



Congreso **Nacional del Medio Ambiente**
CUMBRE DEL DESARROLLO SOSTENIBLE

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DE CATALUNYA

e-EcoRisX

CONAMA 8

Congreso Nacional del Medio Ambiente
CUMBRE DEL DESARROLLO SOSTENIBLE



Análisis de zonas de riesgo cerca de actividades mineras: el proyecto e-EcoRisk

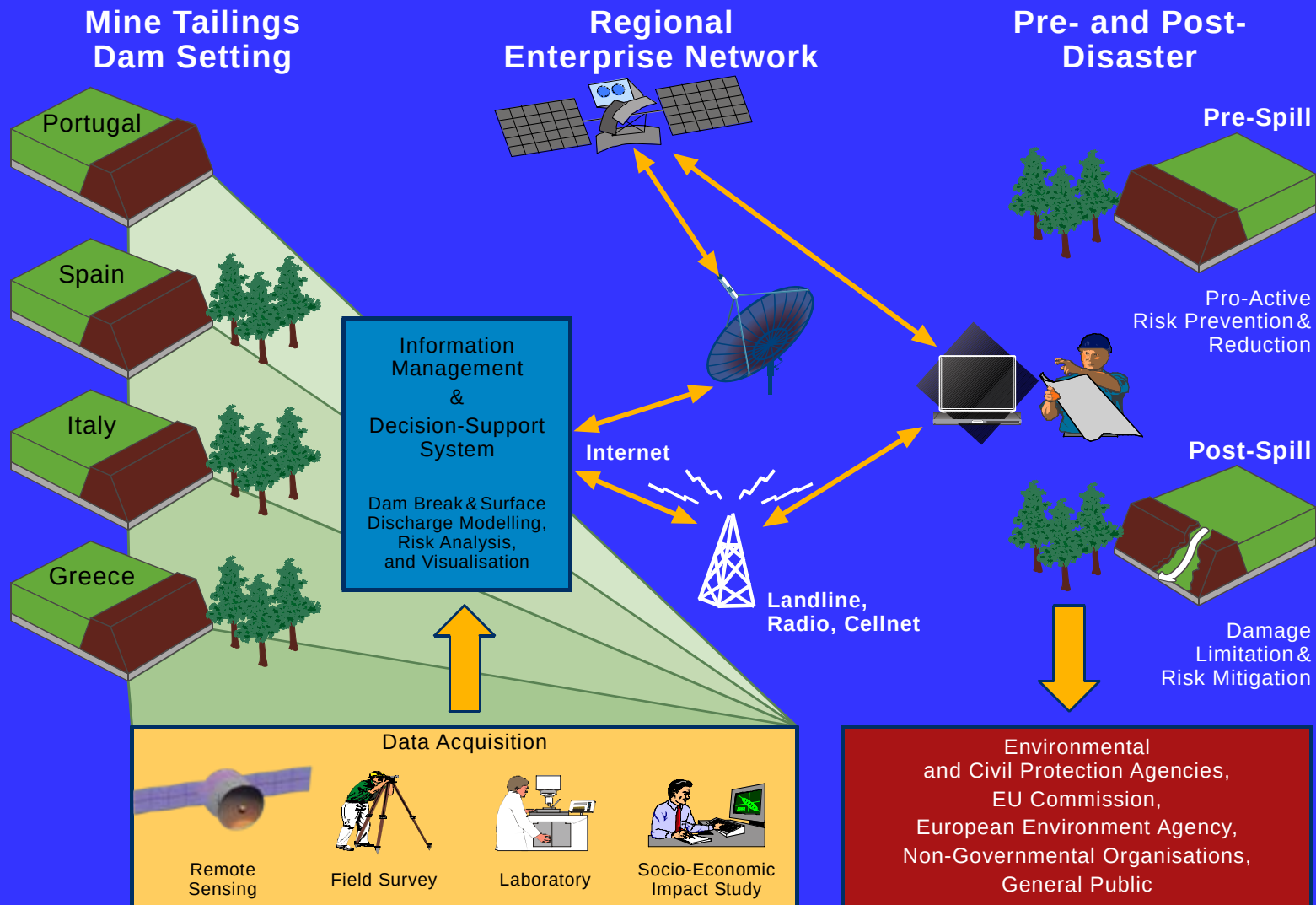
J. Jorge, J. J. Edo, A. Riba



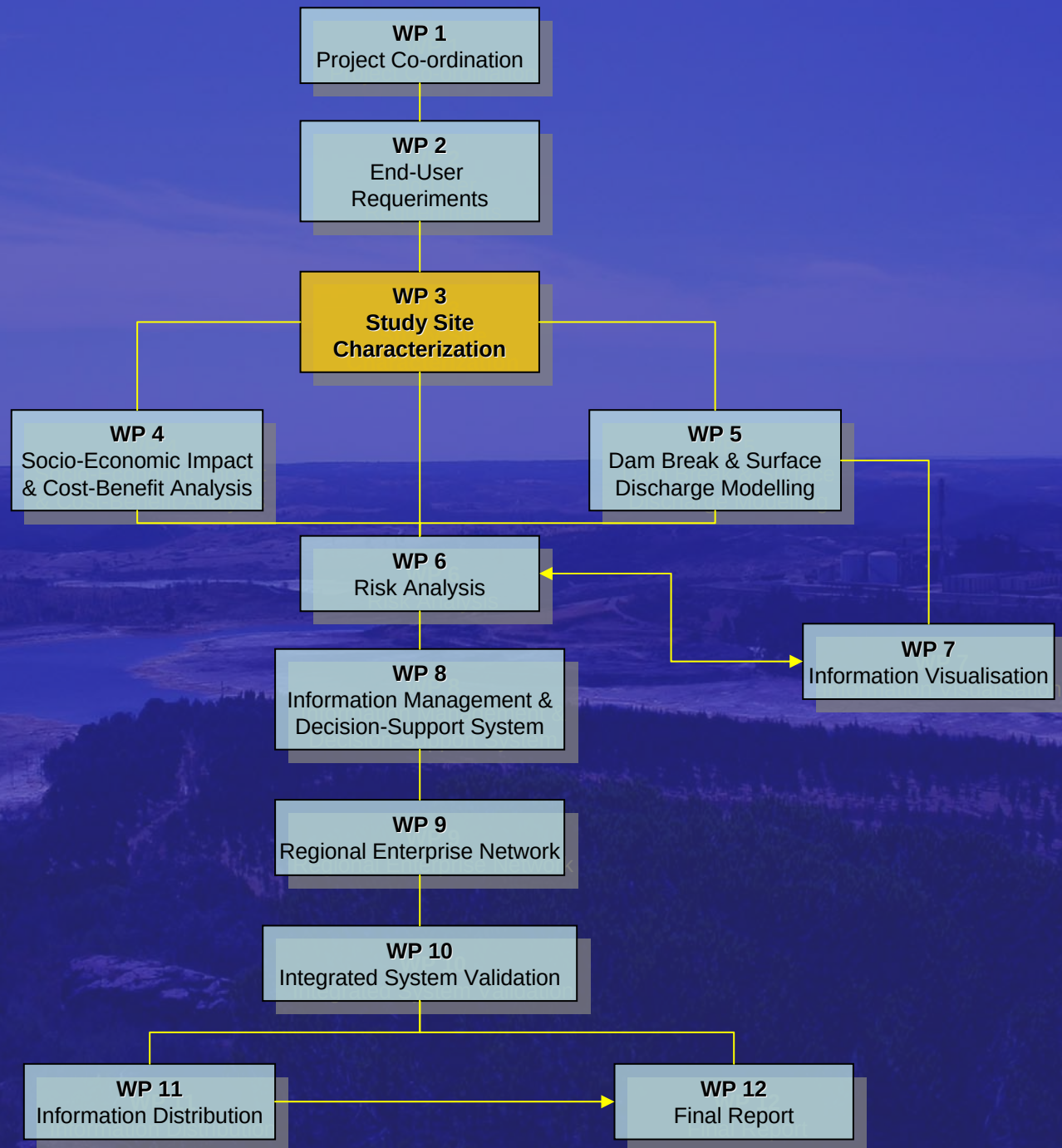
A Regional Enterprise Network Decision-Support System for Environmental Risk and Disaster Management
of Large-Scale Industrial Spills (EVG1-2002-0068)

<http://www.e-ecorisk.info>

e-EcoRisk Concept

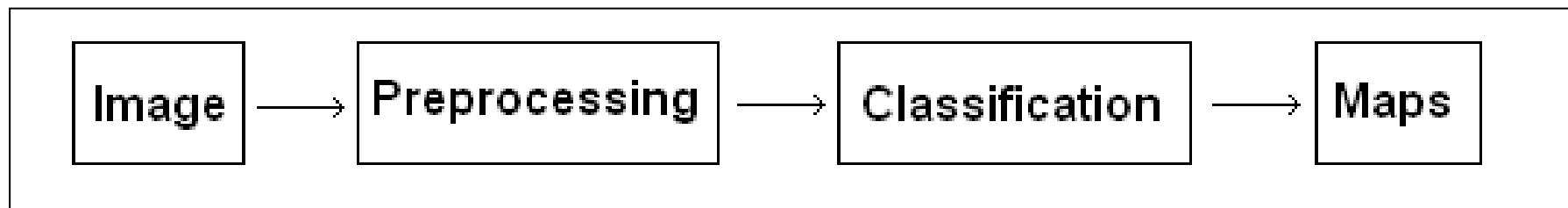


Project Workplan Structure



Protocol for RS Data Processing

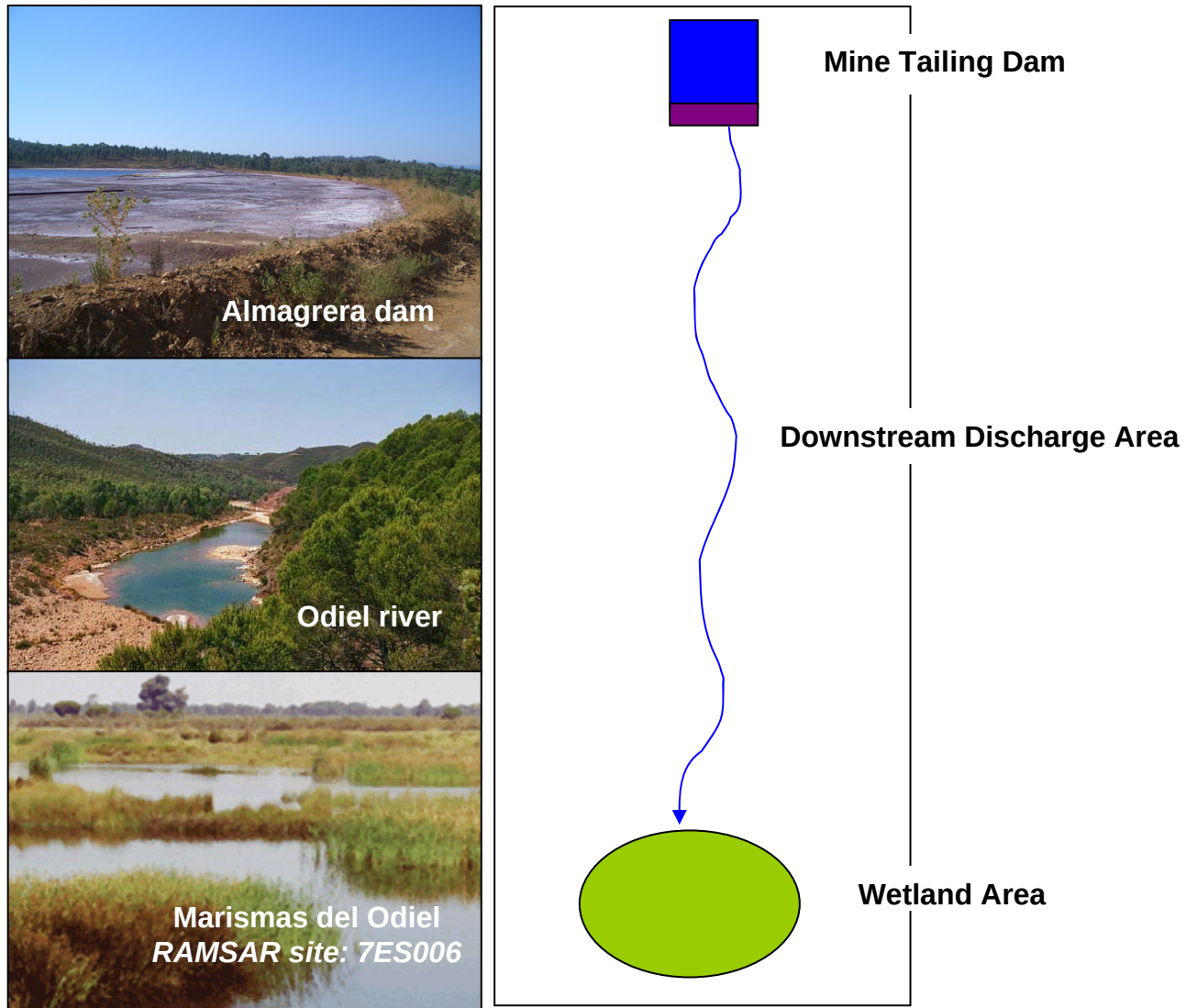
- ❶ General features of the maps
- ❷ Features of the input data
- ❸ Pre-processing steps to apply
- ❹ Processing steps to apply



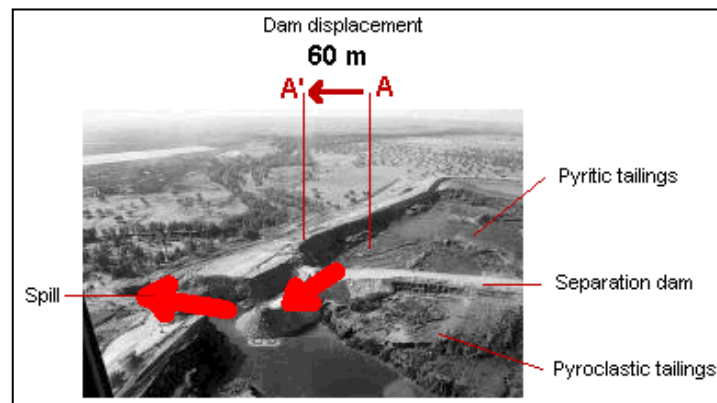
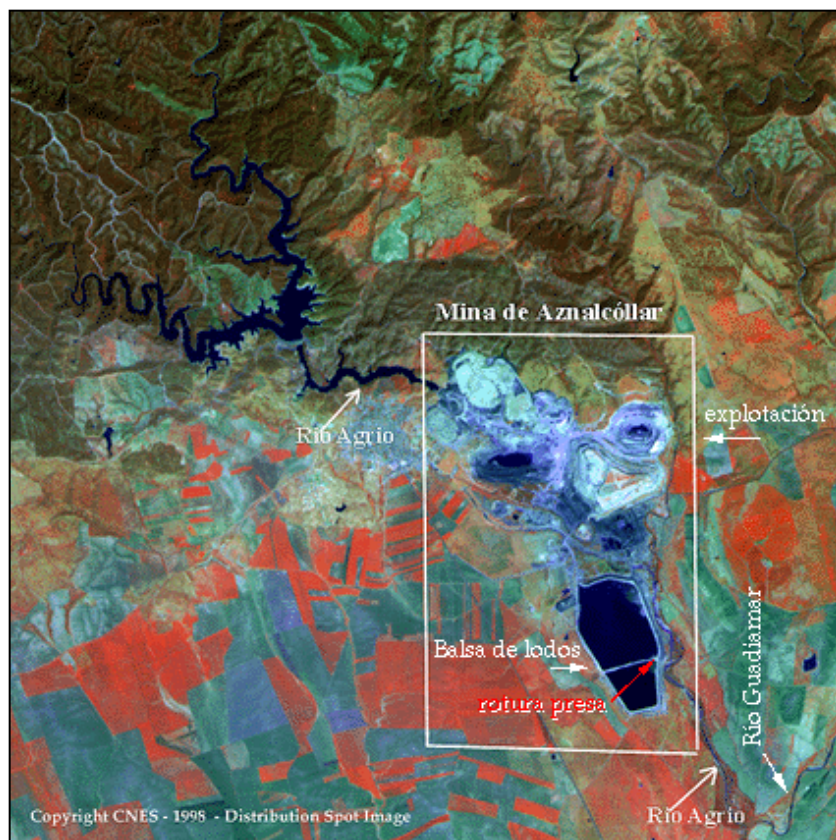
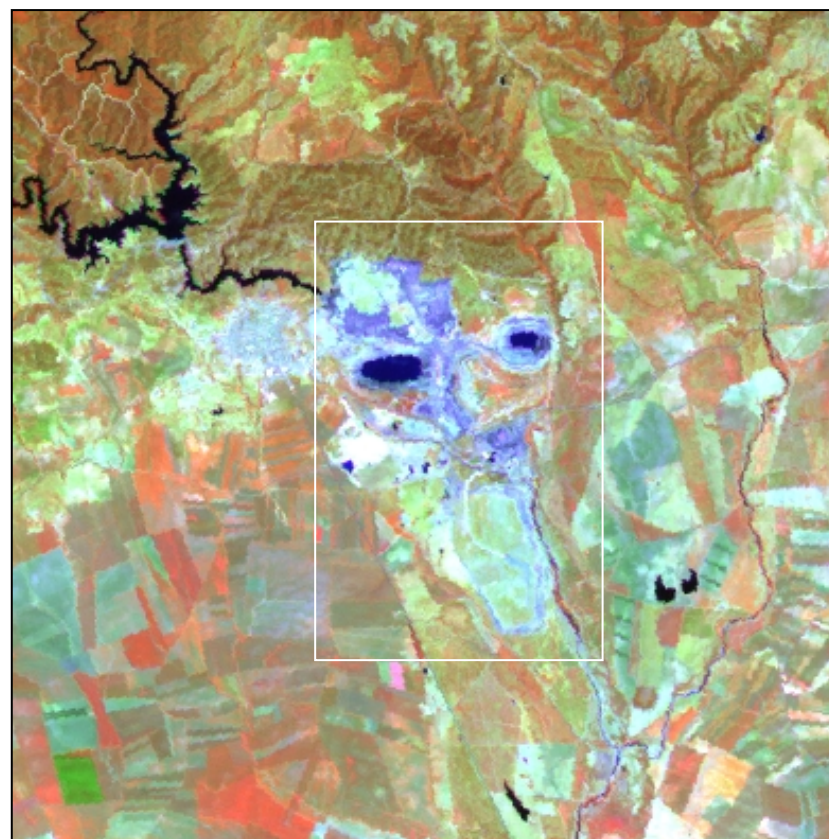
Spanish Test Sites: Mine tailing dams



