



**Wetlands give us ecosystem services for free!**



**SWOS developed and delivers infrastructure for monitoring, reporting and provides a basis for information based decision making and actions.**



**Mapping is a first and basic step!**





# SWOS Team



SWOS has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642088.



# Acknowledgement

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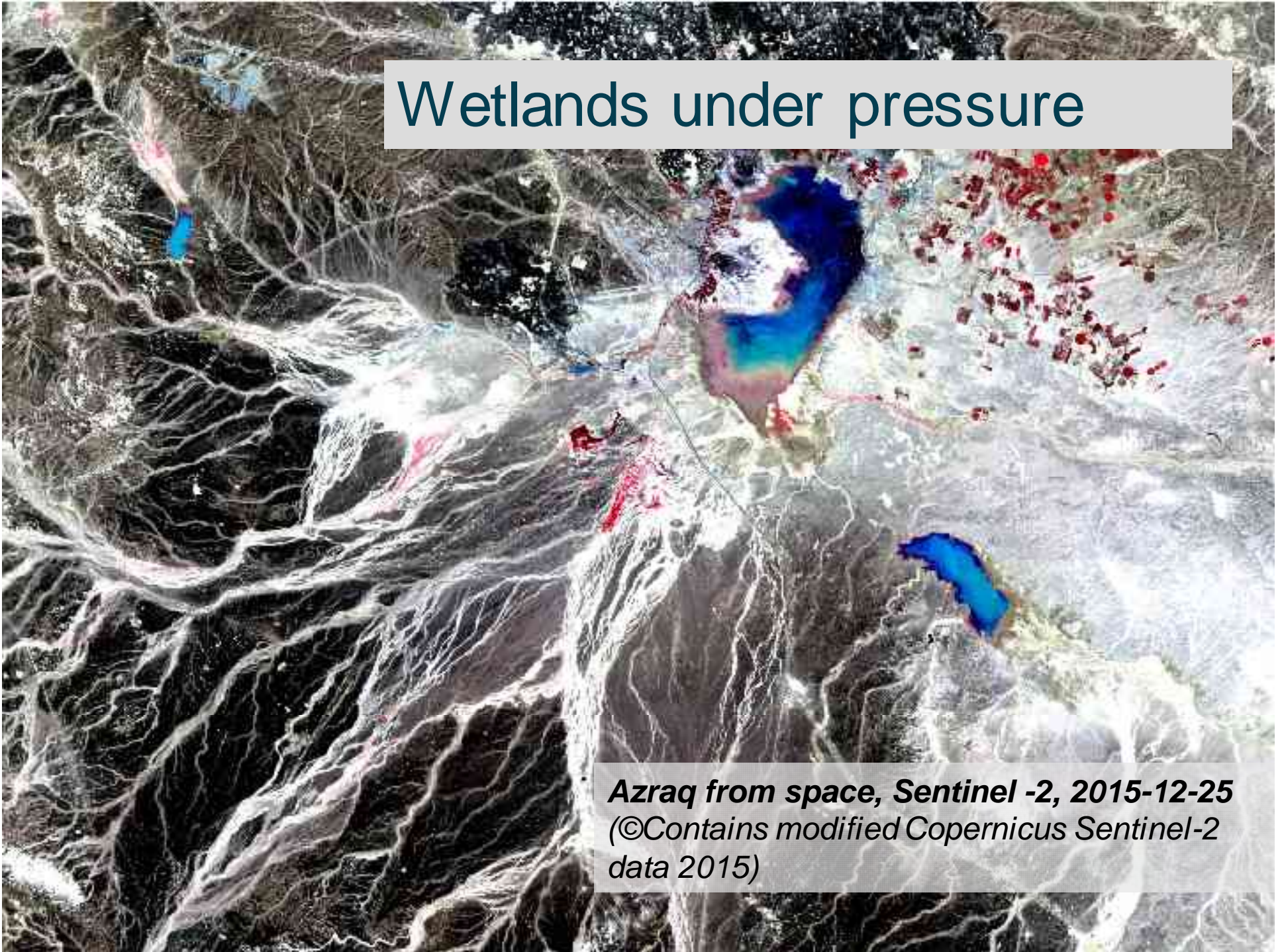
The SWOS team would like to **thank** the **SWOS user group** and the **SWOS advisory board** for their support, commitment and cooperation.

Special thanks go to the **secretariat of the Ramsar Convention on Wetlands** for the support, encouragement, assistance and promotion during the life time of SWOS and previous projects, for altogether nine years of cooperation.



# Wetlands under pressure

*Azraq from space, Sentinel -2, 2015-12-25  
(©Contains modified Copernicus Sentinel-2  
data 2015)*



# Wetlands under pressure

## Oasis Azraq, Jordan

*Sentinel -2,  
2016-01-14*  
Several water  
bodies in  
blue/green and  
(irrigated)  
agricultural  
fields in red are  
visible from  
space,  
Refugee camp  
in NW

*Sentinel -2,  
2016-12-29*  
Just a few water  
bodies contain  
surf ace water

*Sentinel -2,  
2018-01-08*  
No surf ace water



# 3 years in Dubai

Dubai from Space – 3 years ago and today

*How many changes in 3 years?*



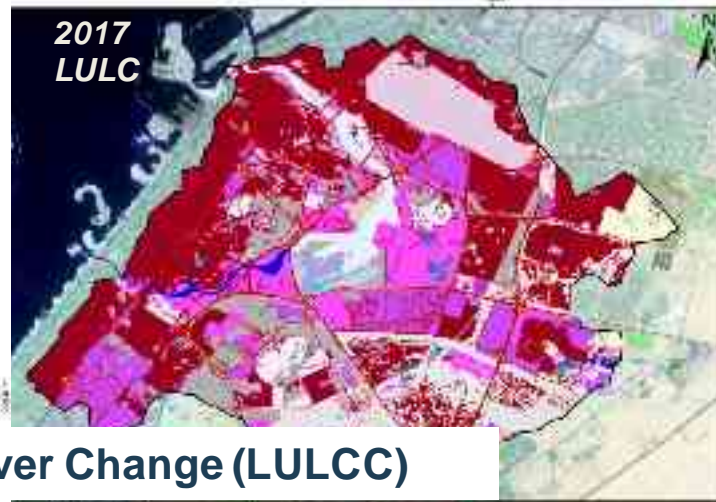
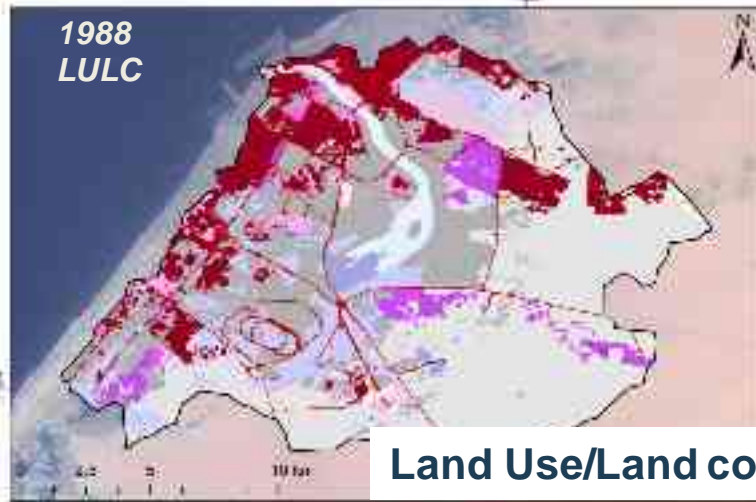
*Dubai from space, Sentinel -2, 2015-10-22*



