SWOS
Satellite-based Wetland Observation Service

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

SWOS (The Satellite-based Wetland Observation Service)

Satellite images for peatland monitoring and management

Kathrin Weise, Jena-Optronik GmbH

SWOS is a service

SWOS
Satellite-based Wetland Observation Service

- Promote and underpin the consideration of wetlands in the implementation of key policy areas
- Provide an operational standardized monitoring
- Deliver a service portal as a unique entry point to easily locate, access, process and connect wetland information

Maps and indicators production

Software delivery

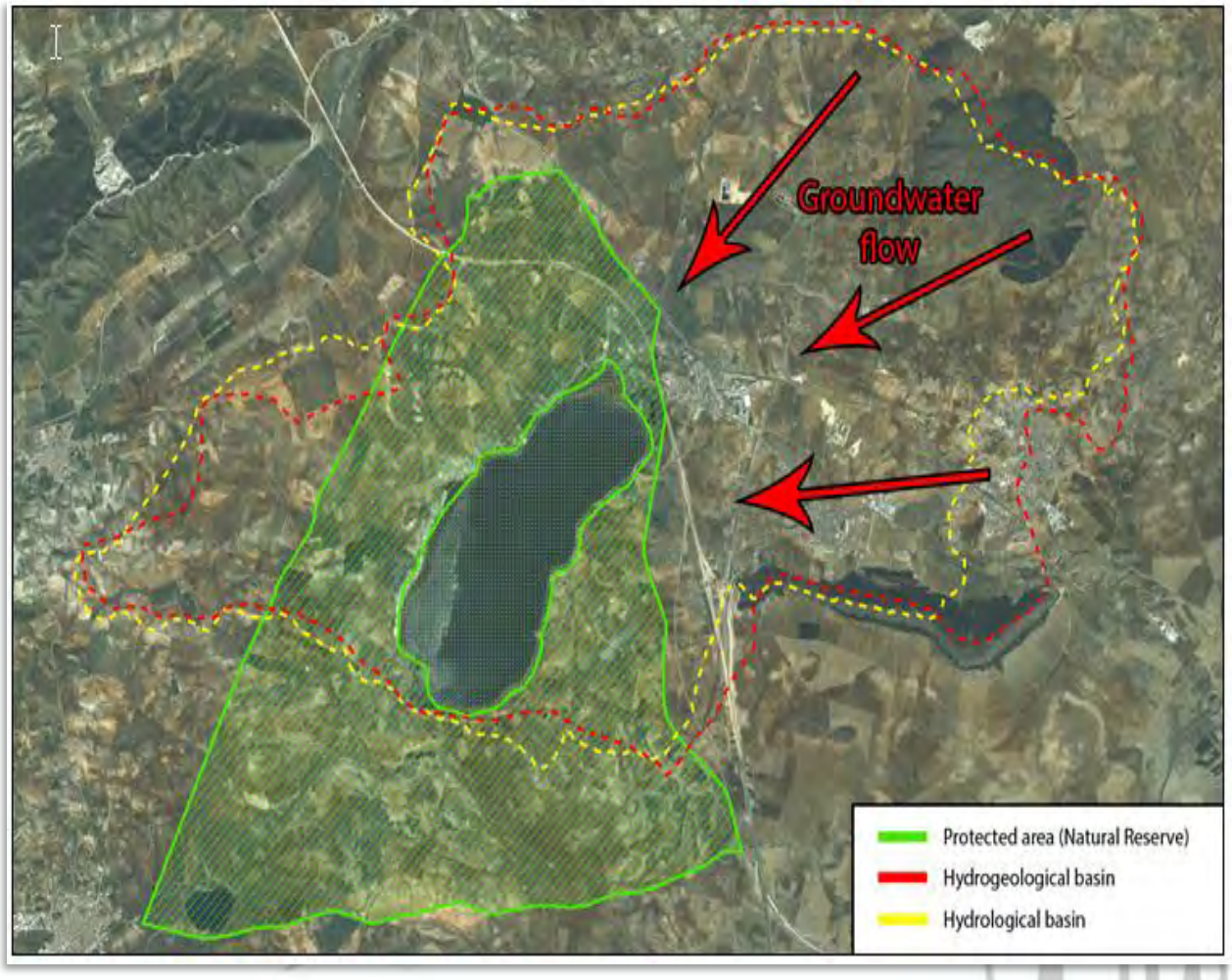
Training/Capacity Building

Portal (Middleware/Data broker/Clients)

Service components

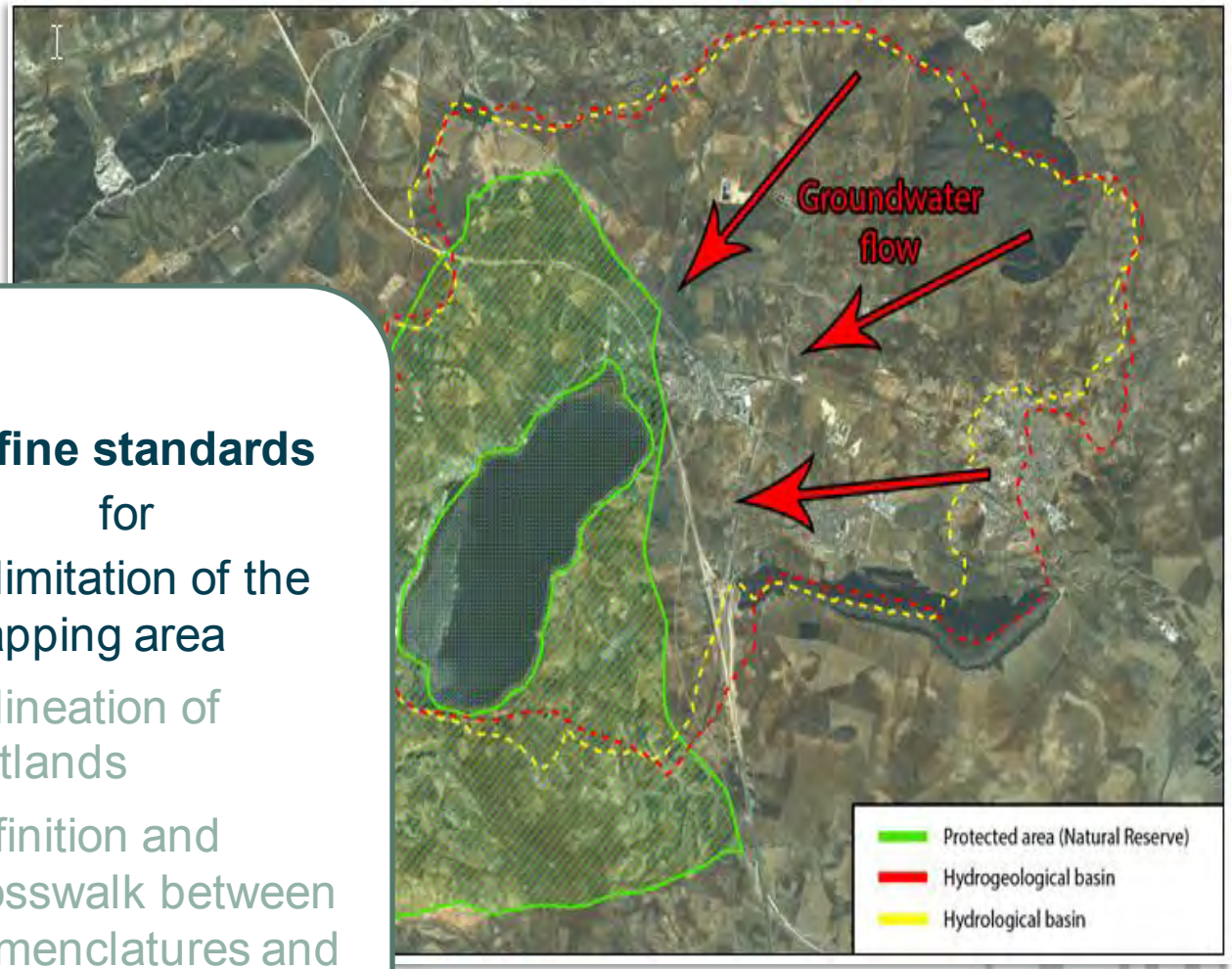
Service demonstration via Multilevel Service cases

Delimitation of the mapping area



Limits of the natural reserve vs the area of hydrological cycle.

Delimitation of the mapping area



Define standards

for

- delimitation of the mapping area
- delineation of wetlands
- definition and crosswalk between nomenclatures and mapping scales

e natural reserve vs the area of
hydrological cycle.

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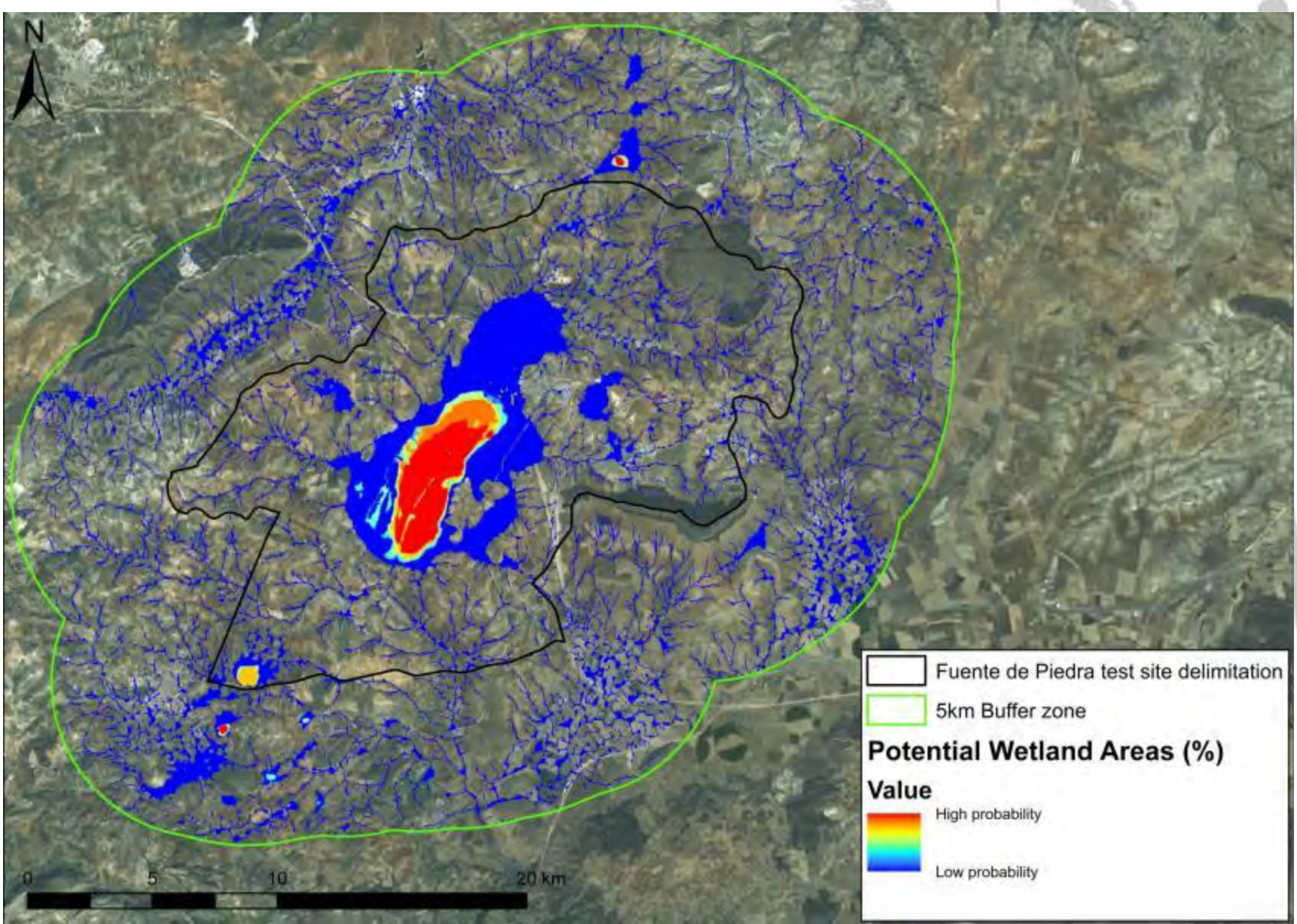
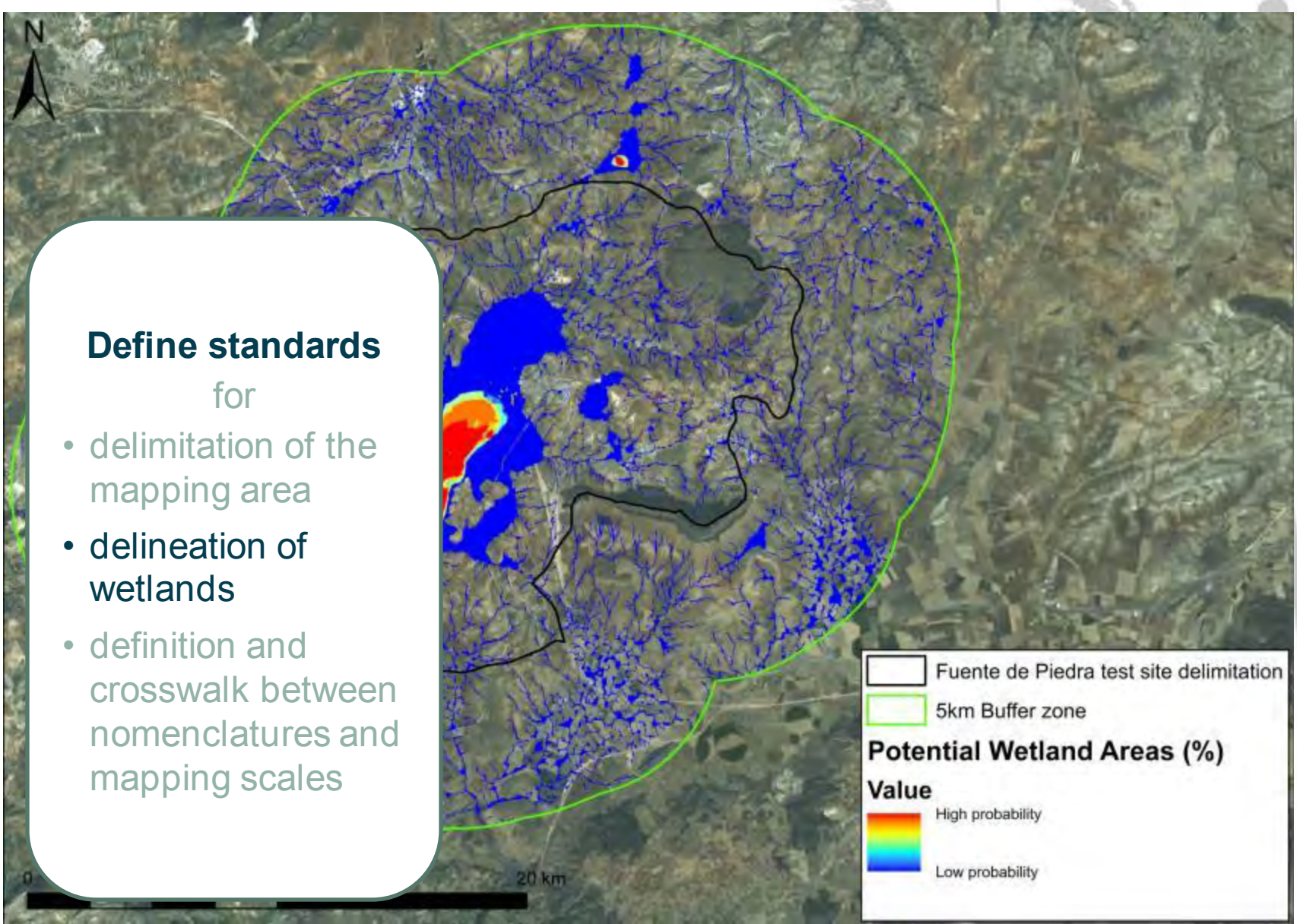
Satellite-based Wetland Observation Service

