
INNOVATIVE SPATIAL MODELLING FOR MAPPING ECOSYSTEM FUNCTIONING
LAURA CASELLA
A NEW BEGINNING
FOR PEOPLE AND NATURE
#EUGreenWeek
19–22 OCTOBER 2020
European Commission

INNOVATIVE SPATIAL MODELLING FOR MAPPING ECOSYSTEM FUNCTIONING

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European Green Deal

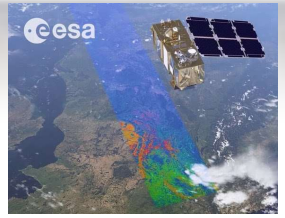
Biodiversity Strategy 2030

EU “Habitats” Directive 92/43

BIODIVERSITY MONITORING AND MAPPING

Environmental Liability Directive

Natural Capital



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BIODIVERSITY MONITORING AND MAPPING

Green Deal Call

Demonstrate the potential of new technologies for the green transition

Biodiversity Strategy 2030

knowledge informed policy & full use of data and knowledge

Big data, artificial intelligence, digitalization

“Member States will have to ensure that at least 30% of species and habitats not currently in favourable status are in that category or show a strong positive trend. The Commission and the European Environmental Agency will provide guidance to Member States in 2020 on how to select and prioritise species and habitats.”

Directive (EU) 2019/1024

of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information

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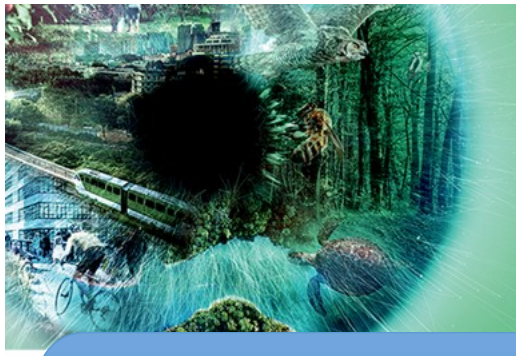

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"Habitats Directive"

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

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

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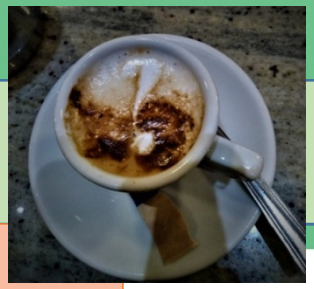

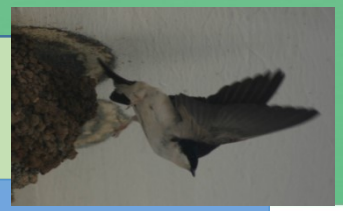

CRITICAL ISSUES

- Lacking of **field data** to produce reliable distributions
- **Gaps** in distribution knowledge
- 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 habitat monitoring and conservation

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CONTRIBUTION:

Federico Filipponi, Emiliano Agrillo e Roberto Inghilesi (ISPRA CN-CRE CSA) - "Convenzione ASI-ISPRA"
Pierangela Angelini (ISPRA Dipartimento BIO) - "Monitoraggio degli habitat", "Progetto Statistiche ambientali per le politiche di coesione 2014-2020"

Papik Genovesi (ISPRA Dip. BIO), Alessandro Chiarucci, Marco Cervellini (BIGEA, Università di Bologna), Lorenzo Fattorini, (Dipartimento di Economia Politica e Statistica - Università di Siena) -"Piano Nazionale per il Monitoraggio Direttiva habitat"
Fabio Attorre, Marco Massimi e Emanuela Carli, (Dipartimento Biologia Ambientale - Museo Orto Botanico-Sapienza Università di Roma) -"Progetto Statistiche ambientali per le politiche di coesione 2014-2020"

Borja Jiménez-Alfaro, Biodiversity Research Institute - University of Oviedo , Oviedo (Spain), Jose Manuel Álvarez-Martínez, Environmental Hydraulics Institute IH Cantabria - Parque Científico y Tecnológico de Cantabria, Santander (Spain) – Progetto "Developing protocols of habitat mapping and monitoring based on ground-truth data and Earth observation (Copernicus) data"

Luciano Bonci ISPRA Dipartimento BIO
Andrea Taramelli - ISPRA Forum Nazionale – User Forum Copernicus; Convenzione ASI-ISPRA
La Direzione e il personale tecnico della Tenuta Presidenziale di Castelporziano

