GROUP ON EARTH OBSERVATIONS

Essential Variables – insights to their development

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UNIVERSITÉ DE GENÈVE

ENVIROSPACE LAB. - SPATIAL PREDICTIONS AND ANALYSES IN COMPLEX ENVIRONMENTS

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Gregory Giuliani - CV

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Born on May 27, 1975 in Lausanne, Switzerland.

Citizen of Italy and Switzerland.

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Education :

2009-2011: PhD in Environmental Sciences, Faculty of Sciences, Institute of Environmental Sciences, enviroSPACE Group.

PhD thesis: Spatial Data Infrastructures for Environmental Sciences.

1998-2001: Master in Natural Sciences of the Environment, Faculty of Sciences, University of Geneva.

Master thesis: Traitement et interprétation de l'imagerie satellitaire multispectrale des lacs subalpins.

1995-1998: Bachelor in Earth Sciences, Faculty of Sciences, University of Geneva.

Professional experience:

Since 2017: Steering Committee Member - CAS Geomatics for a Sustainable Environment WWW

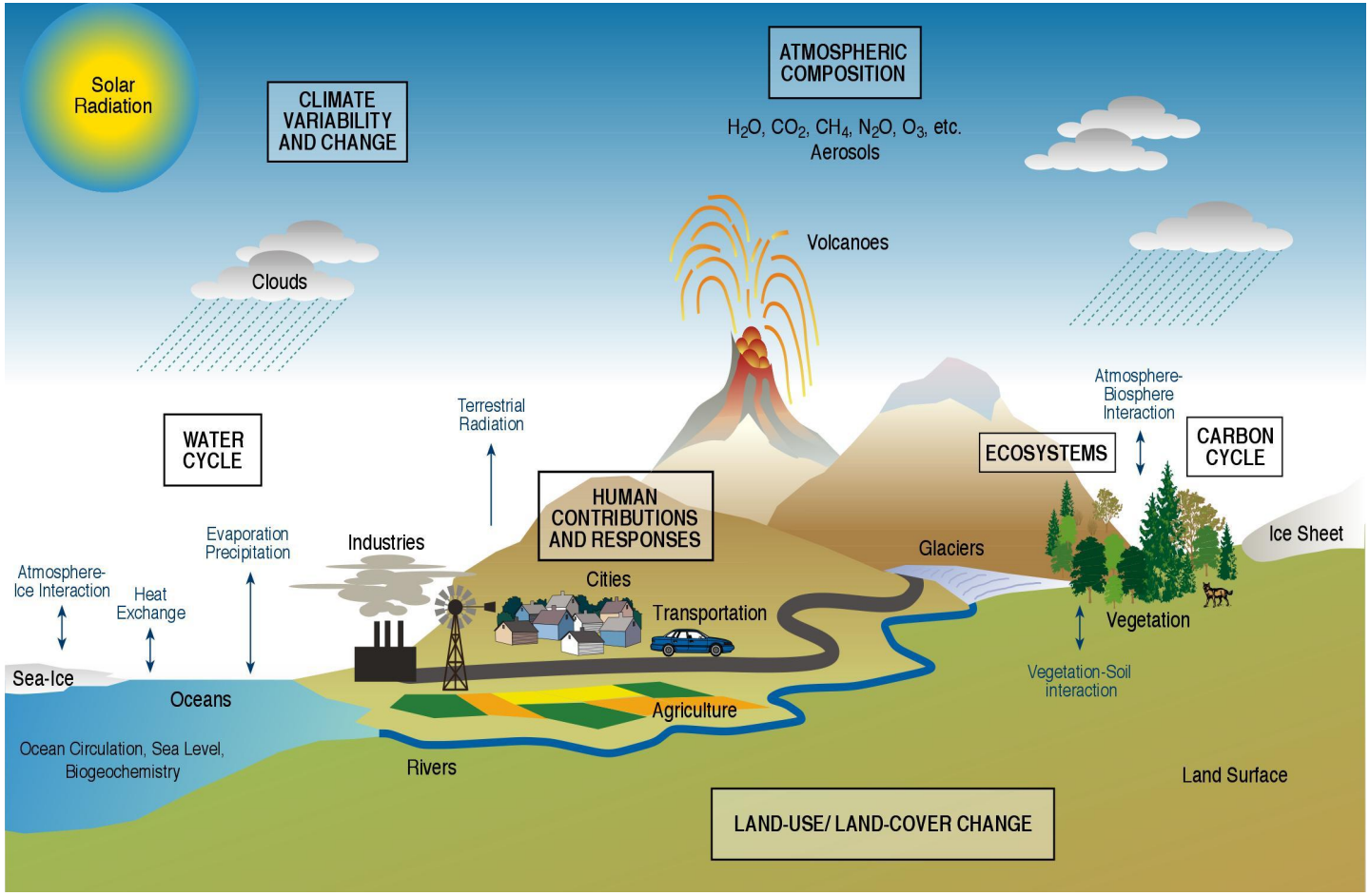
Since 2017: Coordinator of the Workshop "Measuring, evaluating, and monitoring sustainable development" of the Master in Innovation, Human development, and Sustainability (Geneva - Tsinghua Initiative). WWW

2016: Research Data Alliance Brokering Governance Working Group, WP2 leader. WWW

Since 2016: Member of the GEO/GEOSS "GCI Operations" (WWW) & "GEOSS-EVOLVE", co-chair of WP6 "Community Portal" (WWW).

The Earth is a complex system...

...of systems



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Global Sustainability Challenges

SDGs, Paris Agreement, Aichi targets, ...

Informed decisions

Based on evidences

Data is the fuel...