Delineation of Study Area





AZNALCOLLAR**Tailing dam failure - April 25, 1998****SPOT 4 - March 27, 1998****Landsat 7 - May 18, 2003**

AZNALCOLLAR

Guadamar river

ATM 971 sensor

(Hyper-spectral images)

Source: ITGE & INTA, 1999

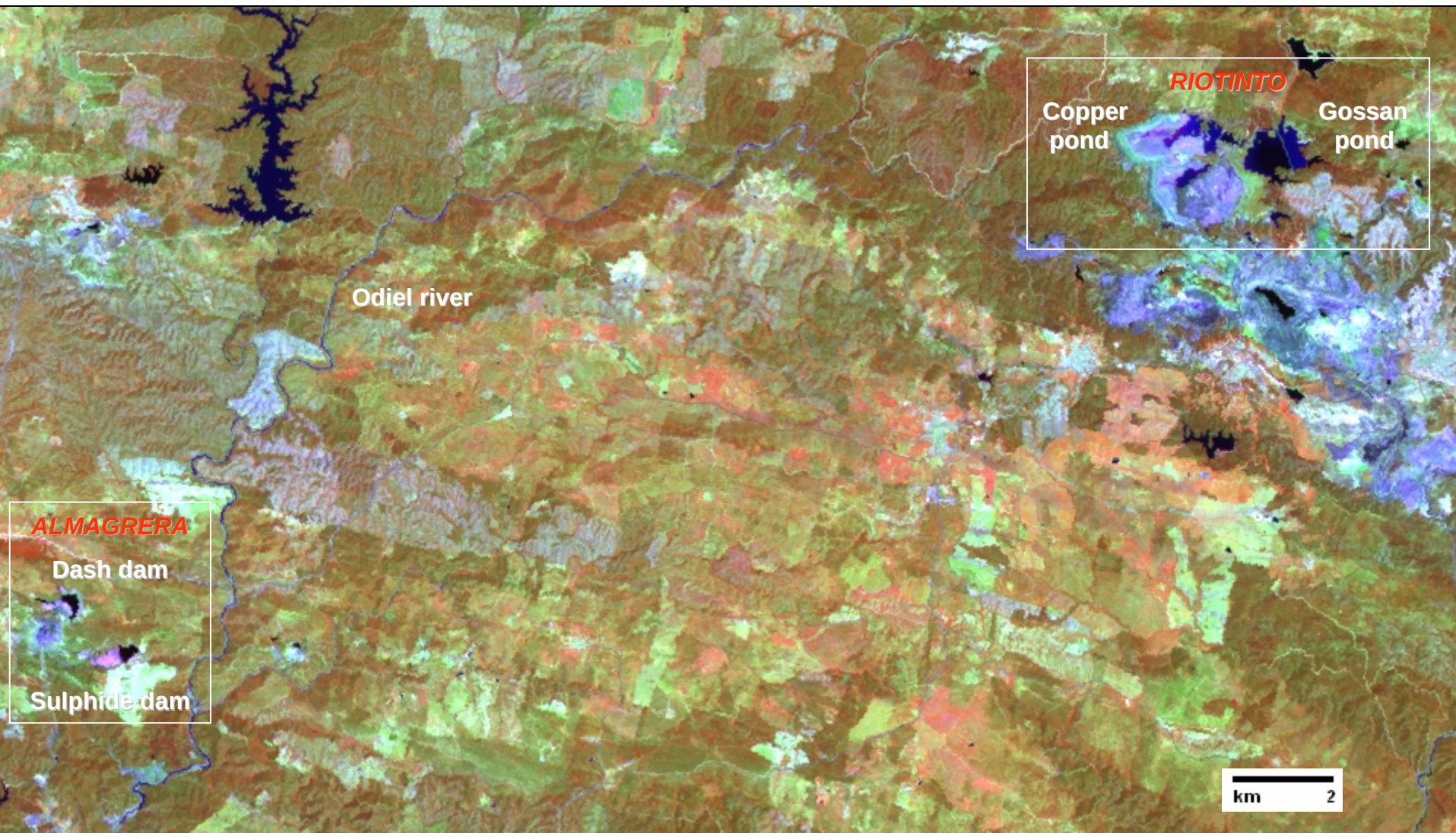


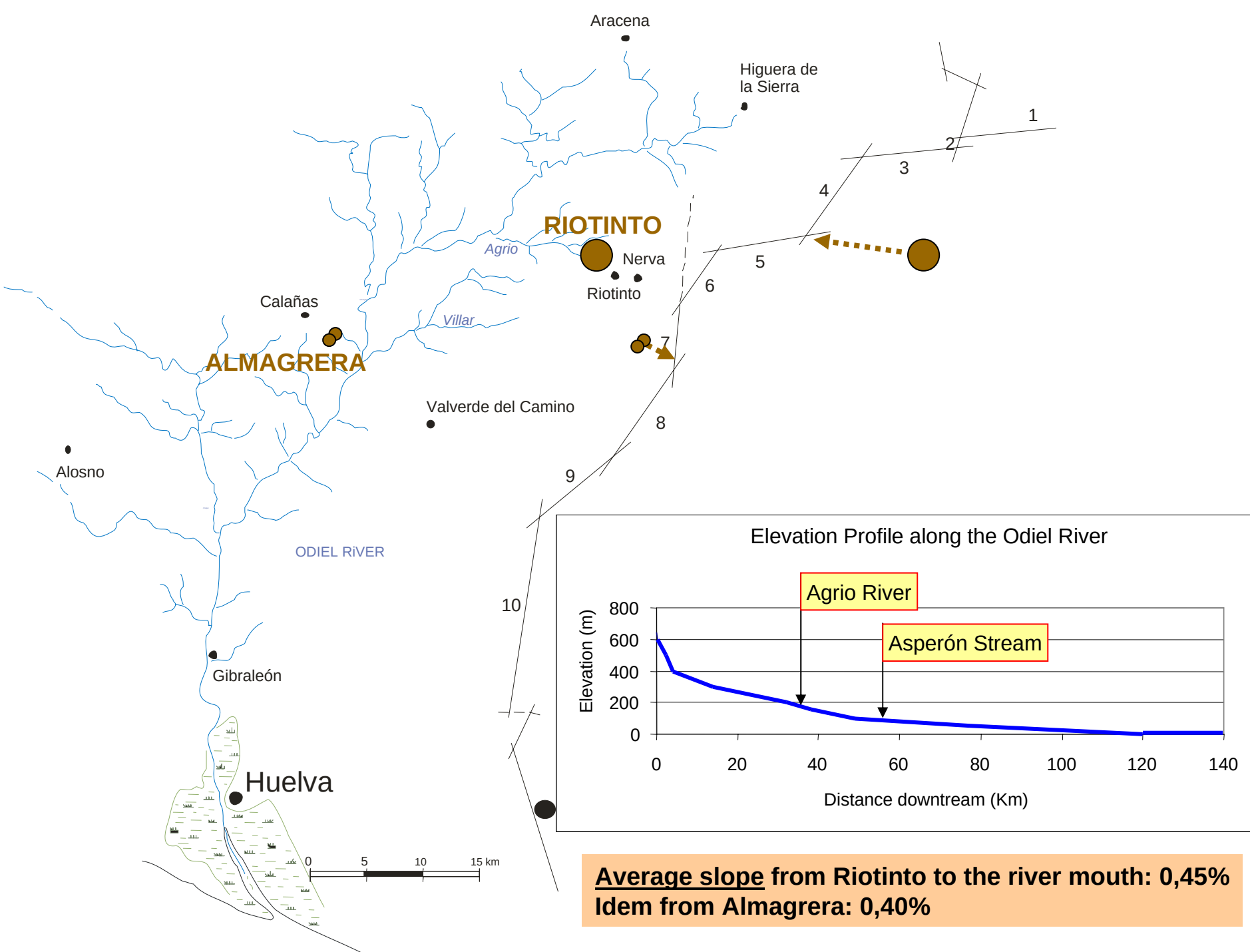
July 7, 1998

mud & salts

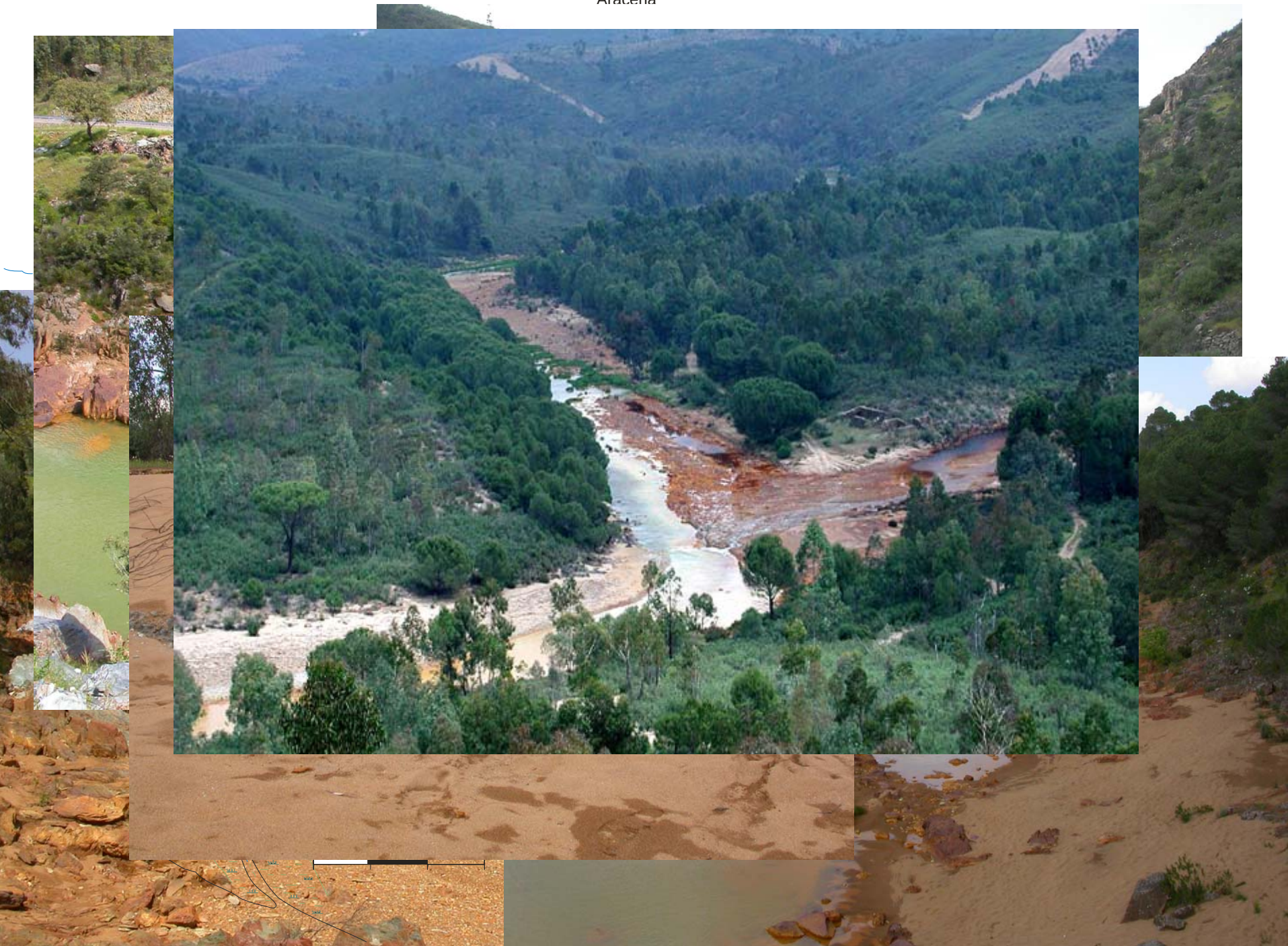
Nov 11, 1998

mud & salts





Aracena





Land cover = f (shadowing)



Land cover = f (detail resolution)



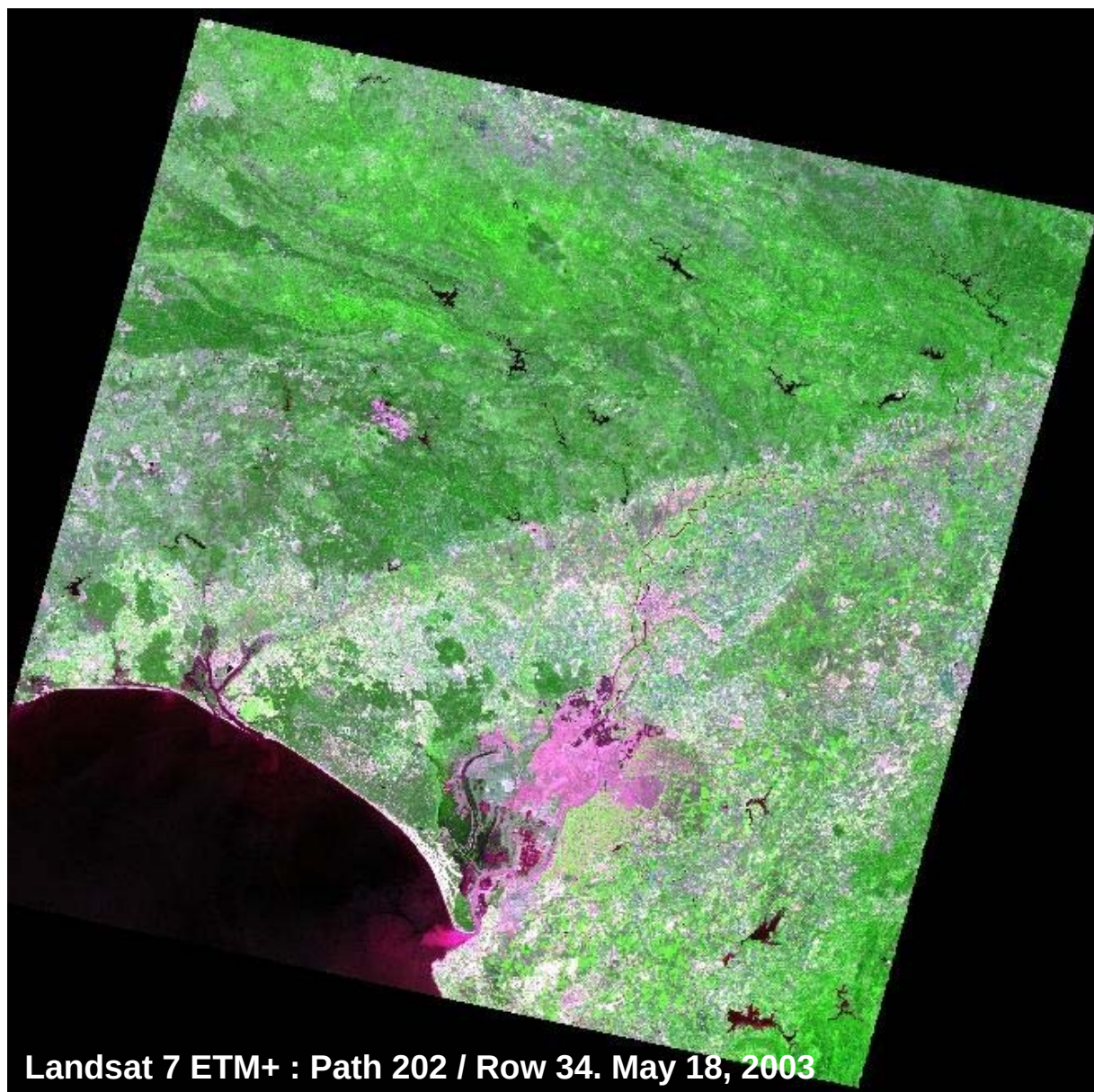
Land cover = f (flow)



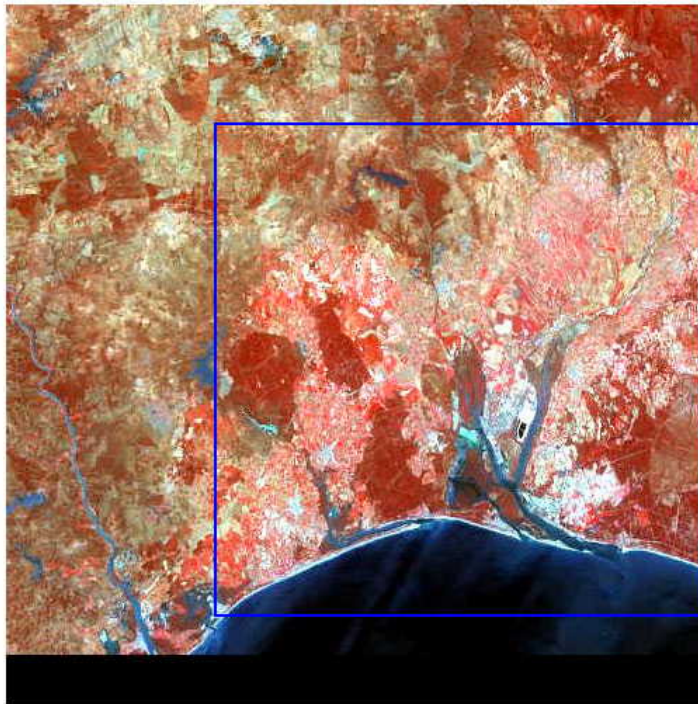
Land cover = f (tide level)

Image Acquisition and Processing

System		Landsat 7	SPOT 5	QuickBird 2	ERS 2
Study area		Downstream area	RAMSAR area	Tailings dam	Downstream area
Study area name		Odiel basin	Marismas del Odiel	Almagrera	DEM
Spatial coverage		185 km x 185 km	40 km x 40 km	8 km x 8 km	
Sensor		ETM+	HGR 1		SAR tandem
Path/row		202/034	029/274		137/2853
Data acquisition		May 18, 2003 10:51	June 19, 2003 11:44	July 20, 2005 11:27	June 29, 1995 11:10 May 9, 1996 11:10
Spatial Resolution		ETM: 30 m	MSS: 10 m	MSS: 2.44 m	30 m
		Pan: 15 m		Pan: 0.61 m	
Spectral Res.	Band 1	0.45- 0.52 μm	0.50- 0.59 μm	0.45- 0.52 μm	
	Band 2	0.52- 0.60 μm	0.61- 0.68 μm	0.52- 0.60 μm	
	Band 3	0.63- 0.69 μm	0.79- 0.89 μmI	0.63- 0.69 μm	
	Band 4	0.76- 0.90 μm	1.58- 1.75 μm	0.76- 0.90 μm	
	Band 5	1.55- 1.75 μm			
	Band 6	10.4- 12.5 μm			
	Band 7	2.08- 2.35 μm			
	Panchromatic	0.50- 0.90 μm	0.48- 0.71 μm	0.45- 0.90 μm	



Full scene N° 50292750306191144391J*



Scene (on the segment)

Shift along the track (SAT) (by tenth of scene)

Scene extract (1/2, 1/4, 1/8 box on the scene)

**Commercial informations**

Delivery time Contact Spot Image

Price 2700.00 Euros

Technical characteristics

SPOT satellite number	5
GRS reference (K / J)	029/276
Acquisition date (MM/DD/YYYY HH:MM:SS)	06/19/2003 11:14:39
HRV / HRG instrument number	1
Spectral mode	10 m Colour
Cloud cover quotes	AAAAAAA
Average cloud cover quotes	A
Snow cover quotes	00000000
Average scene quality quotes	E
Scene quality quotes	EEEE
Gains	5443
Angle of incidence	+28.3
Imaging configuration	

Radiometrical information

Number of bands for the quick look	4		
	Saturated pixels	Minimum threshold dynamic stretching	Maximum threshold dynamic stretching
Band 1	0.0	62	119
Band 2	0.0	33	109
Band 3	0.0	19	116
Band SWIR	0.0	17	153

QUICKBIRD 2 (July 20, 2005)

Almagrera dams



8 km x 8 km

Huelva (Marismas del Odiel)



10 km x 10 km

ERS2 tandem mission



ACS: Generation of the DEM using SAR interferometry

Preprocessing

Geometrical correction

Step 1. Using **1:10,000 digital ortophoto** of the area, like points are sought between the ortophoto and the image to be corrected (control points, 0.5m spatial resolution).

