

WP6 - Terrestrial Biosphere

- Gabriele Guidolotti, Dario Papale & all the WP6 working group

IR0000032 – ITINERIS, Italian Integrated Environmental Research Infrastructures System
(D.D. n. 130/2022 - CUP B53C22002150006) Funded by EU - Next Generation EU PNRR-
Mission 4 “Education and Research” - Component 2: “From research to business” - Investment
3.1: “Fund for the realisation of an integrated system of research and innovation infrastructures”



WP6 - Terrestrial Biosphere – Main Objective

 Integration and harmonization of Terrestrial Biosphere contributing Ris

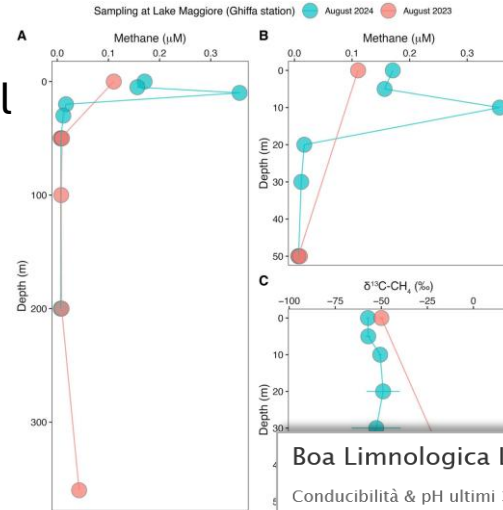


WP6 – Inland waters monitoring

Dissolved gases in Lago Maggiore

found evidence for at least two lateral surface sources of CH₄

- (a) CH₄ imported from the shoreline and inlets
- (b) CH₄ production by photosynthesizing microorganisms in oxic conditions.

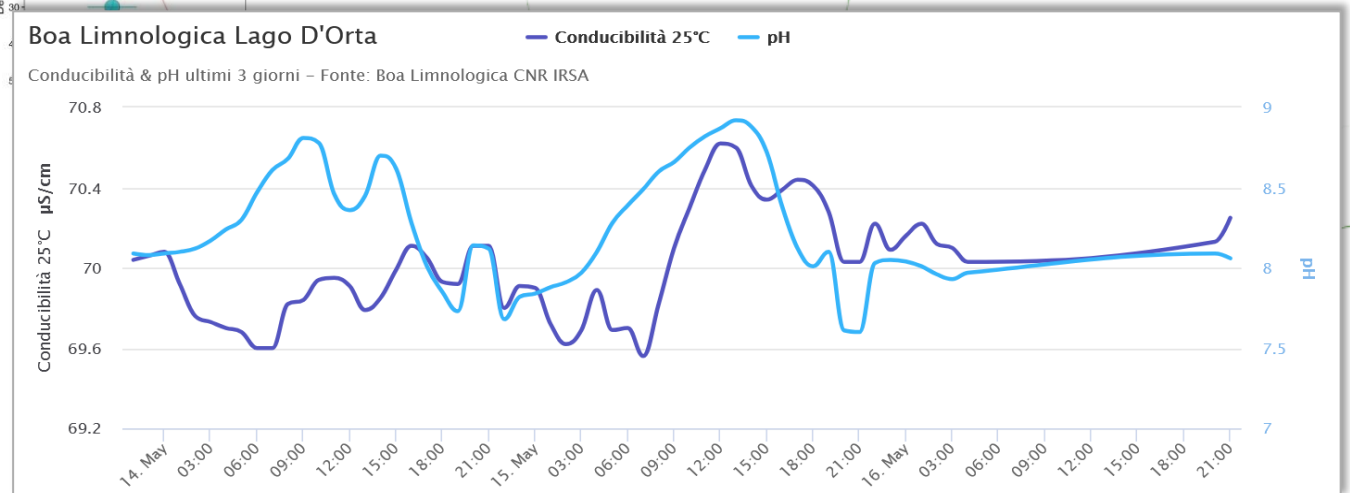


Chemical and physical conditions Lago Orta

Real time data and time series plots from Lake Orta buoy **Informing citizens**

<https://orta.retemet.com>

Ecosystem Functionality in Lago Bidighinzu



Andrea Lami, Michela Rogora, Martina Austoni, Dávid Brankovits, Dario Manca – CNR-IRSA

