EOs improving ecosystem benefits: ECOPOTENTIAL activities in the SCERIN Protected Areas

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EU H2020 funding GA No 641762

Core activities I

Core project activities are

i) the exploitation of Earth Observation data from existing archives and new missions,

ii) the utilization of latest advancements in data mining and image processing,

iii) the adjustment of process-based models to assimilate the aforementioned data, maximizing performance,

iv) the incorporation of cross-scale interactions in the processing concept, and

v) the combination and alignment of the ecosystem functions with the beneficiaries needs.

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Core activities II

ECOPOTENTIAL will

- assess climate change impacts combined with land cover and land use change scenarios,
- will consider ecosystem services including supply and demand, and
- will provide platforms for cyber infrastructures and data interoperability,
- while taking into consideration policy developments,
- benefitting from citizen science activities, and
- implementing capacity building and outreach activities.

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Working team

To address this challenge, the EU H2020 ECOPOTENTIAL project includes a strong trans-disciplinary team of experts and stakeholders from 47 directly-involved renowned Institutions across Europe and beyond.

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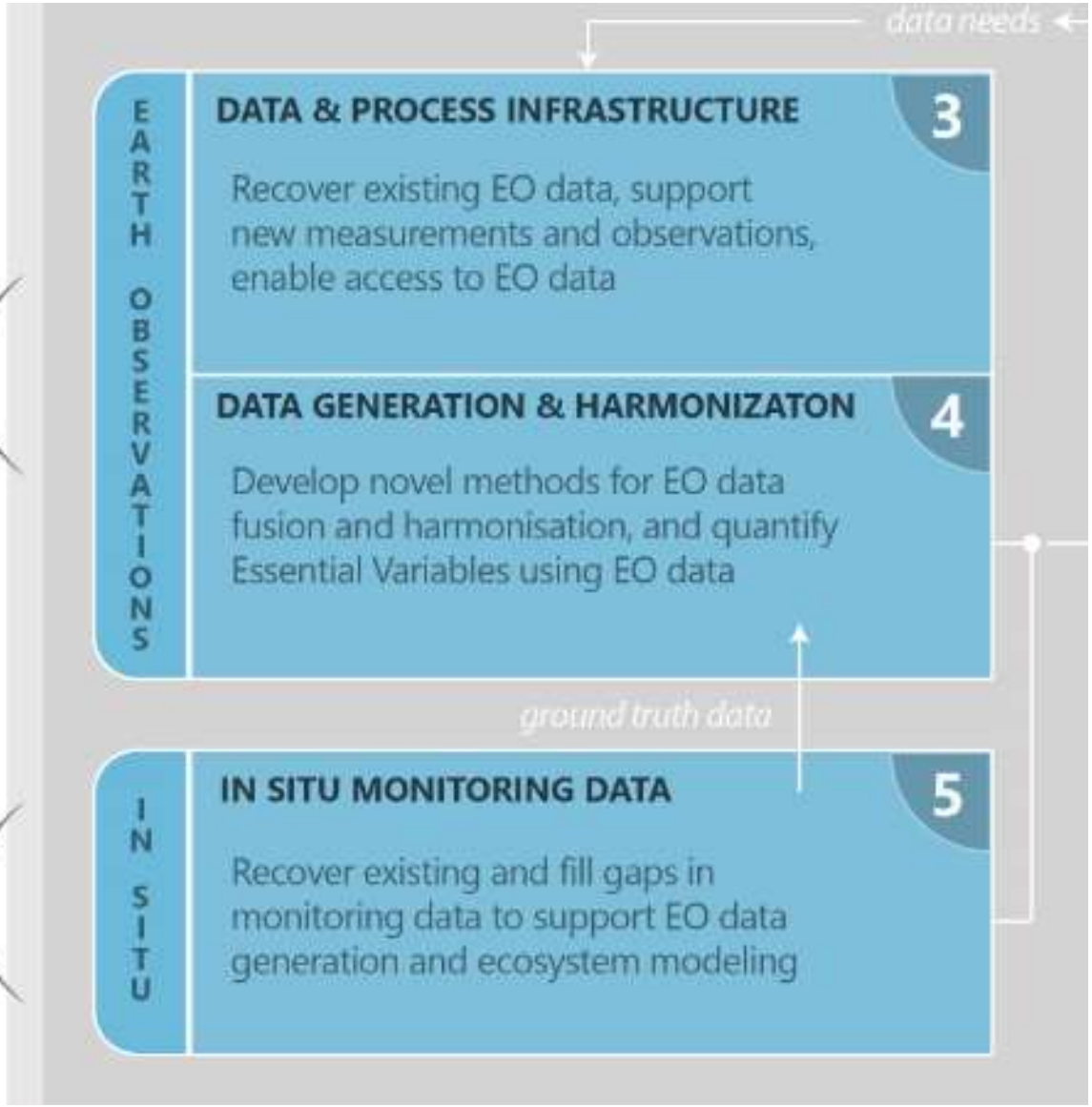
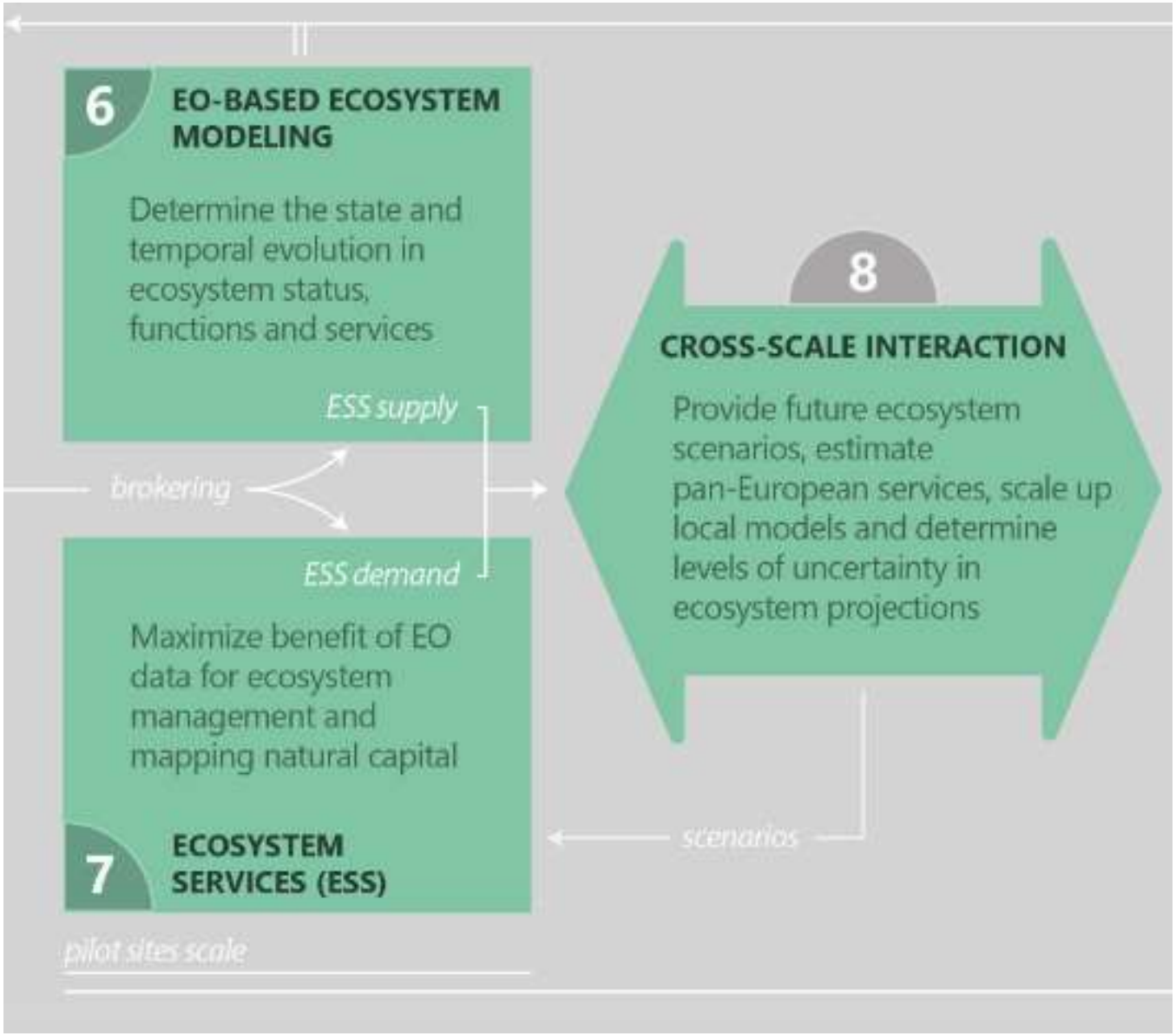
Concept



EU H2020 funding GA No 641762

Concept



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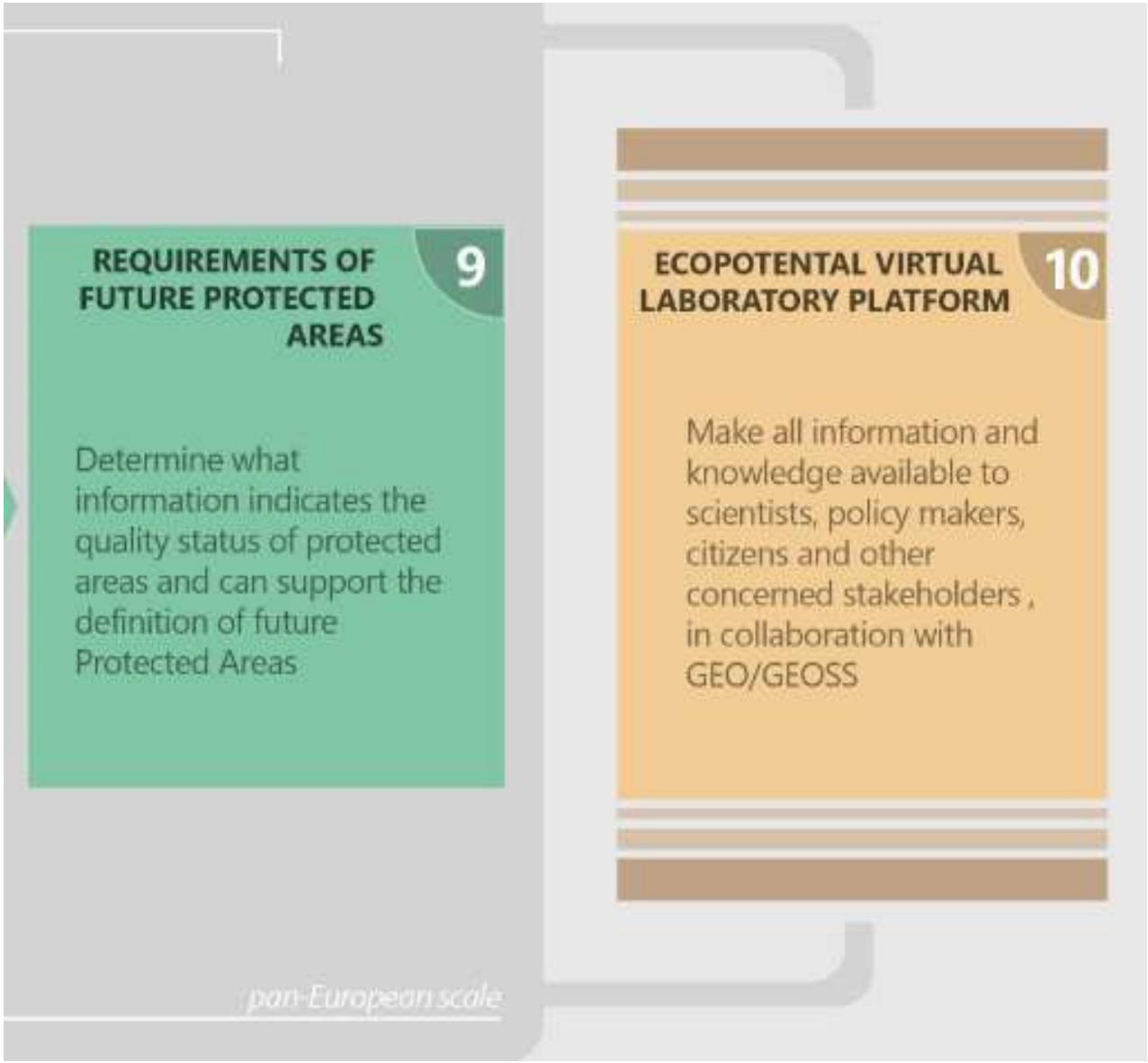
Concept