Step 2. Using these points (~40) of known UTM coordinates, **first degree polynomial equations** are applied to transfer all the points in the image to UTM coordinates. Each pixel is transferred to a corrected position by the "**nearest neighbour**" **method**, to maintain the values of each pixel of the resulting image.

Coordinate system

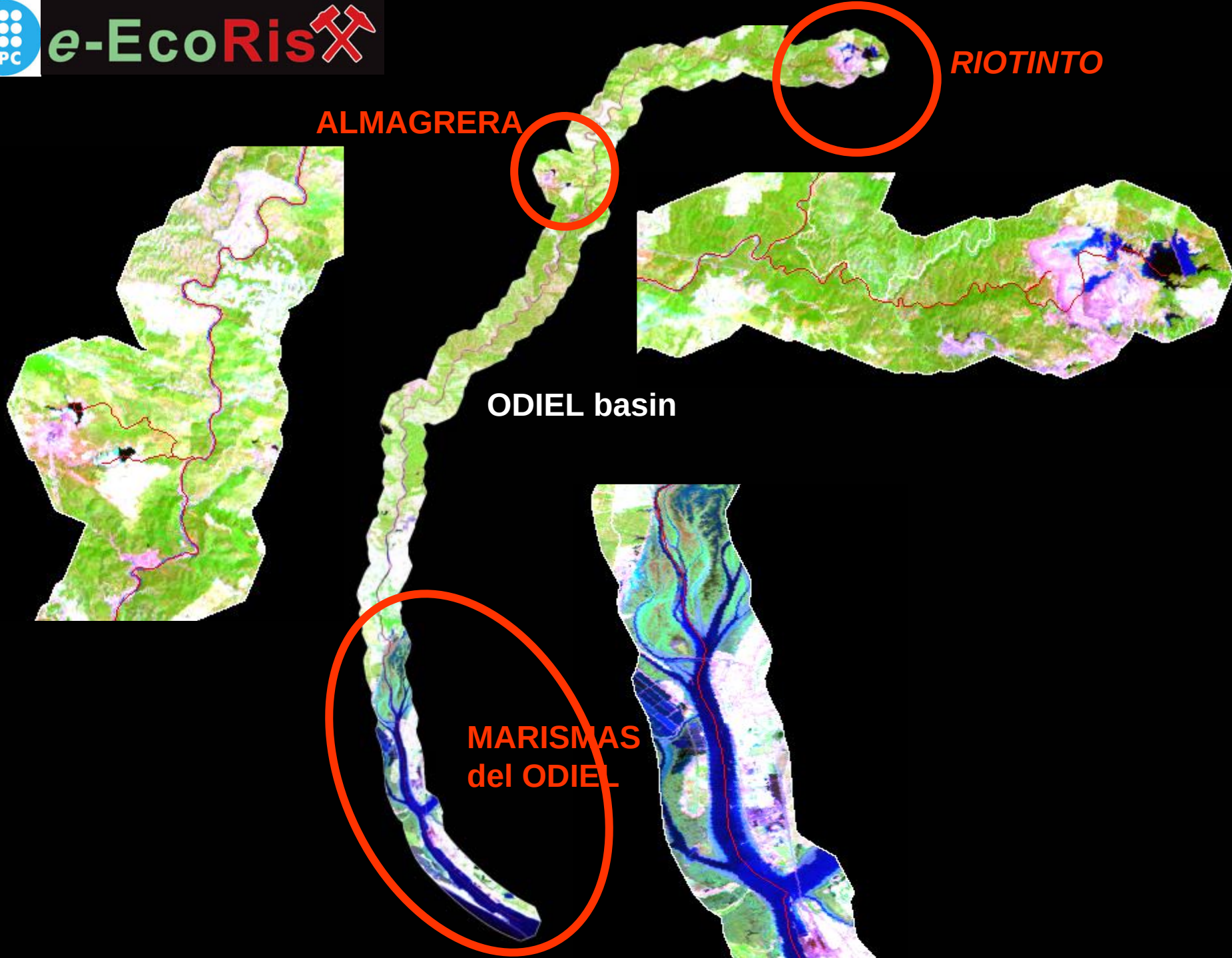
Datum: ED50 (European Datum 1950) reference system

UTM (Universal Transversa Mercator) map projection

Altimetric altitudes - Zone: 30 - Hemisphere: N

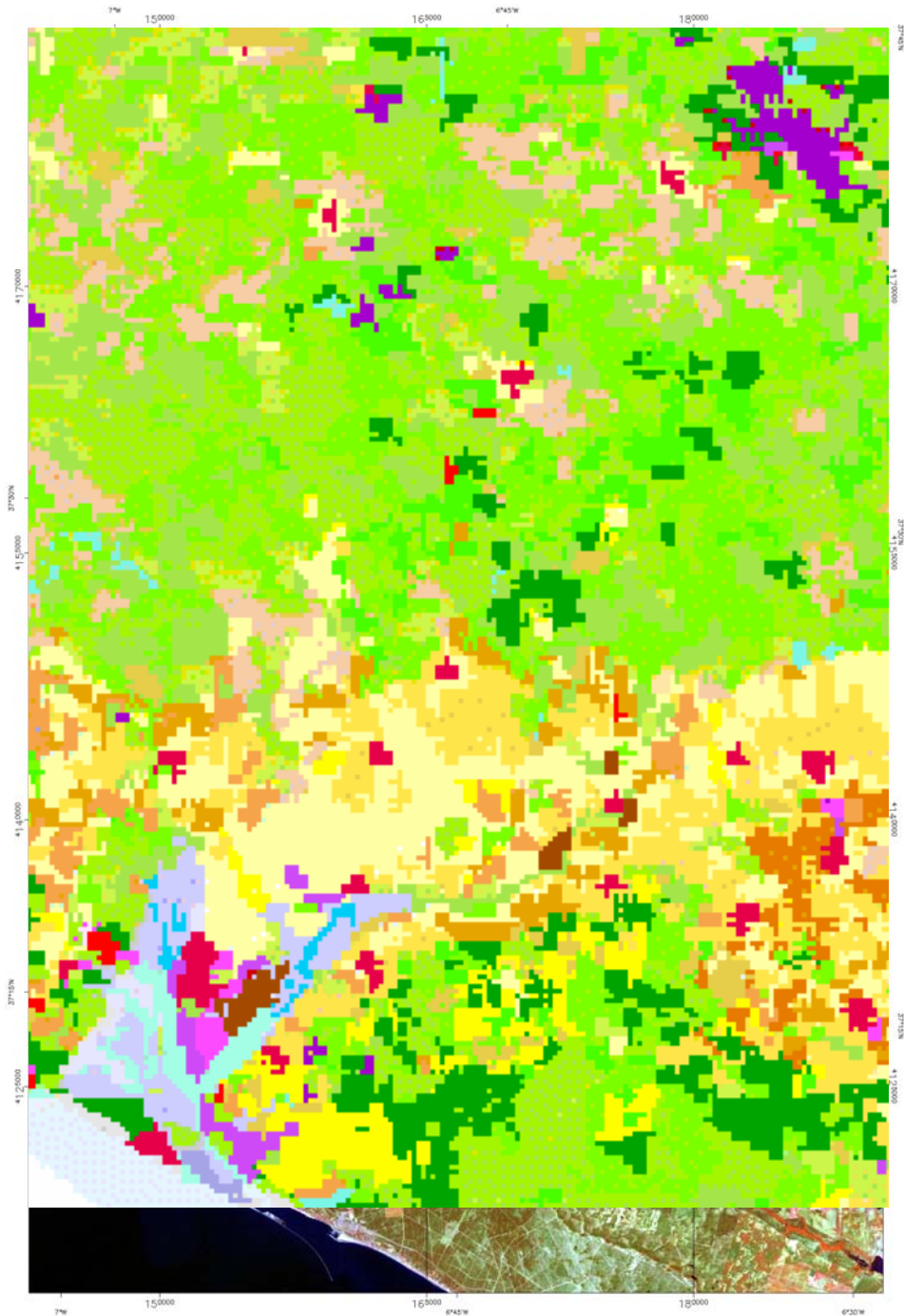
Atmospheric correction

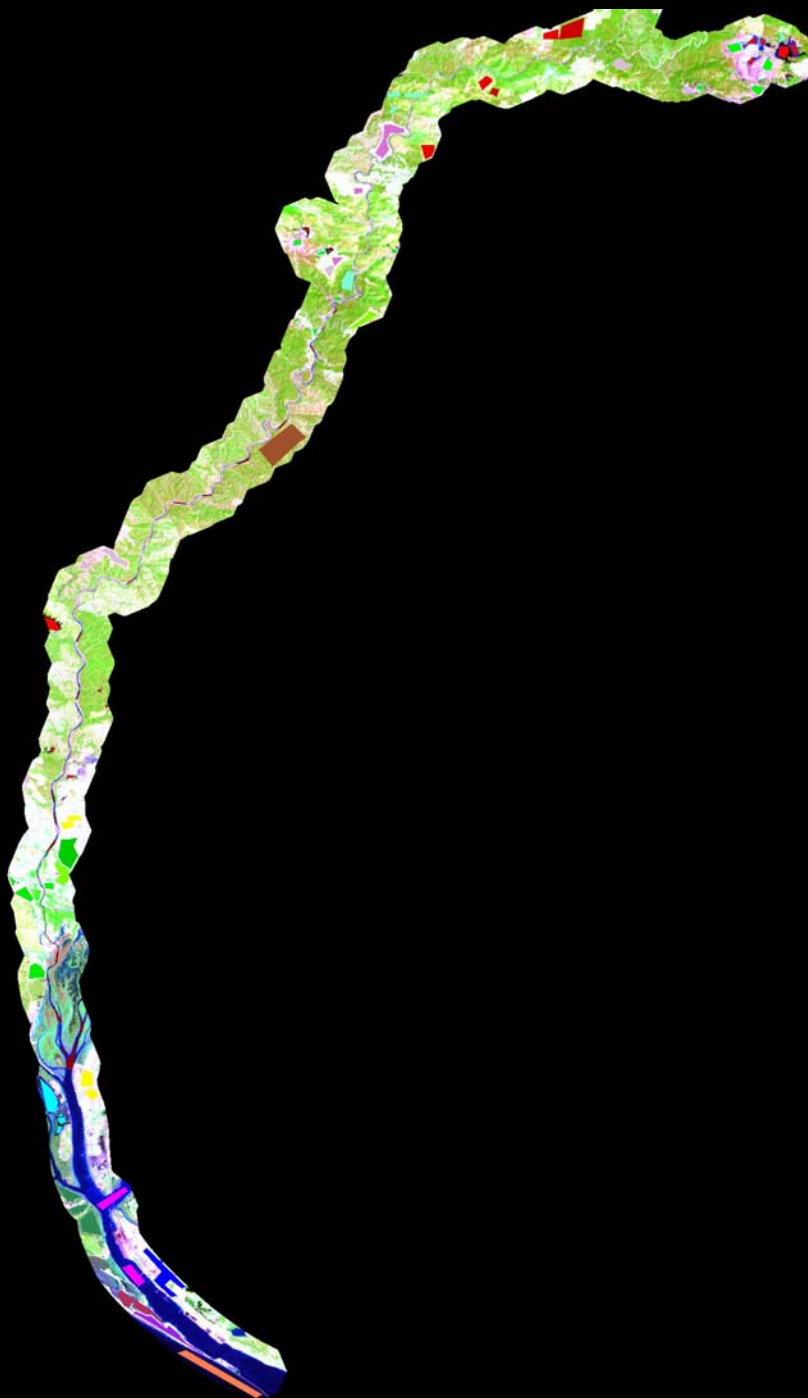
To correct or minimize the atmospheric effects, the **Dark Object Subtraction** has been employed. This technique consists of subtracting the minimum value found for each pixel from each band.



CORINE Land Cover classes

 Continuous urban fabric	 Agro-forestry areas
 Discontinuous urban fabric	 Broad-leaved forest
 Industrial or commercial units	 Coniferous forest
 Road and rail networks and associated land	 Mixed forest
 Port areas	 Natural grasslands
 Airports	 Moors and heathland
 Mineral extraction sites	 Sclerophyllous vegetation
 Dump sites	 Transitional woodland-shrub
 Construction sites	 Beaches, dunes, sands
 Green urban areas	 Bare rocks
 Sport and leisure facilities	 Sparsely vegetated areas
 Non-irrigated arable land	 Burnt areas
 Permanently irrigated land	 Glaciers and perpetual snow
 Rice fields	 Inland marshes
 Vineyards	 Peat bogs
 Fruit trees and berry plantations	 Salt marshes
 Olive groves	 Salines
 Pastures	 Intertidal flats
 Annual crops associated with permanent crops	 Water courses
 Complex cultivation patterns	 Water bodies
 Land principally occupied by agriculture, with significant areas of natural vegetation	 Coastal lagoons
	 Estuaries
	 Sea and ocean
	 NODATA





	CLC code	CLC class	Roughness index
	111	Continuous urban fabric	0.20
	121	Industrial or commercial units	0.20
	131	Mineral extraction sites	0.10
*	211	Non-irrigated arable land	0.127
	222	Fruit trees and berry plantations	0.20
	244	Agro-forestry areas	0.15
	311	Broad-leaved forest	0.20
*	312	Coniferous forest	0.20
	313	Mixed forest	0.20
*	321	Natural grassland	0.10
*	323	Sclerophyllous vegetation	0.15
	324	Transitional woodland-shrub	0.15
	331	Beaches, dunes, sands	0.12
*	421	Salt marshes	0.12
	422	Salines	0.12
	423	Intertidal flats	0.05
*	511	Water courses	0.05
*	512	Water bodies	0.03
	522	Estuaries	0.03
	523	Sea and ocean	0.03

ROIs (regions of interest) for supervised classification over a false colour RGB 742.