Delineation of Wetlands



Delineation of Wetlands



Define standards

for

- delimitation of the mapping area
- delineation of wetlands
- definition and crosswalk between nomenclatures and mapping scales

Crosswalk between nomenclatures

6.2	Bare soil, rock, perennial snow & ice	feasible	
6.2.1	Beaches, dunes, sands	feasible	
6.2.1.1	Beaches	contextual class	A common case is that a beach is adjacent to a dune. Differentiation/delineation not possible at require
6.2.1.2	Dunes	contextual class	A common case is that a beach is adjacent to a dune. Differentiation/delineation not possible at require
6.2.1.3	River banks	feasible	
6.2.1.4	Littoral zone of water bodies	contextual class	this class is covered by other classes, since the littoral zone can be covered by either grassland, sparsely
6.2.2	Bare rocks, burnt areas, glaciers and perpetual snow	contextual/temporal class	
6.2.2.1	Bare rocks	feasible	
6.2.2.2	Burnt areas	temporal class	Burned areas can be mapped, but this is rather an additional product. It's a temporal class that depends
6.2.2.3	Glacier	ancillary data required	e.g. glaciers can be covered by substrate, dust or ashes
7	Inland r	feasible	The delineation product can assist here
7.1	Inland	feasible	
7.1.1	Inland	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.1.1	Inland 5 ha	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.1.2	Inland a	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.2	Inland	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.2.1	Inland	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.2.2	Inland ght	ancillary data required	Differentiation betv sible at required high level of certainty
7.2	Peat bo	ancillary data required	Case dependent if p ncillary data to be preferred
7.2.1	Peat bo	ancillary data required	Case dependent if p ncillary data to be preferred
7.2.1.1	Exploit	contextual/temporal class	
7.2.1.2	Unexpl	contextual/temporal class	
8	Lagoons	feasible	
8.1	Coasta	ancillary data required	Confusion with 82 (coastal waters) likely when flooded
8.1.1	Salt ma	ancillary data required	
8.1.1.1	Salt ma	ancillary data required	
8.1.1.2	Salt ma	ancillary data required	
8.1.2	Salines	functional class	Salines are not always squared features and thus not possible to identify (e.g. Salines in Azraq)
8.1.3	Intertid	contextual class	Too detailed since the tidal range must be incorporated
8.2	Coastal waters	feasible	Confusion with 10 (marine other) likely
8.2.1	Coastal lagoons	feasible	Confusion with 10 (marine other) likely
8.2.2	River estuaries and estuarine waters of deltas	feasible	Confusion with 10 (marine other) likely
9	Rivers and Lakes	feasible	
9.1	Water courses	feasible	
9.1.1	Interconnected running water courses	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive
9.1.1.1	Permanent Interconnected running water courses	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive
9.1.1.2	Seasonal/intermittent interconnected running water courses	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive
9.1.1.3	Highly modified natural water courses and canals	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive

For nomenclatures like

- MAES_SWOS
- Ramsar_SWOS
- CLC&Ramsar (GW-II)_SWOS
- LCCS
- EUNIS
- …

For different mapping scales

feasible

feasible with ancillary data

not feasible

Crosswalk between nomenclatures

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6.2.2.3	Glacier	ancillary data required	e.g. glaciers can be covered by substrate, dust or ashes
7	Inland	feasible	The delineation product can assist here
7.1	Inla	feasible	
7.1.1	In	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.1.1	I	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.1.2	I	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.2	I	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.2.1	I	ancillary data required	Differentiation betv sible at required high level of certainty
7.1.2.2	I	ancillary data required	Differentiation betv sible at required high level of certainty
7.2	P	ancillary data required	Case dependent if p ncillary data to be preferred
7.2.1	P	ancillary data required	Case dependent if p ncillary data to be preferred
7.2.1.1	E	contextual/temporal class	
7.2.1.2	U	contextual/temporal class	
8	L	feasible	
8.1	C	ancillary data required	Confusion with 82 (coastal waters) likely when flooded
8.1.1	S	ancillary data required	
8.1.1.1	S	ancillary data required	
8.1.1.2	S	ancillary data required	
8.1.2	S	functional class	Salines are not always squared features and thus not possible to identify (e.g. Salines in Azraq)
8.1.3	I	contextual class	Too detailed since the tidal range must be incorporated
8.2	C	feasible	Confusion with 10 (marine other) likely
8.2.1	C	feasible	Confusion with 10 (marine other) likely
8.2.2	R	feasible	Confusion with 10 (marine other) likely
9	R	feasible	
9.1	V	feasible	
9.1.1	I	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive
9.1.1.1	P	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive
9.1.1.2	S	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive
9.1.1.3	H	contextual class	Interconnection cannot be fully assessed by remote sensing (e.g. gallery forests that cover parts of a rive

For nomenclatures like

WOS

es

Define standards

for

- delimitation of the mapping area
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- definition and crosswalk between nomenclatures and mapping scales

feasible

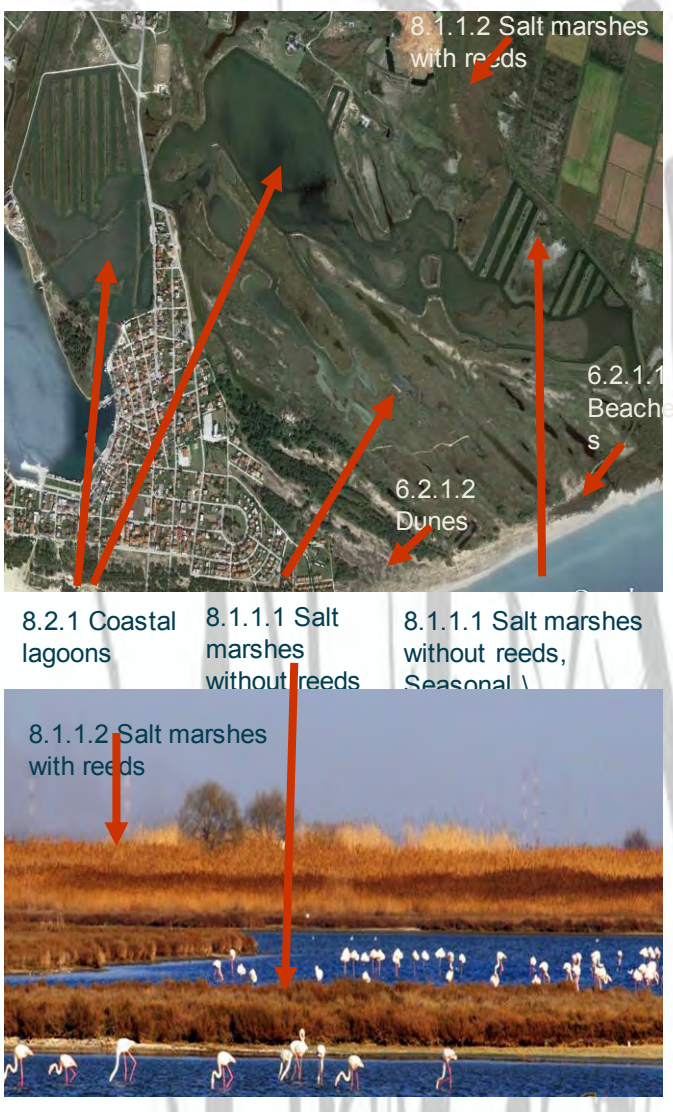
feasible with ancillary data

not feasible

MAES nomenclature – how to classify

How to classify lagoons, coastal wetlands and estuaries

Wetland ecosystem types that can be found in or alongside the boundaries of coastal wetlands, lagoons and estuarine ecosystems: beaches and dunes, riparian forests, riverine and fen scrubs, wet meadows or pastures, wet heaths.



MAES nomenclature – how to classify

How to classify lagoons, coastal wetlands ar estuaries

Wetland ecosystem ty
that can be found in o
alongside the boundar
coastal wetlands, lago
and estuarine ecosyst
beaches and dunes, r
forests, riverine and fe
scrubs, wet meadows
pastures, wet heaths.

Provide guidelines / training

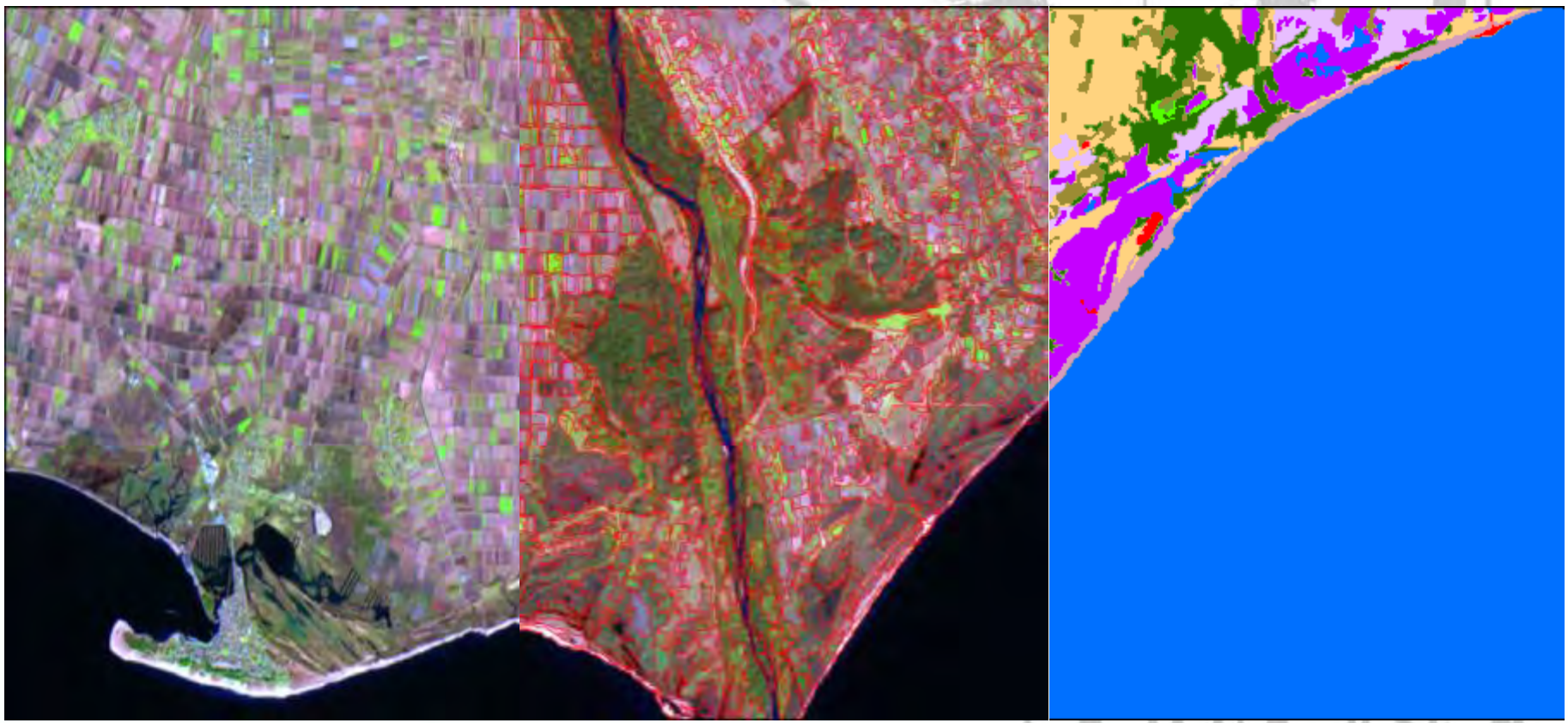
How to

- apply nomenclatures / satellite data ⇒ maps ⇒ indicators
- Bring information to decision makers / prepare reporting obligations

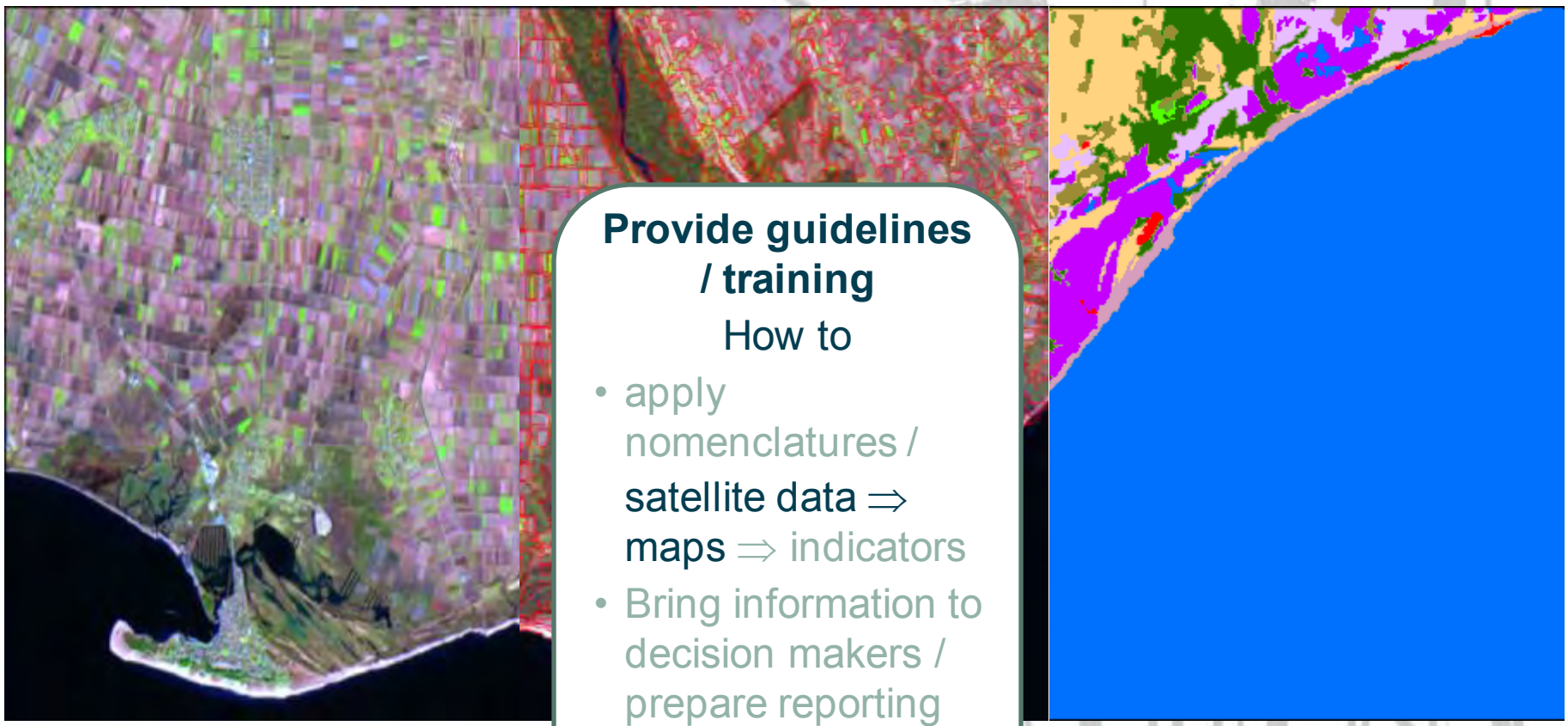
Demonstration via multilevel service cases

