Biodiveristy

Marc Paganini
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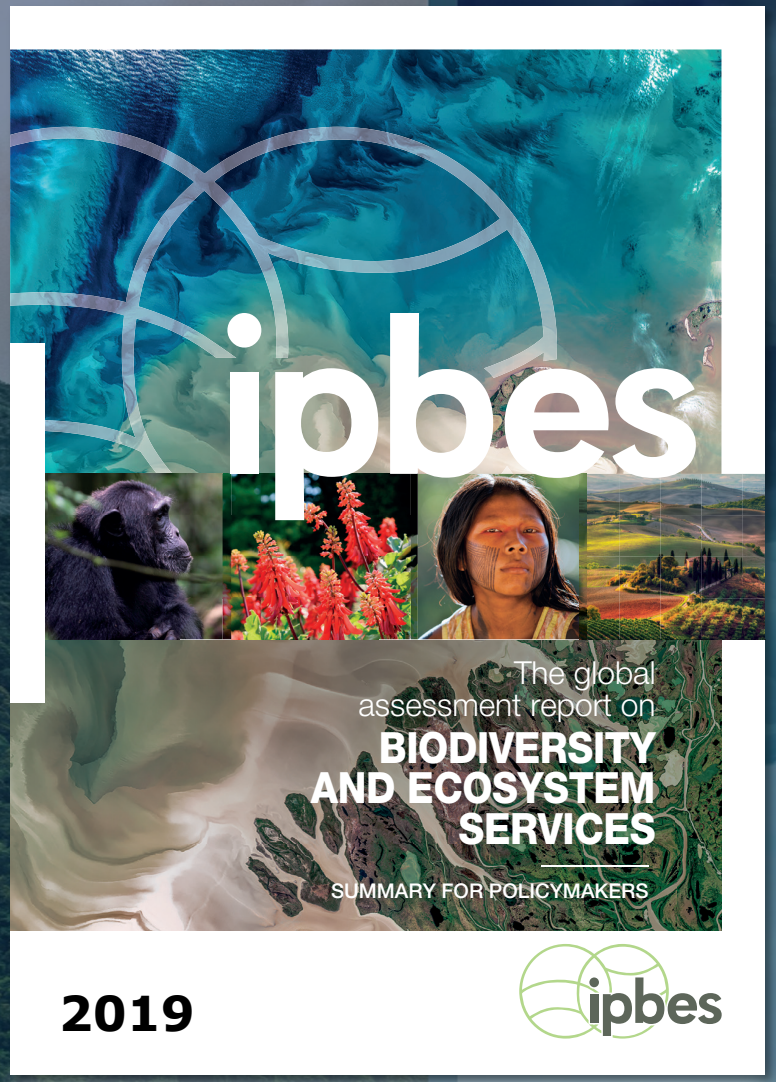
Global Assessment Report on Biodiversity & Ecosystem Services



Key Findings

- 1,000,000 species threatened with extinction
- Current global response insufficient
- Transformative changes needed to restore and protect nature

Five main drivers of the collapse of biodiversity

(1) changes in land and sea use

(2) direct exploitation of organisms

(3) climate change

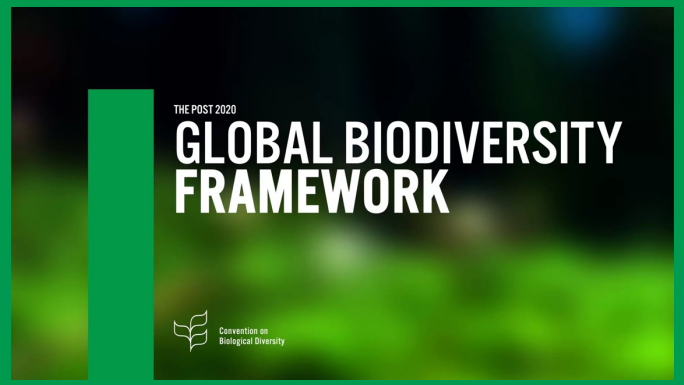
(4) pollution

(5) invasive alien species

ESA Supports the Multilateral Environmental Agreements

Convention on Biological Diversity (CBD)

Post 2020 Global Biodiversity Framework (GBF)



At least 30% of global land and sea areas conserved through effective, equitably managed, ecologically representative and well-connected systems of protected areas (and other effective conservation measures)

Sustainable Development Goals (SDGs)

SDG Target 6.6

Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

SDG Target 14.2

Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts.

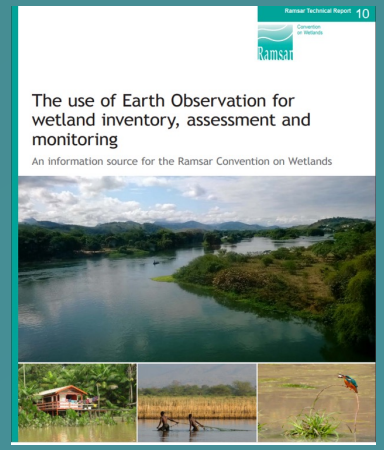
SDG Target 15.1

Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services.

Ramsar Convention on Wetlands

Ramsar Strategic Plan (2016 – 2024)

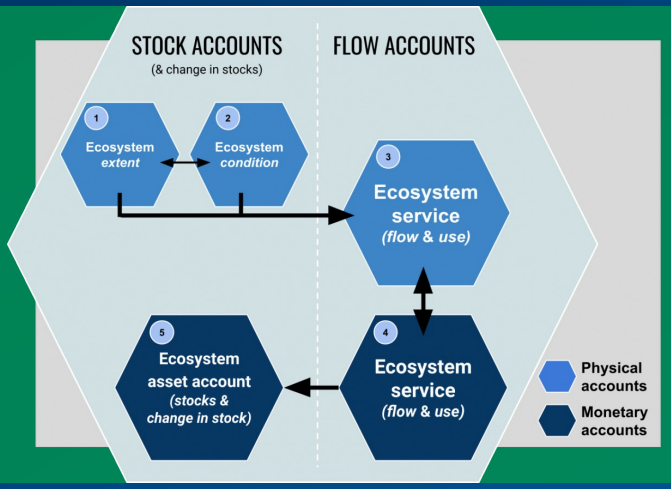
Conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world..

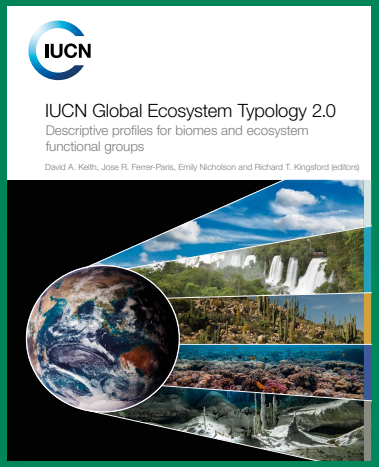


SEEA Ecosystem Accounting

New international standard on Ecosystem Accounting which regulate the production on statistical accounts on ecosystem extent, condition and services.

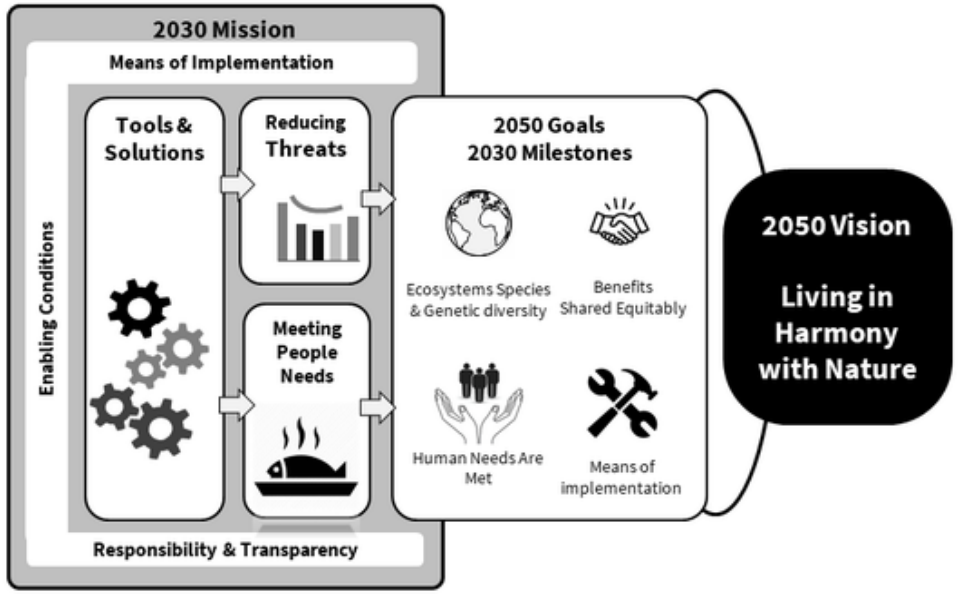
Measurement framework underpinning the development of monitoring frameworks of other MEA, such as the CBD post-2020 GBF, the Ramsar Convention on Wetlands, and the 2030 Agenda on Sustainable Development.





A new horizon for global biodiversity monitoring

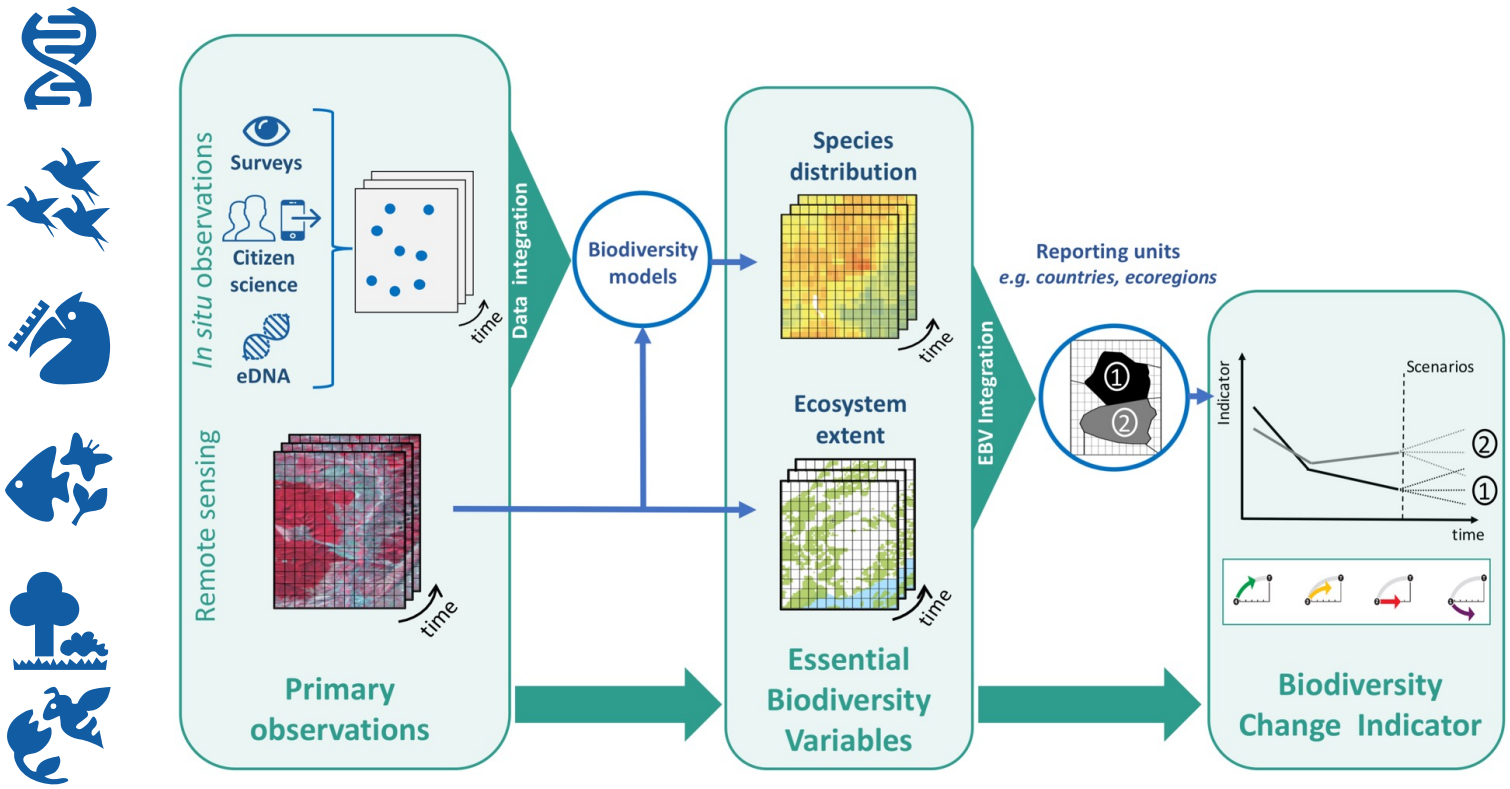
The post-2020 Global Biodiversity Framework



Monitoring framework

GBF has a monitoring framework (CBD/SBSTTA/24/3), which ensures that we monitor the state of nature and our progress toward the targets and goals. Need for national governments and other stakeholders to work together to provide the capacity and resources to track biodiversity change.