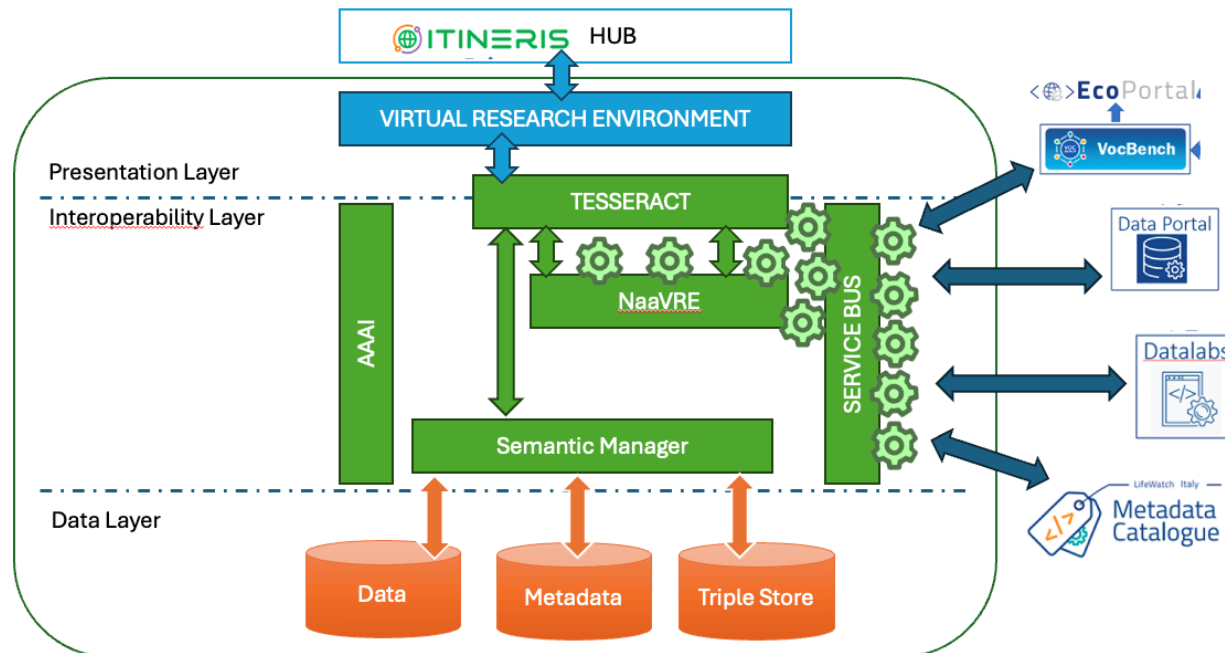
WP6 - Virtual Lab - Strengthening of the LIFEWATCH Italy Phytoplankton Virtual Research Environment



<https://itineris.lifewatchitaly.eu/vreapp>

Key OBJECTIVES

1. Supporting accurate assessments of phytoplankton size structure;
2. Deepen understanding on phytoplankton community organization;
3. Bringing new knowledge on phytoplankton community responses to CC



WP6 - Physical Lab - Data Production Experimental Centre on aquatic organisms: integration and upgrade of facilities.



Mass Spectrometer for Stable Isotope Analysis



Respirometric system



Confocal & Optical Microscope



Artificial water production system



Systems for the study of animal behavior



Next Generation Sequencing equipment for metagenomics analysis



Remote control systems

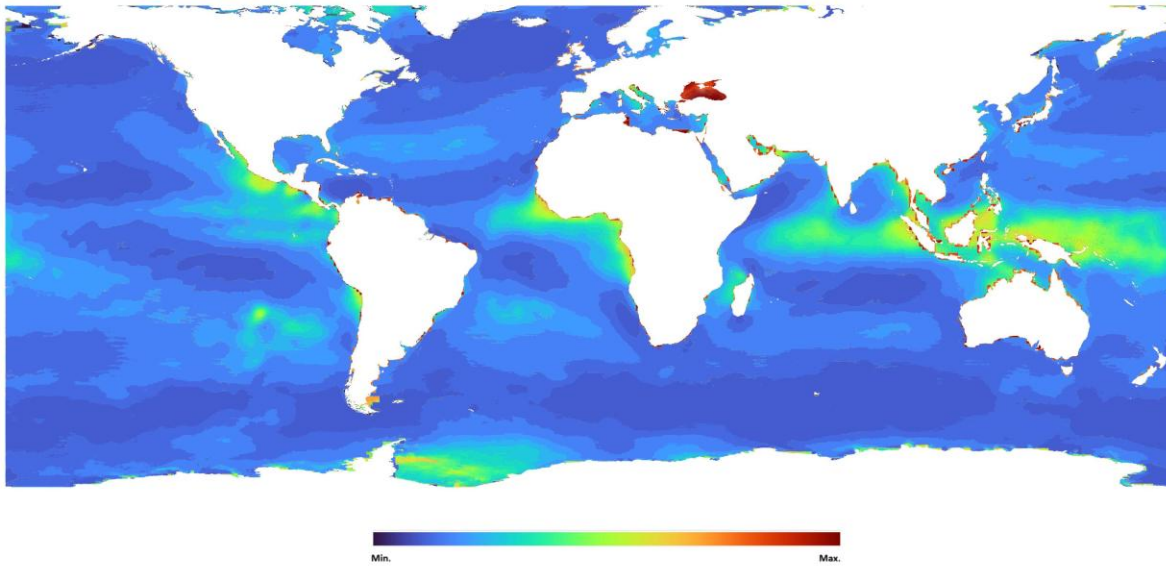


WP6 - Data Production Experimental Centre on aquatic organisms.

