

---

# *Mapeo y seguimiento de humedales con técnicas de teledetección - Posibilidades y limitaciones -*

---

## *Seminario Cartografía de los hábitats españoles*

*Madrid, 17 de octubre*

- *Christoph Schröder, ETC – Universidad de Málaga*
- *Con contribuciones de Antonio Sánchez, Dania Abdul Malak (ETC-UMA), Anis Guelmami (Tour du Valat), Jonas Franke (RSS) y Eleni Fitoka (Ekby)*

# SWOS - ¿qué es?

 is an EU H2020  
funded project,  
start 1 June 2015,  
duration 3 years,  
coordinated by Jena-Optronik



Lake Chad Landsat satellite image April 2015

contact:  
www.swos-service.eu  
kathrin.weise@jena-optronik.de,  
phone +49 (0)3641 200160

## Convocatoria Horizonte 2020

Making Earth Observation and Monitoring Data usable  
for ecosystem modelling and services

## SWOS project partnership

6 organizaciones de usuarios/ONGs



3 Universidades



4 Empresas



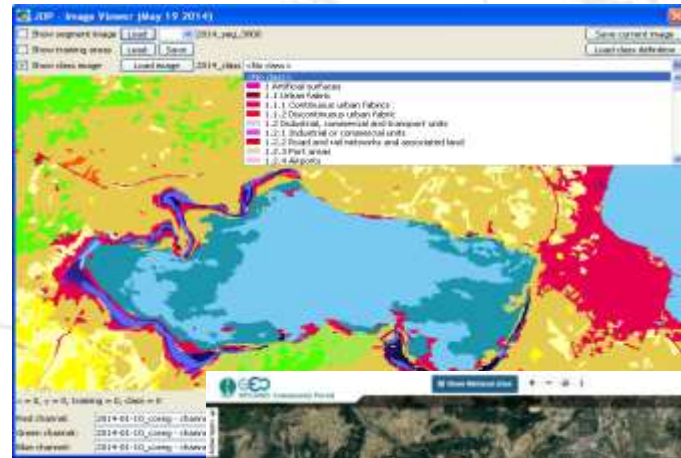
# SWOS - ¿para qué y cómo?



- Lanzar un **proceso consultativo para destacar las necesidades** derivadas de políticas y del seguimiento, y desarrollar el SWOS Service con usuarios para usuarios;
- Generar **productos armonizados de mapeo e indicadores** sobre ecosistemas de humedales para mejorar la respuesta a las obligaciones de información y monitoreo derivadas de políticas relevantes a diferentes escalas
- Proporcionar **formación** para la transferencia de conocimiento sobre el uso de tecnologías de observación terrestre y del SWOS Service para la gestión de humedales;
- Permitir **medidas de conservación, gestión y restauración** basadas en información para asegurar el uso sostenible de humedales.

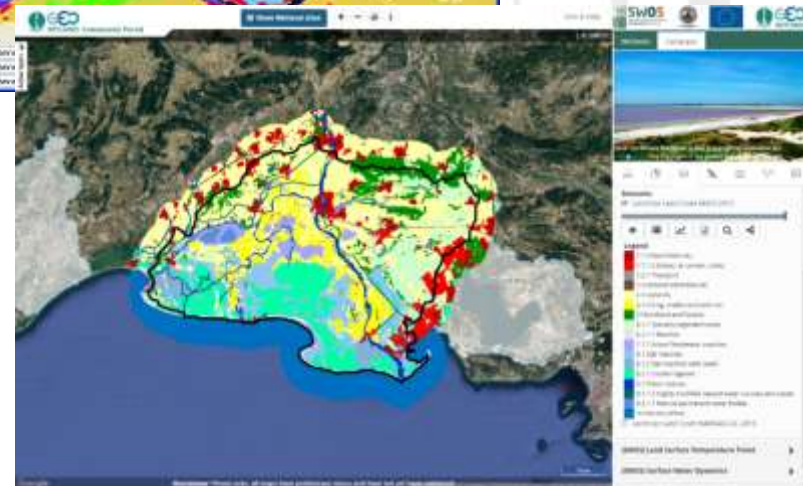
## SWOS Software

- SWOS Portal (and Smartphone App)
- SWOS Toolbox



## SWOS Data

- Pre-processed Earth Observation data
- In-situ/Ground information (for authorized users)

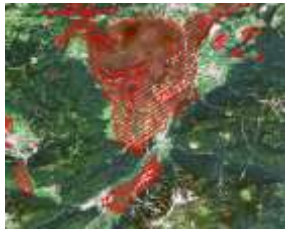


## SWOS Products

- Series temporales de cambios de usos y coberturas de suelo
- Series temporales de humedad del suelo y dinámica de agua superficial
- Inventario de humedales & delineación
- Calidad de agua
- Indicadores para análisis de estado, condiciones, y tendencias de humedales

# Ejemplos de productos

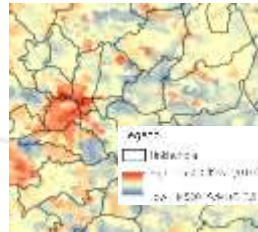
**Inventario de humedales & delineación**



**Calidad de agua**



**Temperatura de superficie terrestre**



**Indicadores**



**Series temporales de cambios de usos y coberturas de suelo**



21.09.2015 (Landsat-8)



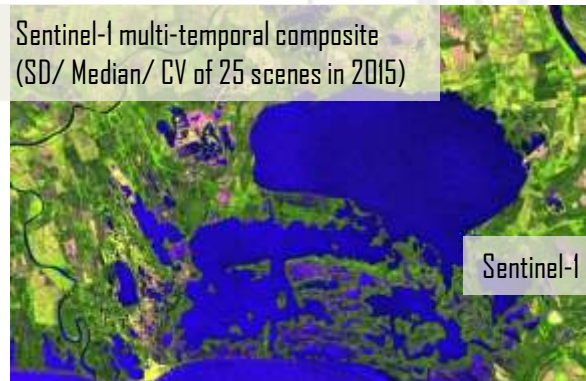
25.12.2015 (Sentinel-2)



14.01.2016 (Sentinel-2)

**Series temporales de humedad del suelo y dinámica de agua superficial**

Sentinel-1 multi-temporal composite (SD/ Median/ CV of 25 scenes in 2015)



Sentinel-1 derived number of inundations in 2015



## MENSAJES CLAVES

- 1) Una clasificación de humedales mejorada es necesaria para responder a las necesidades de las políticas.
- 2) El mapeo de hábitats de humedales y de sus dinámicas es factible – hasta ciertos límites.
- 3) Los productos y herramientas de SWOS pueden ayudar en el cumplimiento de algunas obligaciones derivadas de políticas (p.ej. Ramsar, Estrategia de Biodiversidad/MAES, Directiva Hábitat, SDGs)

## MENSAJES CLAVES

- 1) Una clasificación de humedales mejorada es necesaria para responder a las necesidades de las políticas.
- 2) El mapeo de hábitats de humedales y de sus dinámicas es factible – hasta ciertos límites.
- 3) Los productos y herramientas de SWOS pueden ayudar en el cumplimiento de algunas obligaciones derivadas de políticas (p.ej. Ramsar, Estrategia de Biodiversidad/MAES, Directiva Hábitat, SDGs)