RIOTINTO

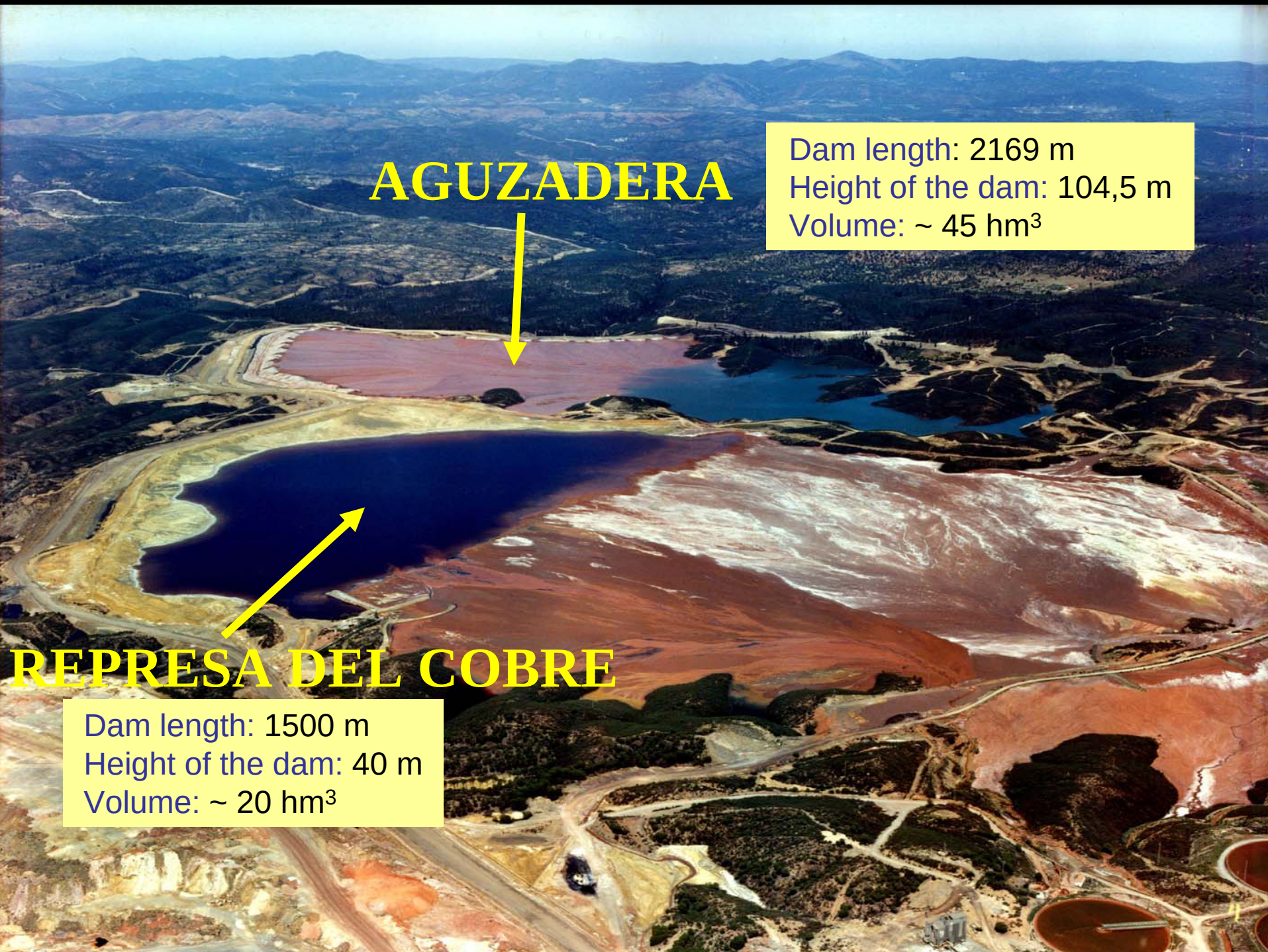


AGUZADERA

Dam length: 2169 m
Height of the dam: 104,5 m
Volume: ~ 45 hm³

REPRESA DEL COBRE

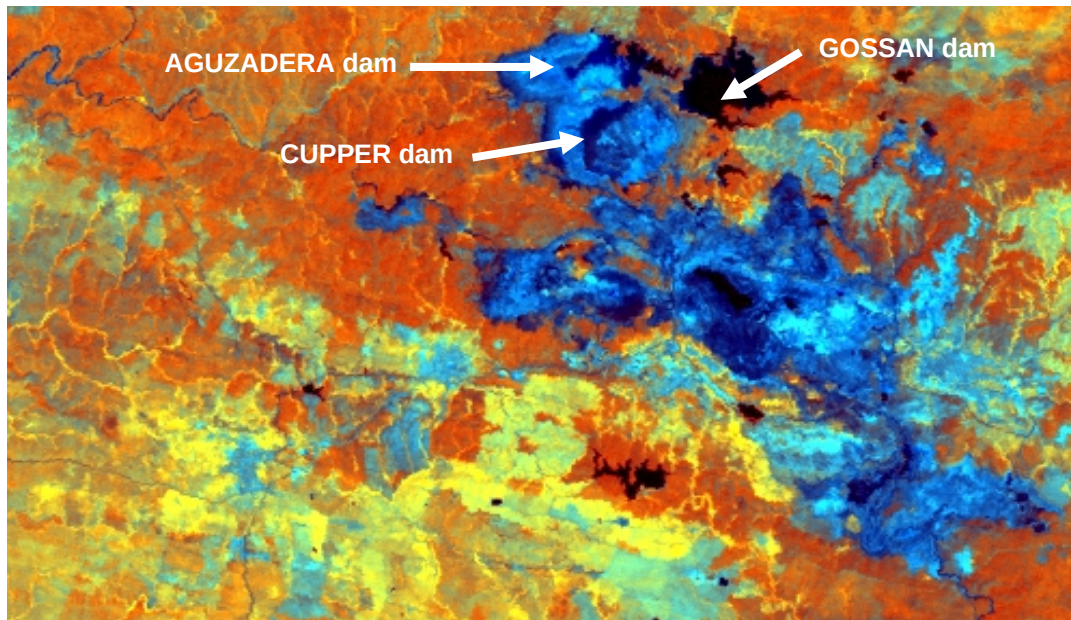
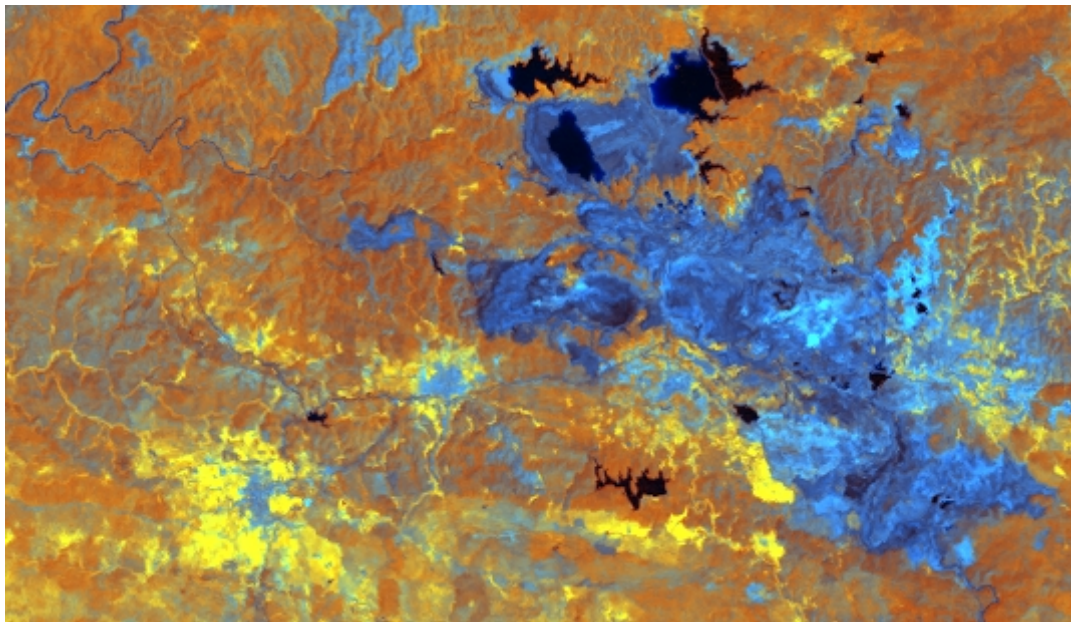
Dam length: 1500 m
Height of the dam: 40 m
Volume: ~ 20 hm³



REPRESA DEL GOSSAN

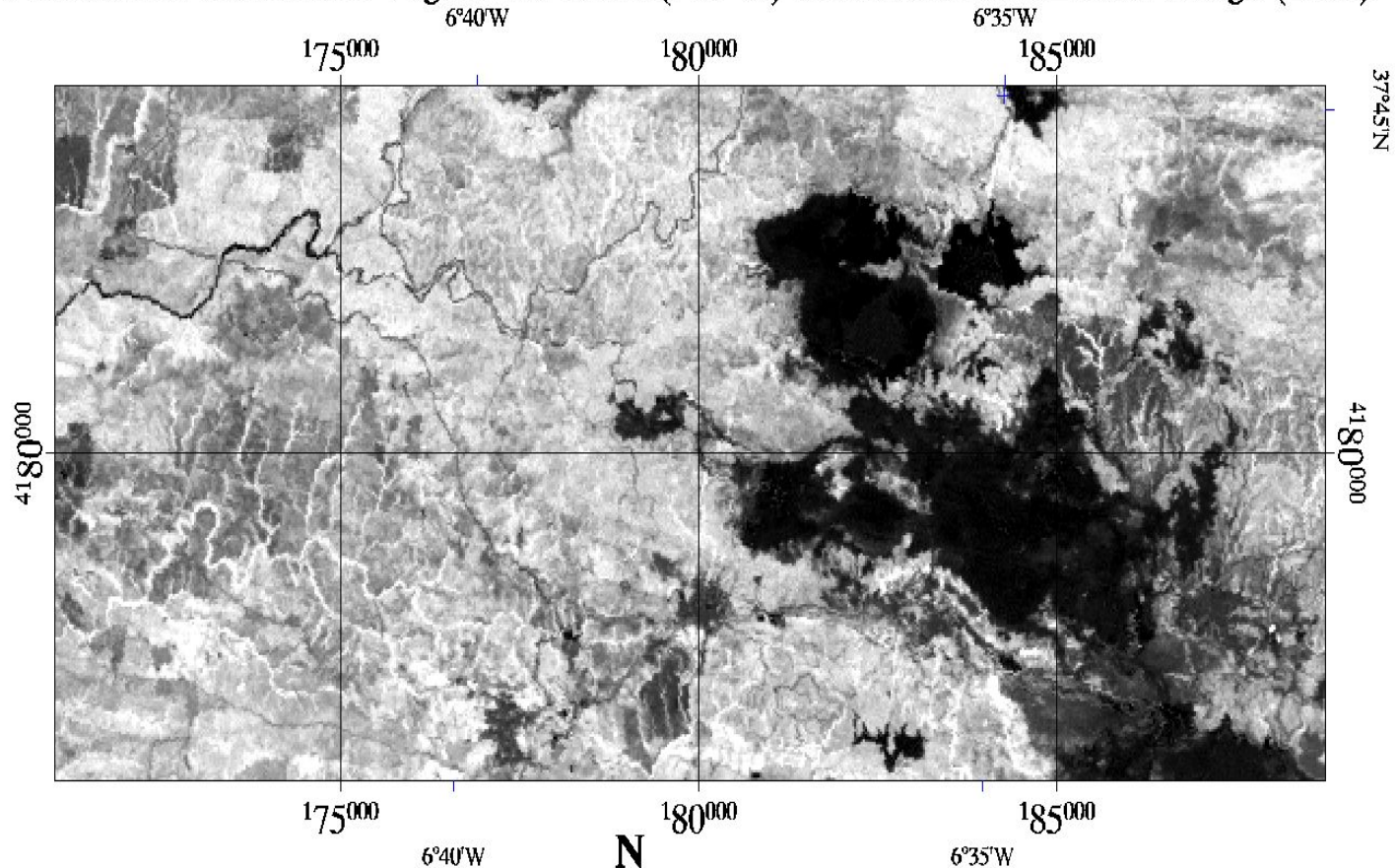
Dam length: 1500 m
Height of the dam: 50 m
Volume: ~ 15 h





False colour image (RGB: NDVI, 4, 3) of Riotinto mining area (up) 1989; (bottom) 2003

Normalized Difference Vegetation Index (NDVI) affected Landsat ETM+ image (2003)



MINING AREA OF RIOTINTO, SPAIN

Author: Joan Jorge

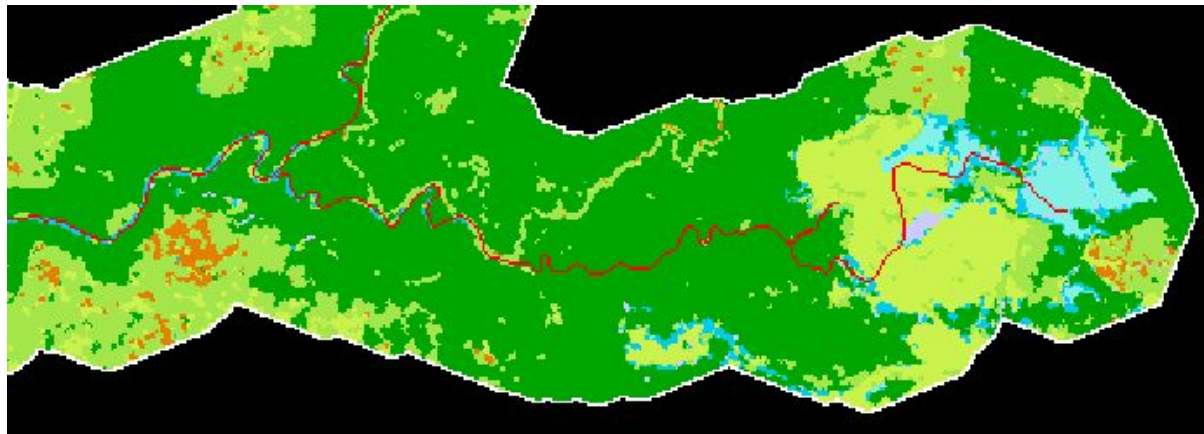
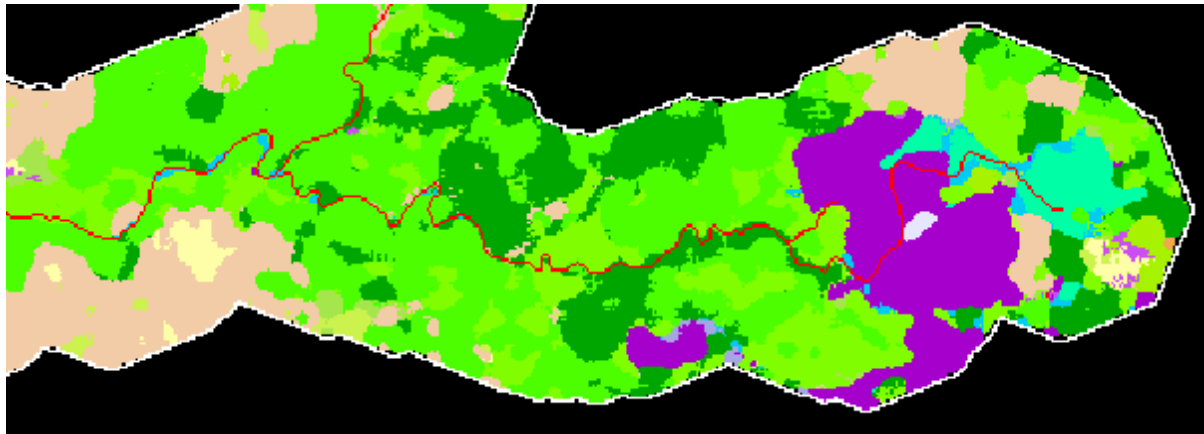
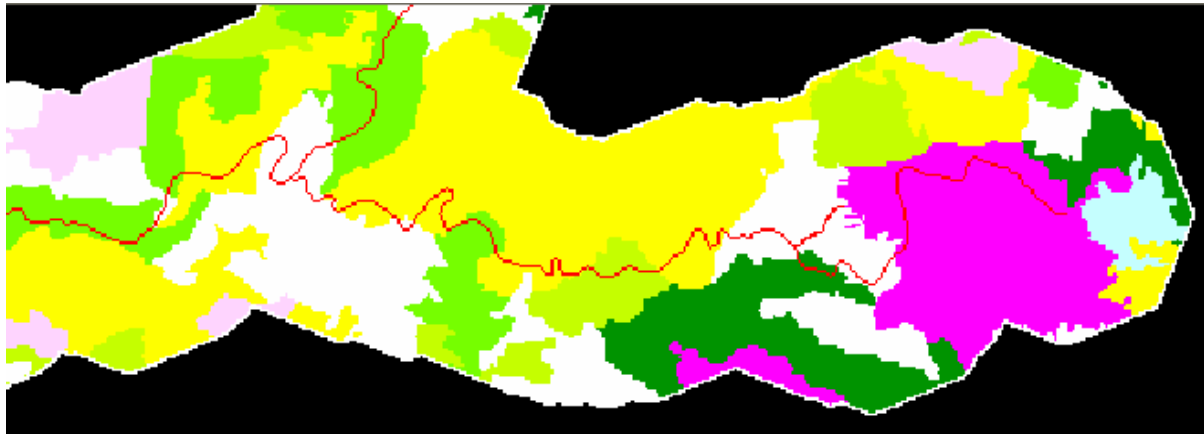
May 2006



Projection: UTM, Zone 30 North

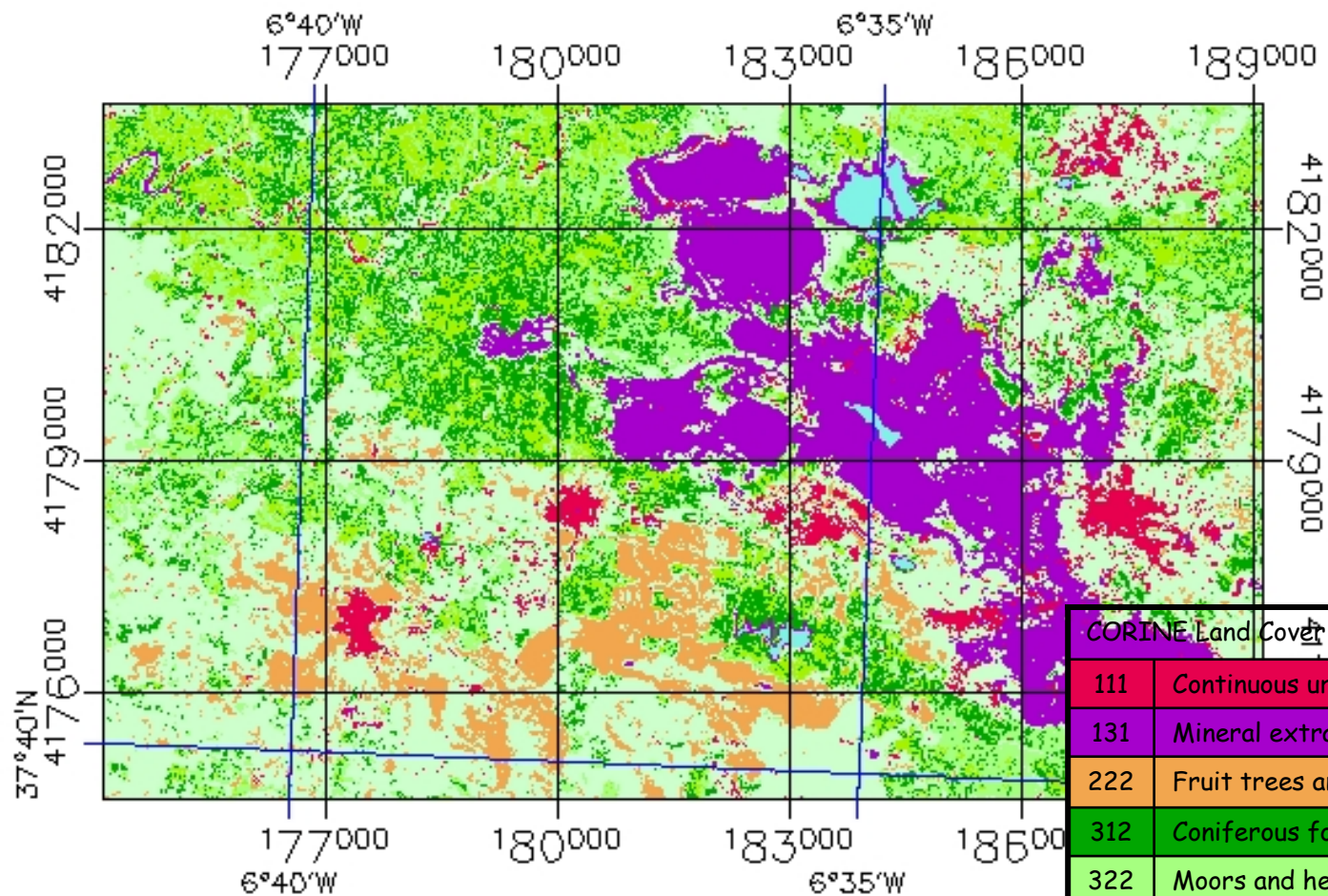
Pixel: 15 Meters

Datum: European 1950



Land Cover of
Riotinto mining area
(up) in CLC2000
Map; (center) after
supervised
classification using
CLC nomenclature;
and (bottom) after
sharpening and
combining classes in
function of roughness
index.

