Earth Observation in Action:

Global Tools and Case Studies for Monitoring Water-Related Ecosystems under SDG 6.6.1

- **Freshwater Ecosystem Explorer**
- **EO4WI**
- **Global Wetland Watch**

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UNEP-DHI
Centre on Water and Environment

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SDG 6.6.1
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Freshwater Ecosystems Explorer
Leverage the best available science to track, monitor, and improve the health of freshwater ecosystems.
TRANSLATE site to other language
ANALYSIS AND STORIES
EXPLORE YOUR FRESHWATER ECOSYSTEM

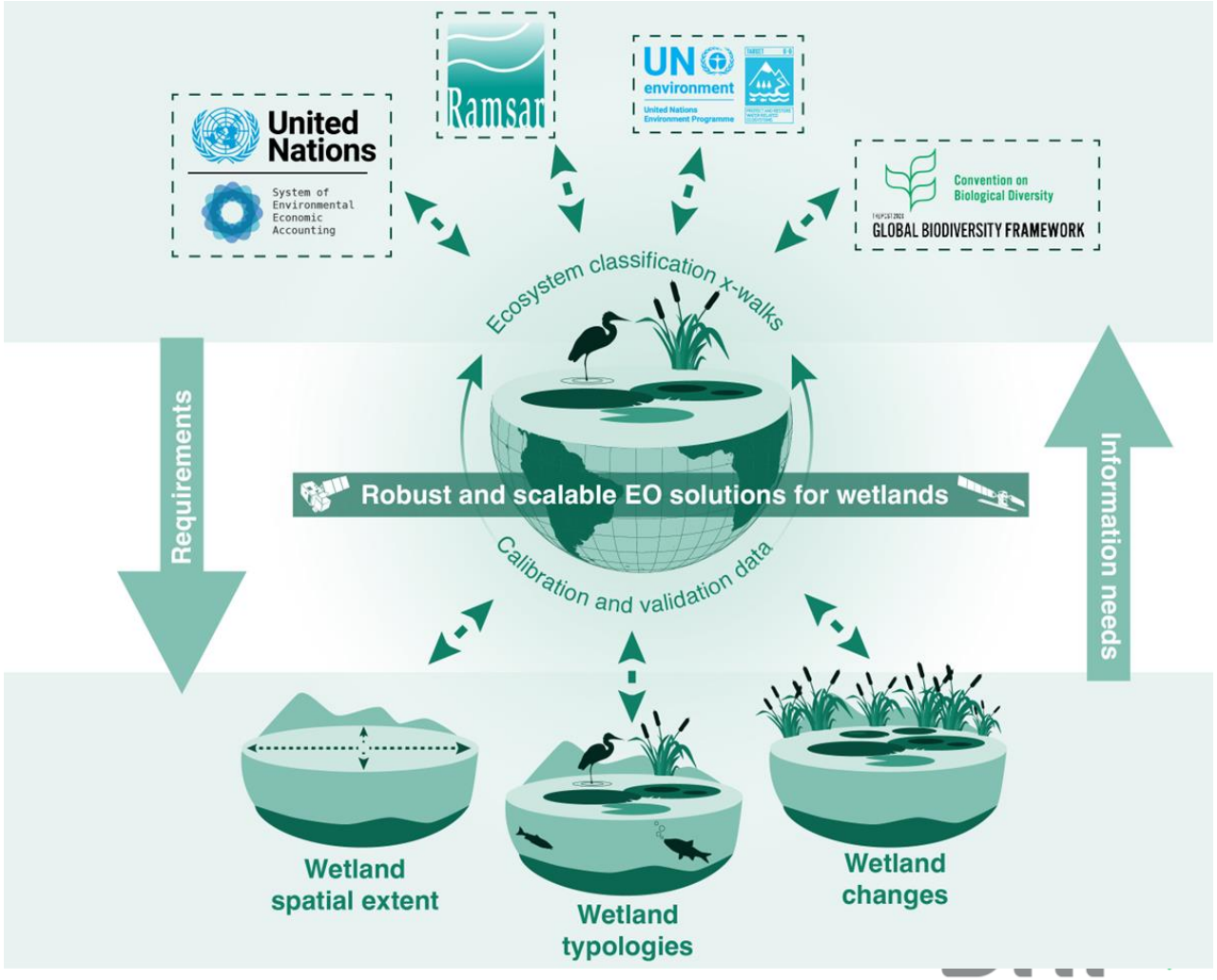
Live demo

EO4WI

WETLAND INVENTORIES

Earth Observation for Wetland Inventories

- To demonstrate how free and open satellite data can be adopted by national stakeholders to independently undertake wetland inventories (i.e., map wetland spatial extent and their changes, disaggregated by wetland types)