SWOS
Satellite-based Wetland Observation Service

From Satellite images to maps



From Satellite images to maps



Provide guidelines / training

How to

- apply nomenclatures / satellite data ⇒ maps ⇒ indicators
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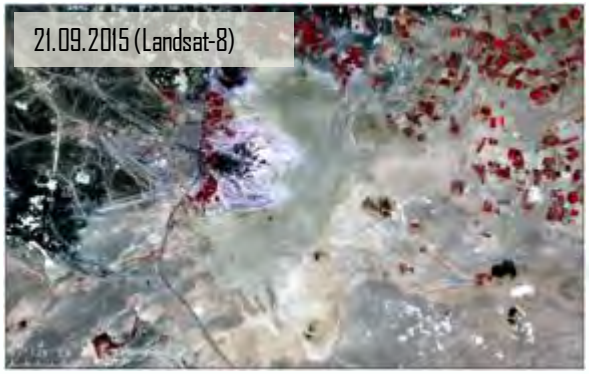
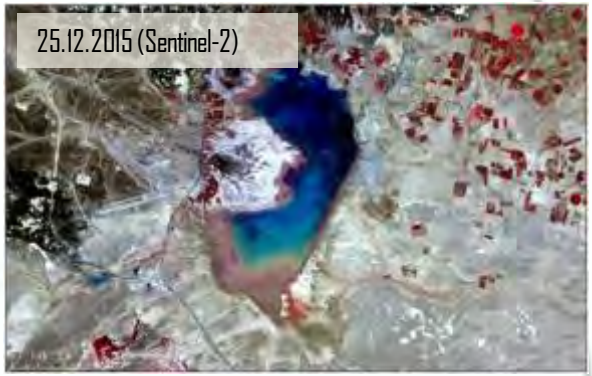
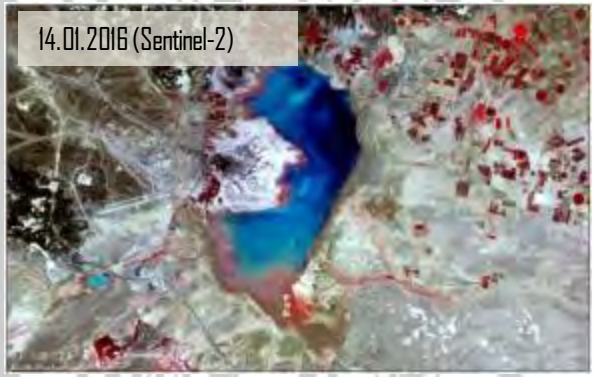
Demonstration via multilevel service cases

Landsat and S2 for wetland monitoring

The temporal scale: **Monitoring of long term changes** / decreasing water table (Dead Sea, Jordan/Israel)







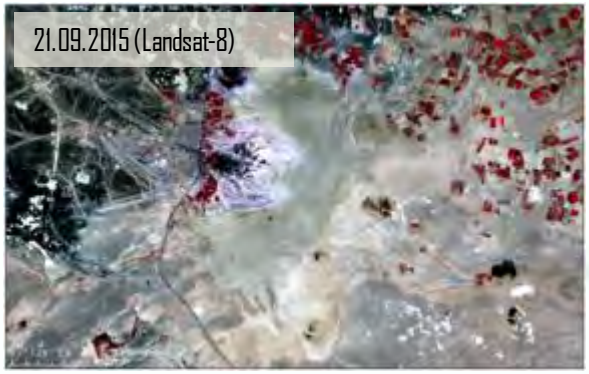
The temporal scale: **Monitoring of short term changes** / wetland characteristics (Azraq Oasis, Jordan)

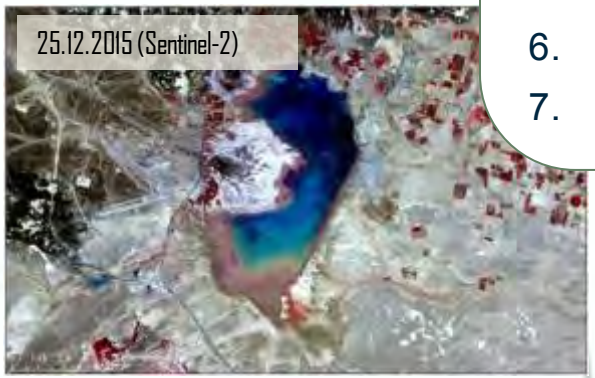
Landsat and S2 for wetland monitoring

The temporal scale: **Monitoring of long term changes** / decreasi srael)

Landsat / S2 for wetland monitoring:

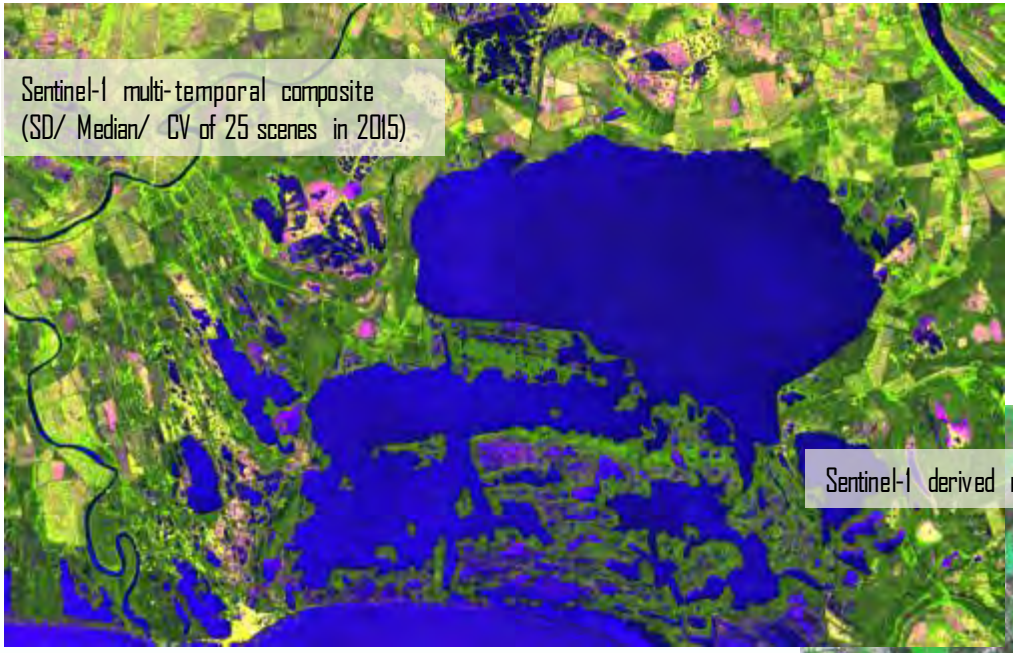
1. Land Use Land Cover
2. Land Use Land Cover Change
3. Water Cycle Regime
4. Inventory and delineation
5. Surface temperature
6. Water quality
7. …

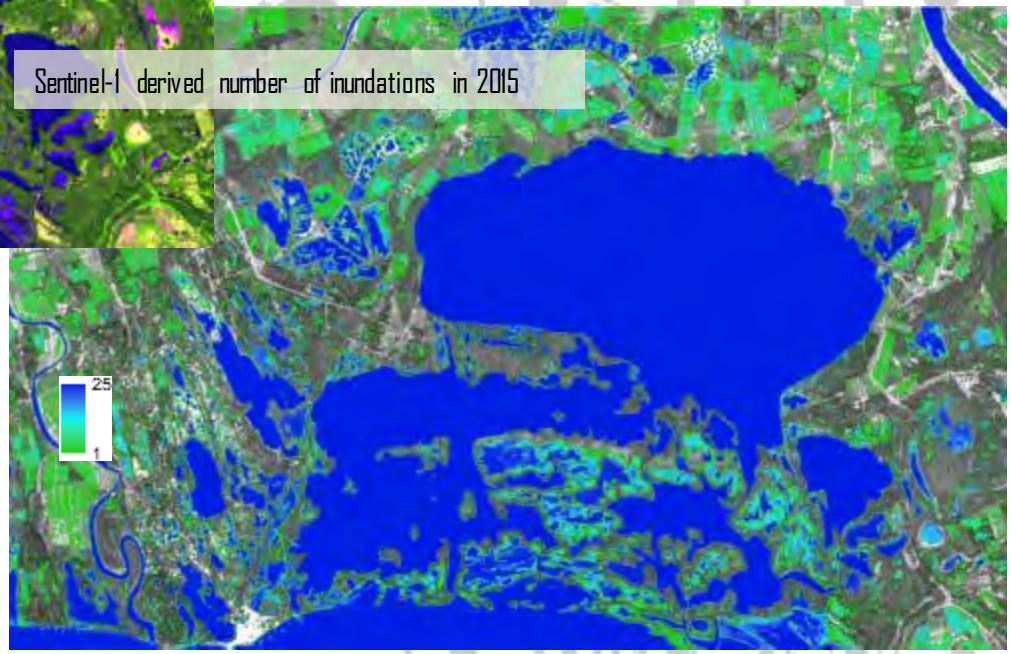




The temporal scale: **Monitoring of short term changes** / wetland characteristics (Azraq Oasis, Jordan)

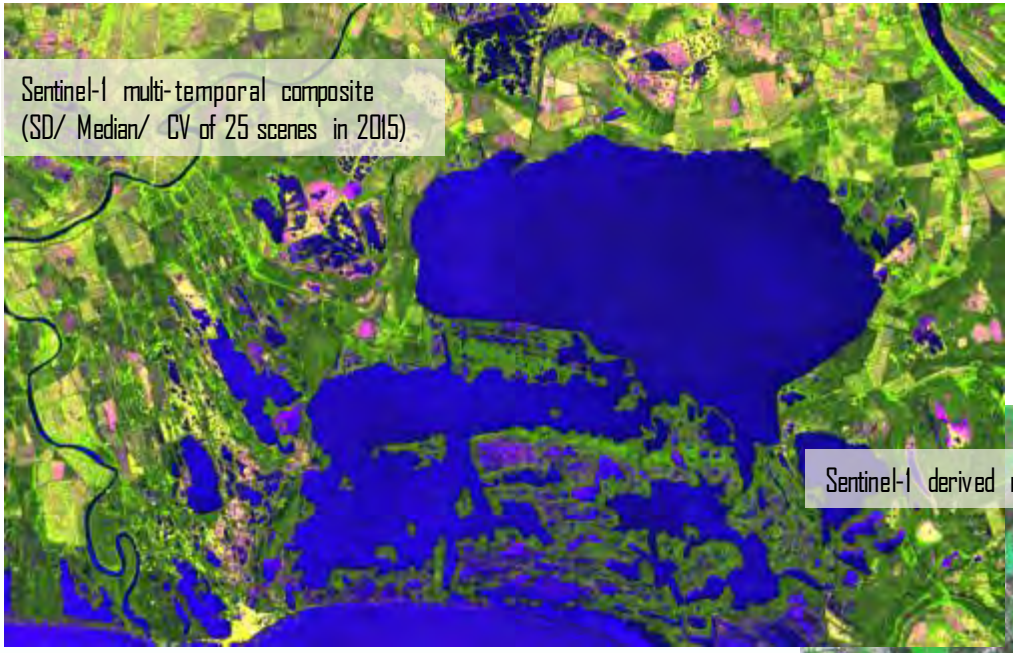
Radar data for wetland monitoring





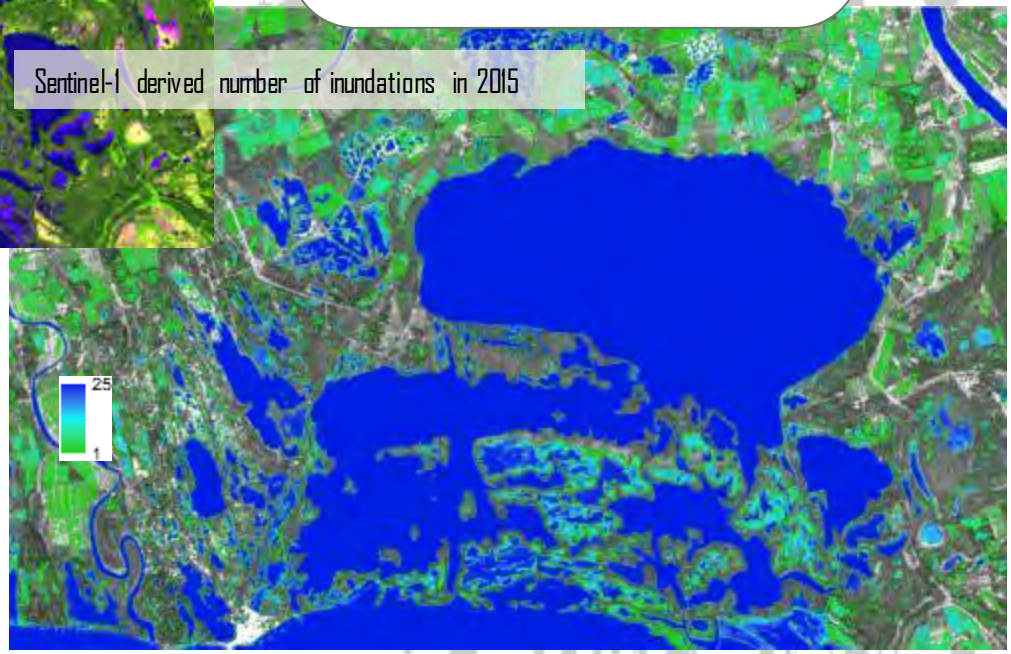
The Radar perspective: SAR-based monitoring of inundation (Camargue, France)

