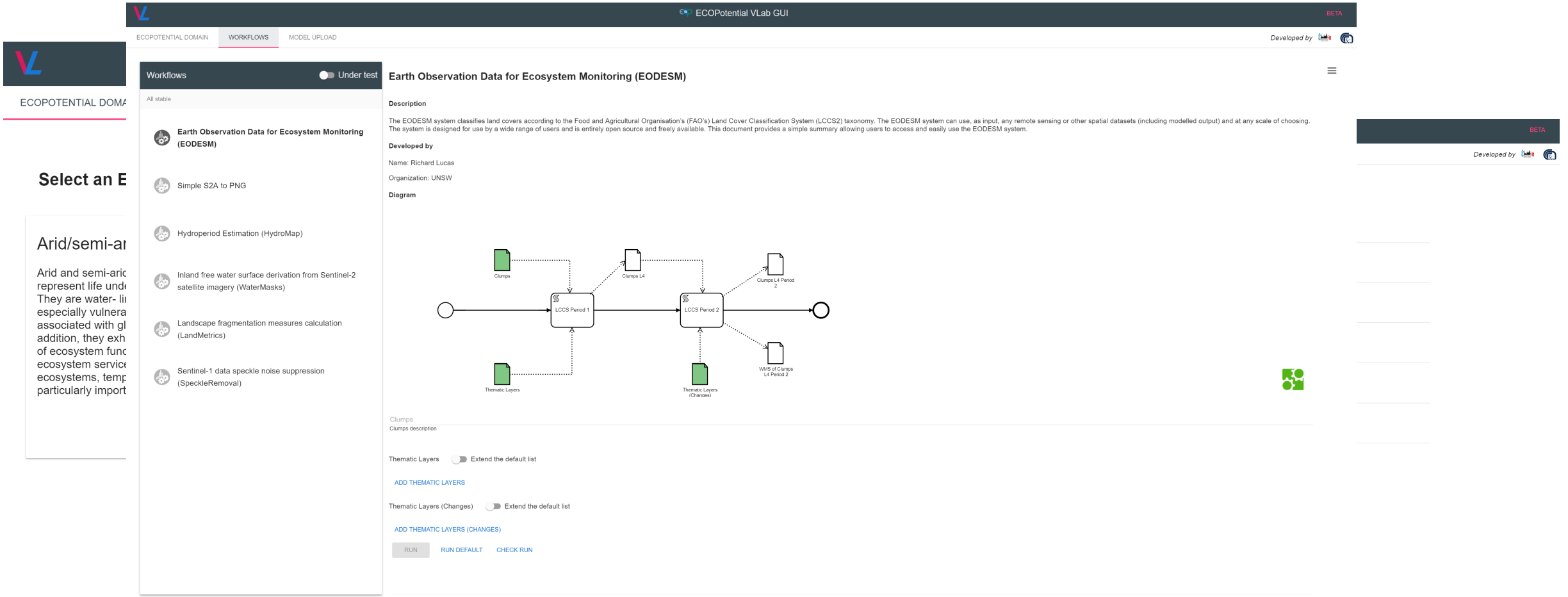
GEOSS INTEGRATION



USER INTERFACE FOR MODELISTS



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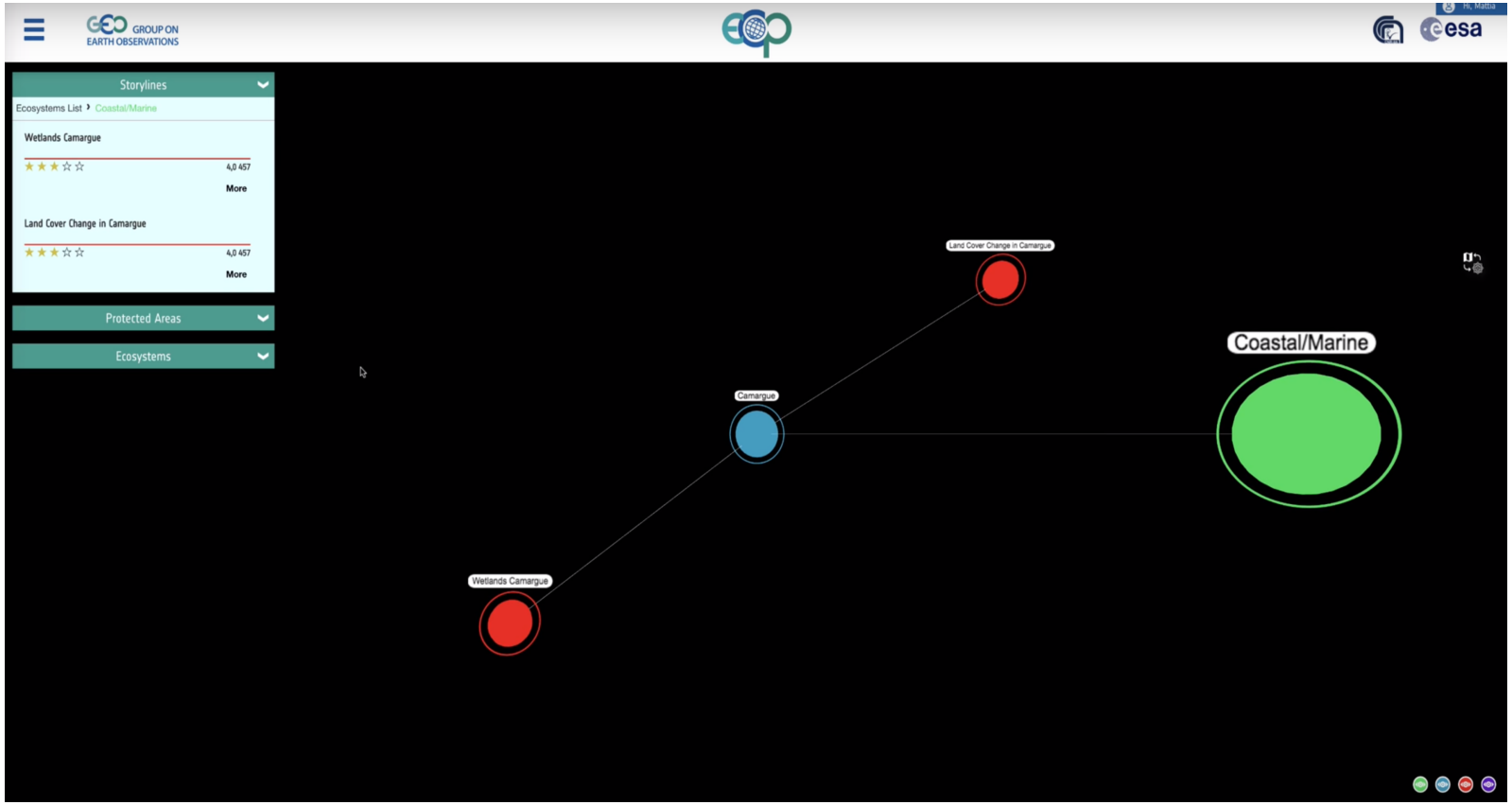
GEOSS COMMUNITY PORTAL

GEOSS Mirrors

GEOSS Widgets

GEOSS Views



https://youtu.be/m8lFGaDabo4

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MODELS AVAILABLE IN THE ECOPOTENTIAL VLAB

Model	Model developers
EODESM (Earth Observation Data for Ecosystem Monitoring)	UNSW/Aberystwyth University
COINS (COntrol of INvasive Species)	CNR-IAC
INSTAR	UGR
Inland free water surface derivation from Sentinel-2 satellite imagery (WaterMasks)	CERTH
Hydroperiod Estimation (HydroMap)	CERTH
Landscape fragmentation measures calculation (LandMetrics)	CERTH
Estimation of phenology metrics (PhenologyMetrics)	CERTH
BFAST: detection of changes in NDVI approximated phenological cycles (PhenologyChanges)	CERTH
Sentinel-1 data speckle noise suppression (SpeckleRemoval)	CERTH
Mountain metapopulation	EPFL
MOHID	IST
Iris-SDM	ICETA
DELFT3D FLOW & GEM	DELTARES

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CURRENT STATUS

Achievements

- Dataset discovery and access supported through GEO DAB technology
  - Functionalities accessible through the user interface and through RESTful API
  - In-situ and EO data and products available
- Documentation available for developers
- Portal based on GEOSS Portal Mirror technology (ESA)
- Live demo at the GEO XIV Week (Washington, October 2017)