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Concept

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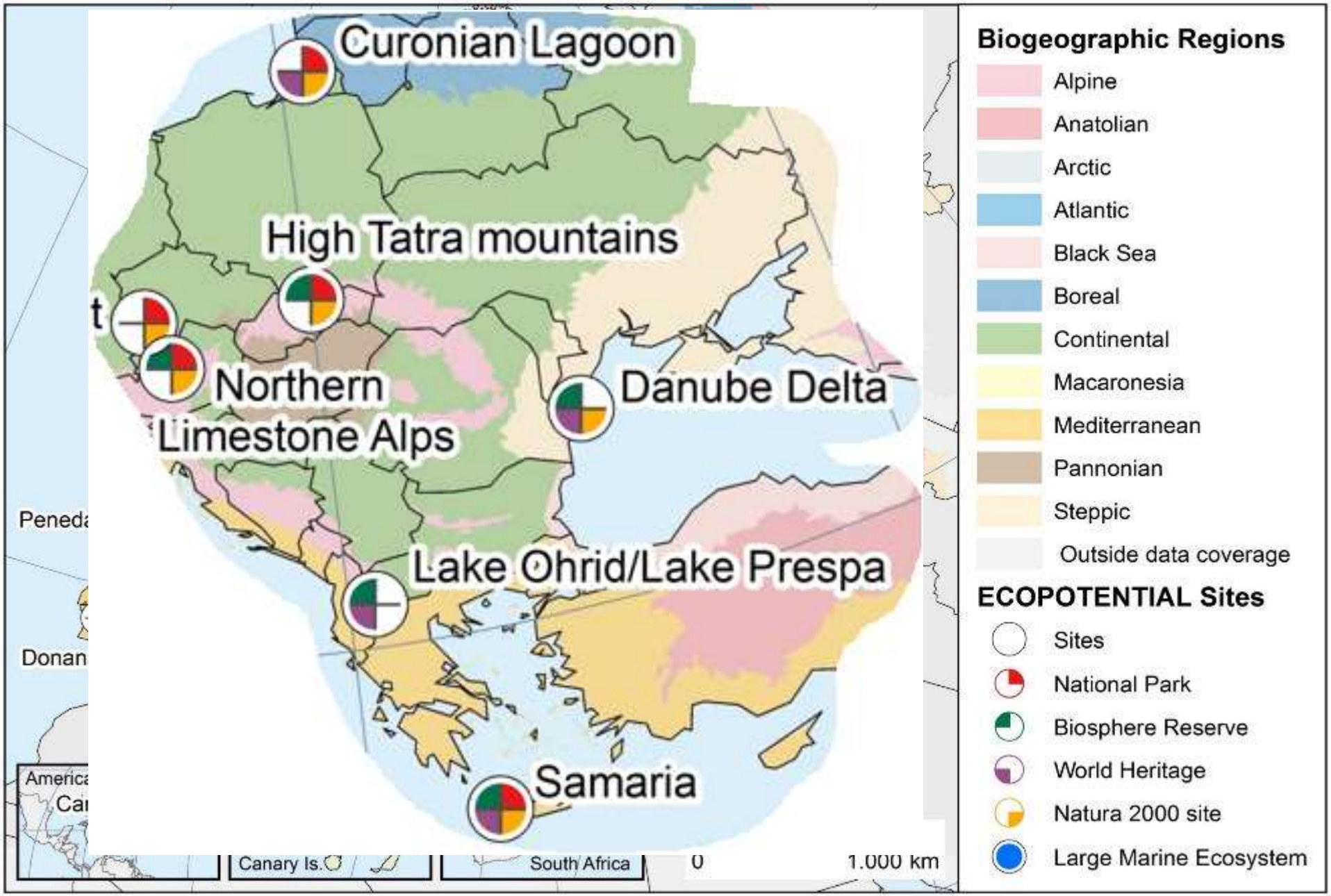
Protected Areas in the SCERIN area



Northern Limenstone Alps

The Northern Limestone Alps National Park storyline in Austria is **focusing on estimating the carbon sink strength of this mountain forest landscape, which is prone to climate driven disturbances such as bark beetle attacks and wind throw.**

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ECOPOTENTIAL Protected Areas in the SCERIN area

Lake Ohrid /Lake Prespa (FYROM – GREECE)

RS coupled with in-situ data will provide information on spatial and temporal changes of environmental parameters across surface waters of the watershed and information at catchment scale on land cover, land use, vegetation status and forest fires **to facilitate the establishment of linkages between catchment scale alterations and lake ecosystem processes.**

Curonian Lagoon (similar to Camargue focusing on fisheries and recreation)

Research activities in Curonian Lagoon mainly focused on analysing services associated with the main socio-economic activities of the delta (fishing, reed harvesting), including supporting service such as biodiversity (endemic species, species richness). Recent developments also have focused on studying the biogeochemical services of the Curonian lagoon including denitrification.

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Danube Delta

The storyline in Danube Delta explores the link between aquatic ecosystem provisioning services and touristic attraction of the area.

High Tatra Mountains

Storyline to support: The increase of flooding and landslides following a large scale deforestation due to windstorm in 2014, has made practitioners to decide the change of land use from former spruce monocultures to more natural mixed forest to assist soil retention, regulate the water cycle and preserve biodiversity.

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TOWARDS A PAN-EUROPEAN PERSPECTIVE - CHALLENGES IN MONITORING CROSS-SCALE PROCESSES

by

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and ECOPOTENTIAL colleagues

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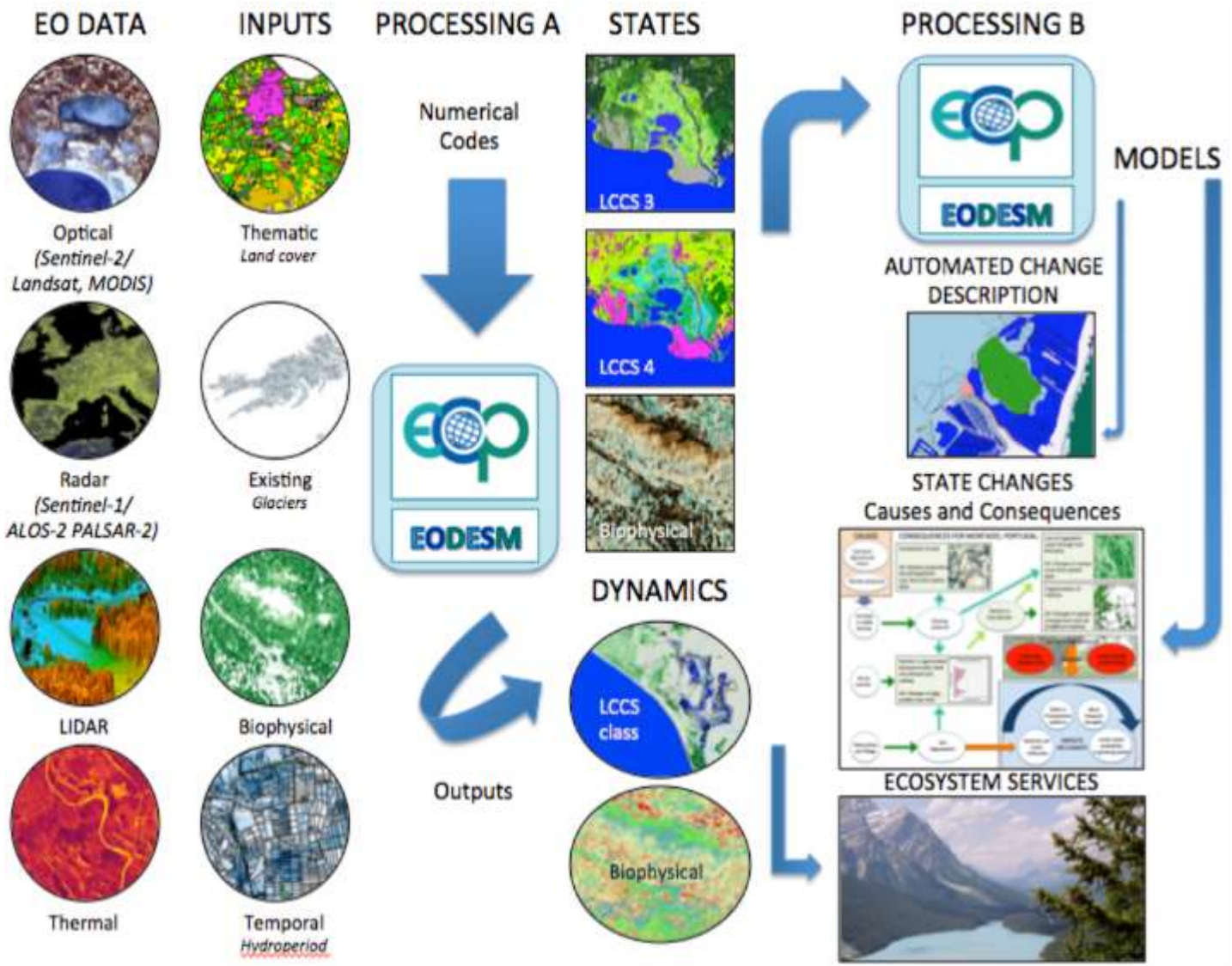
Earth Observation Data for Ecosystem Monitoring (EODESM)