RIOTINTO supervised classification (maximum likelihood)

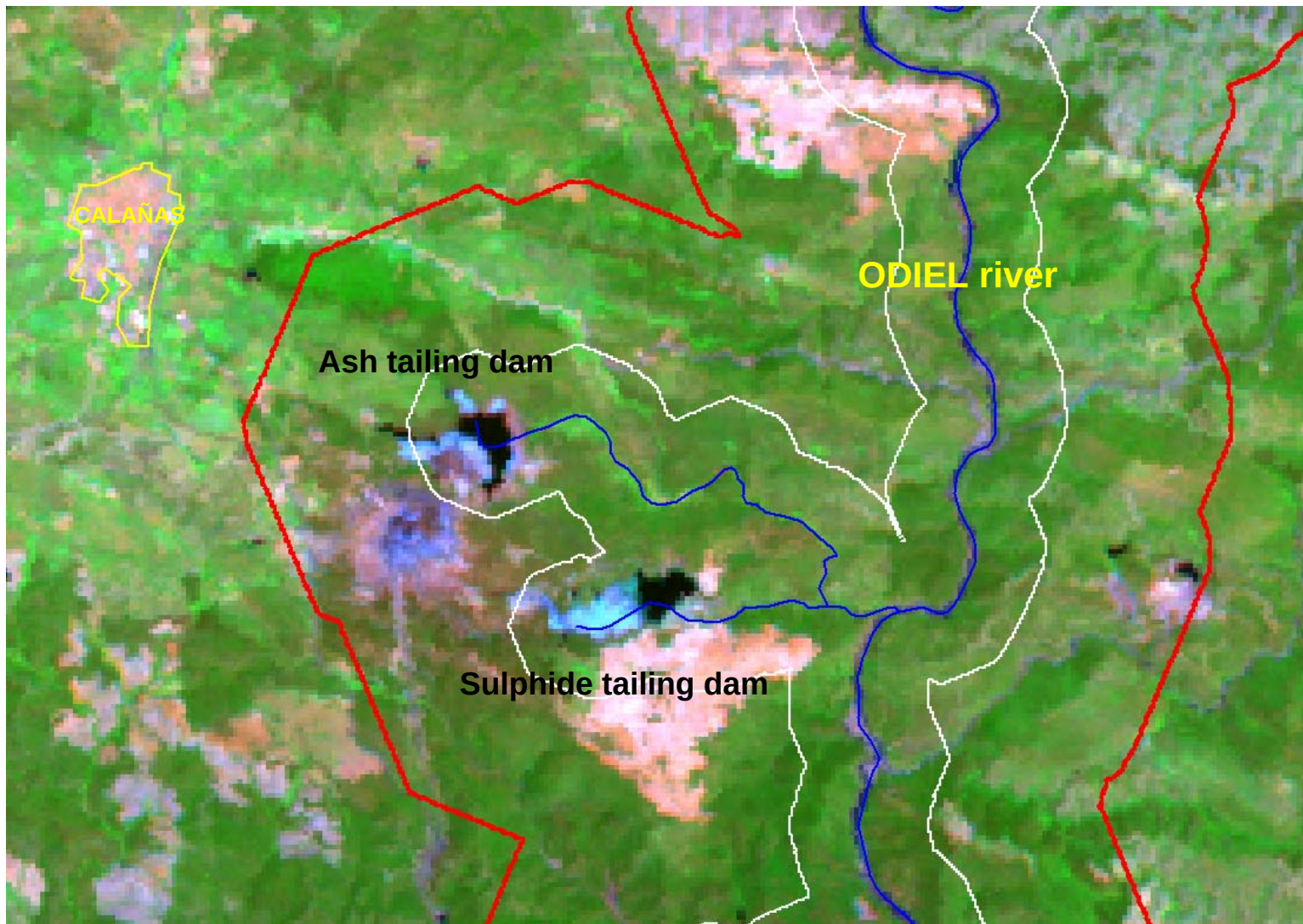


CORINE Land Cover Legend	
111	Continuous urban fabric
131	Mineral extraction sites
222	Fruit trees and berry plantations
312	Coniferous forest
322	Moors and heathland
324	Transitional woodland-shrub
333	Sparsely vegetated areas
512	Water bodies



RGB: 742



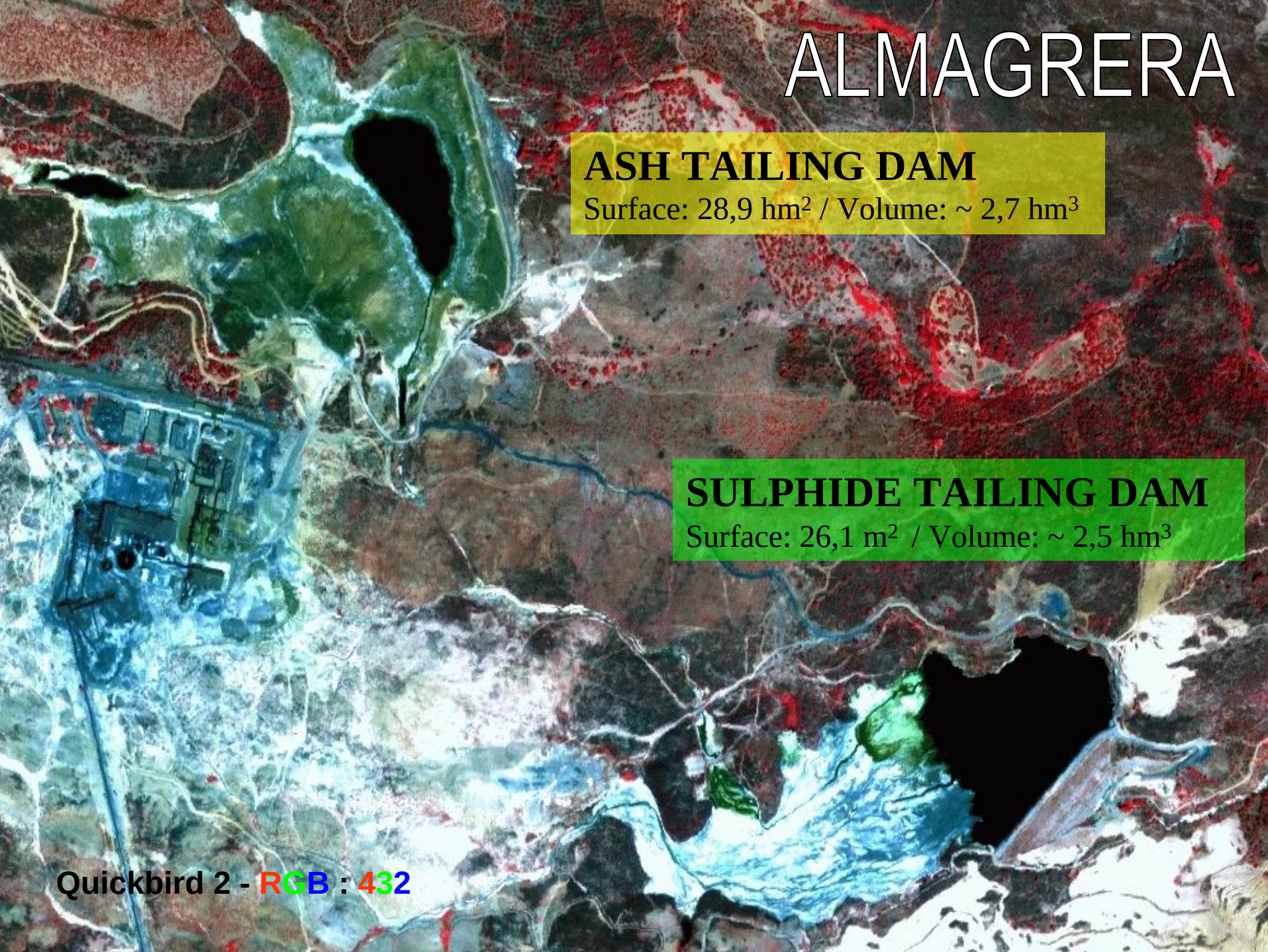


Almagrera tailing dams (Landsat TM 742).





ALMAGRERA



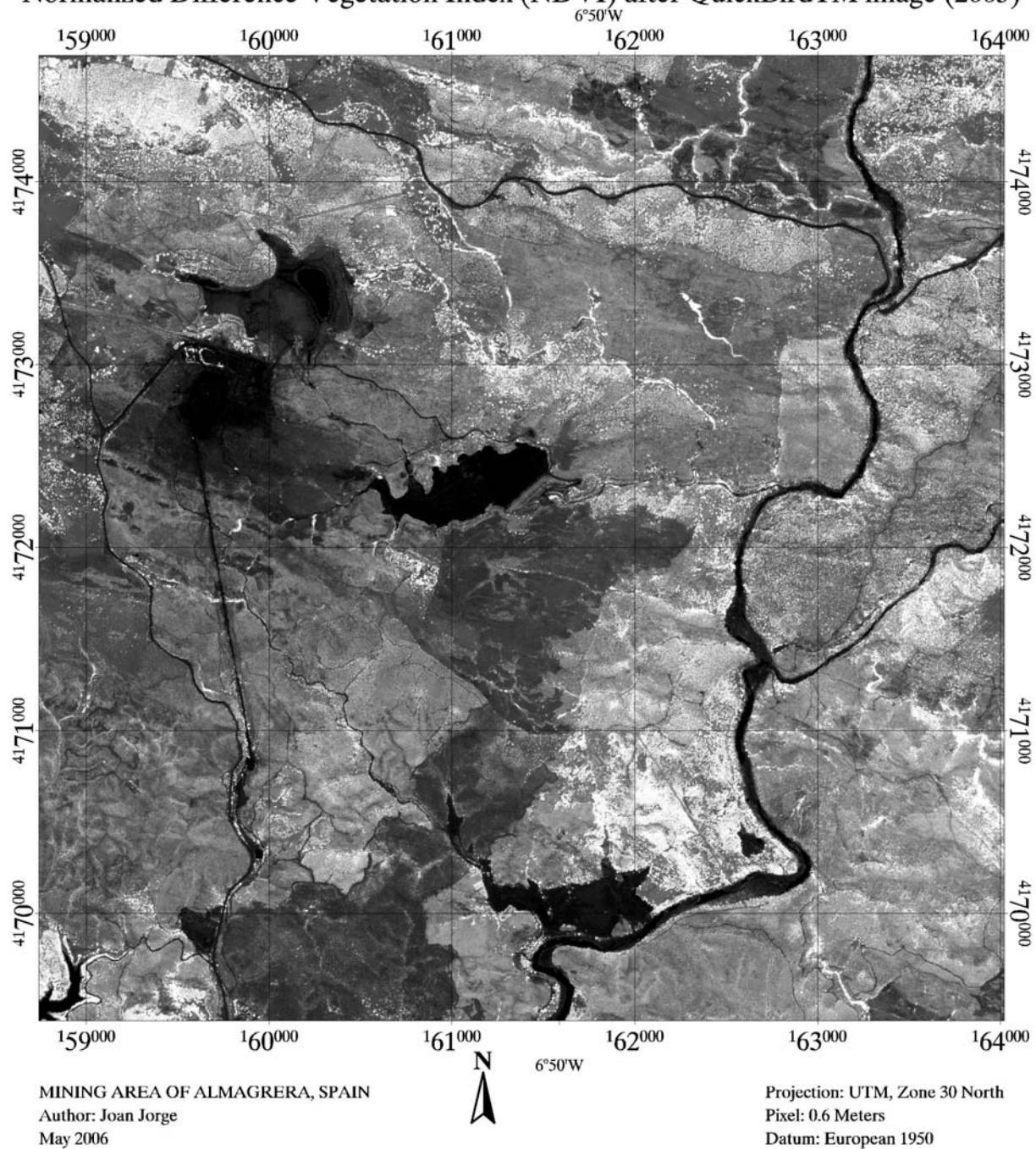
ASH TAILING DAM

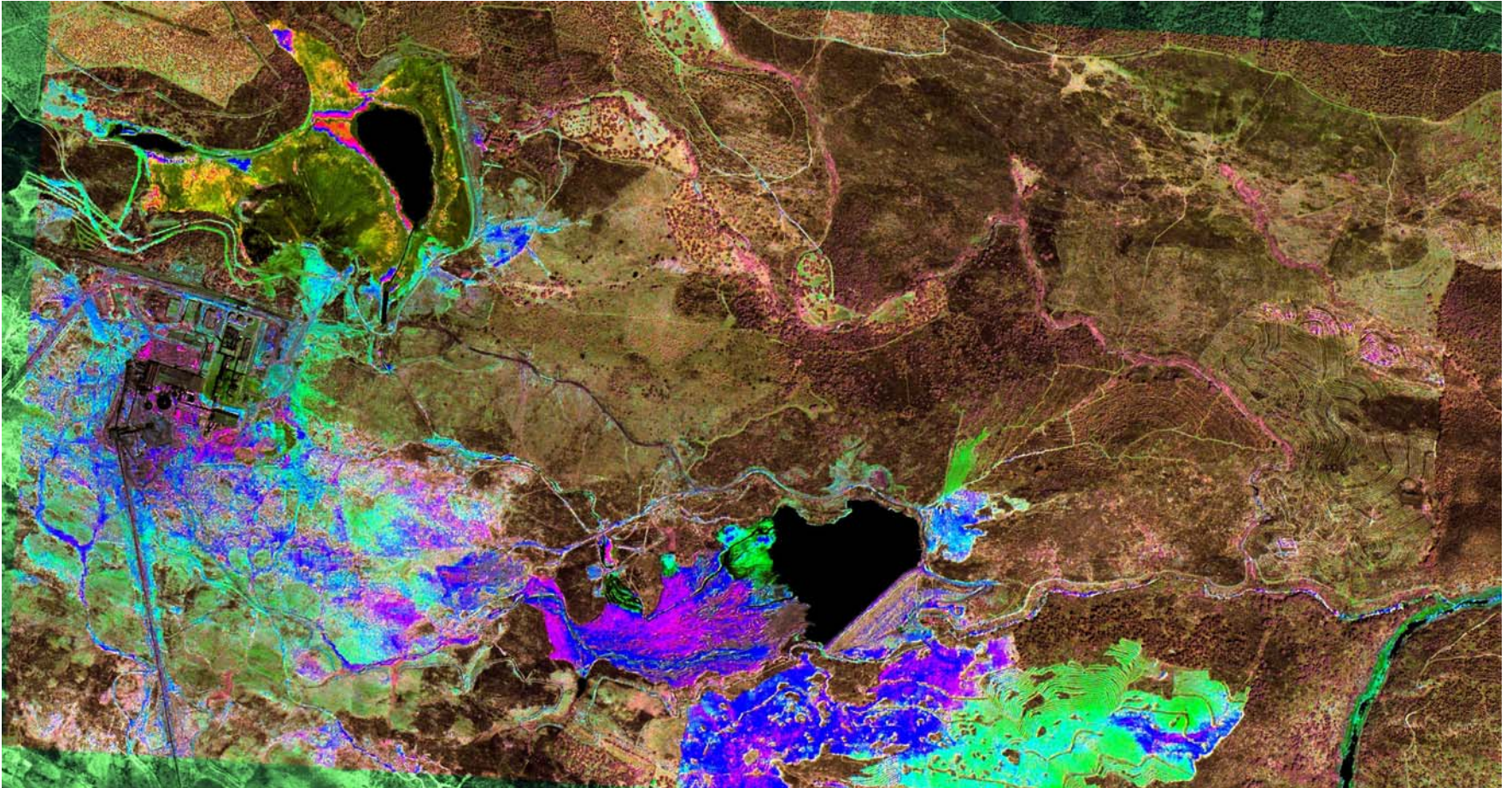
Surface: 28,9 hm² / Volume: ~ 2,7 hm³

SULPHIDE TAILING DAM

Surface: 26,1 m² / Volume: ~ 2,5 hm³

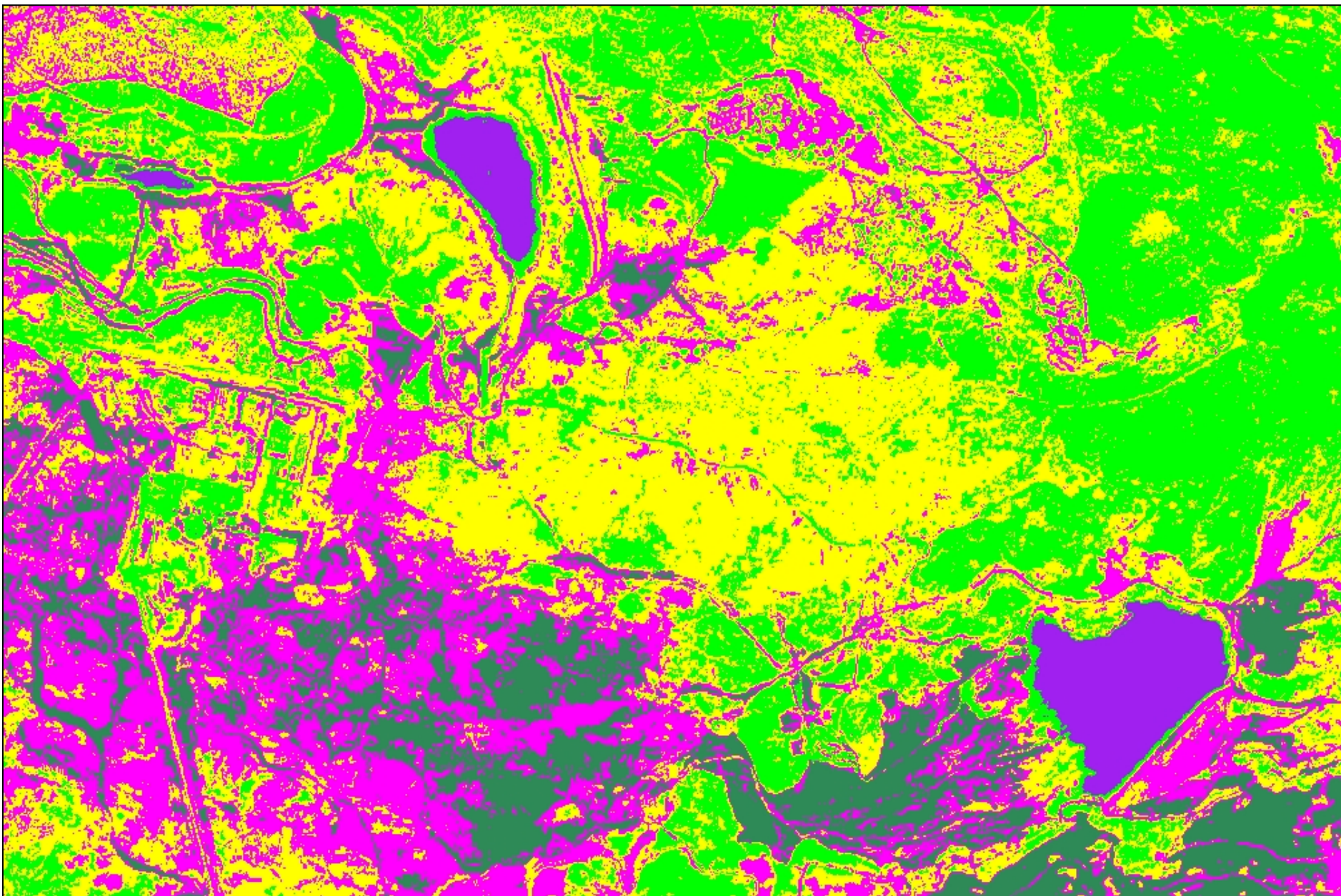
Normalized Difference Vegetation Index (NDVI) after QuickBirdTM image (2005)