Essential Biodiversity Variables for monitoring



EBV production workflows:

1. Collection of primary observations
2. Standardization of primary monitoring observations
3. Data integration and model-based estimation
4. Publication of trends following data guidelines

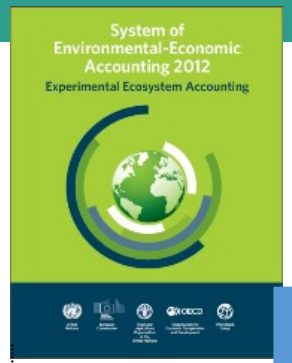
Navarro et al., (2017) Current Opinion in Environmental Sustainability

The UN System of Environmental-Economic Accounting (SEEA)

System of Environmental Economic Accounting

2012 — SEEA Central Framework (SEEA-CF) adopted by UN Statistical Commission

2013 — SEEA Experimental Ecosystem Accounting (SEEA-EEA)



2014

2015

2016

2017

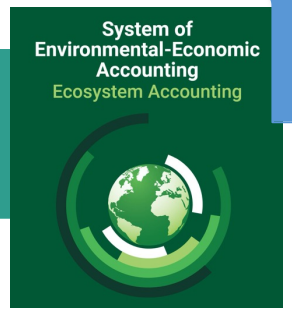
2018 — SEEA Experimental Ecosystem Accounting (SEEA-EEA) Global Revision

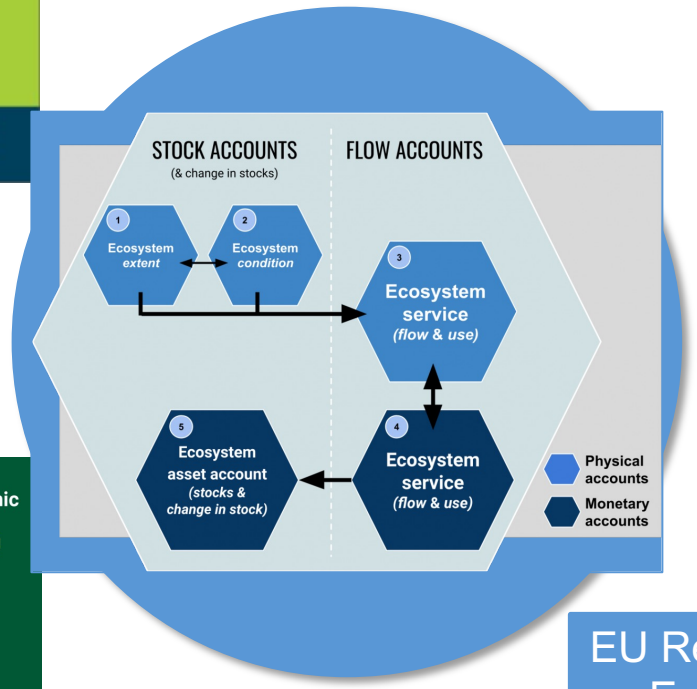
2019

2020

2021 — SEEA Ecosystem Accounting (SEEA-EA) Adopted by the UNSC

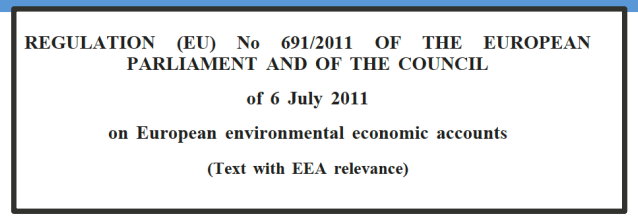
2022





European Natural Capital Accounting

2011 — EU Regulation N 691/2011 on European environmental Economic Accounts


REGULATION (EU) No 691/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 6 July 2011

on European environmental economic accounts

(Text with EEA relevance)

2012

2013

2014

2015

2016

2017

2018

2019

2020

2021

2022 — EU Regulation N 691/2011 amendment on Ecosystem Accounting

https://eo4ea-2022.esa.int

EU Biodiversity Strategy for 2030

Bringing nature back into our lives

Put Europe's biodiversity on the path to recovery by 2030, by addressing the main drivers of biodiversity losses through concrete actions along 4 main strategic lines

Network of protected areas
Establishing protected areas for at least 30% of land in and 30% of sea in Europe.

Measures for transformative changes
Unlocking €20 billion per year for biodiversity.

Nature restoration plans
Restoring degraded ecosystems at land and sea across the whole of Europe.

Contribution to global biodiversity challenges
Making the EU a world leader in addressing the global biodiversity crisis.

EU Nature Restoration Law

European Commission

Nature Restoration Law

For people, climate, and planet

22 June 2022
#EUGreenDeal

Over **half of global GDP depends on nature** and the services it provides. **Construction, agriculture, food and health** sectors all highly depend on it

More than **75% of global food crops depend on pollinators**

40% of the world's land is degraded. Costs associated with soil degradation in the EU already exceed EUR 50 billion a year

Our global food systems are responsible for **80% of deforestation, 70% of freshwater use** and are **the single greatest cause of terrestrial biodiversity loss**

THE NATURE RESTORATION LAW WILL:

- **Restore at least 20% of EU land and sea by 2030,** and all ecosystems in need of restoration by 2050
- Require Member States to develop **National Restoration Plans** taking account of national circumstances
- Build on EU nature laws, focusing on all natural habitats, and not just those protected under **Birds and Habitats Directives or Natura 2000**
- Demonstrate EU **leadership in protecting and restoring nature** and set the bar for global action ahead of the Biodiversity COP15

New binding targets suggested by the law:

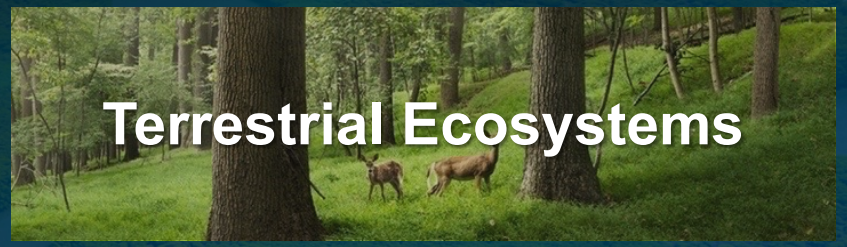
- **restore habitats and species protected by the EU nature legislation**
- **reverse the decline of pollinators by 2030**
- **no net loss of green urban spaces by 2030 and a minimum of 10% tree canopy cover in European cities**
- **improved biodiversity on farmland e.g. for grassland butterflies, farmland birds, high-diversity landscape features**
- **restore drained peatlands**
- **healthier forests with improved biodiversity**
- **at least 25.000 km free-flowing rivers by 2030**
- **restore seagrasses and sea bottoms**

ESA Biodiversity+ Precursors (2021-2023)

Strengthen European Biodiversity Research Networks

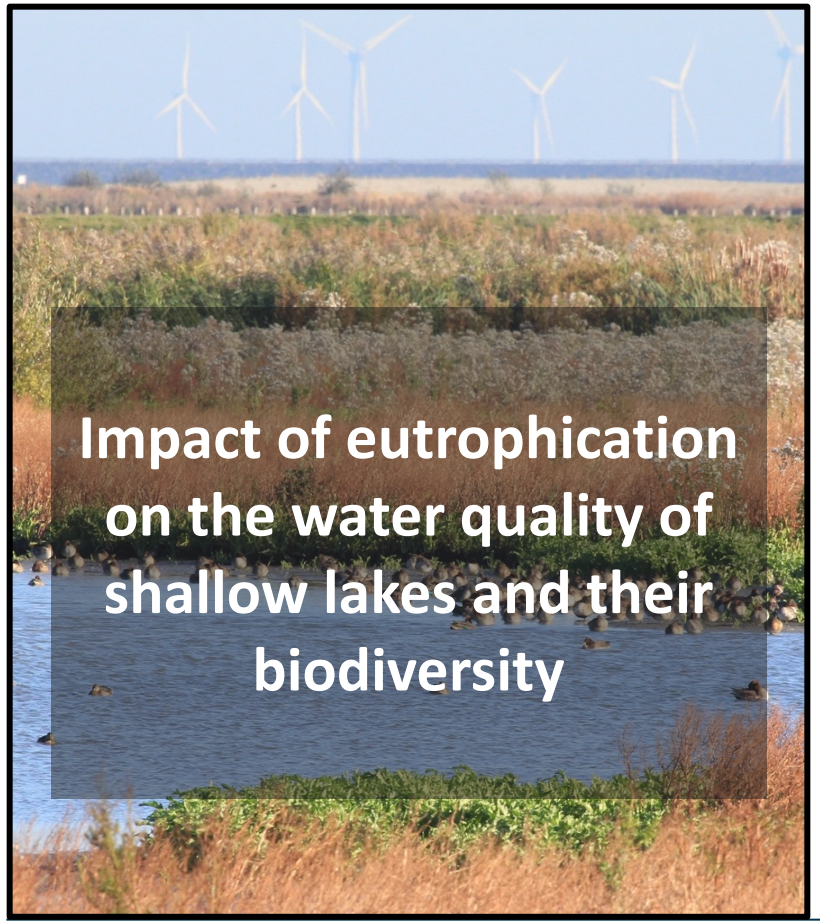
- Analyse the major **Knowledge Gaps** and **Science Questions** on biodiversity and vulnerable ecosystems.
- Assess how the **present and upcoming Earth Observation systems** can help addressing these scientific challenges in biodiversity knowledge.
- Demonstrate the adequacy of Earth System Science approaches with a number of **Earth System Science Pilots for Biodiversity**.
- Develop a **Science Agenda** and a **Scientific Roadmap** for the EC-ESA Flagship Action on Biodiversity.