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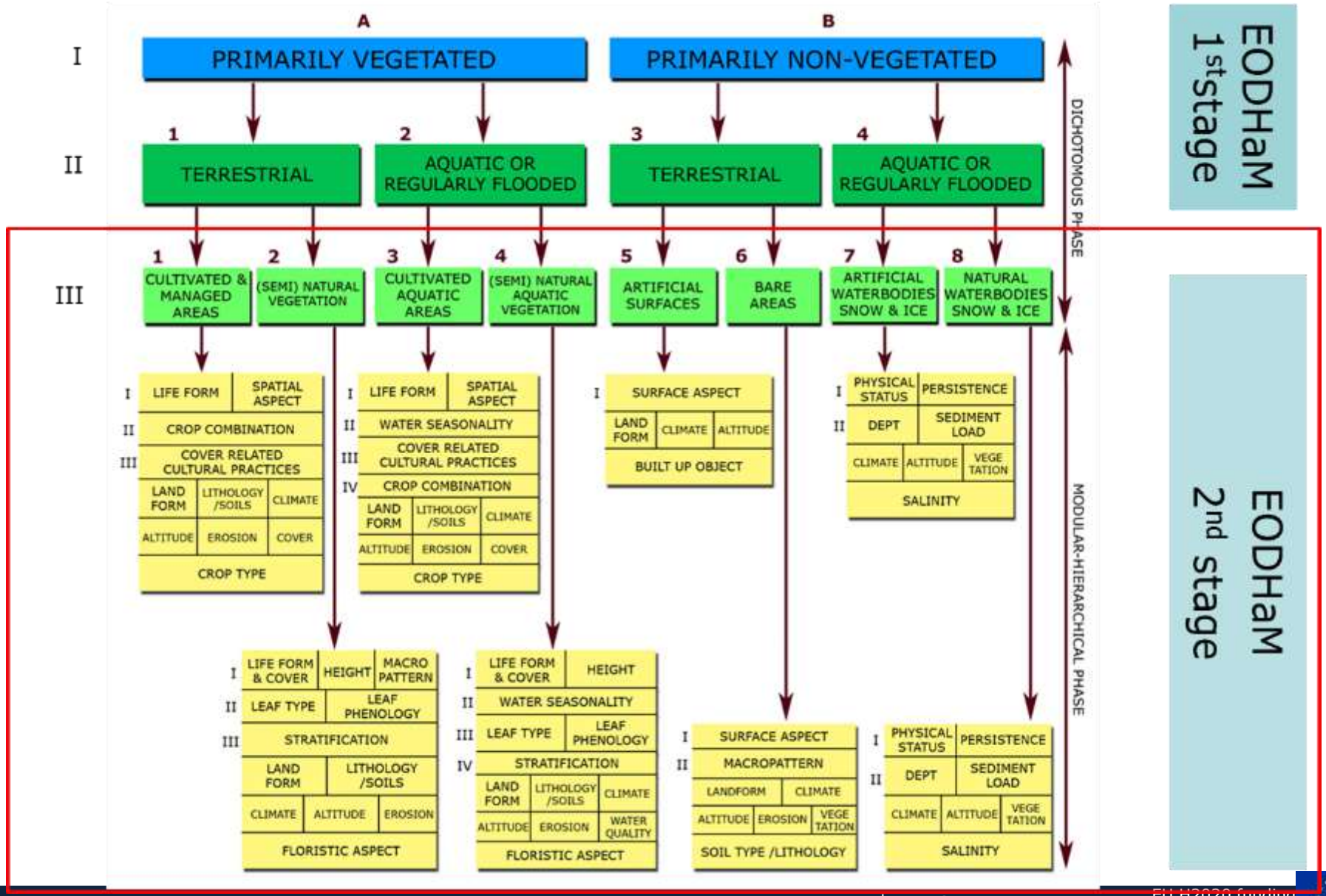
THE FOOD AND AGRICULTURAL ORGANISATION (FAO) LAND COVER CLASSIFICATION SYSTEM LCCS-2



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LCCS-2: COMPREHENSIVE DESCRIPTIONS (E·G·, OF FORESTS)

A12: A- Life form of the main strata	Code	A12: Cover	Code	A12: B-Height	Code	A12: C-Spatial distribution/ macropattern	Code	A12: D-Leaf Type (semi-natural/natural)	Code	A12: E-Phenology (natural/semi-natural)	Code	A12: F-Stratification (Second layer)	Code	A12: G-Cover (Second layer)	Code	A12: H-Height-second layer	Code
Woody	A1	closed (70-60 %)	A10	(7-1 m; woody)	B1	continuous	C1	broadleaved	D1	evergreen	E1	2nd layer absent	F1	closed to open	F7	(7-2 m; woody)	G1
Trees	A3	open (70-60 to 20-10 %)	A11	(>30-3 m; trees)	B2	fragmented	C2	needleleaved	D2	Semi-evergreen	E3	2nd layer present	F2	closed (> 70-69%)	F8	(>14 m)	G5
Shrubs	A4	open (70-60 to 40 %)	A12	(>14 m)	B5	fragmented	C4	Aphyllous	D3	deciduous	E2	2nd layer Woody	F3	open (70-60% to 20-10 %)	F9	(14-7 m)	G6
Herbaceous	A2	open (40-20 to 10 %)	A13	(14-7 m)	B6	cellular	C5			semi-deciduous	E3	2nd layer Trees	F4	sparse (30-10 to 1 %)	F10	(7-3 m)	G7
Forbs	A5	closed to open (100-15 %)	A20	(7-3 m)	B7	parklike patches	C3			mixed	E4	2nd layer Shrubs	F5			(5-0.3 m)	G3
Graminoids	A6	closed to open (100-40 %)	A21	(5-0.3 m)	B3					mixed (forbs+	E5	2nd layer Herbaceous	F4			5-2 m	G8
Lichens/mosses	A7	sparse (20-10 - 1%)	A14	(5-0.05 m)	B14					mixed herbaceous (Annual)	E6					(2-0.5 m)	G9
Lichens	A8	sparse (<20-10 - 4%)	A15	(5-2 m)	B8					mixed herbaceous (Perennial)	E7					(< 0.5 m)	G10
Mosses	A9	scattered (4-1 %)	A16	(2-0.5)	B9											(3-0.03 m)	G4
				(< 0.5 m)	B10											(3-0.3 m)	G11
				(3-0.03)	B4											(0.3 - 0.03 m)	G12
				(3-0.3 m)	B15												
				(3-0.8 m)	B11												
				(0.8-0.3 m)	B12												
				(0.03-0.03 m)	B13												

A3.A10.B2.C1.D1.E1.F1.F9.G7

Trees closed canopy (>70-60 %) tall (14-30 m) continuous broadleaved evergreen with 2nd layer supporting open canopy 7-3 m in height.

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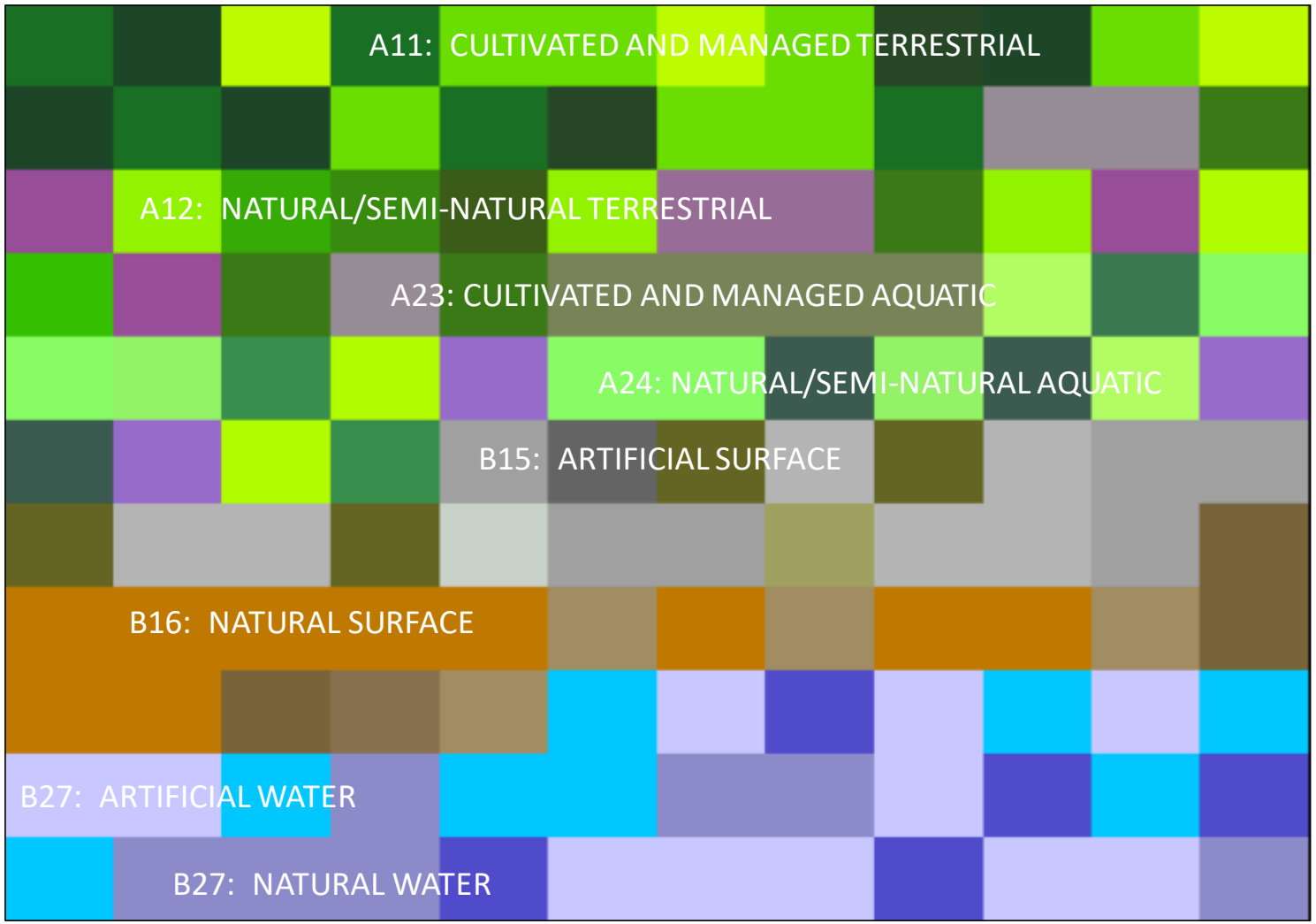
THE EODESM GRID: DEVELOPMENT AND TESTING