Radar data for wetland monitoring



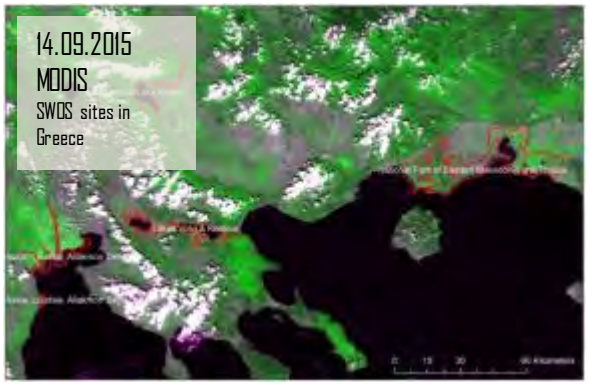
Radar data / S1 for wetland mapping:

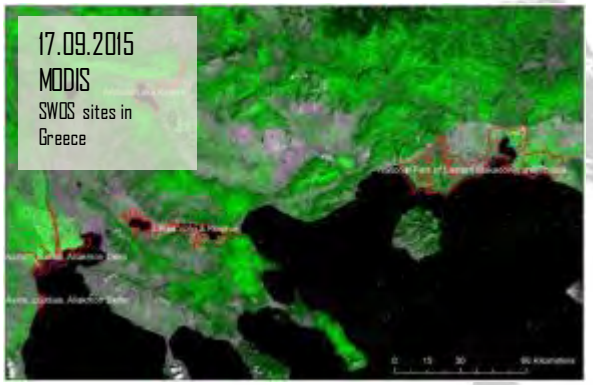
1. Surface water dynamics
2. Inventory and delineation
3. Soil Moisture
4. …

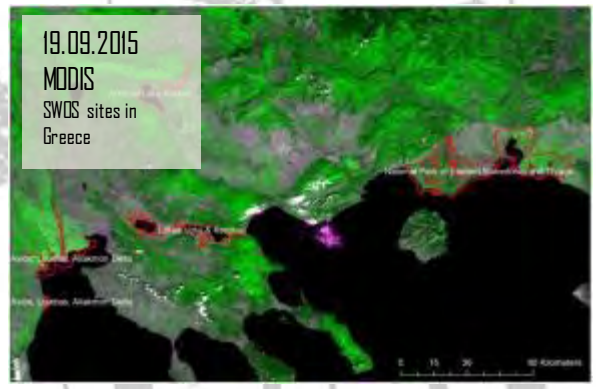


The Radar perspective: SAR-based monitoring of inundation (Camargue, France)

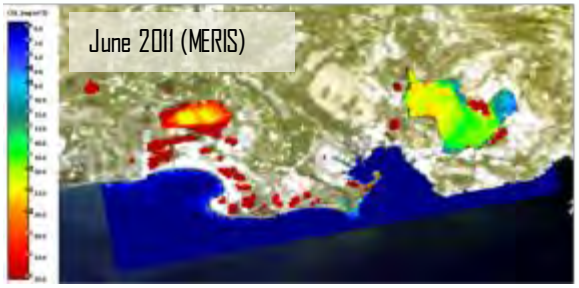
MERIS / S3 / Modis for wetland monitoring

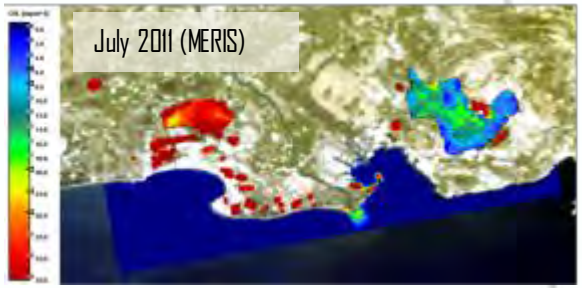


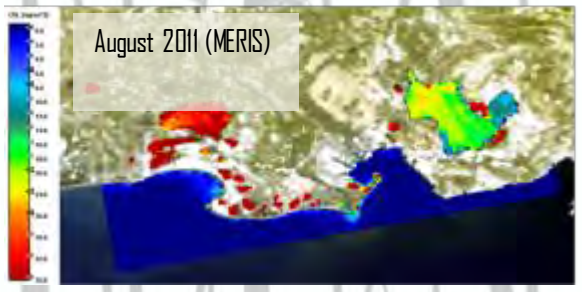




The daily large-scale perspective: large scale monitoring of all the SWOS test sites in one country (Greece)



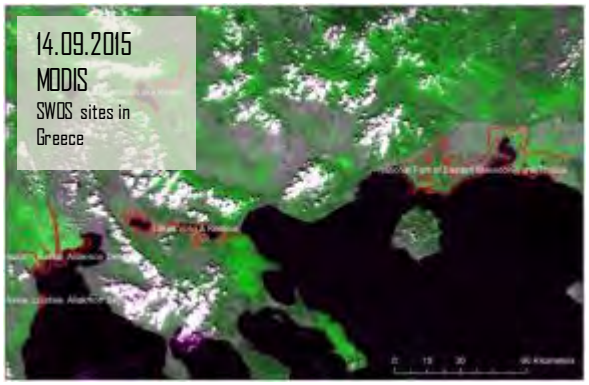


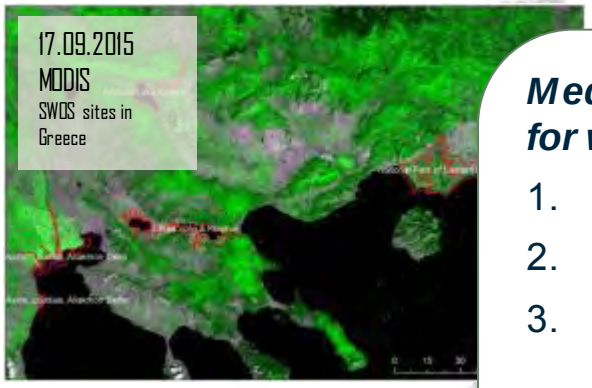


Water quality mapping: Monthly mean chlorophyll concentration based on MERIS (Camargue, France)

The high values and differences in Étang de Vaccarés (left) are most likely a result of bottom reflectance as it is too shallow to derive chlorophyll, the values and differences in the main parts of Etang de Berre (right) reflect true variations in chlorophyll concentrations between the three months.

MERIS / S3 / Modis for wetland monitoring

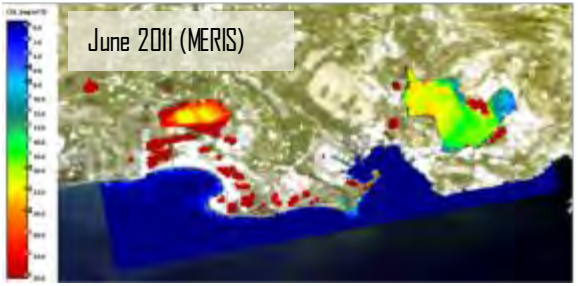


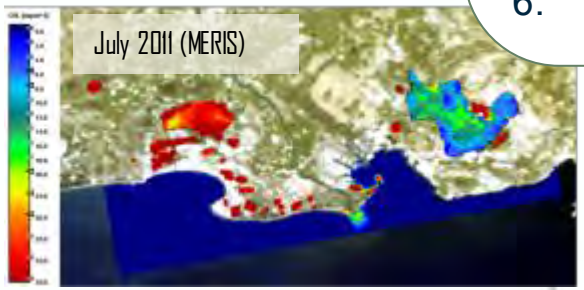


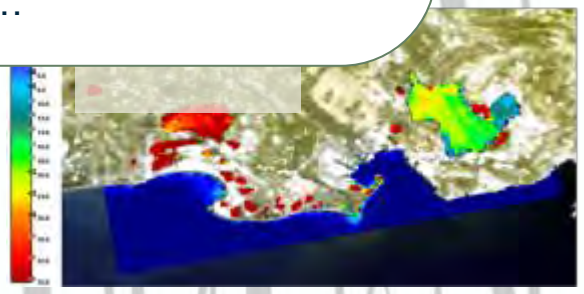
The daily large-scale perspective: large scale monitoring of all the (Greece)

Medium resolution data for wetland mapping:

1. Water quality
2. Surface temperature
3. Inventory and delineation
4. Large scale coverage
5. Short term changes
6. …







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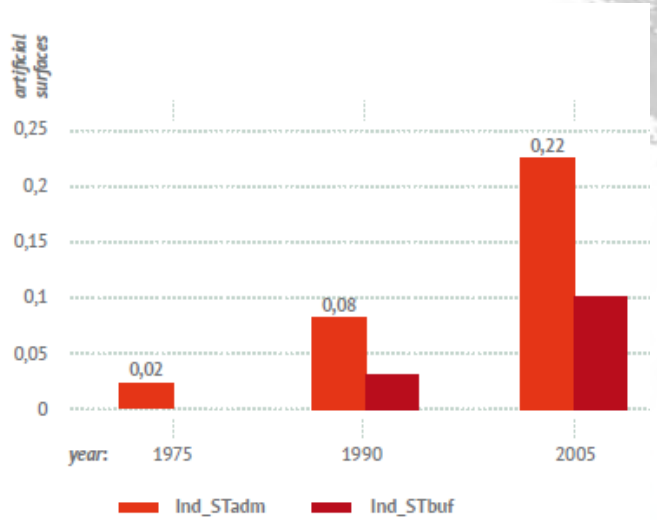
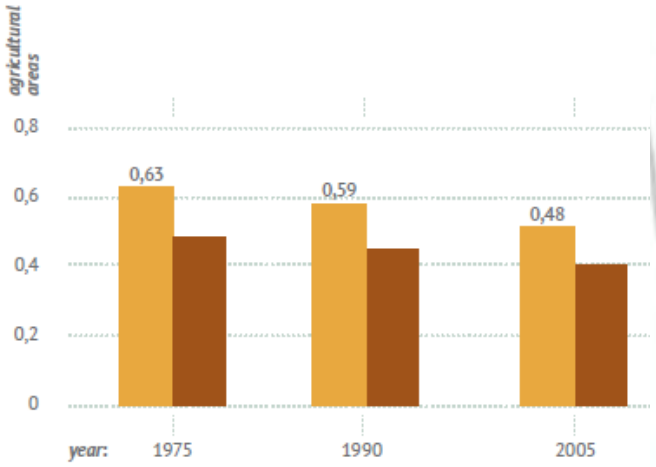
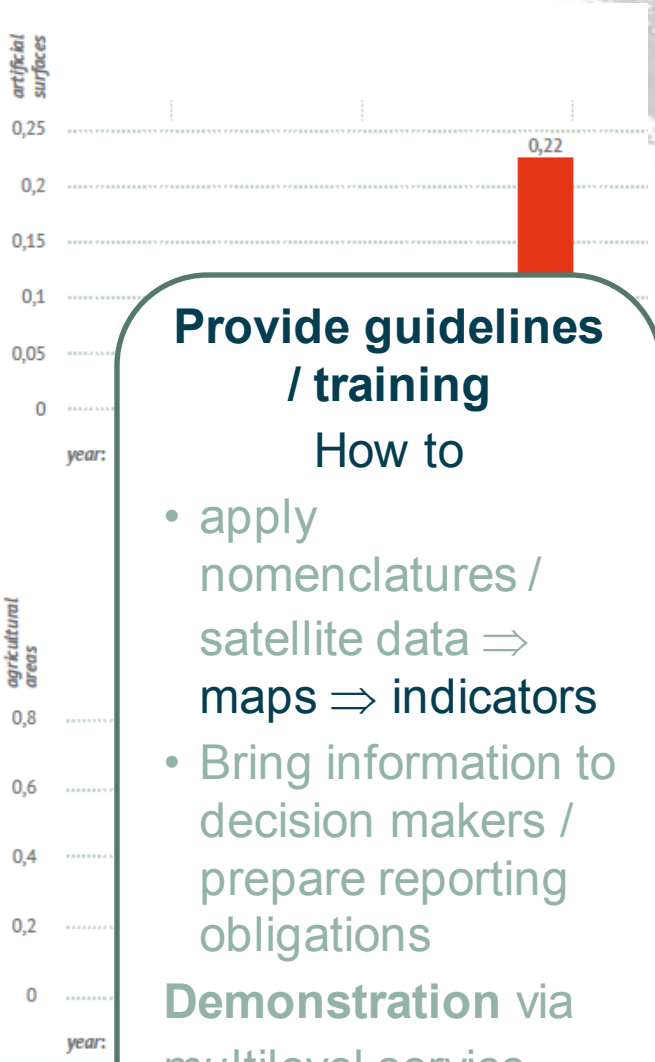
From Maps to indicators





From Maps to indicators



Provide guidelines / training

How to

- apply nomenclatures / satellite data ⇒ maps ⇒ indicators
- Bring information to decision makers / prepare reporting obligations

Demonstration via multilevel service cases

From maps to indicators:

1. Change in wetland area
2. Inundation of the ecosystem
3. Change in wetland area due to urbanization and agriculture
4. Status and trends of wetland threats

SWOS Software Toolbox

Functions

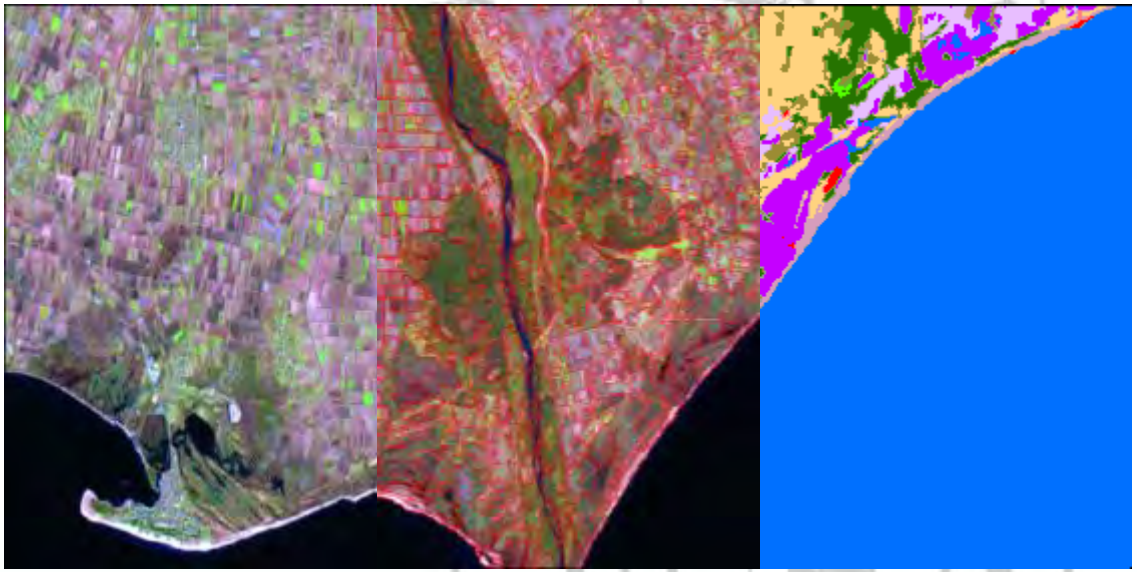
- EO data pre-processing (Optical + SAR)
- Map product generation
- Indicator calculation
- Use GEO*portal* online services