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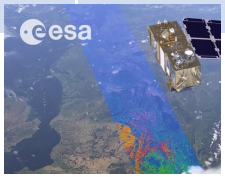
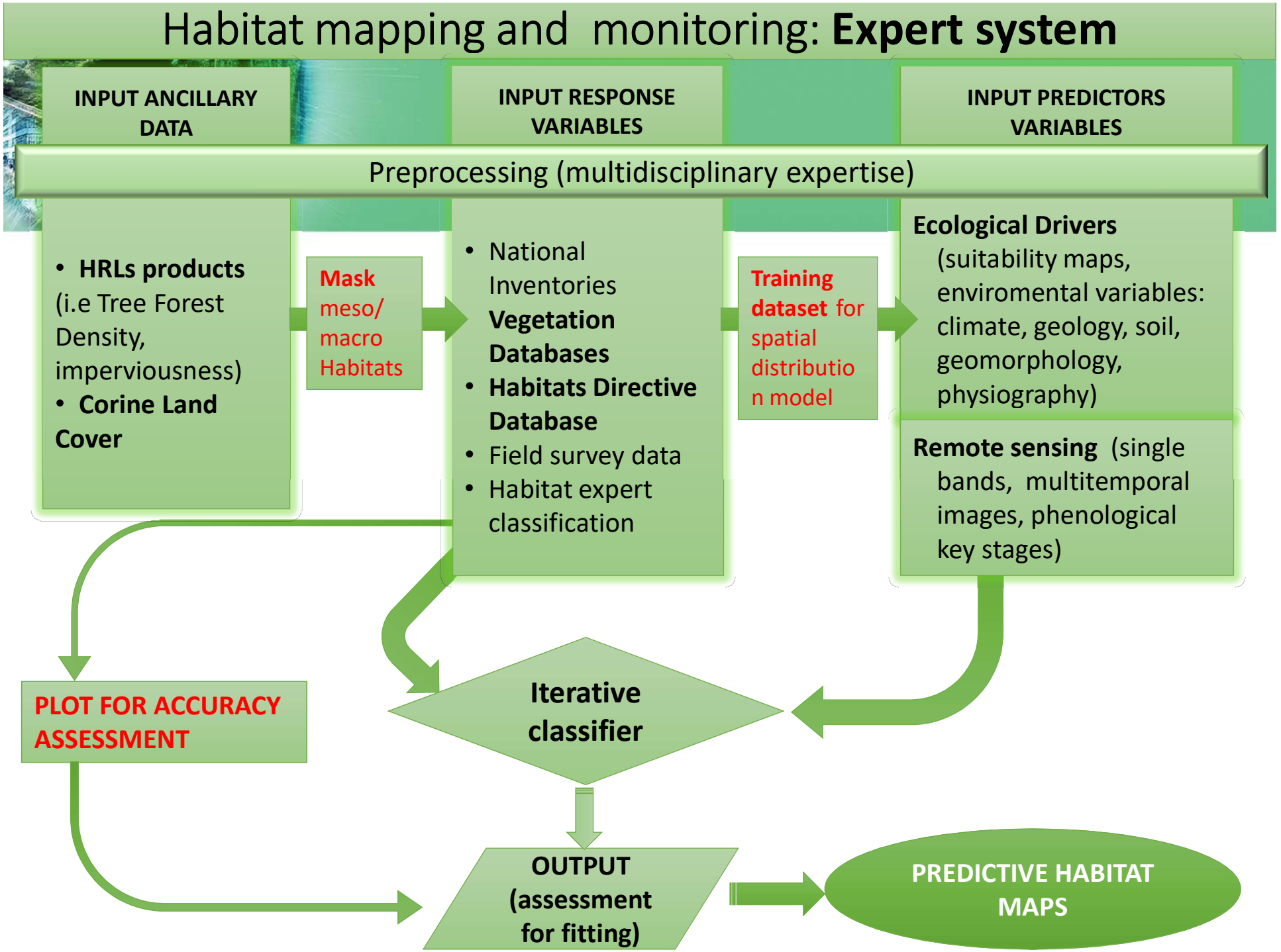
COPERNICUS LAND SERVICE FOR BIODIVERSITY MONITORING AND MAPPING