...for scientific analysis and decision-making

Transform data into knowledge

And take decisions!

To adequately describe systems

The concepts of Essential Variables has emerged

Definition

a minimal set of variables that determine the system's state and developments, are crucial for predicting system developments, and allow us to define metrics that measure the trajectory of the system

Two aspects: (1) technical and (2) social/policy relevance
Crucial for the creation of practice-relevant knowledge!

EVs are domain specific: different communities have different approaches to characterize their variables
>> community process leading to an agreement to meet the objectives of a community to support national to global monitoring, reporting, research and forecasting.

Essential Climate Variables

Supported by Global Climate Observing System (GCOS)

50 ECVs

For more coordinated and consistent climate observations!

Required to support UNFCCC & IPCC!

Selection criteria:

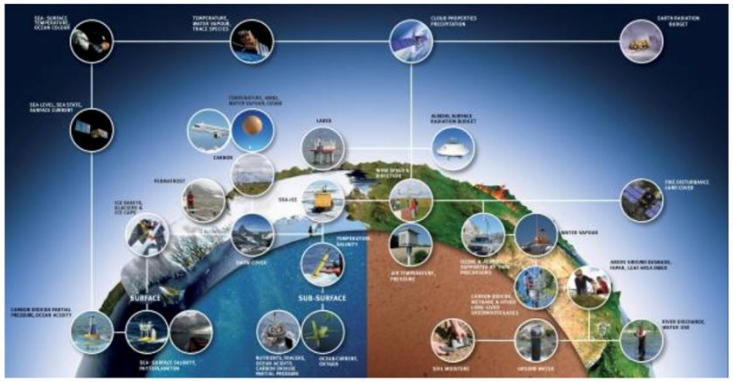
> relevance
> technical feasibility
> economic feasibility

Essential Climate Variables (ECVs)

Domain	Essential Climate Variables	
Atmo-spheric (over land, sea and ice)	Surface:	Air temperature, Precipitation, Air pressure, Surface radiation budget, Wind speed and direction, Water vapour.
	Upper-air:	Earth radiation budget (including solar irradiance), Upper-air temperature, Wind speed and direction, Water vapour, Cloud properties.
	Composition:	Carbon dioxide, Methane, Ozone, Other long-lived greenhouse gases, Aerosol properties.
Oceanic	Surface:	Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea Ice, Current, Ocean colour (for biological activity), Carbon dioxide partial pressure.
	Sub-surface:	Temperature, Salinity, Current, Nutrients, Carbon, Ocean tracers, Phytoplankton.
Terrestrial	River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Biomass, Fire disturbance, Soil moisture.	

Essential Climate Variables

Supported by Global Climate Observing System (GCOS)



Essential Climate Variables

An ECV is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth' s climate.

ECV datasets provide the empirical evidence needed to understand and predict the evolution of climate, to guide mitigation and adaptation measures, to assess risks and enable attribution of climate events to underlying causes, and to underpin climate services.They are required to support the work of the UNFCCC and the IPCC.

ECV are identifies based on the following criteria:

- **Relevance**: The variable is critical for characterizing the climate system and its changes.
- **Feasibility:** Observing or deriving the variable on a global scale is technically feasible using proven, scientifically understood methods.
- **Cost effectiveness:** Generating and archiving data on the variable is affordable, mainly relying on coordinated observing systems using proven technology, taking advantage where possible of historical datasets.

ECV are observed according to the GCOS Climate Monitoring Principles.

The Global Observing Systems Information Center (GOSIC) provides further background, definitions, requirements, network information and data sources for the ECV. It is maintained by the National Centers for Environmental Information (NCEI) of the U.S. National Oceanic and Atmospheric Administration (NOAA) and the U.S. GCOS Program at NCEI on behalf of the global observing community.

The ECV inventory of the joint Committee on Earth Observation Satellites (CEOS)/ Coordination Group for Meteorological Satellites (CGMS) working group on climate (WGClimate) provides data of ECV measured from space.

Essential Biodiversity Variables

Supported by GEO Biodiversity Observation Network (BON)