*Dubai from space, Sentinel -2, 2018-10-11*

# Wetlands under pressure

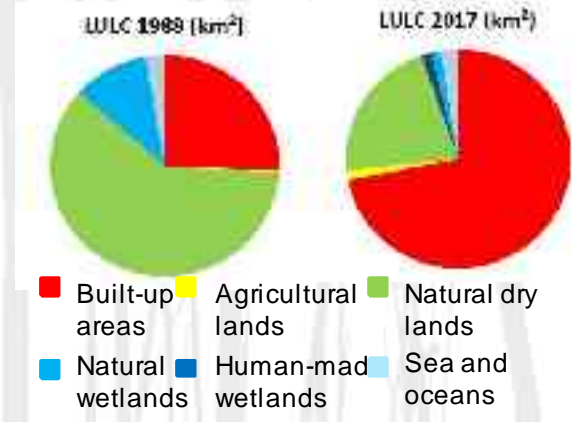
## Ras Al Khor, Dubai, UAE



Land Use/Land cover Change (LULCC)



Map showing (in red) all natural wetlands destroyed and converted into built-up areas between 1988 and 2017 (Based on SWOS tools and derived from Landsat TM and Sentinel-2 time series)





# Service lines & demonstration

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Maps and indicators production

**SWOS is a Service**

Training/Capacity Building

SWOS provides different service components and service cases to demonstrate the usability and application of satellite based information for planning, management and reporting





# Maps and Indicators production

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- ***Service line :***

## Maps and indicators production

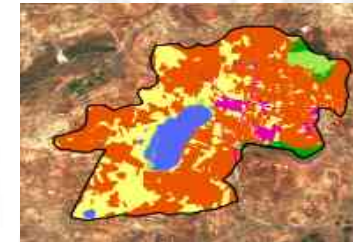
- The production of maps and indicators has been demonstrated for about 50 wetland locations in Europe, Africa and Middle East
- Standards for the map production & nomenclatures
- 9 wetland indicators and about 50 sub-indicators as it can be applied e.g. for Ramsar or SDG 6.6.1 reporting
- An educated team is ready to deliver maps and indicators on request

# Maps and Indicators production

From Satellite Images to Segment



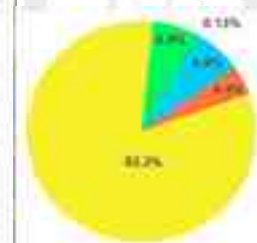
From Segments to Maps



From maps to Indicators



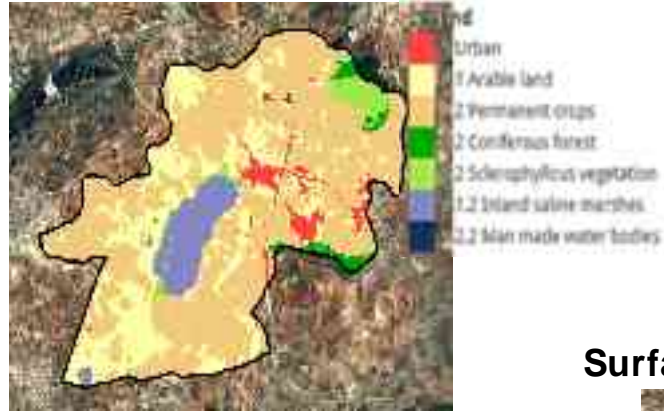
Indicators and operations	2005	2007	2009	2011
Water	11,537 ha	121,010 ha	190,617 ha	223,211 ha
Non-saturated (no pool)	1,707,507 ha	1,281,707 ha	1,547,771 ha	1,774,754 ha
Saturated (no pool)	1,070,000 ha	1,221,271 ha	1,281,118 ha	1,280,022 ha
Saturated	1,070,000 ha	1,221,271 ha	1,281,118 ha	1,280,022 ha
Total	3,884,544 ha	2,524,088 ha	2,919,506 ha	3,278,087 ha



From satellite images to maps and indicators

# SWOS products

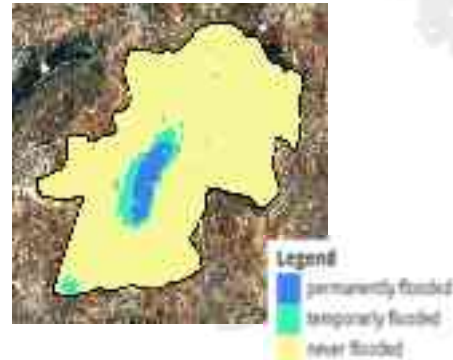
### Land Use Land Cover (LULC)