# 1) Clasificación de humedales mejorada

## Nomenclaturas consideradas en SWOS

<b>Política</b>	<b>Información necesaria</b>	<b>Nomenclatura</b>
Directiva Hábitat	Tipos de habitat	Annex I => EUNIS
Convención de diversidad biológica (MAES)	Tipología de ecosistemas	MAES (enlaza con nivel 4 y 5 de EUNIS)
Convención de Ramsar	Tipología de ecosistemas	Globwetland-II Hybrid (Ramsar+CLC)
	Cobertura terrestres	Corine & FAO Land cover



# 1) Clasificación de humedales mejorada

## *The wetland ecosystems in MAES nomenclature*

SWOS modifications  
Version 1.2

Date of Creation  
11/05/2017



**SWOS**  
Satellite-based Wetland  
Observation Service

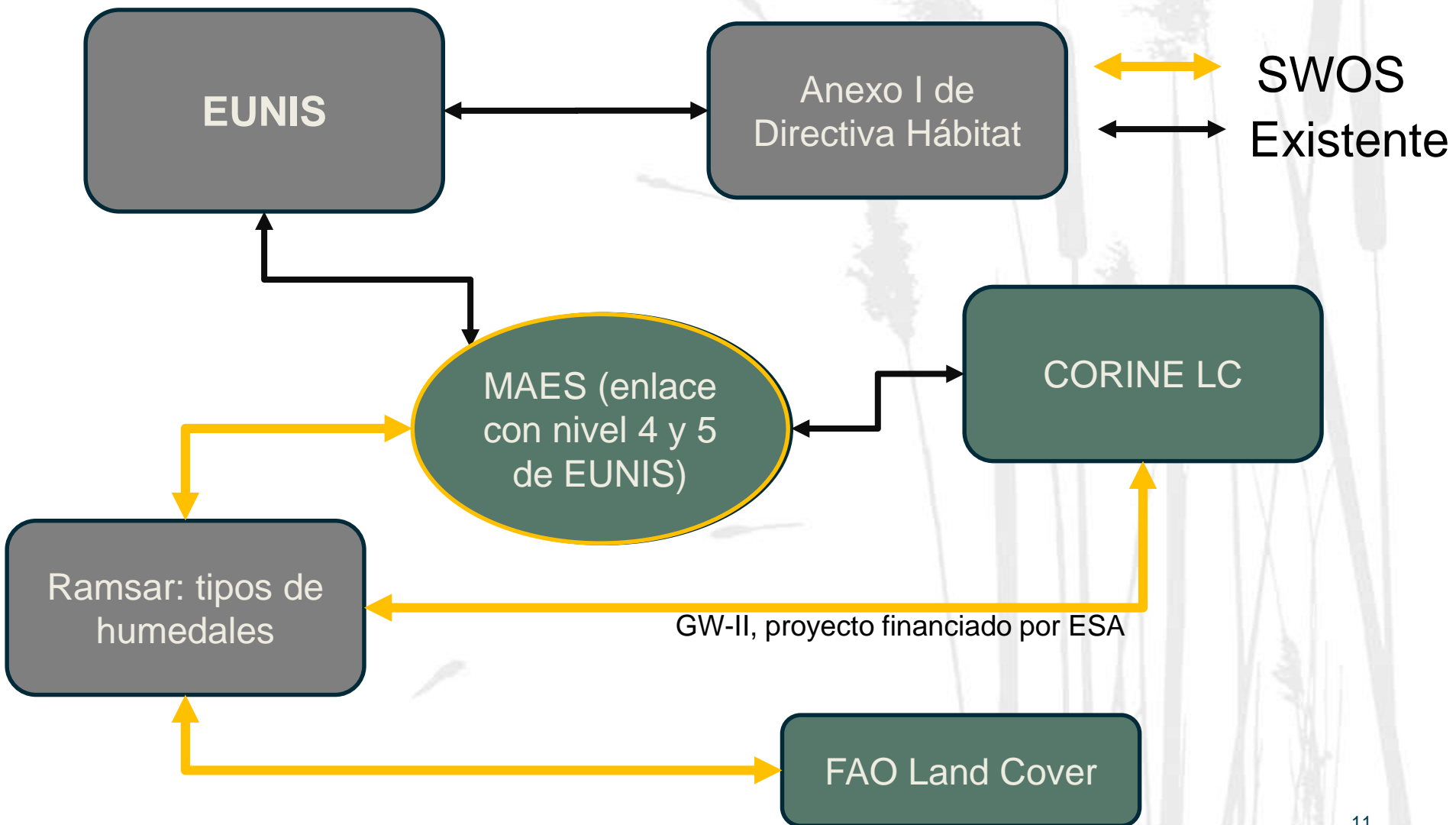


# 1) Clasificación de humedales mejorada

---

- Introducción de nuevas clases relacionadas con humedales: arrozales, pastizales húmedas, matorrales húmedas, bosques de ribera
  - Son clases de otros ecosistemas (bosques, agro-ecosistemas, etc.) pero forman parte de ecosistemas de humedales.
  - Clasificación basada en presencia (temporal)/ influencia del agua
- Creación de “pasarelas” para relacionar nomenclatura MAES con nomenclaturas usadas por los usuarios principales: Ramsar, CLC, EUNIS

# 1) Clasificación de humedales mejorada



# 1) Clasificación de humedales mejorada

MAES L1	MAES (L1-4) Description	RZ project modifications	SWOS modifications
7 Wetland	<p>Inland marshes and peat bogs are included in MAES Level 2.</p> <p>MAES Level 3 differentiates between inland freshwater marshes and inland saline marshes.</p> <p>In MAES Level 4 marshes are divided in marshes with reeds and in marshes without reeds, and peat bogs are divided in exploited and unexploited.</p>	<p>Excluded the Level 4 division into marshes with and without reeds.</p>	<p>SWOS changes the names of classes and introduces new subclasses for peatbogs.</p> <p>Level 1 class name is changed from "Wetland" into "Inland marshes and open mires" and Level 2 class name "peatbogs" is changed to "open mires"</p> <p><u>Reason:</u> the term "Wetland" is too broad since in SWOS / Ramsar understanding it includes many categories found under each MAES Level 1 class. The term "open mires" is suggested instead of the term "peatbogs" because "peat bogs" are one <u>type</u> of open mire, mainly sustained by precipitation (ombrotrophic) and does not include other open mires, for example minerotrophic mires such as fens and transition mires. Also, all mires are peatlands, with active formation of peat, but not all peatlands are mires (e.g. drained/modified peatlands now agricultural/forested lands where new peat is not currently formed).</p> <p>At Level 3 and 4:</p> <ul style="list-style-type: none"> <li>- in class names of marshes is added: "small ponds below 8 ha might be included".</li> <li>- in class names of saline marshes is added the word "brackish";</li> <li>- "open mires" new subclasses are proposed following subdivisions of EUNIS in most cases.</li> </ul> <p>Attributes are introduced for water regime:</p> <ul style="list-style-type: none"> <li>- Permanently flooded</li> <li>- Seasonally</li> <li>- intermittently flooded</li> <li>- Permanently wet</li> <li>- Temporary wet</li> </ul>