COMPONENT	LAYER NAME	YEAR OF PRODUCTION	COVERAGE
Pan-European	• Corine Land Cover • High Resolution Layers • Biophysical parameters • European Settlement Map	• From 1990 to 2018 • 2012 and 2018 • Annual • 2016 and 2017	• EU • EU • EU • EU
Local	• Urban Atlas • Riparian Zones • Natura 2000 • Coastal Zones	• From 2006 to 2012 • nd • 2006 and 2012 • 2012 and 2018	• Thematic • Thematic • Thematic • Thematic
Imagery and reference data	• EU-Hydro	• nd	• Thematic



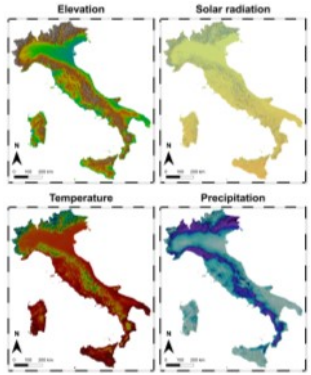
Habitat mapping and monitoring: **Expert system**



Macro- habitats

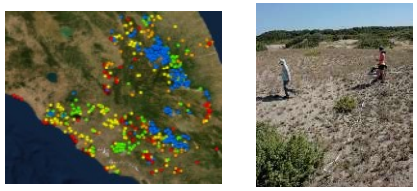
"Integration of in situ and remote sensing data for mapping and monitoring habitat of Community interest"

Ecological PREDICTORS



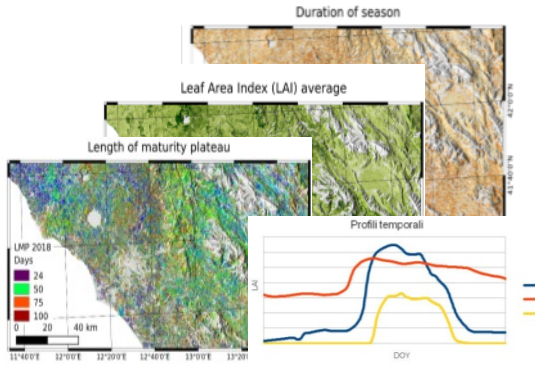
Ecological drivers

RESPONSE



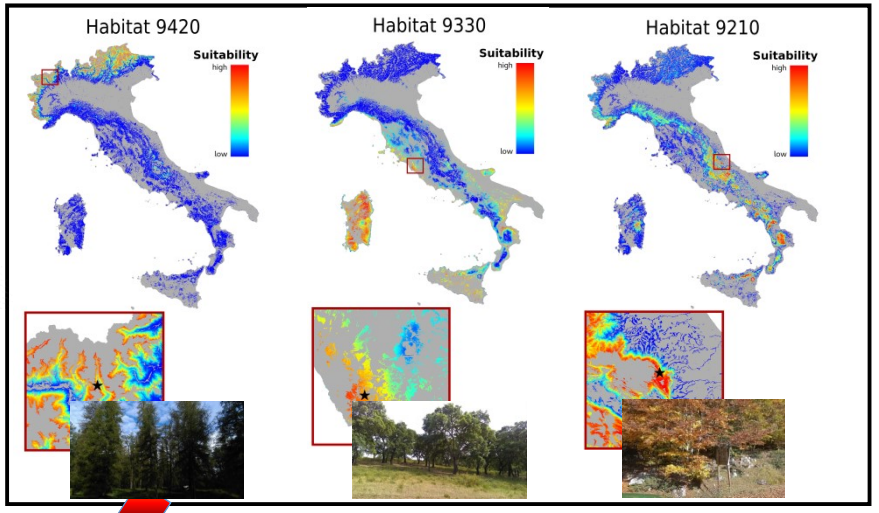
Vegetation plot database

Spectral PREDICTORS



Earth Observation products

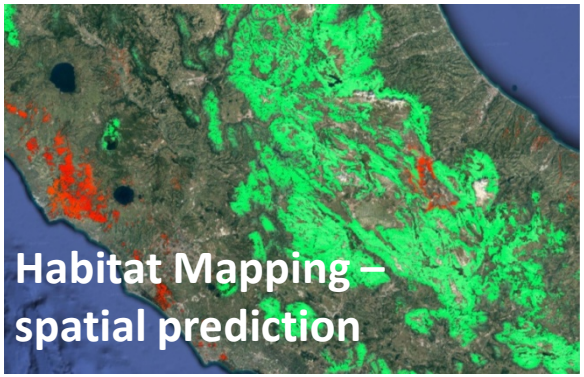
Spatial Distribution Modeling



Habitat Suitability

Machine Learning Classifier

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)