### LULC Change (short-and long-term)



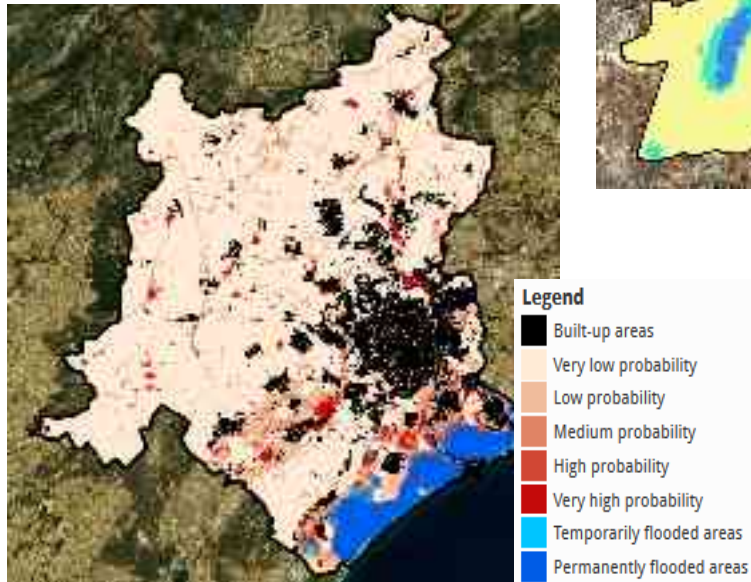
### Surface Water Dynamics



### Water Quality / Trends



### Potential Wetlands



### Land Surface Temp. Trends



# Portal

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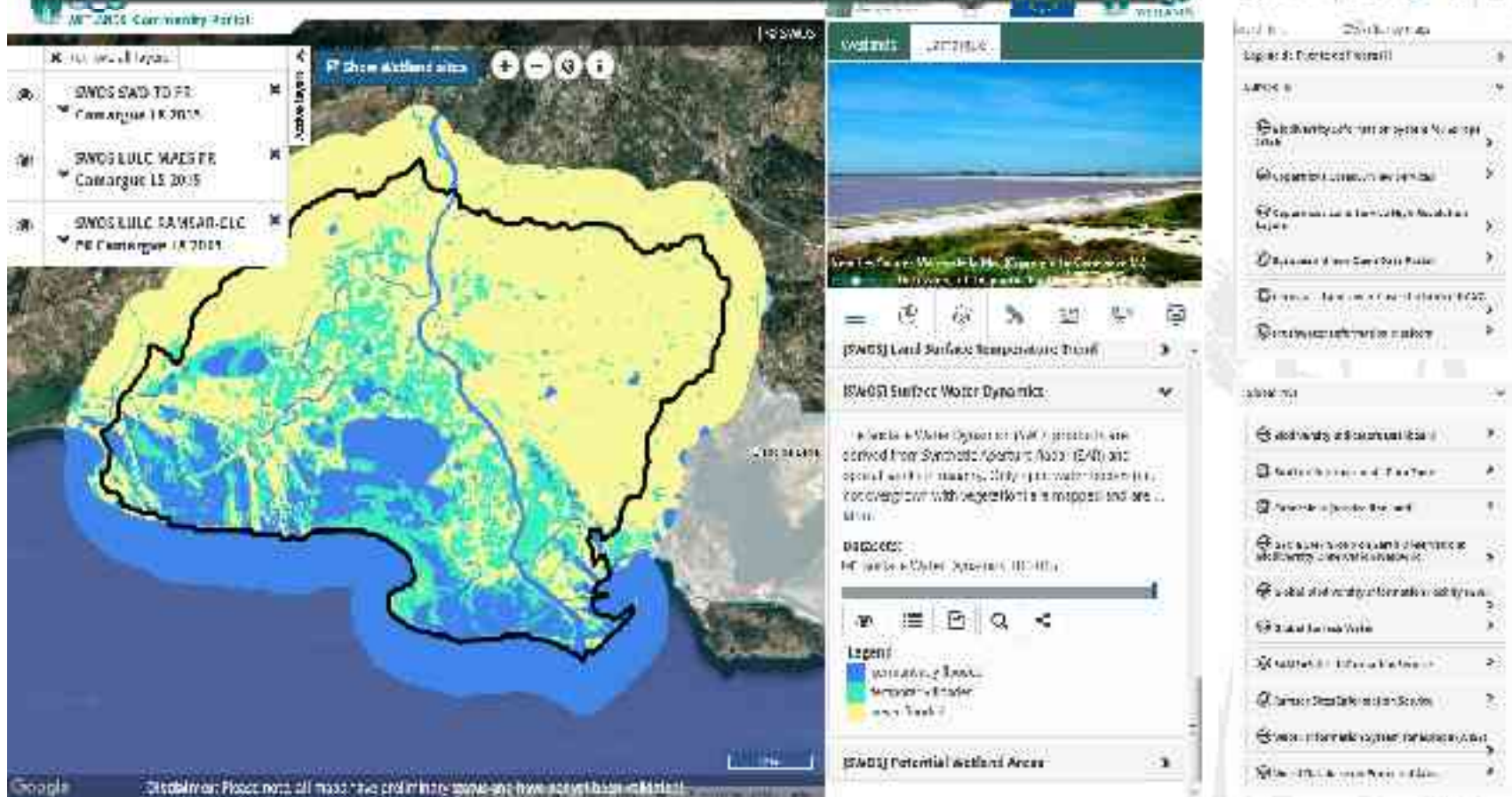
- ***Service line :***

SWOS Portal

- The SWOS portal = Wetland community portal,
- Is making available all maps produced in the frame of SWOS
- In addition the portal connects wetland information with free available European and global layers that are useful for wetland monitoring
- The portal will be maintained after the life time of SWOS and provides the possibility to integrate additional layers

# GEOwetlands

**SWOS Portal = GEOwetlands Community Portal**



The screenshot displays the SWOS Portal interface. On the left, a sidebar menu lists data layers such as 'SWOS SAG TO PE Comarque 1K 2015', 'SWOS LULC MAES PE Comarque 1S 2015', and 'SWOS LULC RAMSAR-ELC PE Comarque 1K 2015'. The main map area shows a satellite-based map with a yellow and green overlay representing wetland areas. On the right, a panel titled 'Wetlands' contains a list of data layers including 'SWOS Land Surface Temperature (LST)', 'SWOS Surface Water Dynamics', and 'SWOS Potential Wetland Areas'. Below the map, there is a legend and a scale bar.

<http://swos-service.eu/swos-portal/>

**SWOS / GEO-Wetlands Community Portal to publish and connect satellite based wetland information**

# Software delivery

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- ***Service line :***

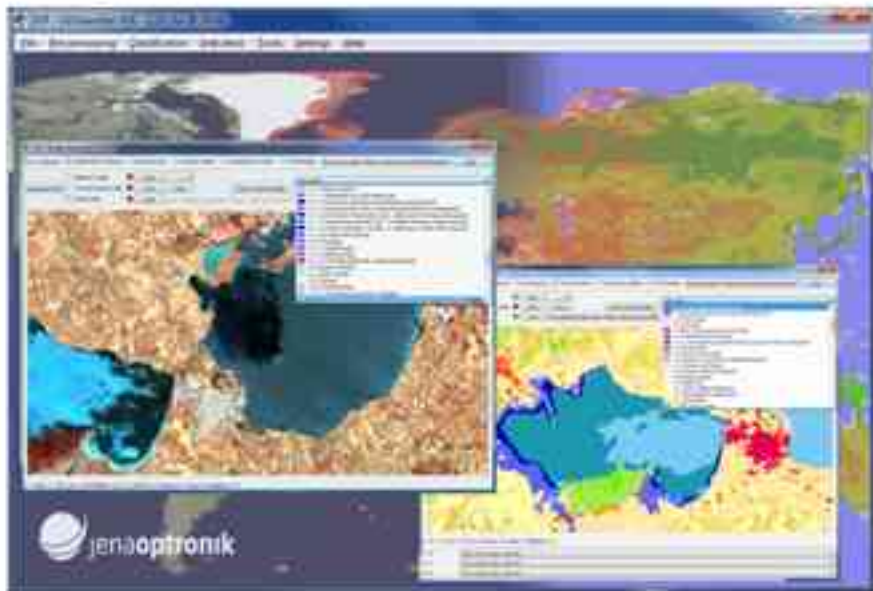
**Software delivery**

- Delivery of a software toolbox GEOclassifier, which provides all tools for map production and indicator calculation.
- The Desktop software is independent / stand alone and available for free
- The GEOclassifier Cloud demonstrator is ready
- A software team is available to maintain, update and further develop the software

# SWOS toolbox GEOclassifier

## **GEOclassifier - GUI**

Desktop version, freely available



- Pre-processing / geometric & radiometric adaptation
- Image viewer / Image analysis
- Segmentation
- Supervised segment based classification
- Indicator calculation
- Metadata creation
- Map exporter