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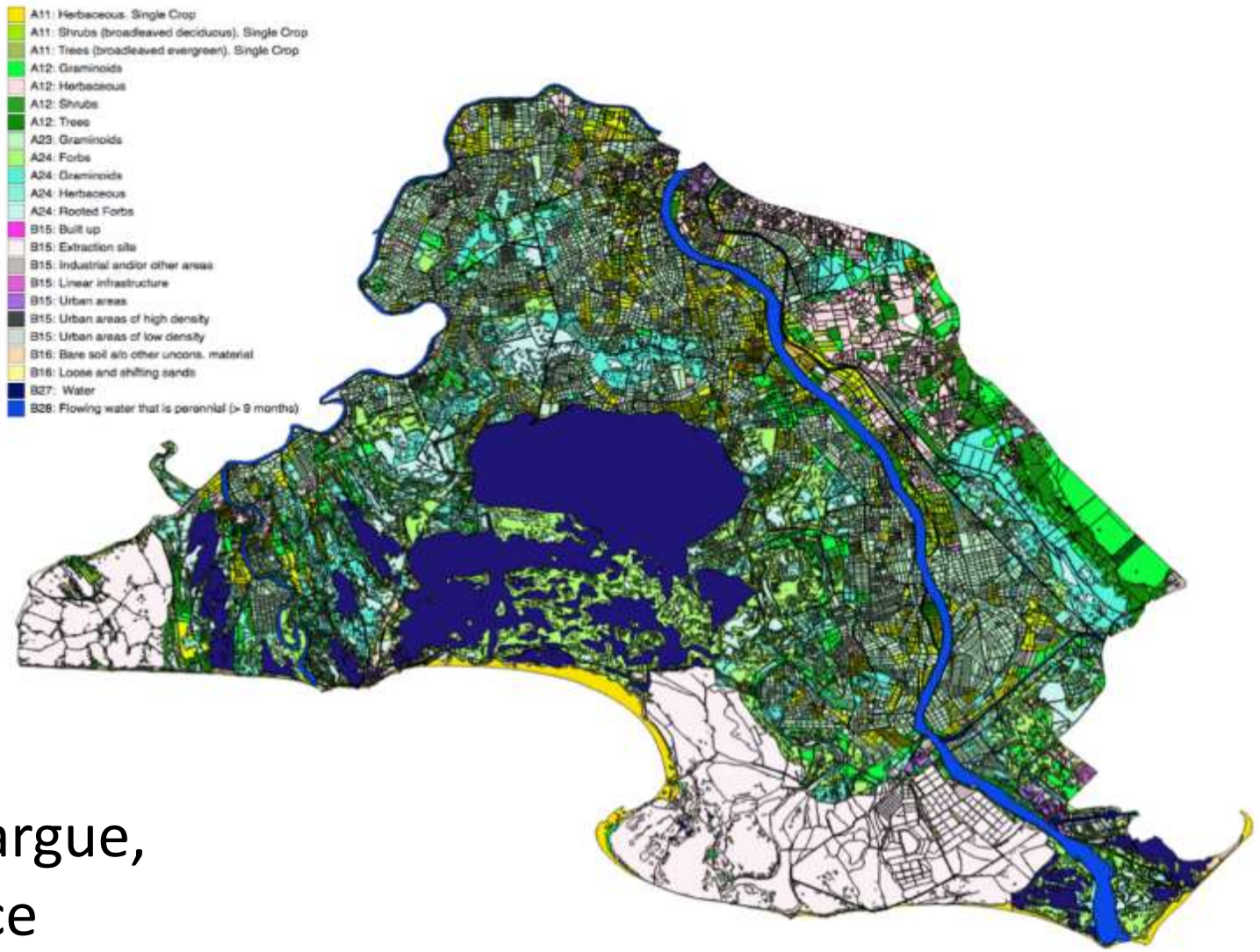
Translation from existing Land cover and/or habitat maps



Camargue, France

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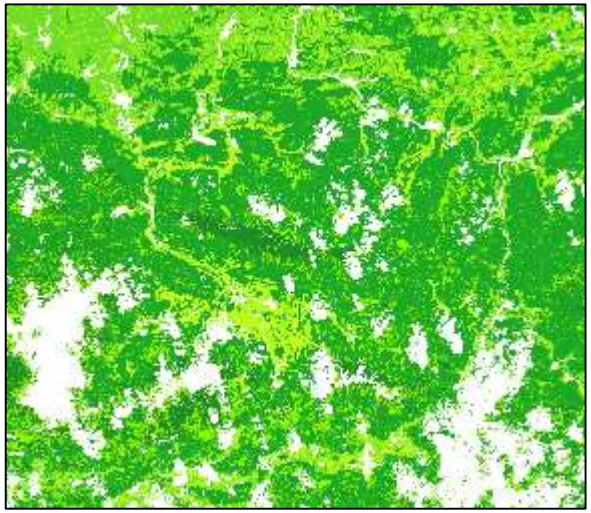
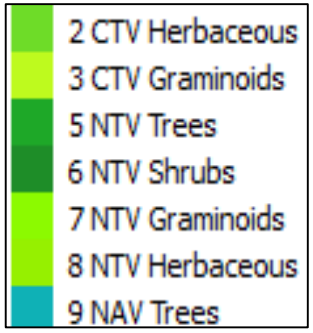
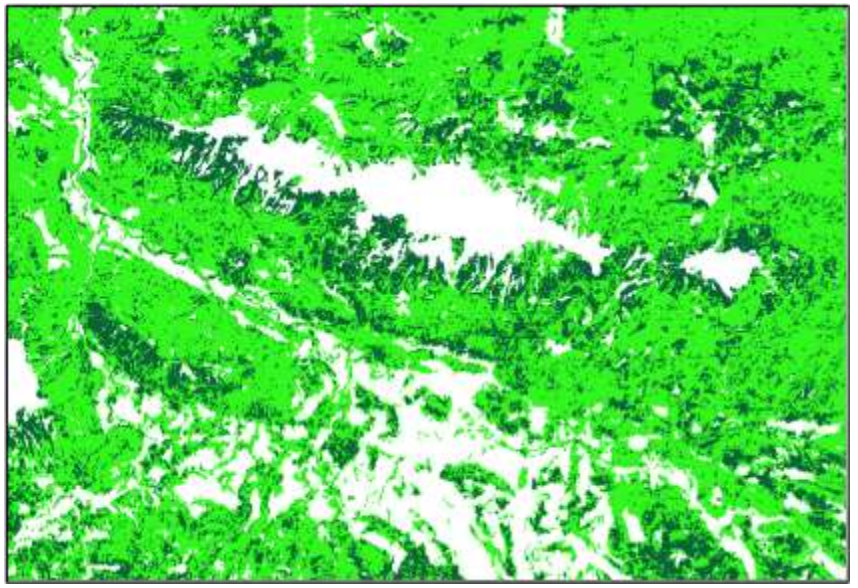
Classes Derived from Thematic Layers

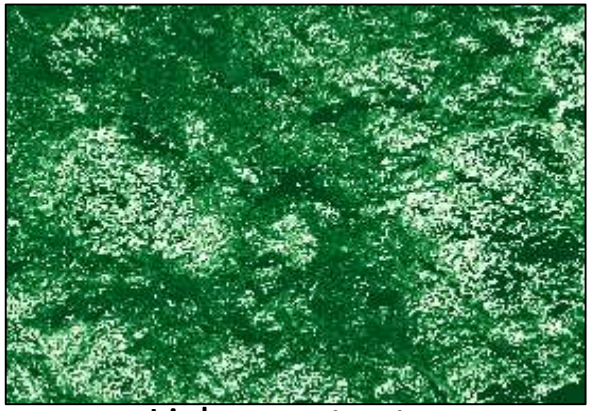


Lifeform





Leaf type (broadleaved, needleleaved)



Lichen extent

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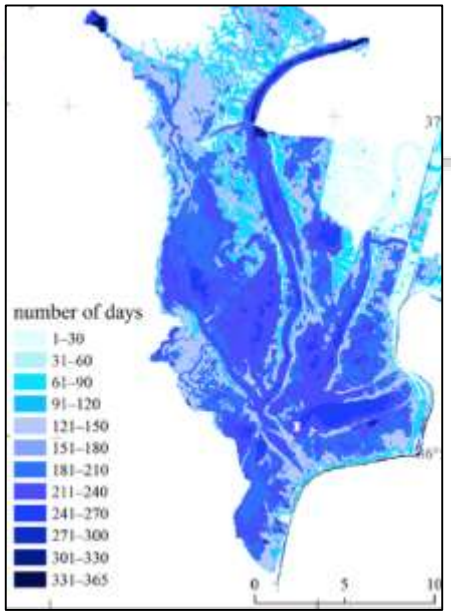
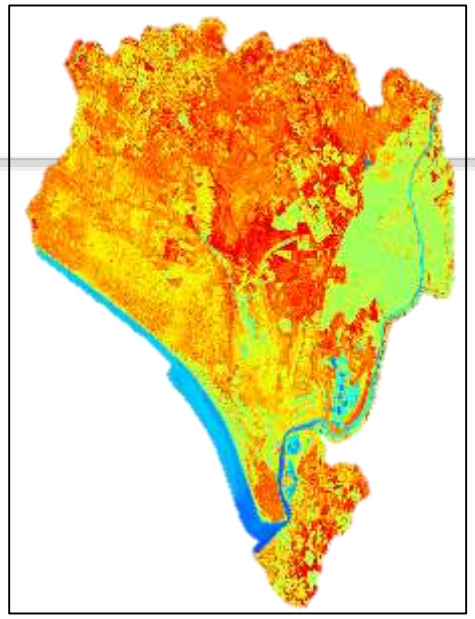
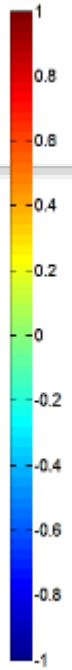


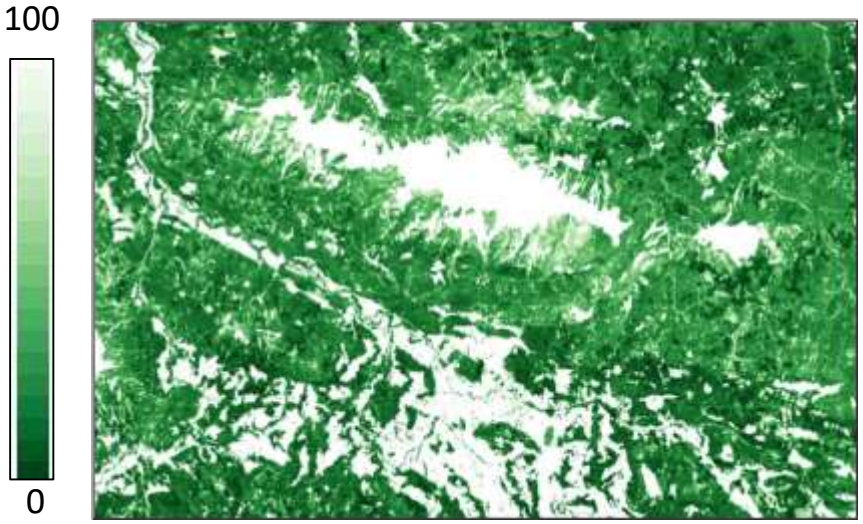
Hydro-period (days)



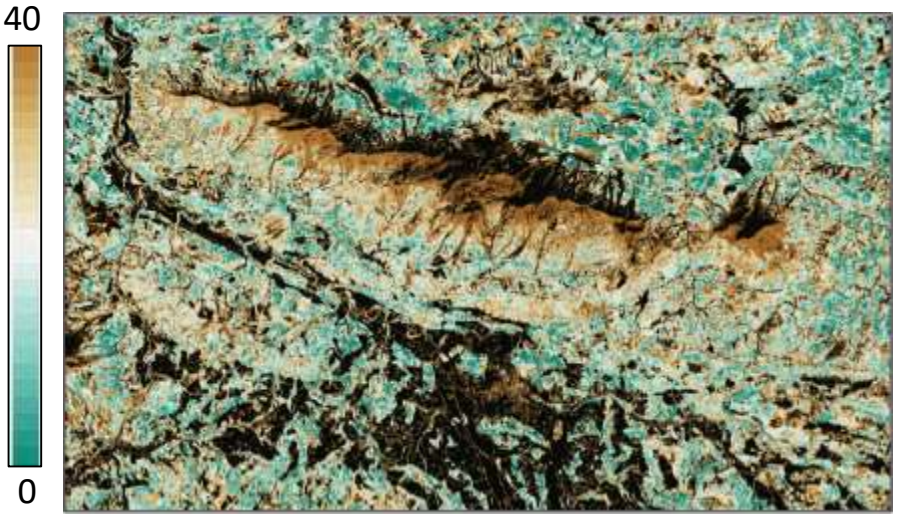


Phenology metrics (based on NDVI)