# 1) Clasificación de humedales mejorada

Annex I	Annex I_ EUNIS Relation	EUNIS Level 3 Class Code	EUNIS Level 3 Class Name	MAES Class Name and Code (as modified by SWOS H2020 project)
				7.1.2 Inland saline or brackish marshes (small ponds below 8 ha might be included)
1340	<	D6.1	Inland saltmarshes	7.1.2.1 Inland saline or brackish marshes without reeds (small ponds below 8 ha might be included)
1510	#	E6.1	Mediterranean inland salt steppes	
1530	<	E6.2	Continental inland salt steppes	
1410	#	D6.2	Inland saline or brackish species-poor helophyte beds normally without free-standing water	7.1.2.2 Inland saline or brackish marshes with reeds (small ponds below 8 ha might be included)
				7.2 Open mires
				7.2.1 Bogs
7120	<	D1.1	Raised bogs	7.2.1.1 Raised bogs
7130	>	D1.2	Blanket bogs	7.2.1.2 Blanket bogs
				7.2.2 Fens

# 1) Clasificación de humedales mejorada

MAES classes	
<b>8. Lagoons, coastal wetlands and estuaries</b>	
<b>8.1 Coastal wetlands</b>	
8.1.1 Salt marshes	
8.1.1.1 Salt marshes without reeds	
8.1.1.2 Salt marshes with reeds	
8.1.2 Salines	
8.1.3 Intertidal flats	
<b>8.2 Coastal waters</b>	
8.2.1 Coastal lagoons	
8.2.2 River estuaries and estuarine waters of deltas	
<b>Other relevant classes (sparsely vegetated areas)</b>	
6.2.1.1 Beaches	
6.2.1.2 Dunes	



## MENSAJES CLAVES

- 1) Una clasificación de humedales mejorada es necesaria para responder a las necesidades de las políticas.
- 2) El mapeo de hábitats de humedales y de sus dinámicas es factible – hasta ciertos límites.
- 3) Los productos y herramientas de SWOS pueden ayudar en el cumplimiento de algunas obligaciones derivadas de políticas (p.ej. Ramsar, Estrategia de Biodiversidad/MAES, Directiva Hábitat, SDGs)

## 2) Cartografía de hábitats

<b>7</b>	<b>Inland marshes and open mires</b>	<b>feasible</b>	The wetland delineation product can assist here as well as data on soil type		
7.1	Inland marshes (small ponds below 0.5 ha might be included)	feasible	The wetland delineation product can assist here as well as data on soil type		
7.1.1	Inland freshwater marshes (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data		
7.1.1.1	Inland freshwater marshes without reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data		
7.1.1.2	Inland freshwater marshes with reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data		
7.1.2	Inland saline or brackish marshes (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data		
7.1.2.1	Inland saline or brackish marshes without reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data		
7.1.2.2	Inland saline or brackish marshes with reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data		
7.2	<b>Open mires</b>	<b>feasible</b>			
8	<b>Coastal marshes, waters, flats</b>	<b>feasible</b>			
8.1	Salt marshes	ancillary data required	Confusion with 82 (coastal waters) likely when flooded. Time series (seasonal differences) can be used to discriminate permanently flooded and seasonally flooded marshes. Differentiation between freshwater and salt marshes might require ancillary data		
7.2.1	Bogs	8.1.1	Salt marshes without reeds	feasible	Reeds can be mapped by image time series, but differentiation of salt marshes needed with ancillary data as described above
7.2.1.1	Raised bogs	8.1.2	Salt marshes with reeds	feasible	Reeds can be mapped by image time series, but differentiation of salt marshes needed with ancillary data as described above
7.2.1.2	Blanket bogs	8.2	Coastal waters	ancillary data required	Manual post-classification or ancillary data required. Confusion with 10 (marine) likely (per definition)
		8.2.1	Coastal lagoons	ancillary data required	Manual post-classification or ancillary data required. Confusion with 10 (marine) likely (per definition)
		8.2.2	River estuaries and estuarine waters of deltas	ancillary data required	Manual post-classification or ancillary data required. Confusion with 10 (marine) likely (per definition)
		8.3	Coastal saltpans (highly artificial salines)	ancillary data required	Salines are not always squared features and thus difficult to identify. Ancillary data can assist
		8.4	Intertidal flats	ancillary data required	Very difficult since the tidal range must be incorporated. Ancillary data



## 2) Cartografía de hábitats

- Caso de estudio: Parque Nacional Makedonia y Thrace Oriental

Dos fases del ecosistema de humedal han sido integrado en la clasificación, la temporada húmeda (ws) y seca (ds)



Sentinel-2A, 10 de julio 2016: ds



Sentinel-2A, 21 de abril 2016: ws

## 2) Cartografía de hábitats



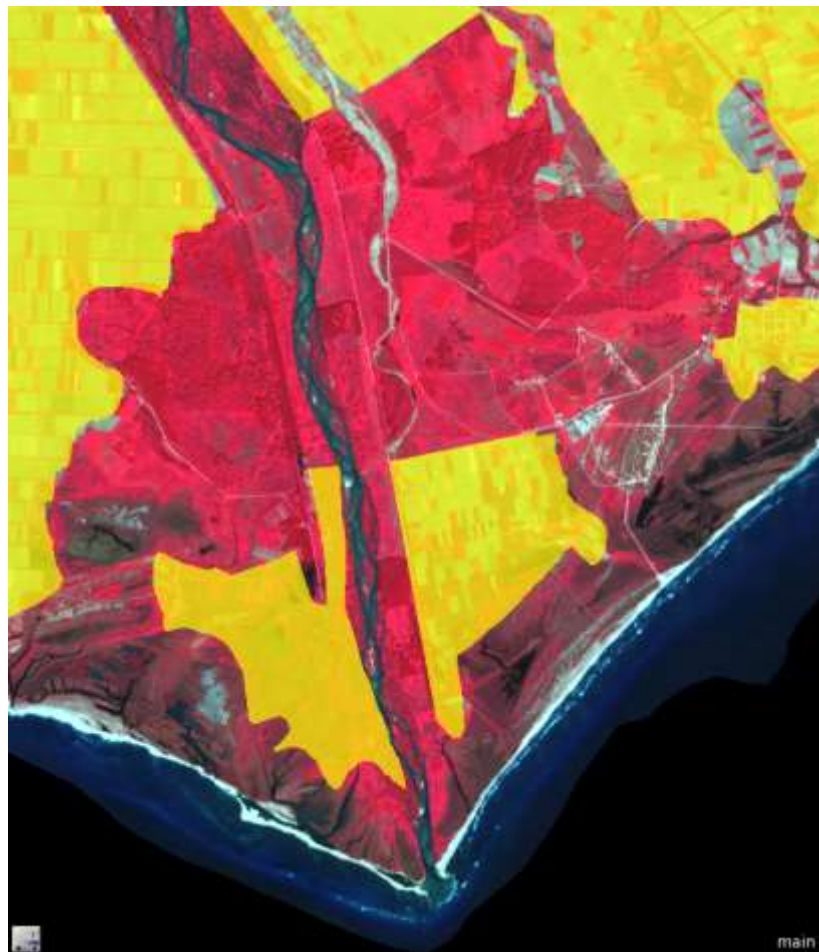
De la imagen de  
satélite al mapa de  
humedal