### Applicable for

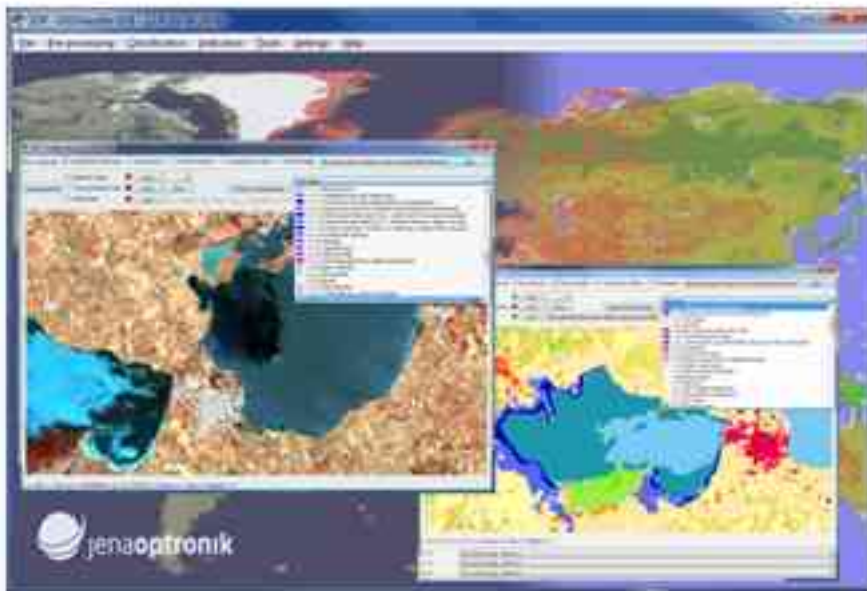
- freely available satellite data (optical & radar) of the Sentinel and Landsat missions
- data from other sources

**GEOclassifier, the SWOS toolbox to establish satellite based wetland information**

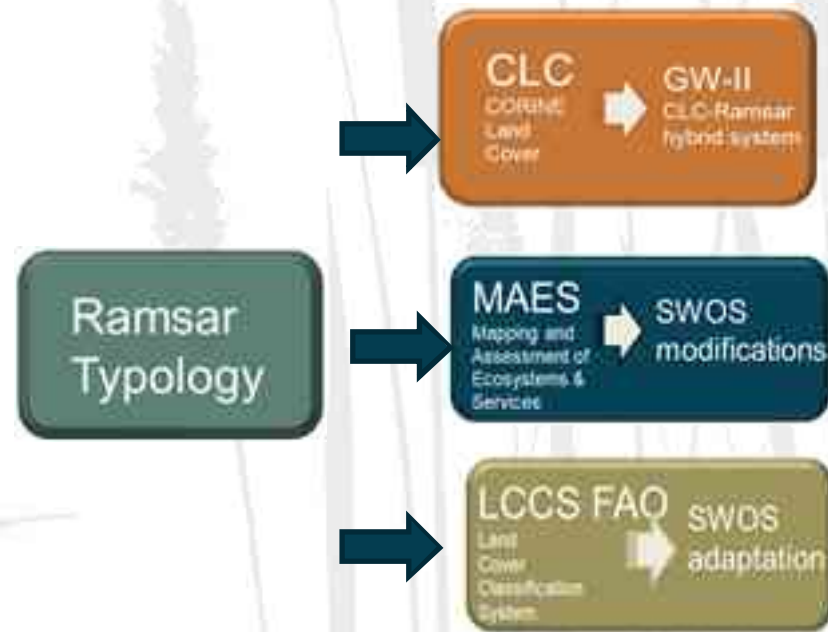
# Nomenclatures integrated

**GEOclassifier - GUI**

Desktop version, freely available



- *Standardized Nomenclatures*
- *Crosswalks via Ramsar typology*



**Nomenclature standards and crosswalks established**



# GEOclassifier Cloud data acquisition

**Filters** **Layers**

TIME FILTER -  
Using same time as for map  
2018-09-23 00:00:00 - 2018-10-23 00:00:00

Start  
2018-09-23 00:00:00

End  
2018-10-23 00:00:00

SPATIAL FILTER -  
Coordinates are in degrees (longitude, latitude) WGS84

Draw  
Rectangle

Current Selection  
55,081 25,100 55,276 25,247  
Zoom to Selection Clear Selection

ADDITIONAL FILTERS FOR SENTINEL-2 MSI - LEVEL 1C (TOP-OF-ATMOSPHERE REFLECTANCE) -



**Search Results** **Inputs (1)**

SENTINEL-2 MSI - LEVEL 1C (TOP-OF-ATMOSPHERE REFLECTANCE) -

trying to download thumbnail

2018-10-16 06:48:41

- 1 B01
- 2 B02
- 3 B03
- 4 B04
- 5 B05
- 6 B06
- 7 B07
- 8 B08
- 9 B09
- 10 B10
- 11 B11
- 12 B12

Advanced options - Add to session

# GEOclassifier Cloud LULC/SWD mapping & indicator calculation

Run segmentation

## Classification

Sensor	Date	Band	Label	Actions
Sentinel-2		2	B02	
Sentinel-2		3	B03	
Sentinel-2		4	B04	
Sentinel-2		6	B06	
Sentinel-2		7	B07	

