

# Earth Observation and habitat conservation: a perspective from biodiversity

## Policy framework with legally binding Directives

European Green Deal

Biodiversity Strategy

EU "Habitats"  
Directive 92/43

Environmental Liability  
Directive

Common Agricultural  
Policy

...many other EU  
initiatives



# Policy framework with legally binding Directives

“conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements” in EU Member States.

EU “Habitats”

maintaining and restoring a favourable conservation status for habitat types & species of Community interest

Every 6 years – MS monitoring & reporting under Article 17 is focusing on capturing the status and trends of selected habitat types and species

Habitats Distribution

Habitat Cover Area

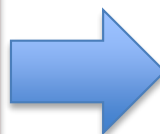
Habitat Structure and function



# Critical issues



- **Gaps** in distribution knowledge
- Lacking of **field data** to produce reliable distributions
- Difficulty in **detecting changes in space and time** of habitat structure and functions
- Need for huge **investments**



# Exit Strategy



- Accurate review of **all available in situ and EO data**
  - Official and **certified** environmental **databases** (e.g. EVA, Natura2000)
- Effective **sampling strategy**
- Detecting **drivers** of changes
- **Modeling** surface estimates



Research Project: Integration of data from Earth Observation for monitoring and conservation of habitats

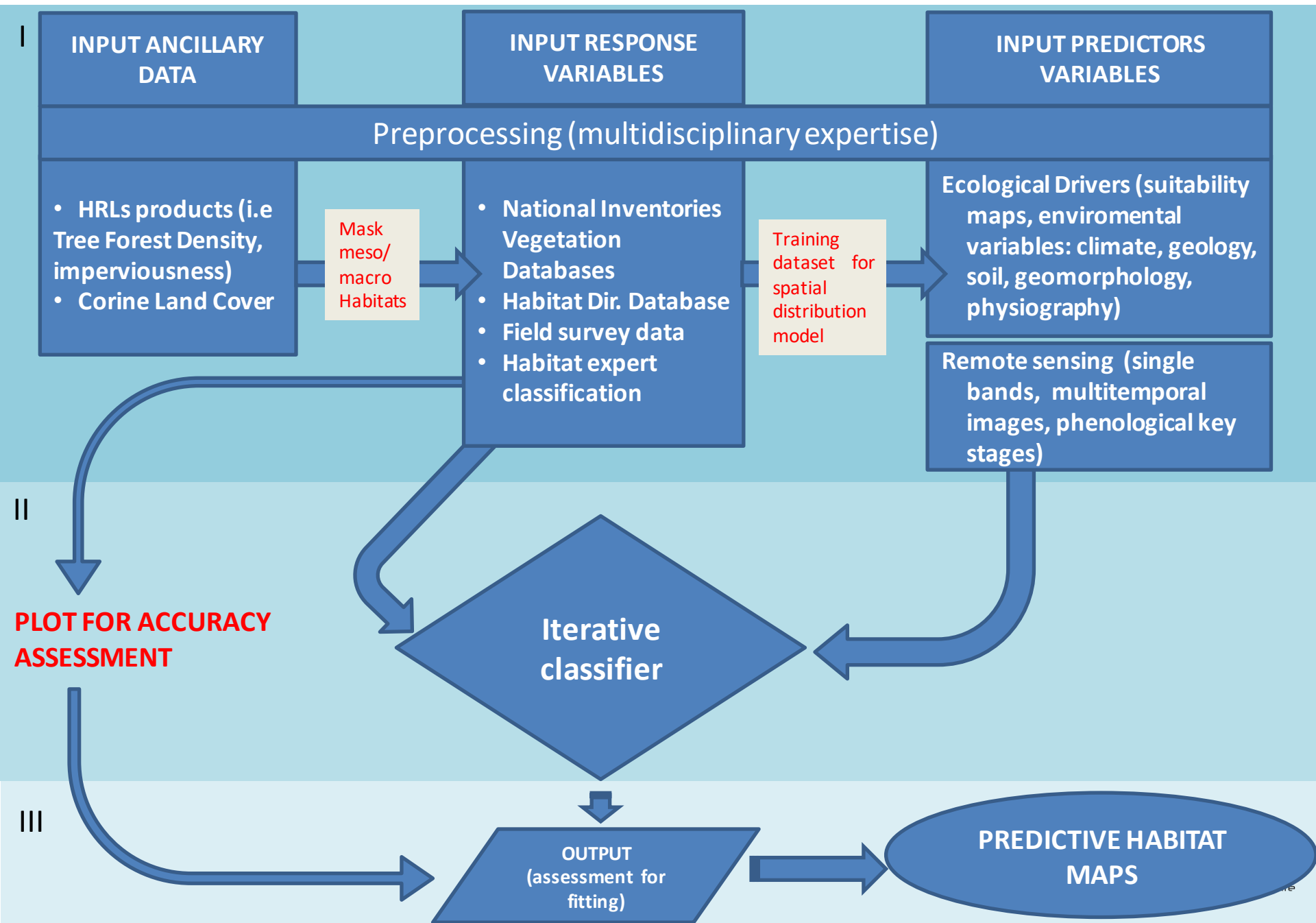


# Copernicus Land Service for Biodiversity monitoring and mapping

COMPONENT	LAYER NAME	YEAR OF PRODUCTION	COVERAGE
<b>Pan-European</b>	<ul style="list-style-type: none"> <li>• Corine Land Cover</li> <li>• High Resolution Layers</li> <li>• Biophysical parameters</li> <li>• European Settlement Map</li> </ul>	<ul style="list-style-type: none"> <li>• From 1990 to 2018</li> <li>• 2012 and 2018</li> <li>• Annual</li> <li>• 2016 and 2017</li> </ul>	<ul style="list-style-type: none"> <li>• EU</li> <li>• EU</li> <li>• EU</li> <li>• EU</li> </ul>
<b>Local</b>	<ul style="list-style-type: none"> <li>• Urban Atlas</li> <li>• Riparian Zones</li> <li>• Natura 2000</li> <li>• Coastal Zones</li> </ul>	<ul style="list-style-type: none"> <li>• From 2006 to 2012</li> <li>• nd</li> <li>• 2006 and 2012</li> <li>• 2012 and 2018</li> </ul>	<ul style="list-style-type: none"> <li>• Thematic</li> <li>• Thematic</li> <li>• Thematic</li> <li>• Thematic</li> </ul>
<b>Imagery and reference data</b>	<ul style="list-style-type: none"> <li>• EU-Hydro</li> </ul>	<ul style="list-style-type: none"> <li>• nd</li> </ul>	<ul style="list-style-type: none"> <li>• Thematic</li> </ul>



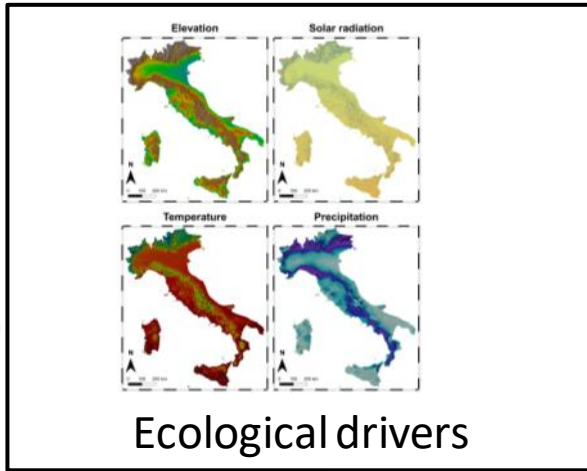
# WORKFLOW HABITAT DIRECTIVE MONITORING AND ASSESSMENT FROM COPERNICUS PRODUCTS



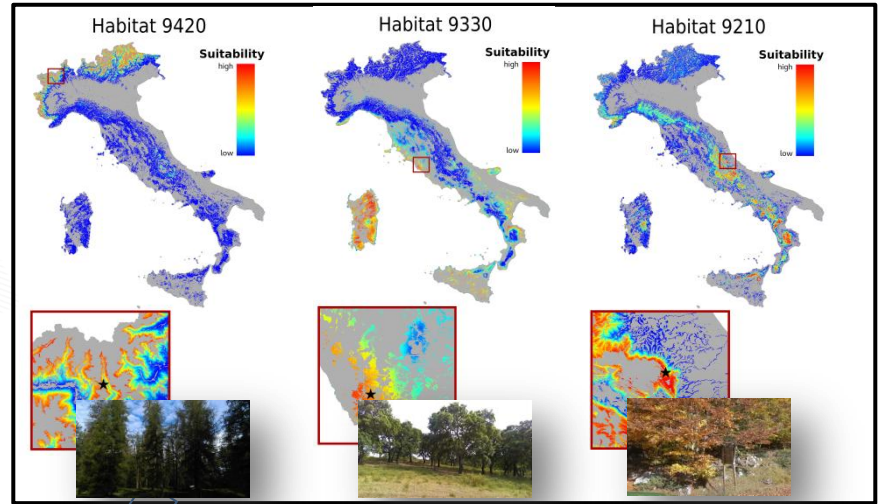
# Macro- habitats

“Integration of in situ and remote sensing data for mapping and monitoring habitat of Community interest”