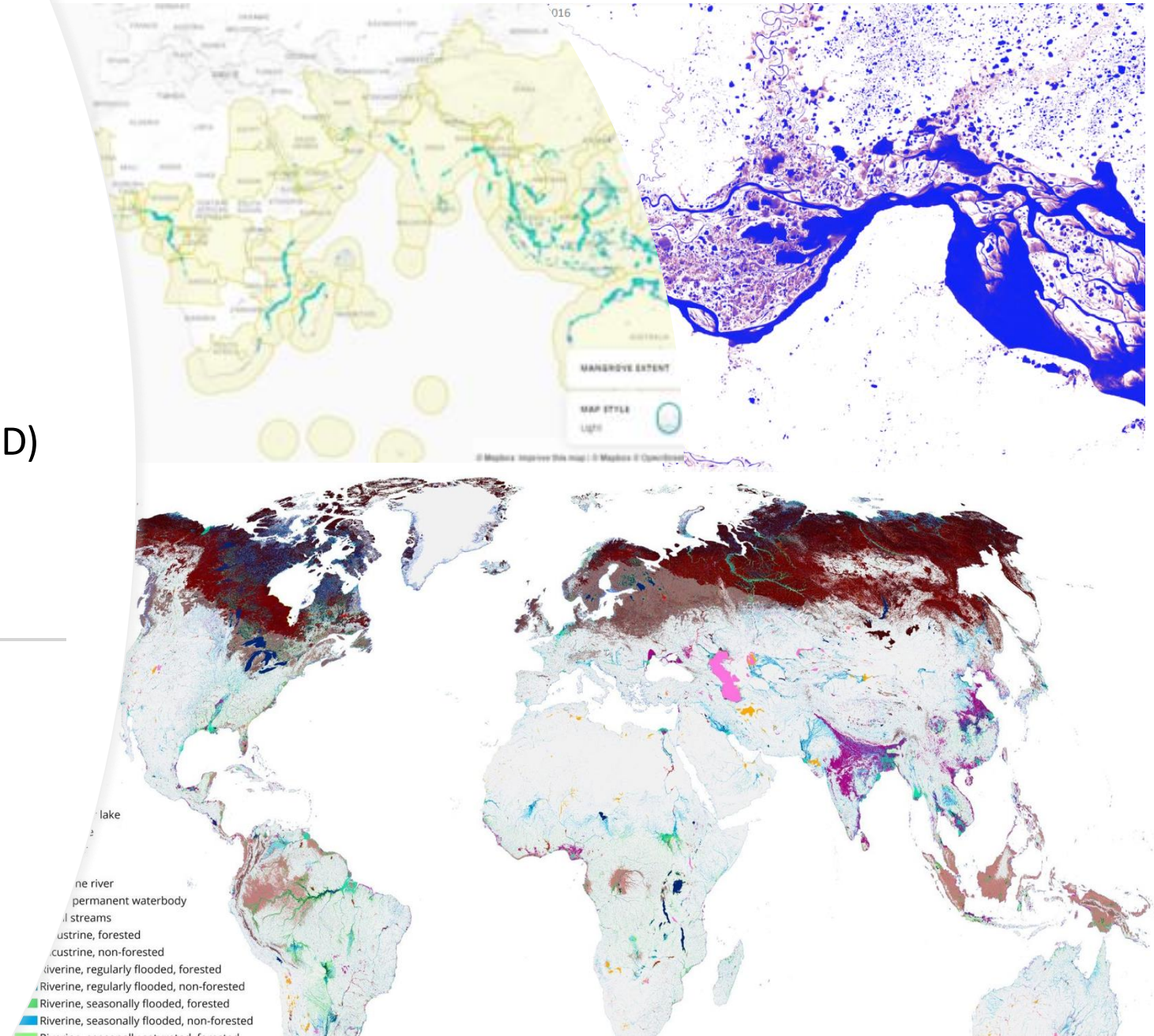
GLOBAL WETLAND WATCH

A new system for globally mapping and monitoring changes to wetland ecosystems

Towards high resolution global datasets

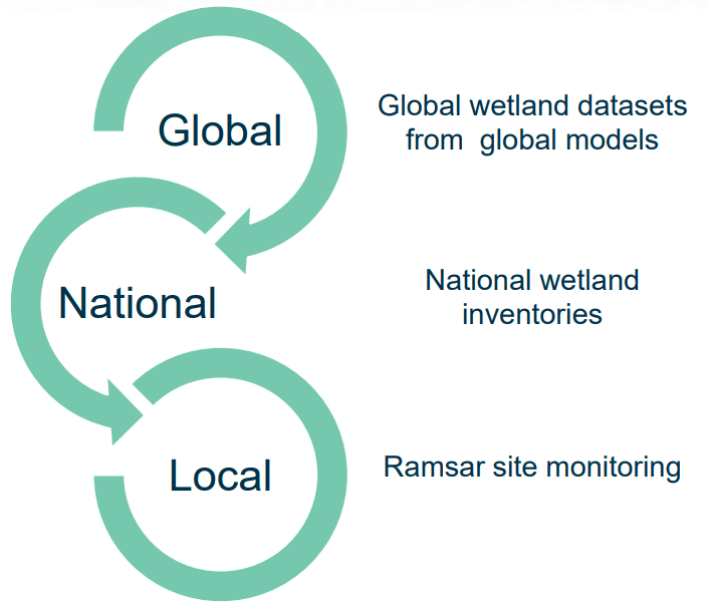
- Global Mangrove Watch
- Global Surface Water Explorer
- Global Lakes and Wetlands Database (GLWD)
- Global tidal flats (30m)
- Etc.

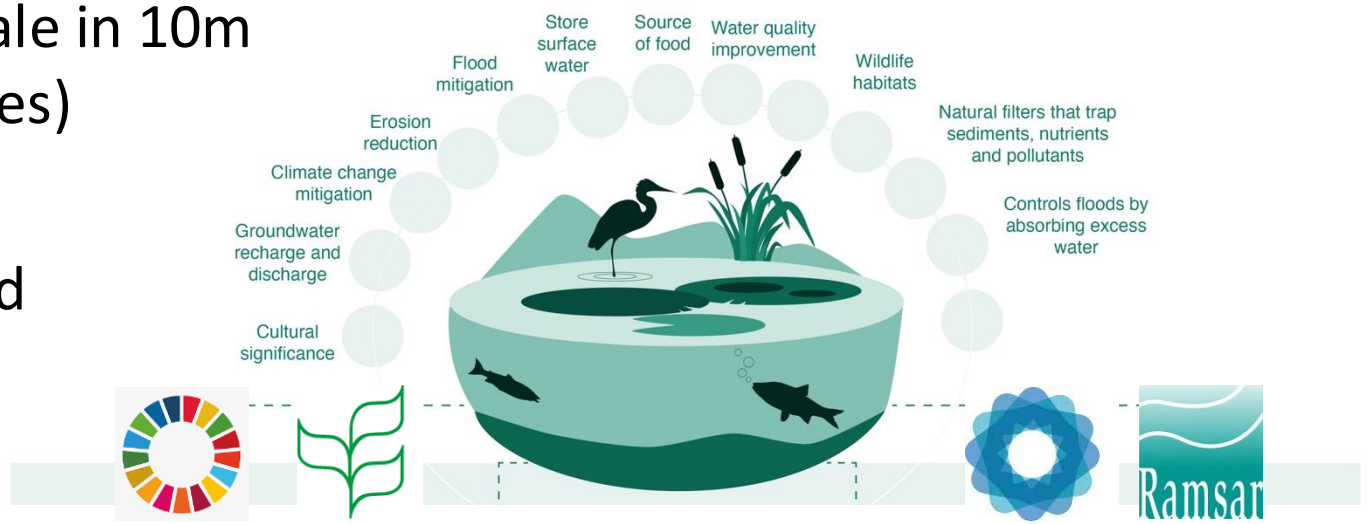
Limitations in thematic, and or spatial/temporal resolution



Objective and scope

- Monitor and map ‘all’ wetlands at scale in 10m spatial resolution (with annual updates)
- Contribute to global agendas and frameworks and national wetland conservation and restoration