## 2) Cartografía de hábitats

### Másquera de zonas urbanas y agrícolas

- Urban
- Agricultural



## 2) Cartografía de hábitats

**“Agua Permanente” primer clase general reclasificada en :**

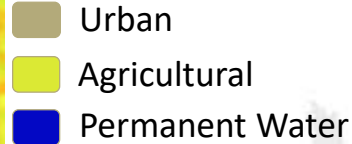
8.2.1 Coastal lagoons

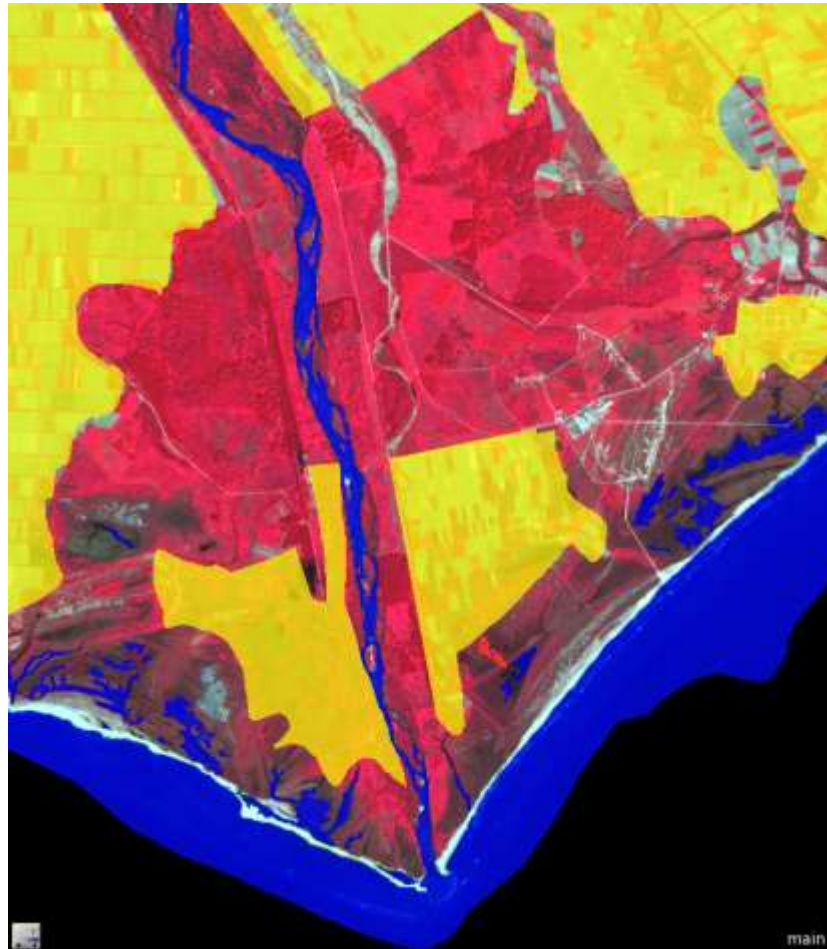
8.2.2 River estuaries and estuarine waters of deltas

9.1 Water courses

9.2 Lakes (not in this subset)

10.1 Marine

- 
- Urban
  - Agricultural
  - Permanent Water



Regla: Cuerpos de agua discriminados utilizando NDWI\_ds >-600 y Brightness mean value <7150 thresholds.

## 2) Cartografía de hábitats



- Urban
- Agricultural
- Permanent Water
- Marine

De “agua permanente” a

### 10.1 Marine

Feature: segment size (segments classified as permanent water observed to be quite bigger than those located inland)

Rule: Permanent Water discriminated in **Marine** using  $\text{Area} > 800\text{pxl}$  and  $\text{border to Sea} > 0$ .

## 2) Cartografía de hábitats



- Urban
- Agricultural
- Marine
- Coastal lagoon
- River estuaries and estuarine waters of deltas
- Permanent interconnected running water courses

**From “Permanent Water” to:**

### **8.2.1 Coastal lagoon**

Feature: The mean value of blue band

### **8.2.2 River estuaries and estuarine waters of deltas**

Feature: Manual reclassification of segments of 9.1.1.1 based on visual interpretation

### **9.1.1.1 Permanent interconnected running water courses**

Feature: The rest of “permanent water” segments

Rule: Waterbodies discriminated in **Lagoon** using Mean Blue\_ws<2724.63 and **River** the rest of the objects classified as Waterbodies.

## 2) Cartografía de hábitats

“Bare” is the second general class

- Urban
- Agricultural
- Marine
- Coastal lagoon
- River estuaries and estuarine waters of deltas
- Permanent interconnected running water courses
- Bare



Rule: **Bare** using  $NDWI_{ds} > -400$  and  $Brightness > 7032$

## 2) Cartografía de hábitats










From “Bare” to:

### 6.2.1.1 Beaches

Feature: Border to the neighbor class 10.1  
Marine

### 6.2.1.3 River banks

Feature: Border to the neighbor class 9.1.1.1  
Permanent interconnected running water  
courses

-  Urban
-  Agricultural
-  Marine
-  Coastal lagoon
-  River estuaries and estuarine waters of deltas
-  Permanent interconnected running water courses
-  Bare
-  Beaches
-  River banks



Rule: **Bare** class further discriminated in **Beach** using  
border to Sea>0 and in **Dunes** using border to Rivers>0



## 2) Cartografía de hábitats

“Grassland” is the third general class

- Urban
- Agricultural
- Marine
- Coastal lagoon
- River estuaries and estuarine waters of deltas
- Permanent interconnected running water courses
- Bare
- Beaches
- River banks
- Grassland



Rule: Grassland using Mean Green\_ws>4002.52  
and NDWI\_ds<-392

## 2) Cartografía de hábitats

From “Grassland” to:

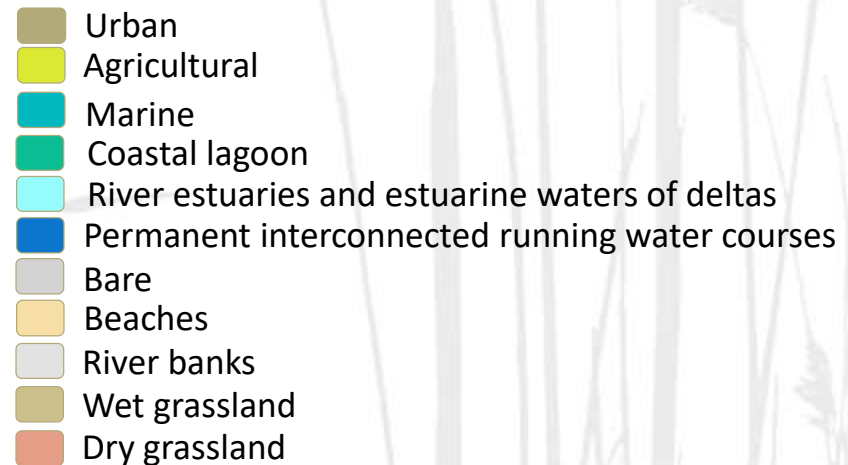
### 4.3 Wet grasslands

Features:

- Border to the neighbor class 9.1.1.1  
Permanent interconnected running water courses
- Border to the neighbor classes 3.x.1  
Riparian and fluvial forests