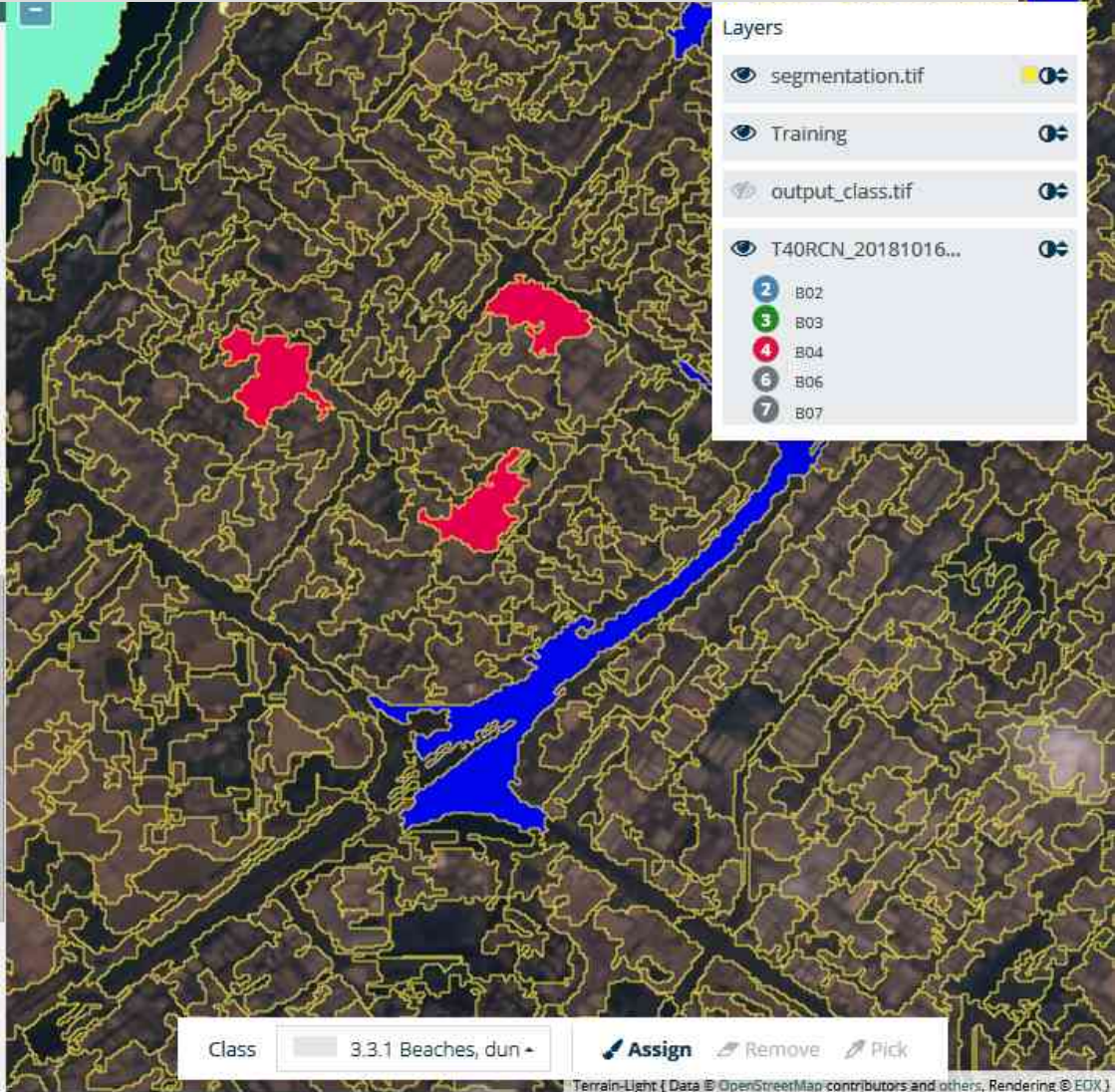
Drag and drop additional input bands!

Module	Time	Label	Actions
Segmentation		segmentation.tif	

Drag and drop additional classification results!

### Status

Running task max-likelihood-class  
(task:0756dae04f7b497d9fc3841c69eda19c)  
Image segmentation module  
Number of given parameters = 2



Layers

- segmentation.tif
- Training
- output\_class.tif
- T40RCN\_20181016...

Legend:

- 2 B02
- 3 B03
- 4 B04
- 6 B06
- 7 B07

Class: 3.3.1 Beaches, dun

Assign Remove Pick

Terrain-Light | Data © OpenStreetMap contributors and others, Rendering © EDX

Jenaoptronik SWOS mundi EOX



# Training & Capacity Building

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- ***Service line :***

**Training/Capacity Building**

- A training program and experienced training team is available to teach users from different working levels on
  - how to apply and work with satellite data for wetland mapping
  - how to use the SWOS service components (maps and indicators, software tools and the portal)
  - how to integrate SWOS products into selected service cases



# Service cases

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Service  
demonstration via  
Multilevel Service  
cases

- The service case approach of SWOS has been applied
  - to translate the technical possibilities to their practical application
  - within a certain political and geographical context specified by the SWOS users.

# Indicators for reporting

Wetlands give us ecosystem services for free!



## Satellite derived products

- Land Use Land Cover and Change
- Surface water dynamics
- Inventory and delineation
- Surface Moisture
- Water quality
- Surface temperature



## 9 Indicators, 50 Sub-indicators

1. Total wetlands extent
2. Change in wetland area
3. Change to Agriculture & Urbanization
4. Wetlands artificialization and degradation
5. Status of Wetland Threats
6. Extent of Open Water
7. Status and Trend of Water Quality
8. Ecosystem Fragmentation
9. Wetland Ecosystem Services

From maps and indicators

# SDG 3, 6, 15





# Sub-Indicators for reporting



e.g. Subindicators

- 1.1 – All wetland extent
- 1.2 – Natural wetland extent
- 1.3 – Artificial wetland extent
- 1.4 – Vegetated wetlands
- 1.5 – Spatial extent of lakes, rivers and estuaries
- 1.6 – selected classes area