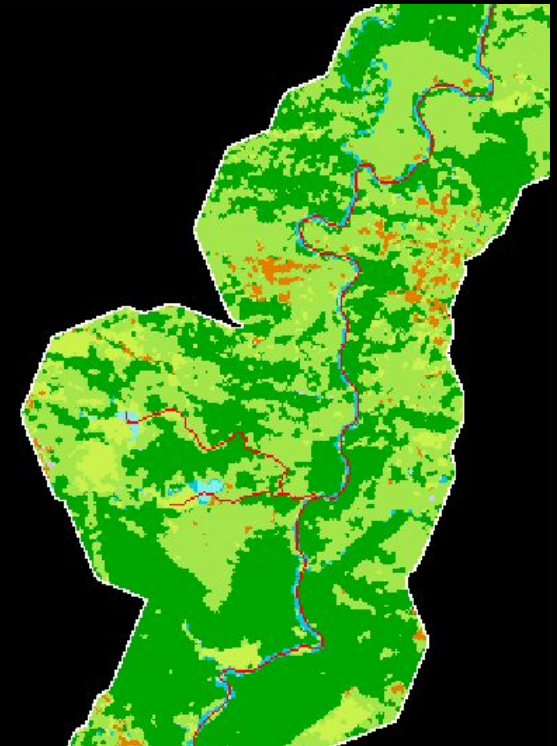
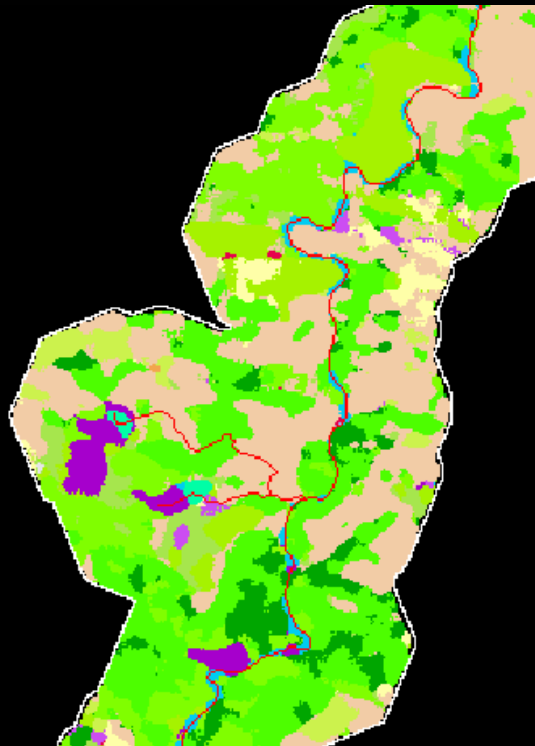
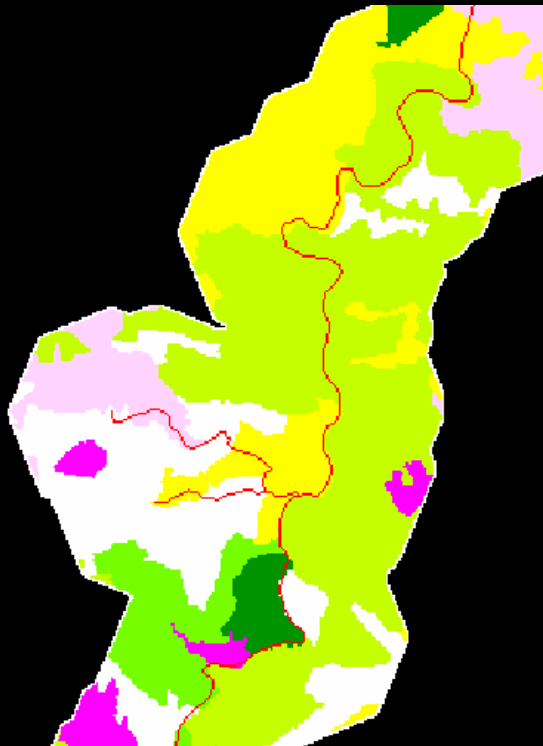




Detail of the Almagrera mining area with MNF factors 214. Pixel=0.6m

Unsupervised ISODATA classification





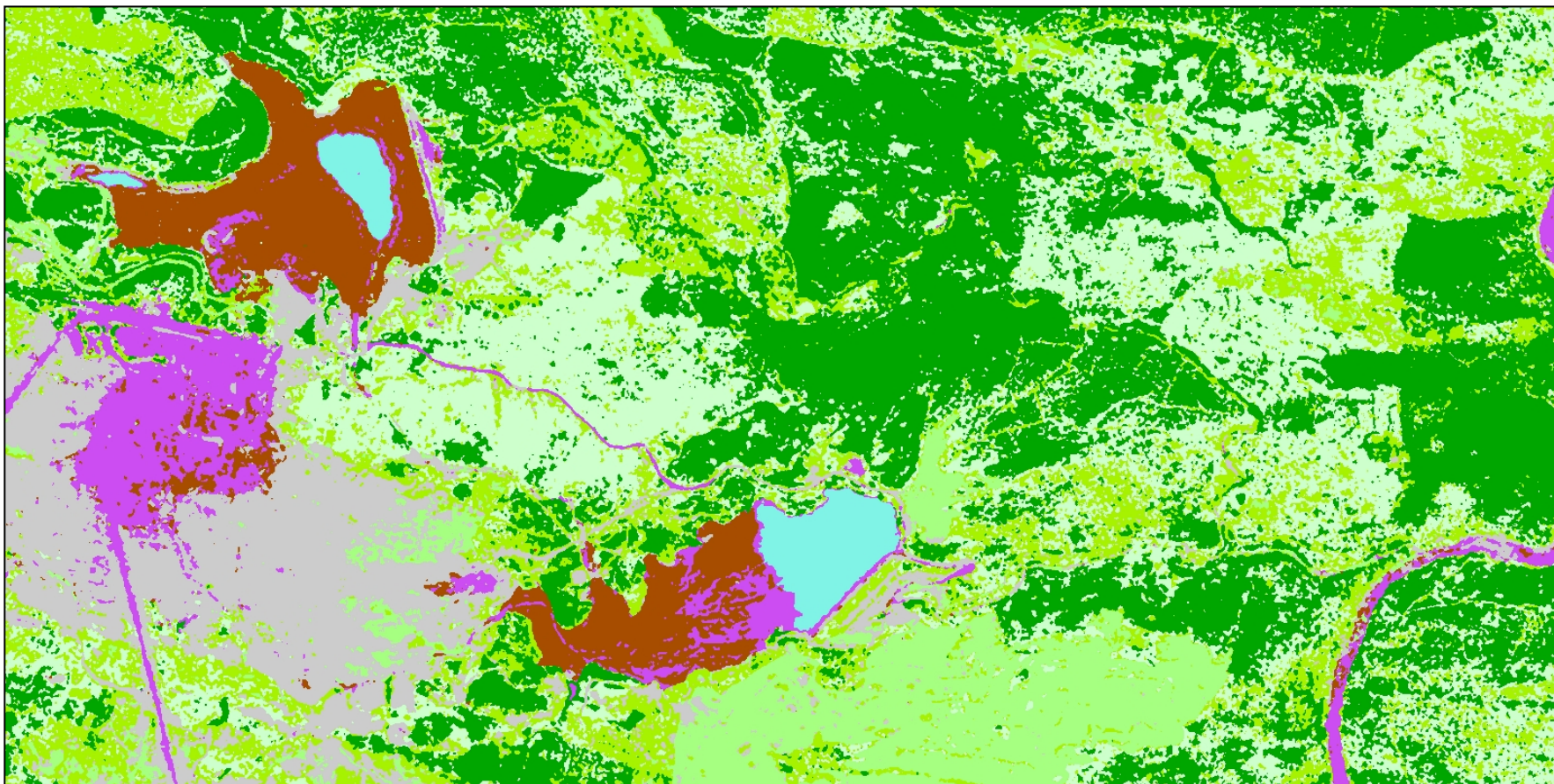
Land Cover of Almagrera mining area (left) in CLC 2000 Map; (center) after supervised classification using CLC nomenclature; and (right) after sharpening and combining classes in function of roughness index.

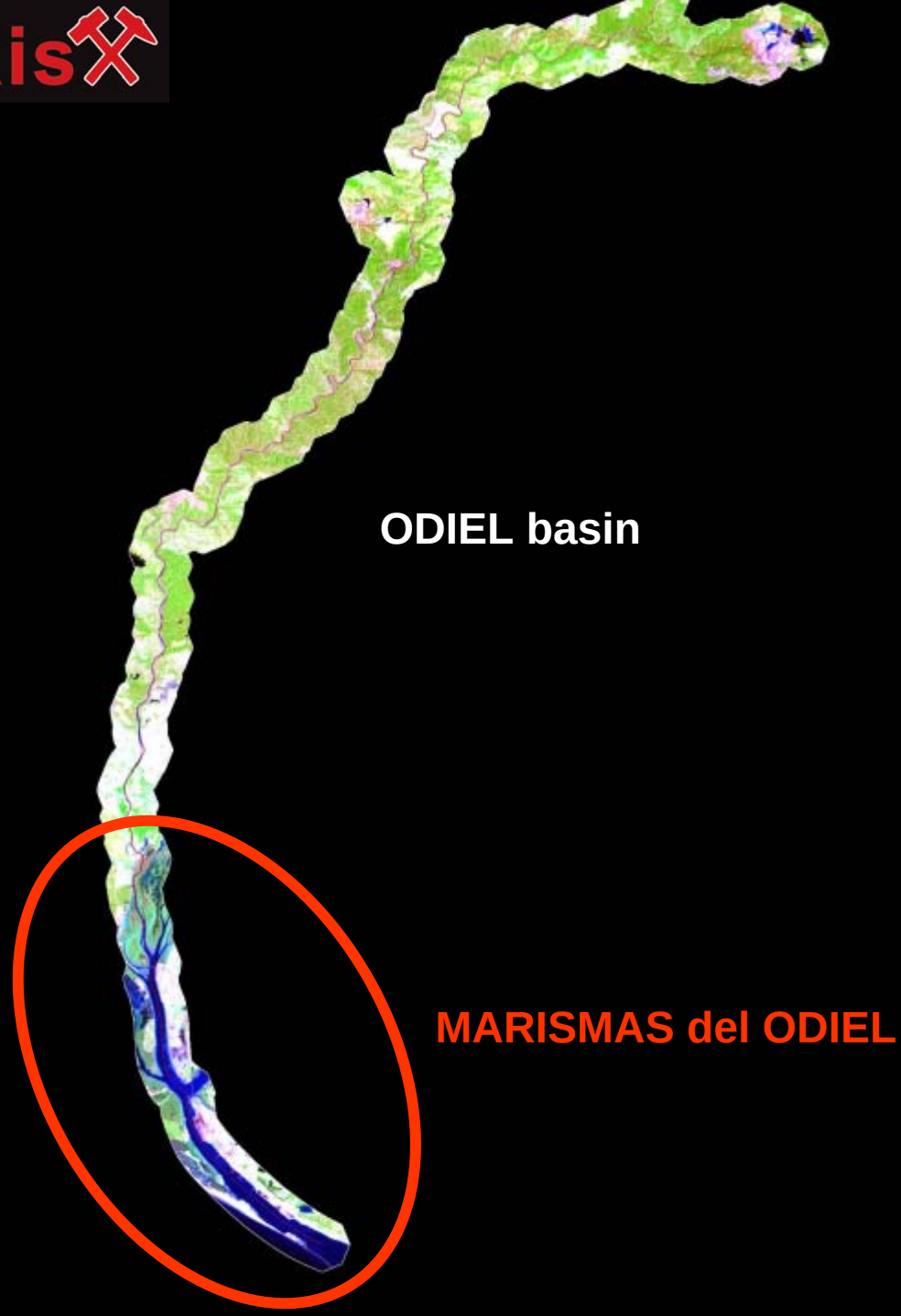
ALMAGRERA

Supervised classification (maximum likelihood)

CORINE Land Cover Legend

121	Industrial or commercial units
132	Dump sites
312	Coniferous forest
322	Moors and heathland
324	Transitional woodland-shrub
332	Bare rocks
333	Sparsely vegetated areas
512	Water bodies

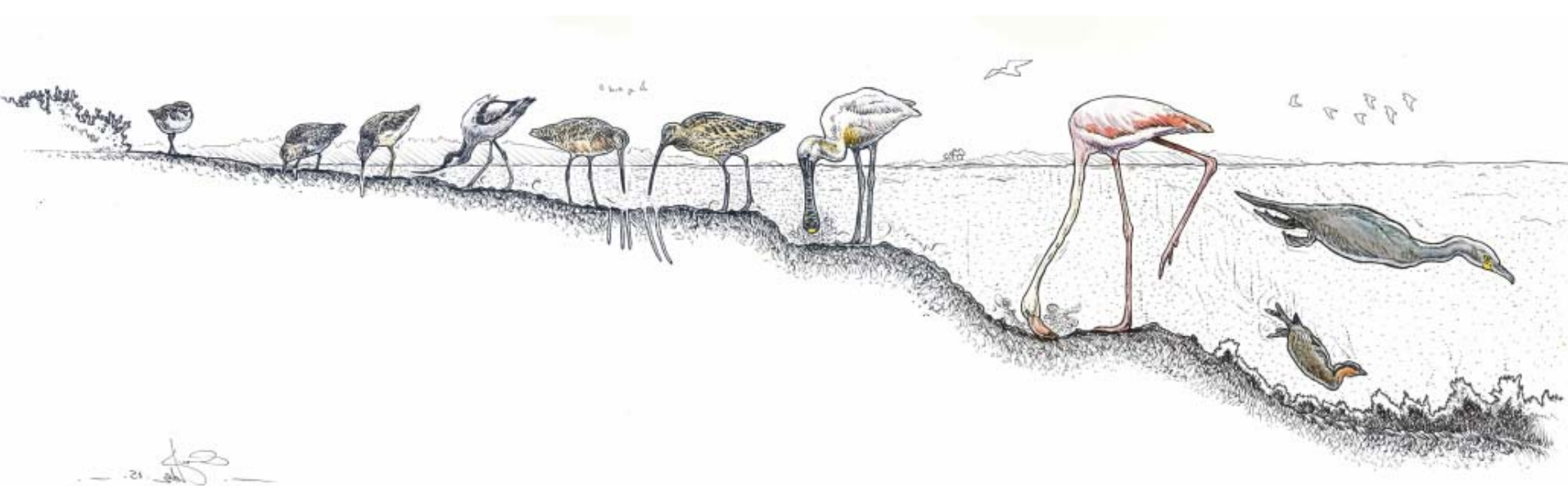
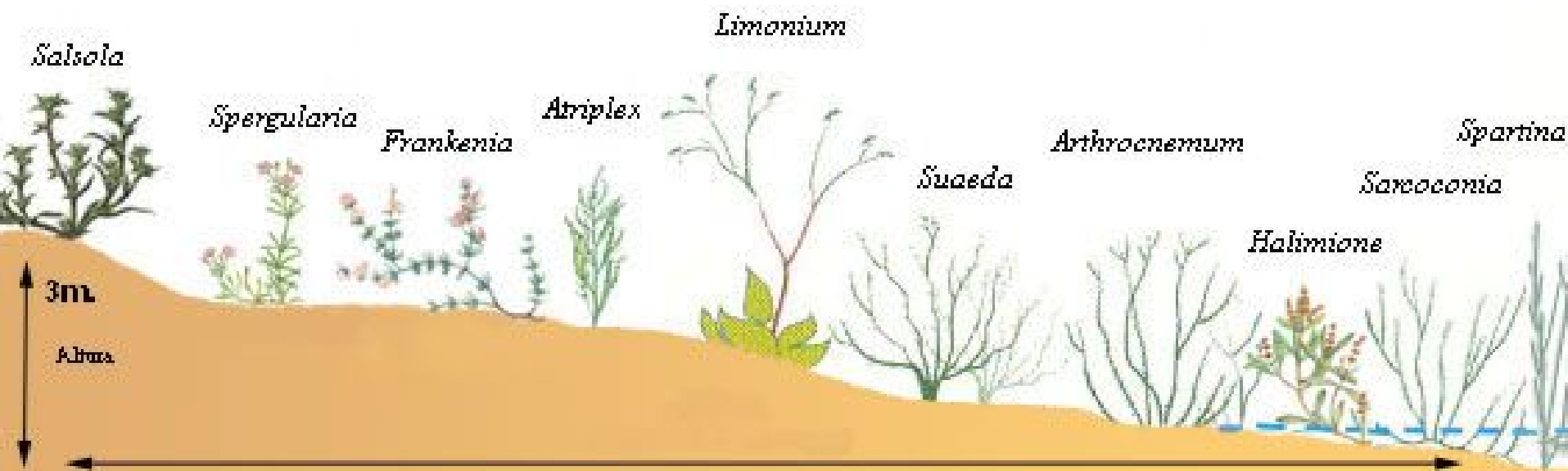




