



II Jornada en Innovación en la Cartografía e Inventarios de Recursos Forestales

19 y 20 de mayo
2020

SOSO

Interactúa con
[#innovacioncartografia](#)

Organizan



Cofinancia

competitividad
empresarial





Caracterización hiperespectral y fenológica de pastizales y humedales

Del modelado espacial a mapear lo inmapeable



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Interactúa con
#innovacioncartografia

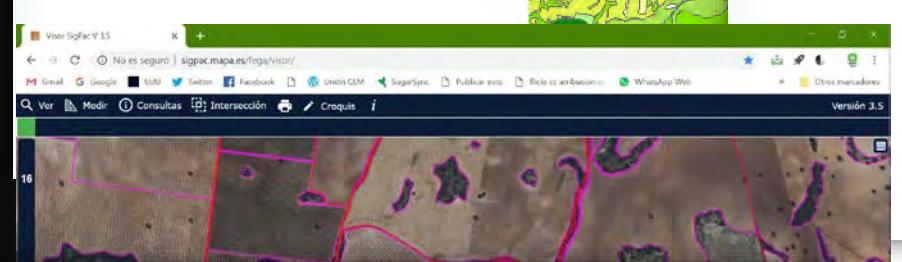
Organizan



Cofinancia

competitividad
empresarial

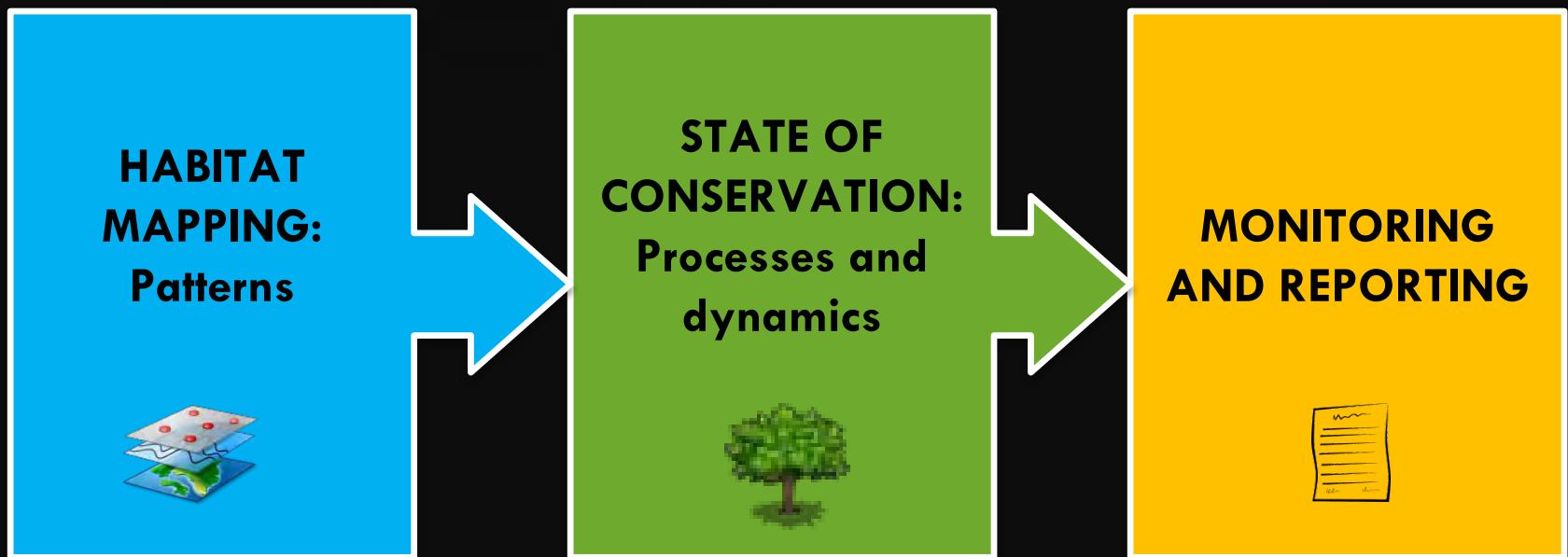




Towards CLC+
Conceptual design and product outlines

Geoff Smith
EAGLE
Land Monitoring in Europe

Copernicus European Commission European Environment Agency





GOBIERNO
DE ESPAÑA

VICEPRESIDENCIA
CUARTA DEL GOBIERNO
MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO

#ESTE
VIRUS
**LO
PARAMOS
UNIDOS**

Bienvenidos • Benvinguts • Benvidos • Ongi etorri • Benvinguts • Welcome • Bienvenues



Ministerio

Áreas de actividad

Participación pública

Cartografía y SIG

Estadísticas

Sede electrónica

Sala de prensa

Temas

Conservación de la Biodiversidad

Espacios protegidos

Ecosistemas y conectividad

Conservación de especies

Inventarios nacionales

Recursos genéticos

Días mundiales y fechas destacadas

Servicios

Ayudas y subvenciones

Campañas

Estadísticas

Formación, congresos y jornadas

Legislación

Organismos y organizaciones

Participación pública

Planes y estrategias

Proyectos de cooperación

Publicaciones y documentación

Metodologías para el seguimiento del estado de conservación de los tipos de hábitat



Roquedos, pedregales y glaciares

Cuevas

Pastizales

Bosques y matorrales no fluviales

Bosques y matorrales de ribera

Ríos

Formaciones tobáceas

Lagos, lagunas y humedales de interior

Turberas

Ecosistemas costeros

Novedades



Listas patrón
El MAPAMA establece las Listas Patrón de las especies terrestres y marinas y de los hábitats terrestres...

+info



Preguntas frecuentes...

Acceso a los recursos genéticos y reparto de beneficios

+info

Noticias sobre Biodiversidad

28/02/2020

Finaliza con éxito el primer operativo realizado en España contra el tráfico internacional de maderas

14/02/2020

La COP13 del Convenio de Conservación de Especies Migratorias abordará la inclusión de 10 nuevas especies para las que es necesario reforzar su protección

https://www.miteco.gob.es/es/biodiversidad/temas/ecosistemas-y-conectividad/Seguimiento_habitats_metodologia.aspx



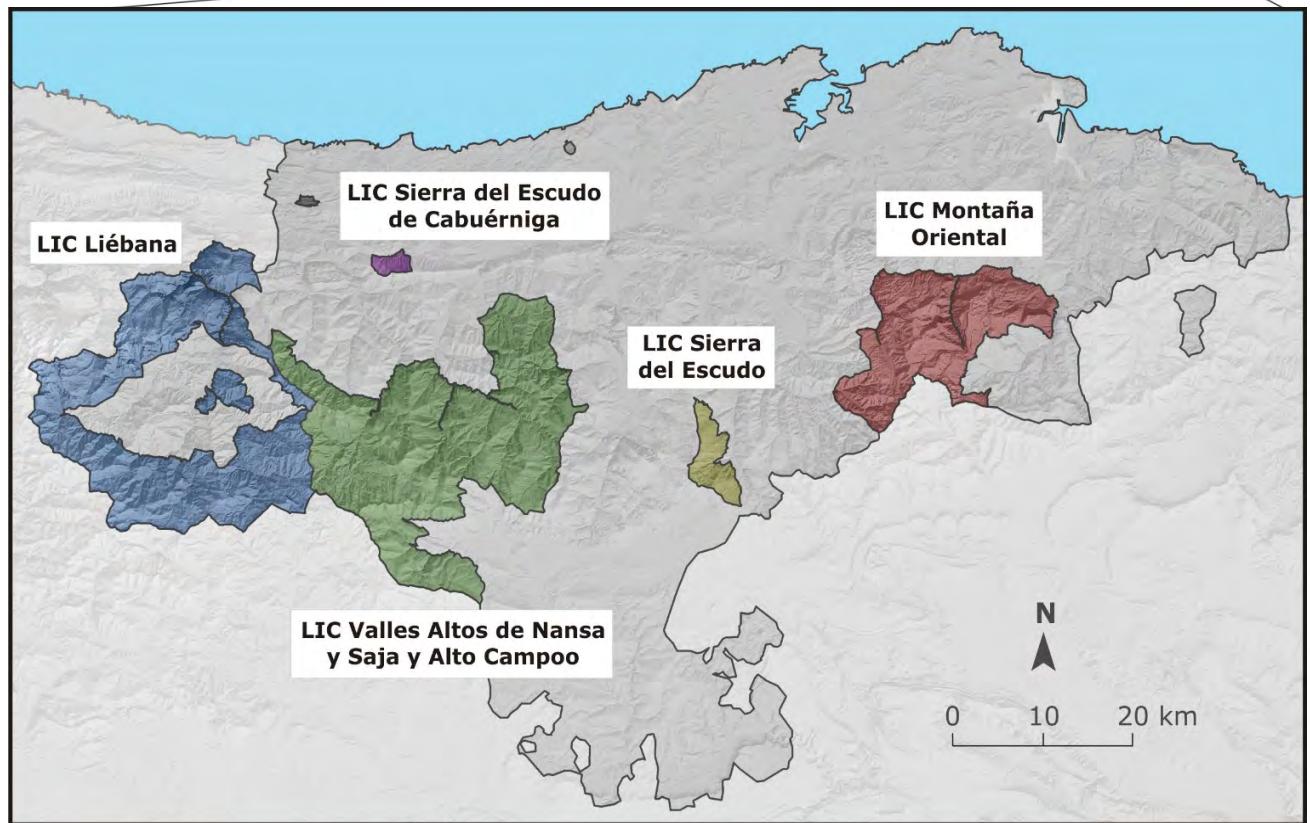
Management plan
Art. 17 reporting

↓ Annex I

- 1. Spatial distribution
- 2. Conservation Status
- 3. Management Plan-Local actions

Mapping broad-scale vegetation patterns in complex mountainous territories

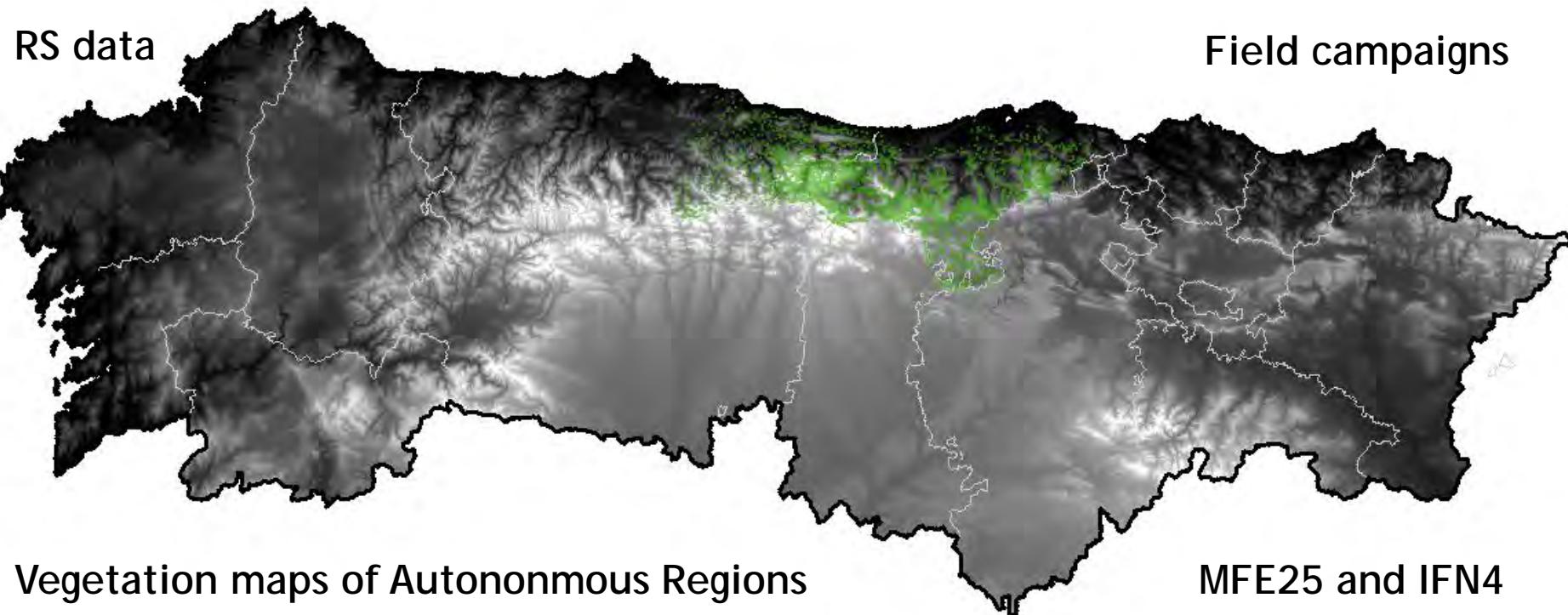
Habitat maps using modelling techniques across Natura 2000 Network in Cantabria (NW Spain)
26% of the whole region



Data for **mapping at the biogeographical region level**
Different data quality → **homogenization** at the UENIS level

RS data

Field campaigns



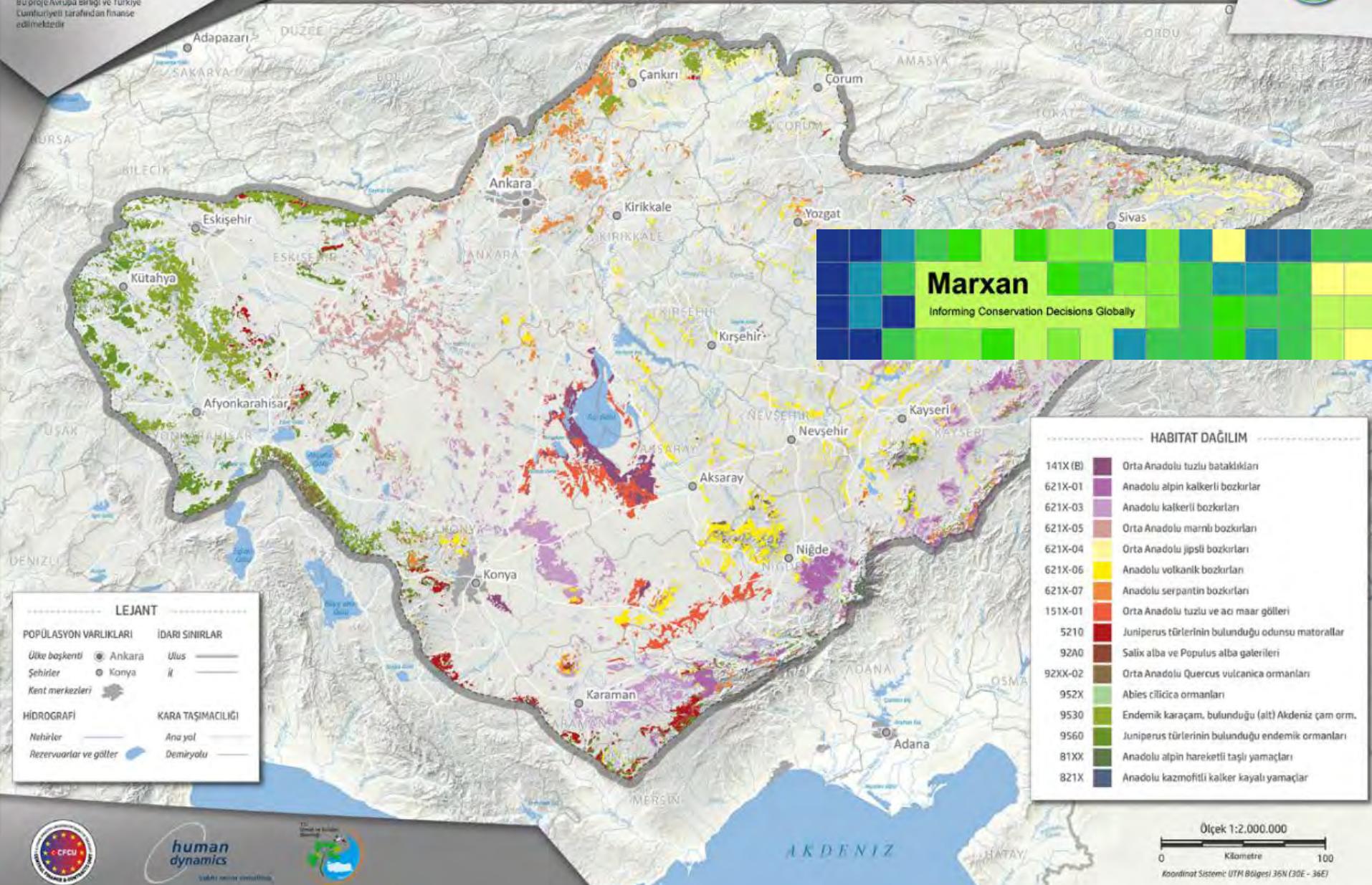
Extrapolation of EUNIS types to the whole region in not sampled areas
Assumption of **similar communities** at the biogeographical level



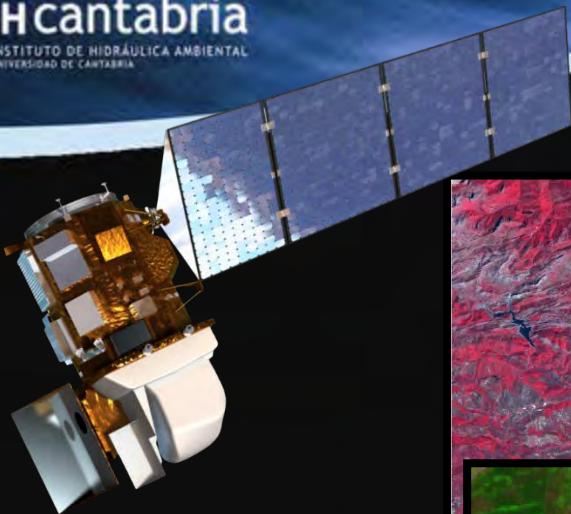
Bu proje Avrupa Birliği ve Türkiye Cumhuriyeti tarafından finanse edilmektedir



Habitat dağılım haritası



Extrapolating samples using digital data



Remote Sensing (RS)

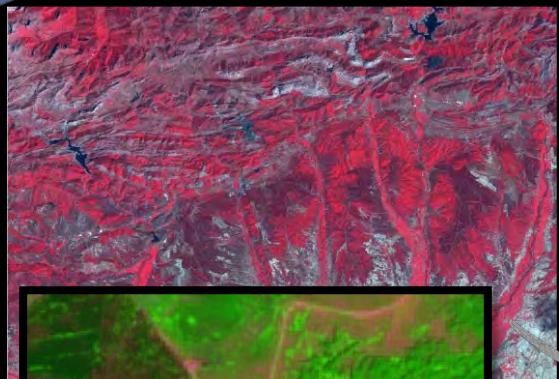
Satellite imagery: Landsat,
Sentinel 1and 2, Deimos (m)
Hyperion, Chris-Proba (h*)

LiDAR and SAR data

Derived indicators,
different resolution

Env. limiting factors

Topo, clima, soil prop.