22 EBVs

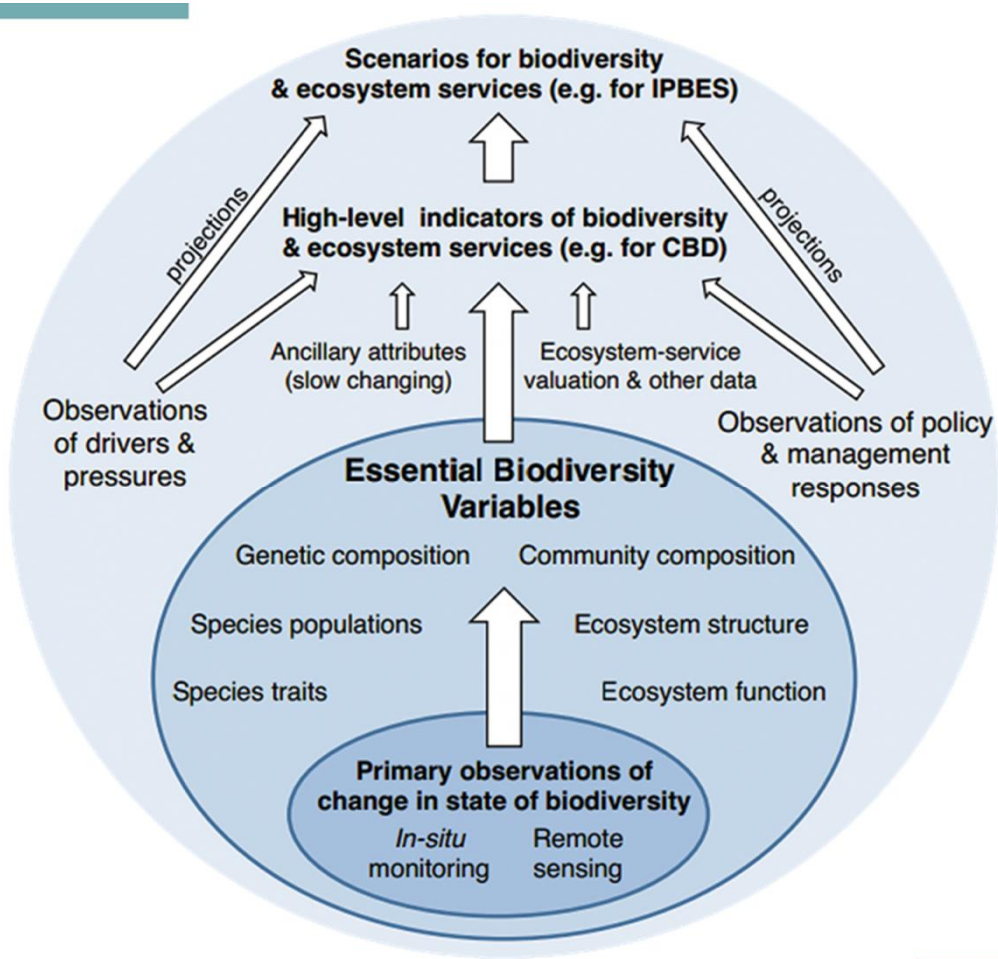
Further clarifies the role of EVs lying between primary observations and indicators

Required to support CBD!

Accommodating:

> diversity of data providers

> changing demand for indicators



Essential Biodiversity Variables

Supported by GEO Biodiversity Observation Network (BON)

What are EBVs?

EBVs

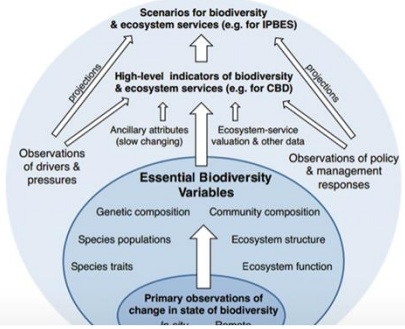
- What are EBVs?
- Working Groups
- Ecosystem Services
- Indicators

EBVs are the abbreviation for Essential Biodiversity Variables.
These Essential Biodiversity Variables, defined as the derived measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity should play the role of brokers between monitoring initiatives and decision makers. They provide the first level of abstraction between low-level primary observations and high-level indicators of biodiversity.

Criteria for Essential Biodiversity Variables

An ideal EBV should be

- able to capture critical scales and dimensions of biodiversity
- biological
- a state variable (in general)
- sensitive to change
- ecosystem agnostic (to the degree possible)
- technically feasible, economically viable and sustainable in time



These Essential Variables should also be able to be measured or modeled globally, and should ideally capitalize from integrating remote sensing with in-situ observations.
EBVs should be relevant to the broader community in the biodiversity monitoring and research projects, networks and initiatives, offering robust computations that can help populate the indicators to assess progress towards the 2020 Targets of the Convention on Biological Diversity. Finally EBVs should provide the foundation for developing biodiversity forecasts under different policy and management scenarios.

ECVs vs. EBVs

A short comparison

Comparison done by UZH/RSL

>> ECVs represent singularities (at least the first 20 or so)
>> EBVs represent aggregated data (observations, inventories, ...)

>> ECVs cover any physical (or biological) component of the Earth system
>> EBVs may cover biotic components only

>> ECVs are observations
>> EBVs may represent model output

>> ECVs undergo coordinated validation schemes (CEOS) and are coordinated by GCOS
>>EBVs have not (yet) been validated and are coordinated by GEO-BON

EVs under definition

In different communities

Various communities are currently defining EVs

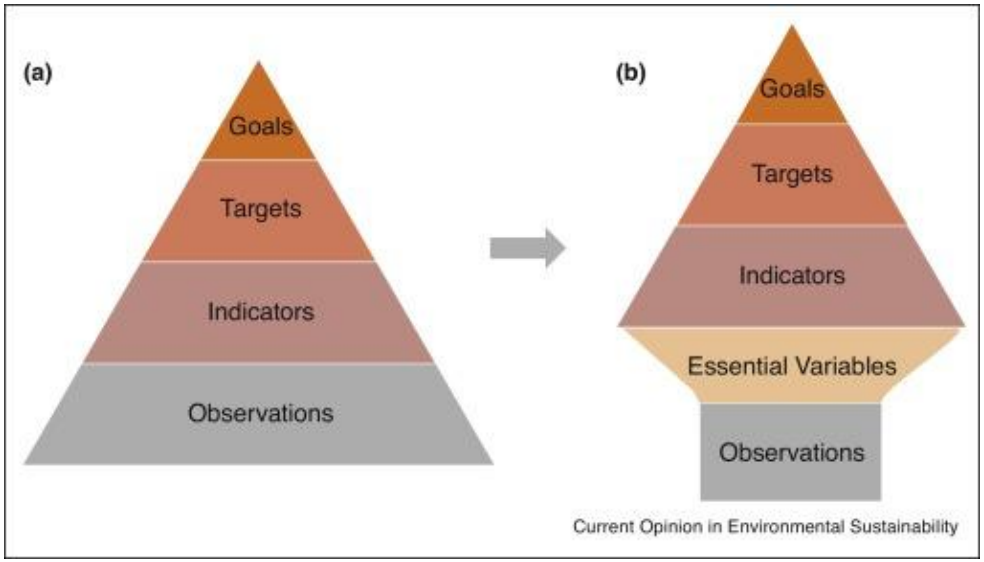
>>Water

>>Ocean

>>Agriculture

>>Ecosystems

>>...