Snow cover duration



Tree Cover Density (%)



Canopy Height (m)

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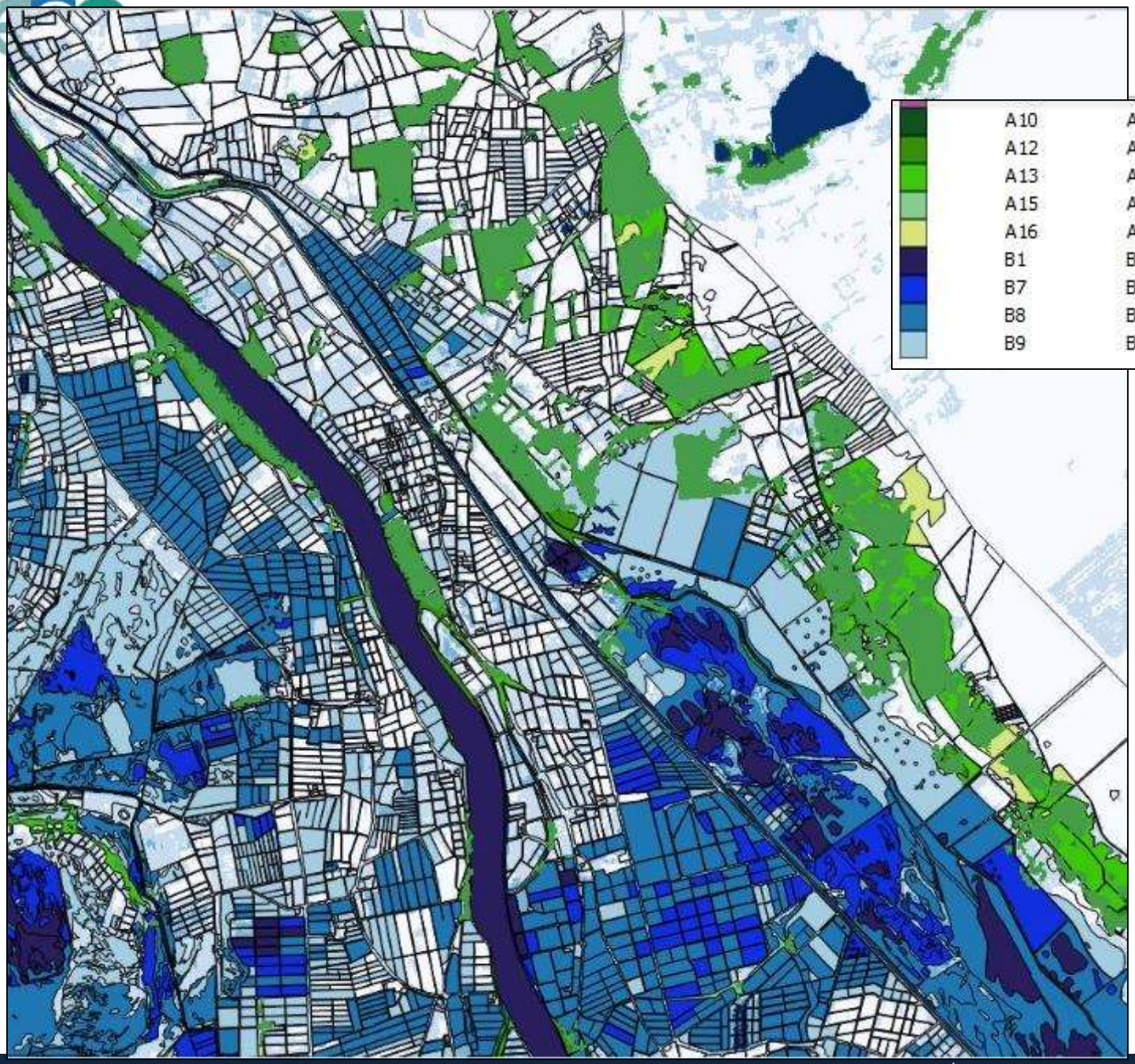

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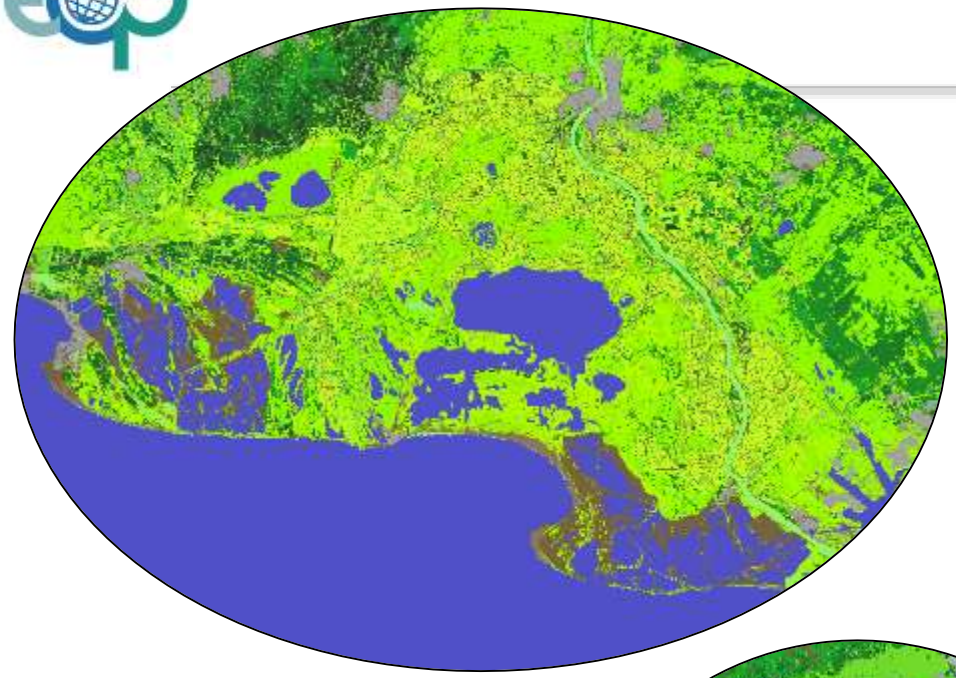
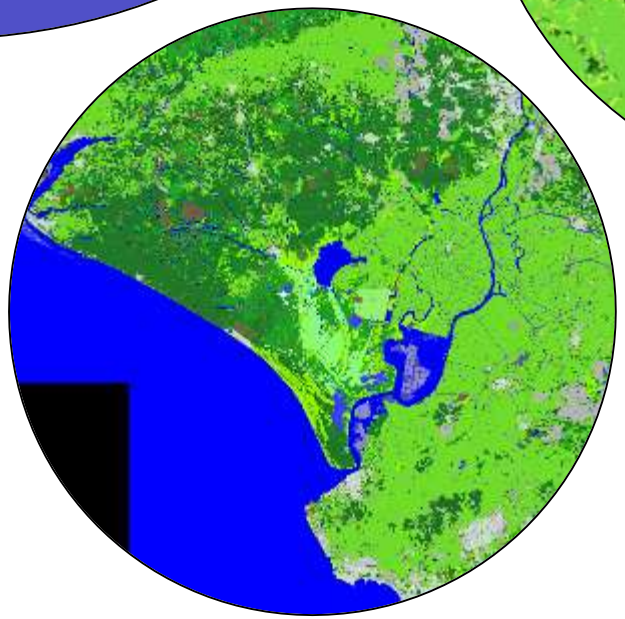
The Camargue, France



Danube Delta, Romania/Ukraine

LCCS:
A Scalable
And Globally
Consistent
Classification
Taxonomy



Donana, Spain

WETLANDS

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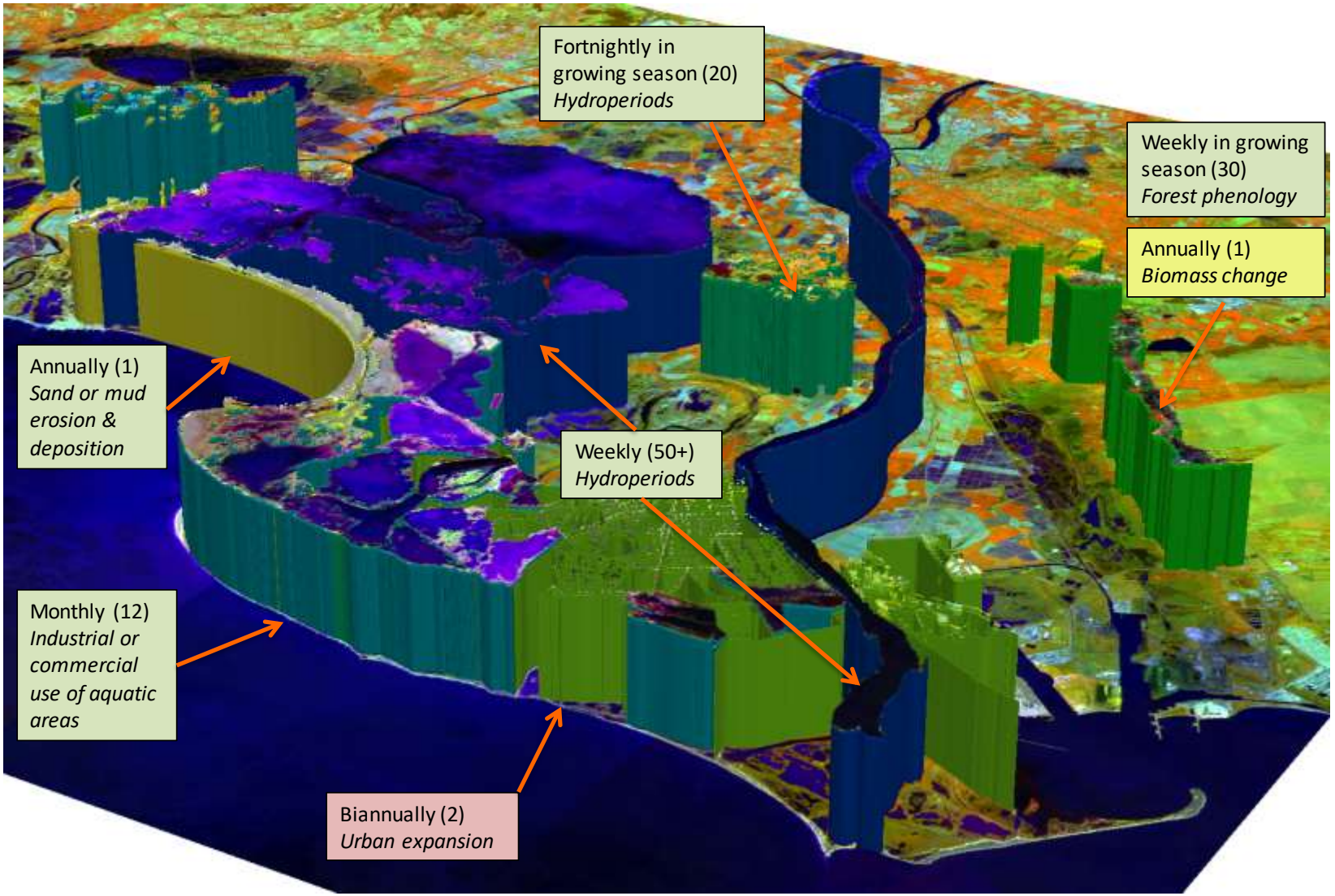
CHANGE DETECTION RATES AS FUNCTION OF LAND COVER TYPES AND USES