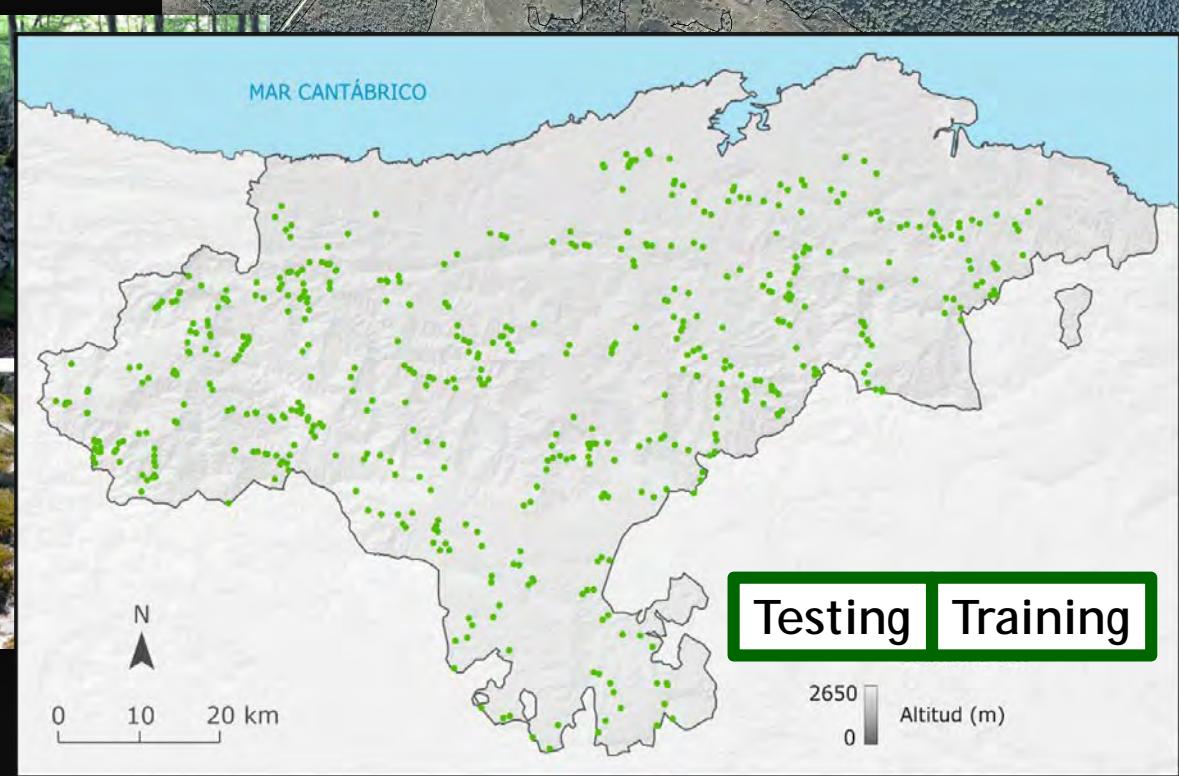
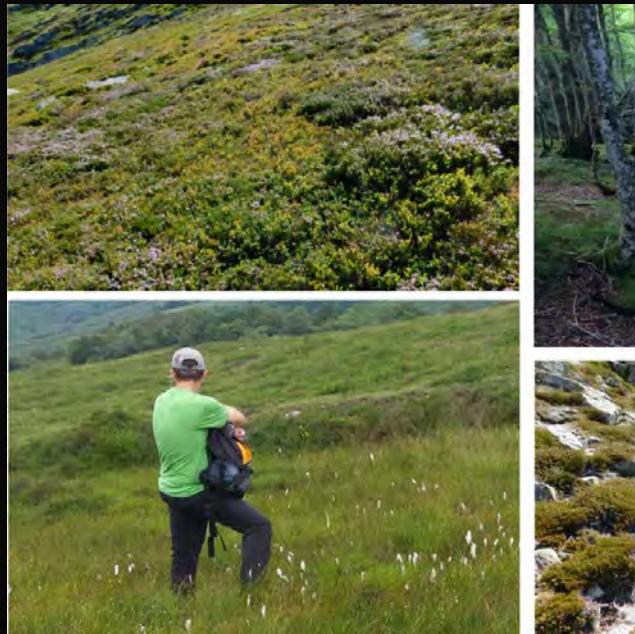


Field campaigns with expert criteria

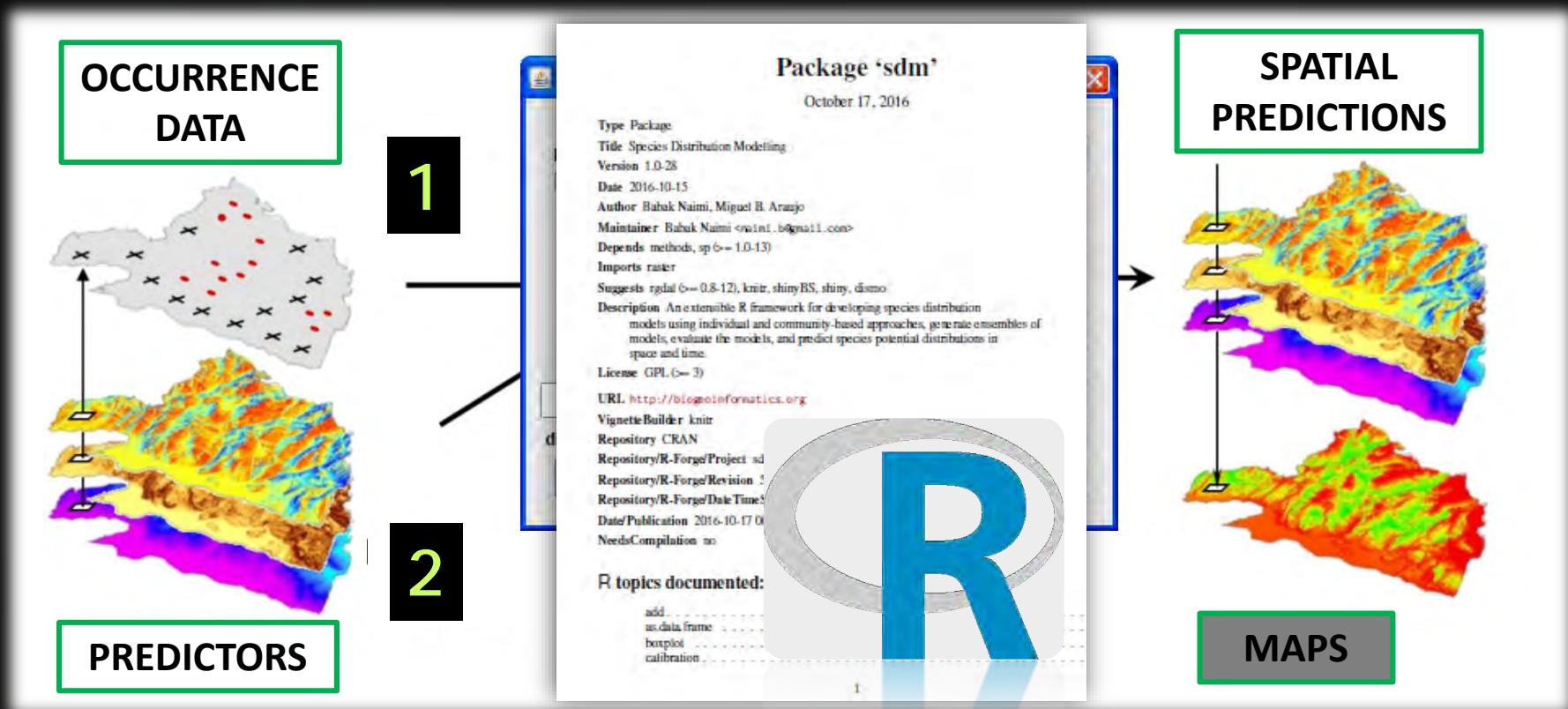
F4.22

- EUNIS (level 1): Heathland, scrub and tundra
EUNIS (level 2): Temperate shrub heathland
EUNIS (level 3): Dry heaths
EUNIS (level 4): Sub-Atlantic [Calluna] - [Genista] heaths F4.22

HABITATS DIRECTIVE ANNEX I: 4030-EU dry heathlands



A statistical method or modelling algorithm for habitat mapping that relates occurrence data and the process-based environmental and RS predictors



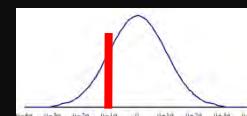
MaxEnt: SWD format, Tuning parameters, Phillips et al (2006)

SDM: Multiple algorithms, Bootstrapping, Naimi and Araújo (2016)



E 1:50 000

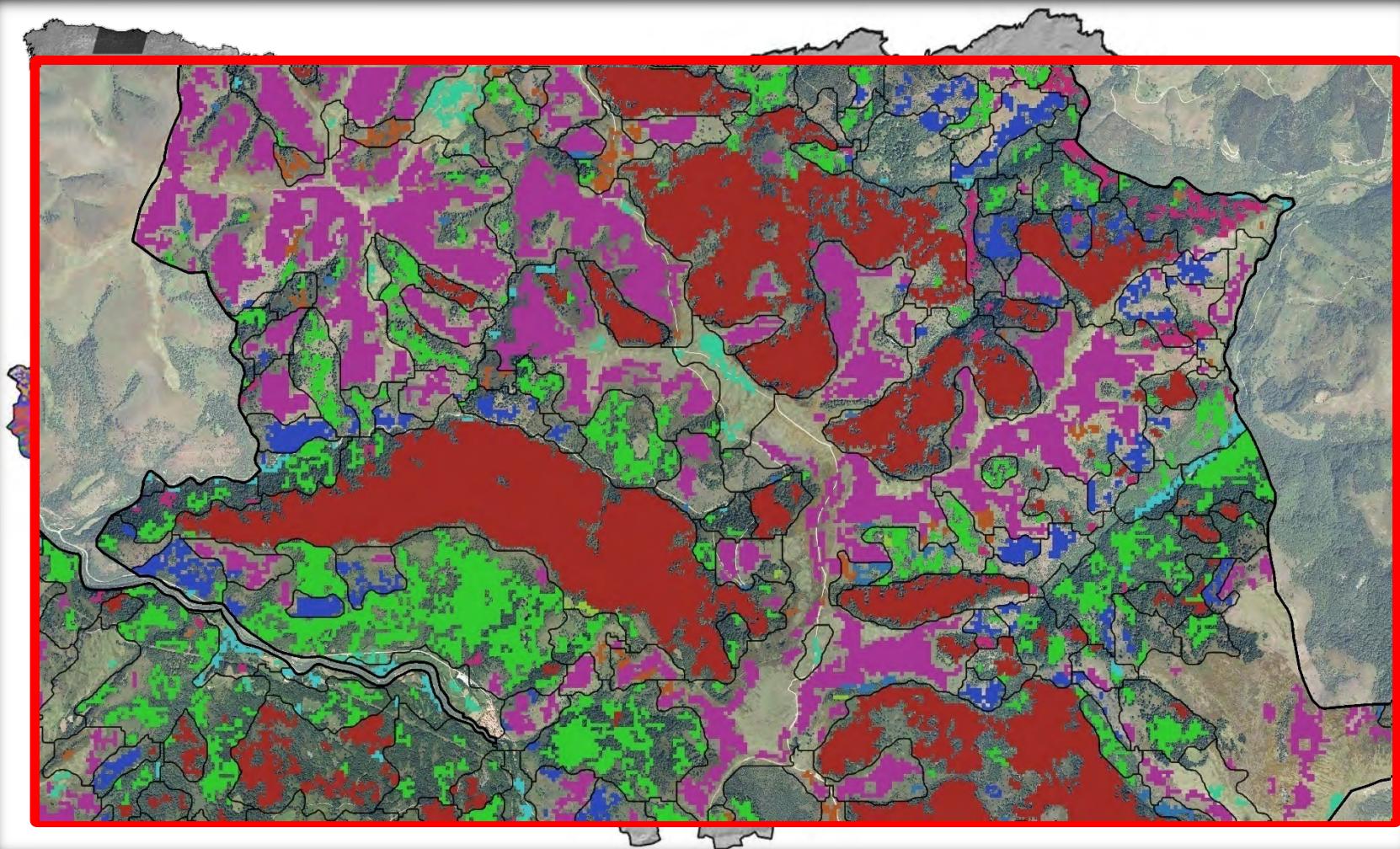
Local AOO



0

1

Local AOO (vegegation) maps



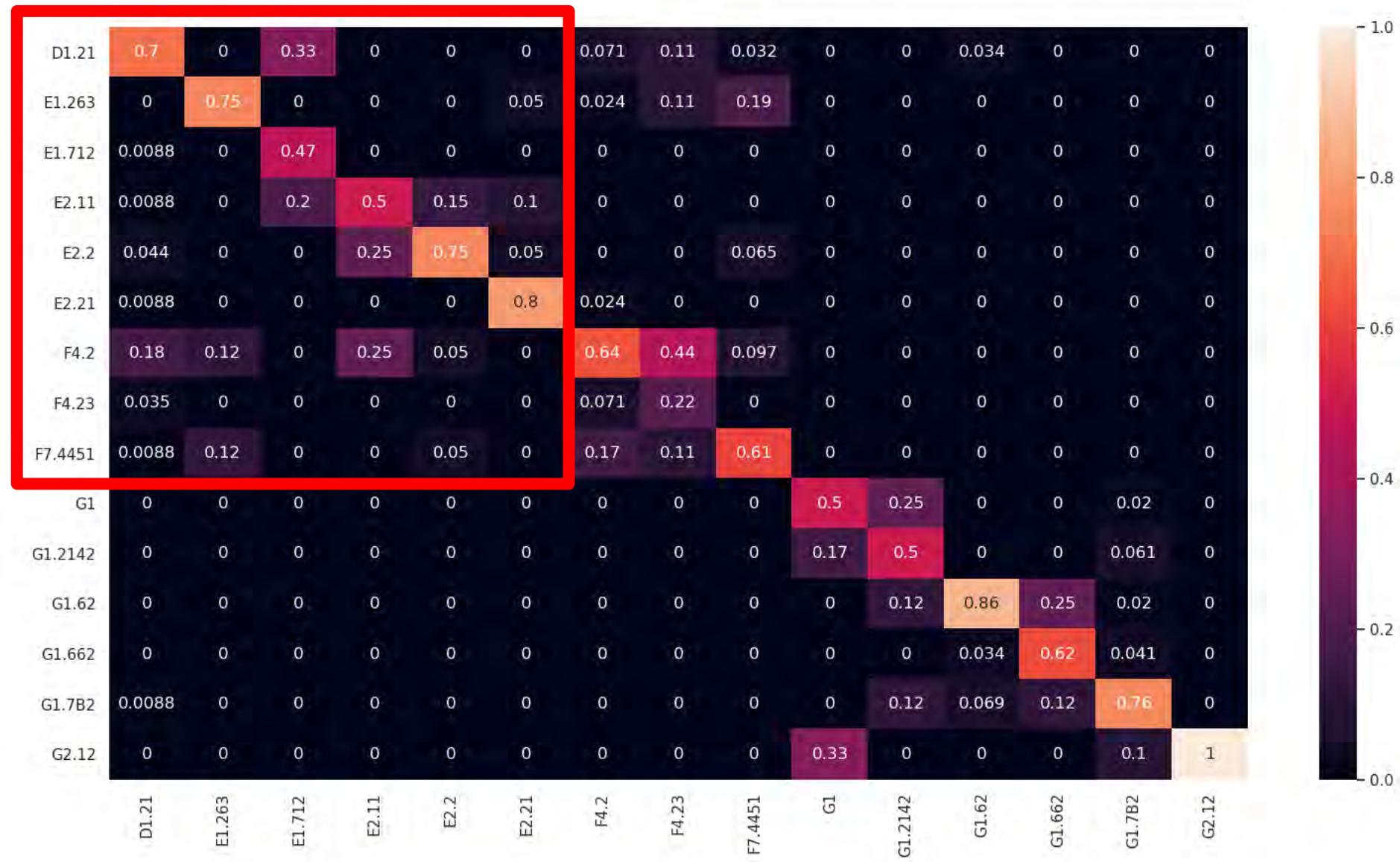
E 1:25 000

DOMINANCE

+

UNCERTAINTY

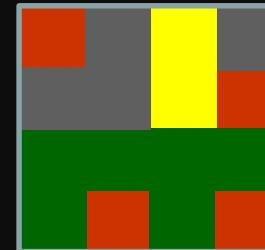
CONFUSION MATRIX



CONFUSION INDICES

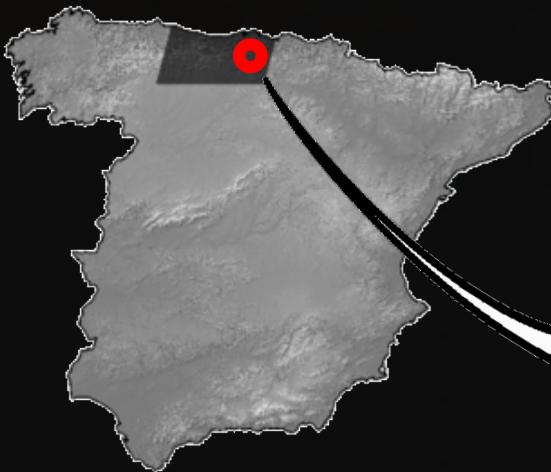


Landsat 8 OLI (30 m)