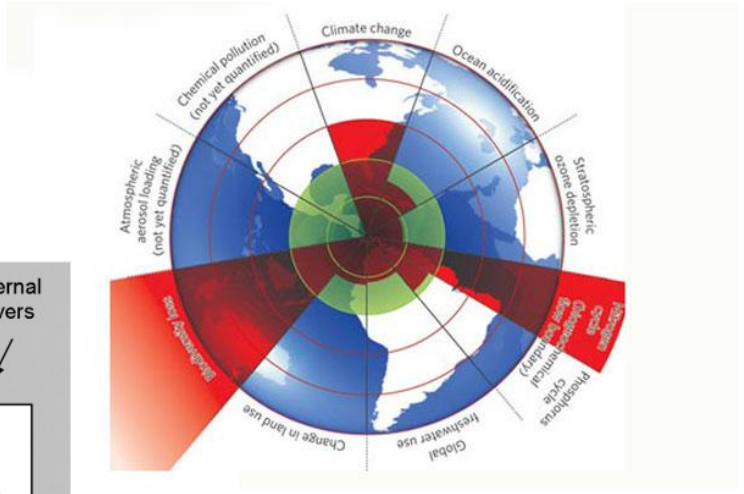
The need for ESEV

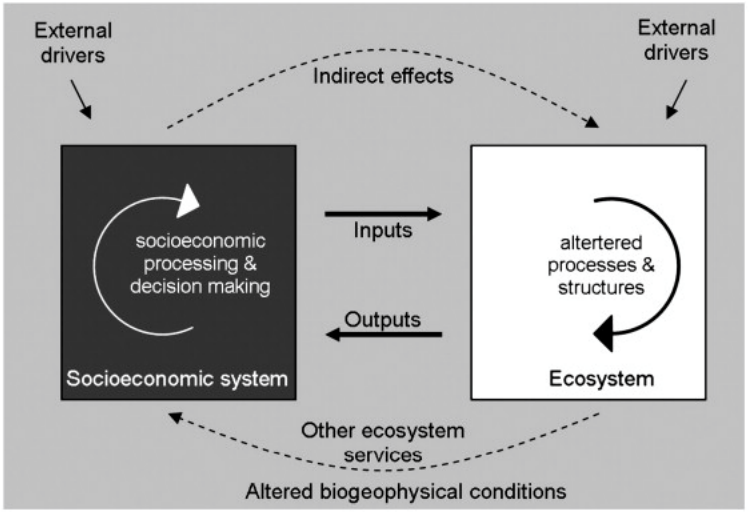
Essential Socio-Economic Variables

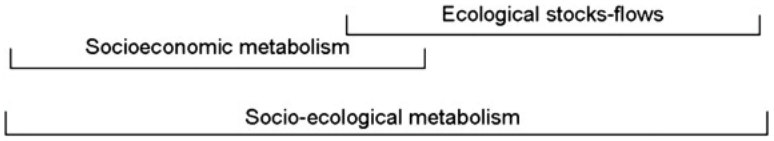
Environmental dimension of sustainability is decently characterized by EV

Social and economic dimensions are yet adequately addressed!

We need to define ESEVs!







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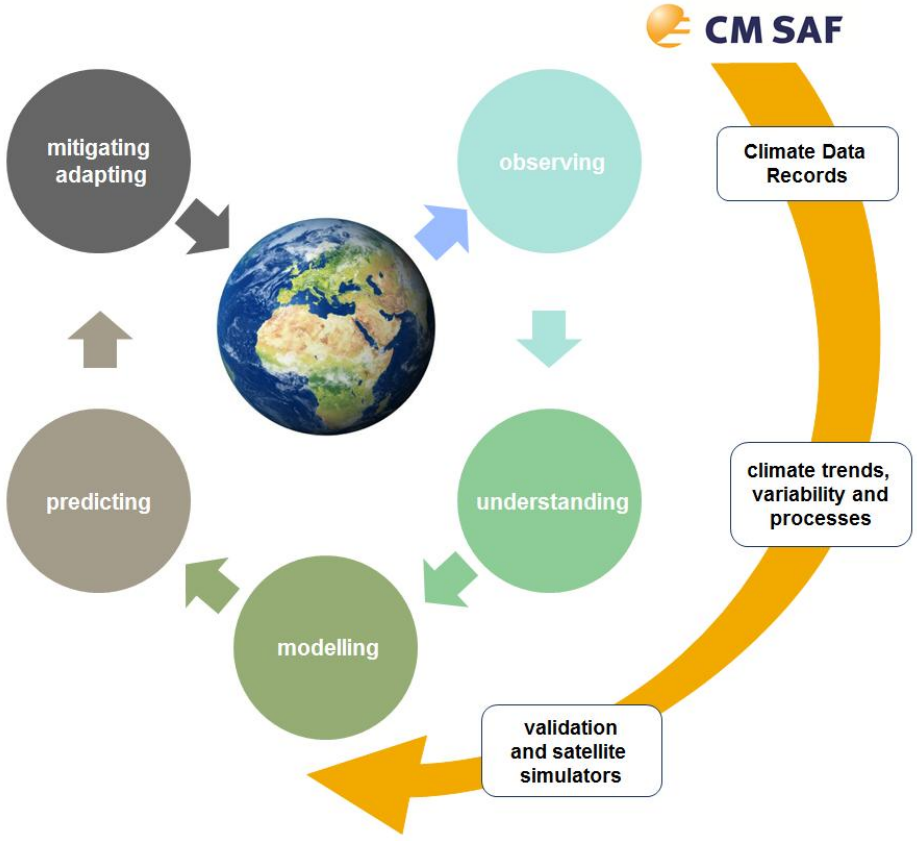
EVs allow tracking changes...