Three Parallel Earth System Science Studies on Biodiversity



Freshwater Biodiversity Pilots

Pilot 1 – Shallow lake Eutrophication



Pilot 2 – Lake Temperature

Pilot 3 – River Connectivity

Terrestrial Biodiversity Pilots

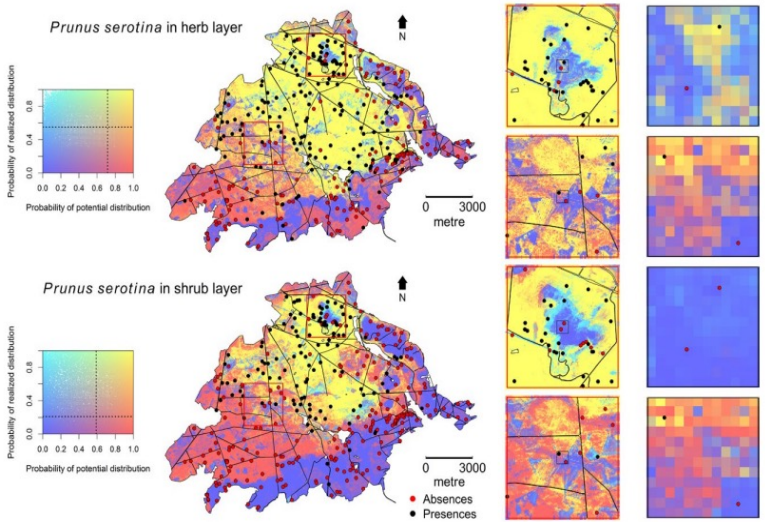
Pilot 1 - Ecosystem productivity and health

- Estimate forest productivity to assess forest health
- Quantify forest ecosystem condition (resilience to drought)
- Identify potential areas for forest restoration

Pilot 2 – Terrestrial Habitat modelling

- Integration of EO products within habitat modelling
- Improved European habitat modelling at the level 3 of the EUNIS classification
- Production of European habitat suitability maps

Pilot 3 - Invasive species modelling



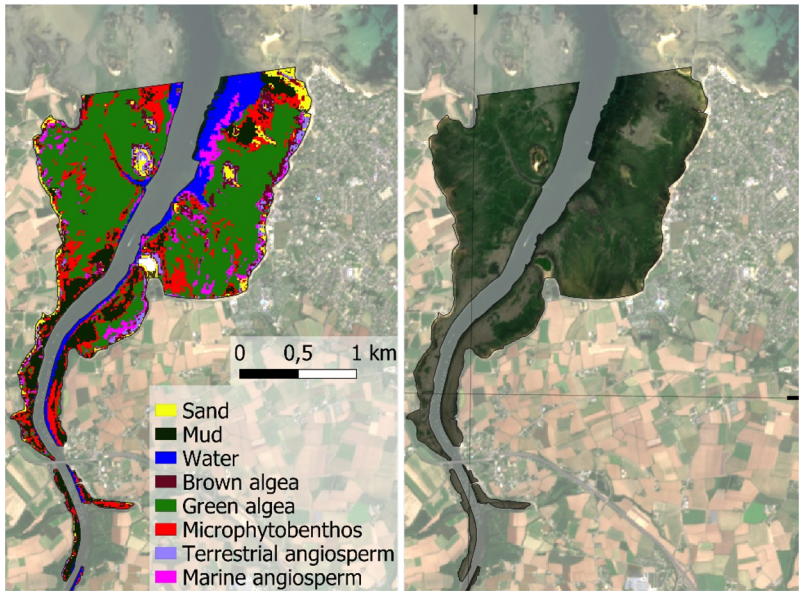
- Integrate advances in deep learning architectures & EO data within SDMs
- Estimate potential distribution of invasive species

Coastal Biodiversity Pilots

Pilot 1
Pelagic ecosystems

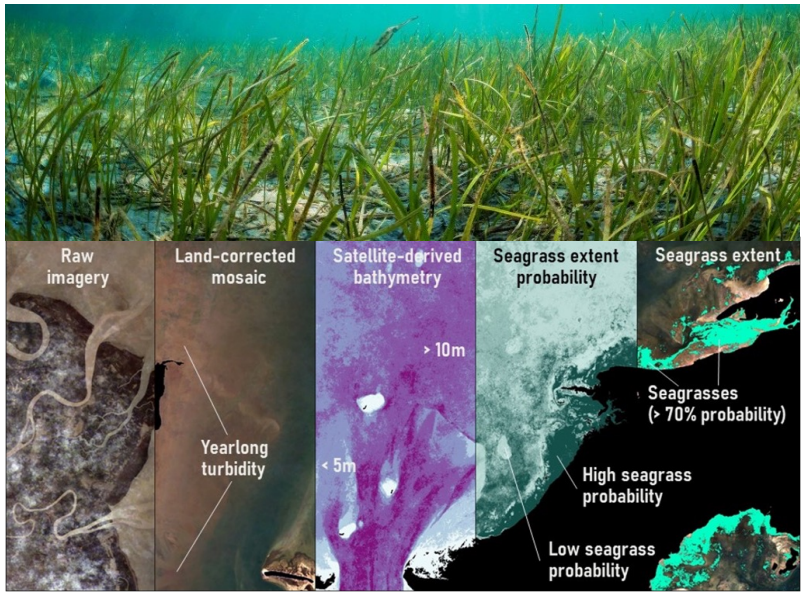
- Mapping of pelagic biodiversity: phytoplankton diversity and floating macro-algal vegetation
- Seascape mapping
- Impact of land use

Pilot 2
Intertidal ecosystems



- Intertidal habitat mapping (seagrass, microphytobenthos , macroalgae, oyster reefs, and polychaetes reef)
- Impact of anthropogenic pressures

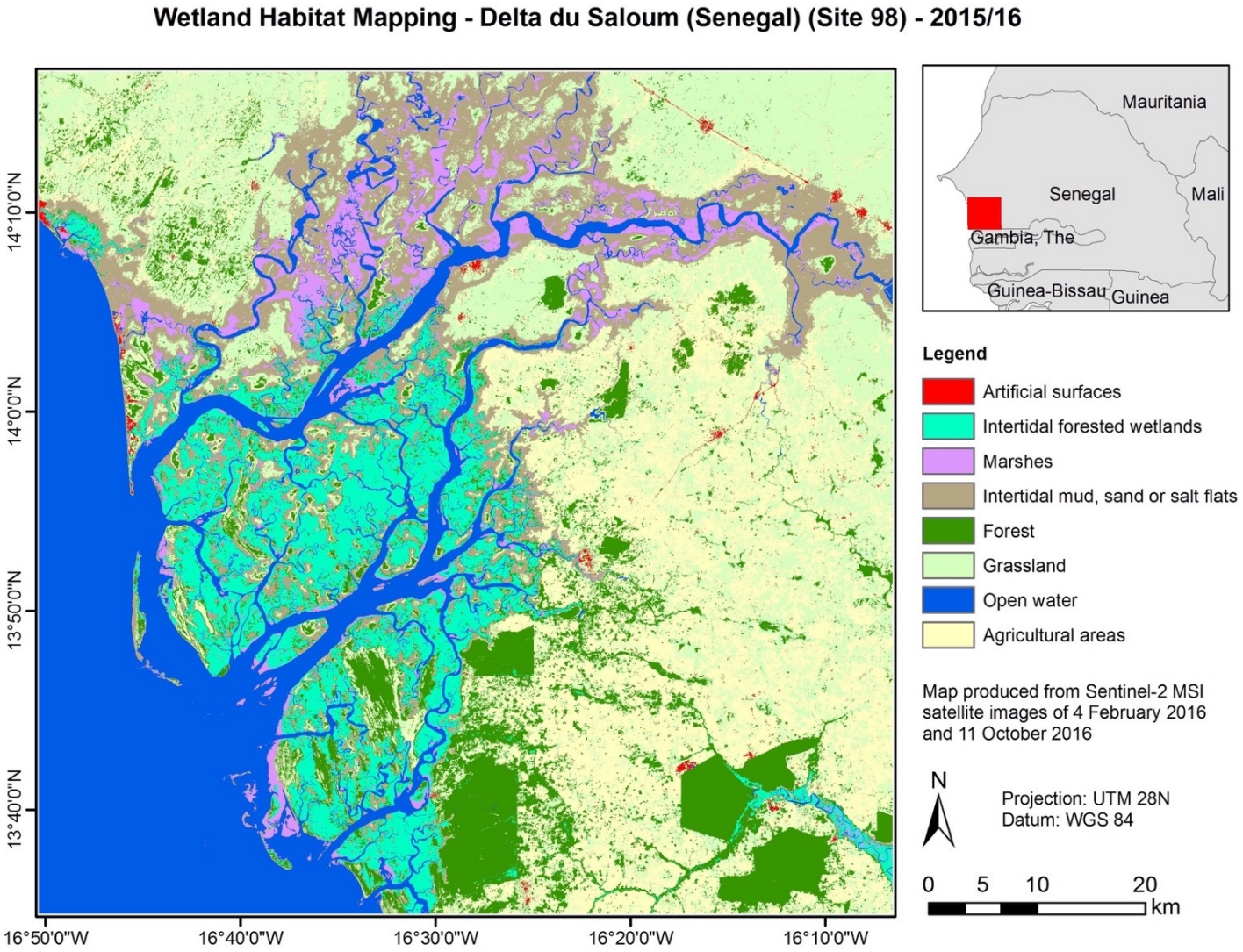
Pilot 3
Subtidal ecosystems



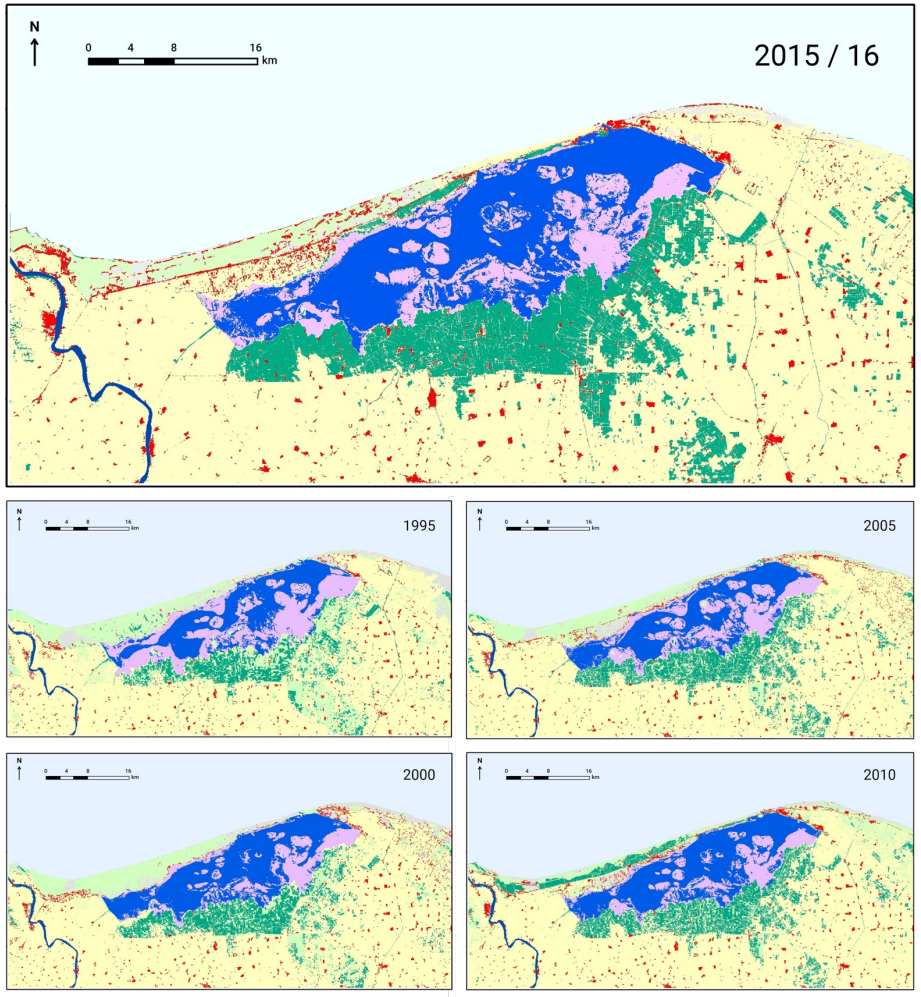
- Measure the extent of seagrass meadows and assess their changes over time
- Estimation of carbon sequestration