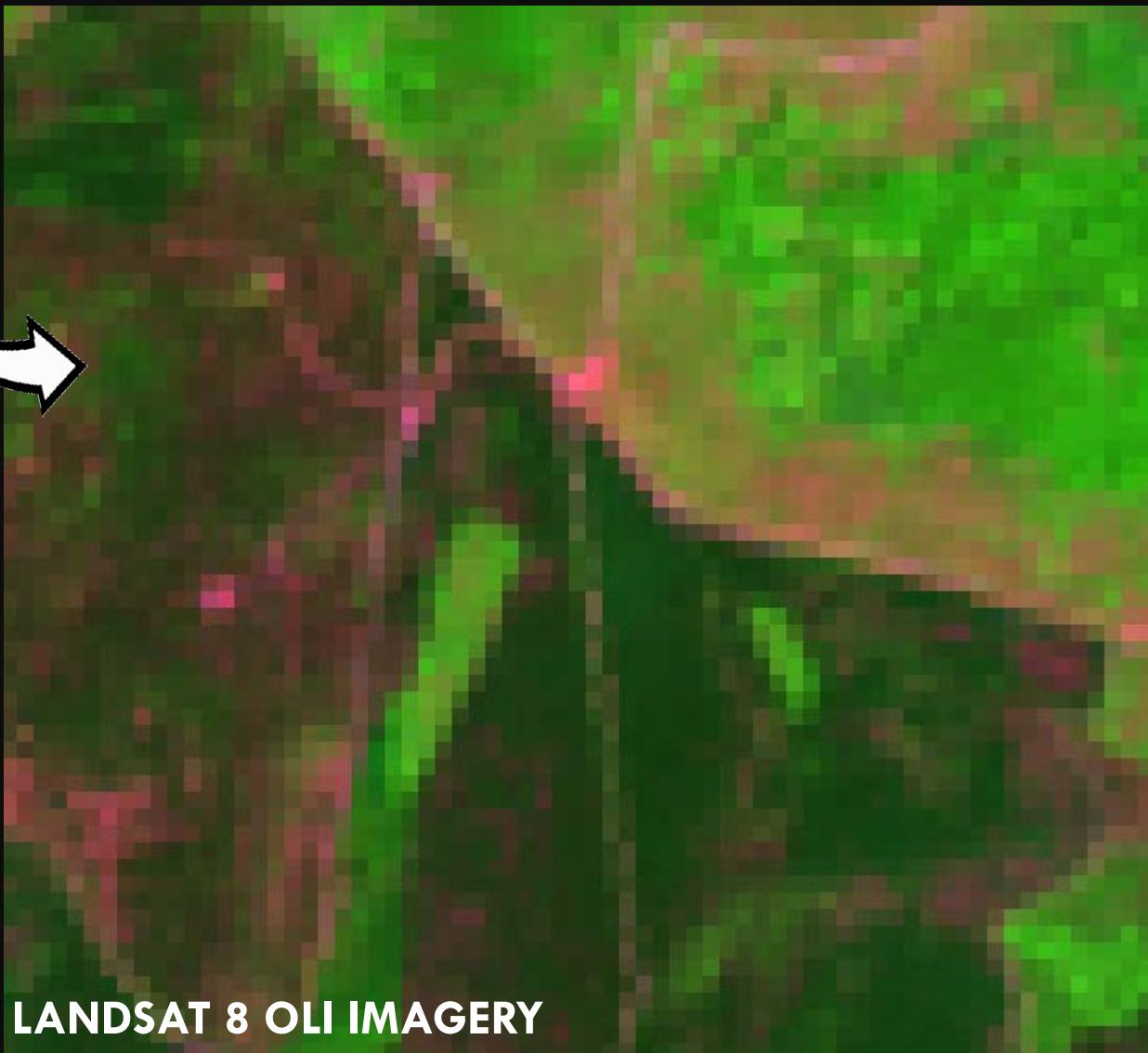
Spectral uncertainty and unmixing

Higher sun elevation and minimum cloud cover from USGS and ESA

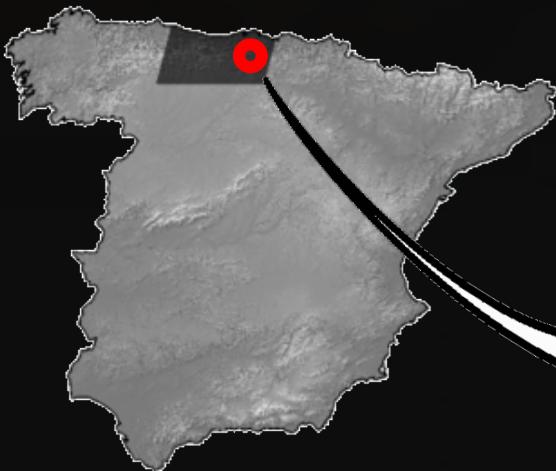


Zoom

175_033
false_color_752
Reflect BOA
Roads detail



Higher sun elevation and minimum cloud cover from ESA



Zoom

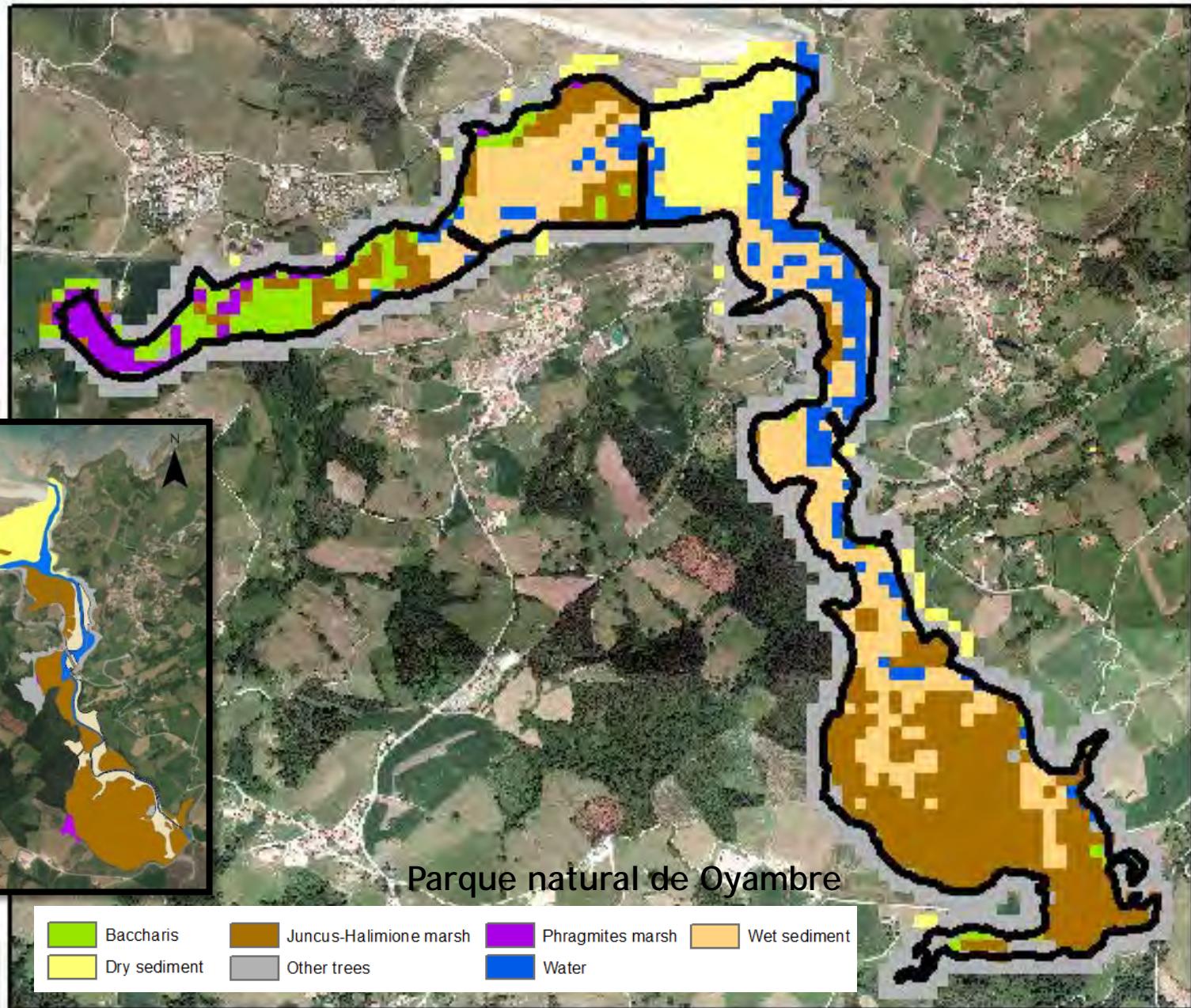
Sentinel_2A_1282
ReflecBOA_topo
Roads detail



Landsat 8

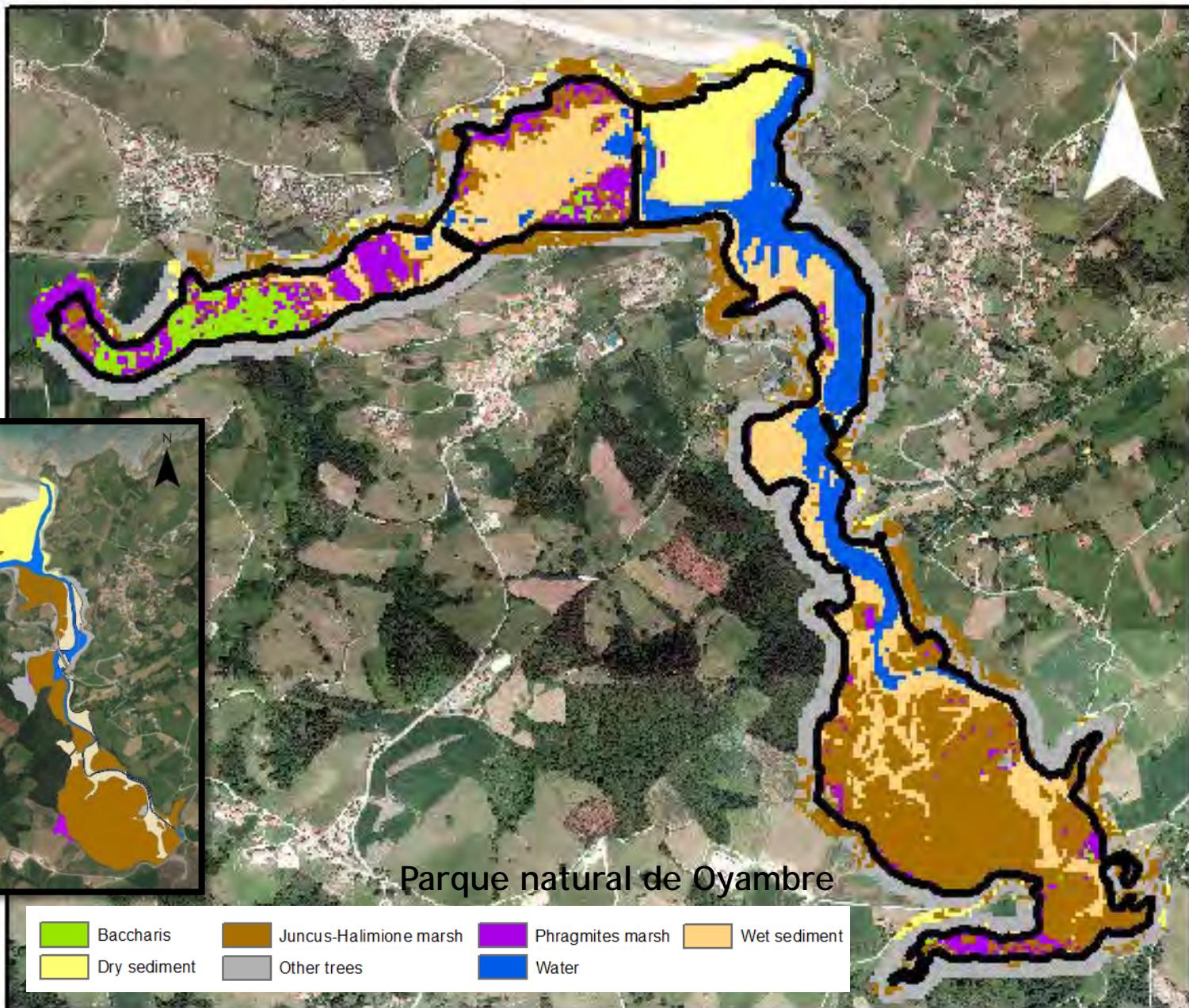
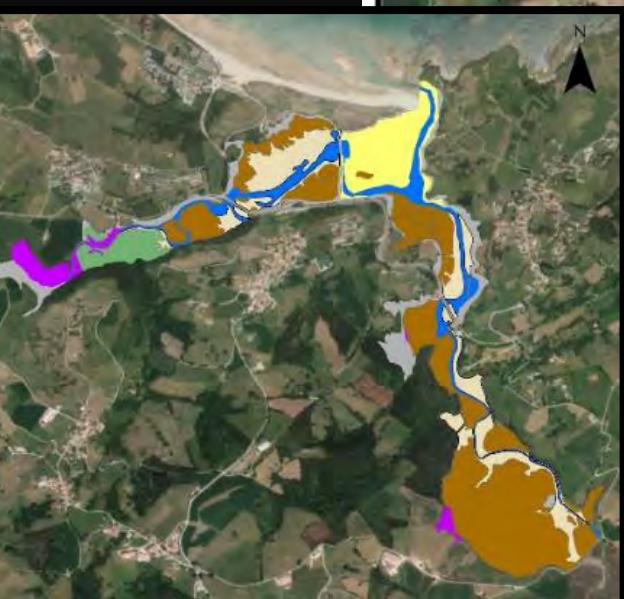
Evi2

Tasseled Cap:
Humidity
Bathymetry



Sentinel 2

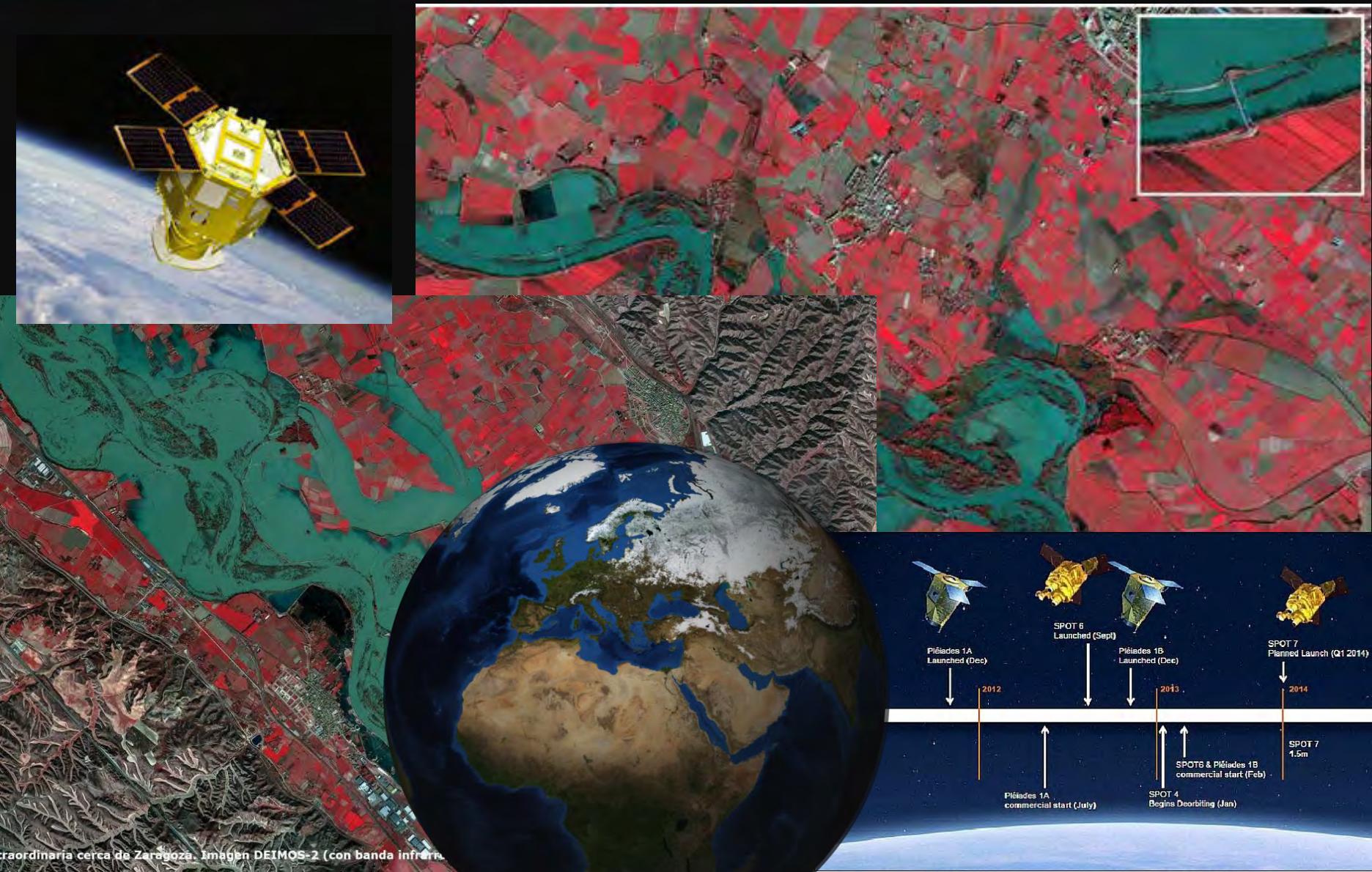
Evi2 (band 5)
Principal
Component 1
Bathymetry



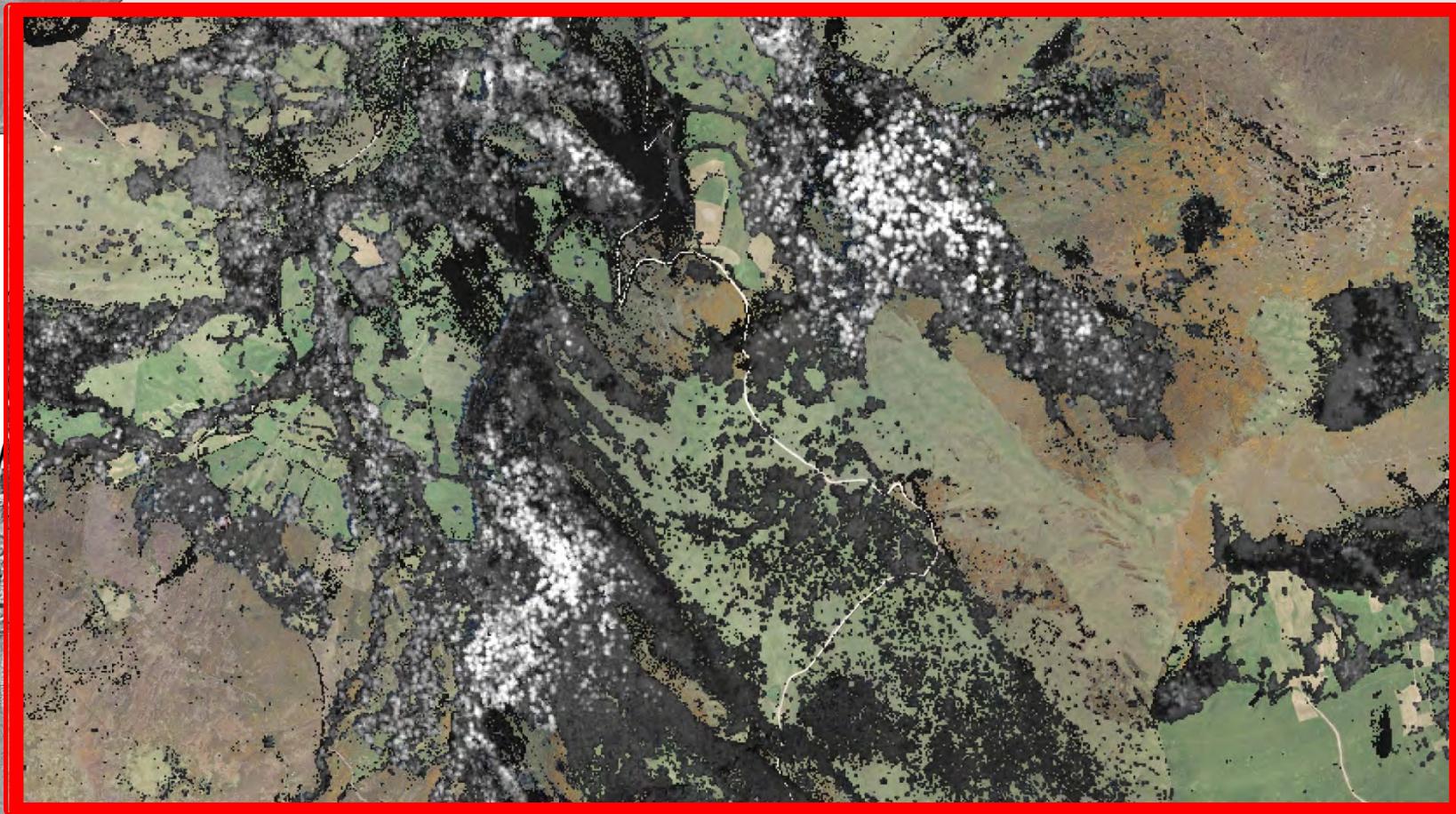
RS DATA RESOLUTION

DEIMOS2, Pleiades...

VHR spatial resolution and RGB and NIR spectral data



Vegetation structure (LIDAR derived data) (cnig 2015)
all predictor layers created at large scale but high resolution



Study area: Sierra del Escudo (Natura2000)

Vegetation (habitat) types:

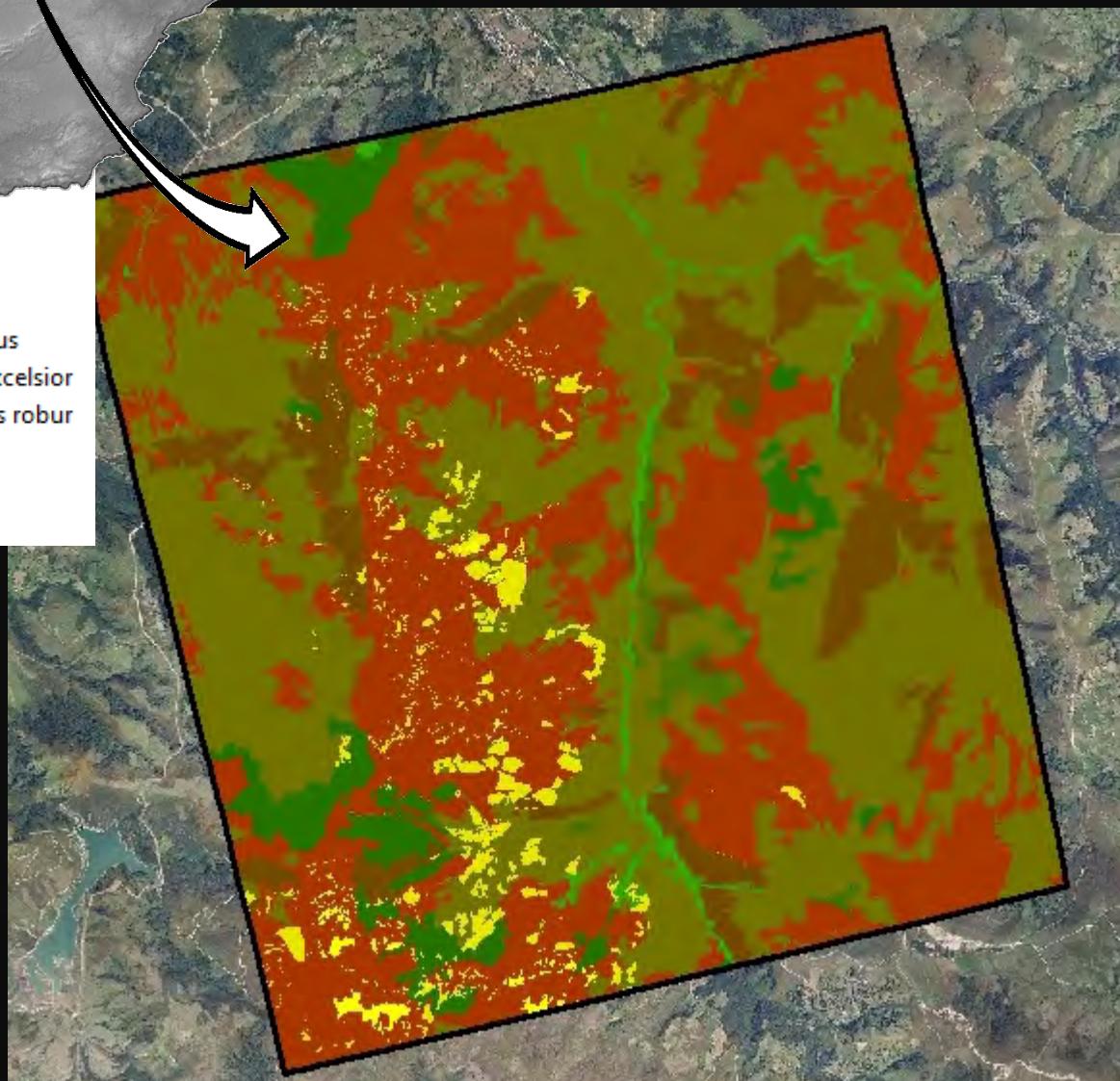
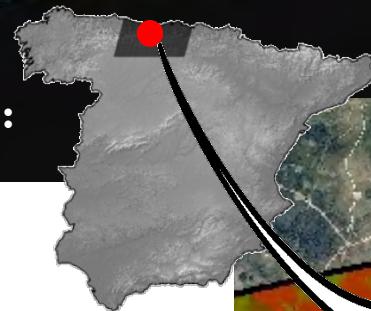
- Oligotrophic waters
- European dry heaths
- Lowland hay meadows
- * Blanket bogs
- Transition mires and quaking bogs
- Undefined bog habitat type
- Atlantic acidophilous beech forests with *Ilex* and *Taxus*
- * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*
- Forests of *Quercus pyrenaica* y robledales de *Quercus robur*
- Forests of *castanea sativa*
- Other shrub habitat types (not Annex I)
- Other forest habita types (not Annex I)