and evolution on the 3 dimensions of sustainability

EV concept represents a significant opportunity:

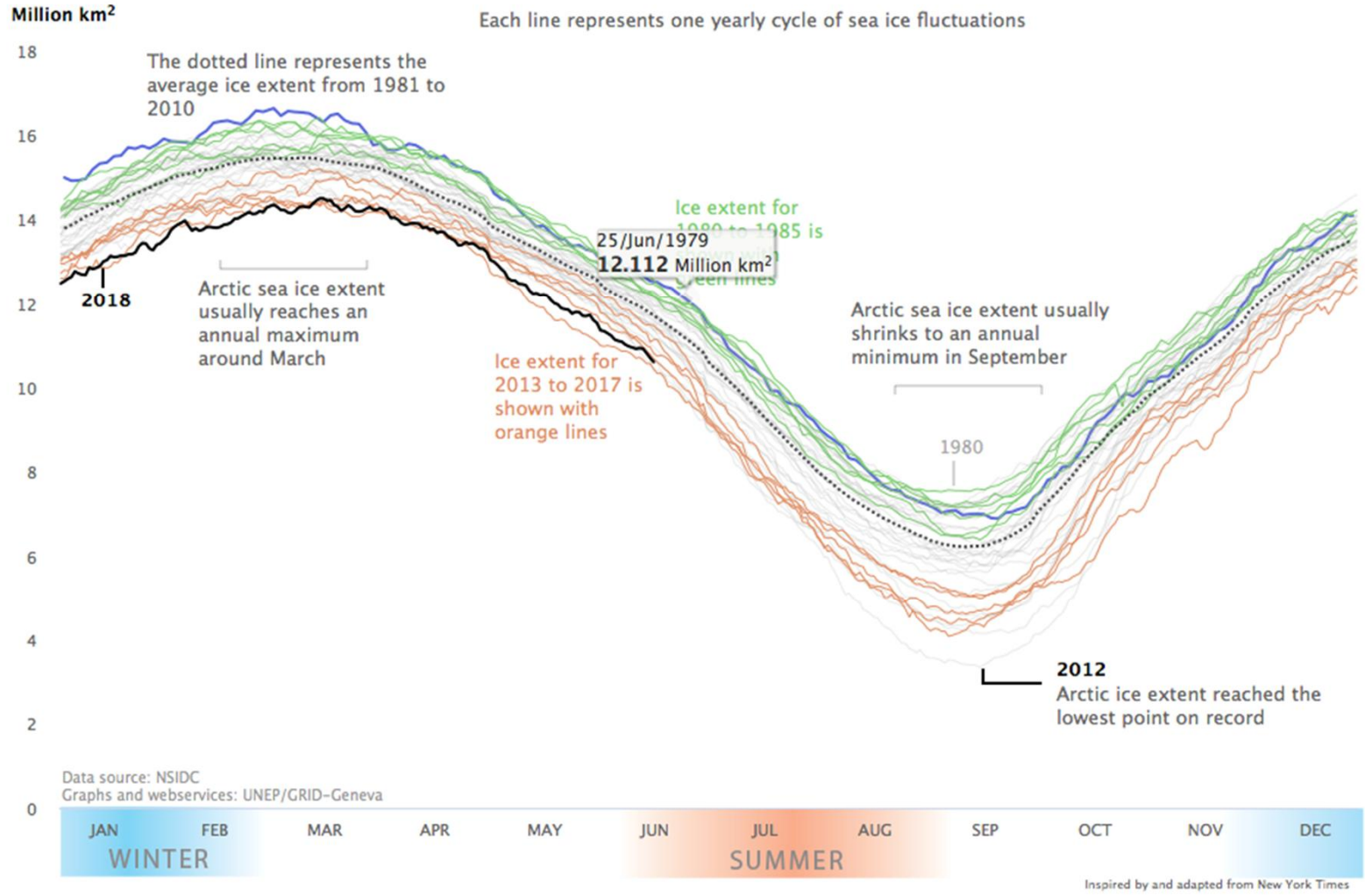
> To strengthen monitoring systems
> Providing more efficient observations
> Seize fundamental system dimensions

> One EV can contribute to multiple indicators
> A given observation can be linked to more than one EV
> Can enable a potential reduction of the number of observations required to deliver indicators.