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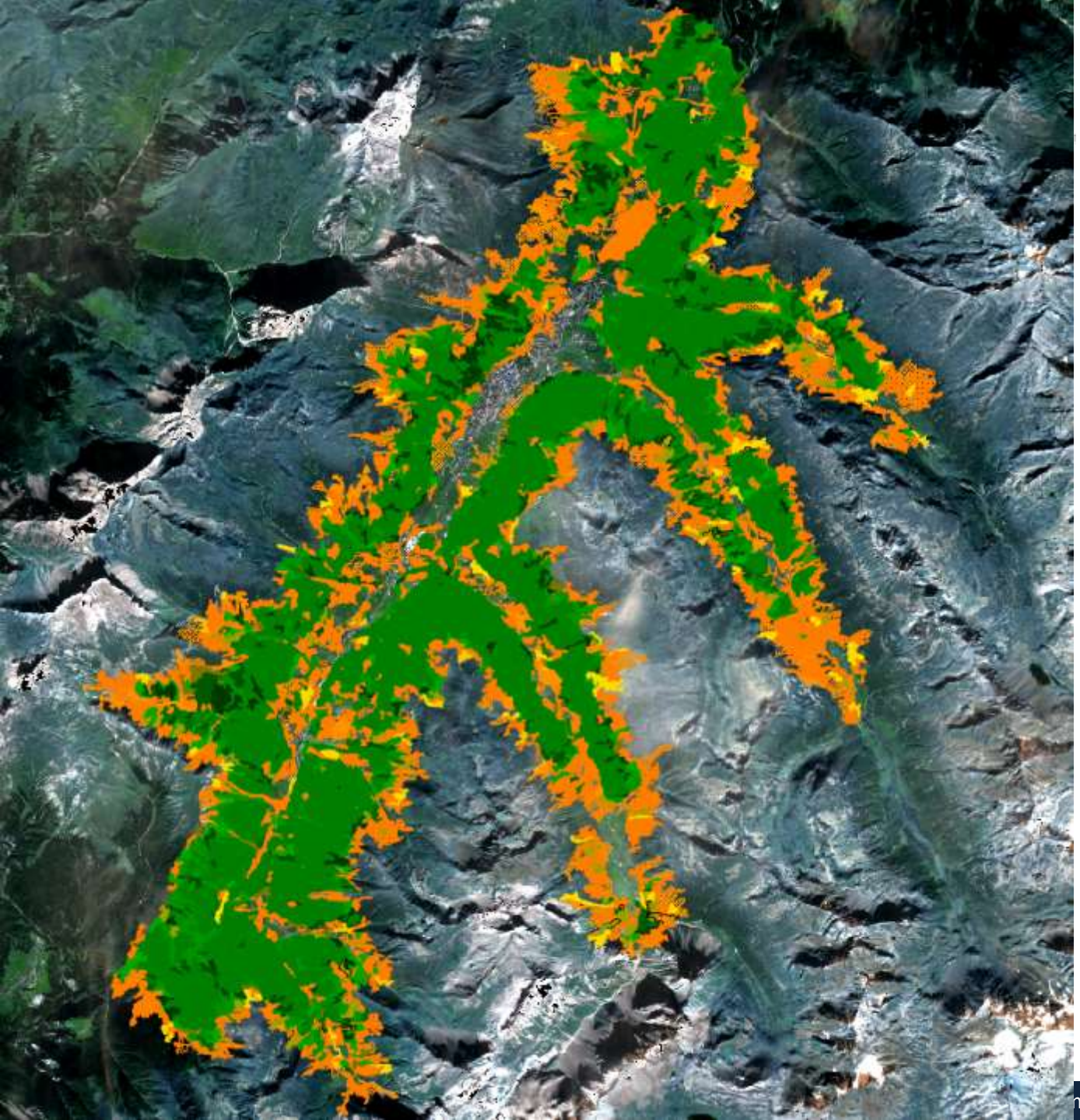

DAVOS, Switzerland
FAO LCCS Change (Woody Vegetation) 2003 – 2012

- Remained as Shrubs (< 0.5 m)(B10)
- Remained as Shrubs (5-0.5 m)(B14)
- Remained as Trees (7-3 m)(B7)
- Remained as Trees (14-7 m)(B6)
- Remained as Trees (>14 m)(B5)
- Bare to Shrubs (< 0.5 m)(B10)
- Bare to Shrubs (5-0.5 m)(B14)
- Bare to Trees (7-3 m)(B7)
- Bare to Trees (14-7 m)(B6)
- Bare to Trees (>14 m)(B5)
- Shrubs (< 0.5 m)(B10) to Bare
- Shrubs (5-0.5 m)(B14) to Bare
- Shrubs (< 0.5 m)(B10) to Shrubs (5-0.5 m)(B14)
- Shrubs (5-0.5 m)(B14) to Shrubs (< 0.5 m)(B10)
- Shrubs (< 0.5 m)(B10) to Trees (7-3 m)(B7)
- Shrubs (5-0.5 m)(B14) to Trees (7-3 m)(B7)
- Shrubs (5-0.5 m)(B14) to Trees (14-7 m)(B6)
- Trees (7-3 m)(B7) to Bare
- Trees (14-7 m)(B6) to Bare
- Trees (>14 m)(B5) to Bare
- Trees (7-3 m)(B7) to Shrubs (5-0.5 m)(B14)
- Trees (14-7 m)(B6) to Shrubs (5-0.5 m)(B14)
- Trees (>14 m)(B5) to Shrubs (5-0.5 m)(B14)
- Trees (7-3 m)(B7) to Trees (14-7 m)(B6)
- Trees (7-3 m)(B7) to Trees (>14 m)(B5)
- Trees (14-7 m)(B6) to Trees (7-3 m)(B7)
- Trees (14-7 m)(B6) to Trees (>14 m)(B5)
- Trees (>14 m)(B5) to Trees (7-3 m)(B7)
- Trees (>14 m)(B5) to Trees (14-7 m)(B6)

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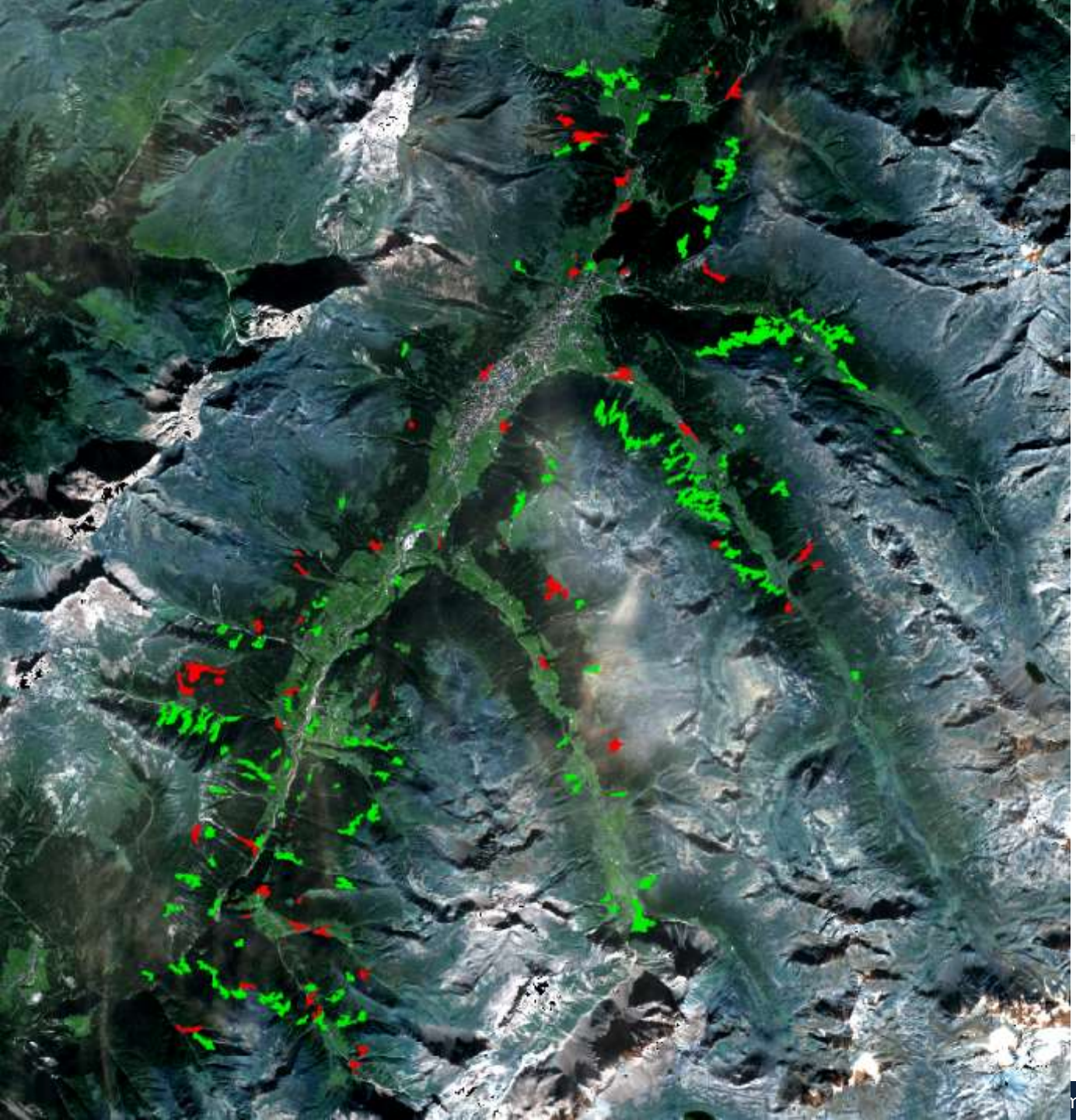

EVIDENCE-BASED CHANGE DAVOS, Switzerland FAO LCCS Change Events (Woody Vegetation) 2003 – 2012

Deforestation
Height change: Tall (trees) to short (shrubs, graminoids) or bare

Change in Biomass: decrease between 2003-2012

Regrowth
Height change: Short (shrubs and trees) to tall (trees)