Acid fens larger than 0.1ha

Types 7130 and 7140

Grasslands

Other vegetation types



MODELLING RESULTS

Complex landscapes

Landsat 8 MVC

Landsat8 x2

Sentinel2 x2

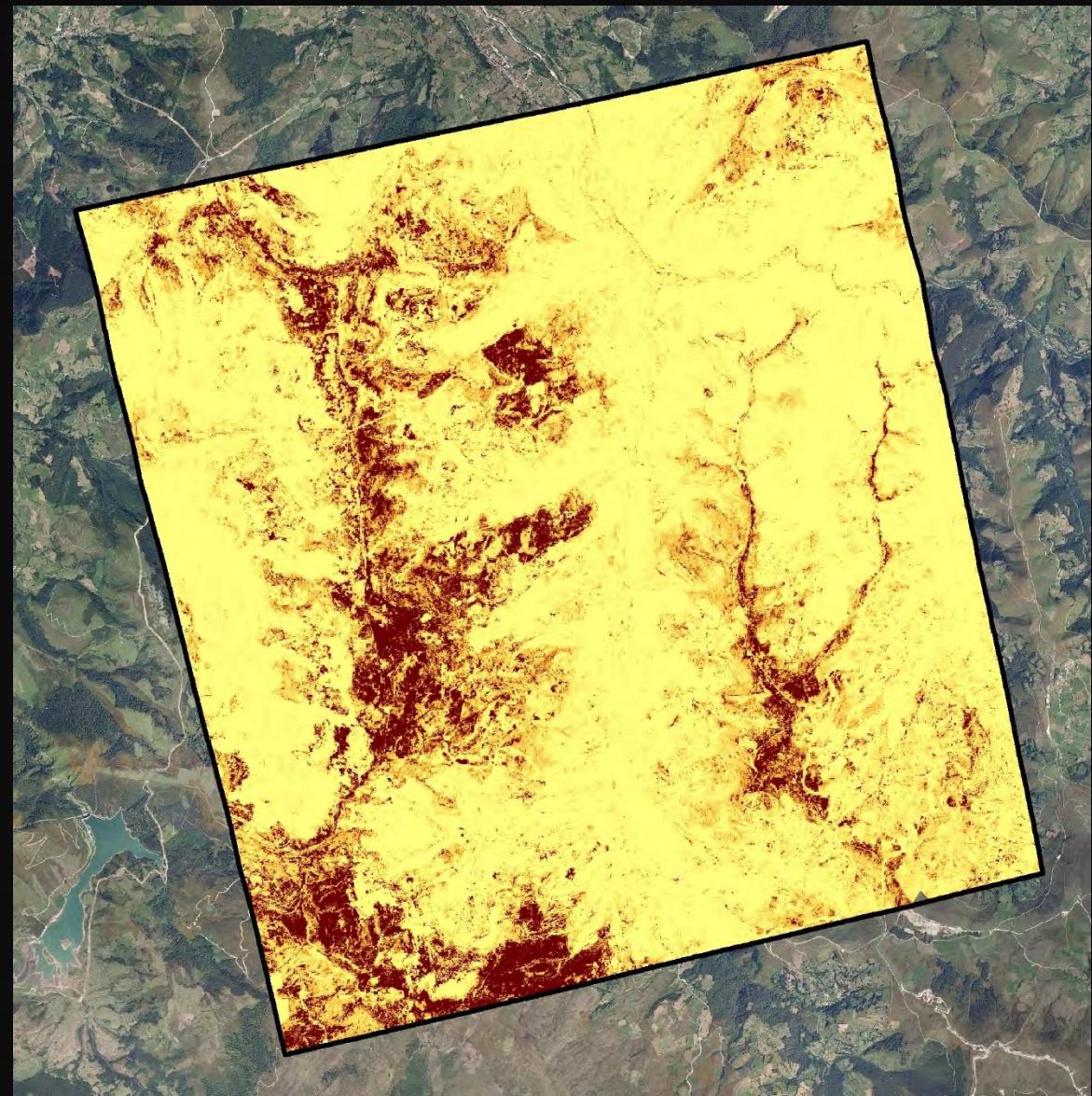
Deimos2 x2

+LiDAR +MDT

High
suitability



Low
suitability



Landsat 8 MVC
Landsat8 x2
Sentinel2 x2
Deimos2 x2
+LiDAR +MDT

High
suitability



Low
suitability



Landsat 8 MVC

Landsat8 x2

Sentinel2 x2

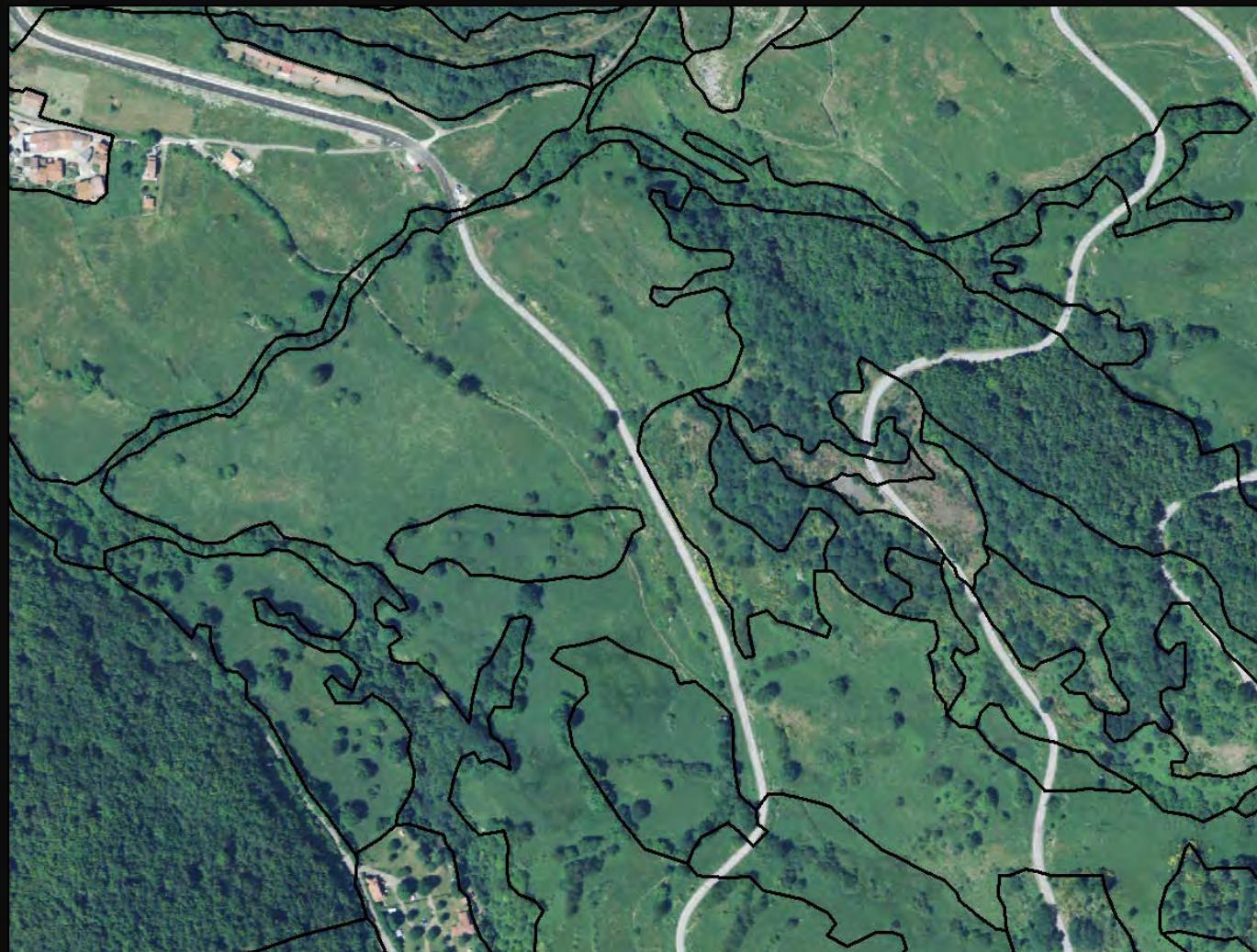
Deimos2 x2

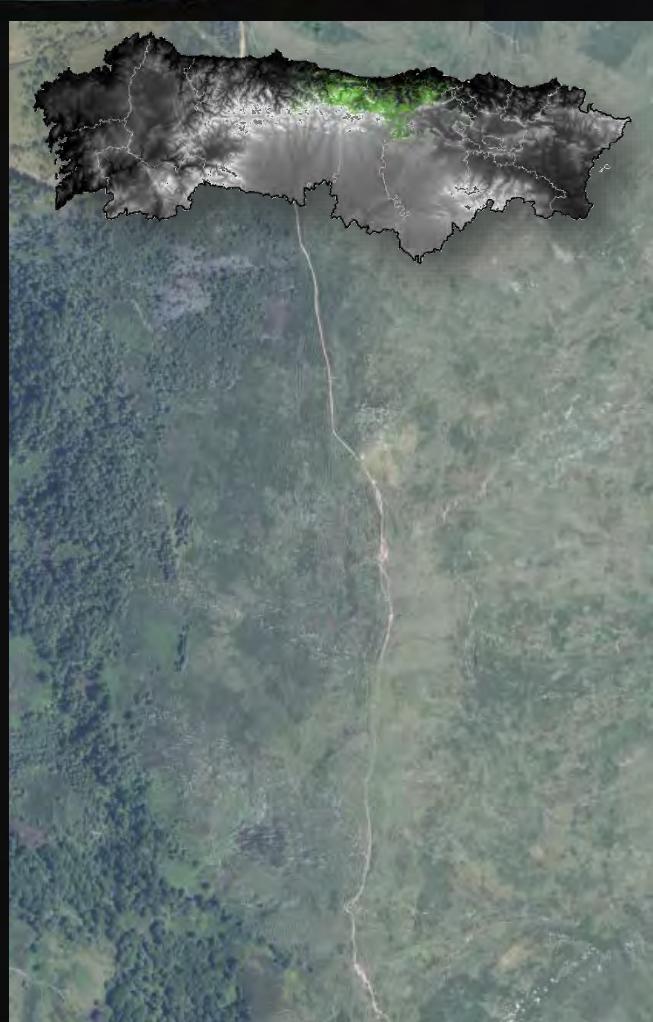
+LiDAR +MDT

High
suitability

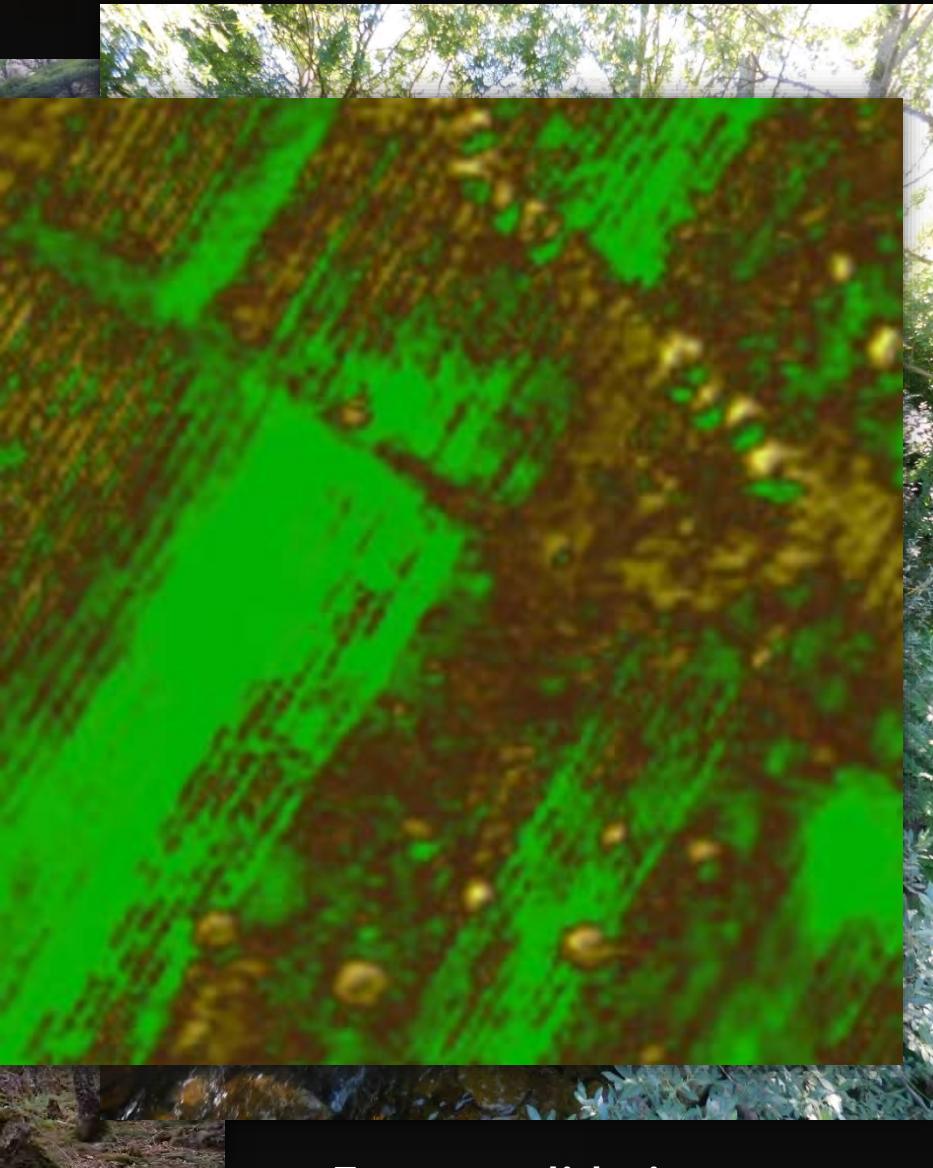
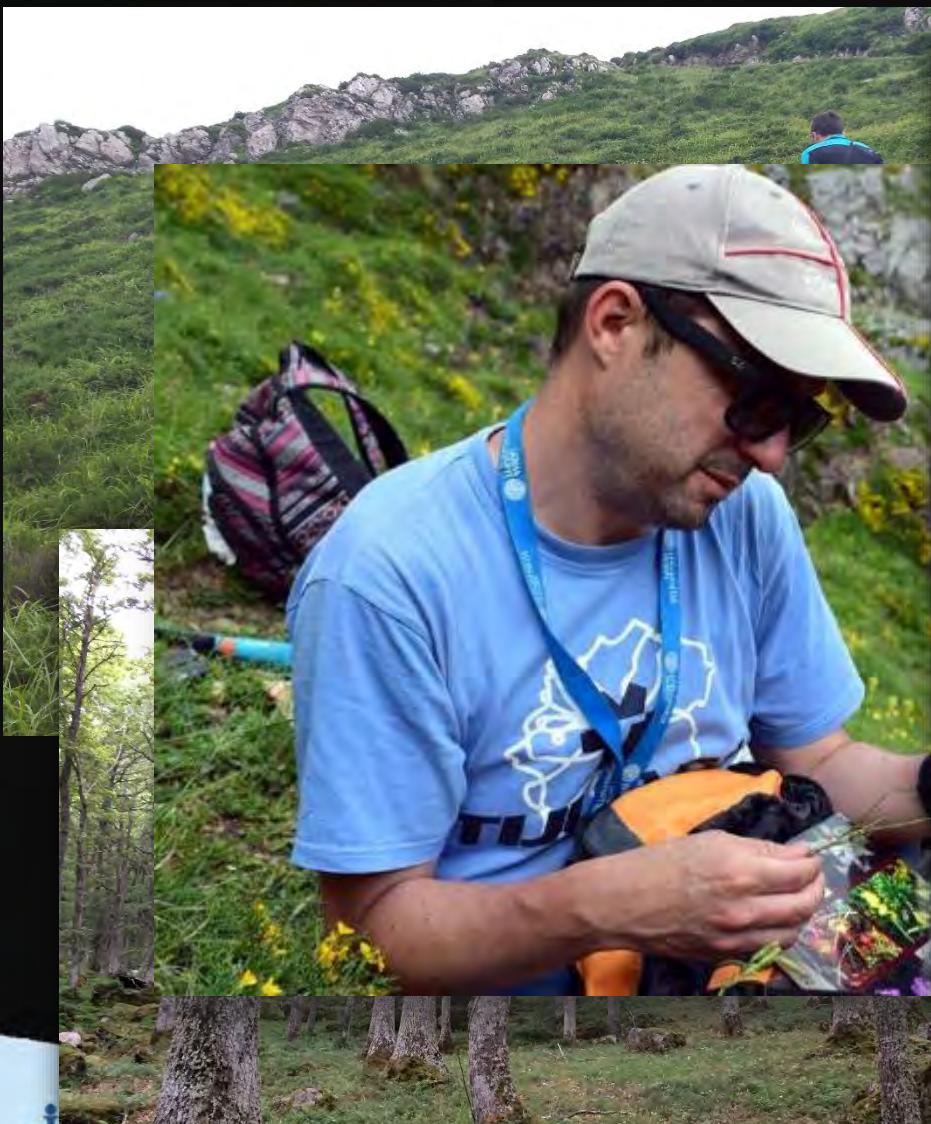