Spanish Test Sites: Wetland area







HABITATS OF COMUNITARIAN INTEREST



1150



2270



2250



2120



2110



1320



1220



1420



1140

30m

15m

10m

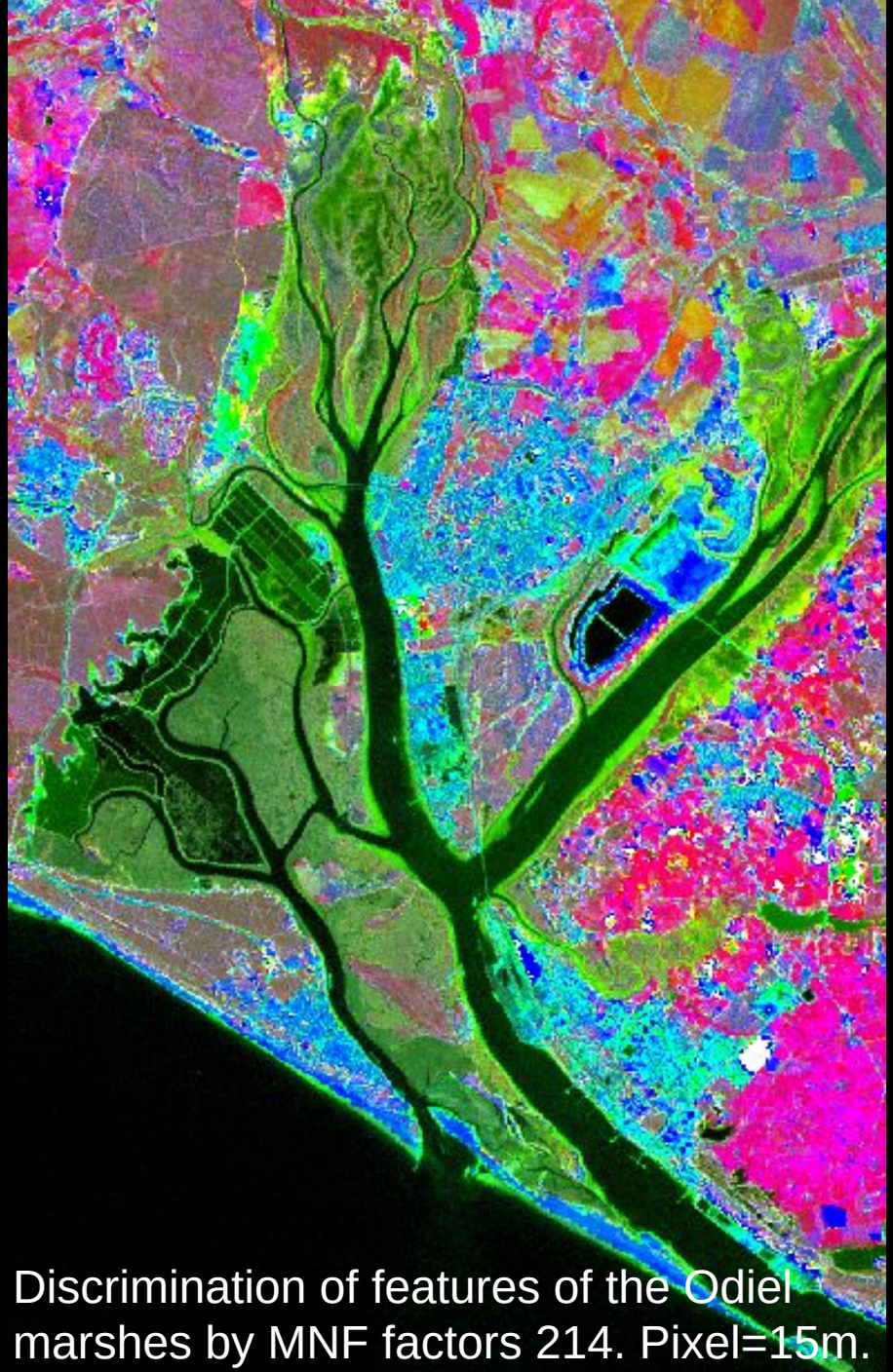
2.5m

0.7m





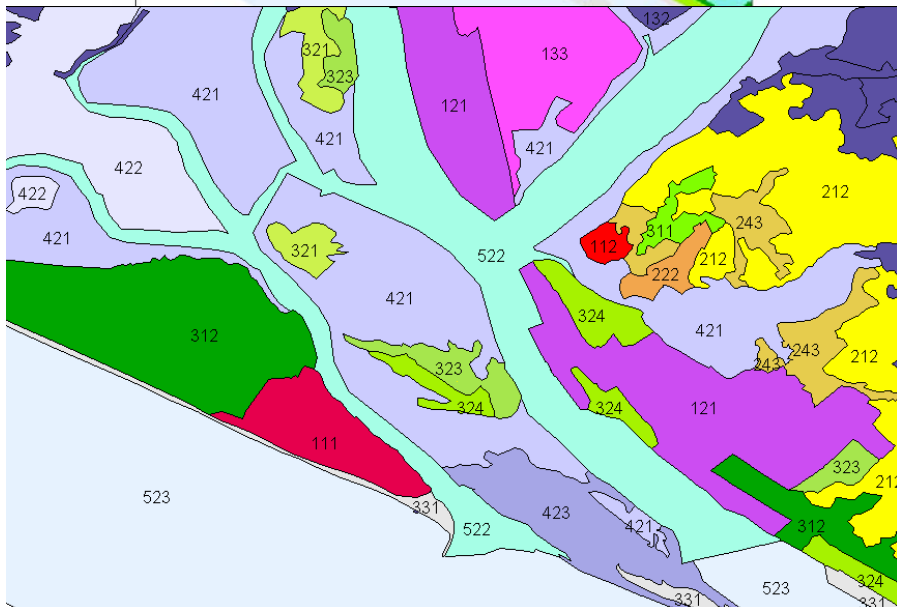
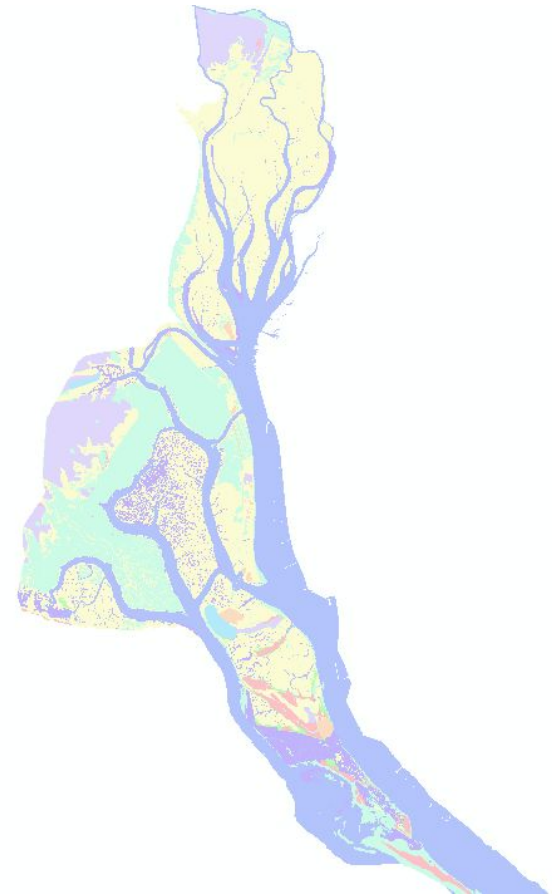
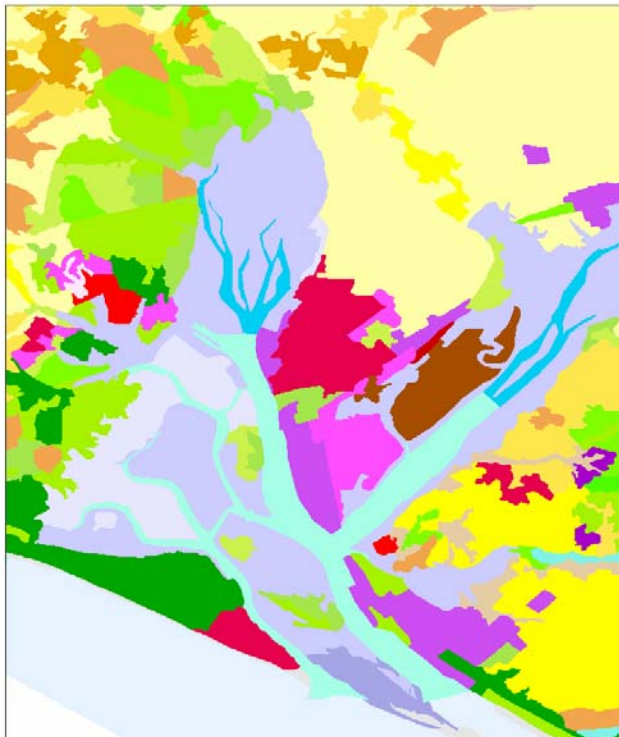
Border of wetland area on
a SPOT false colour image



Discrimination of features of the Odiel
marshes by MNF factors 214. Pixel=15m.

Unsupervised classification (ISODATA)





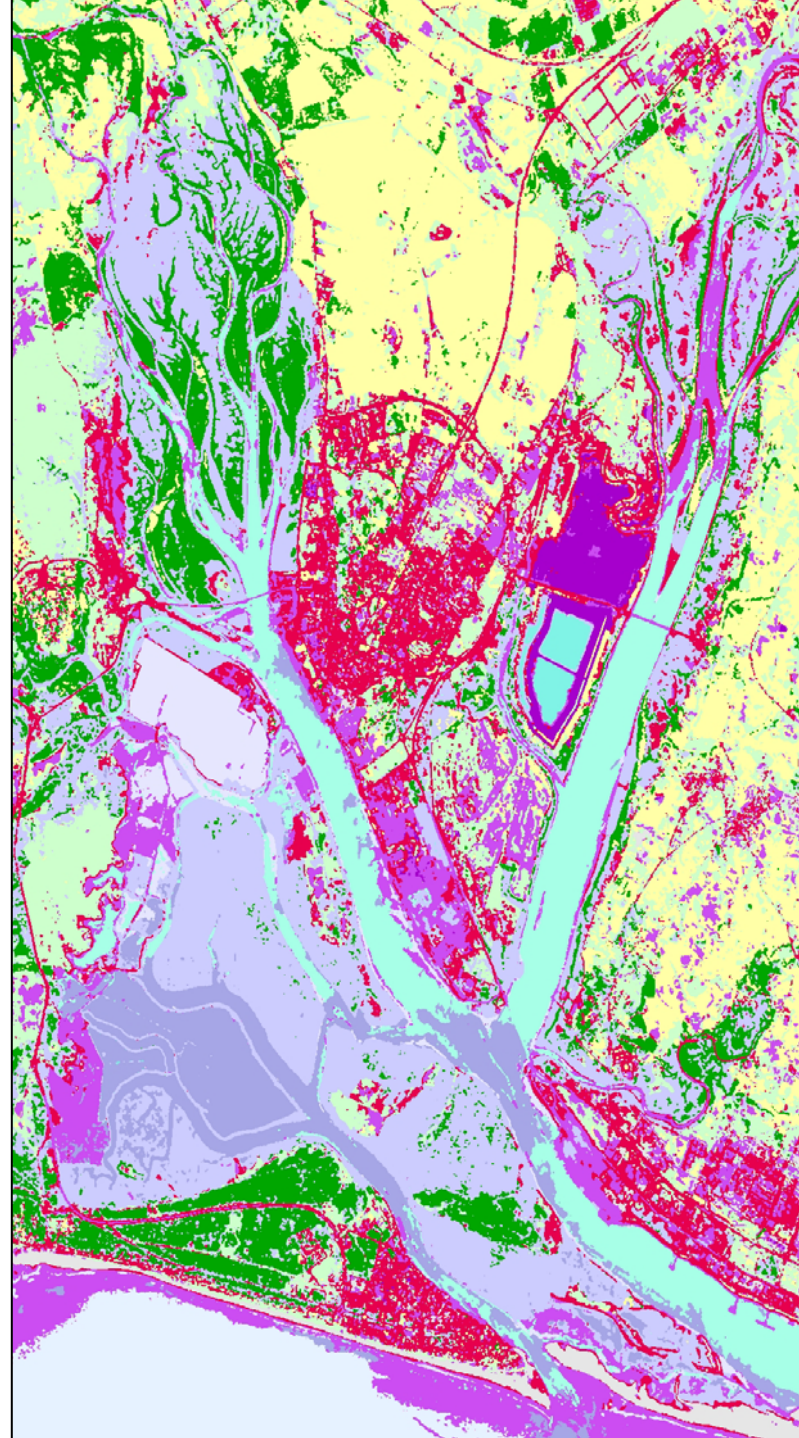
- Comunidades matorrales y herbáceas sobre arenas
- Cultivos
- Formación de arbolado sobre sustrato arenoso
- Marisma alta
- Marisma baja
- Marisma degradada
- Red de drenaje
- Vegetación glicófila
- Vegetación perimarisméfila
- Zonas sin vegetación

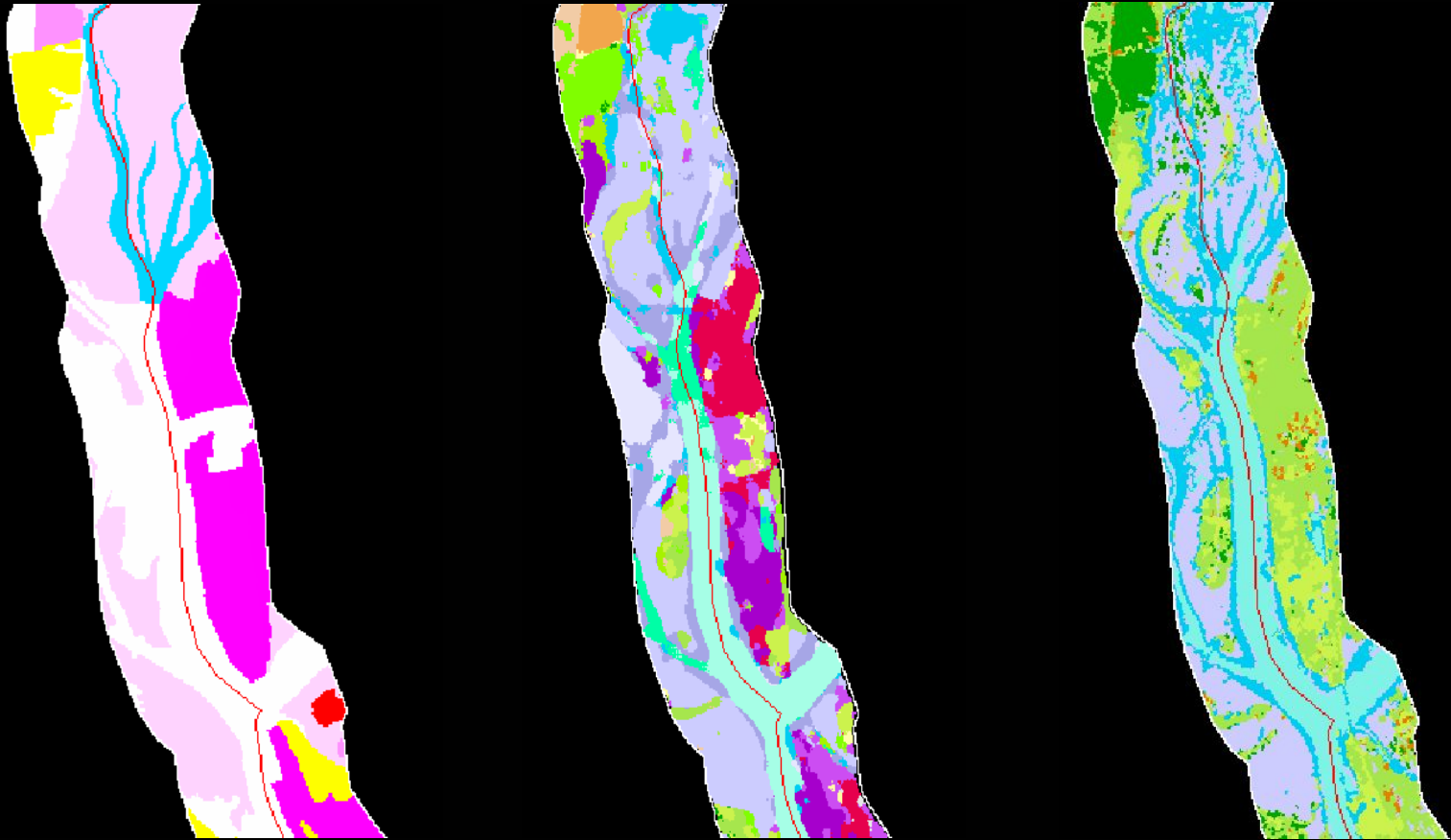
MARISMAS DEL ODIEL

Supervised classification (maximum likelihood)