Ramsar reporting

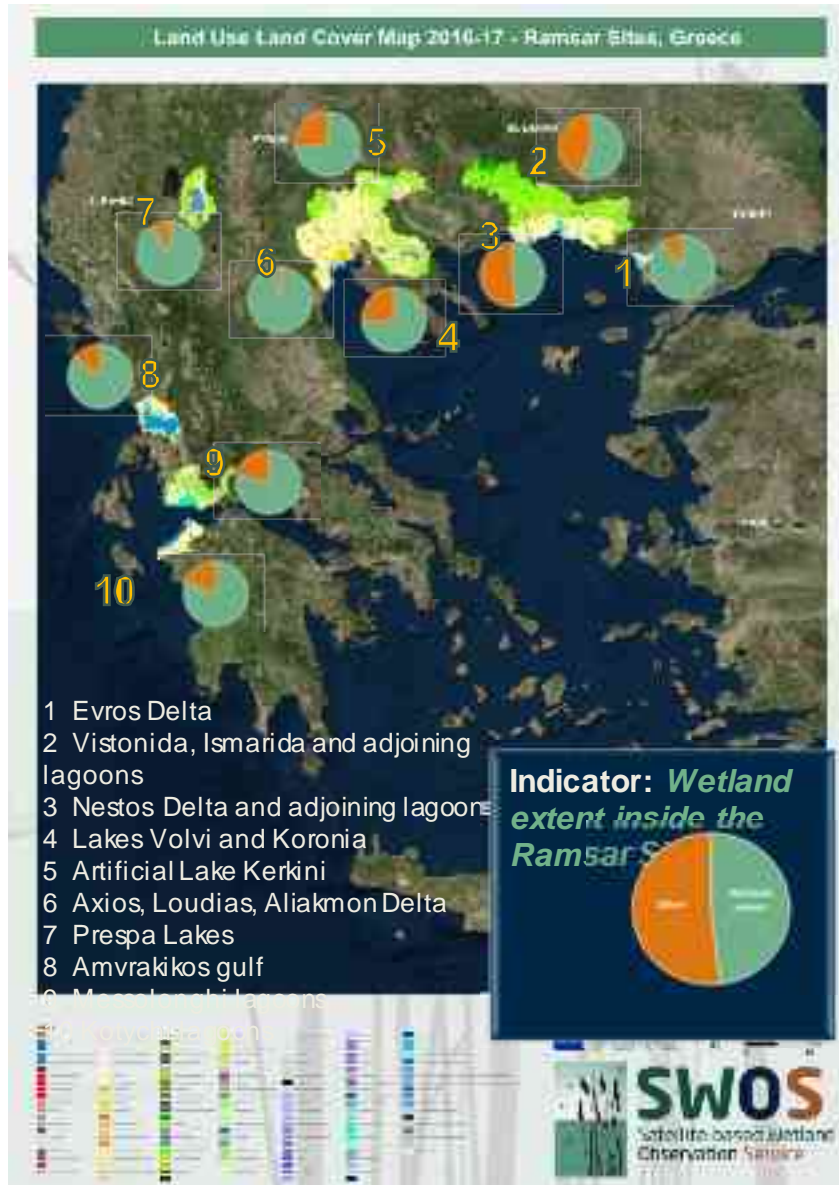


SDG 6.6.1 reporting

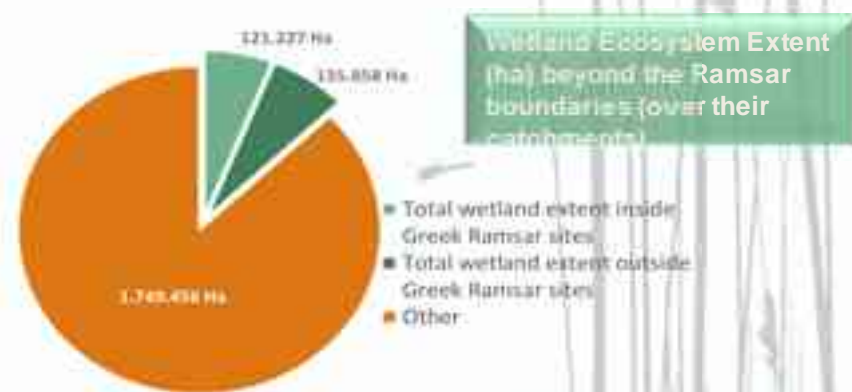
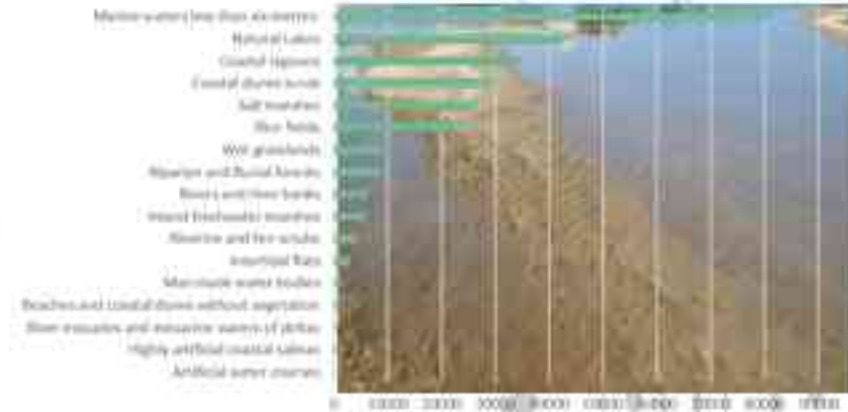


From Indicators & Sub- indicators to Ramsar & SDG 6.6.1 reporting

# Support national reporting



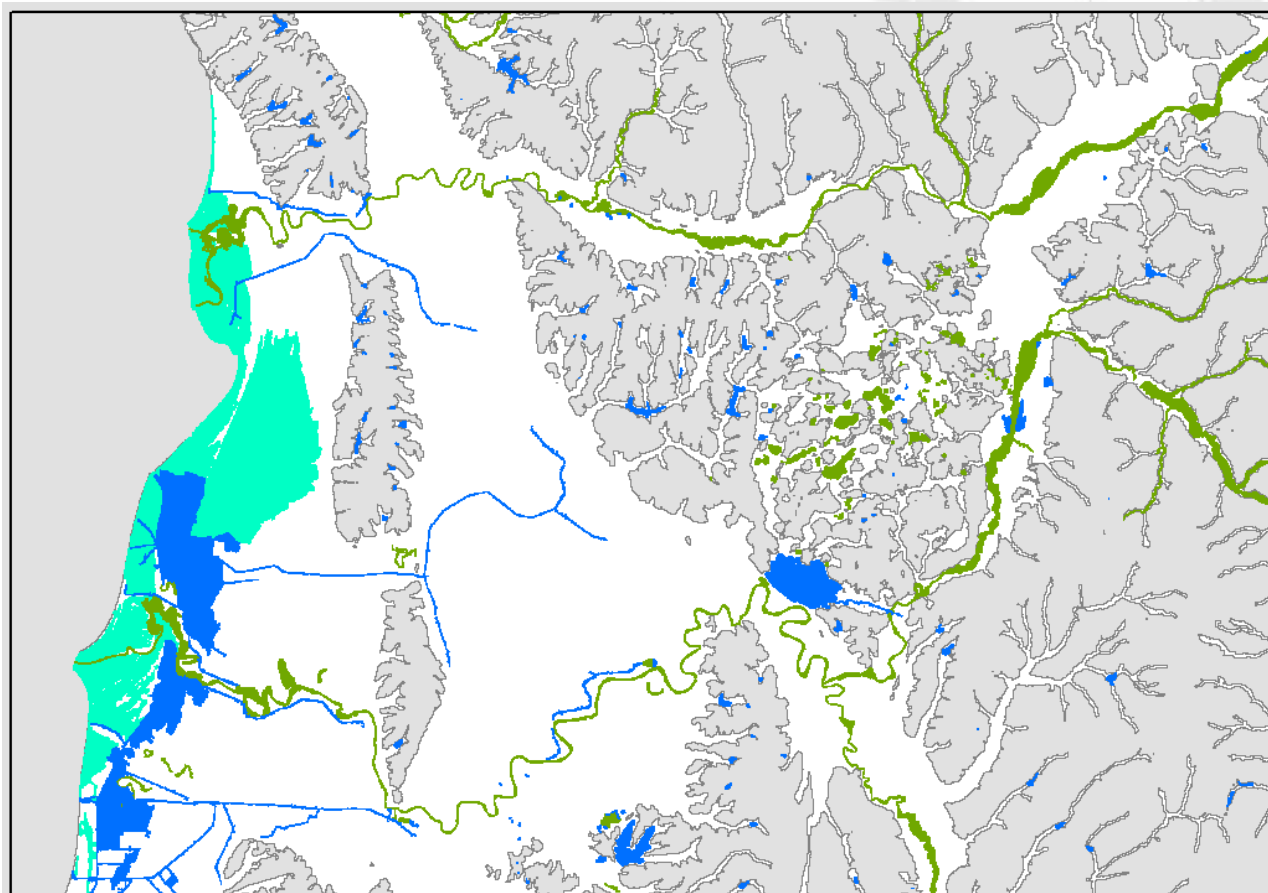
## Wetland Ecosystem Extent (ha) inside the 10 Greek Ramsar sites