Low
suitability

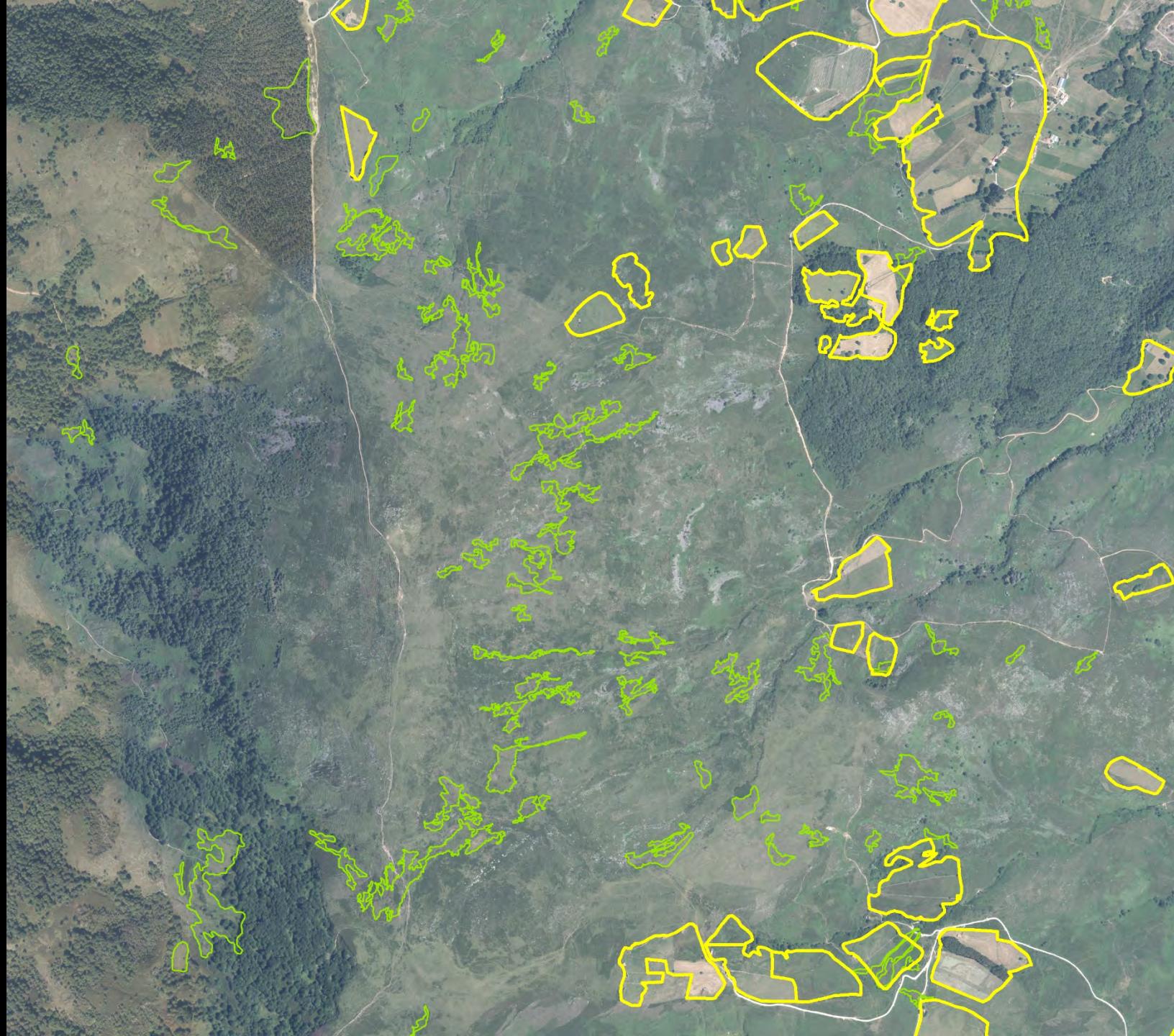




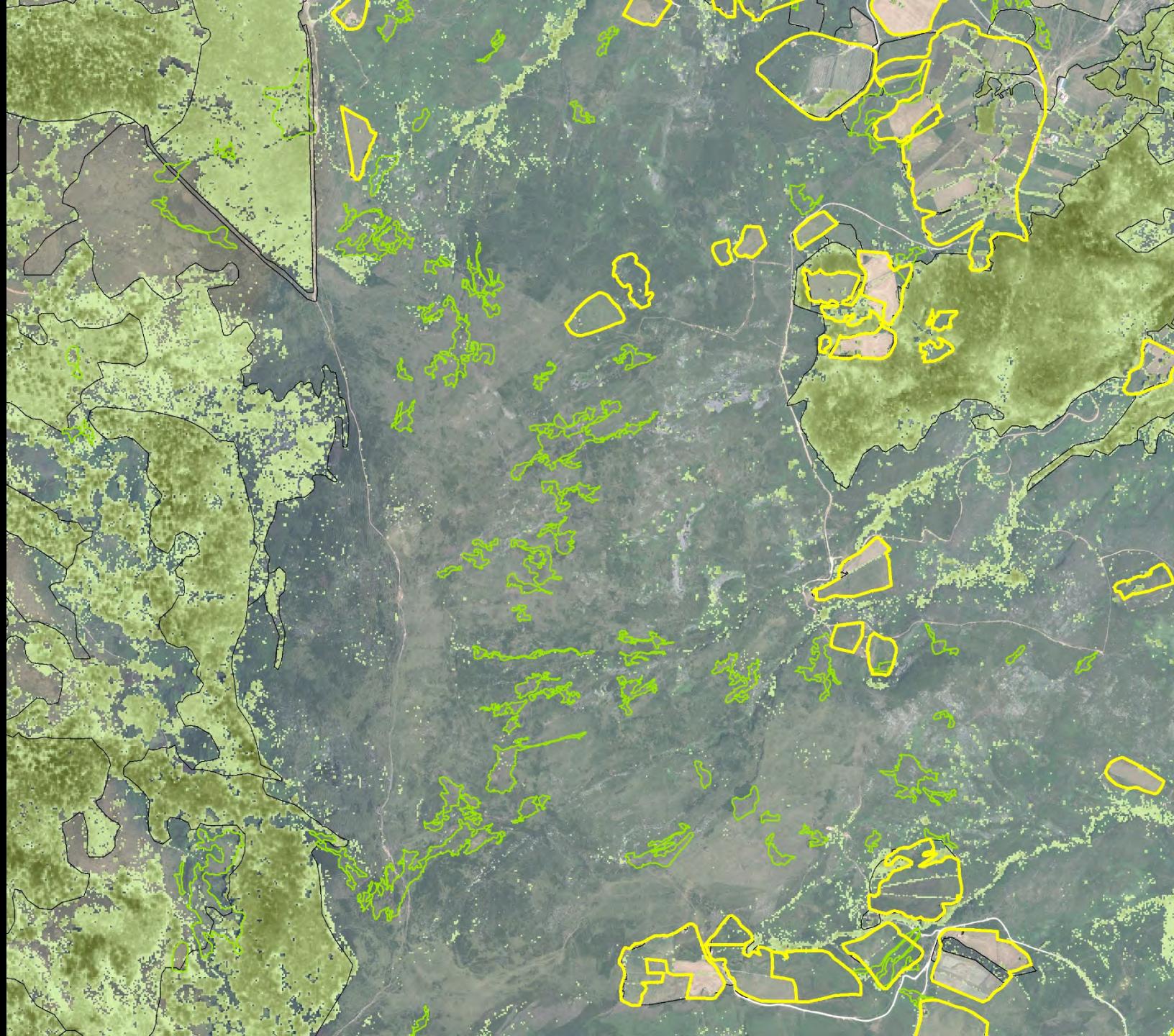
ID	Name(en)	Name(es)	DH	Modellin
D111	Active, relatively undamaged	Turberas abombadas	7110	yes*
D121	Hyperoceanic low-altitude	Turberas de cobertura de baja altitud	7130	yes*
D122	Montane blanket bogs, [Calluna]	Turberas de cobertura de montaña	7130	yes*
D22X	Cantabrian mountain acidic fens	Tremedales ácidos de montaña	no	yes*
D22Y	Cantabro-Atlantic acidic fens	Tremedales ácidos oceánicos	no	yes*
D233	[Carex rostrata] quaking mires	Tremedales con Carex rostrata	7140	no
D23H	Wet, open, acid peat and sand,	Depresiones sobre sustratos	7150	no
D41X	Cantabrian alkaline fens	Tremedales neutro-basófilos	7230	yes*
D53X	Cantabrian <i>Juncus</i> -dominated	Junciales higroturbosos	no	yes*
E111	Euro-Siberian rock debris swards	Prados calcáreos de suculentas	6110	no
E126	Sub-Atlantic semi-dry calcareous	Lastonares calcícolas	6210	yes
E131	West Mediterranean grassland	Prados xerofíticos submediterráneos	6220	no
E153	Iberian fescue frost-influenced	Prados crioturbados montanos	no	yes
E171	<i>Nardus stricta</i> swards	Cervunales acidófilos atlánticos	6230	yes
E172	<i>Agrostis-Festuca</i> grasslands	Prados mesófilos atlánticos	no	yes*
E211	Unbroken pastures	Prados de manejo intenso	no	yes
E223	Medio-European submontane	Prados de siega	6510	yes
E341	Atlantic and subatlantic humid	Pastos húmedos atlánticos	no	yes
E342	<i>Juncus acutiflorus</i> meadows	Prados-junciales cantábricos	no	no
E31X	Submediterranean	Prados húmedos mediterráneos	6420	no
E351	[<i>Molinia caerulea</i>] meadows and	Prados-junciales acidófilos	6410	no
E352	Heath <i>Juncus</i> meadows and	Cervunales higro-turbosos	no	no
E431	Alpic [<i>Nardus stricta</i>] swards and	Cervunales orocantábricos	6230	yes
E43X	Orocantabrian acidophilous	Prados alpinos silícicos	6160	yes
E43Y	Orocantabrian acidophilous	Prados alpinos con <i>Festuca eskia</i>	6140	yes
E441	Closed calciphile alpine grassland	Prados alpinos calcícolas continuos	6170	yes
E442	Wind edge [<i>Kobresia</i>]	Prados alpinos con <i>Kobresia</i>	6170	no
E443	Calciphilous stepped and garland	Prados alpinos calcícolas	6170	yes
E52X	Thermophilous forest fringe of	Bordes forestales basófilos	no	no
E52Y	Cantabrian forest fringe of acidic	Bordes forestales acidófilos	no	no
E531	Sub-Atlantic <i>Pteridium</i>	Helechales	no	yes
E543	Shady woodland edge fringes	Megaforbios de bosques umbrosos	6430	no
E553	Pyreneo-Iberian tall-herb	Megaforbios subalpinos	6430	no



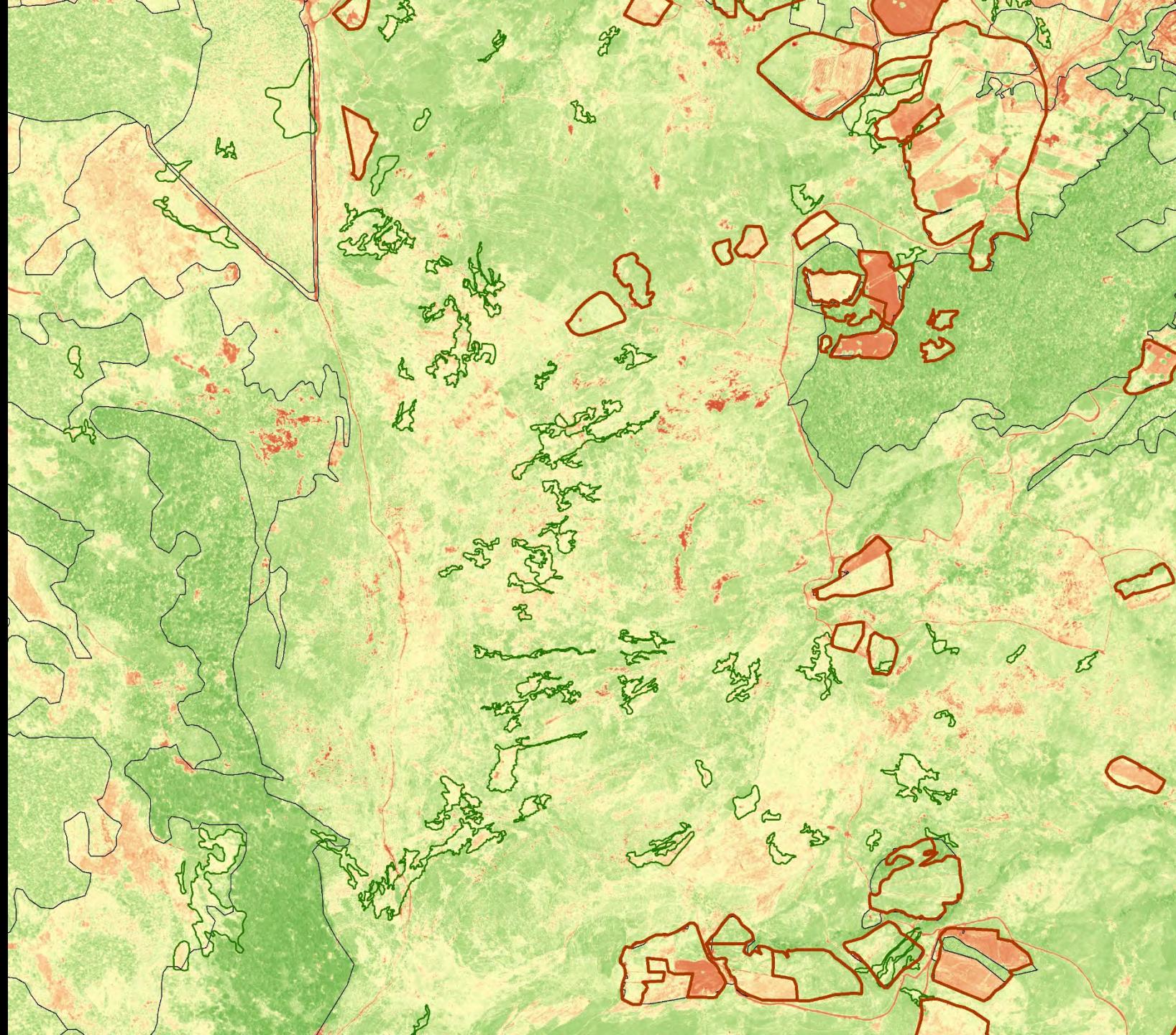
Expert validation surveys









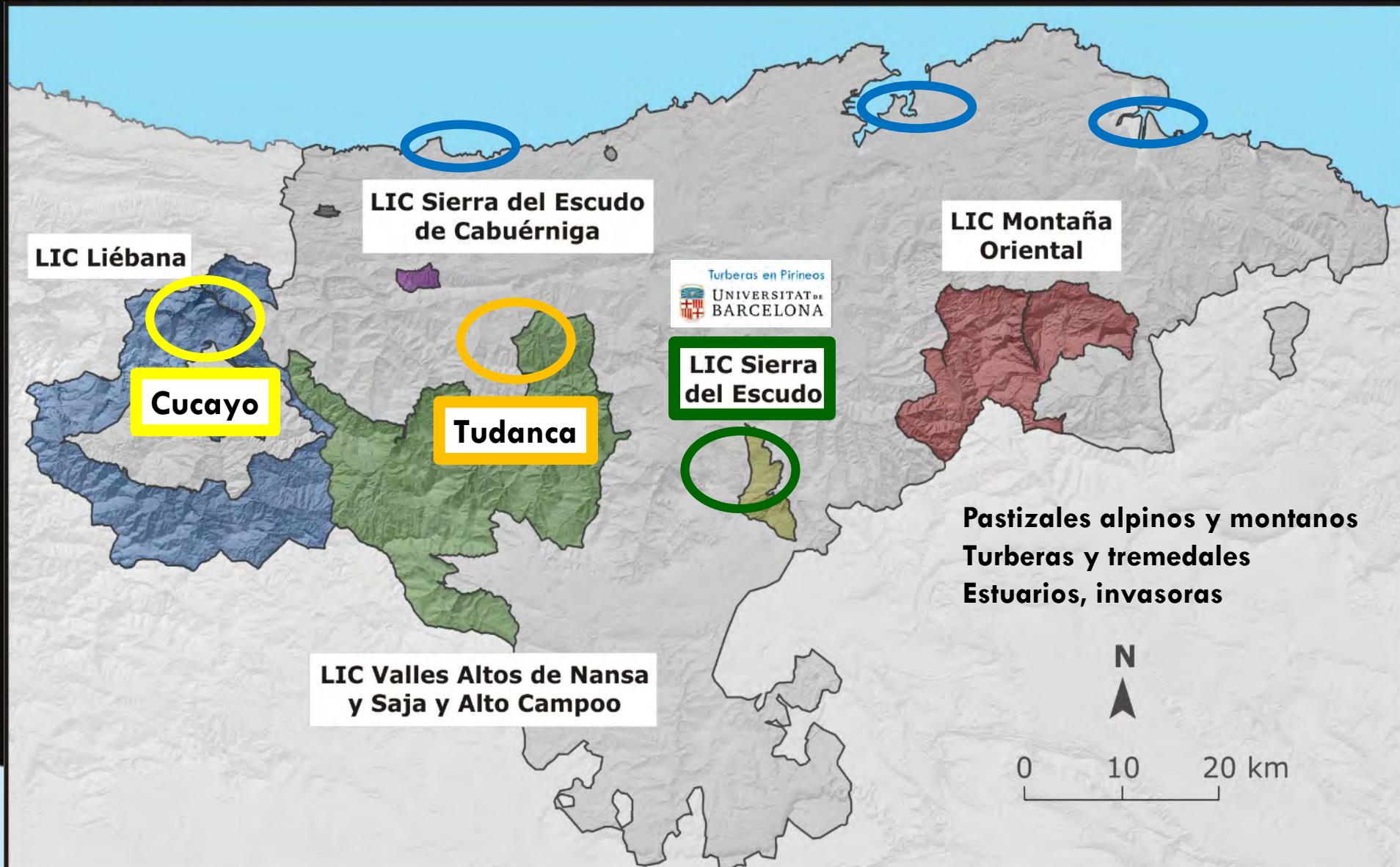




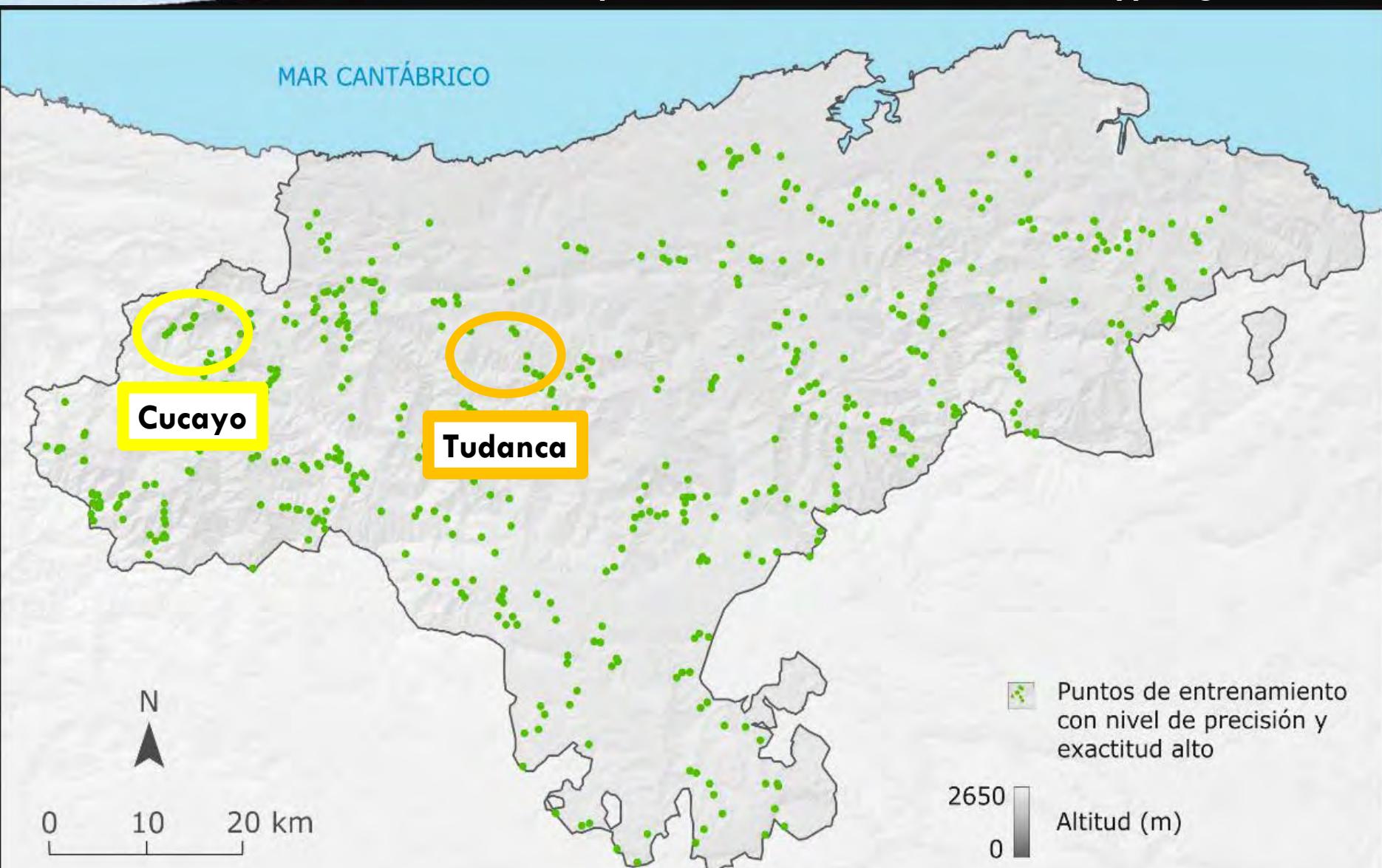
Caracterización hiperespectral y fenológica de pastizales y humedales

Del modelado espacial a mapear lo inmapeable

From mountains to coast, main typologies Annex I



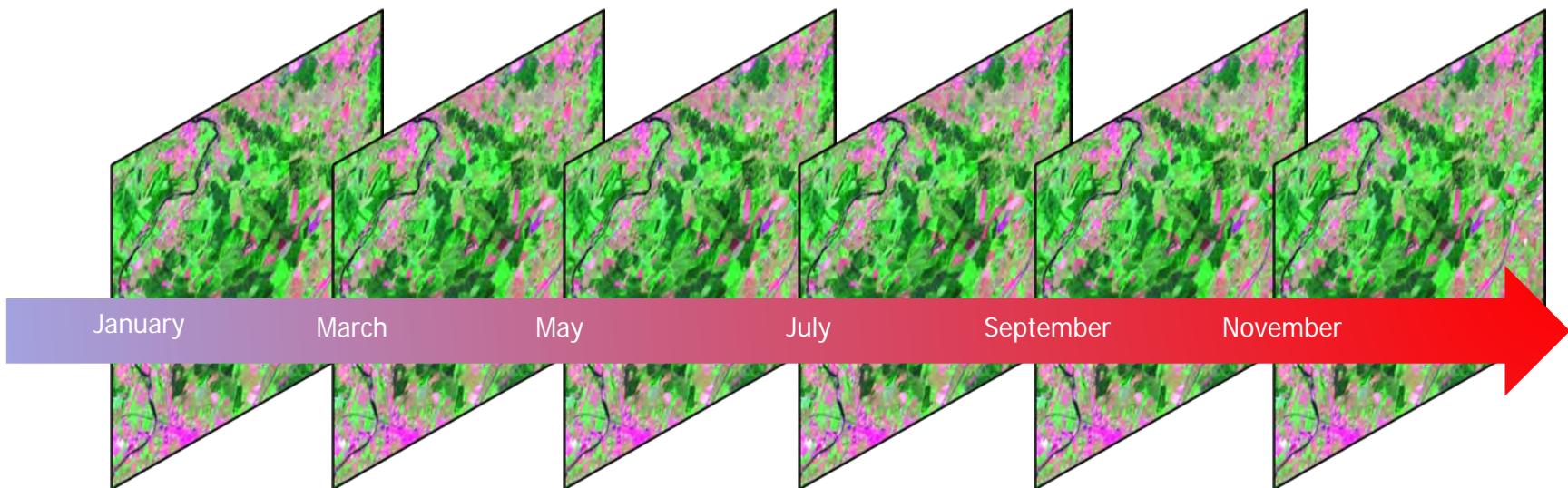
Alpine and montane domains, main typologies Annex I