Change in Biomass: increase between 2003-2012

Deforestation
Regrowth

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EVIDENCE FOR CHANGE: CLASSES AND VARIABLES

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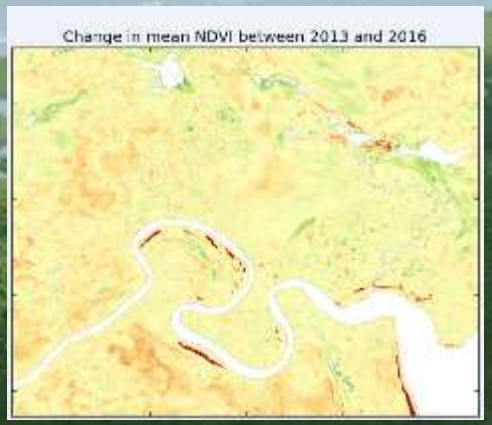
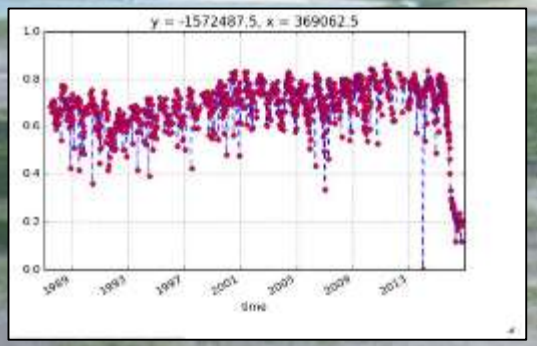


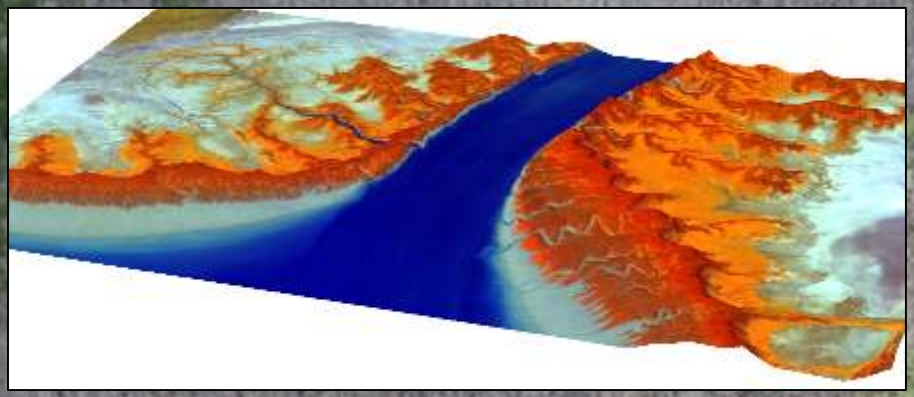
Trees closed canopy (>70-60 %) tall (14-30 m) continuous broadleaved evergreen.second layer absent

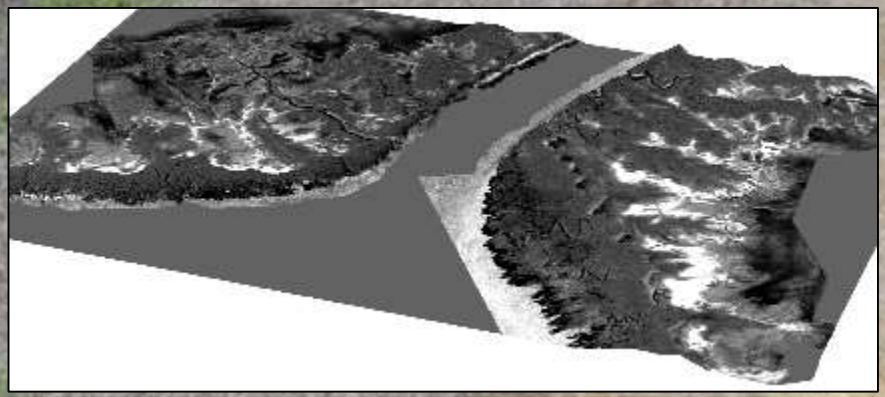


A3.A14.B2.C1._._.F1

Trees **sparse canopy (20-10-1%).** tall (14-30 m). continuous broadleaved.evergreen.second layer absent + other EV change*

EVIDENCE:
Dieback
NOT
Deforestation





CONSEQUENCES FOR MONTADO, PORTUGAL

CAUSES

Common Agricultural Policy

Market pressures

Increase in cattle density

Grazing pressure

Shrub control

Destructive soil tillage

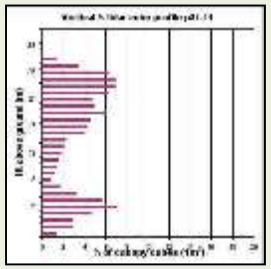
Soil degradation

Compaction of soils

EO: Relative proportions of soil/vegetation over time from optical data

Decline in regeneration because of poor seed recruitment and cutting

EO: Changes in lidar profiles over time



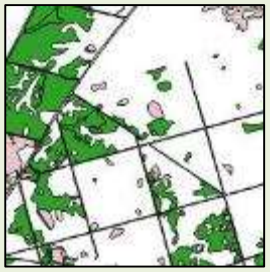
Decline in tree density

Loss of vegetation cover through tree Mortality

EO: Changes in canopy cover from optical data

Fragmentation of Habitats

EO: Changes in spatial arrangement and size of different habitats



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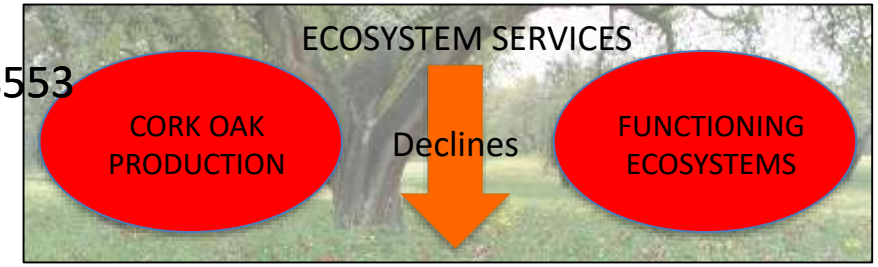
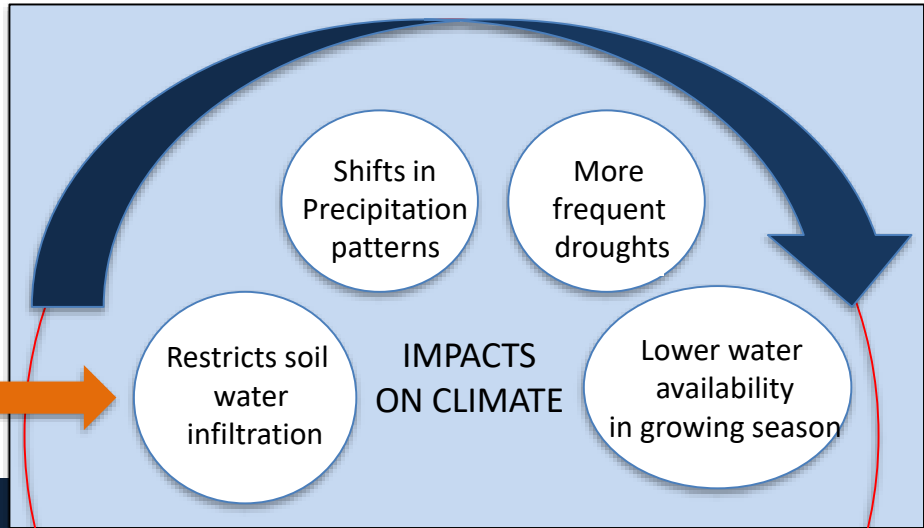
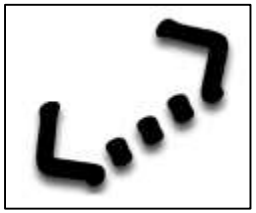




EODESM: SUMMARY AND CONCLUSIONS

The EODESM system allows:

- Consistent classification of land covers for any site globally using the FAO LCCS-2 taxonomy.
- Inclusion of biophysical layers (thematic and continuous), including time-series (e.g., hydroperiod, snow cover, phenology) within the classification but also external to the classification.
- Inclusion of image-wide or land cover specific classifications (e.g., of floating or rooted aquatic vegetation or water turbidity)
- Detection of change in LCCS codes and also biophysical attributes.
- Evidence-based approach to change detection.
- Attribution of change to a potential cause and consequence (in development).
- Capacity to translate LCCS to Habitat and other taxonomies.

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EODESM: SUMMARY AND CONCLUSIONS

The EODESM system has the following advantages:

- Selection of any data layers, no matter how derived and including knowledge, into the classification.
- Inclusion of local, european and/or global layers
- Applicable at any scale
- Can be replicated with in situ data
- Mobile App (based on Open Data Kit)
- Able to ingest all forms of earth observation and other geographical (spatial) data.
- Simple to use, understand and implement
- Is informative, utilizes ecological knowledge, and allows for targeted applications.
- Open source software (Python, RSGISLib, KEA, EODESM, ARCSI)
- Well suited for protected area classification (and of surrounding areas)

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Near Real Time Ground Data Collection

LCCS Classification

Collection Details

What is the name of your site?

ESRIN, Frascati

What is your name?

A.N. Other

***Record your location:**

latitude (x.y °)

41.802615

longitude (x.y °)

12.683543

altitude (m) 30C

accuracy (m)

search for place or addre

Take a picture of the site

...

***Which Level 1 class?**

image

- (•) Primarily vegetated
- ( ) Primarily non-vegetated

***Which Level 2 class?**

image

- (•) Terrestrial
- ( ) Aquatic or regulary flooded

Lifeform (terrestrial)

image

- (•) Woody
- ( ) Herbaceous
- ( ) Lichens/Mosses

Lifeform modified (terrestrial)

- (•) Trees
- ( ) Shrubs

Canopy cover (%)

- ( ) closed to open (100-15 %)
- ( ) sparse (20-10 - 1%)

Canopy height

- ( ) 7-2 m (woody)
- (•) >30-3 m (trees)
- ( ) 5-0.3 m (shrubs)
- ( ) 3-0.03

Canopy height trees

- (•) >14 m
- ( ) 14-7 m
- ( ) 7-3 m

Spatial distribution

- (•) Continuous
- ( ) Fragmented
- ( ) Parklike patches
- ( ) Fragmented (striped)
- ( ) Fragmented (cellular)

Leaf type

image

- (•) Broadleaved
- ( ) Needleleaved
- ( ) Aphyllous

Phenology

image

- (•) Evergreen
- ( ) Deciduous
- ( ) Mixed deciduous/evergreen (trees and shrubs)
- ( ) Semi-evergreen or semi-deciduous
- ( ) Mixed (Forbs, graminoids)

***Which Level 3 class?**

- ( ) Artifical surfaces
- (•) Bare areas

Bare surface type

- (•) Consolidated
- ( ) Unconsolidated
- ( ) Hardpans
- ( ) Loose and shifting sands