ECV in action

Arctic Sea Ice Extent



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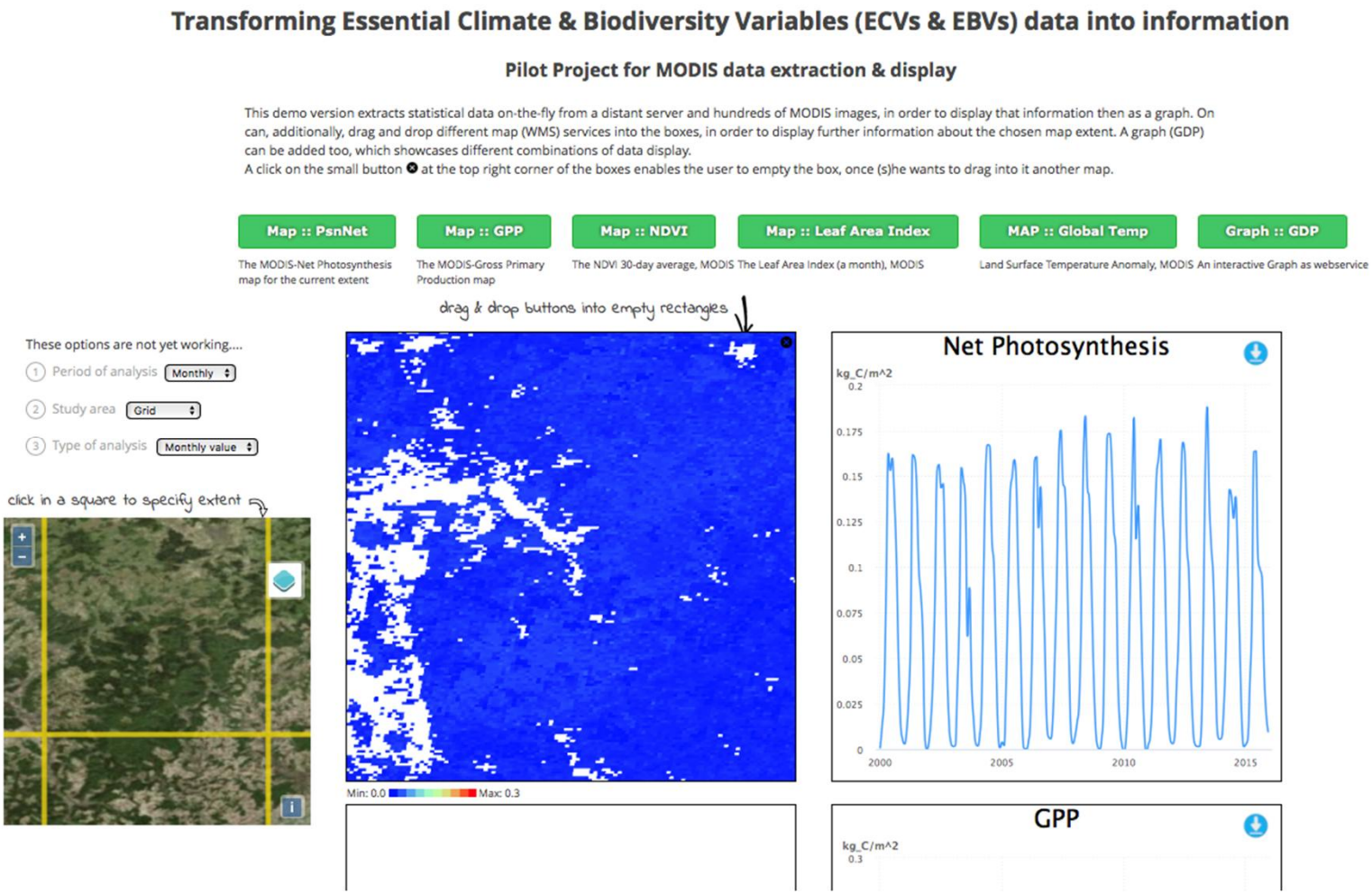
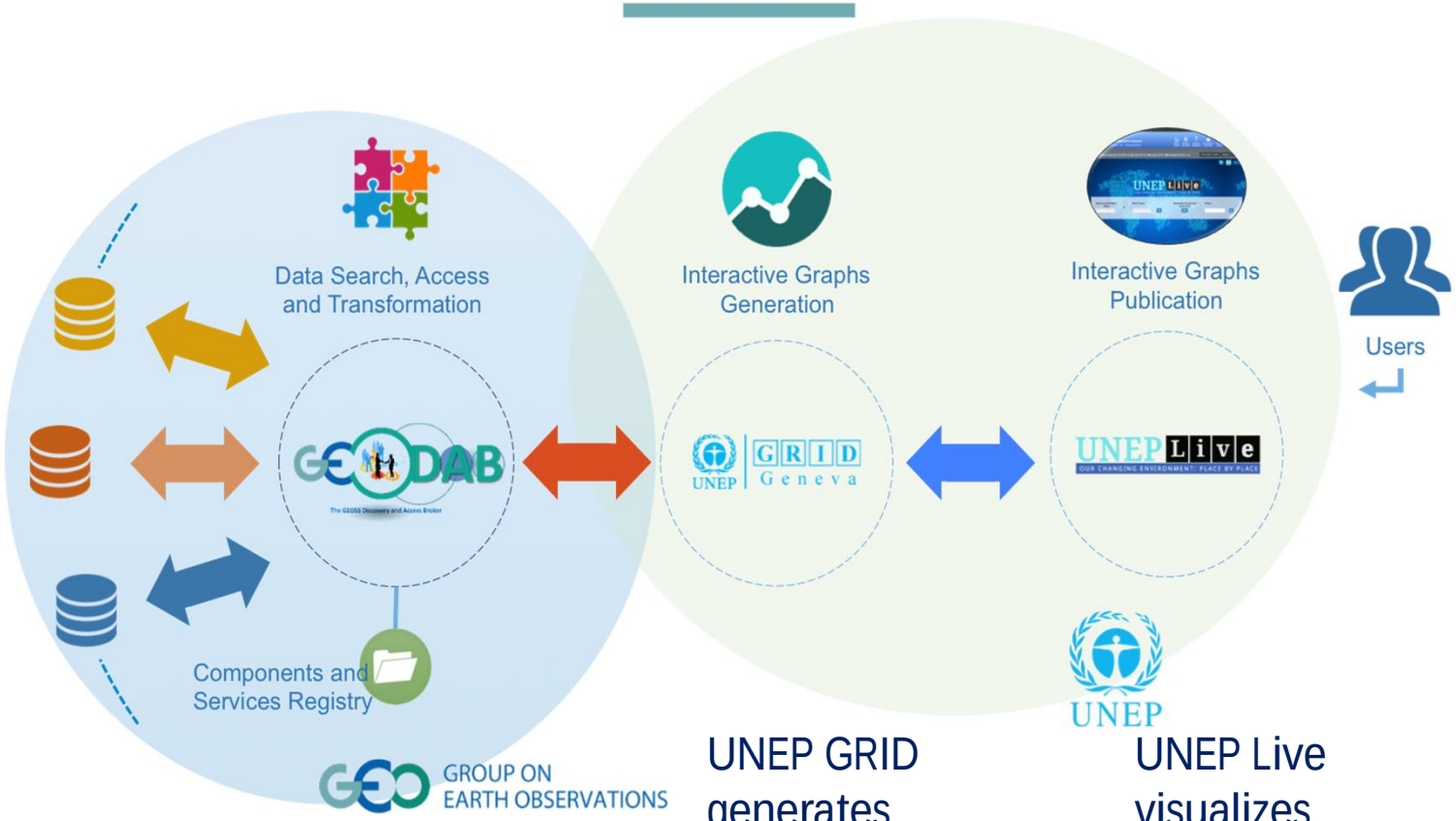
EBV in action