Wetland ecosystems: Wetland Habitat Mapping

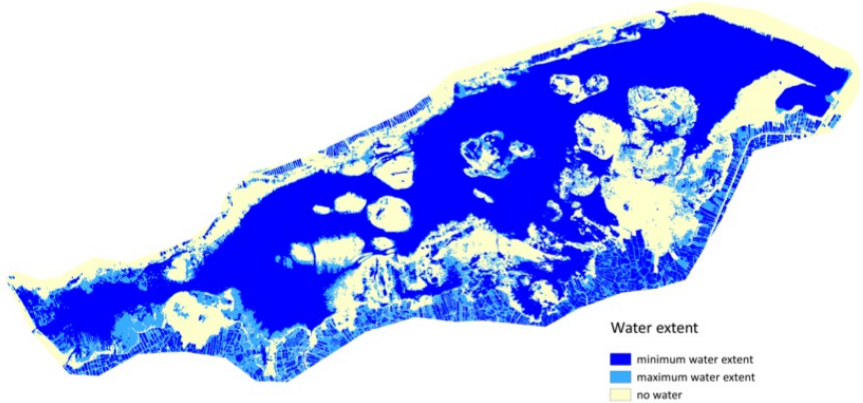
- Supervised **classification of the land cover and land use** inside and around the wetland site.
- Exploit **time series of HR optical satellite images** to capture the variety of wetland habitats.
- Detect **changes in wetland habitats**, derive **trends**, **assess threats and estimate impacts.**
- **Standardized** Land Cover / habitat **classification scheme** with Ramsar wetlands typologies

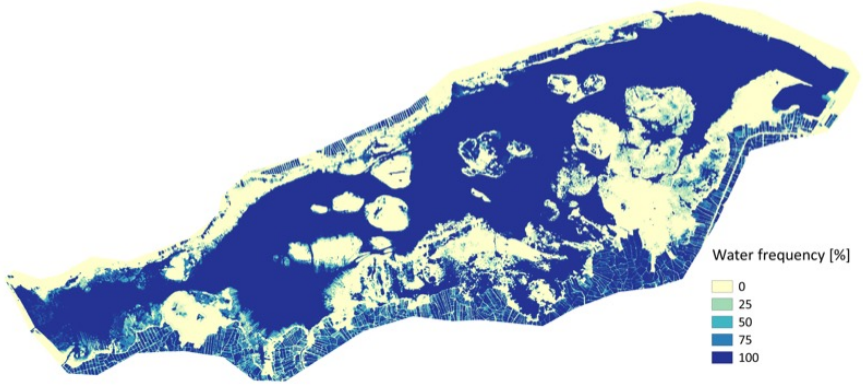


Wetland ecosystems: Wetland Habitat Monitoring



Lake Burullus, Egypt

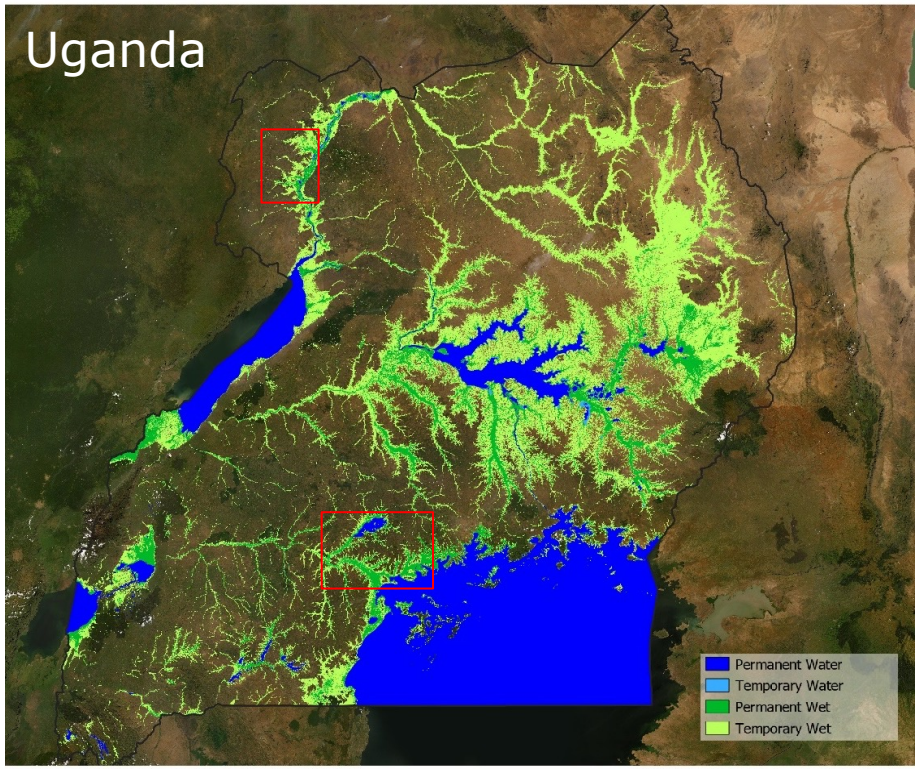


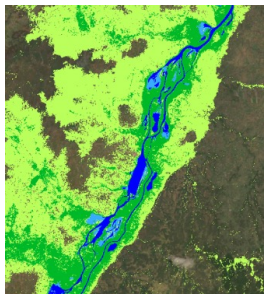


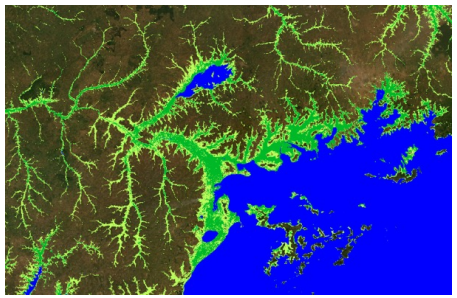
- Artificial surfaces
- Agricultural areas
- Sand shores
- Sparse vegetation
- Aquaculture ponds
- Salt marshes
- Rivers
- Sea
- Brackish lakes