Ecological PREDICTORS



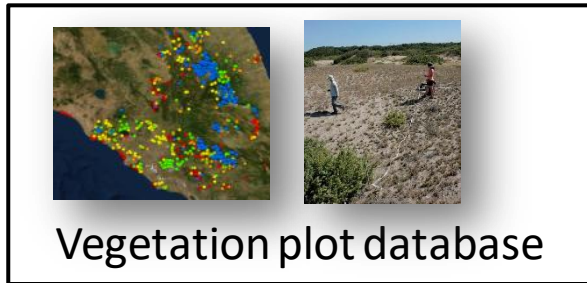
Spatial Distribution Modeling



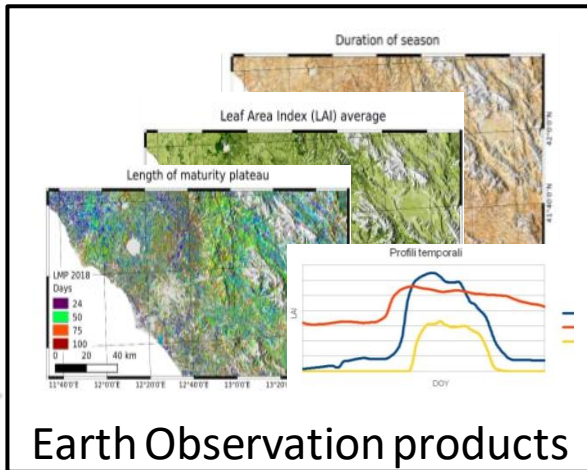
Habitat Suitability

research funded by the Italian Space Agency (ASI) in the framework of agreement between ASI and the Italian Institute for Environmental Protection and Research (ISPRA)

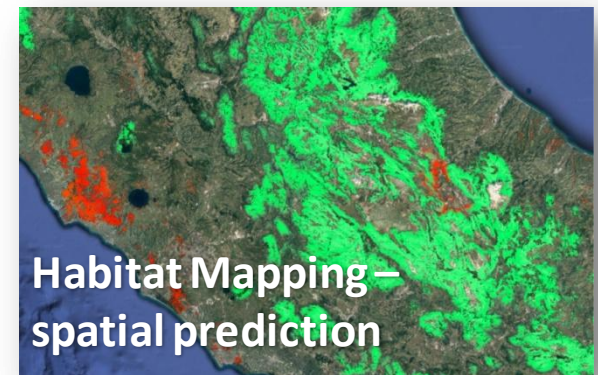
RESPONSE



Spectral PREDICTORS



Machine Learning Classifier



- Expert System for ecosystem mapping and monitoring
- Multidisciplinary competences

# Field Survey

Image Sentinel-2 Copernicus false color bands 11-8A-4

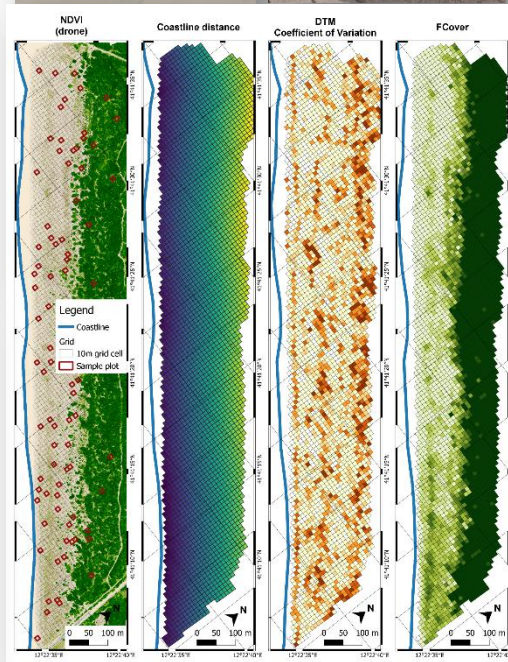
Image Sentinel-2 Copernicus false color bands 8-4-3



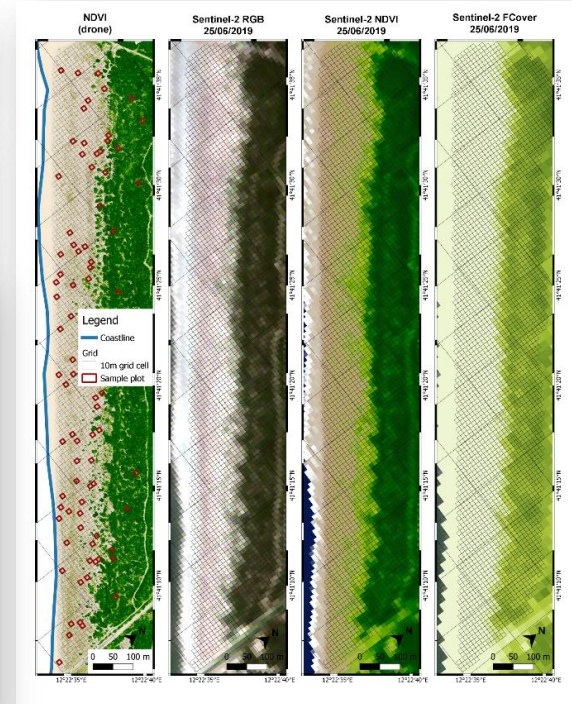
Percentage species table with fidelity (FI) coeff. C) (5 columns)