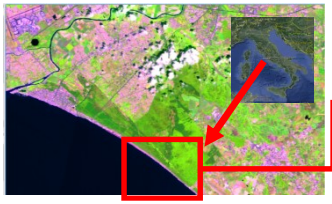


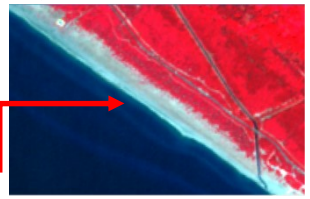
+ SPATIAL RESOLUTION -

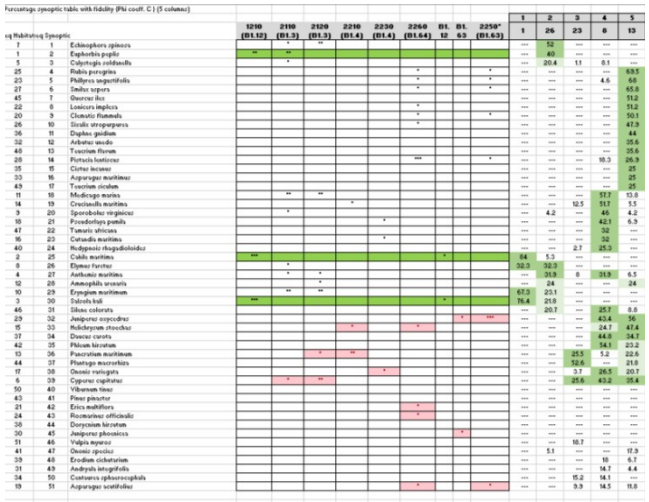
Field Survey

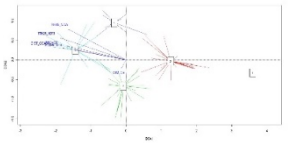
Image Sentinel-2 Copernicus false color bands 11-8A-4

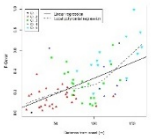
Image Sentinel-2 Copernicus false color bands 8 -4- 3