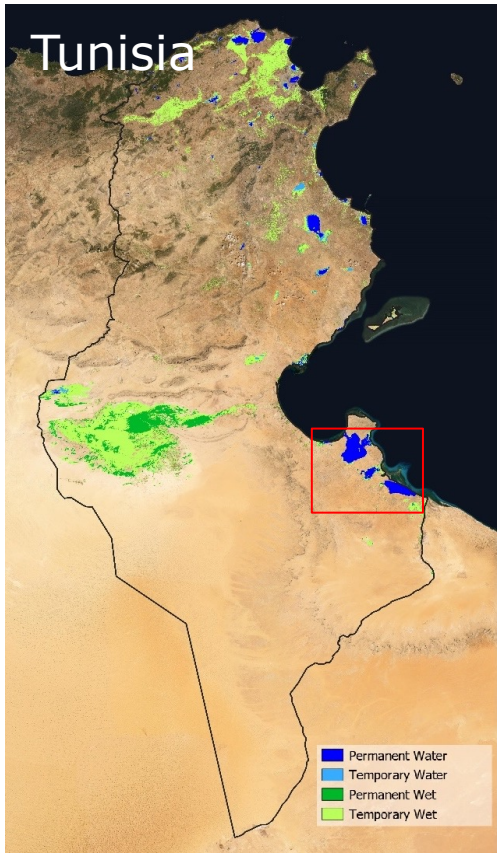
Wetland ecosystems: Wetland Inventories

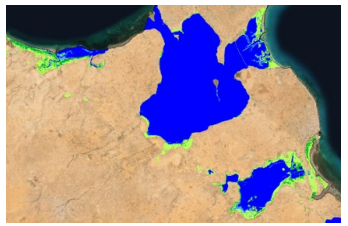
http://globwetland-africa.org

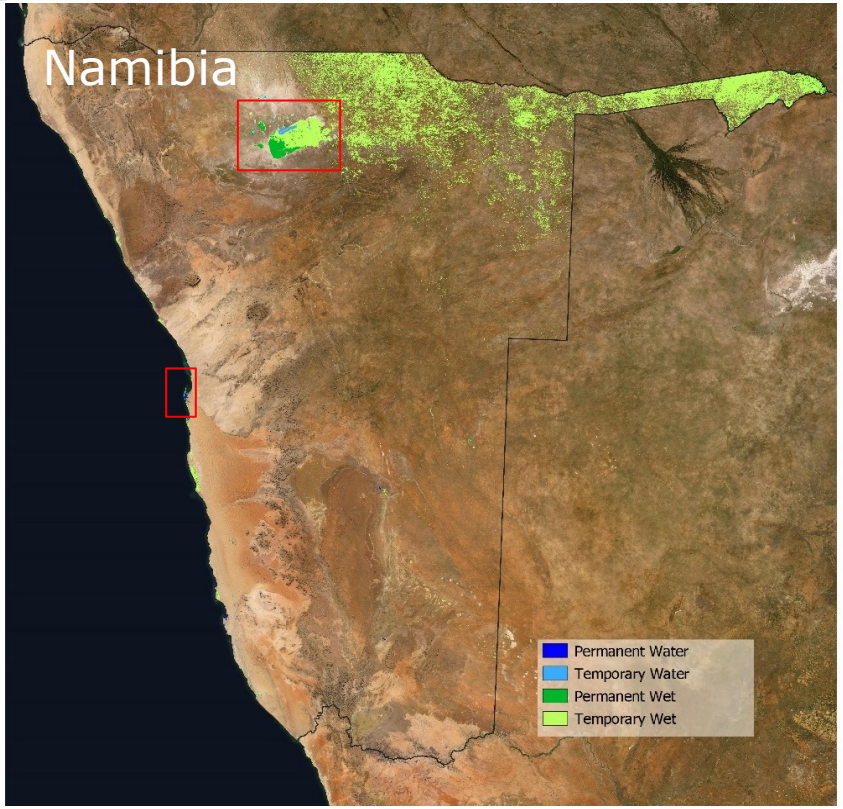


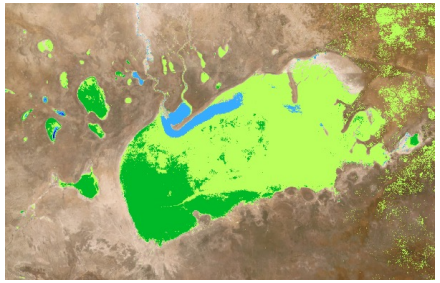




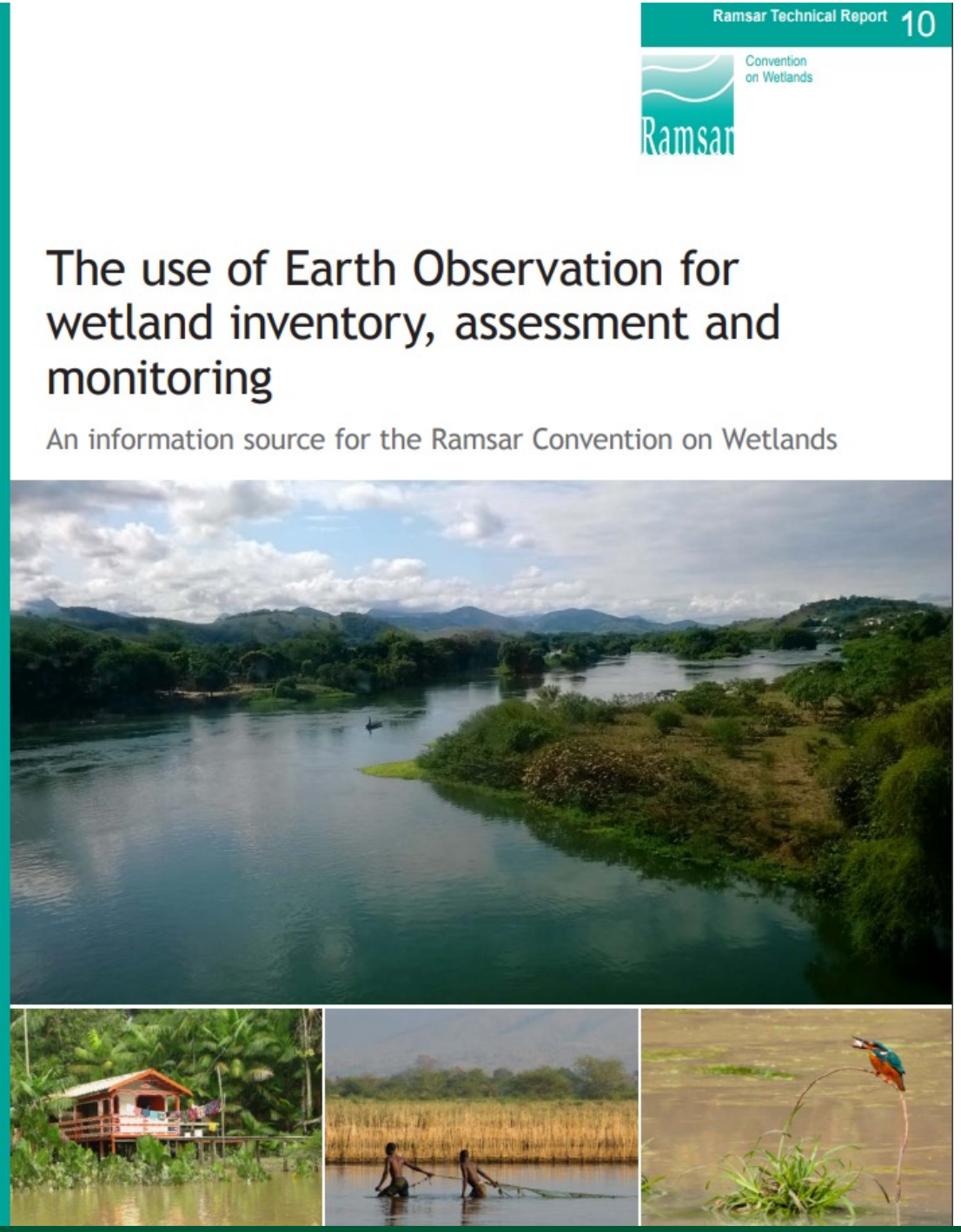








DHI GeoVille



Provide practitioners with an overview and illustration, through case studies, on the use of EO for implementation of the Convention and the wise use of wetlands.

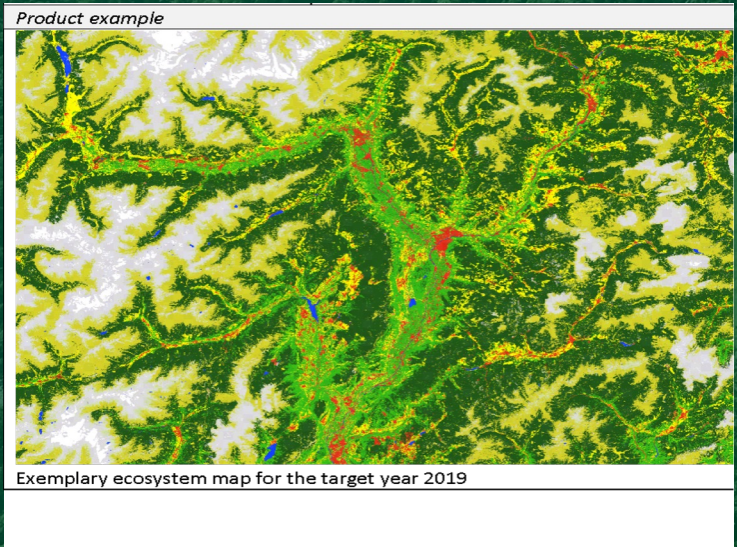
Objective of the report is to:

- Review and report on the **role and use of EO** for inventorying, mapping, and assessment of wetlands, including Ramsar Sites
- Highlight **existing projects and EO efforts**
- Present a series of **case studies** which highlight current practices: with an emphasis on practical application

Alpine ecosystems

Ecosystem mapping:

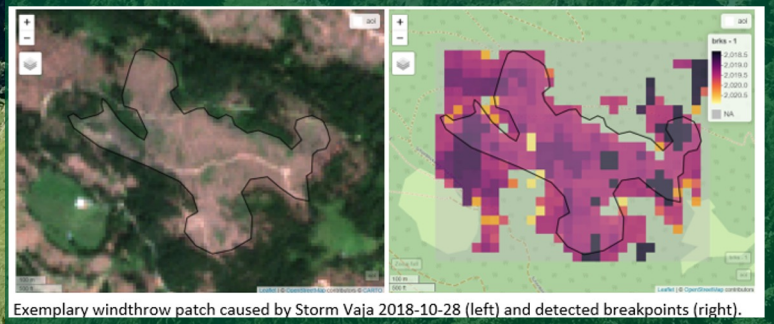
- Information on the spatial distribution of land cover
- Land cover classification legend addressing alpine ecosystems

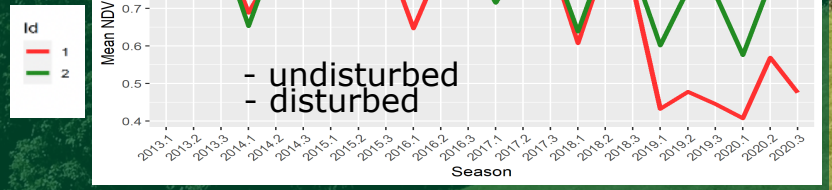


Exemplary ecosystem map for the target year 2019

Forest disturbance:

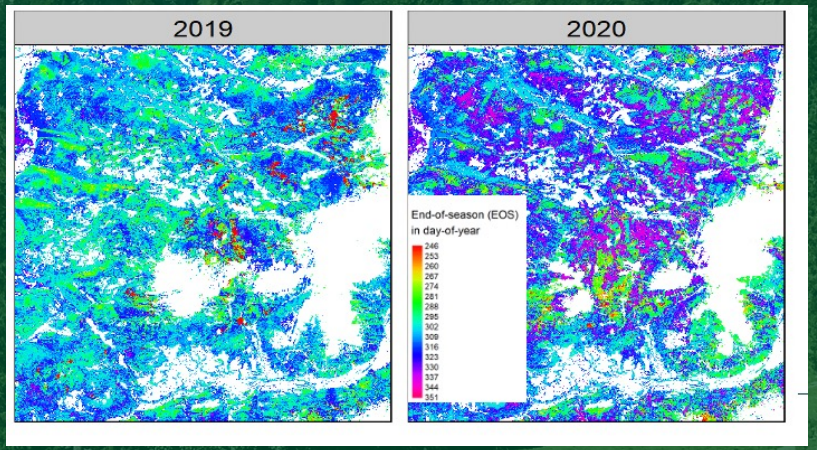
- Spatial information on forest cover changes
- Temporal information on the timing of the change event


Exemplary windthrow patch caused by Storm Vaja 2018-10-28 (left) and detected breakpoints (right).



Forest phenology:

- Spatial information on End of Season
- Trends on End of Season



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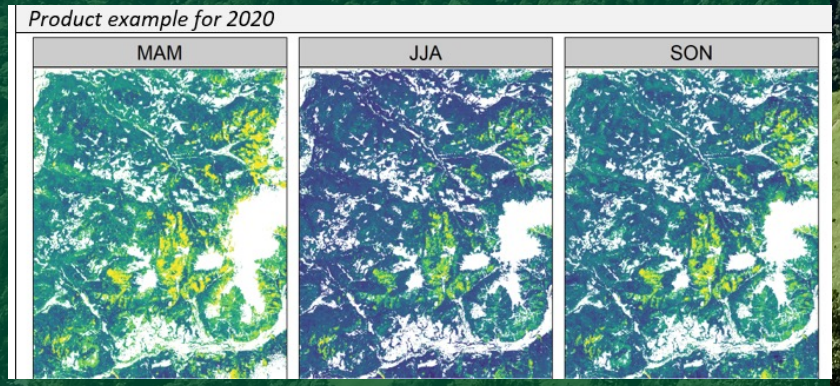
Alpine ecosystems

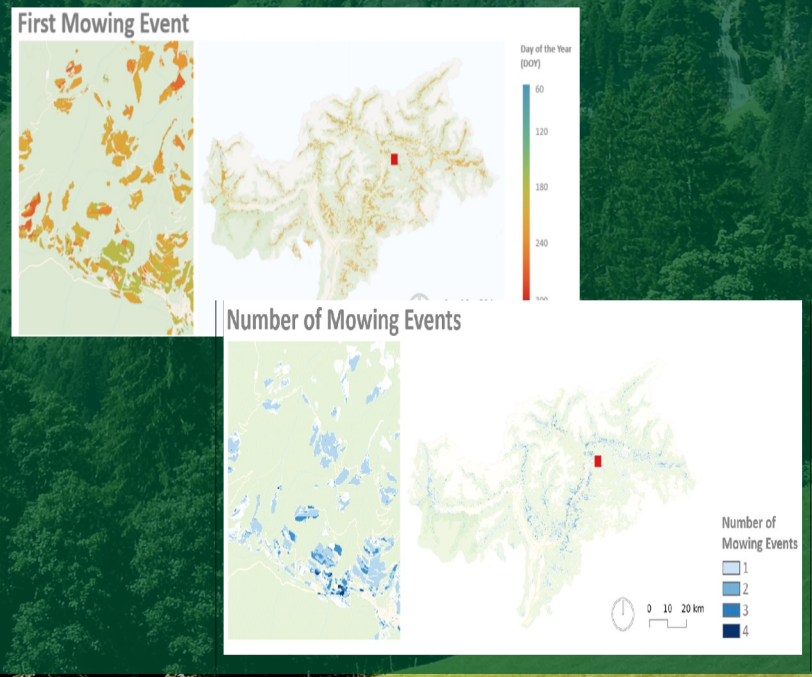
Fire recovery:

- Forest recovery seasonal trajectory
- Forest recovery annual trajectory



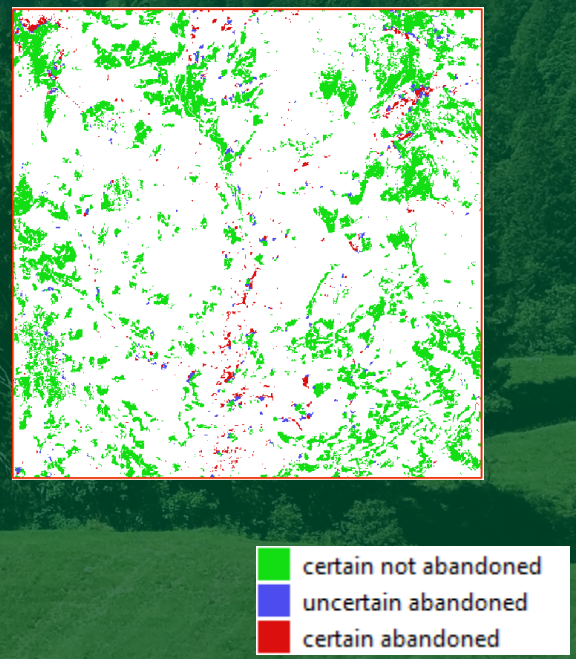
Grassland monitoring:

- Spatial information on the timing of grassland moving events
- Annual frequency of mowing events



Grassland abandonment:

- Spatial information on identified abandoned areas



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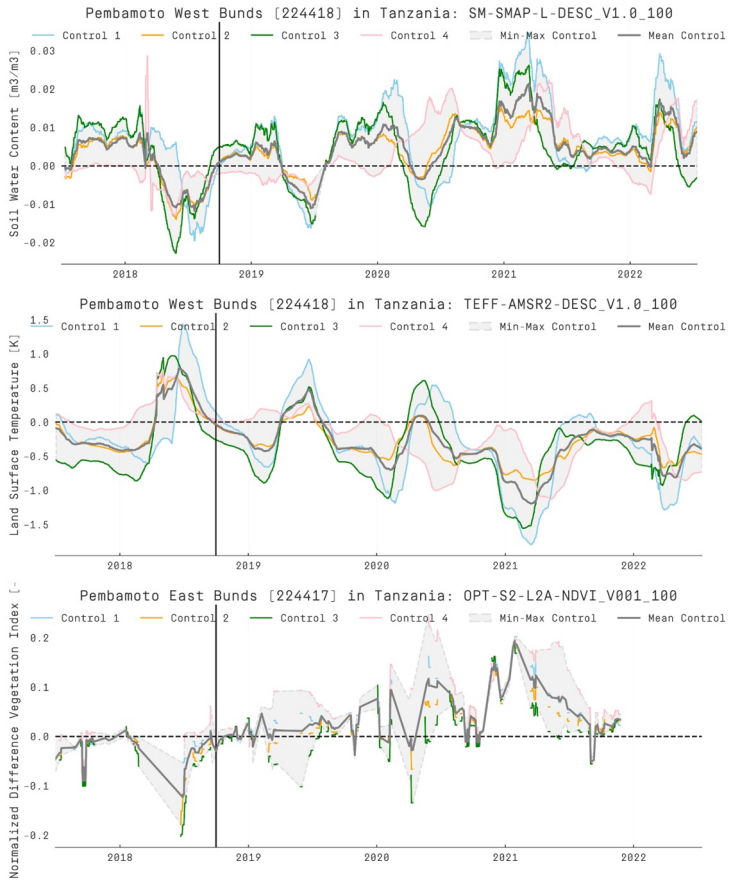
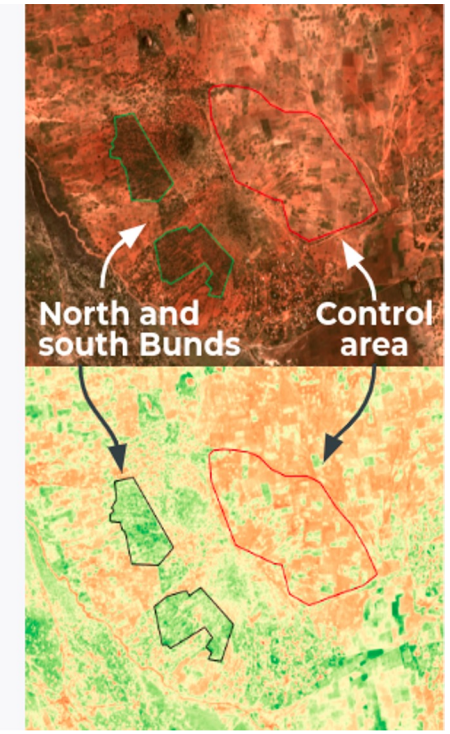
RESTORE-IT, Ecosytem Restoration Monitoring

Monitor the **impact of ecosystem restoration activities**, by exploiting global **Climate Data Records (CDR)** from ESA Climate Change Initiative (CCI), through downscaling techniques (LST and Soil Moisture) for local use.

To restore degraded lands, **Justdiggit digs bunds** (left) to improve **rainwater collection** and vegetation growth, which is reflected in **Soil Water Content** (SWC), **Land Surface Temperature** (LST) and **NDVI** changes in time (middle) and space (right) of both bund areas compared to the control area in Tanzania





Sustainable Water Management

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Science, Applications and Climate Department

6 CLEAN WATER AND SANITATION

TARGET 6.1 SAFE AND AFFORDABLE DRINKING WATER

By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

TARGET 6.2 END OPEN DEFECATION AND PROVIDE ACCESS TO SANITATION AND HYGIENE

By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

TARGET 6.3 IMPROVE WATER QUALITY, WASTEWATER TREATMENT AND SAFE REUSE

By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

TARGET 6.4 INCREASE WATER-USE EFFICIENCY AND ENSURE FRESHWATER SUPPLIES

By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

TARGET 6.5 IMPLEMENT INTEGRATED WATER RESOURCES MANAGEMENT

By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

TARGET 6.6 PROTECT AND RESTORE WATER-RELATED ECOSYSTEMS

By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

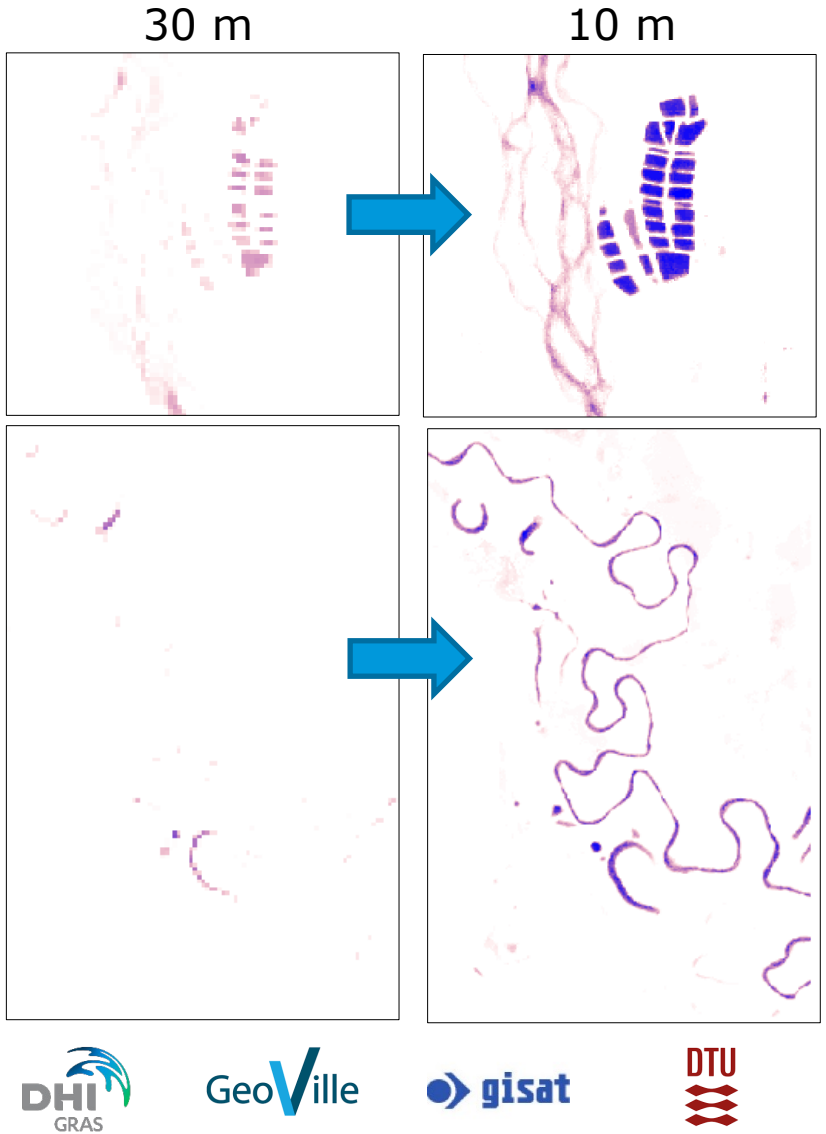
TARGET 6.A EXPAND WATER AND SANITATION SUPPORT TO DEVELOPING COUNTRIES

By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.

TARGET 6.B SUPPORT LOCAL ENGAGEMENT IN WATER AND SANITATION MANAGEMENT

Support and strengthen the participation of local communities in improving water and sanitation management.

Advanced Surface Water Dynamics

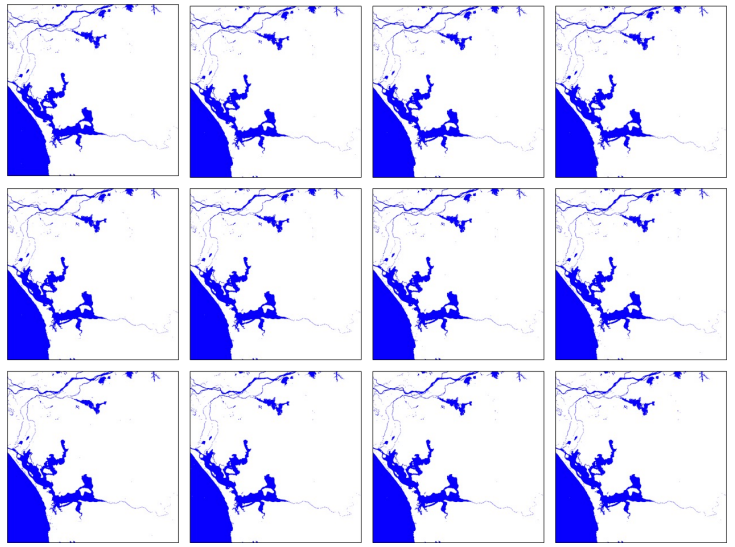


WorldWater
SURFACE WATER DYNAMICS FROM SPACE

New advanced algorithms.
for the monitoring of the intra-annual and inter-annual variations of surface waters, in extent and volume.

https://www.worldwater.earth

Monthly water occurrences (S1+S2)