## National Service Case - Albania

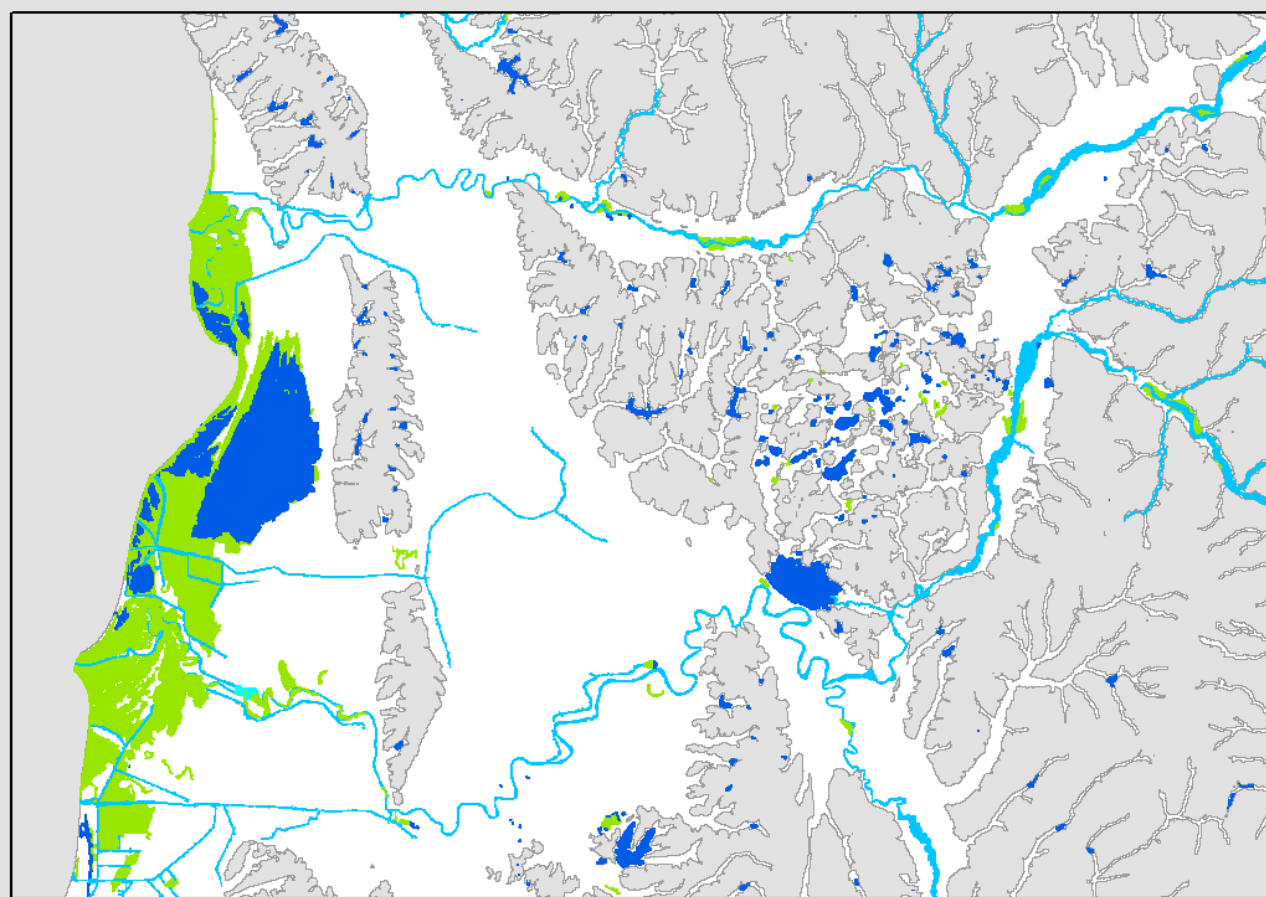
**Ramsar:** Total wetlands extent reporting indicator



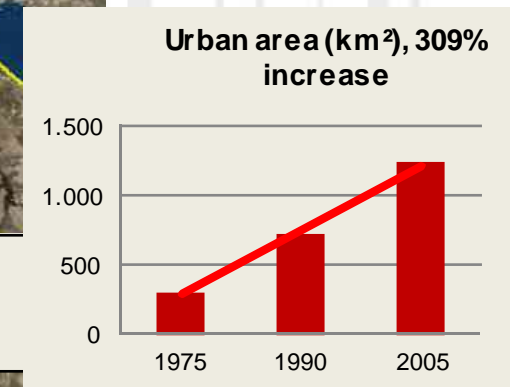
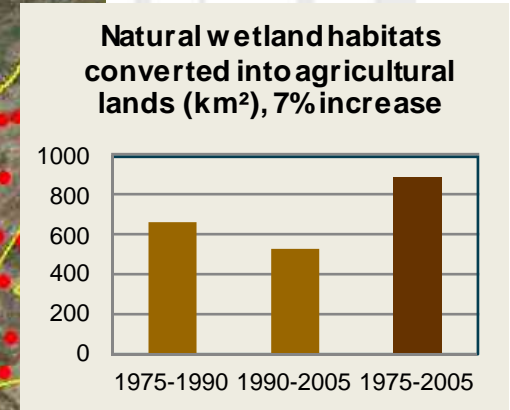
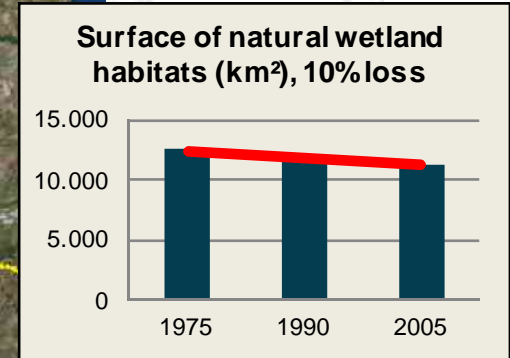
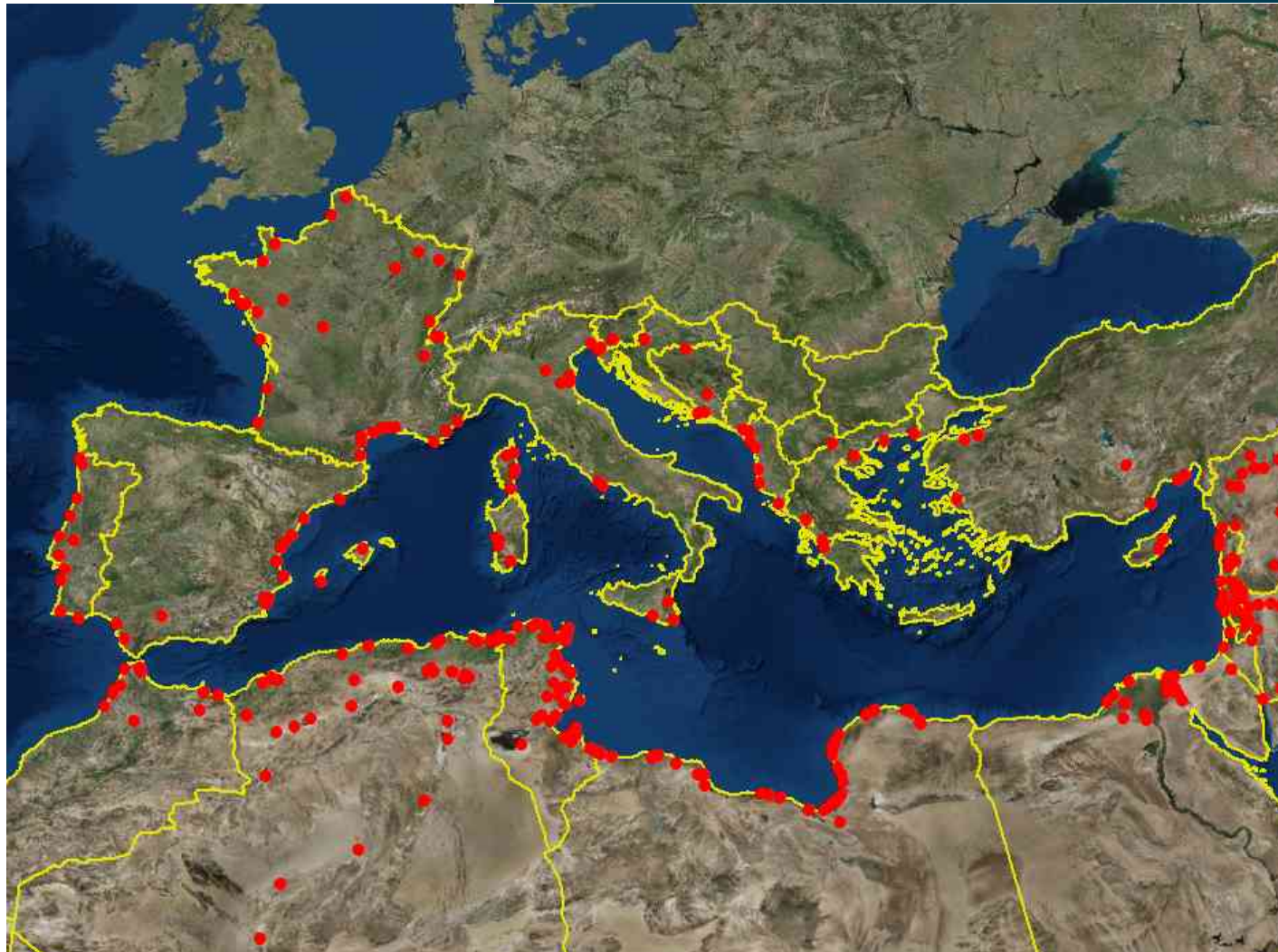
 Coastal wetlands  Inland wetlands  Man-made wetlands