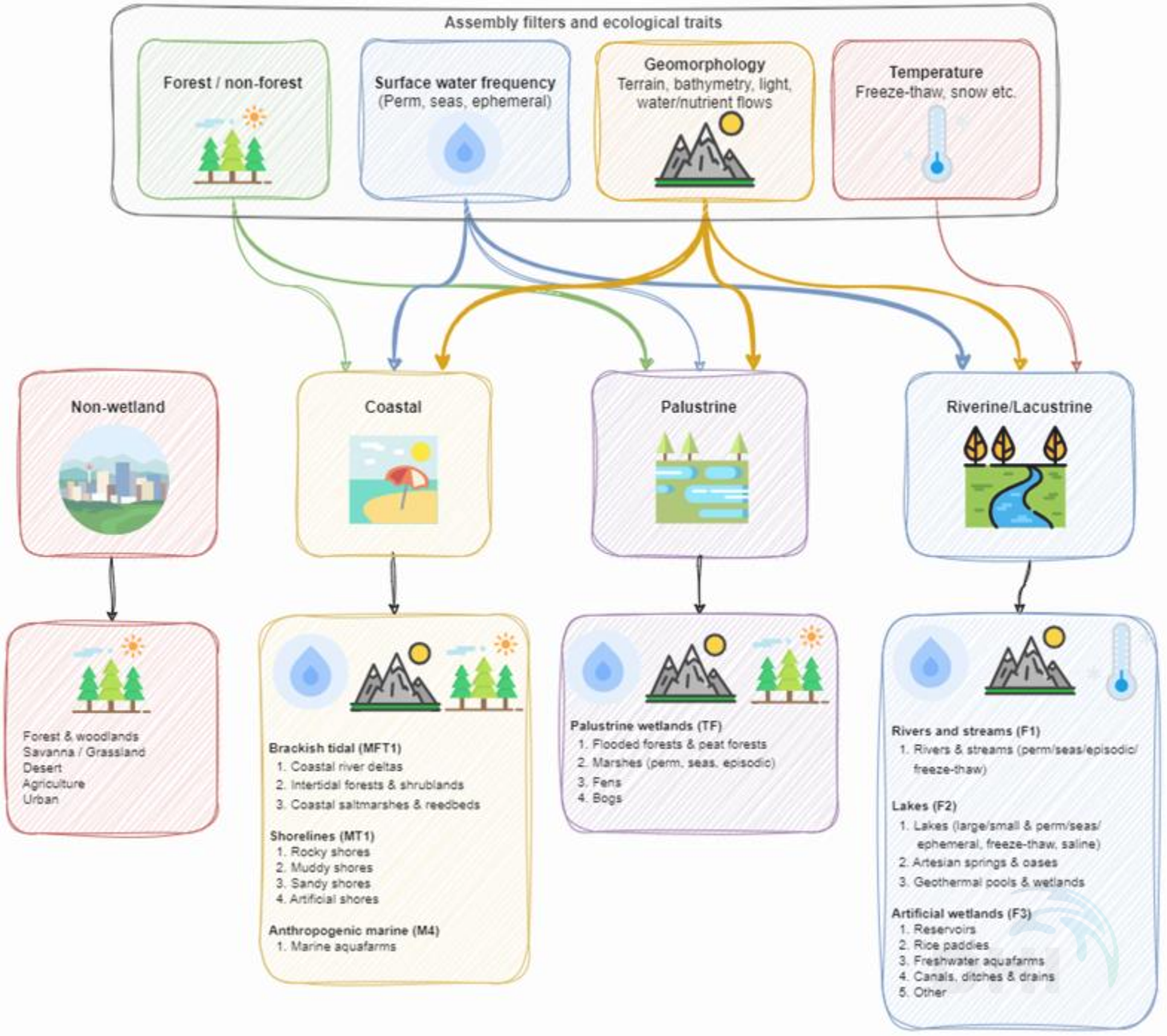


A global wetland inventory serves as a vital tool for monitoring and reporting requirements outlined in numerous global agendas.

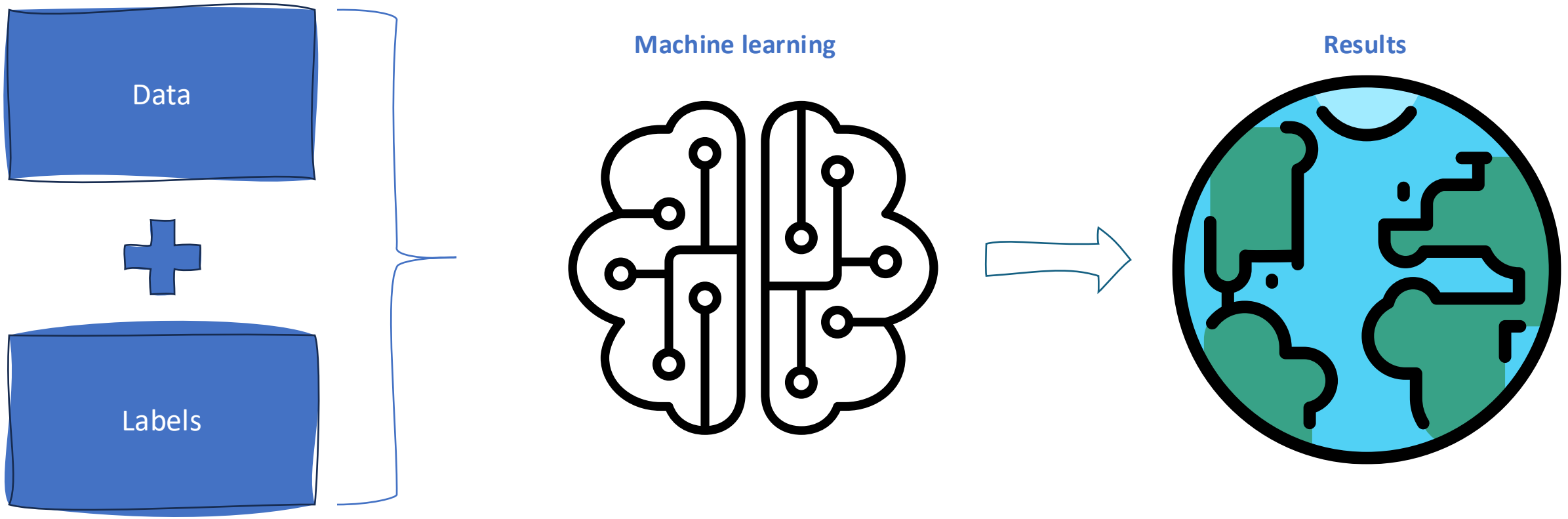
GWW will be a system capable of informing subnational policies while maintaining compatibility at a global scale

Classification framework

- Wetland types classified using **IUCN Global Ecosystem Typology**
- One-size-fits-all approach not feasible
- **Tailored models** for biomes, ecoregions and a wetland categories
- **Individual workflows** for coastal, palustrine and lacustrine/riverine ecosystems