Net Primary Production



System Architecture

Using the GEOSS platform



GEOSS brokered EO datasets to UNEP

UNEP GRID generates the datasets to graph

UNEP Live visualizes the datasets to users

ConnectinGEO

http://www.connectingeo.net

Gap analysis table

This page has the following equivalent URL: http://tinyurl.com/EOgaps

- Gap analysis table
  - Gaps table
  - Gap view by code
  - Gap types
  - Essential Variables
  - Threads

Ref. Ares(2016)85023 - 07/01/2016

EU Framework Program for Research and Innovation (SC5-18a-2014 - H2020)

ConnectinGEO

Project Nr: 641538

Coordinating an Observation Network of Networks EnCompassing saTellite and IN-situ to fill the Gaps in European Observations

Save PDF to Evernote

Deliverable D2.2

EVs current status in different communities and way to move forward

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GEOEssential

http://www.geoessential.eu

Essential Variables workflows for resource efficiency and environmental management

The project aims at demonstrating the feasibility and generality of the concept of Essential Variables (EVs) across the Nexus of GEOSS Societal Benefit Areas (SBAs).

- ü Sustainable and trustable sources of data and information to monitor the progresses made on environmental conditions

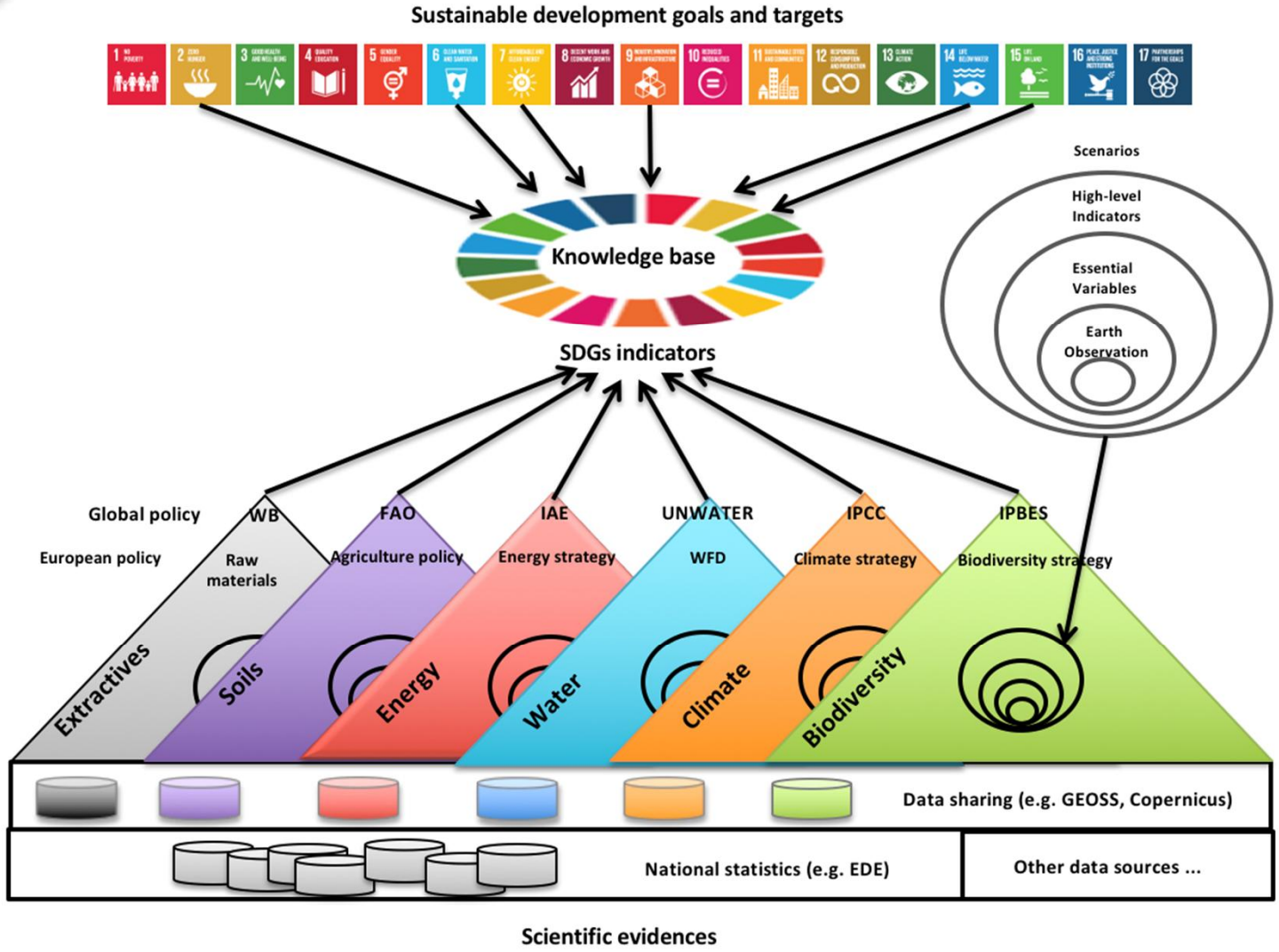
- ü Cross-thematic workflows and knowledge base to evaluate, predict and monitor Sustainable Development Goals (SDGs)