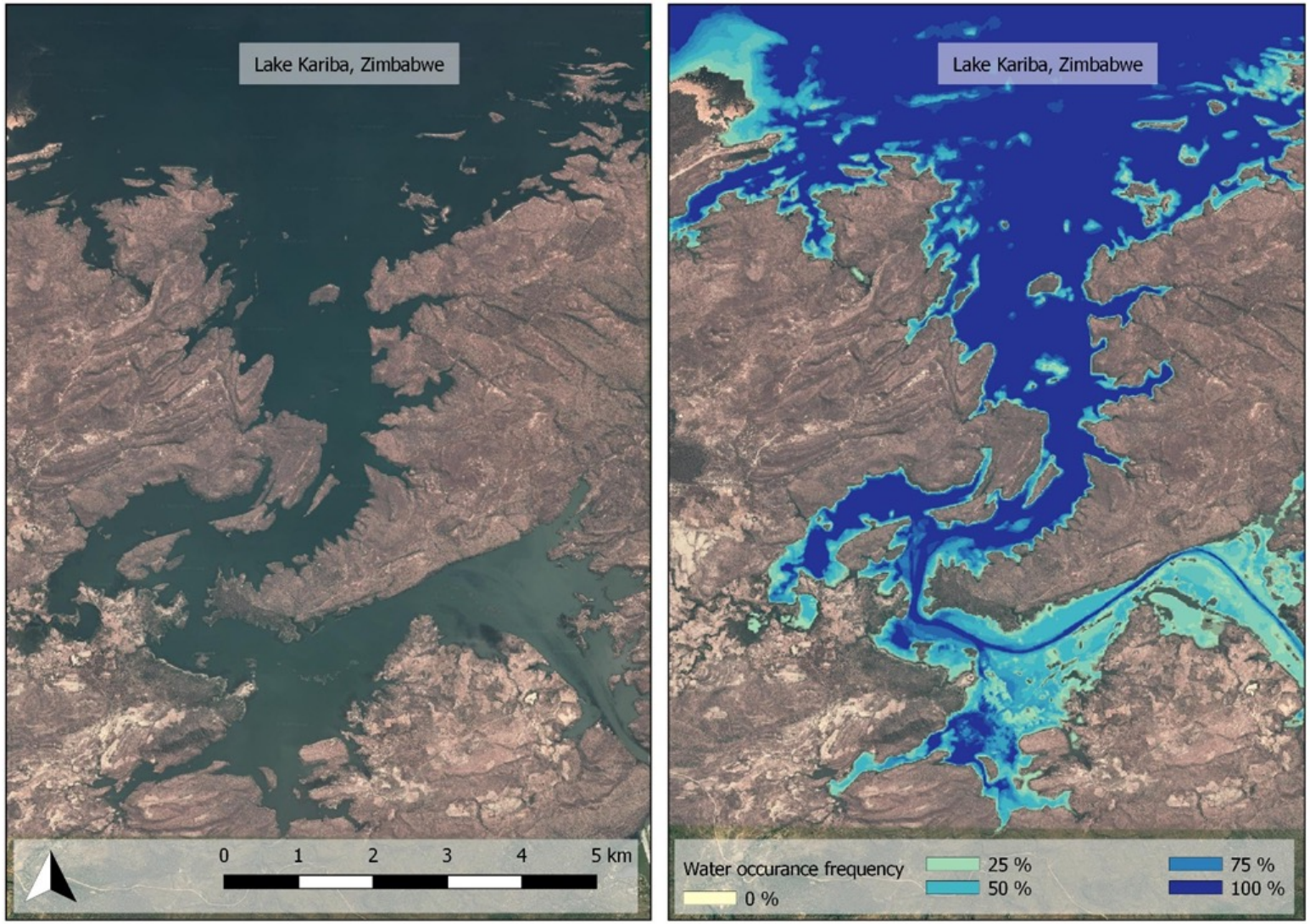


Involved stakeholders

National Water Management Agencies, River Basin Authorities

DHI GRAS · GeoVille · gisat · DTU · UN environment programme · United Nations · UN WATER · United Nations Statistics Division · European Commission

Changes in surface water extent

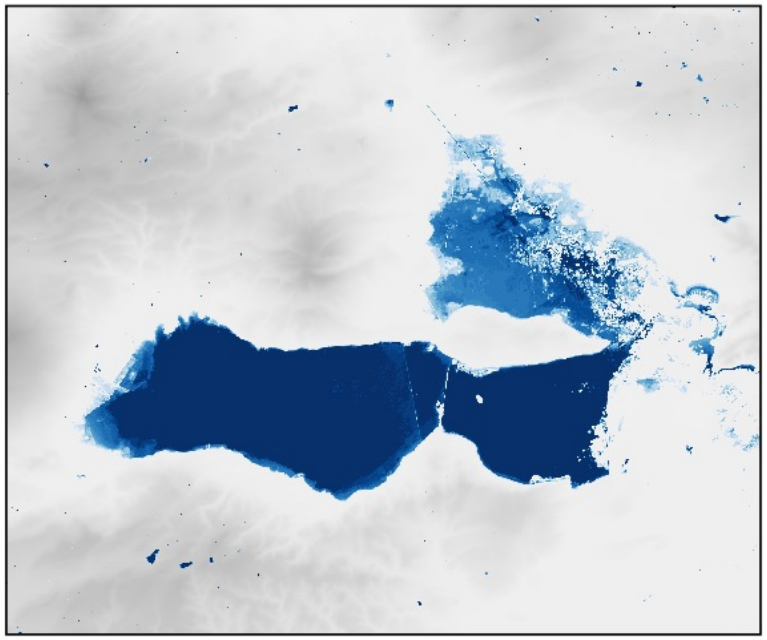


WorldWater
SURFACE WATER DYNAMICS FROM SPACE

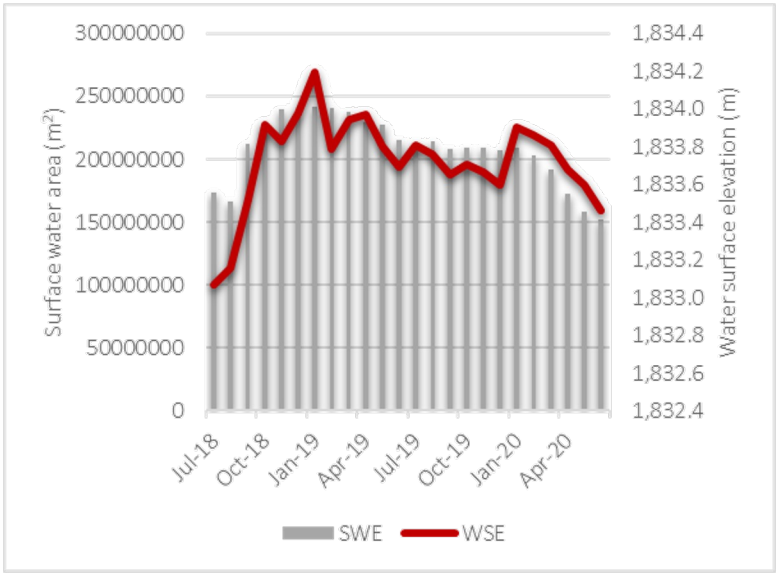
*Southern shore of Lake Kariba, Zimbabwe, 12-month **water occurrence frequency map** synergistic use of Sentinel –1 and -2*

Changes in Lake volume

Lake Chievtzu, Mexico



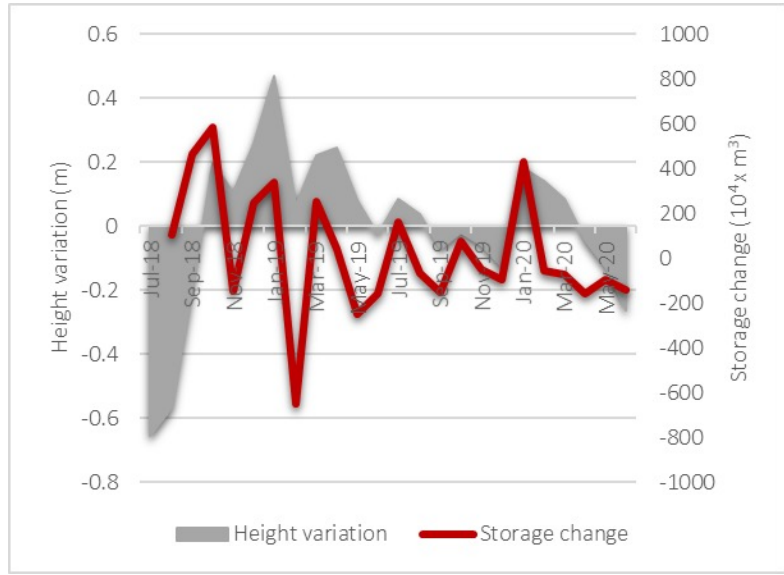
Multi-annual surface water frequency from Sentinel-1 and Sentinel-2.



Monthly water surface elevation (WSE) timeseries from Sentinel-3

Monthly surface water extent (SWE) timeseries from Sentinel-1 and Sentinel-2

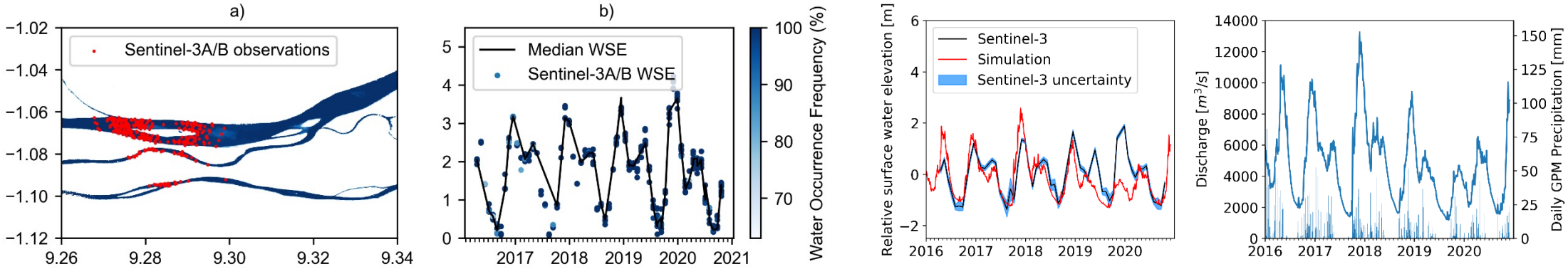
WorldWater
SURFACE WATER DYNAMICS FROM SPACE



Water level variations and **Lake water storage changes**

Changes in river discharge

From river water level to river discharge



- Satellite altimetry missions monitor river level changes globally
- Fleet of satellites carrying altimeters growing
- Synergies between **water surface elevation and surface water extent**
- Synergy with **hydrologic and hydraulic modelling** to produce river discharge
- High value in **poorly instrumented catchments and remote regions**

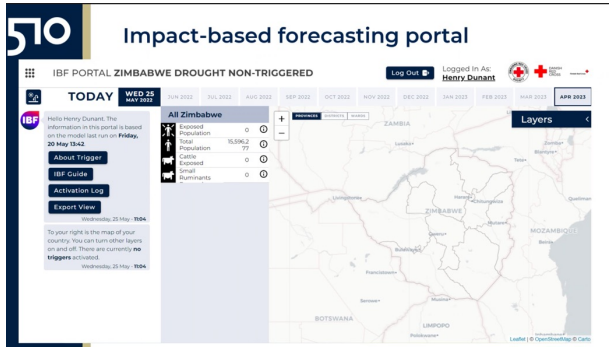
WorldWater
SURFACE WATER DYNAMICS FROM SPACE

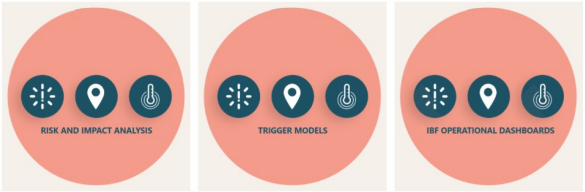
Surface-2-Storage

From water surface to water storage

Enhance country resilience to droughts with NRT monitoring of water volumes in small to medium sized reservoirs

- In partnership with RedCross 510 and the Red Cross societies of Zimbabwe, Lesotho and Swaziland (Eswatini).
- Build on the Global Water Watch (GWW) data platform that monitors extent of surface water globally.
- extend GWW monitoring of lakes and reservoirs, to the changes in water storage by exploiting satellite altimetry data (NASA ICESAT-2).





Integration of GWW data platform with RedCross 510 Impact Based Forecasting (IBF)

Deltares

510 AN INITIATIVE OF THE NETHERLANDS RED CROSS

→ THE EUROPEAN SPACE AGENCY

Resilient Cities

Marc Paganini
Directorate of Earth Observation Programmes
Science, Applications and Climate Department

Global Urban Agendas

"The science and policy communities increasingly recognize that cities […] and the underlying urbanization processes are at the center of global climate change and sustainability challenges.