## National Service Case - Albania

### **SDG 6.6.1:** Wetlands and water related ecosystems extent

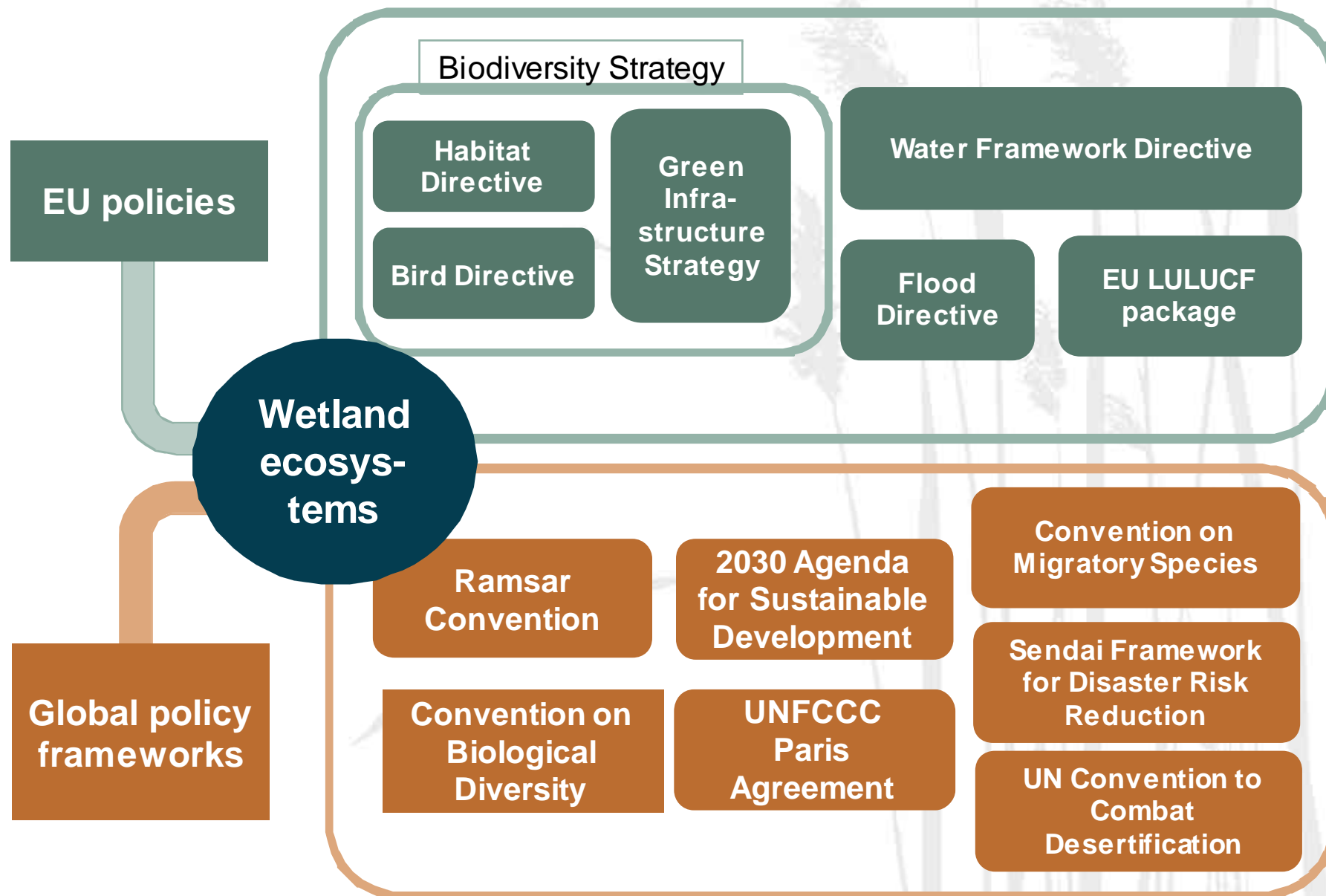


# Regional / Local management



A regional assessment with more than **310** sites were mapped from Morocco to Portugal with **trends from 1975 to 2015**

# Global & EU wetland related policies





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Information based decision making

User and policy-orientation

Standardisation,  
improved nomenclatures

**GEO-Wetlands**

**Portal**

User network

**GEOclassifier  
Desktop/ Cloud**

**Alliances and cooperation  
established**

Cooperation with partner  
projects and initiatives

⇒ Impact on wetland  
management and  
conservation



***Thanks***

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