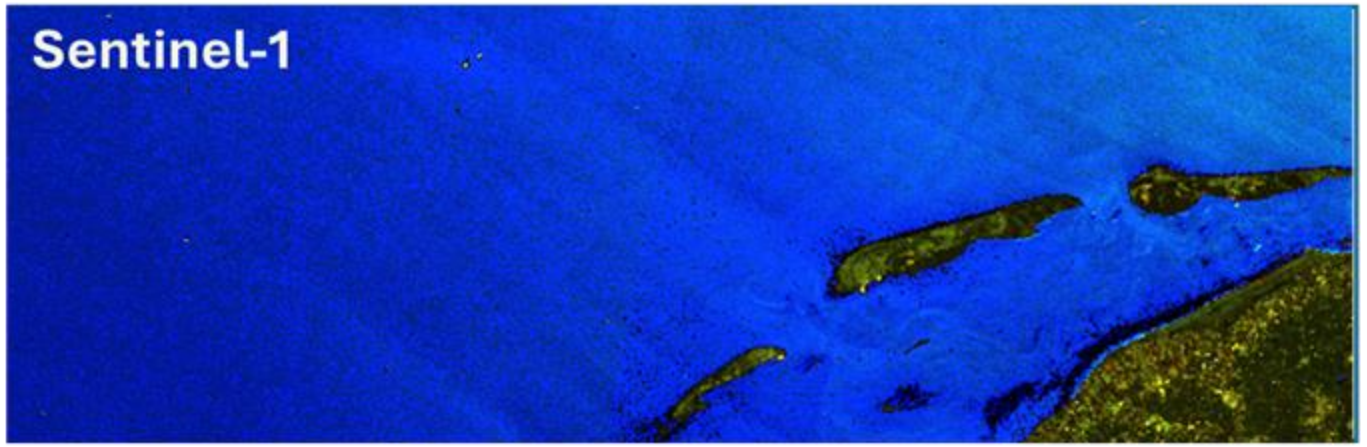


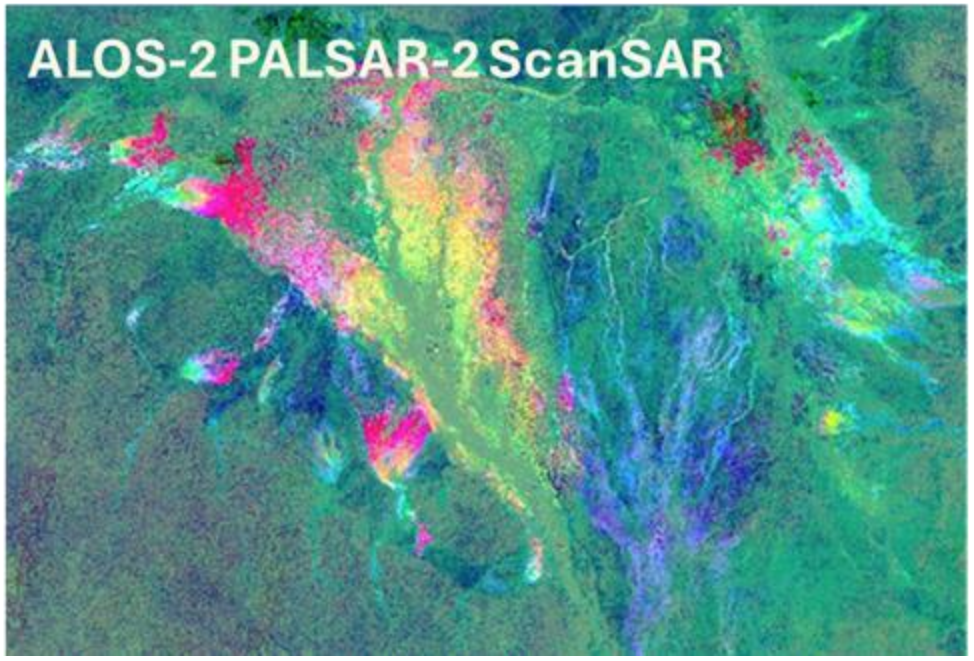
Method

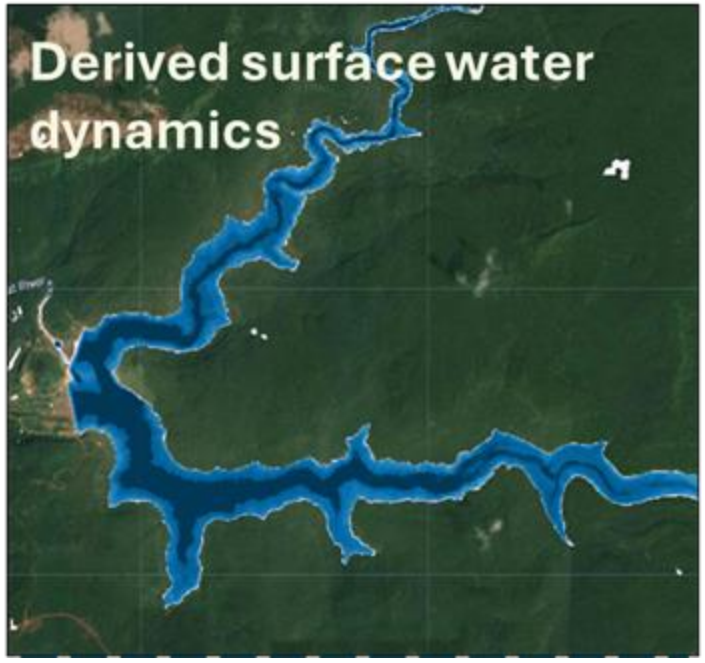


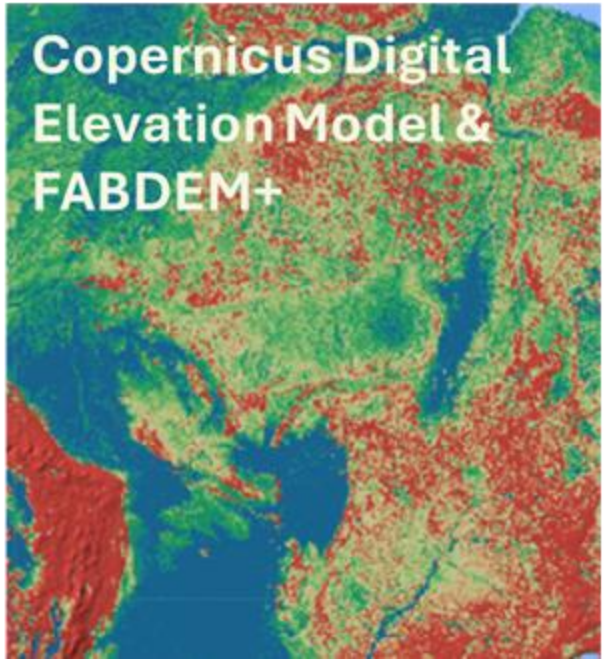
Input data

Multi-data approach allows different types of environmental parameters and processes to be observed



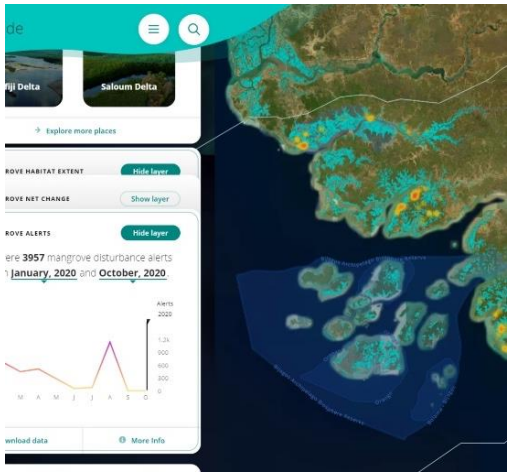




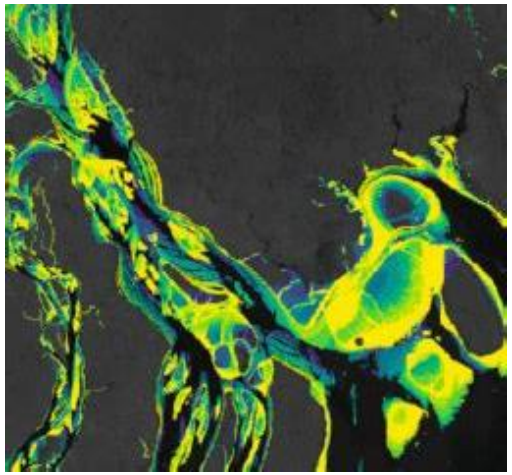


Labels

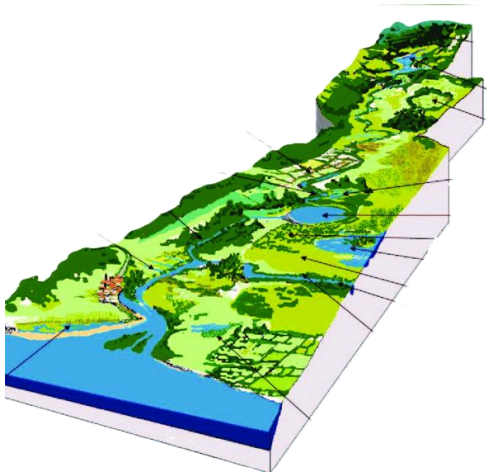
- High quality labels are required for ML (pixel/patches). No single dataset exists and those that do are imperfect and may require cleaning, and harmonizing.