### 4.1 Dry grasslands

Feature: Rest of grasslands



**Rules: Grassland** further discriminated in **WetGrassland** using distance to rivers >50pxl;













**Sparsely veg. areas** with Mean 8a\_ds < 30689.6 and Mean Blue\_ds > 2413.47 were reclassified as **WetGrassland**.

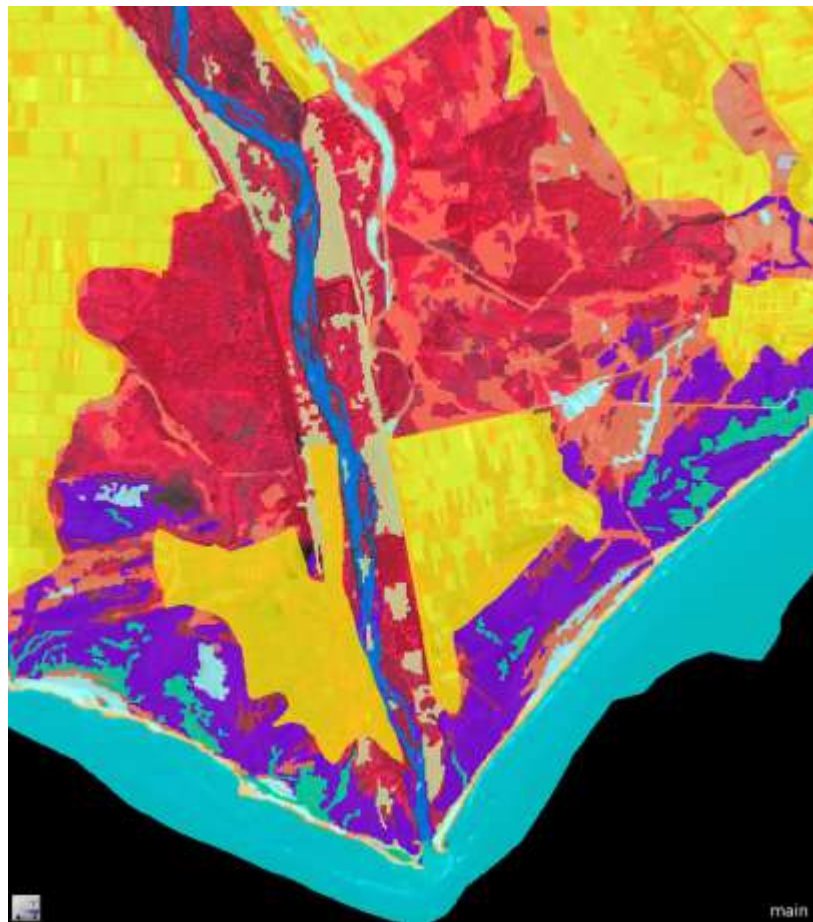
## 2) Cartografía de hábitats

### 8.1 Salt marshes – Permanently flooded (use of Attribute)

Features:

- Differentiation between NDWI of dry season and of wet season
- Distance to neighbor class 10.1 Marine

-  Urban
-  Agricultural
-  Marine
-  Coastal lagoon
-  River estuaries and estuarine waters of deltas
-  Permanent interconnected running water courses
-  Bare
-  Beaches
-  River banks
-  Wet grassland
-  Dry grassland
-  Salt marshes – Permanently flooded



Rule: **Salt marsh\_permanent** using NDWI\_ws > -638 and NDWI\_ds <= -392 and Distance to Sea > 200pxl

## 2) Cartografía de hábitats


“Woodland and Forests” is the fourth general class which reclassified into:


### 3.1 Broadleaved Forests

#### 3.1.1 Riparian and fluvial broadleaved forests

Feature: Distance to neighbor class 9.1.1.1  
Permanent interconnected running water courses

Specifically for this test site 3.1.1 reclassified into:

 -Riparian Broadleaved regenerated

 -Riparian Broadleaved dense

 -Riparian Broadleaved sparse

This reclassification was done to avoid misclassifications between wet grasslands and riparian broadleaved forests with low tree cover density.

The rest segments were classified as “Wet Grasslands”

### 3.2 Coniferous Forests

#### 3.2.1 Riparian and fluvial coniferous forests (not in this subset)

Feature: Distance to neighbor class 9.1.1.1  
Permanent interconnected running water courses



**Rules: Broadleaved** using  $NDWI\_ws < -638$  and  $Mean\ 8A\_ds > 22399$ . They further discriminated in:

- **Riparian Broadleaved regenerated** ( $Mean\ 8A\_ds > 30689.6$  and  $Std\ Blue\_ws < 142.3$ )
- **Riparian Broadleaved dense** ( $Mean\ 8A\_ds < 30689$  and  $Mean\ Blue\_ds < 2413$  and  $Mean\ Green\_ds < 2971.05$ )
- **Riparian Broadleaved sparse** (the same as above with  $Mean\ Green\_ds > 2971.05$ )

## 2) Cartografía de hábitats

### 5.1.1.4 Riverine and fen scrubs

Feature: Segments of riparian broadleaved regenerated and sparse segments of wet grassland where further reclassified based on different layer values of wet and dry seasons.



- Urban
- Agricultural
- Marine
- Coastal lagoon
- River estuaries and estuarine waters of deltas
- Permanent interconnected running water courses
- Bare
- Beaches
- River banks
- Wet grassland
- Dry grassland
- Riparian Broadleaved regenerated
- Riparian Broadleaved dense
- Riparian Broadleaved sparse
- Riparian and fluvial coniferous forests
- Riverine and fen scrubs

Rule: mean 8A\_ds>30689.6 and Std Blue\_ws>142.32  
are further classified as **Riverine and fen scrubs**

## 2) Cartografía de hábitats

### 8.1 Salt marshes – Seasonally flooded (Attribute)

Features:

(i) Segments classified 4.3 Wet Grasslands with border to 8.1 Salt marshes – Permanently flooded and in certain distance from the 10.1 Marine.

(ii) Segments classified as 6.2 Bare soil with:

- Border to the neighbor class 6.2.1.1 Beaches

- Border to the neighbor class 8.1 Salt marshes

Permanently flooded

- Distance from class 10.1 Marine to the approximate upper boundary of 8.1 Salt marsh Permanently flooded



**Rule:** WetGrassland with border to salt marsh\_permanent and distance to sea<200pxl reclassified to **salt marsh\_seasonal**; Bare with border to beach>0 was reclassified as **salt marsh\_seasonal**; Bare with border to salt marsh\_permanent and distance to sea<200pxl reclassified to **salt marsh\_seasonal**

# Estudio de viabilidad de mapeo

7	Inland marshes and open mires	feasible	The wetland delineation product can assist here as well as data on soil type
7.1	Inland marshes (small ponds below 0.5 ha might be	feasible	The wetland delineation product can assist here as well as data on soil type
7.1.1	Inland freshwater marshes (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data
7.1.1.1	Inland freshwater marshes without reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data
7.1.1.2	Inland freshwater marshes with reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data
7.1.2	Inland saline or brackish marshes (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data
7.1.2.1	Inland saline or brackish marshes without reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data
7.1.2.2	Inland saline or brackish marshes with reeds (small ponds below 0.5 ha might be included)	ancillary data required	Differentiation between freshwater and saline/brackish marshes require ancillary data
7.2	Open mires	ancillary data required	Case dependent if possible through image interpretation, but ancillary data to be preferred. Image time-series should be used (there should be no mid-season NIR peak compared to herbaceous vegetation on mineral soils) in conjunction with ancillary data on forest, open land/agricultural areas or wetland delineation products to mask out the wetland areas
7.2.1	Bogs	ancillary data required	Case dependent, whether identifiable via remote sensing. High-resolution Digital
7.2.1.1	Raised bogs	too detailed	Raised bogs and blanket bogs cannot be differentiated at high level of certainty, since the shape of bog and the vegetation can be very similar. Peat drillings or electrical conductivity measurements required.
7.2.1.2	Blanket bogs	too detailed	Raised bogs and blanket bogs cannot be differentiated at high level of certainty, since the shape of bog and the vegetation can be very similar. Peat drillings or electrical conductivity measurements required.
7.2.2		ancillary data required	Electrical conductivity measurements required.
7.2.3		ancillary data required	Electrical conductivity measurements required.