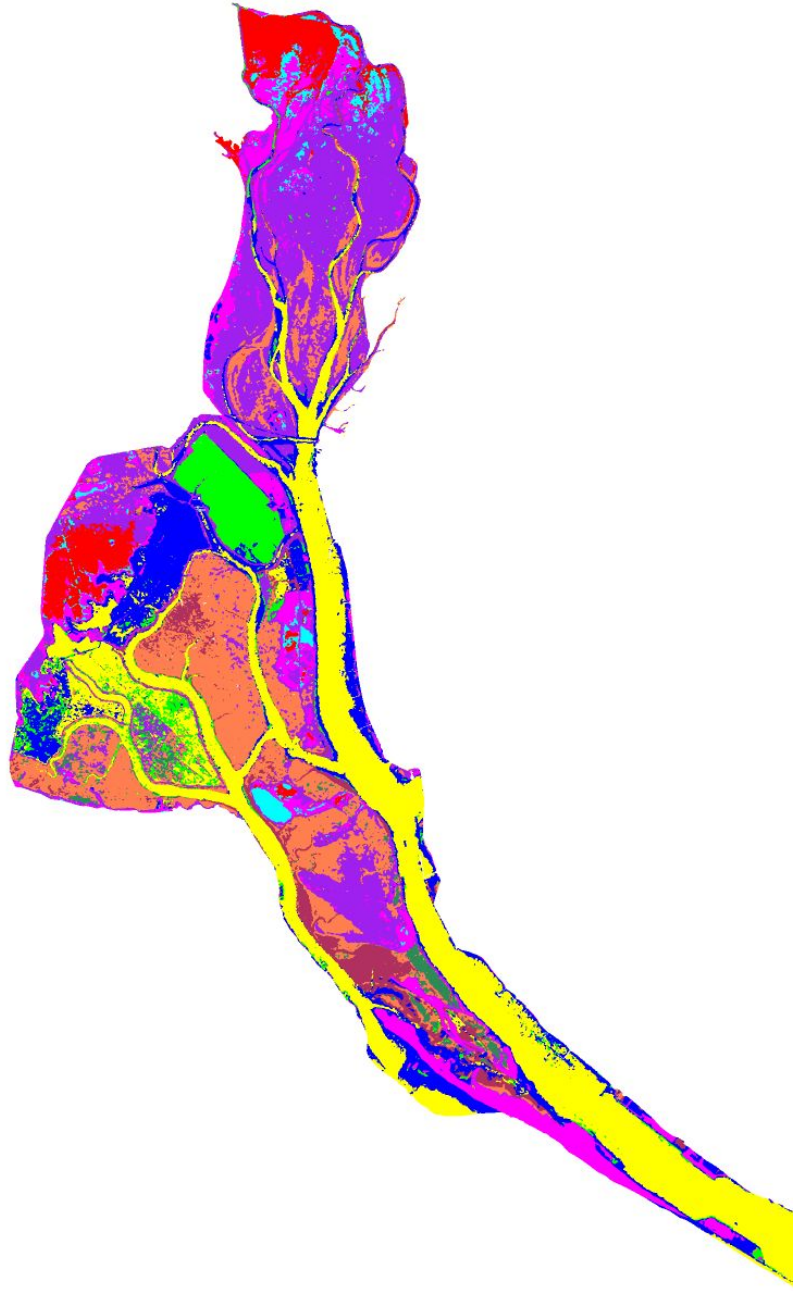
CORINE Land Cover Legend

111	Continuous urban fabric
121	Industrial or commercial fabric
131	Mineral extraction sites
211	Non-irrigated arable land
312	Coniferous forest
331	Beaches, dunes, sands
333	Sparsely vegetated areas
421	Salt marshes
422	Salines
423	Intertidal flats
512	Water bodies
522	Estuaries
523	Sea and ocean

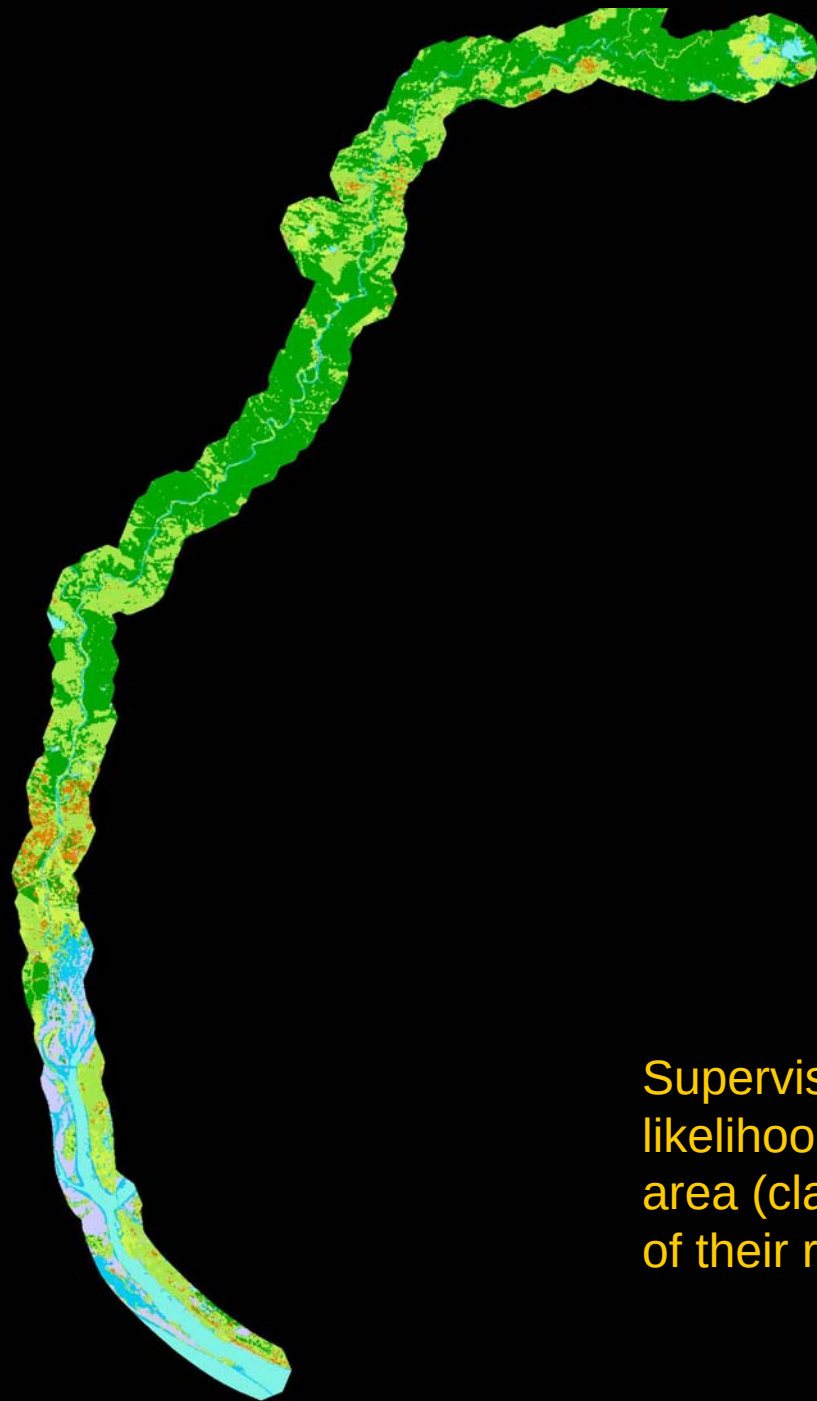




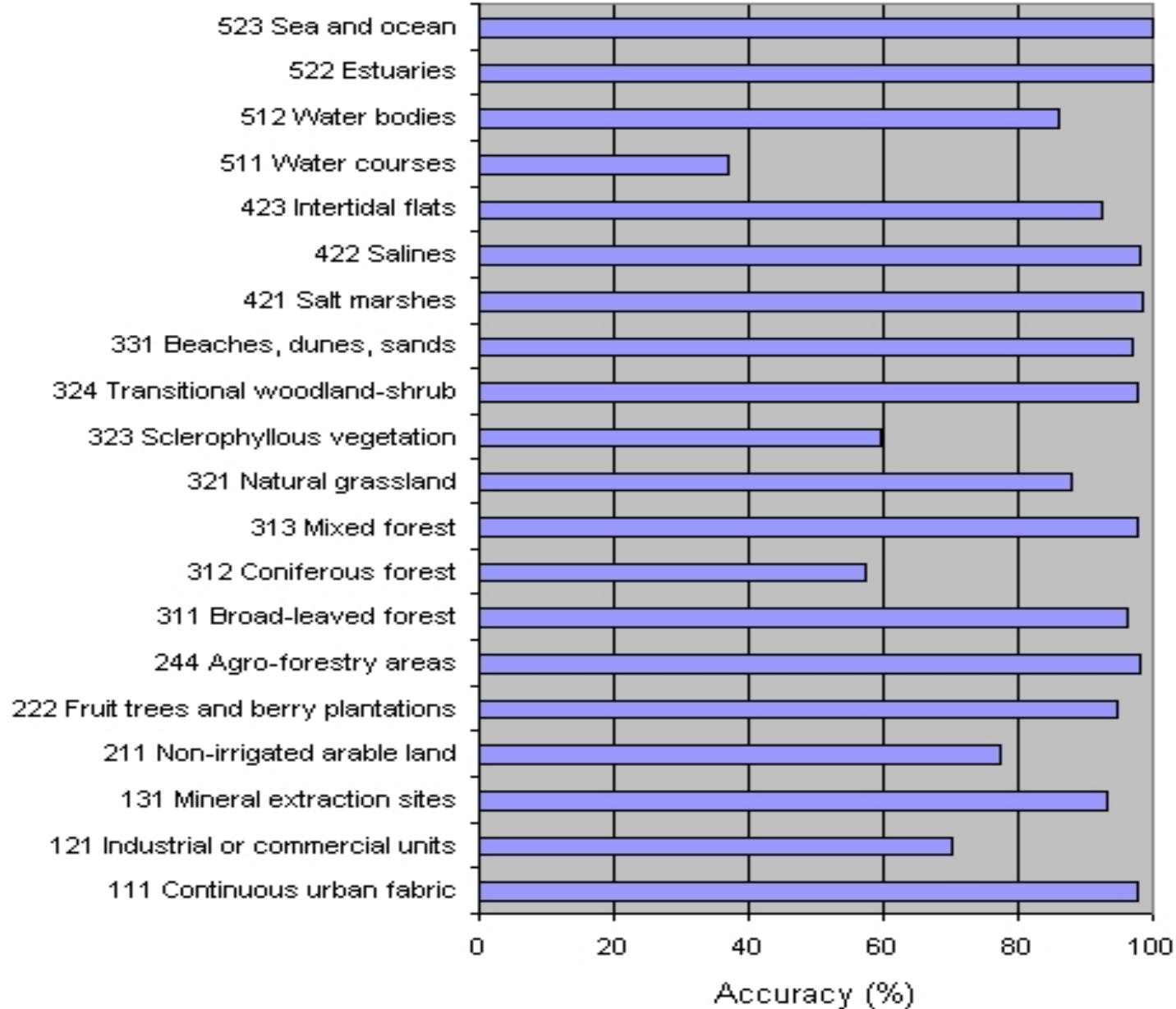
Land Cover of Wetland area (left) in CLC2000 Map; (center) after supervised classification using CLC nomenclature; and (right) after sharpening and combining classes in function of roughness index



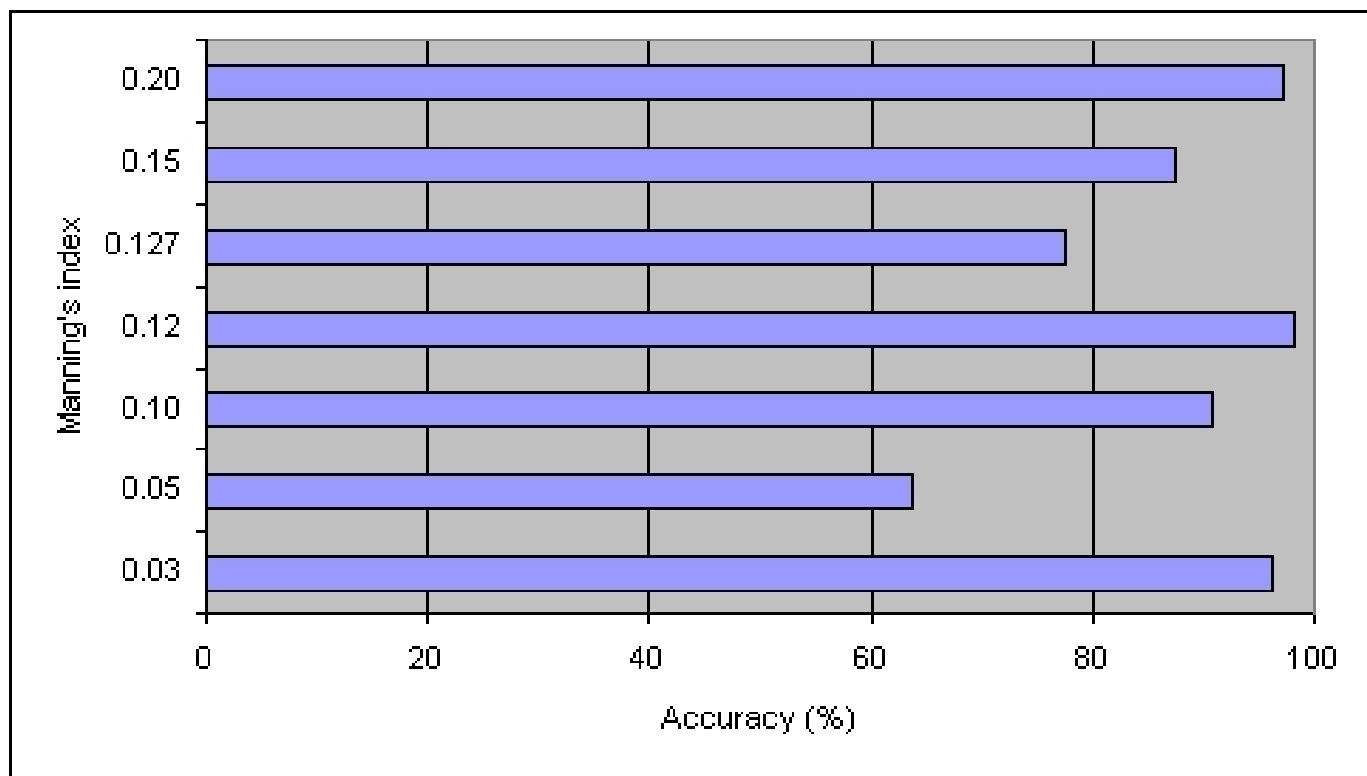
- Limite Odiel Natural Park
- Comunidades matorrales y herbáceas so
- Cultivos
- Formación de arbolado sobre sustrato arc
- Marisma alta
- Marisma baja
- Marisma degradada
- Red de drenaje
- Vegetación glicófila
- Vegetación perimarismeña
- Zonas sin vegetación

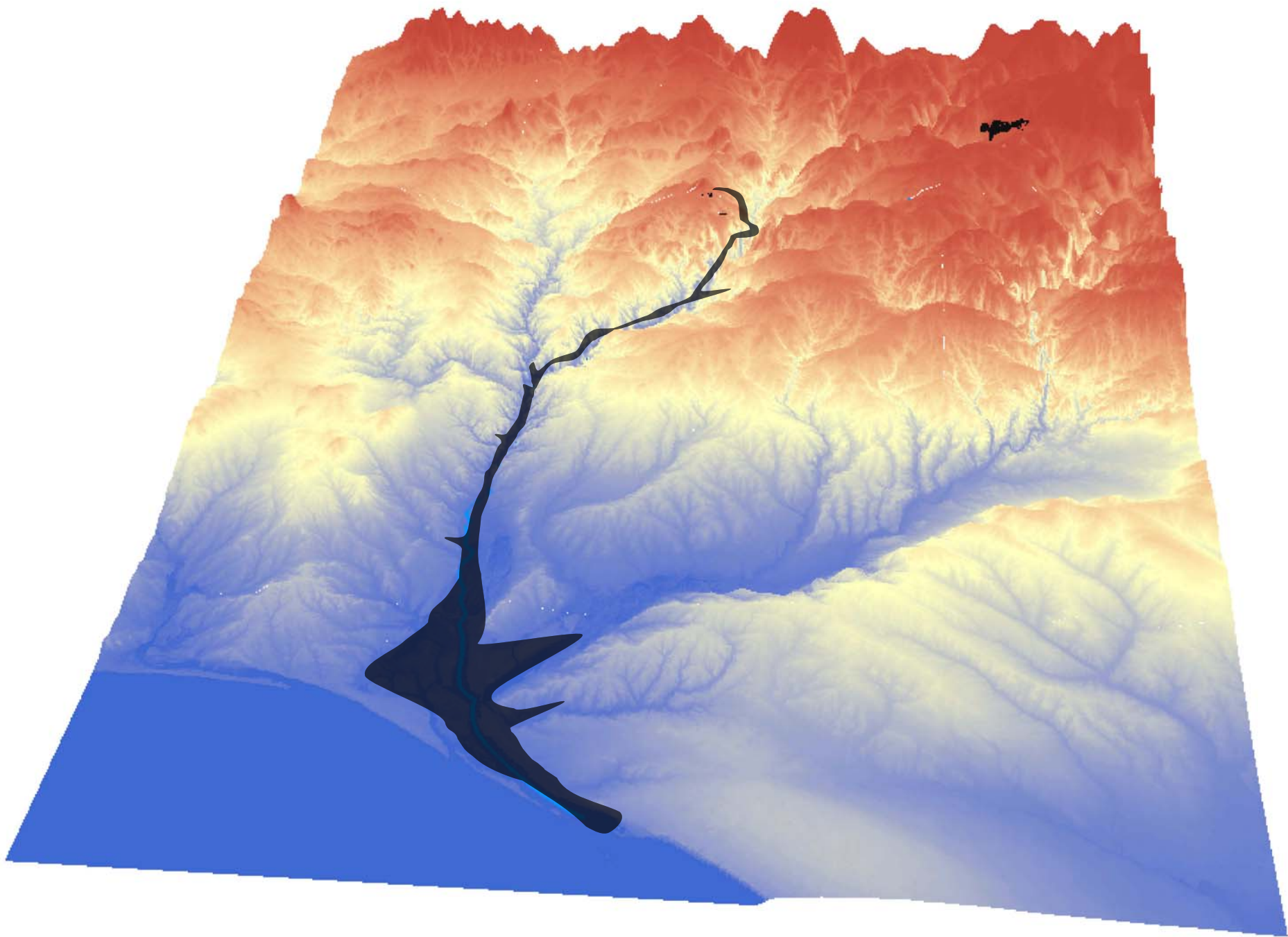


Supervised classification (maximum likelihood) of downstream discharge area (classes are combined in function of their roughness index)



Manning' index	0,03	0,05	0,1	0,12	0,127	0,15	0,2	Commission error
0,03	96,22	15,17	0,00	0,28	0,00	0,00	0,00	7,48
0,05	0,03	63,77	0,05	0,83	0,00	0,00	0,21	3,72
0,1	0,51	0,54	90,74	0,00	3,62	0,23	0,43	6,15
0,12	2,64	12,49	0,00	98,19	0,09	0,00	0,03	9,49
0,127	0,00	0,11	0,00	0,00	77,39	0,19	1,82	14,87
0,15	0,27	1,55	8,19	0,00	4,06	87,36	0,21	8,58
0,2	0,21	5,73	0,75	0,68	14,84	12,22	97,25	8,27
Unclassified	0,13	0,64	0,27	0,03	0,00	0,00	0,05	
Omission error	3,78	36,23	9,26	1,81	22,64	12,64	2,75	







Muchas gracias