Mangroves



Tidal flats



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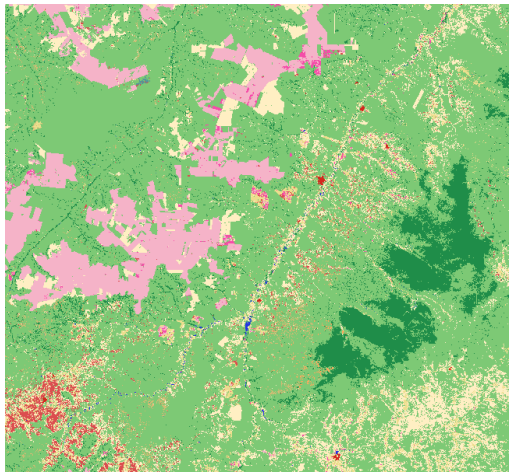
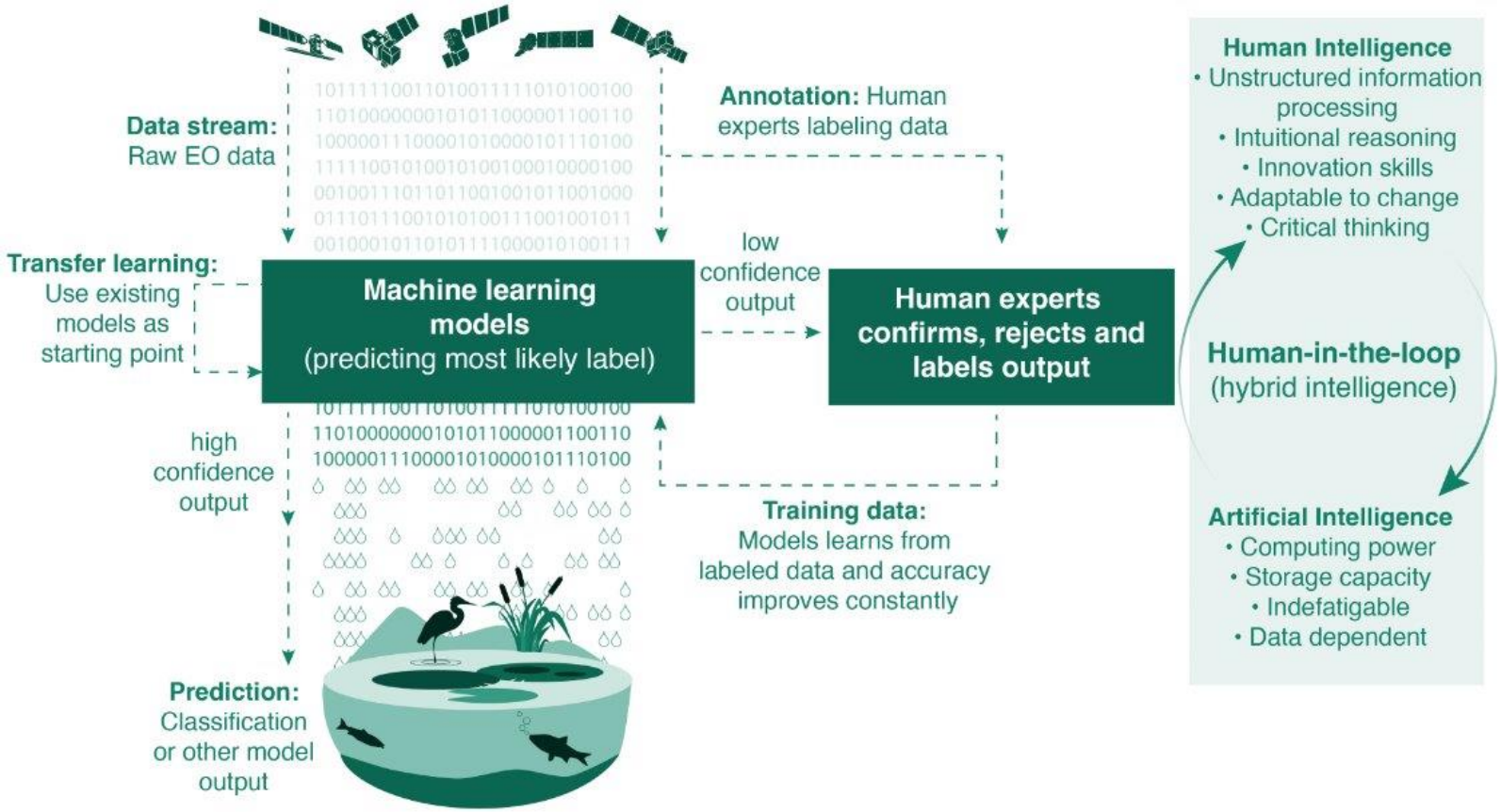


Topgraphy

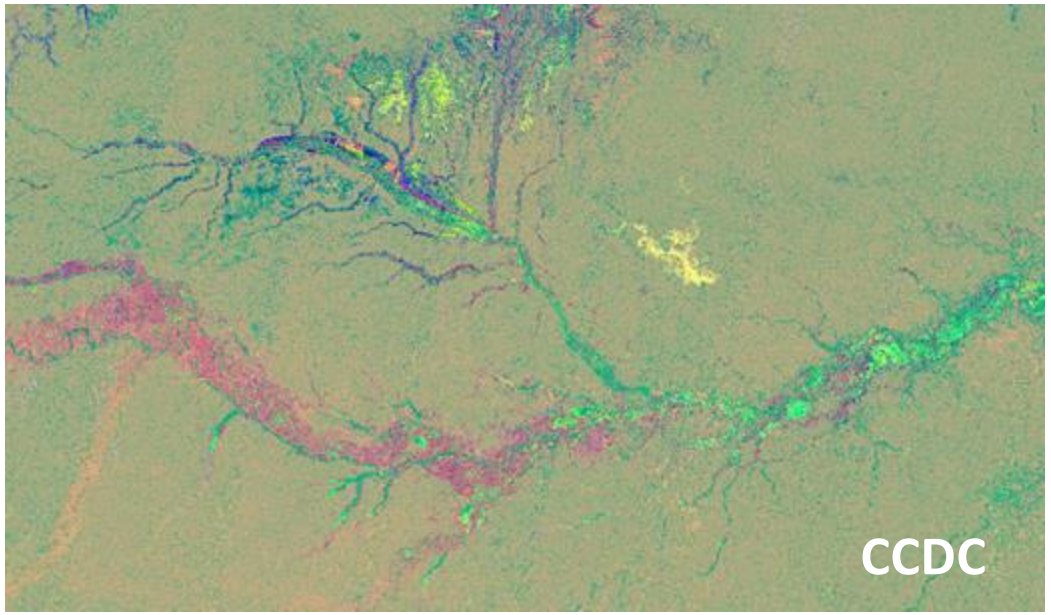
Human-in-the-loop:

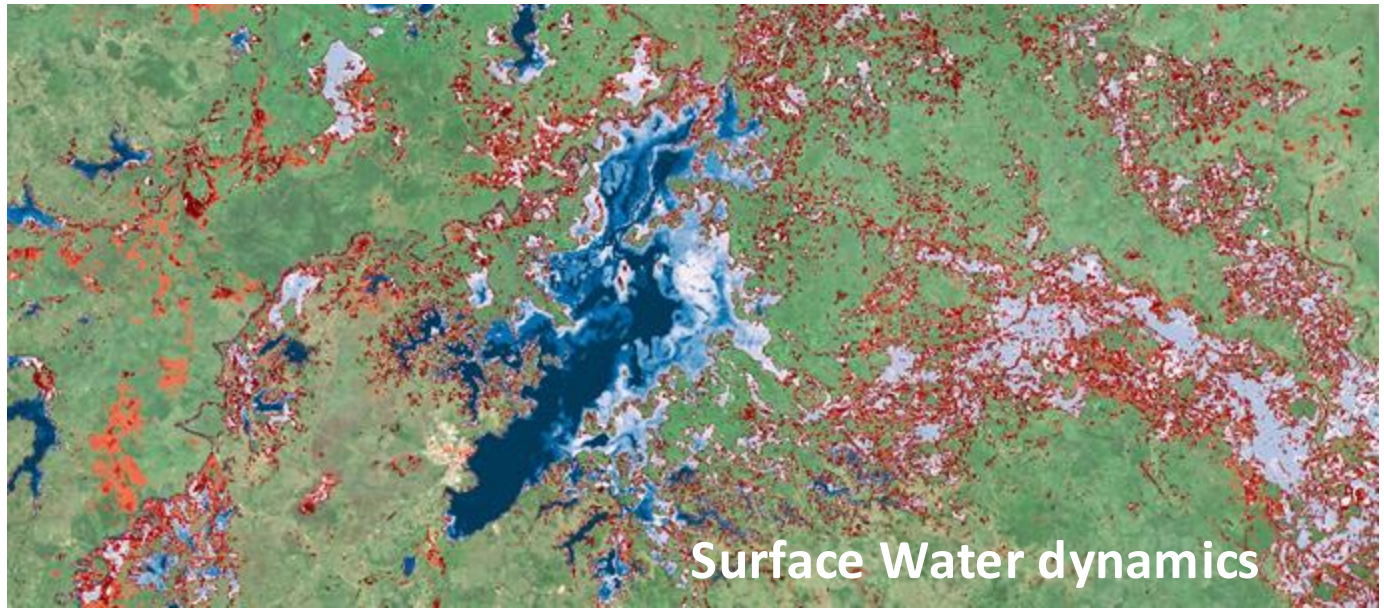
Models are only as good the data they are trained on!

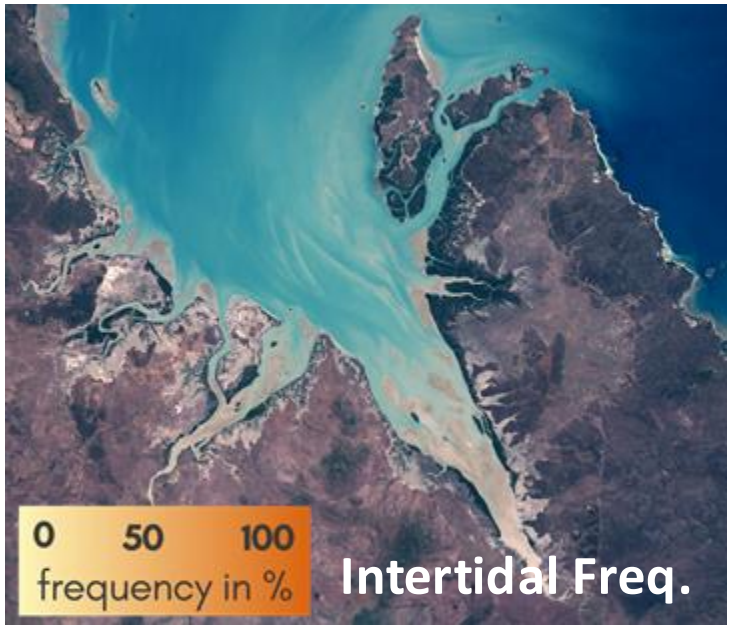
- Space-borne observations are inherently borderless, impartial, and inclusive.
- Yet, global maps tend to have local biases
- Humans can be involved in tuning the model to improve its accuracy (and validate the outcome)

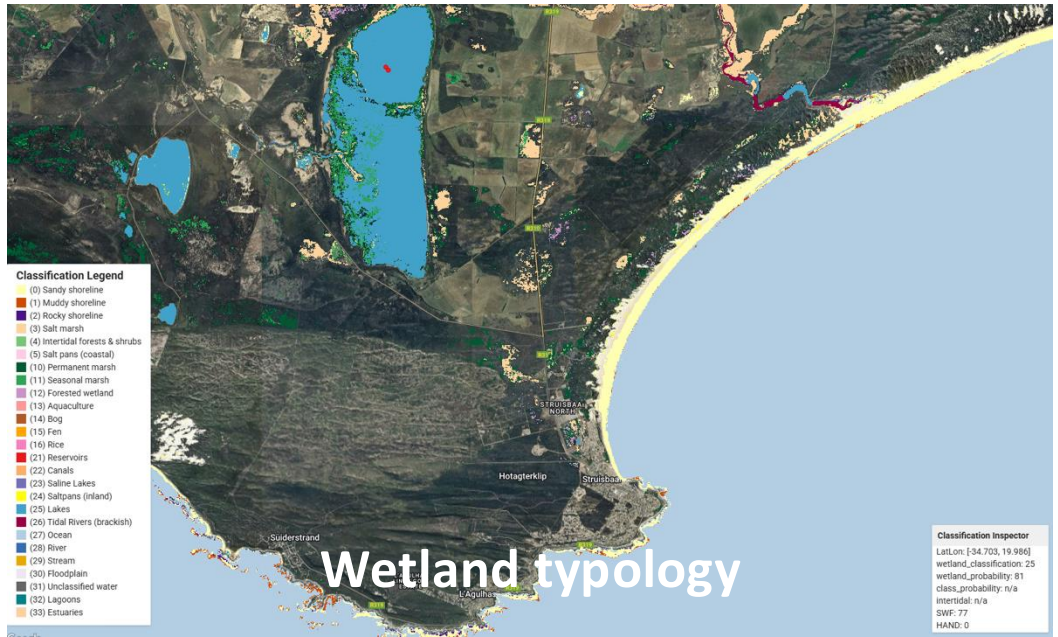


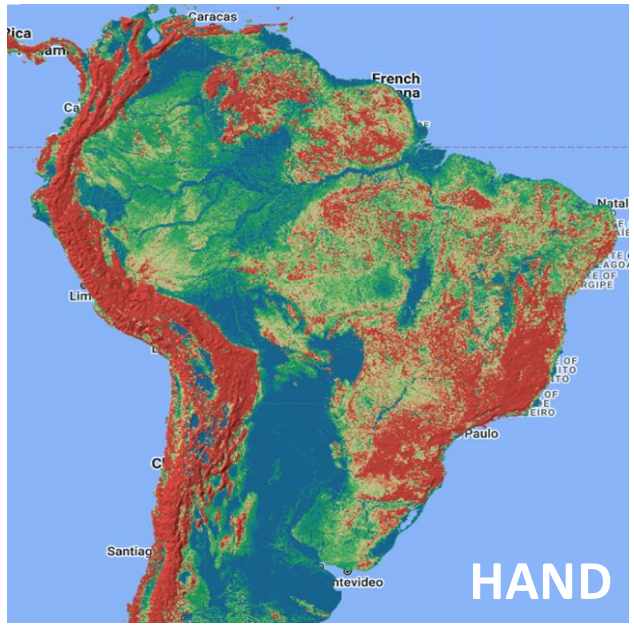
Beyond Classification - Associated products will also be released!