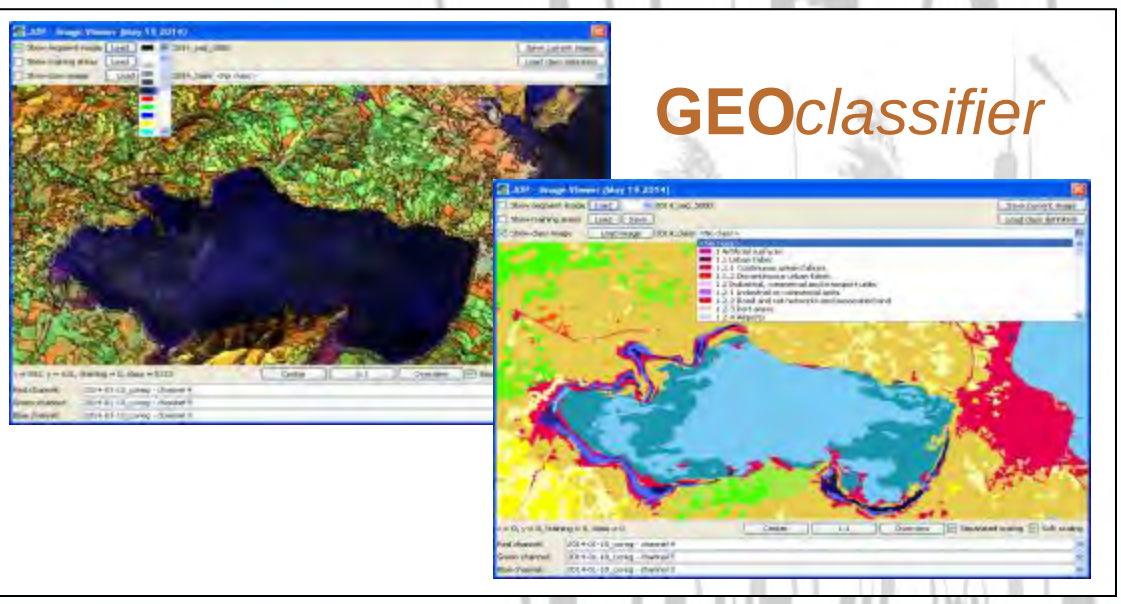
Easy integration of

- Local knowledge for supervised classification and interpretation
- New and updated **nomenclatures**

Available as

- standalone version (GUI & command line)
- integrated in external software e.g. ArcGIS, QGIS





GEO*classifier*

SWOS Software Toolbox

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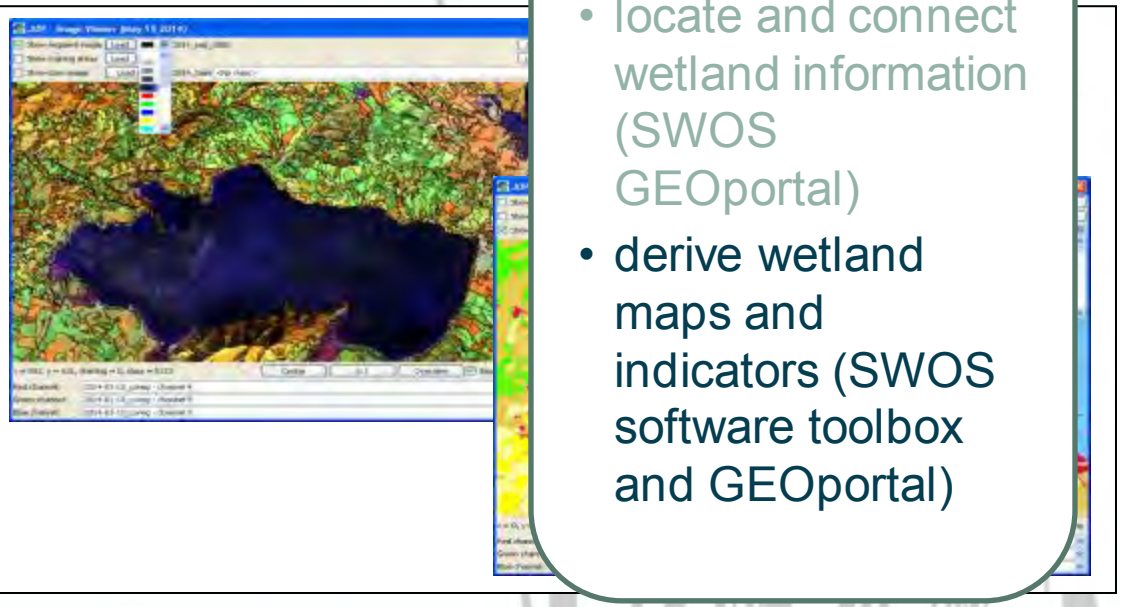

Deliver the infrastructure

to

- locate and connect wetland information (SWOS GEOportal)
- derive wetland maps and indicators (SWOS software toolbox and GEOportal)

SWOS test sites (1st iteration)

SWOS test sites (1st iteration)

Provide guidelines / training

How to

- apply nomenclatures / satellite data ⇒ maps ⇒ indicators
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Demonstration via multilevel service cases

SWOS implementation – Ramsar reporting

SWOS mapping protocol

addresses the following requirements as they are set in Annex III of the Ramsar Information Sheet

Extent mapping beyond Ramsar designated boundaries

- ❑ Delineate wetland and non-wetland parts of the Ramsar site and depict the wetland boundary with respect to the site's boundary
- ❑ Depict the on a map the Ramsar wetland types
- ❑ Depict key hydrological features: Wetland extent in the wet and in the dry seasons.
- ❑ Depict land uses land cover types in the catchment(s) area

SWOS implementation – Ramsar reporting

SWOS mapping protocol

addresses the following requirements as they are set in Annex III of the Ramsar In t

Extent mapping beyond Ram s

- ❑ Delineate wetland and nor nsar site and depict the wetland boundary with respe
- ❑ Depict the on a map the R
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- ❑ Depict land uses land cove s) area

Provide guidelines / training

How to

- apply nomenclatures / satellite data ⇒ maps ⇒ indicators
- Bring information to decision makers / prepare reporting obligations

Demonstration via multilevel service cases

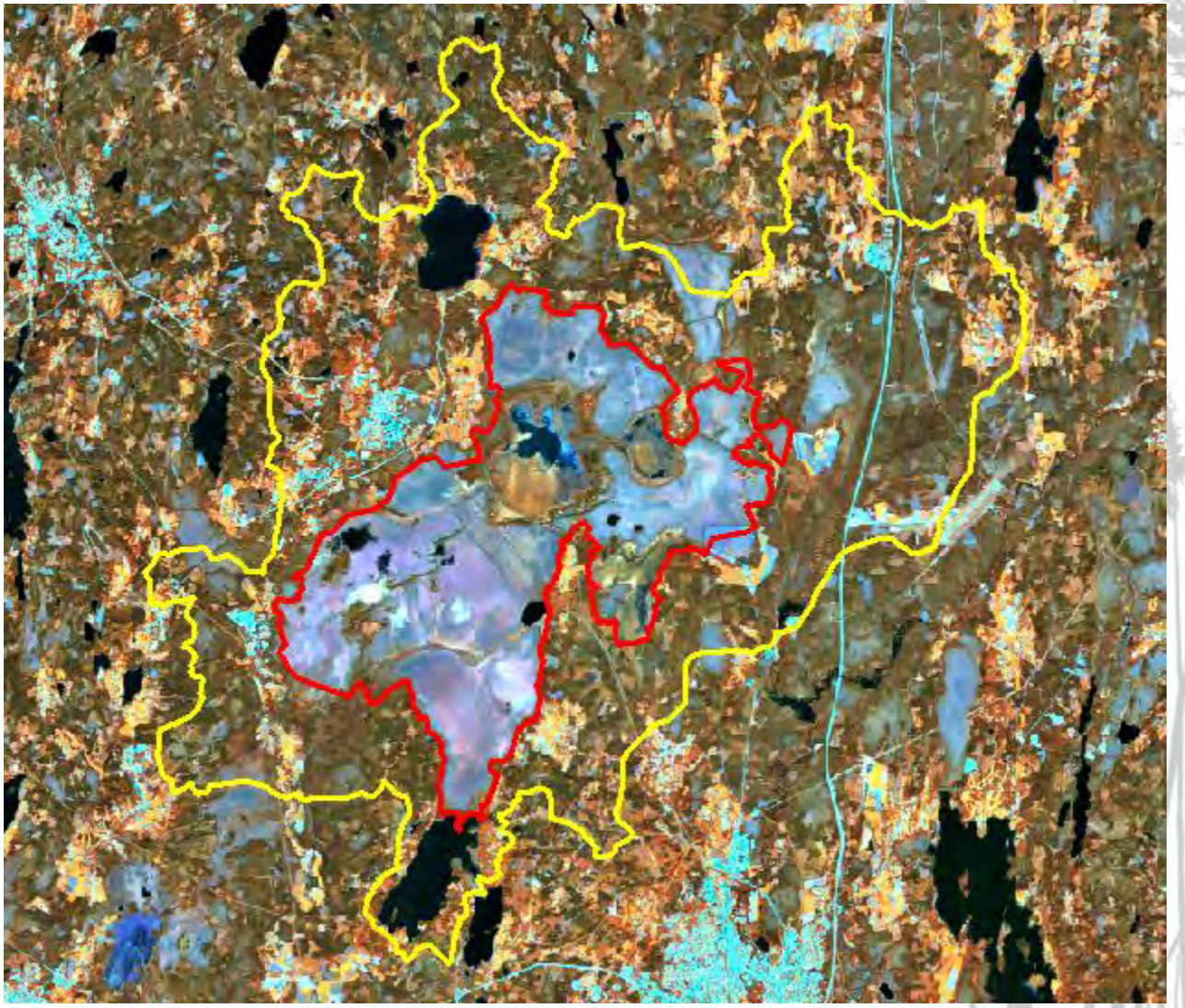
Store Mosse-Kävsjön

Located in southern Sweden

Most extensive and largely untouched mire area in Sweden south of Lappland.