Policymakers need facts, empirical evidence, and scientifically sound theories on how to plan and manage cities and urbanization…"

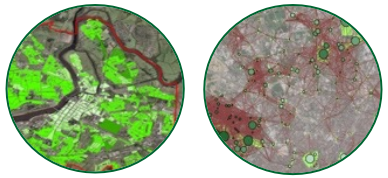
*Solecki et al. (2013): **It's time for an urbanization science**. Environment 55(1), pp. 12-16*

"***Data** and **evidence** are the foundation of development policies and effective program implementation"*

Mahmoud Mohieldin, SVP, World Bank

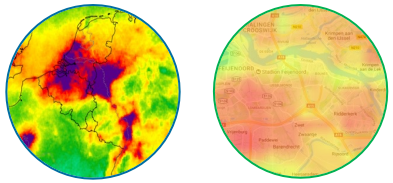
EO for sustainable and resilient cities

Green Areas/Networks



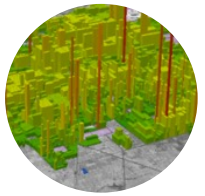
Urban Extent and Change

Urban Climate

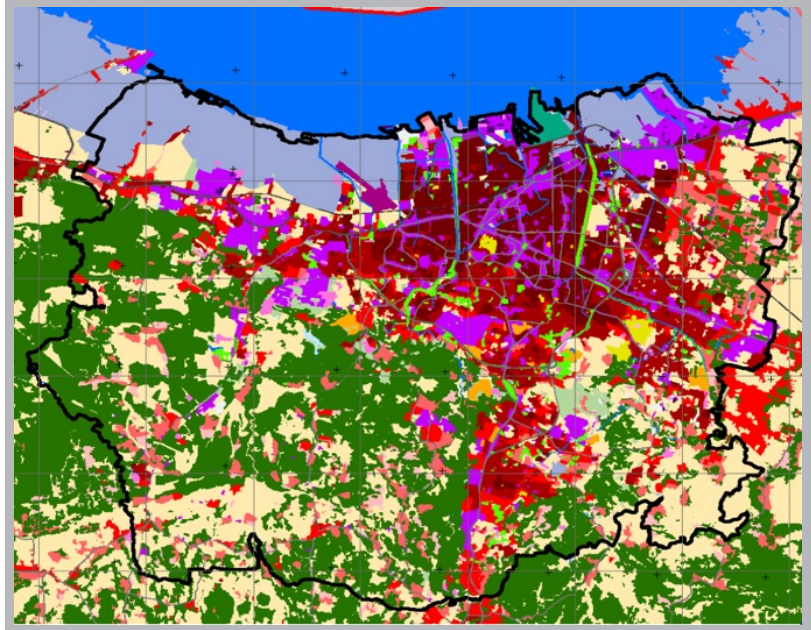


Building Footprint

Population Density

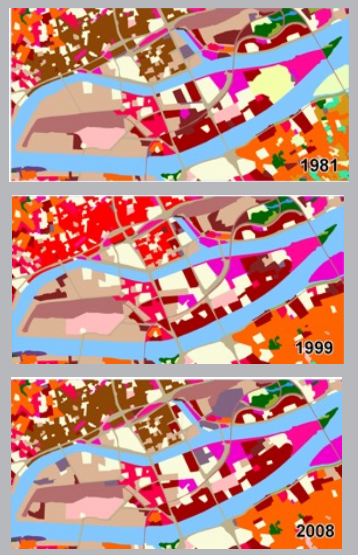


Baseline Products: Urban and Peri-Urban LU /LC



Detailed

Change

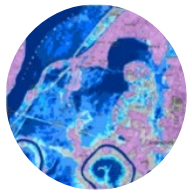


Transport Infrastructure

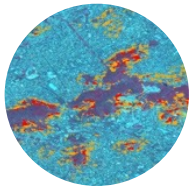
Informal Settlements

Waste Sites

Flood Risk

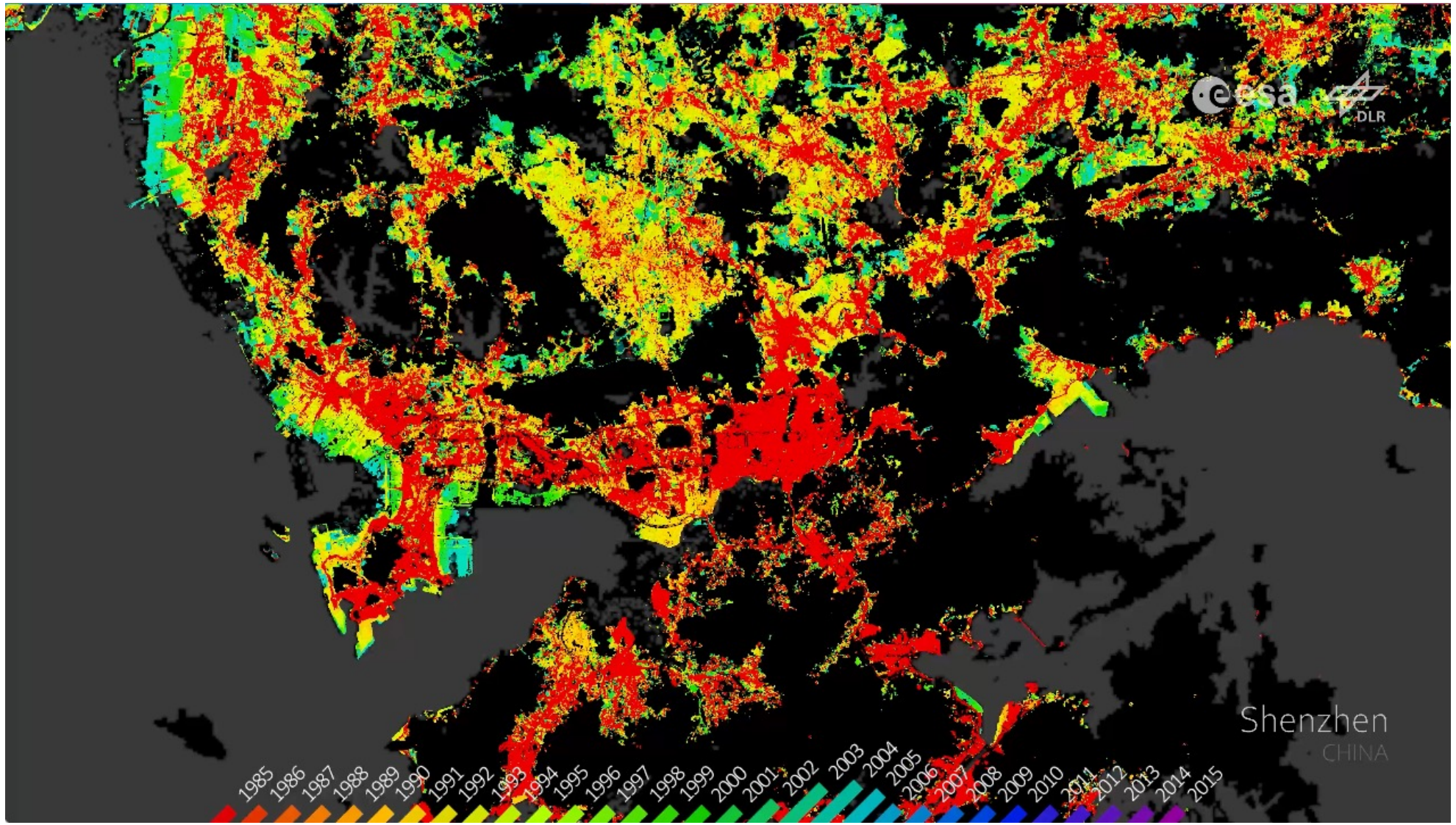


Landslide Risk



Terrain Motion

Dynamic World Settlement Footprint (WSF) products



UN HABITAT
FOR A BETTER URBAN FUTURE

World Settlement footprint and its dynamic evolution in time, with Landsat and Copernicus Sentinel-1 and Sentinel-2.

Advance the **understanding of urbanization** at planetary scales.

Stakeholders: UN Habitat, National Statistical Offices (NSOs), National Mapping Agencies, Cities councils.

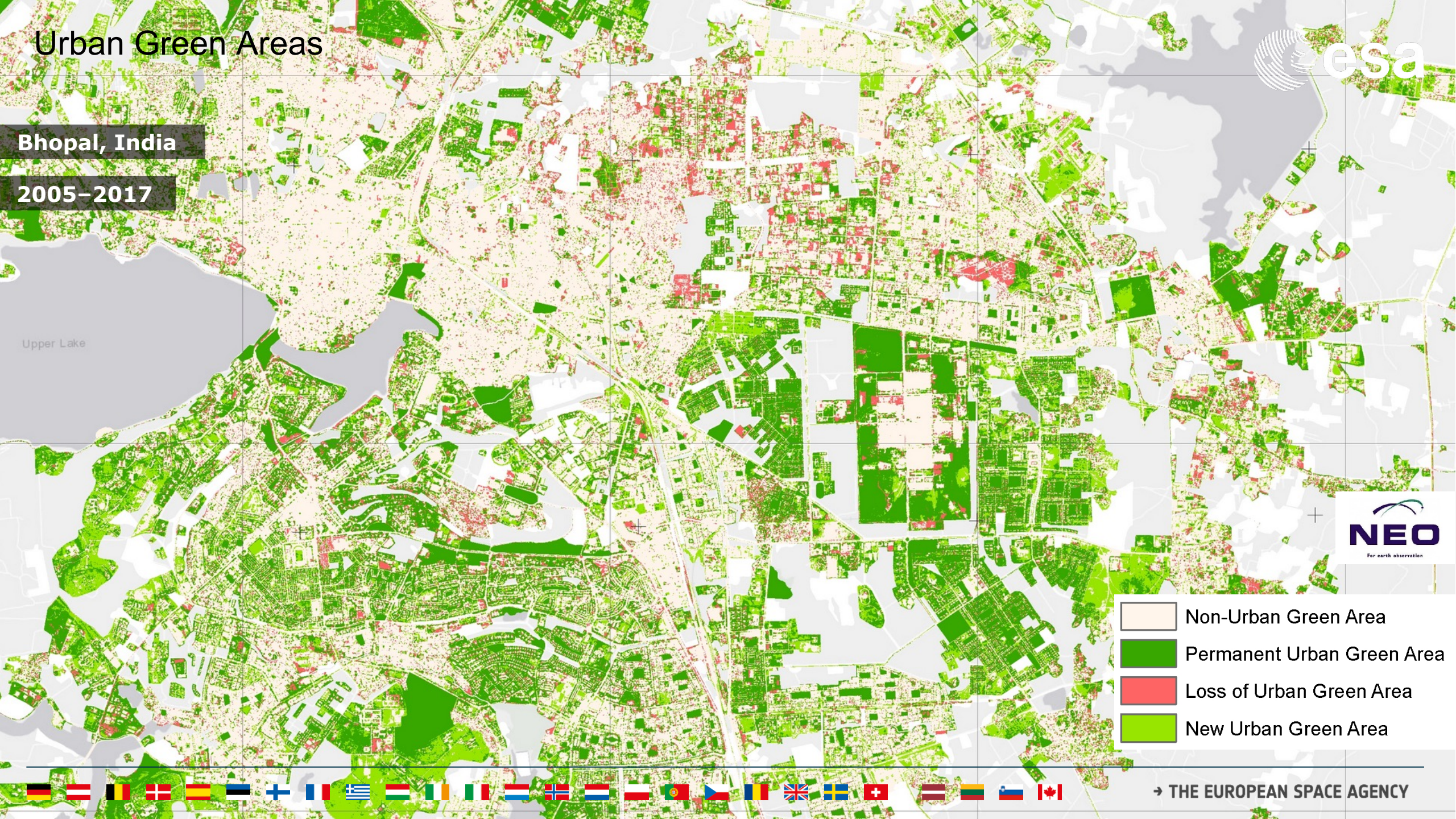
Urban effective planning for sustainable solutions and direct contribution to the **SDGs**.

DLR urban tep

Urban Green Areas

Bhopal, India

2005–2017



MAKE SPACE FOR EVERYONE