	1010	2110	2120	2210	2230	2260	FI	FI	FI	2250*
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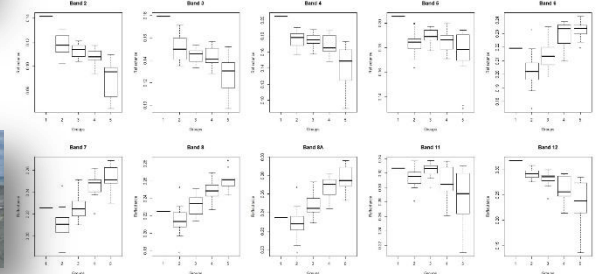
# UAV Flight Mission



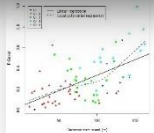
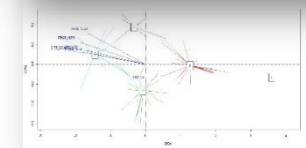
# SENTINEL-2 Data



Single- and multi-temporal products were generated from Sentinel-2 MSI data. Spectral reflectances (belonging to 10 spectral bands ranging from 490 to 2100 nm), NDVI and FCover were generated. Below boxplots for the bands acquired on 26/06/2019, for each of the vegetation plots groups obtained from the classification.

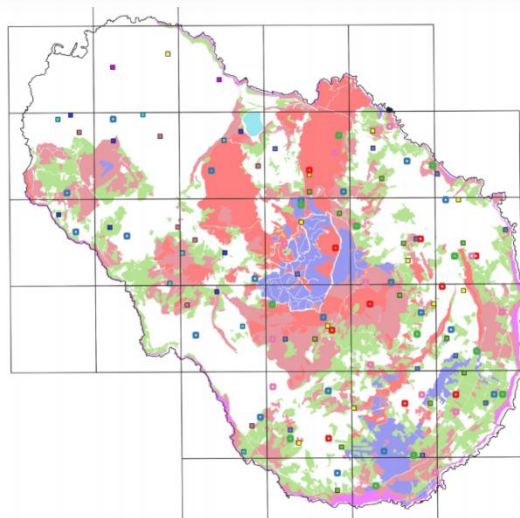
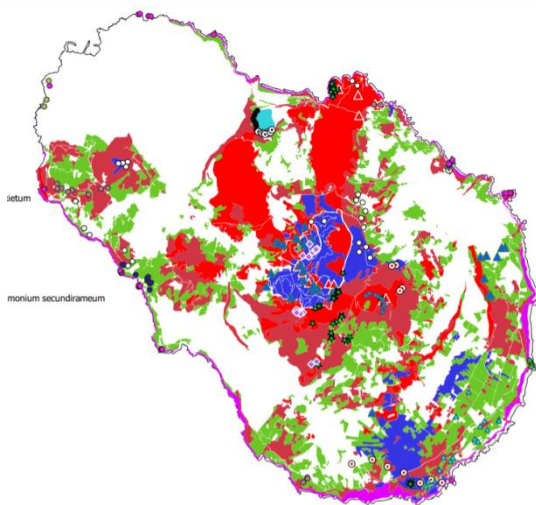


# Meso-habitats

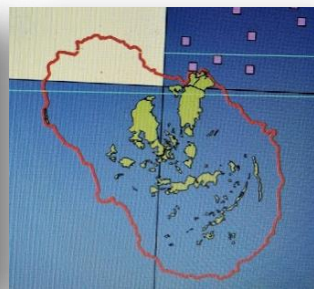
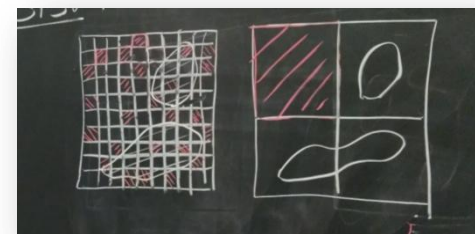


# Refinement of suitability maps

# Pantelleria Island



“A sampling approach for habitat monitoring at national scale” Chiarucci et. al.



# Earth observation and natural habitat conservation: a growing process



- Elements of success
  - Allows the transition from **status** analysis to **trend** analysis
  - Cost effective**, with greater data production



- Elements of weakness (?)
  - Necessary integration of numerous highly **specialized/innovative skills**

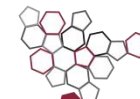


- Future perspectives
  - Biophysical variables** - Structure and Functions – plant/community traits
  - Better structuring of dedicated resource
  - New innovative competences (e.g. Data steward)



# References

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# complexity