Processing in real time of data series of imagery (C++)

Landsat, MODIS and Sentinel 2

Daily data for the 1985 - 2000 - 2016 - present period



esa

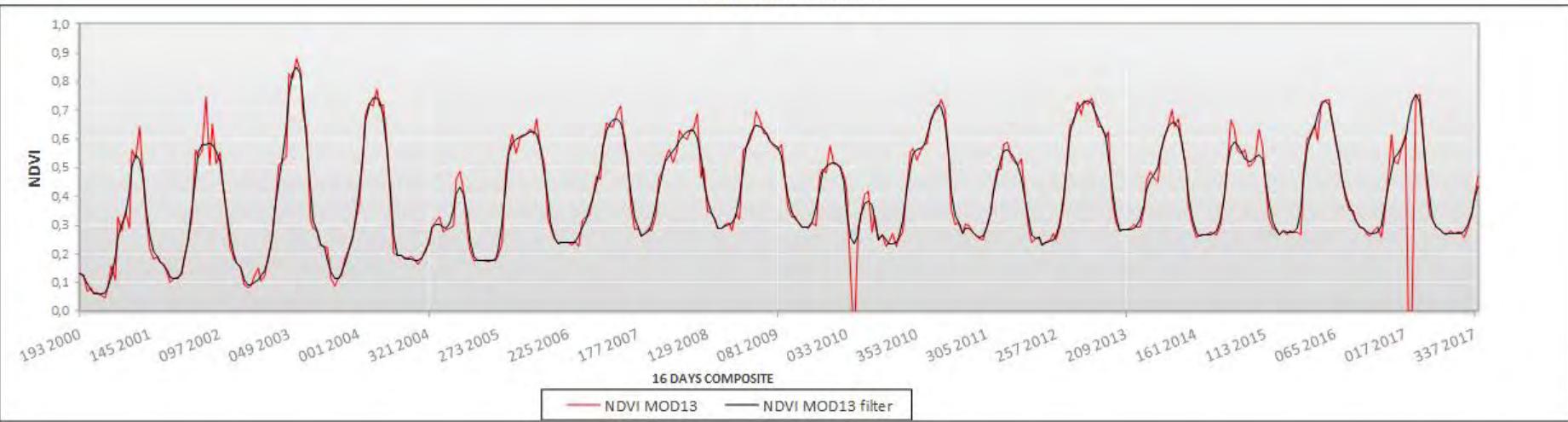
copernicus
The European Earth Observation Programme



N2K PROTECTED AREA DOÑANA NATIONAL PARK (ANDALUSIA-SOUTHERN SPAIN)



TEMPORAL PROFILE



— NDVI MOD13 — NDVI MOD13 filter

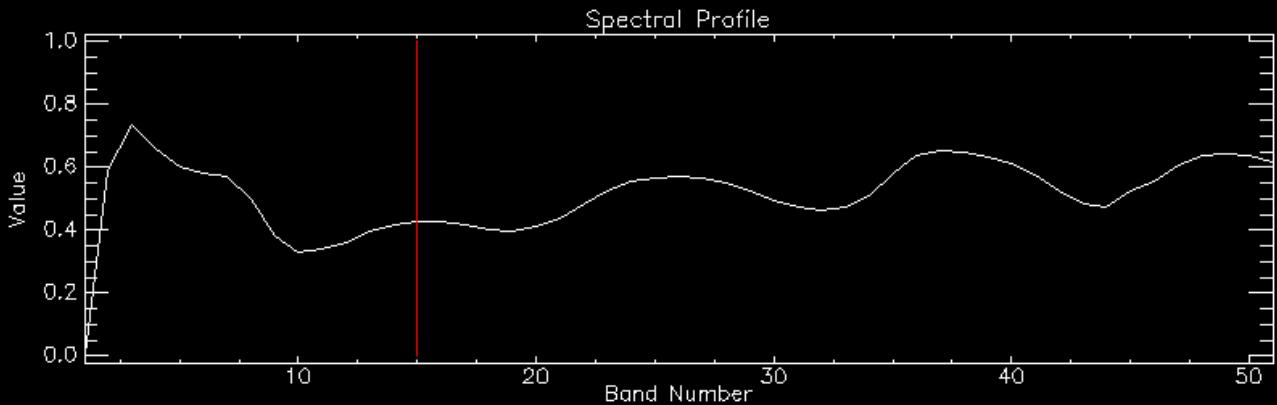
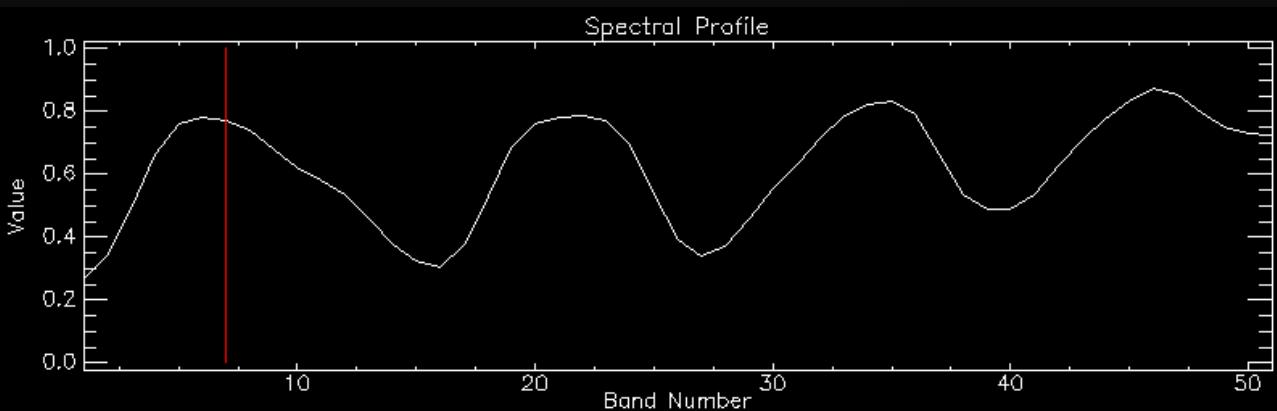
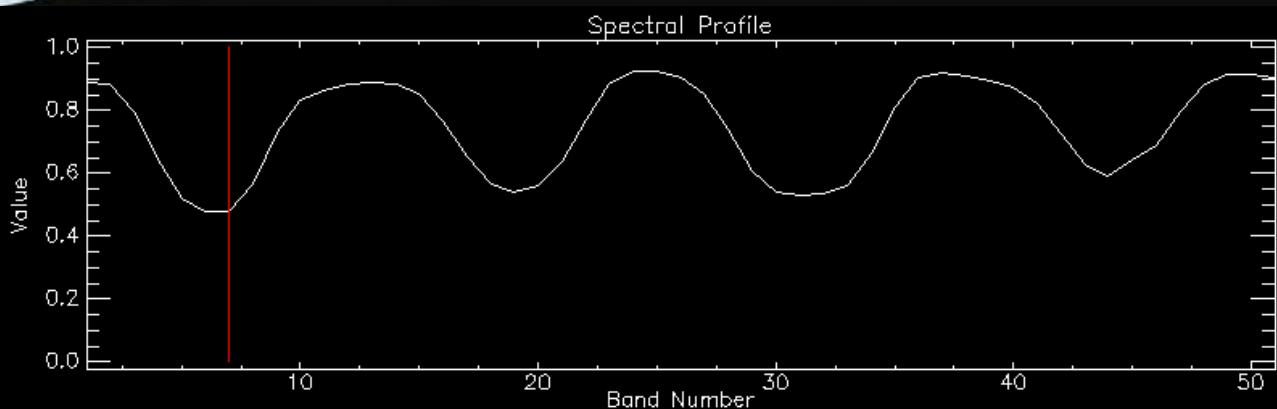
NDVI,
EVI

Beech forest,
Stable,
Climatic variation

EBVs
HRLs

Secondary succession,
positive trend
Grassland decrease
Higher minimums

Vegetation recovery
after disturbance (fire).
Seasonal patterns

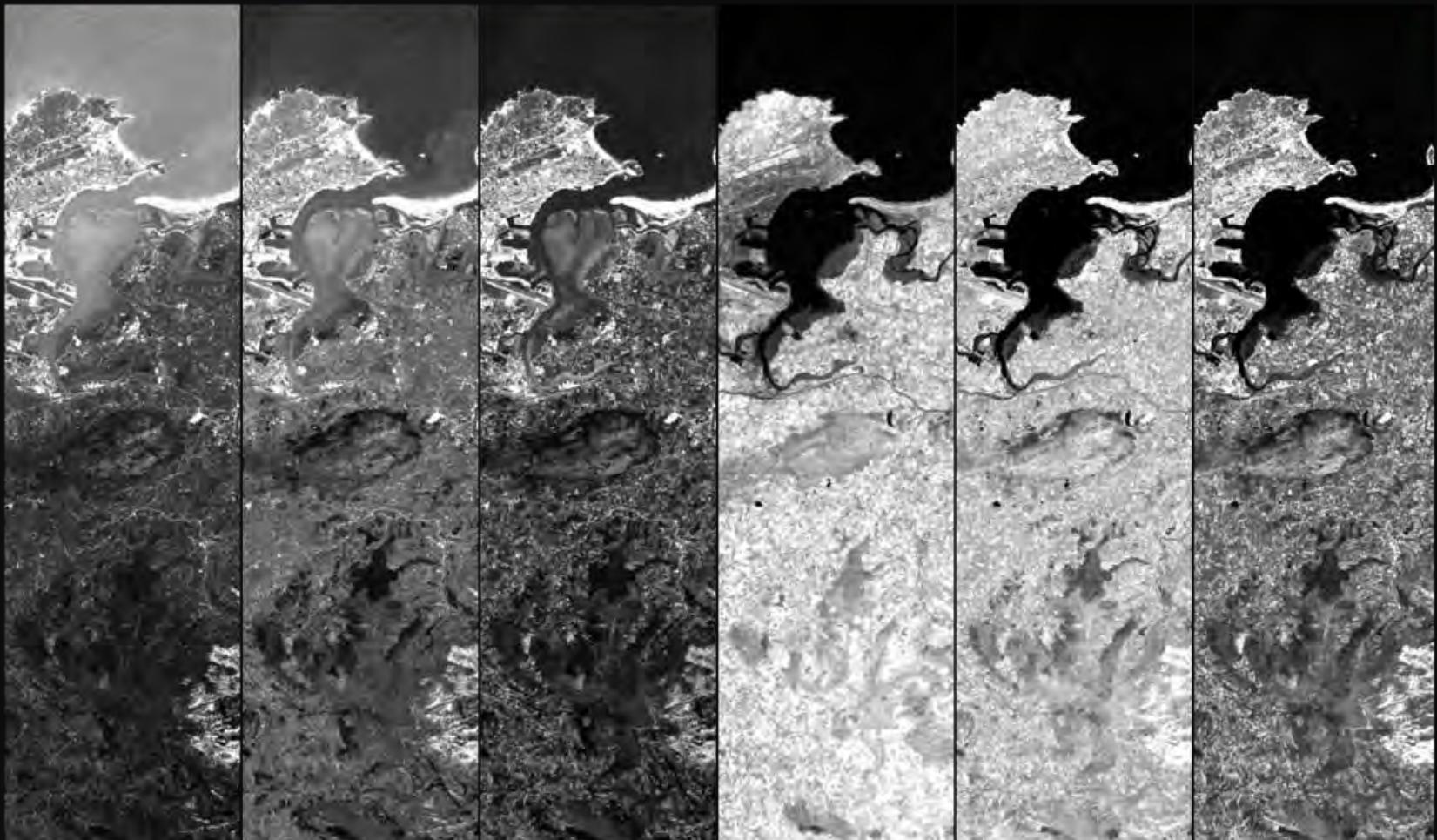


TEMPORAL TO SPECTRAL SIGNATURES

Longitud de Onda

(-)

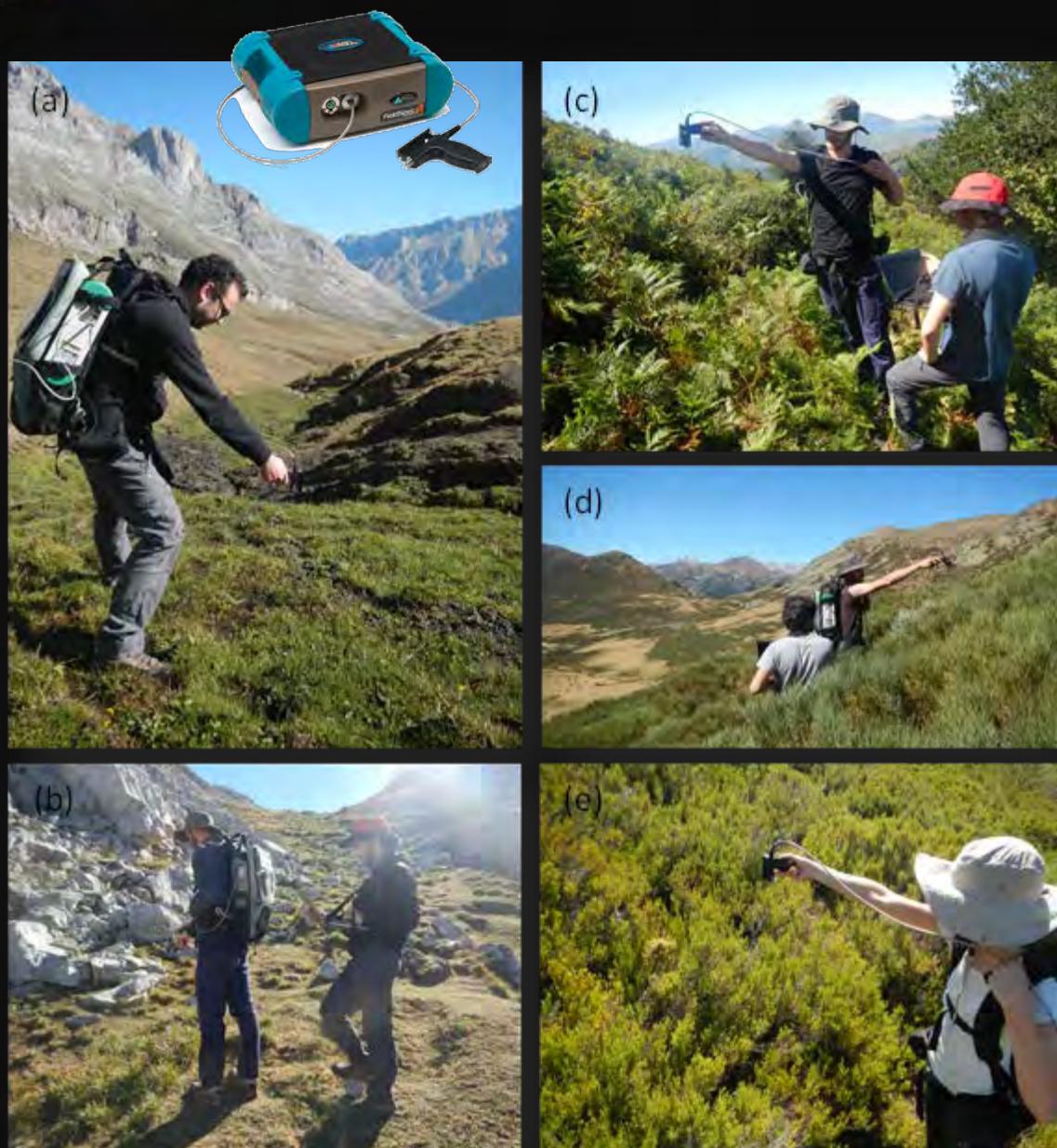
(+)



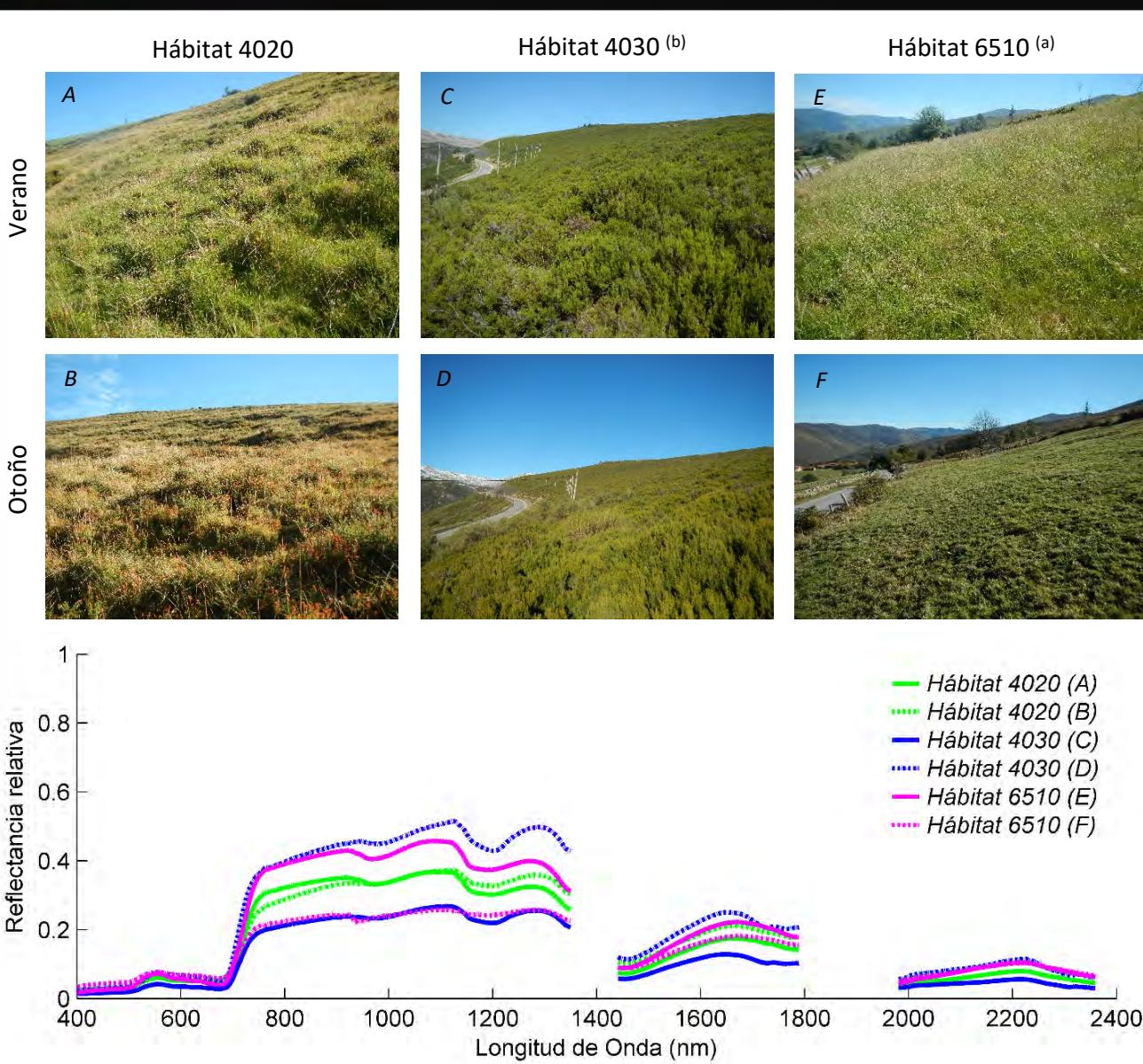
Hyperspectral Campaigns: PASTURES AND WETLANDS



ASD FieldSpec 4



Spectral library: HABITAT TYPES



Spectral library: PHENOLOGY

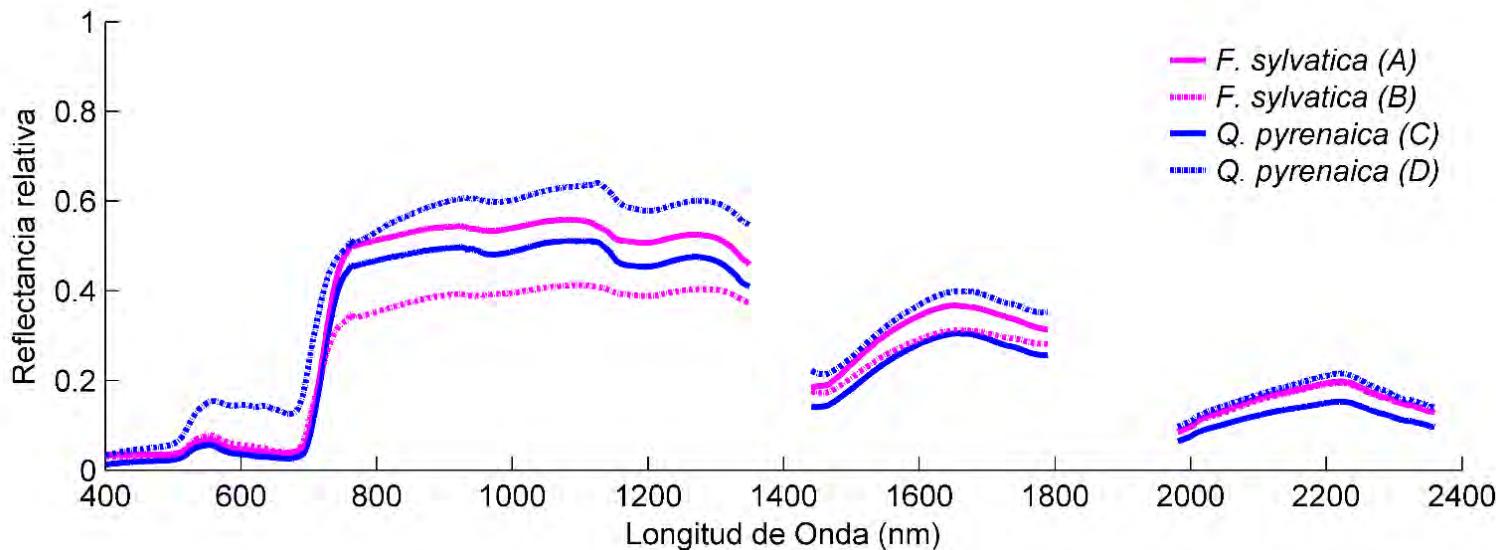
Hábitat 9120
(*F. sylvatica*)