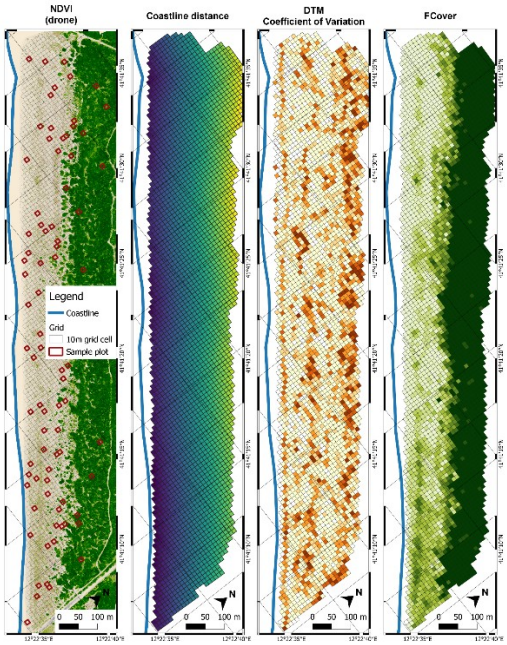






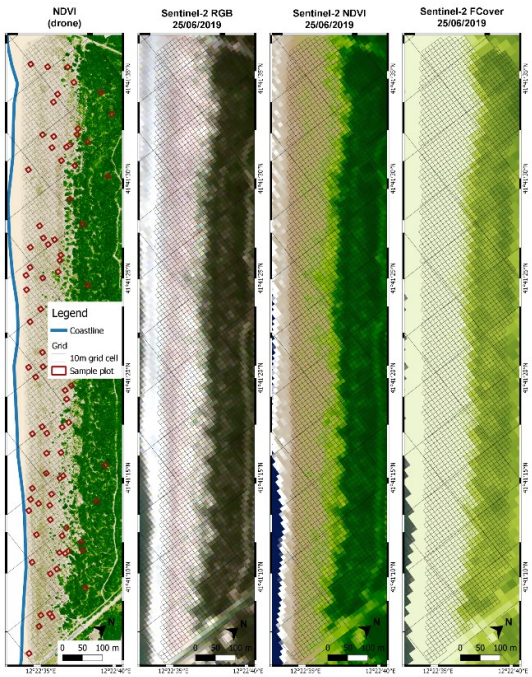


UAV Flight Mission

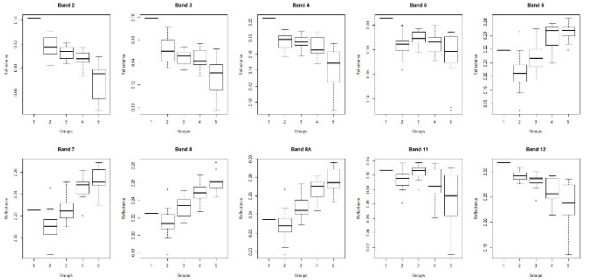


Meso-habitats

SENTINEL-2 Data



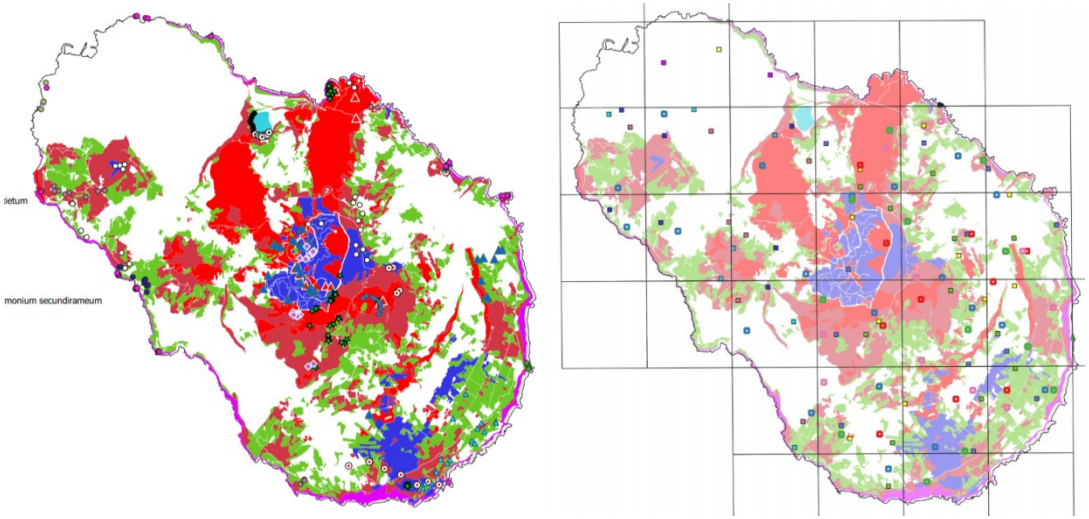
Single- and multi-temporal products were generated from Sentinel-2 MSI data. Spectral reflectances (belonging to 10 spectral bands ranging from 490 t0 2100 nm), NDVI and FCover were generated. Below boxplots for the bands acquired on 26/06/2019, for each of the vegetation plots groups obtained from the classification.



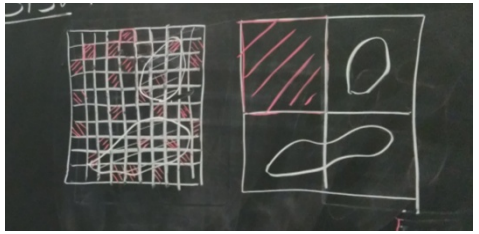
+ TEMPORAL RESOLUTION -

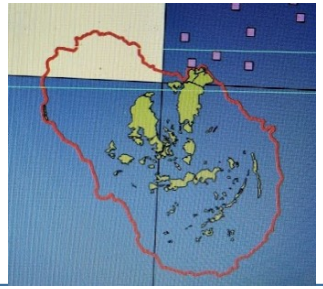
REFINEMENT OF SUITABILITY MAPS

Pantelleria Island



"A sampling approach for habitat monitoring at national scale" Chiarucci et. al. 2019





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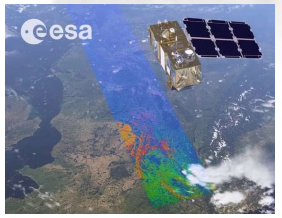
Earth observation and biodiversity: a growing process

- 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
  - Detection of potential sites for Restoration
  - New innovative competences (e.g.Data steward)



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Presenter: Laura Casella – Researcher ISPRA

BIG DATA

complexity

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…thank you for your attention

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