- Training event for ECOPOTENTIAL users (developers) held on February 2018

Supported workflows

- Despeckling module (CERTH))
- EODESM scenario (CNR and UNSW)
- Phylogenetic Diversity Estimation (CNR)
- MOHID Land (IST)
- Metapopulation presence of a focus species (EPFL)
- INSTAR (UGR)
- Optimal allocation of resources for the harvesting of an invasive species (CNR-IAC)
- Water quality (DELTARES)

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CONCLUSIONS

- ECOPOTENTIAL is developing a Virtual Laboratory to facilitate activities in the ecosystem science community of practice
- The VLAB will be adopted and enhanced in other initiatives and projects including ERA-PLANET GEOEssential
- The VLAB adopts widespread and mature technologies to provide harmonized low-level functionalities (Cloud IaaS/PaaS, Docker container, DAB mediator)
- The VLAB adds advanced functionalities tailored to ecosystem science community-of-practice: ECOPOTENTIAL ontology, execution of scientific business processes, etc.
- The VLAB is aligned with major international activities on resource sharing for science and environmental policy (namely GEO)

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Thank you for your attention!

http://www.ecopotential-project.eu

ECOPOTENTIAL VLAB: http://vlab.geodab.eu/
ECOPOTENTIAL VLAB Documentation: http://confluence.geodab.eu/

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