↓ Verano Otoño ↓



Hábitat 9230
(*Q. pyrenaica*)

↓ Verano Otoño ↓



SPECTRAL SIGNATURES



METADATOS

Metadatos asociados al proyecto/campaña

Metadatos asociados al muestreo

Metadatos asociados al espectro

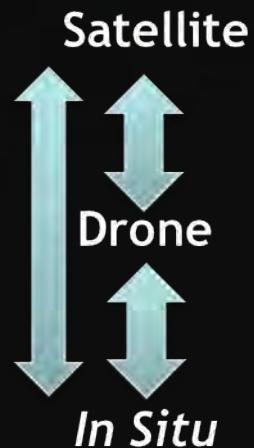
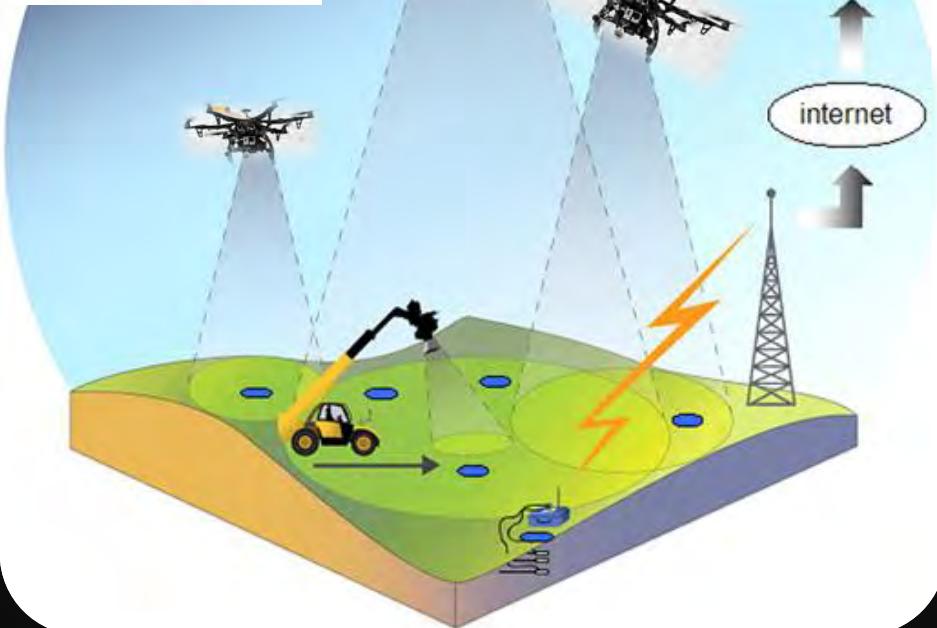
DATOS
ESPECTRALES

Datos hiperespectrales procesados

Incertidumbre de los datos

Se trata de recabar la mayor (y más completa) información posible que facilite el análisis espectral

Dr Ricardo Díaz Delgado

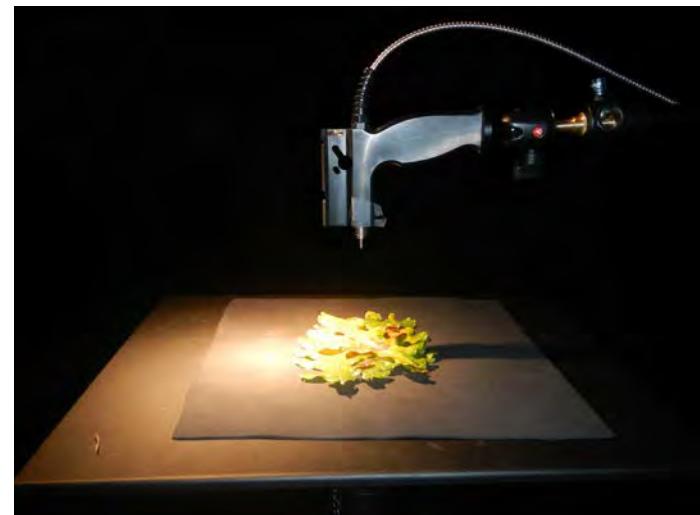
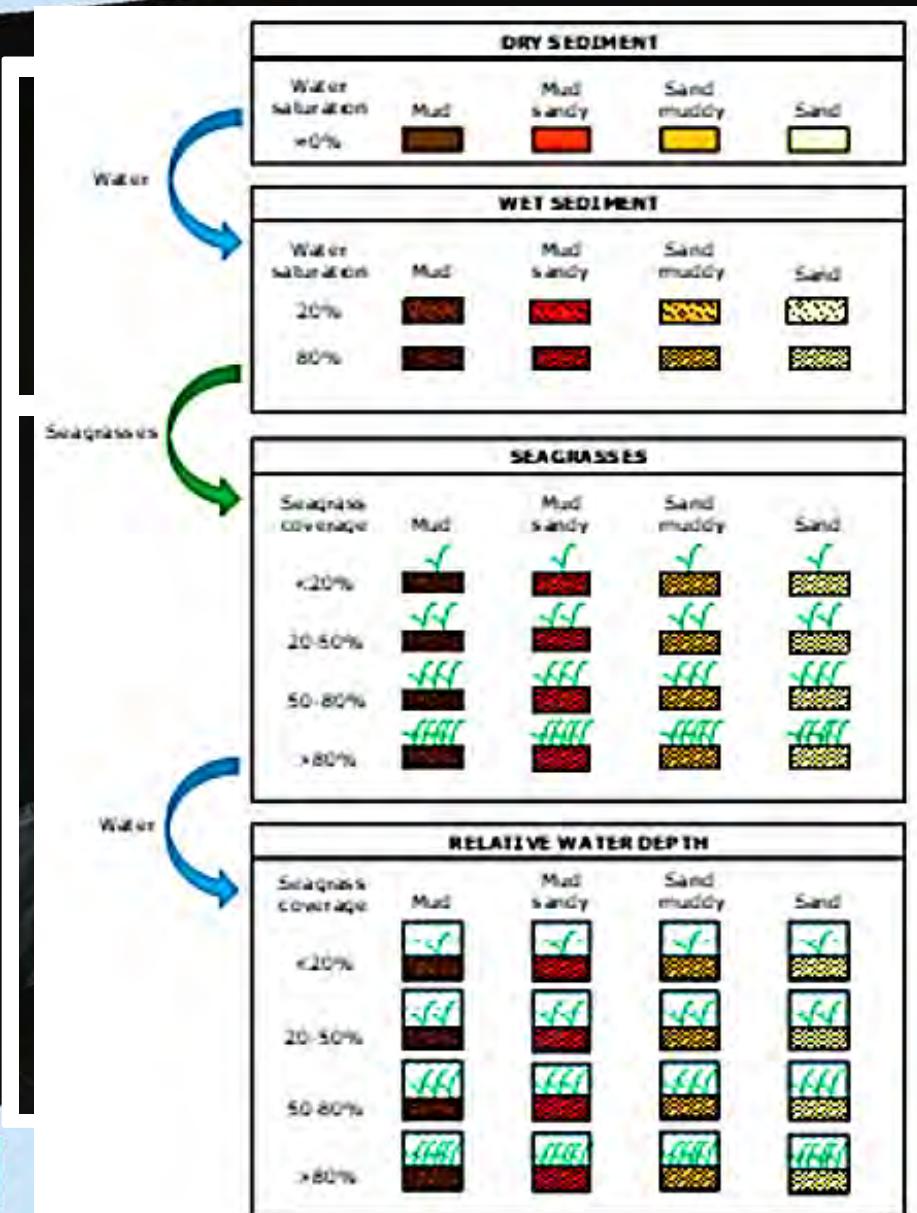


Se van a sobrevolar una serie de zonas estratégicas de muestreo, localizadas en zonas estuáricas, costeras, continentales y fluviales de Cantabria.

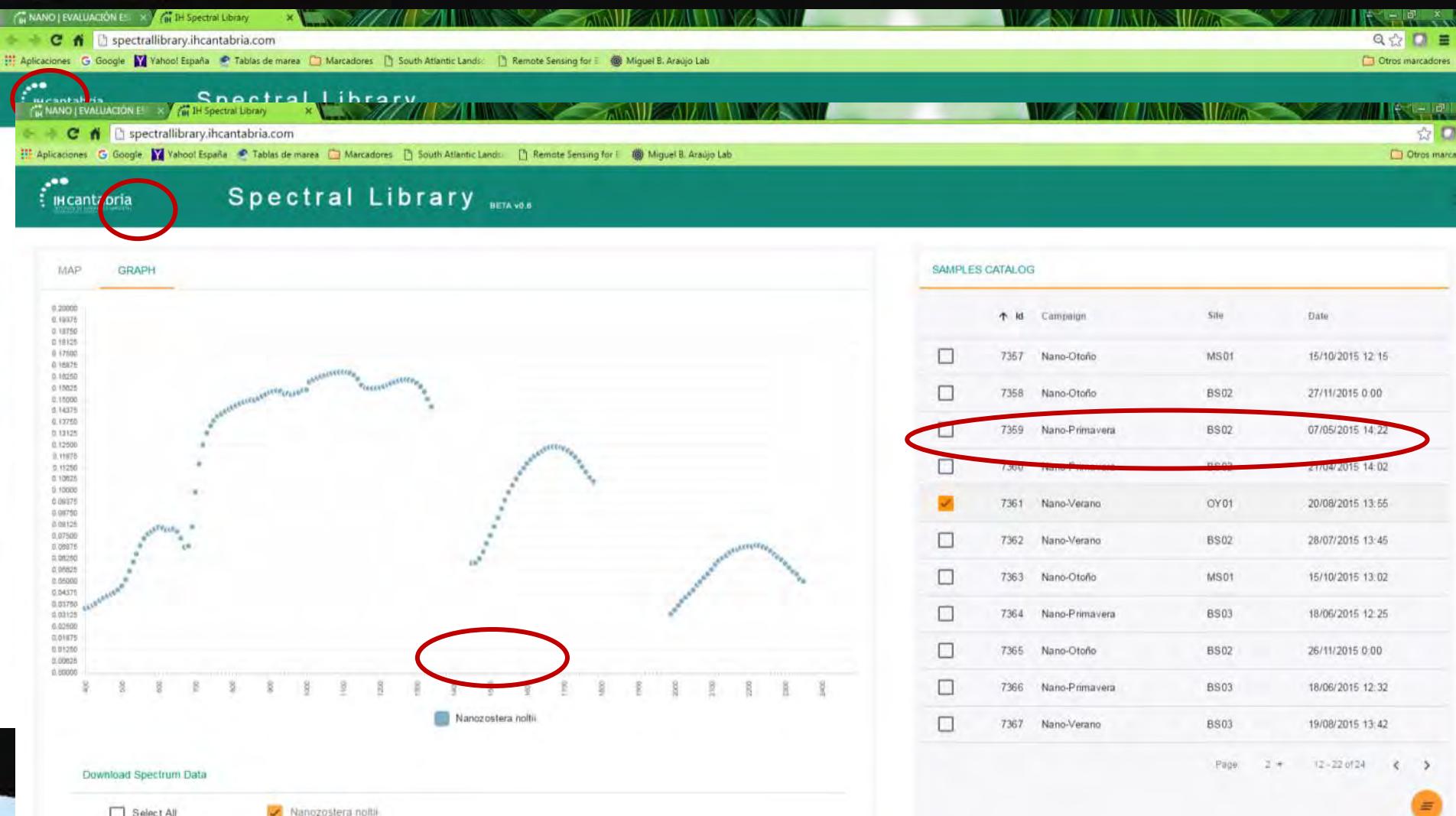
Los sensores hiperespectrales ofrecen información en un espectro prácticamente continuo, lo que permite discriminar parámetros críticos de la vegetación y los suelos que no serían perceptibles con sensores convencionales.

De esta manera se llega a discriminar diversos aspectos muy específicos relacionados con la vegetación como el **estado fenológico** (Chen et al., 1998), la **estructura de la vegetación** (Ustin y Trabucco, 2000), el **contenido de agua** (Serrano et al., 2000, Riaño et al., 1999) o la **cantidad de clorofila** (Zarco Tejada et al., 2000 y 2001).

Lab analyses



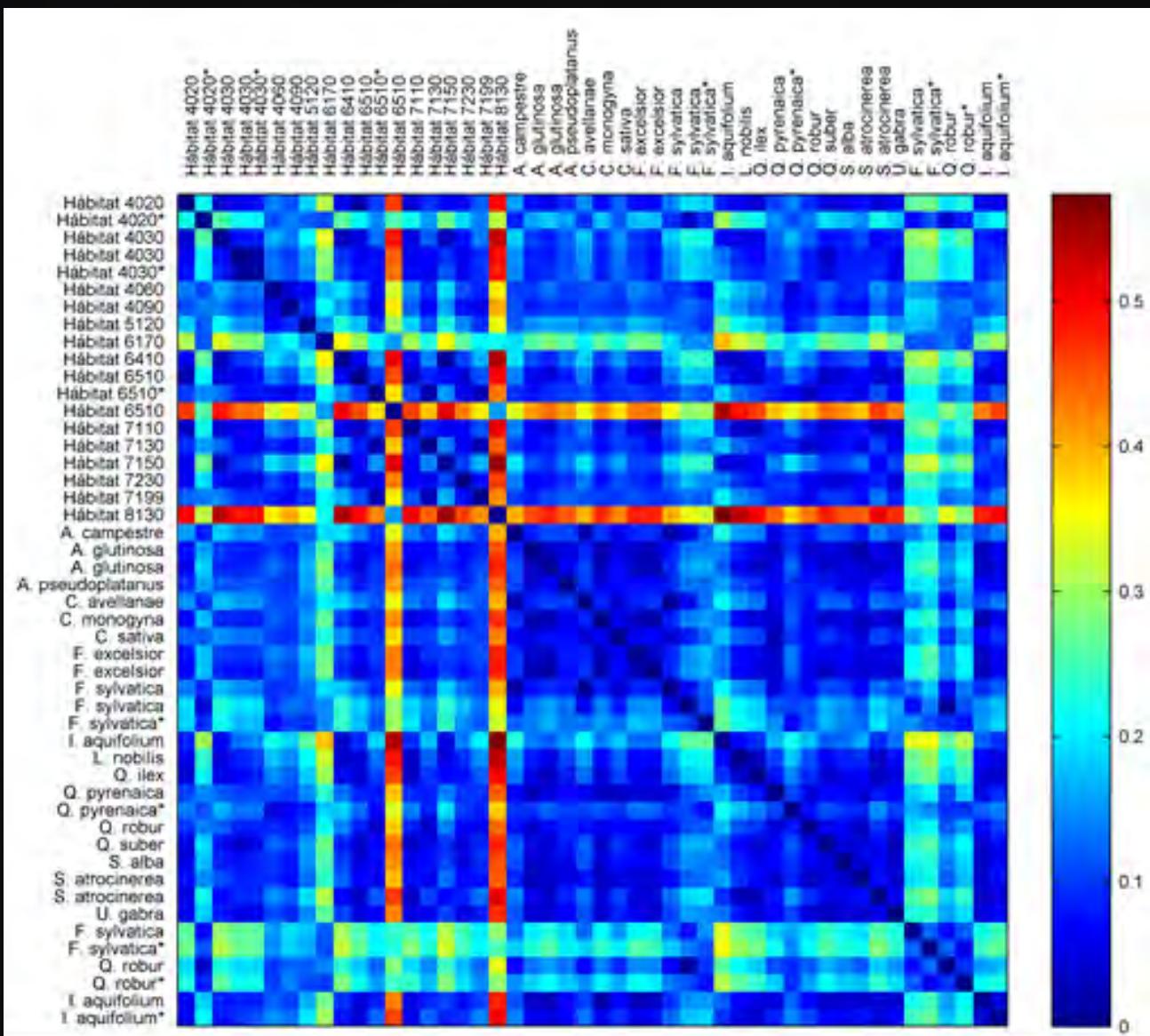
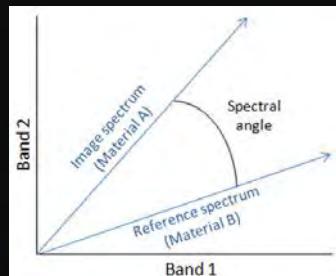
OBJECTIVE: To keep and organize spectral data of different habitats obtained by means of field radiometry or in the spectral radiometry laboratory



<http://spectrallibrary.ihcantabria.com/>

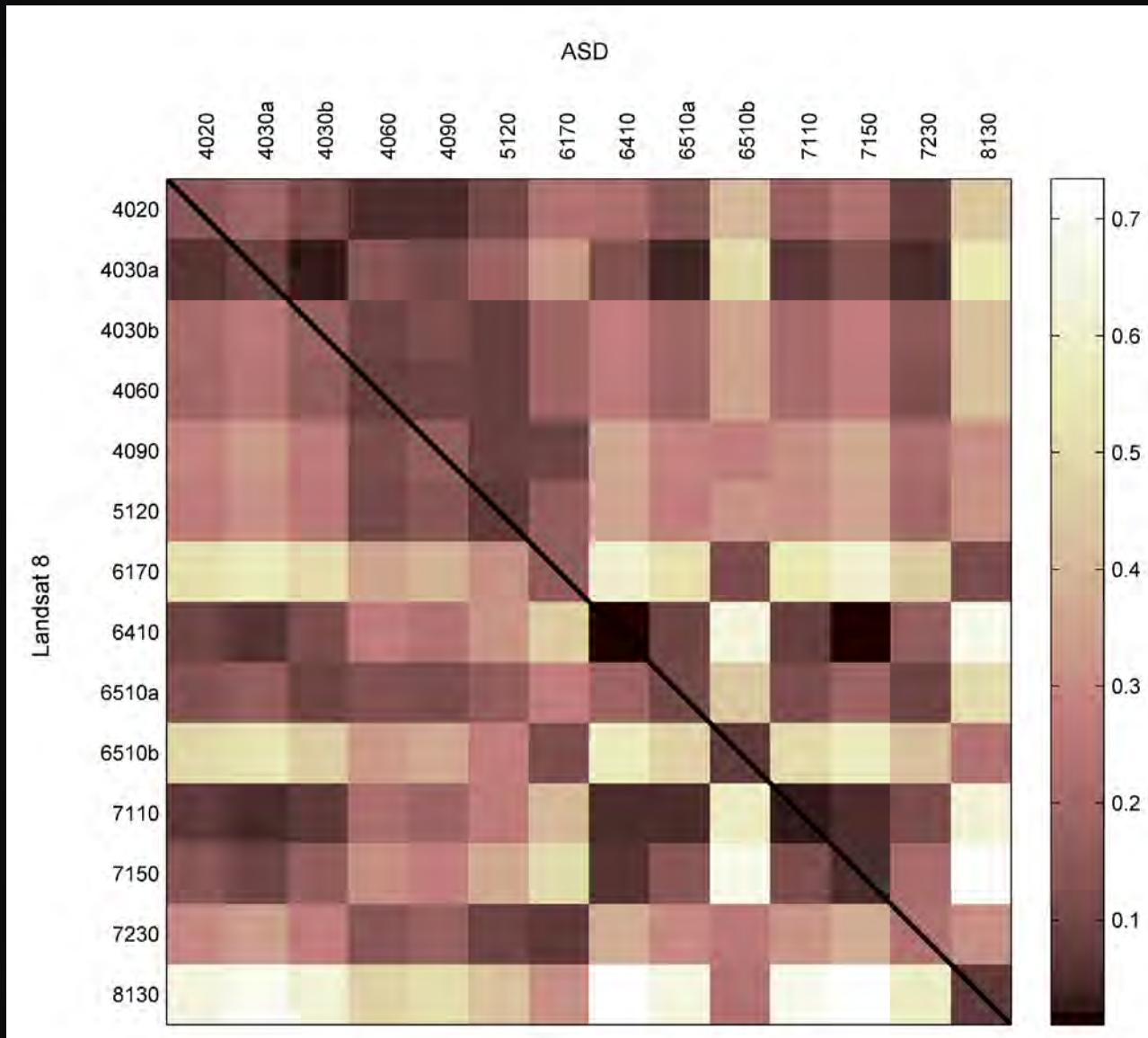
Finding differences

Matriz de similaridad espectral basada en el *Spectral Angle Mapper* (SAM). La escala de colores representa la diferencia angular en radianes. Una diferencia angular de 0 se corresponde con una similaridad del 100% y valores superiores, hasta un máximo de $\pi/2$, con una similaridad menor.