# Mensajes claves

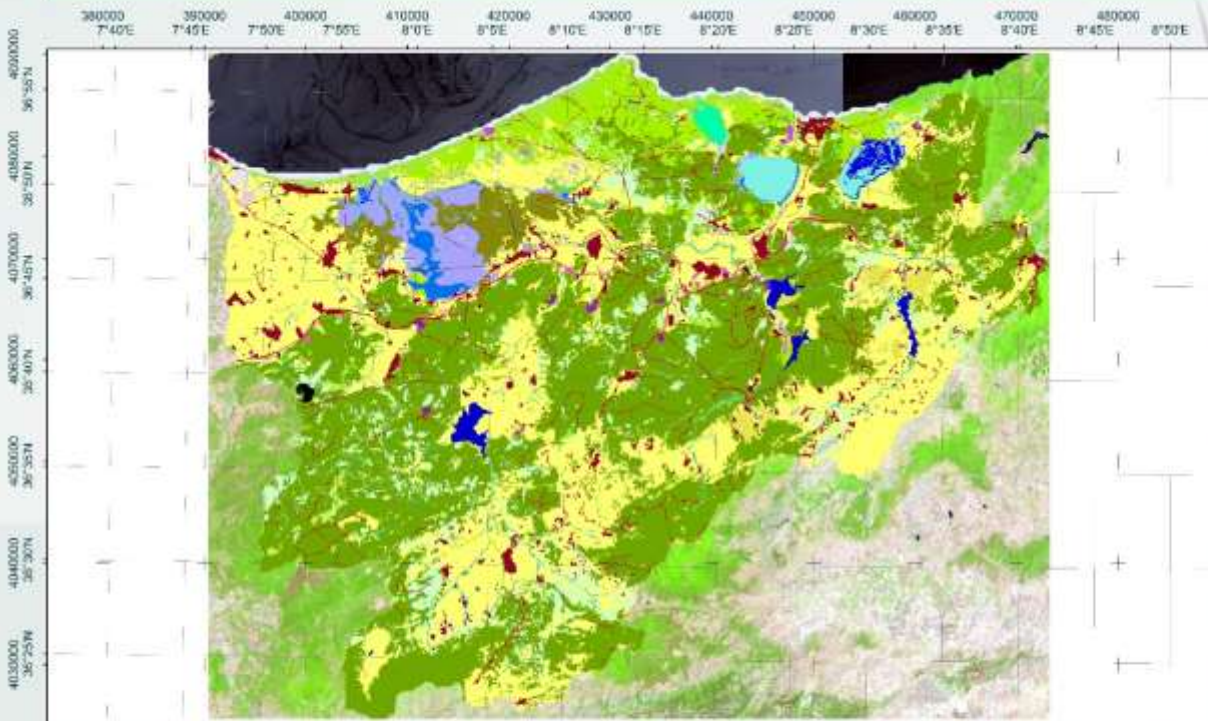
---

- 1) Una nueva nomenclatura de humedales para mejorar la clasificación es necesaria para responder a las necesidades de las políticas.
- 2) El mapeo de hábitats de humedales y de su dinámica es factible – hasta ciertos límites
- 3) Los productos y herramientas de SWOS pueden ayudar en el cumplimiento de algunas obligaciones derivadas de políticas (p.ej. Ramsar, Estrategia de Biodiversidad/MAES, Directiva Hábitat, SDGs)



# 3) Apoyo a políticas - Ramsar


## CLC/Ramsar LULC - 2015 - El Kala NP, Algeria



This map depicts the Land Use Land Cover in 2015, based on an object-based classification of a time series of Landsat-8 satellite images. The accuracy of the map has been established to be >85%.

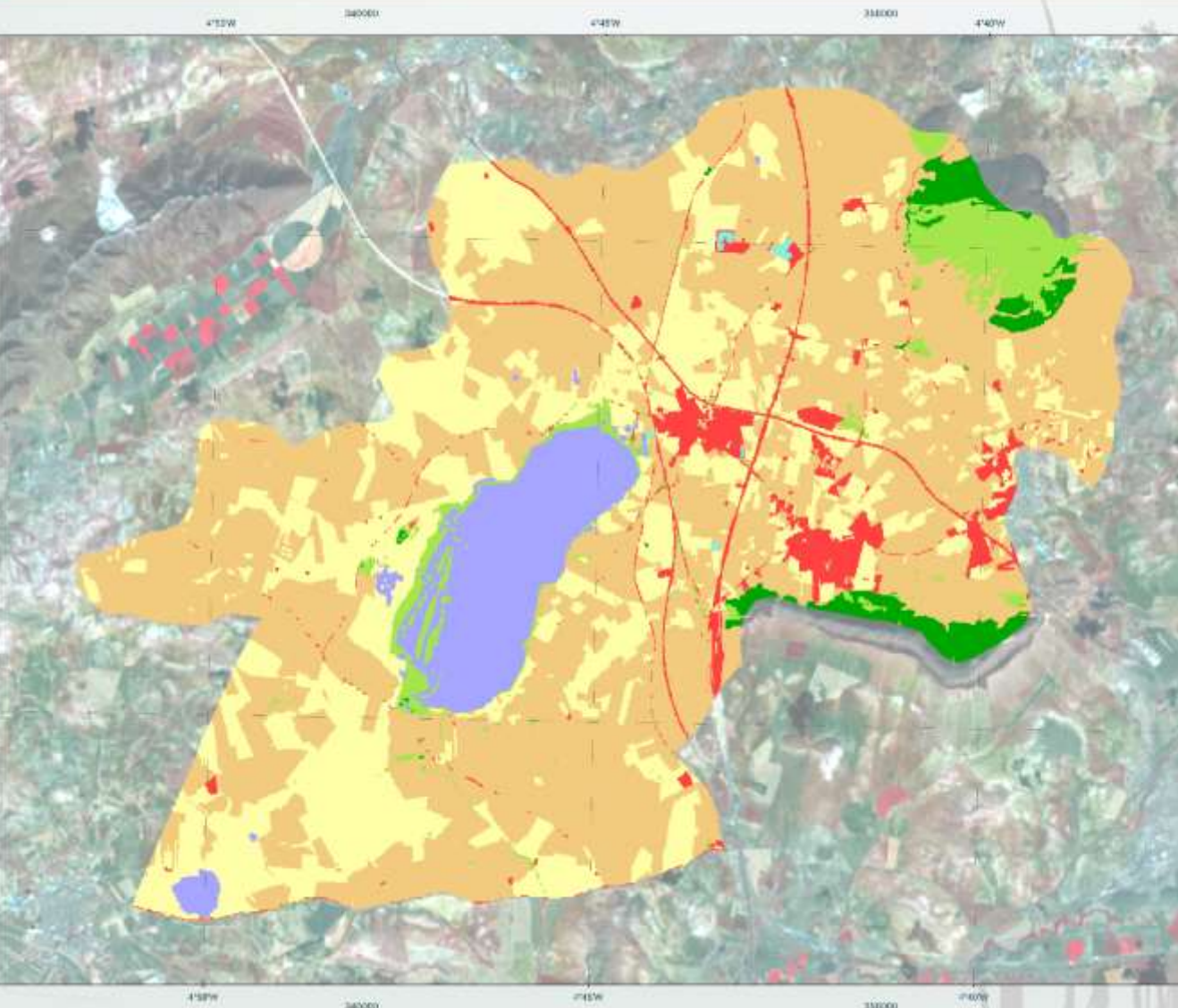
Projection: UTM 32 N  
 Spheroid: WGS 84  
 Datum: WGS 84  
 Elevation: London 0  
 Point size: 32m  
 Acq. dates: 2015-01-29; 2015-02-10; 2015-04-15; 2015-05-17; 2015-06-18; 2015-07-20; 2015-09-21; 2015-09-06 and 2015-11-09  
 Background: 2015-06-29  
 RGB = 64bit, N/A, R  
 Data source: © USGS / ESA

Created: 01-03-2016  
 Produced: Tour du Valat  
 Website: www.swos-service.eu

 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842500.