Bare surface type modified

- (•) Bare rock a/o coarse fragments

Bare material

- ( ) Bare rock
- (•) Gravel/stones/boulders

Bare material modified

- (•) Gravel
- ( ) Stones
- ( ) Boulders

Hardpans

- ( ) Ironpan/Laterite
- ( ) Petrocalcic
- ( ) Petrogypsic

Macropattern

- ( ) Dunes
- ( ) Salt flat
- ( ) Gilgal
- ( ) Termite mounds

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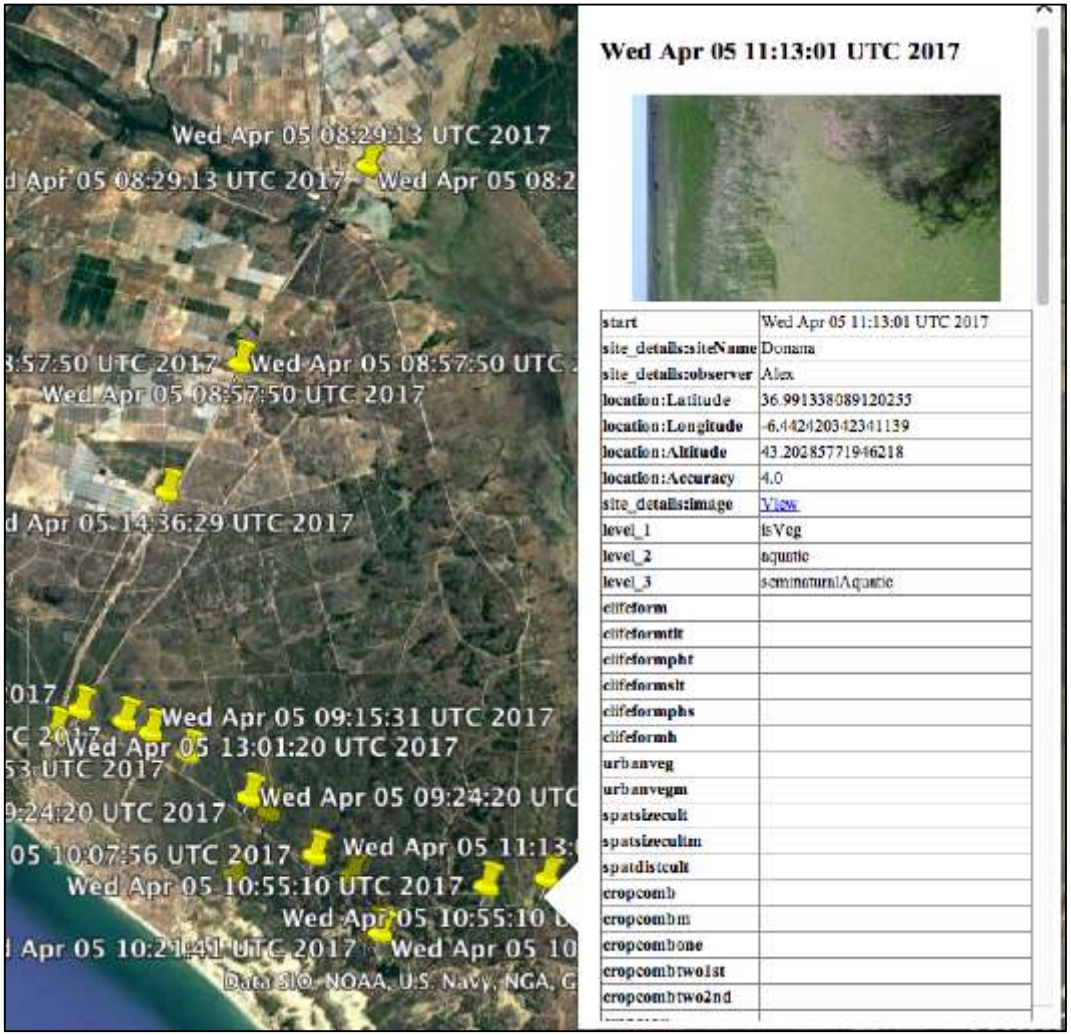
Near Real Time Ground Data Recording (30'')



start	Wed Apr 05 11:13:01 UTC 2017
site_details:siteName	Donana
site_details:observer	Alex
location:Latitude	36.991338089120255
location:Longitude	-6.442420342341139
location:Altitude	43.20285771946218
location:Accuracy	4.0
site_details:image	View
level_1	isVeg
level_2	aquatic
level_3	seminaturalAquatic
clifeform	
clifeformtlt	
clifeformpht	
clifeformslt	
clifeformphs	
clifeformh	
urbanveg	
urbanvegm	
spatsizecult	
spatsizeculim	
spatdistcult	
cropcomb	
cropcombm	
cropcombone	
cropcombtwo1st	
cropcombtwo2nd	

Stores individual LCCS codes

A3.A10.B2.C1.D1.E1.F1.F9.G7

Trees closed canopy (>70-60 %) tall (14-30 m) continuous broadleaved evergreen with 2nd layer supporting open canopy 7-3 m in height.

Capacity to record additional attributes

Plant species
pH
Soil moisture
Water turbidity

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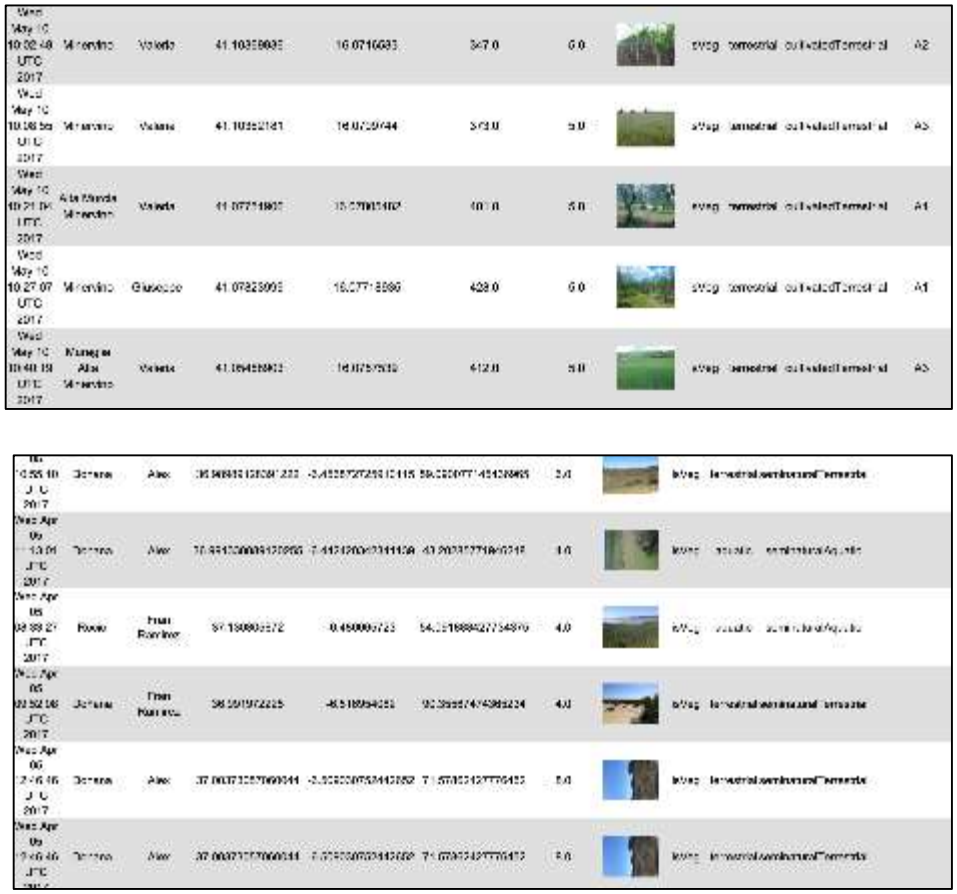
Centralized and Near Real Time Storage



Data stored immediately or following access to phone network

Classifications relevant for any region and at multiple scales
- MODIS 1 km or Drone 10 cm data

Globally Applicable Taxonomy

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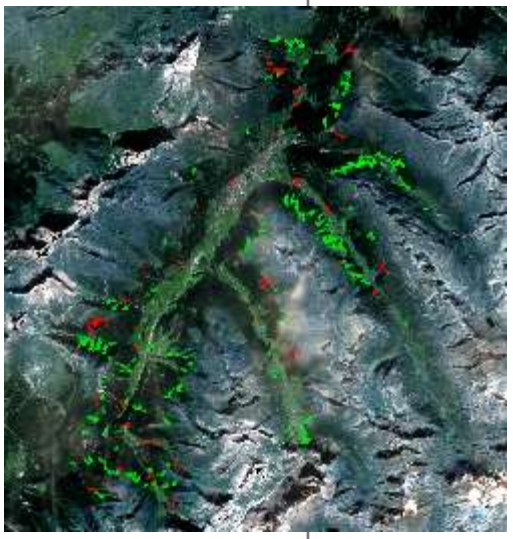
Supports Automated Detection of Change with Alerts (Based on Weighted Evidence of LCCS and biophysical change)

Natural Vegetation	Agriculture	Urban	Water	Bare ground
Deforestation	Herbicide Spraying	Road Abandonment	Flooding	Lava Flows
Degradation	Burning	Greening	Inundation	Sedimentation
SelectLogging	Cutting	Browning	DryingEvent	Erosion
Defoliation	Grazing	Planning	Long Term Drying	Dune Change
Thinning	Growth	Urban Densification	Net Snow Accumulation	
Dieback	Stubble Formation	Urban Renewal	Net Snow Loss	
Growth	Agri. Expansion	Waste Dumps/Extraction	SnowFall	
Thickening	Agri. WaterSupp	Comm. Installation	SnowMelt	
Encroachment	Agri. TimeFactor	Comm. Abandonment	Waterlogging	
Abandonment	Tillage	Rail Conversion	Water OutBurst	
Hedgerow removal	Pasture Degradation	Rail Construction	Dam Creation	
	Pasture Replanting	Urban Expansion	Land Drainage	
	Crop Change	Road Conversion	Freezing	
	Crop Growth	Road Construction	Thawing	
	Crop Sequence change	Road Improvement	Glacial Flow	
	Agri. Homogenisation	Industrialisation	Sea Level Rise	
	Agri. Division	Infilling/levelling	Water Pollution	
	Plantations		Tida lLoss	
	Plantation Growth			
	Grass Fertilization			
	Orchard planting			
	Slurry or sediment spreading			
	Liming			

CHANGES MAPPED BASED ON EVIDENCE



Deforestation
Height change: Tall (trees) to short (shrubs, graminoids) or bare; Decrease in biomass between 2003-2012

Regrowth
Height change: Short (shrubs and trees) to tall (trees); Increase in biomass between 2003-2012

Deforestation
Regrowth

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47 prestigious partners across Europe and beyond, across disciplines, work together for the next 2 years on
'Improving Future Ecosystem Benefits through Earth Observation'

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SCERIN & GEO ECO ?
GEO ECO is a GEOBON initiative

Based on these existing perspectives and results, the GEO ECO Initiative (GEO Global Ecosystem Initiative) intends

- to build upon available results and extend them to a global scale,
- identifying Protected Areas of international relevance where the same methodology used in ECOPOTENTIAL can be applied.
- to support the efforts of extending and improving the Ecological Land Units, Ecological Marine Units, and Ecological Freshwater Units maps currently in development, and fostering other research initiatives of the same kind.

Contributors may benefit of

- an already established scientific approach that will be shared among many protected areas around Europe, possibly becoming a benchmark if not a standard,
- an opportunity to gain visibility at (at least) European level
- an opportunity for networking

Contributors have to dedicate time and researchers' effort, because ECOPOTENTIAL partners don't have additional resources to work on other protected areas.

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SCERIN meets ECOPOTENTIAL

With my thanks and appreciation to **Garik, Petya, Jana and GOFC-GOLD and START** for providing us this opportunity

At your disposal for questions/ clarifications

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