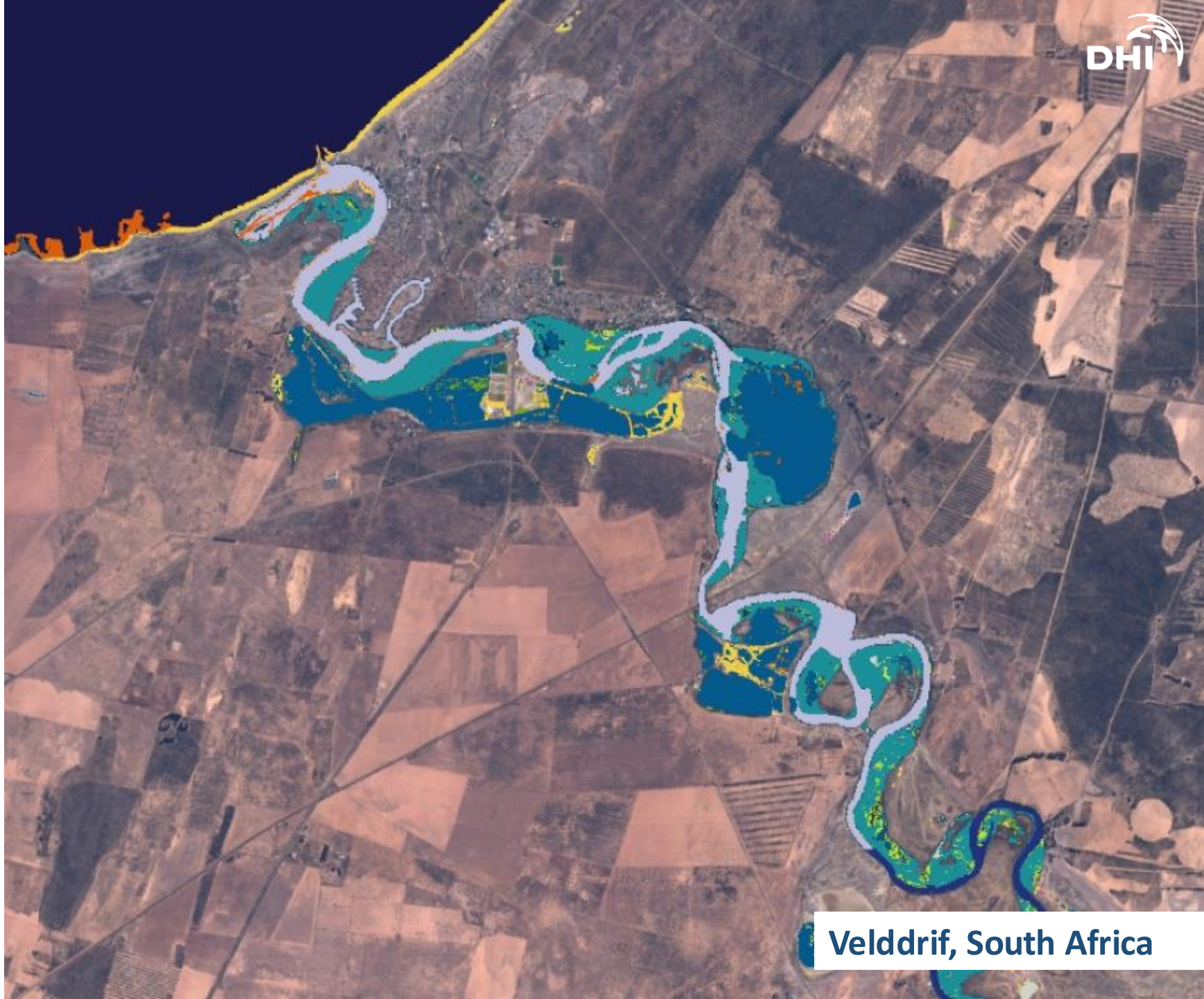


Surface water

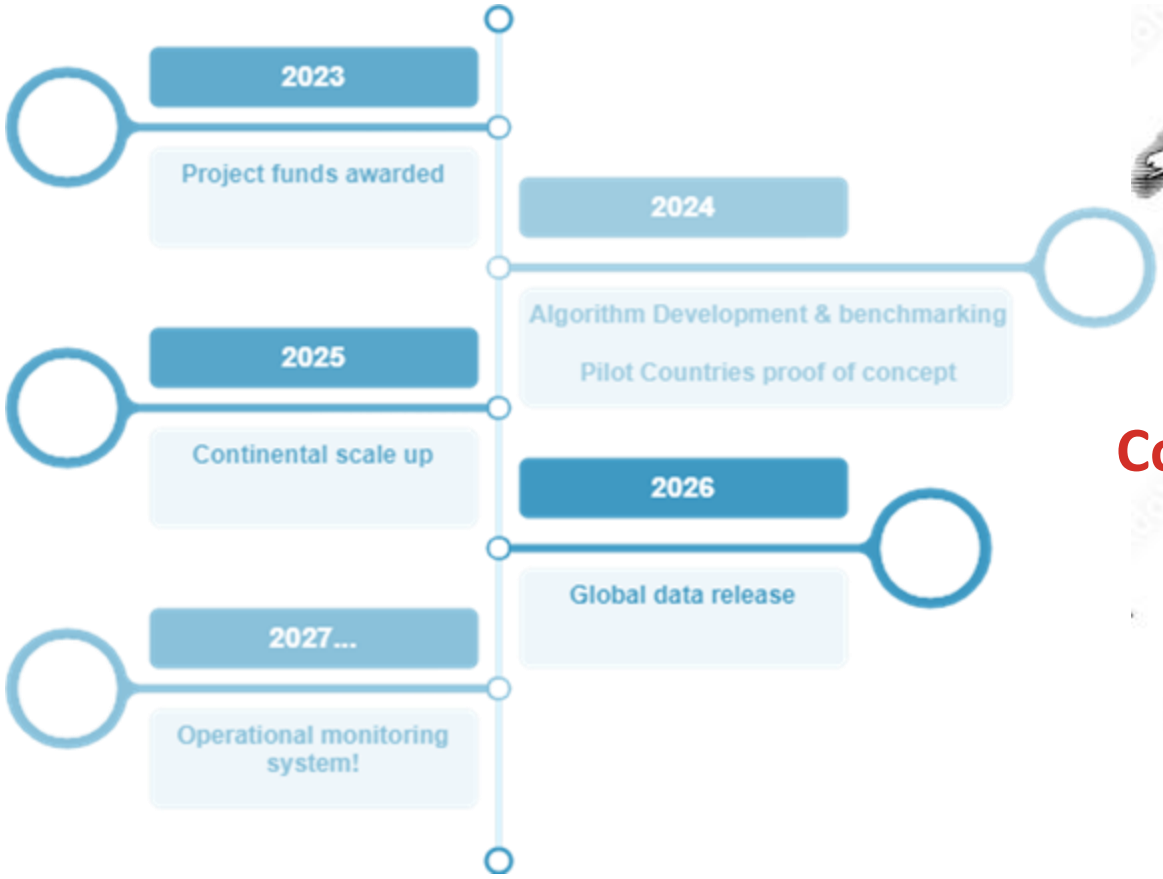
Preliminary results

Wetland typology

Preliminary results



Project timeline & Pilot Countries



Labels, validation & feedback

- Built on Google Earth Engine the GWW will support implementation of relevant Global Agendas
- Promote improved wetland monitoring and reporting
- An open platform co-developed with UNEP with option to adapt to national needs
- Interoperable with other global platforms of relevance (incl. www.sdg661.app)
- Funded by Google.org (2023-2026)

DHI

UN environment programme

UNEP-DHI Centre on Water and Environment

Google Earth Engine

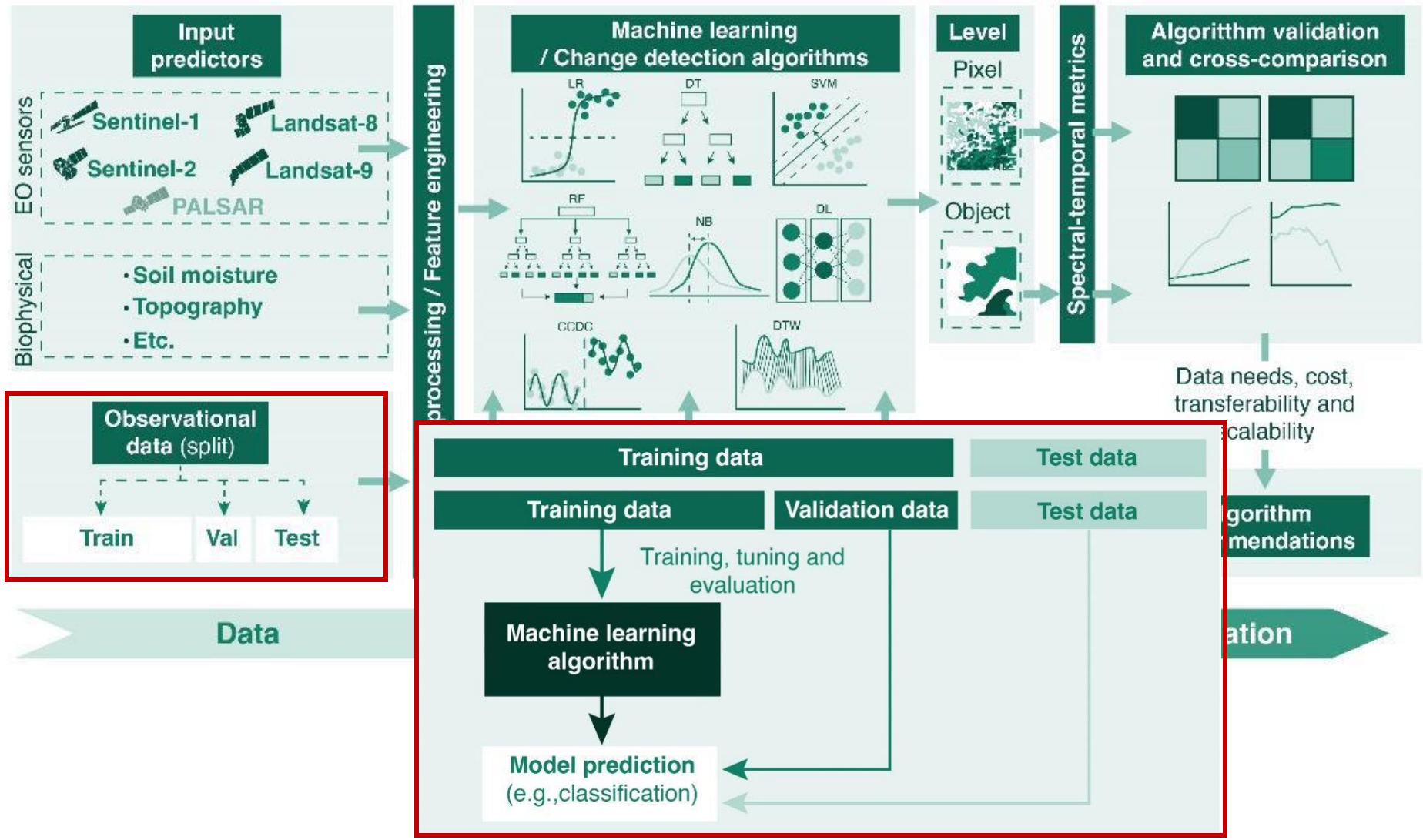
Thanks

Background

- Wetlands are one of our most important ecosystems thus it is somehow ironic that wetlands are very poorly mapped and characterized.
- In fact, most countries in the world do not have a good account of their wetlands and this represent a very critical information gap as **you cannot manage, what you do not measure**.

User empowerment

- **Assess** user requirements based on an in-depth analysis and understanding of the SDG and related MEA-C policy and indicator frameworks with characterization of key stakeholders, their operational practices and information needs.
- **Develop**, validate, and demonstrate high resolution robust, scalable, and scientifically sound operational EO methods to map and characterize wetland extent, typology, and change (Proof-of-Concept).
- **Integrate** wetland products, indicators, and related data into a data analytics platform to foster the wider usage of EO data for reporting and understanding of wetland issues and processes.
- **Proof** scalability with large-scale demonstrations and utility by involving key stakeholders in participatory design of use cases covering a range of different application areas.
- **Support** users and improve national EO capacities through capacity building and user webinars and events (cf., SDG Living Labs).


Input predictors
EO sensors
Sentinel-1
Landsat-8
Sentinel-2
Landsat-9
PALSAR
Biophysical
•Soil moisture
•Topography
•Etc.
processing / Feature engineering
Machine learning / Change detection algorithms
LR
DT
SVM
RF
NB
DL
CCDC
DTW
Level
Pixel
Object
Spectral-temporal metrics
Algoritthm validation and cross-comparison
Data needs, cost, transferability and scalability
Observational data (split)
Train
Val
Test
Training data
Test data
Training data
Validation data
Test data
Training, tuning and evaluation
Machine learning algorithm
Model prediction (e.g.,classification)
Data
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Results

Implementation with Pilot countries

- Phase 1
  - Italy
  - Algeria
  - Kenya
  - Colombia
- Phase 2
  - Madagascar
  - Jordan?
  - Zimbabwe?
  - ..?