## Land Use Land Cover 2015/2016 - Fuente de Piedra, Spain



SWOS ES-04



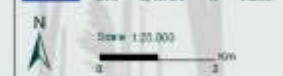
- MAES 1: Urban
- MAES 21: Arable land
- MAES 22: Permanent crops
- MAES 32: Coniferous forest
- MAES 52: Siderophytous vegetation
- MAES 712: Inland saline marshes
- MAES 992: Artificial water bodies

This map depicts the Land Use Land Cover and was produced using a time-series of Sentinel 2 satellite images.

Projection: UTM 30 N  
 Spheroid: WGS 84  
 Datum: WGS 84  
 Units: Seters 2  
 Proj. unit: 1:0  
 Acquisition dates: Aug-2015, Jan, Mar-2016  
 Background image: Mar-2016  
 CRS: EPSG:31436  
 Data source: 0110205 / F-54

Creation: 01-08-2017  
 Producer: a\_jarcho@oma.es  
 Website: www.swos-service.eu

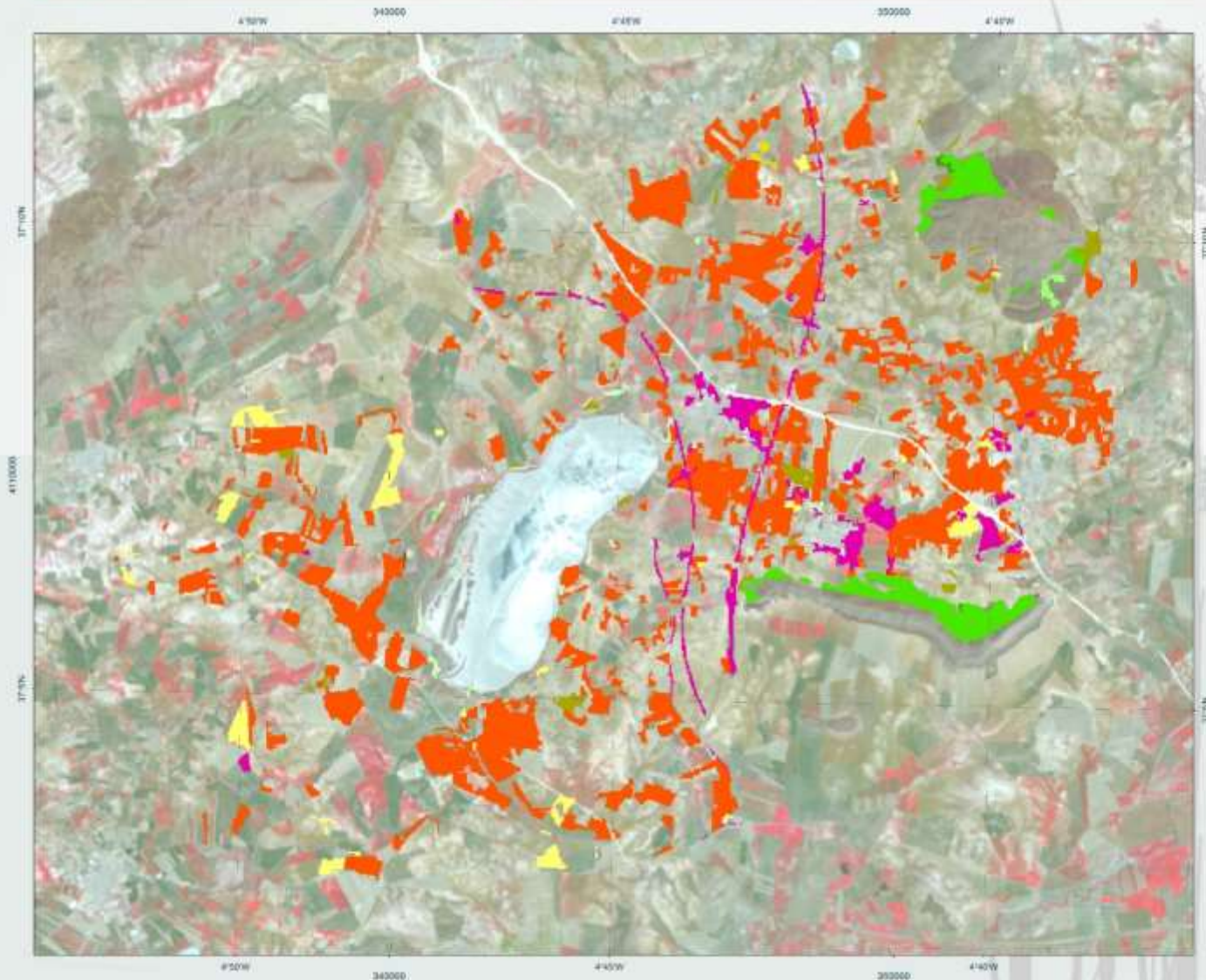
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 962022



# 3) Apoyo a políticas – Direct. Hábitat

## Long Term Land Use Land Cover Change 1989-2007 - Fuente de Piedra, Spain

## SWOS ES-10



- LCP1: Urban land cover change
- LCP2: Permanent water to other use
- LCP3: Irrigated land to permanent water
- LCP4: Forest to agriculture
- LCP5: Semi natural area to agriculture
- LCP6: Urbanisation agriculture
- LCP7: Urbanisation of farming with wooded habitat
- LCP8: Urbanisation of farming with open wetland habitat
- LCP9: Conversion from temporary wetland to forest
- LCP10: Conversion from forest to wetland and other use
- LCP11: Other forest change
- LCP12: Wetland habitat and water
- LCP13: Other change and other use

This map depicts the Land Use Land Cover Change and was produced using a time-series of Landsat TM satellite images.