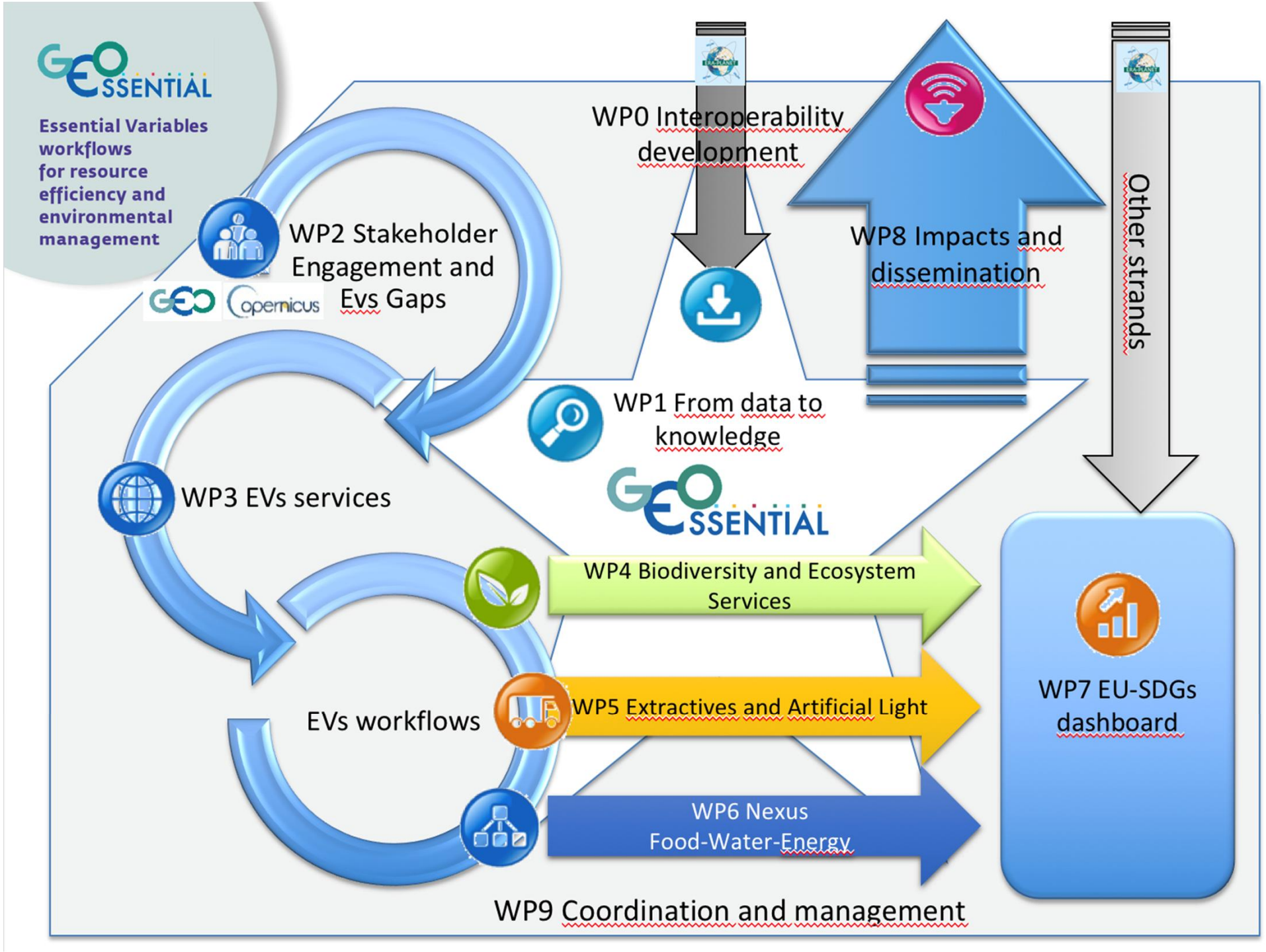
- ü Gaps and synergies for addressing the needs of environmental policy in agriculture, soil, water, biodiversity, energy, light, and raw materials

GEOESSENTIAL

Essential Variables workflows for resource efficiency and environmental management

Generalisation of the EV concept across SBAs and connection with SDGs through a knowledge base




GEOESSENTIAL
Essential Variables workflows for resource efficiency and environmental management
WP0 Interoperability development
WP8 Impacts and dissemination
Other strands
WP2 Stakeholder Engagement and Evs Gaps
GEO
Copernicus
WP1 From data to knowledge
GEOESSENTIAL
WP3 EVs services
WP4 Biodiversity and Ecosystem Services
EVs workflows
WP5 Extractives and Artificial Light
WP7 EU-SDGs dashboard
WP6 Nexus Food-Water-Energy
WP9 Coordination and management

Thank You

Communicate and Collaborate with GEO:

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