National Park, Ramsar Site, Natura 2000

Store Mosse-Kävsjön



Ramsar site

SWOS site

Sentinel 2A, 2015-08-19

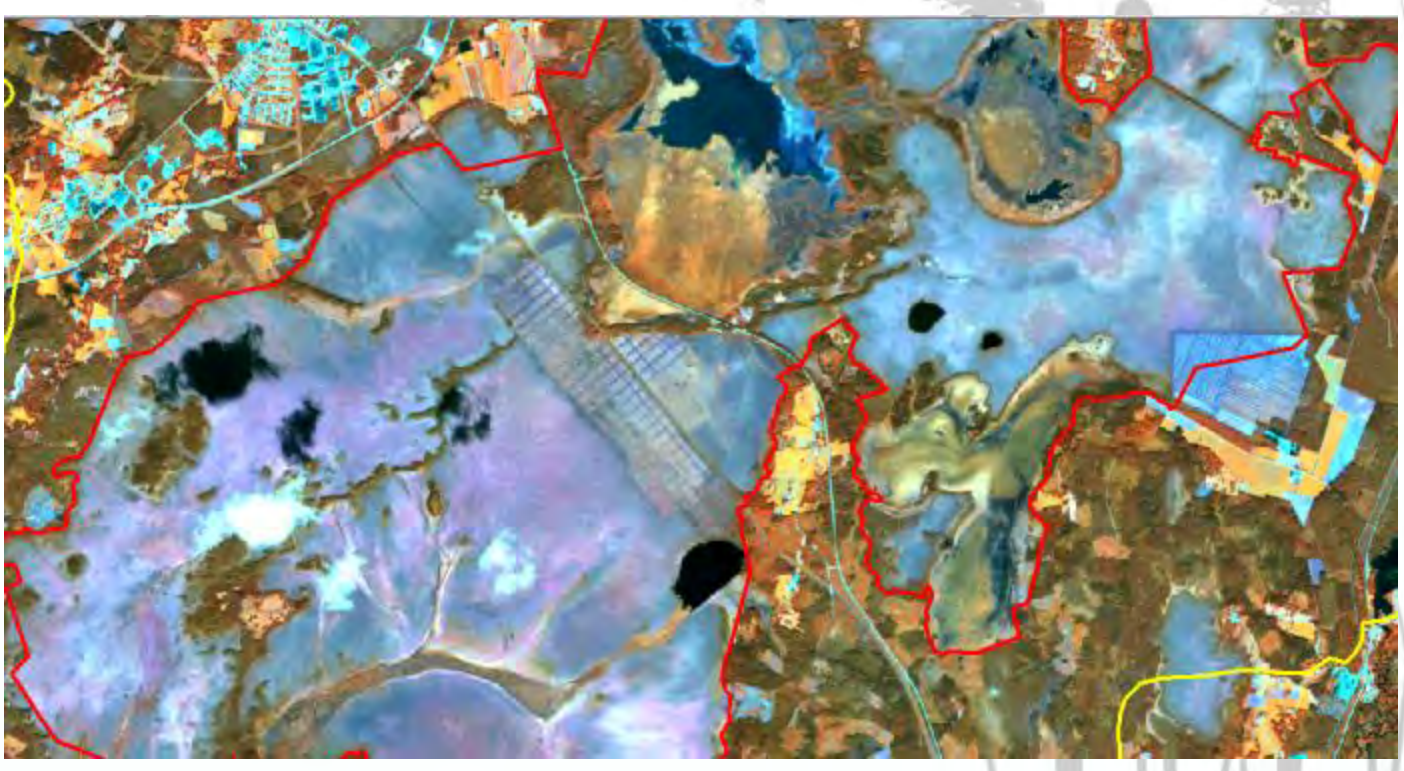
Store Mosse-Kävsjön

Photos are by Bergslagsbild AB

Hädingetäkten

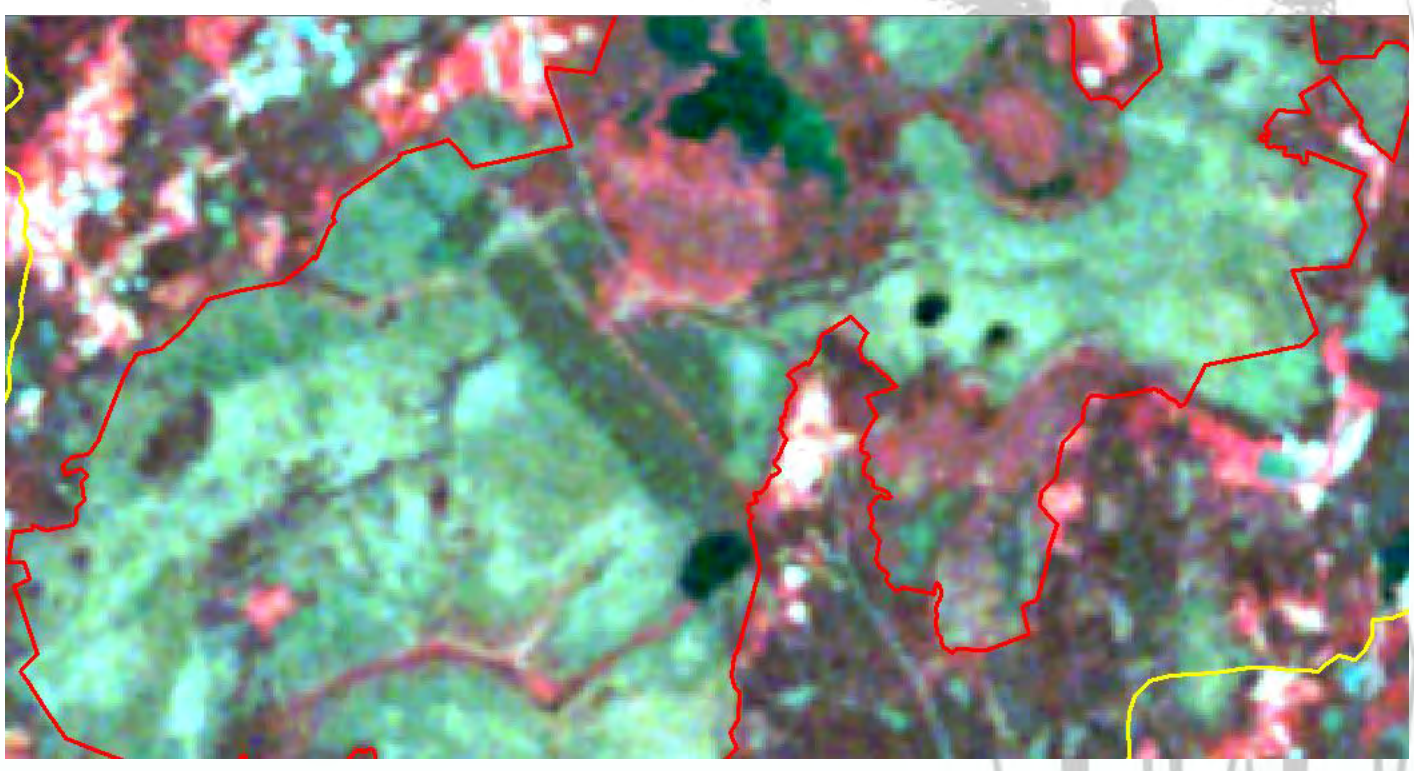
- The area is a mosaic of raised bogs, fens and oligotrophic lakes and lagoons.
- Ramsar class
  - U = non-forested peatlands (dominating)
  - Xp = forested peatlands
- Peat extraction site
- Restauration of peat extraction sites are ongoing removal of trees, opening of ditches, …)
- Needs for monitoring of restauration effects

Store Mosse-Kävsjön



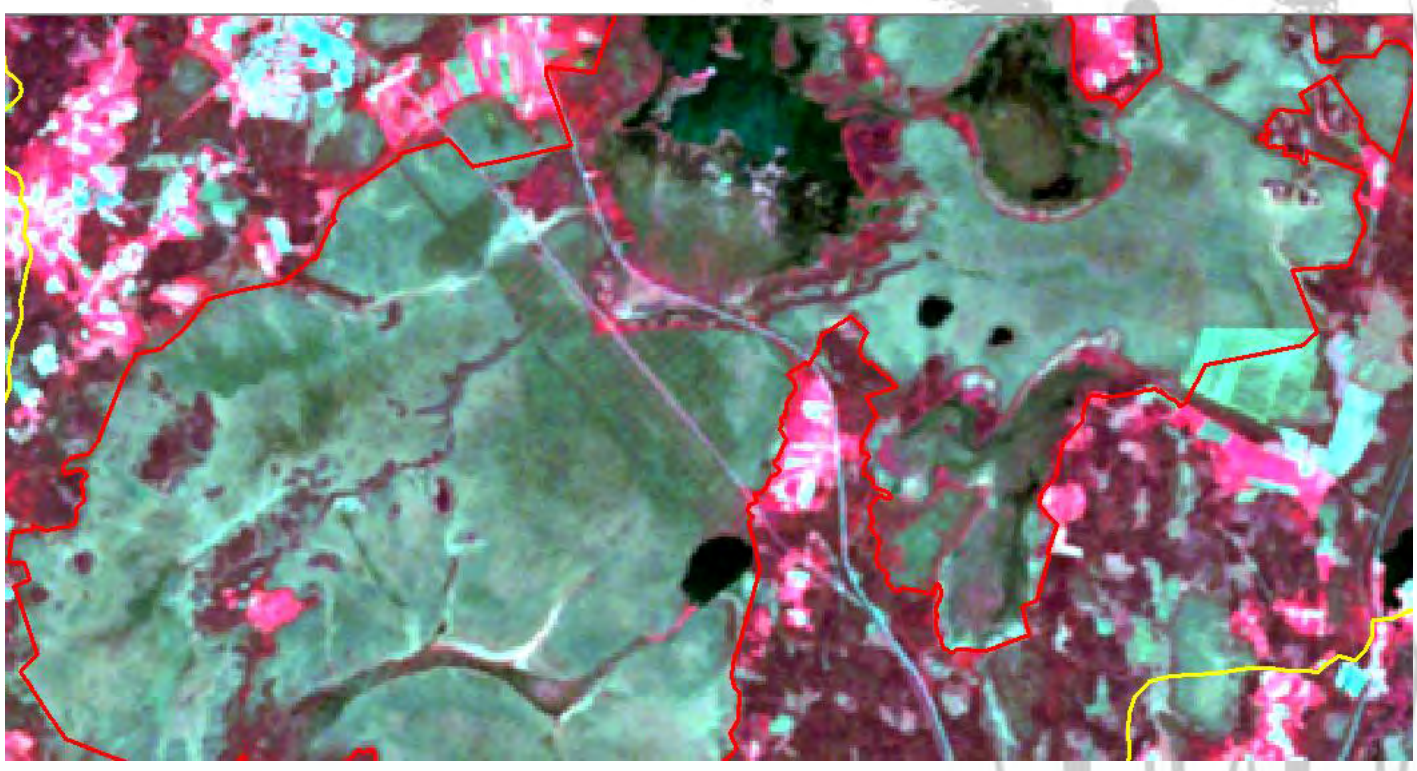
S2A 2015-08-19

Store Mosse-Kävsjön



LS MSS 1975-07-03

Store Mosse-Kävsjön



LS TM 1985-06-01

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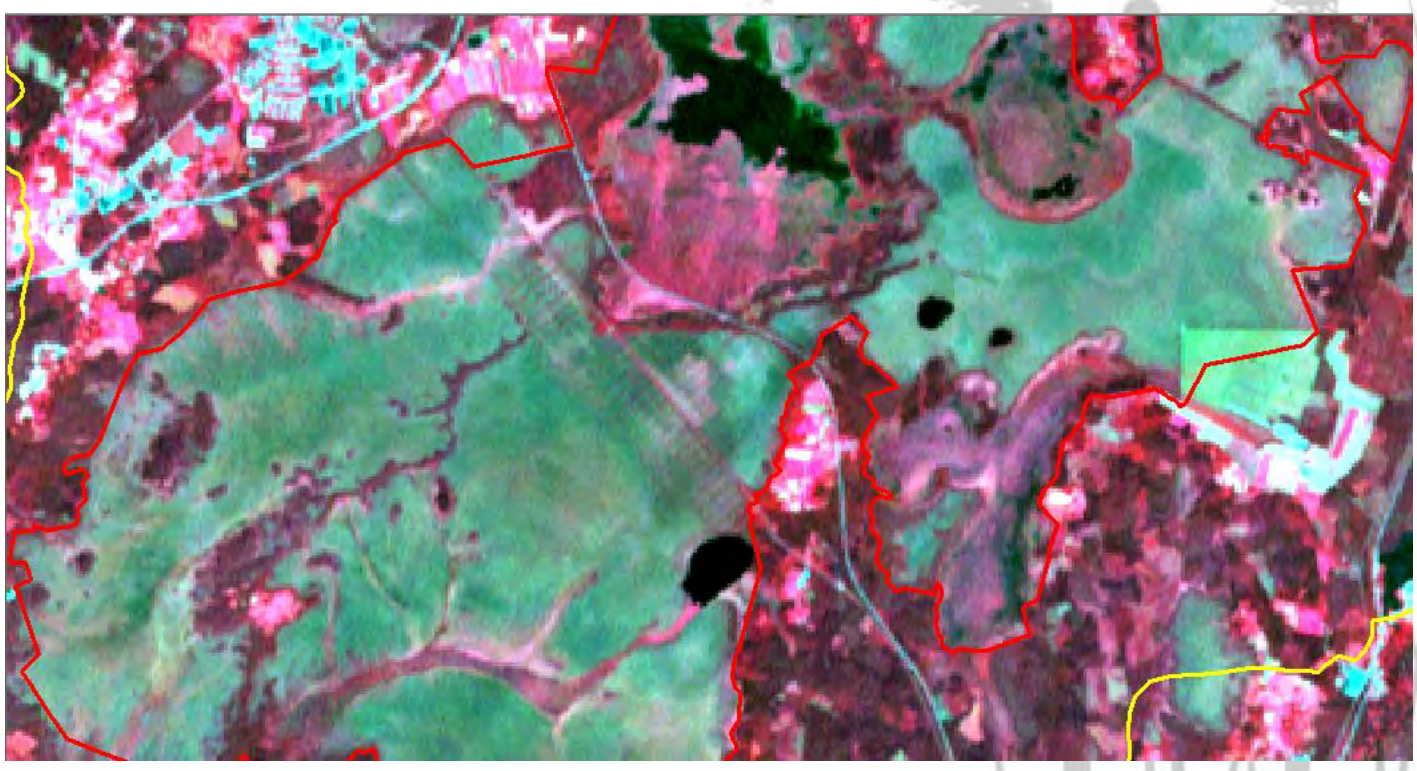

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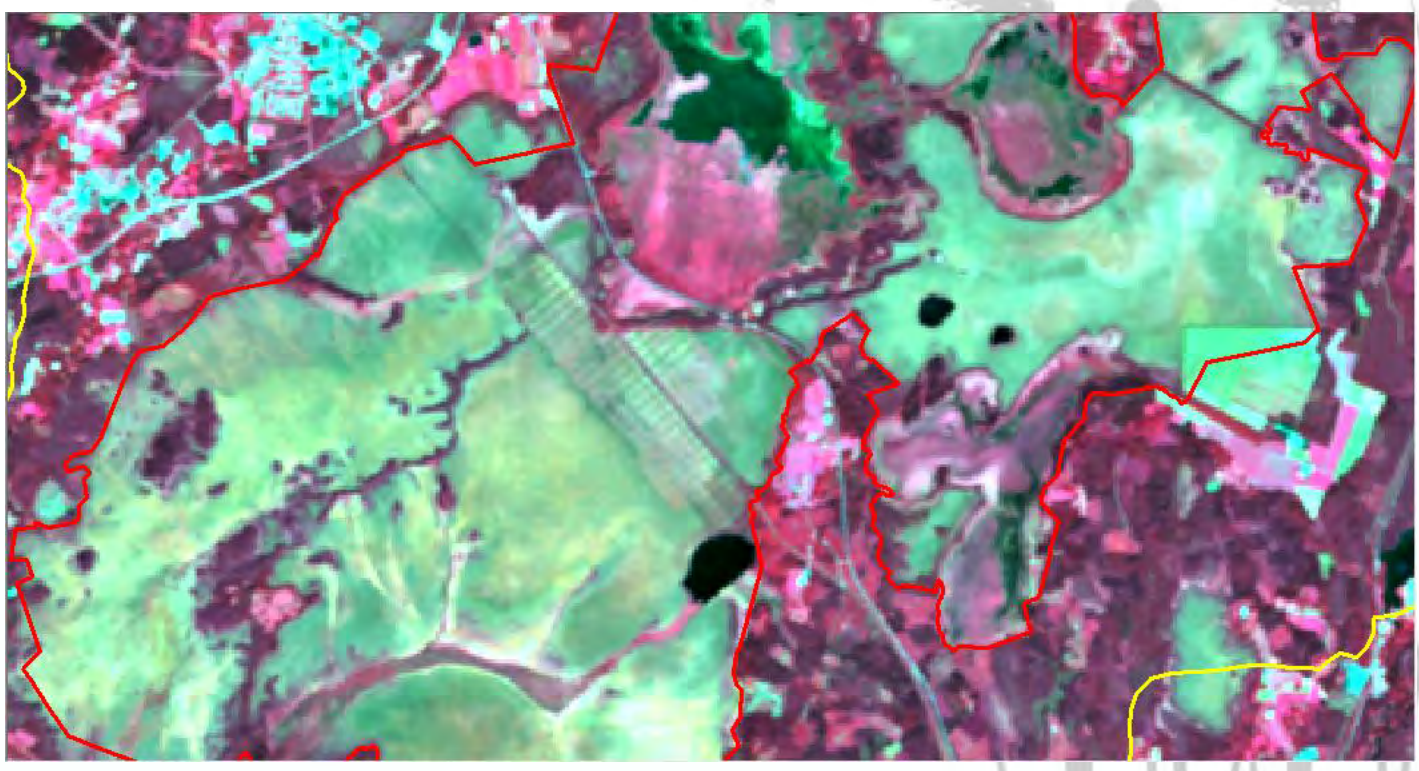