Projection: UTM 30 N  
 Spheroid: WGS 84  
 Datum: WGS 84  
 Stationing: Local  
 Pixel size: 30m  
 Acquisition dates: 1989, 2007  
 Background image: Sep-2007  
 Data source: RGB + NIR; Red: Green  
 © 1989 / ESA  
 Creation: 01-09-2017  
 Producer: S. Sanfeliu@swos.es  
 Website: www.swos-service.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 942000

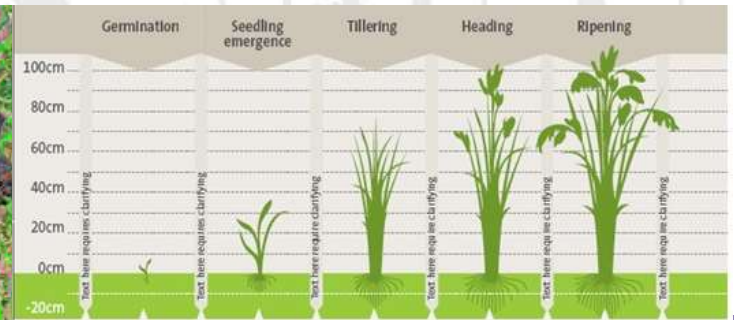
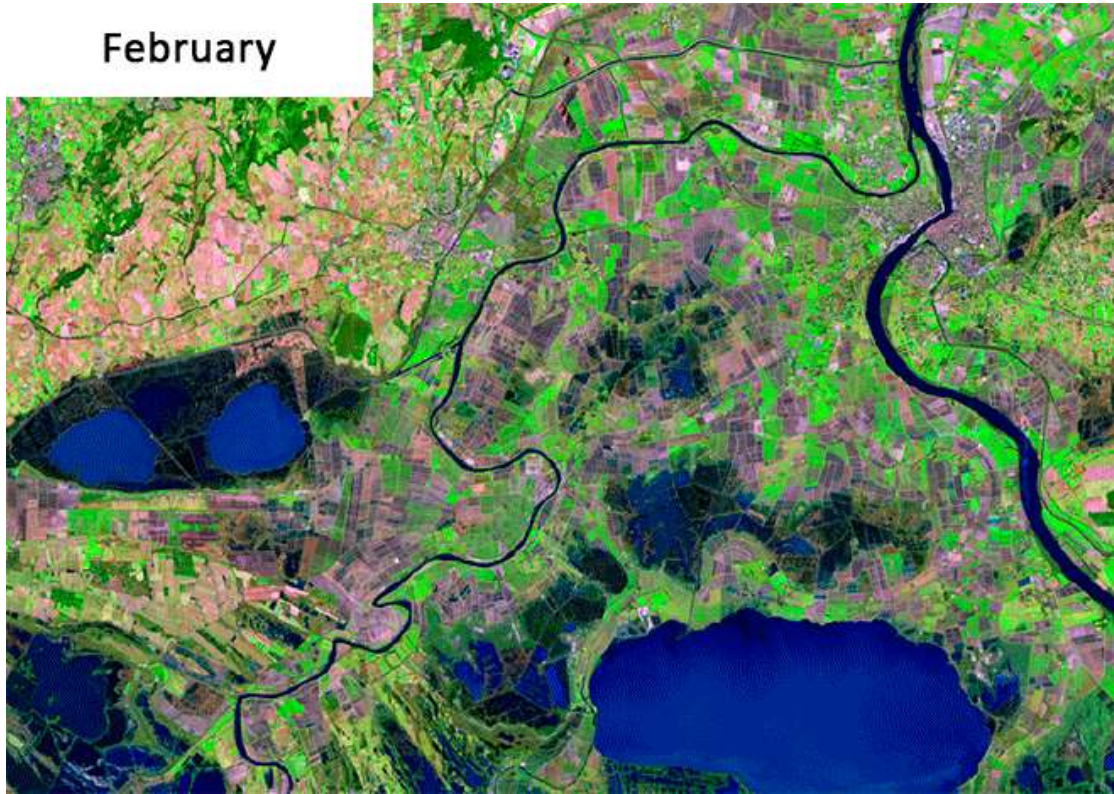


## 3) Apoyo a políticas – Direct. Hábitat

### Detección de arrozales

1. El ciclo comienza con la inundación de campos en mayo.
2. Crecimiento de arroz durante los meses de verano (altura máxima en agosto).
3. Cosecha a mitad/final de septiembre, dejando las parcelas secas y sin vegetación.

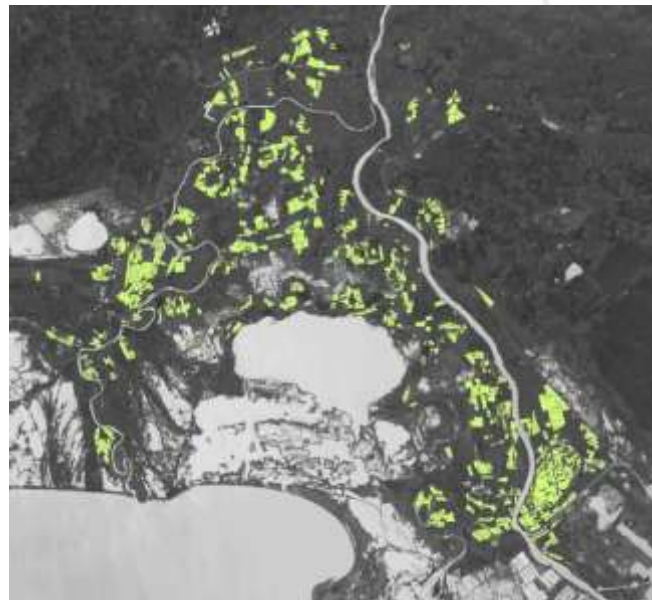
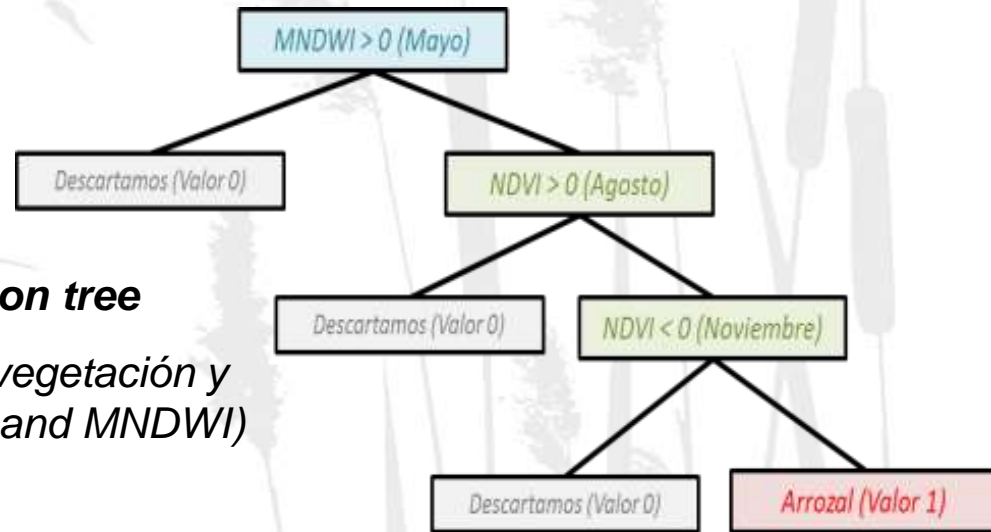
February



### 3) Apoyo a políticas – Direct. Hábitat



**Decision tree**  
Índices de vegetación y agua (NDVI and MNDWI)



## MENSAJES CLAVES

- 1) Una clasificación de humedales mejorada es necesaria para responder a las necesidades de las políticas.
- 2) El mapeo de hábitats de humedales y de sus dinámicas es factible – hasta ciertos límites.
- 3) Los productos y herramientas de SWOS pueden ayudar en el cumplimiento de algunas obligaciones derivadas de políticas (p.ej. Ramsar, Estrategia de Biodiversidad/MAES, Directiva Hábitat, SDGs)

---

# GRACIAS

---

[www.swos-service.eu](http://www.swos-service.eu)

@SWOS\_H2020

*Christoph Schröder*  
*christoph.schroder@uma.es*