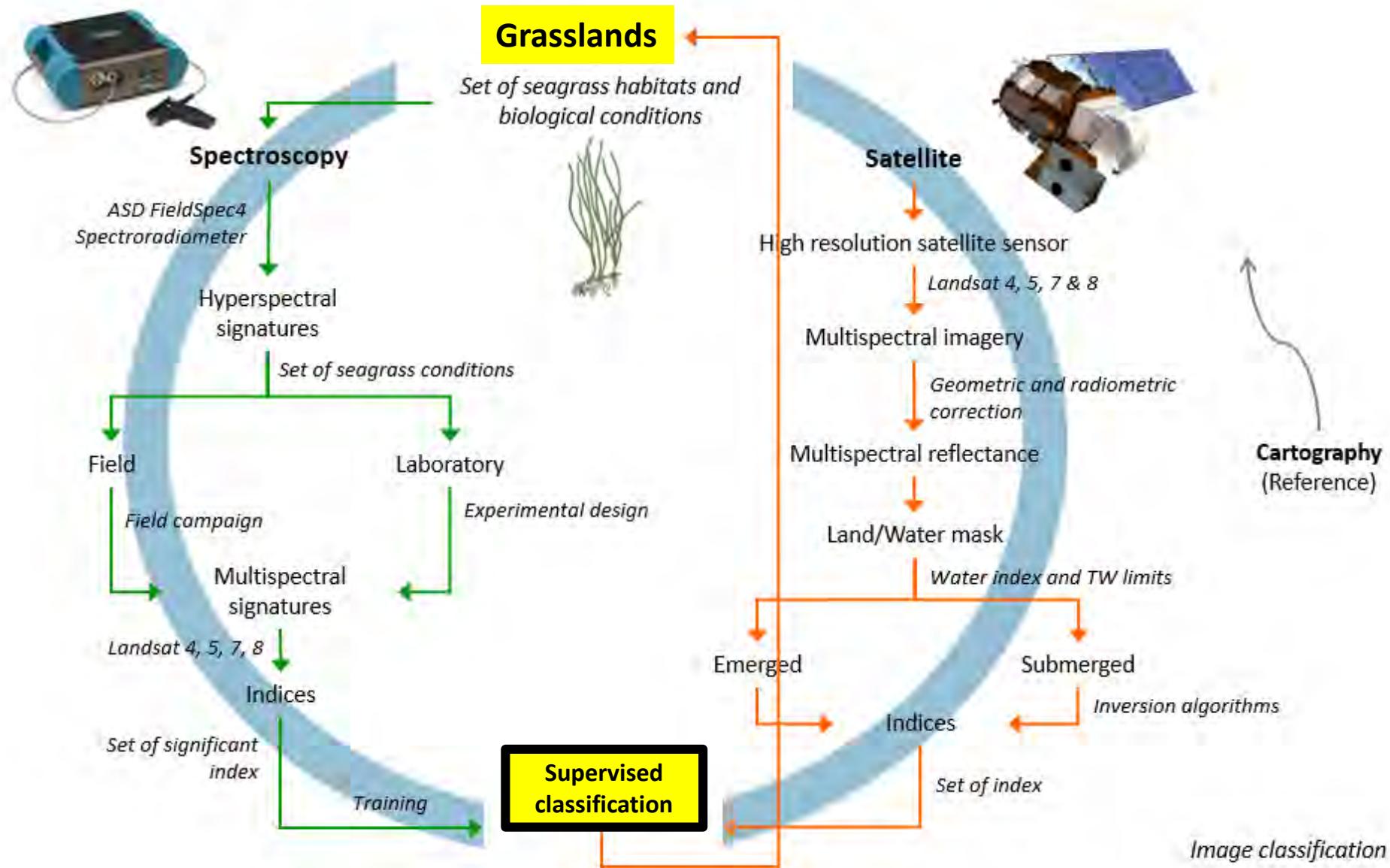
Upscaling to satellite sensors

Matriz de similaridad espectral basada en el Spectral Angle Mapper (SAM) entre las firmas espectrales de los hábitats de tipo pastizal, matorral, turbera y rocosa obtenidas *in situ* (ASD) y de sensores remotos (Landsat 8). La escala de colores representa la diferencia angular en radianes. Una diferencia angular de 0 se corresponde con una similaridad del 100% y valores superiores, hasta un máximo de $\pi/2$, con una similaridad menor.

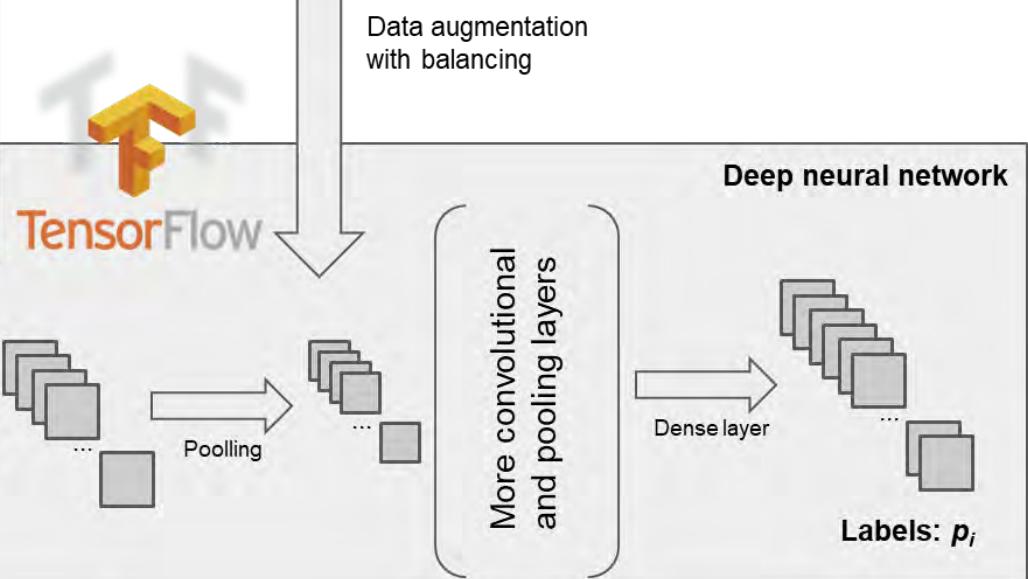
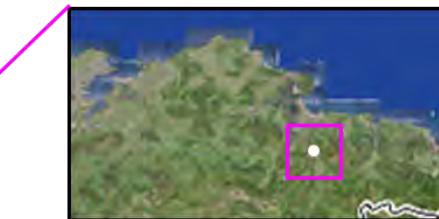
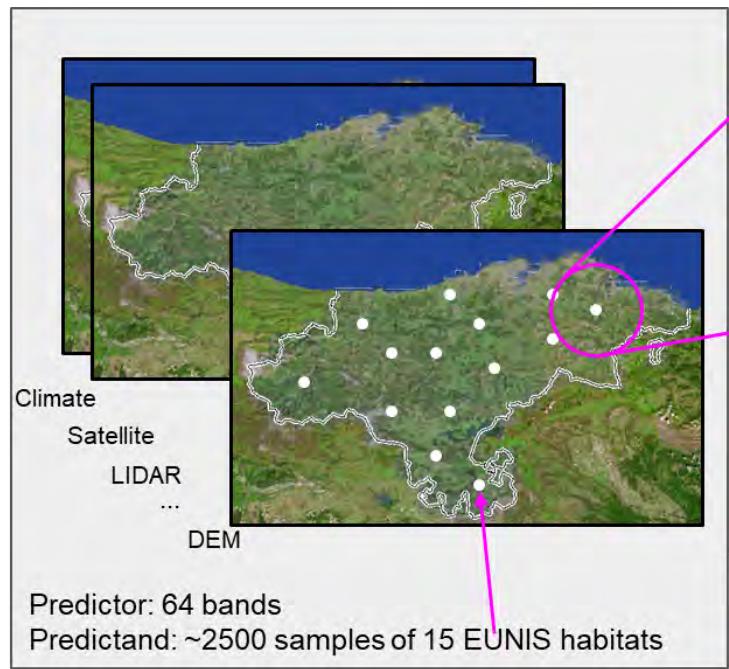


SPECTRAL SIGNATURES

From field and lab data to satellites



Advancing knowledge



predictia
INTELLIGENT DATA SOLUTIONS S.L.

```

mo.add(
    Conv2D(6, (1, 1), activation='relu', input_shape=input_shape))
mo.add(MaxPooling2D((2, 2)))
mo.add(Conv2D(12, (1, 1), activation='relu'))
mo.add(MaxPooling2D((2, 2)))
mo.add(Flatten())
mo.add(Dense(self.eunis_types, activation='softmax'))
mo.compile(loss='categorical_crossentropy',
            optimizer=keras.optimizers.Adam(),
            metrics=[acc, 'binary_accuracy'])

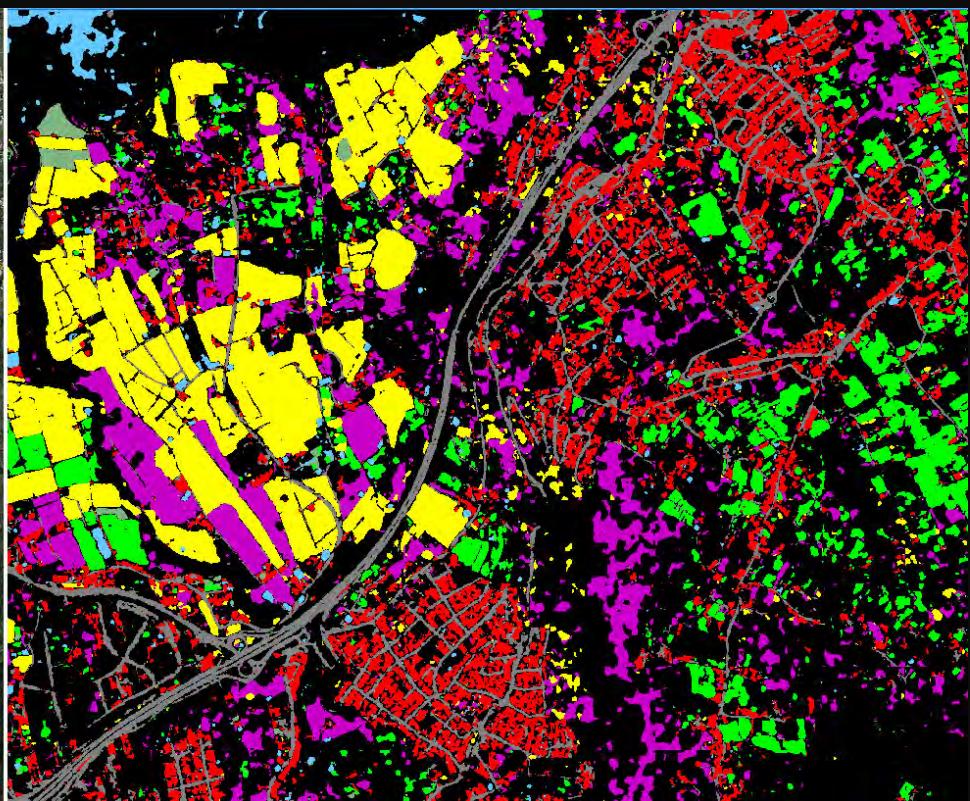
return mo

def train(self, x_train, y_train, trained_model_path=None):
    x_train, y_train = self.reshape_matrices(x_train, y_train)
    file_name = None
    if trained_model_path is None:
        mo = self.define_model()
        mo.fit(x_train, y_train, epochs=100, batch_size=32, verbose=1)
        # Save trained model
        file_name = self.save_model_and_headers(mo)
    else:
        # load
        mo = load_model(trained_model_path)
    return mo, file_name

```

Deep learning is a class of machine learning algorithms that use a cascade of multiple layers of nonlinear processing units for feature extraction and transformation to learn about the feature to represent by using supervised or unsupervised approaches

COMPLEX LANDSCAPES



Deep learning with multispectral imagery and limiting factors





Copernicus for the Environmental Policies



Copernicus
Europe's eyes on Earth

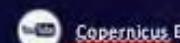
Space



Copernicus EU



Copernicus EU



Copernicus EU



www.copernicus.eu





Bi+De



föra



tecnosylva

LULUCF REPORTING



IHCantabria LULUCF

ABOUT THE PROJECT DEVELOPMENTS IN SPAIN DOWNLOADS COMMUNICATION AND DISSEMINATION  

SWOT Analysis

		HELPFUL	HARMFUL
INTERNAL	Strengths	Weaknesses	
	Opportunities	Threats	

GAP

Key steps to bridge gap

Current State → Desired State

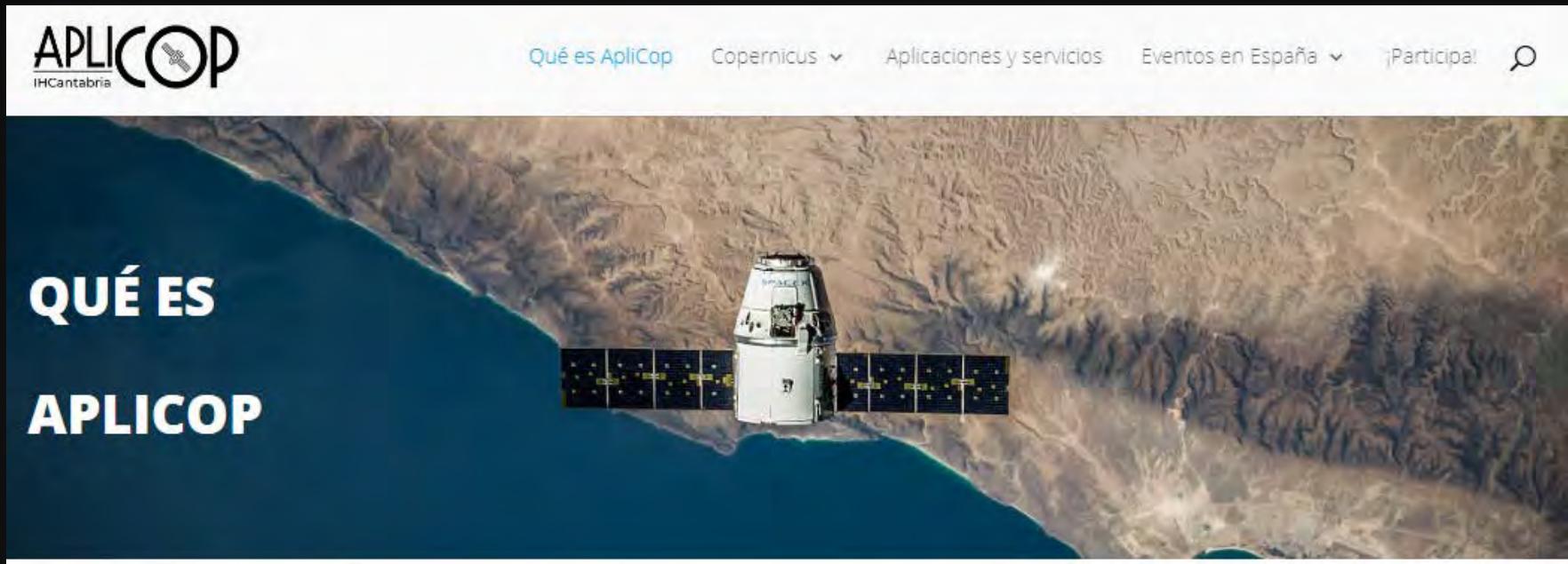
Action Plan

QuestionPro

LULUCF REPORTING



Stakeholder meetings (MINERD)



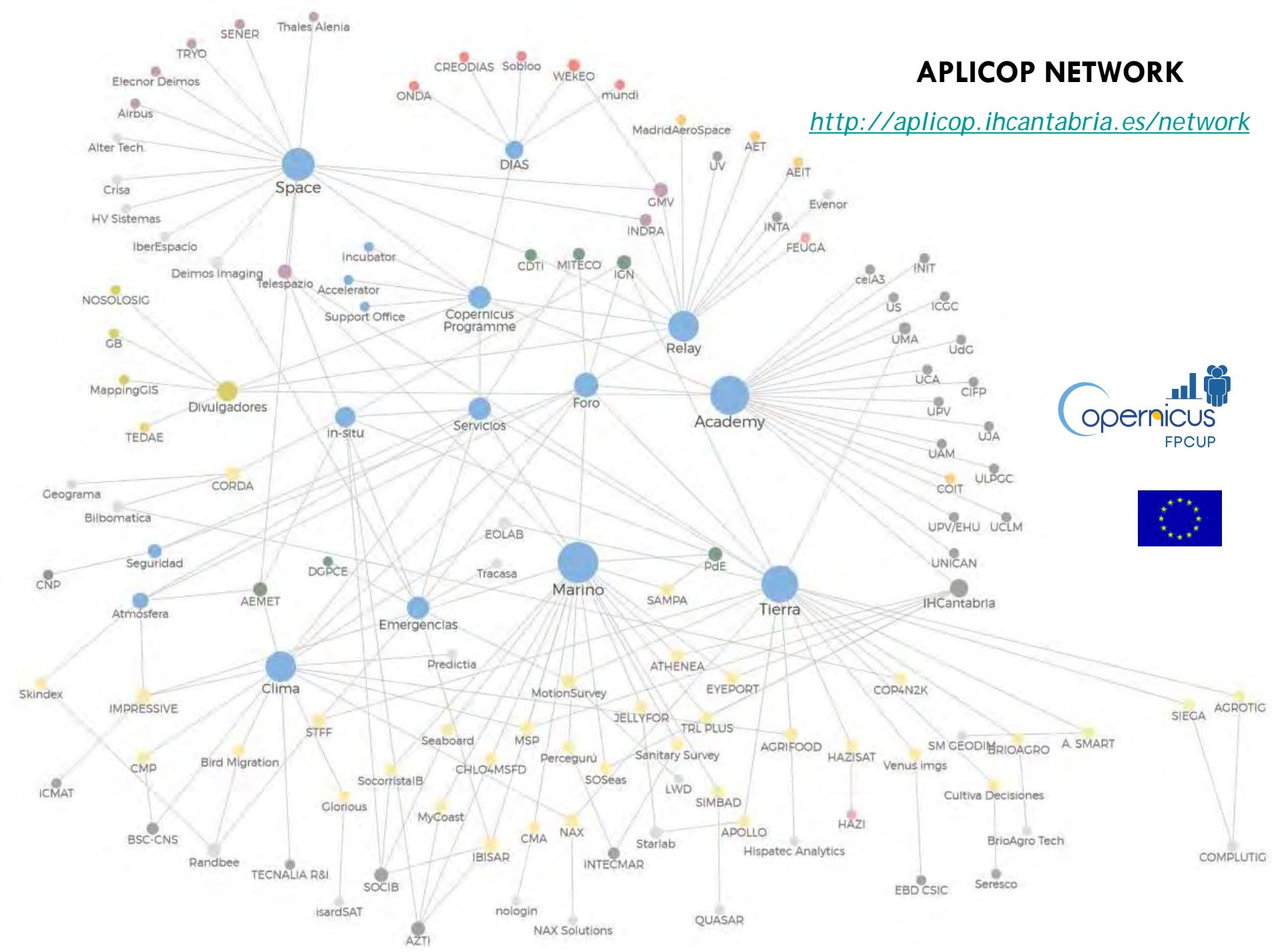
**QUÉ ES
APLICOP**

ApliCop es un Proyecto financiado por la Comisión Europea a través del Caroline Herschel **Framework Partnership Agreement**.

El objetivo del Proyecto es establecer la **red de actores del ecosistema Copernicus en España**: empresas, administración, centros de investigación, etc. para fomentar la interacción y la explotación de datos Copernicus.

APLICOP NETWORK

<http://aplicop.ihcantabria.es/network>



A wide-angle photograph of a winding asphalt road through a mountainous landscape. The mountains are covered in dense forests with autumn-colored leaves (yellow, orange, red). In the foreground, there's a large, modern building with a glass facade and a circular structure made of a grid of vertical pipes or tubes. Bare tree branches are visible in the upper left corner.

¡Gracias!

Jose Manuel Álvarez-Martínez

jm.alvarez@unican.es