LS 8 2015-08-14

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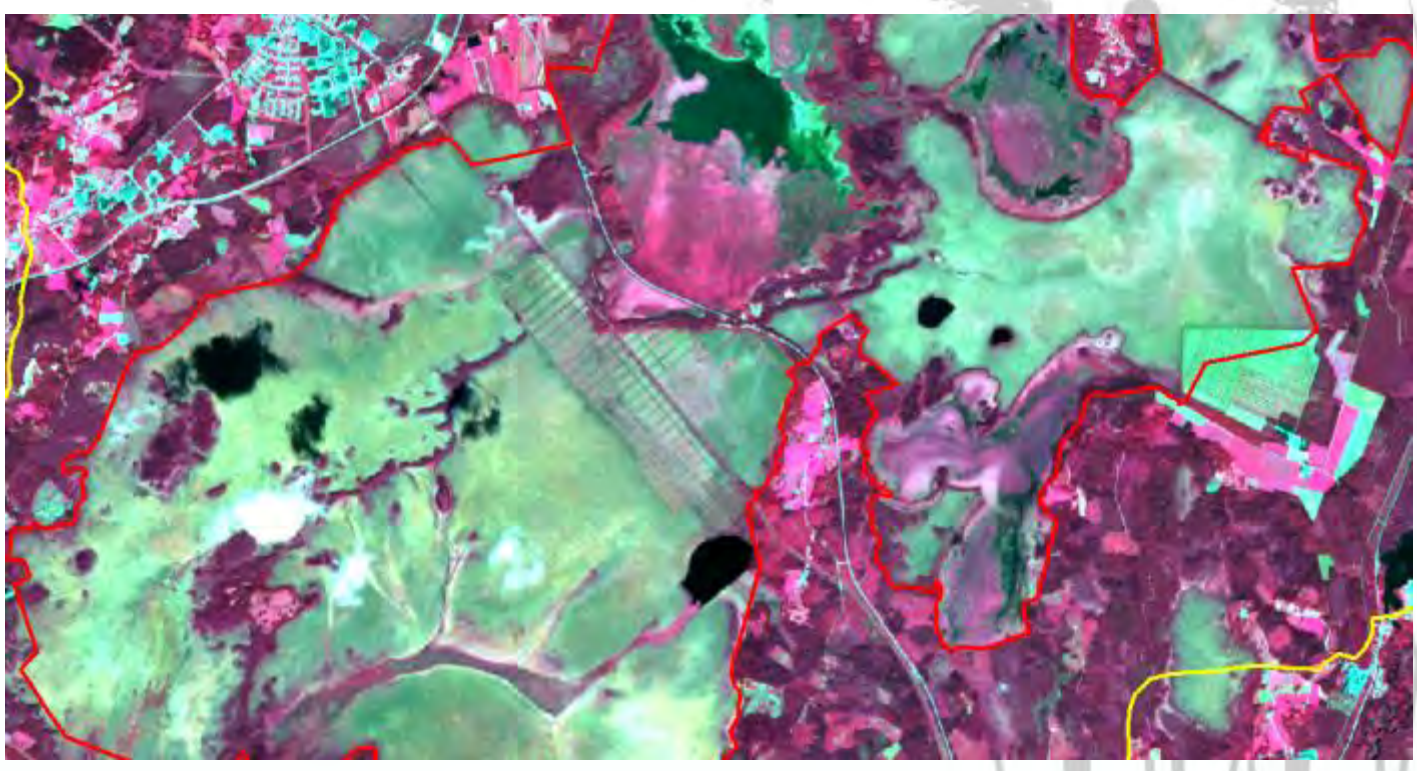

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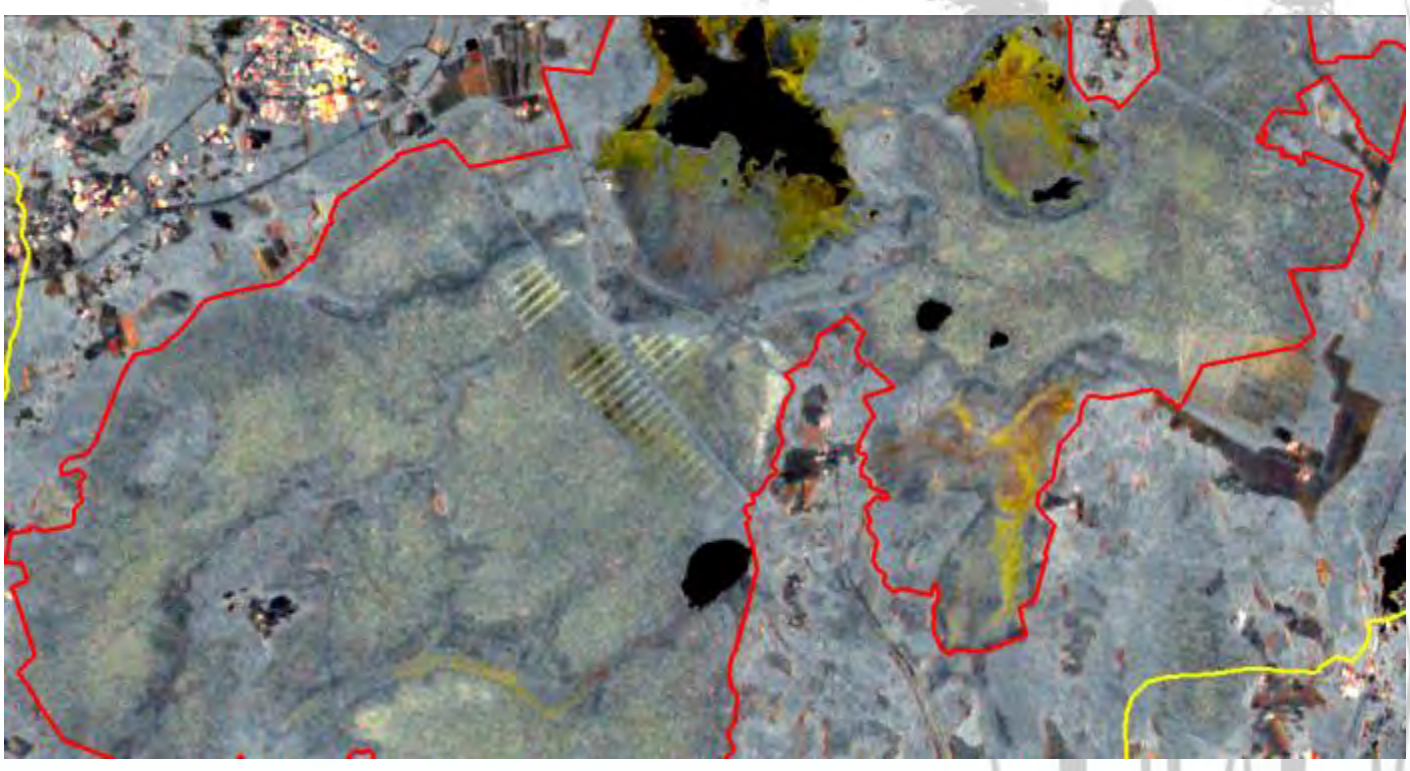
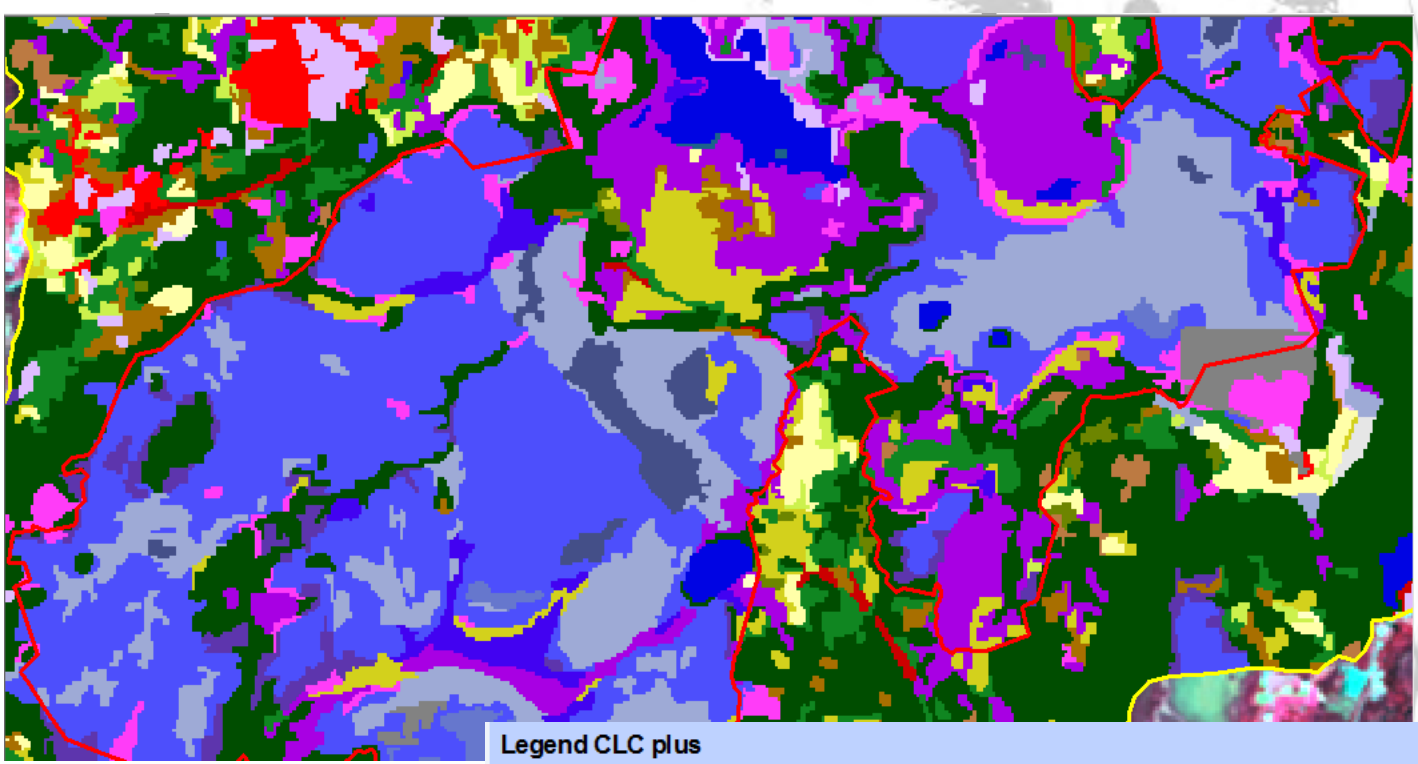


S1 (VV) 2014-2016

Store Mosse-Kävsjön



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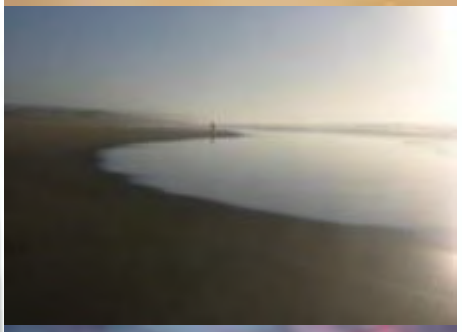
SWOS
Satellite-based Wetland Observation Service

Thank you !





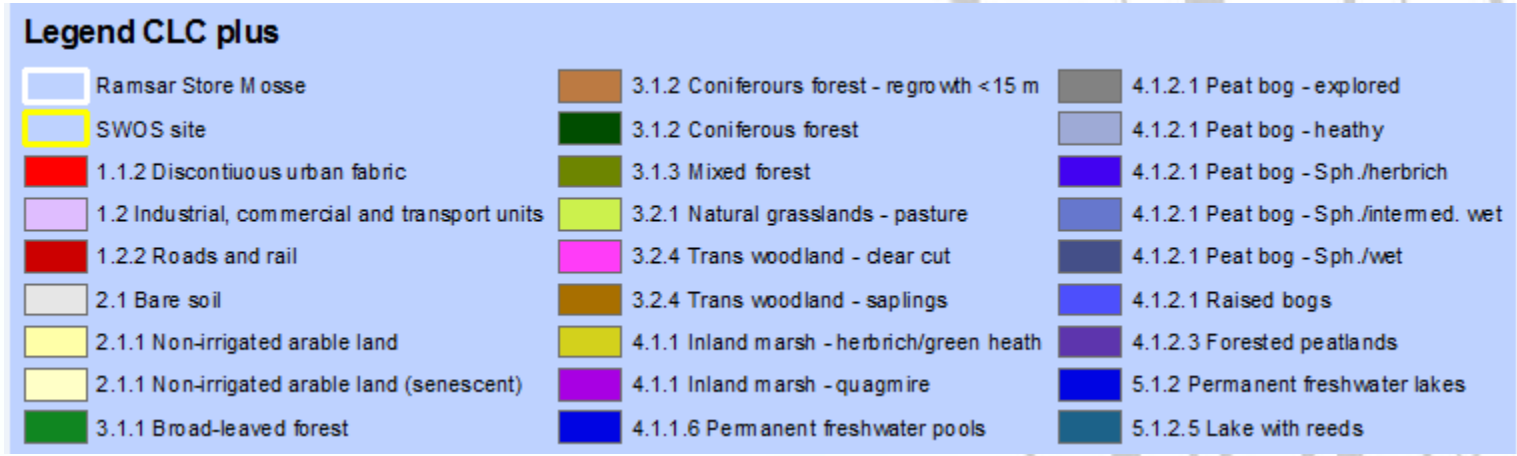

For more information, contact

http://swos-service.eu

jenaoptronik

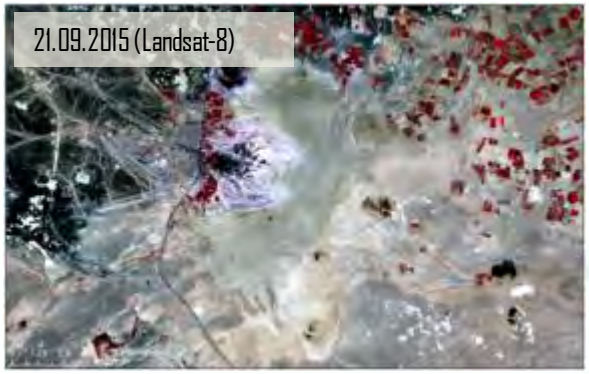
Kathrin Weise
kathrin.weise@jena-optronik.de
phone +49 (0)3641 200160

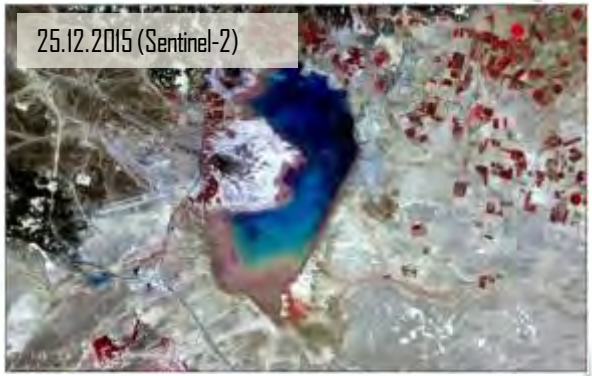
Store Mosse-Kävsjön

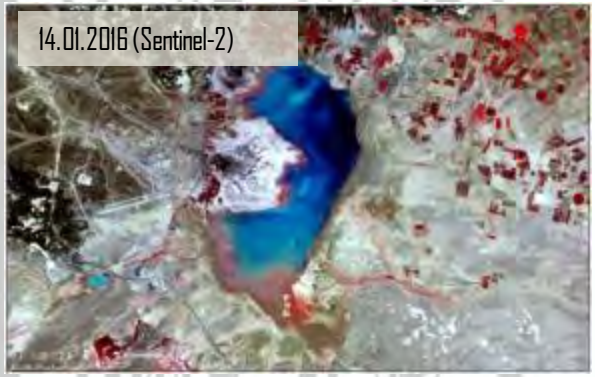


Landsat and S2 for wetland monitoring

The temporal scale: **Monitoring of long term changes** / decreasing water table (Dead Sea, Jordan/Israel)







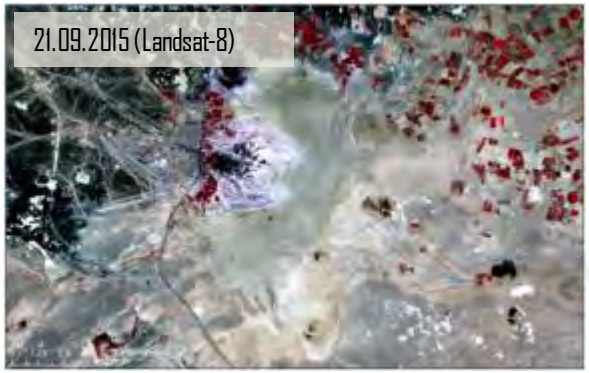
The temporal scale: **Monitoring of short term changes** / wetland characteristics (Azraq Oasis, Jordan)

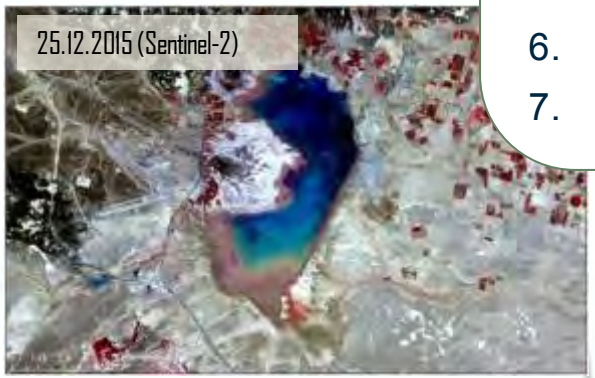
Landsat and S2 for wetland monitoring

The temporal scale: **Monitoring of long term changes** / decreasi srael)

Landsat / S2 for wetland monitoring:

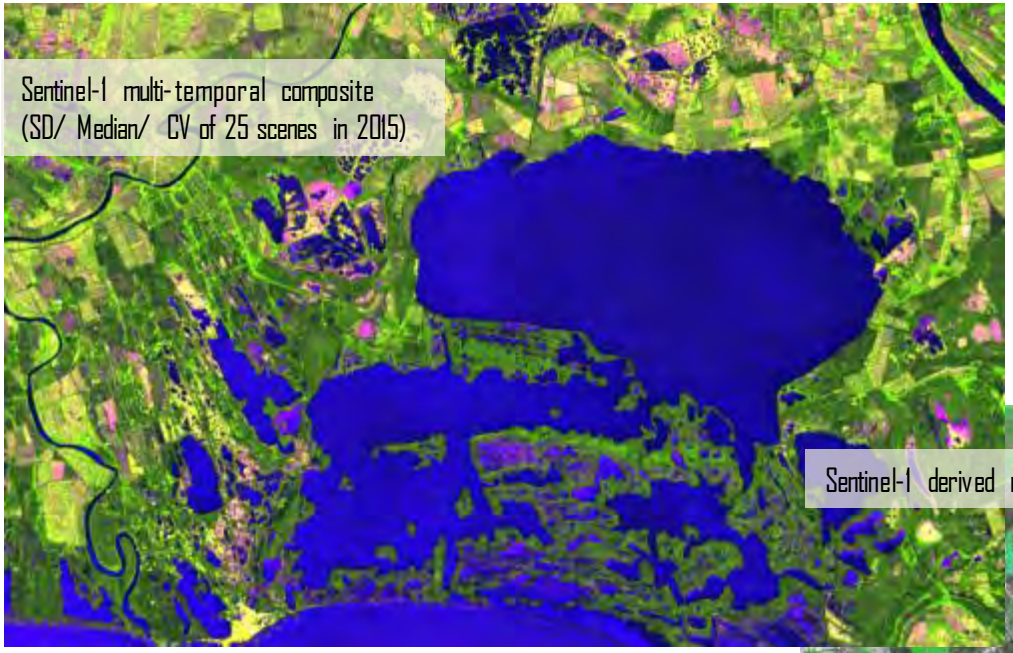
1. Land Use Land Cover
2. Land Use Land Cover Change
3. Water Cycle Regime
4. Inventory and delineation
5. Surface temperature
6. Water quality
7. …





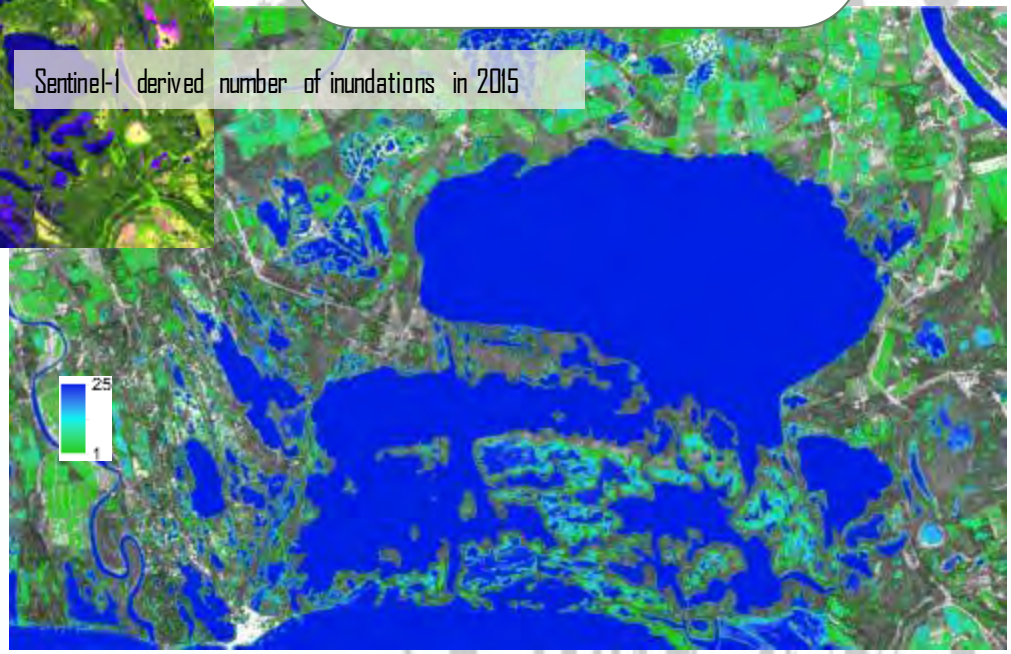
The temporal scale: **Monitoring of short term changes** / wetland characteristics (Azraq Oasis, Jordan)

Radar data for wetland monitoring



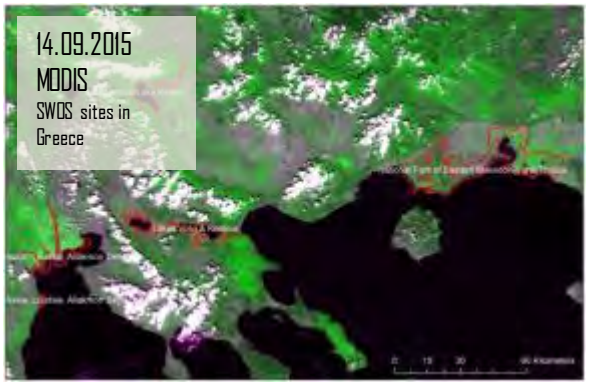
Radar data / S1 for wetland mapping:

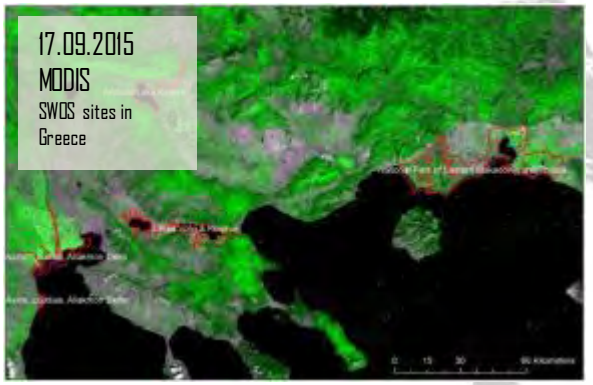
1. Surface water dynamics
2. Inventory and delineation
3. Soil Moisture
4. …

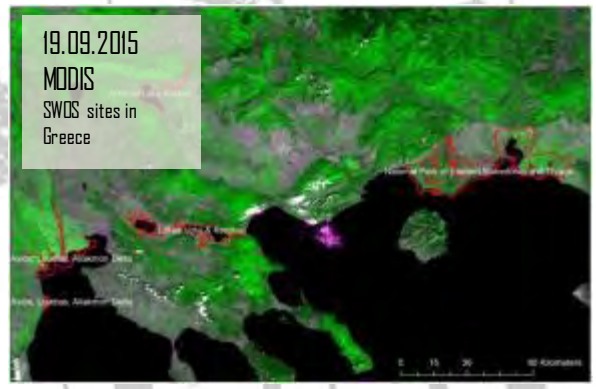


The Radar perspective: SAR-based monitoring of inundation (Camargue, France)

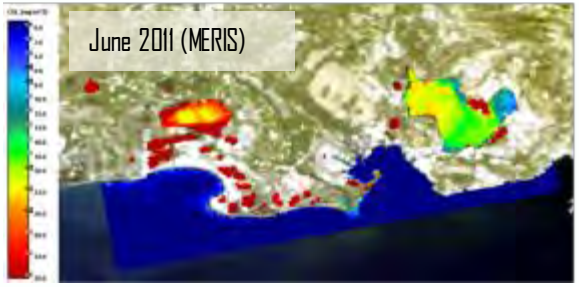
MERIS / S3 / Modis for wetland monitoring

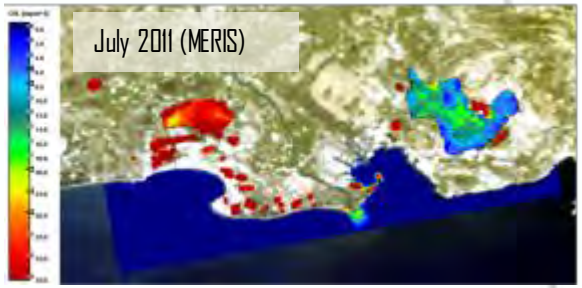


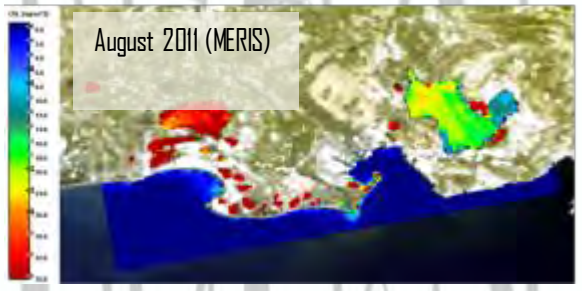




The daily large-scale perspective: large scale monitoring of all the SWOS test sites in one country (Greece)



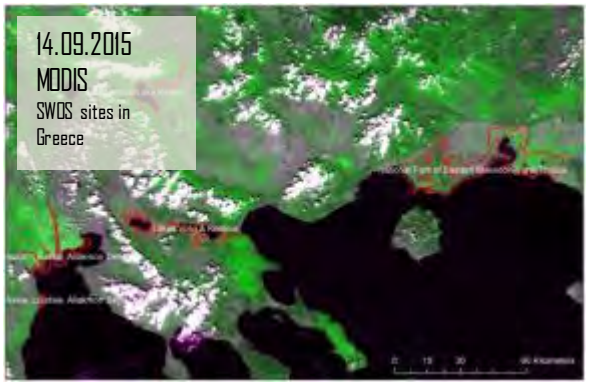


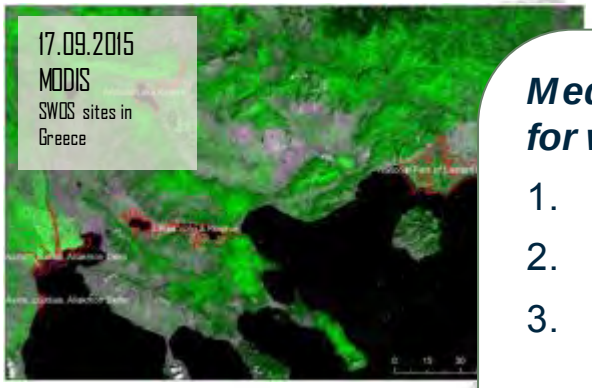


Water quality mapping: Monthly mean chlorophyll concentration based on MERIS (Camargue, France)

The high values and differences in Étang de Vaccarés (left) are most likely a result of bottom reflectance as it is too shallow to derive chlorophyll, the values and differences in the main parts of Etang de Berre (right) reflect true variations in chlorophyll concentrations between the three months.

MERIS / S3 / Modis for wetland monitoring

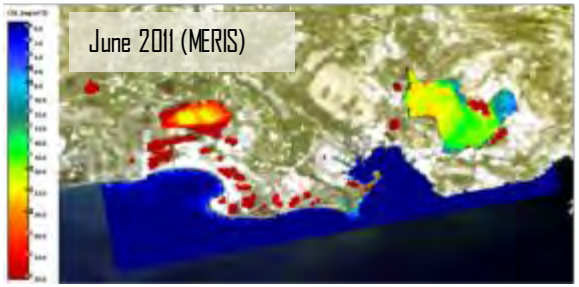


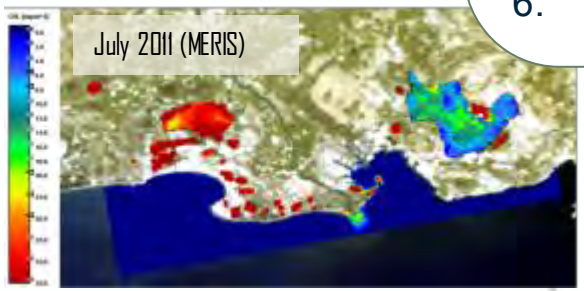


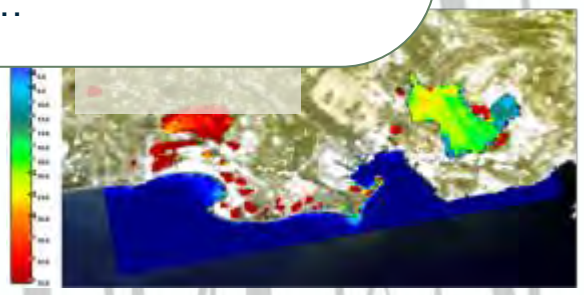
The daily large-scale perspective: large scale monitoring of all the
(Greece)

Medium resolution data for wetland mapping:

1. Water quality
2. Surface temperature
3. Inventory and delineation
4. Large scale coverage
5. Short term changes
6. …







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SWOS implementation – wetland stories

Transboundary Management

(Skadarsko Jezero/Liqeni i Shkodrës, Montenegro/Albania)

- Transboundary management and monitoring
- Establishment of a transboundary Ramsar site (& Biosphere Reserve) Skadar Lake

Policy context

- Joint Strategic Action Plan
- Big Win 2 (Dinaric Arc)
- Ramsar Convention
- Water Framework Directive

Users

- Public Enterprise National Parks of Montenegro
- National Agency of Protected Areas of Albania

Information needs & SWOS products

- Detect seasonally flooded areas and river fragmentation
- Detect potential wetland areas
- Assess water quality

SWOS implementation – wetland stories

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(Skadarsko Jezero/Liqeni i Shkodrës, Montenegro/Albania)

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