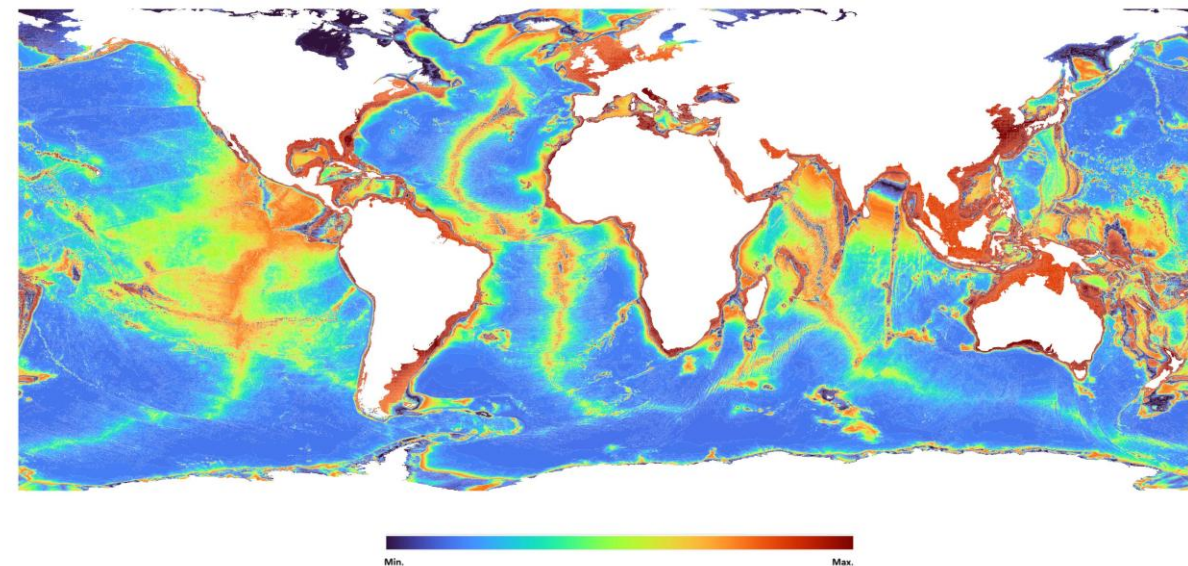
An example of adaptation of morpho-functional trait to climate change: phytoplankton cells

Species Distribution Model approach to analyze the suitability areas distribution of phytoplankton body shape in actual scenario and in global warming future scenario (+2,18°C at year 2100, see A2 scenario in IPCC Assesment Report)

Suitability for "ellipsoid + cone" shape in actual scenario



Suitability for "ellipsoid + cone" shape in future scenario



From phytoplankton body shape to spatial niche model of organisms related to climate change forecast, starting from 127311 occurrence data in 6 lagoon areas over the world it can be highlight the **increase of spherical/globular shapes** at 2100, because more adaptable to sea parameters changes in global warming scenario than organisms with an elongated and slender body.

WP6 - TOWARDS A MULTI-SENSOR APPROACH FOR LARGE SCALE ECOSYSTEMS AND BIODIVERSITY MONITORING



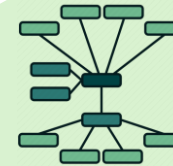
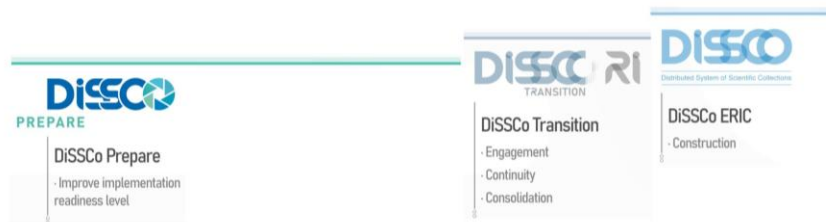
DiSSCo-ITINERIS community



Distributed System of Scientific Collections

The **Distributed System of Scientific Collections - DiSSCo** is a Research Infrastructure for Natural Science Collections, which aims to virtually bring together NSCs and related information from natural history museums, botanical gardens, research institutes and universities in a single platform at the European level. DiSSCo aims to:

- digitally unify all European natural science assets
- sharing common access, curation, policies and practices across countries
- ensuring that all the data complies with the FAIR principles



Terrestrial biosphere



Activity 6.4: "Italian natural history collections (NHCs)"
(OU UNIFI-SMA)

Activity 6.5: "Mining and mapping the functional biodiversity in in vivo and ex-situ research collections"
(OU CNR-IBBR-BA)

Activity 6.6: "National network of the aquatic science collections"
(OU CNR-ISMAR-VE e CNR-IRSA)



Highlights from OUs DiSSCo



104 | dataset released on **GBIF**



>300,000 | specimens digitized



>96,000 | images acquired



1 | Metadata Catalog dissco-itineris.it



3 | Deliverables and **11** | Papers



11 | Training activities



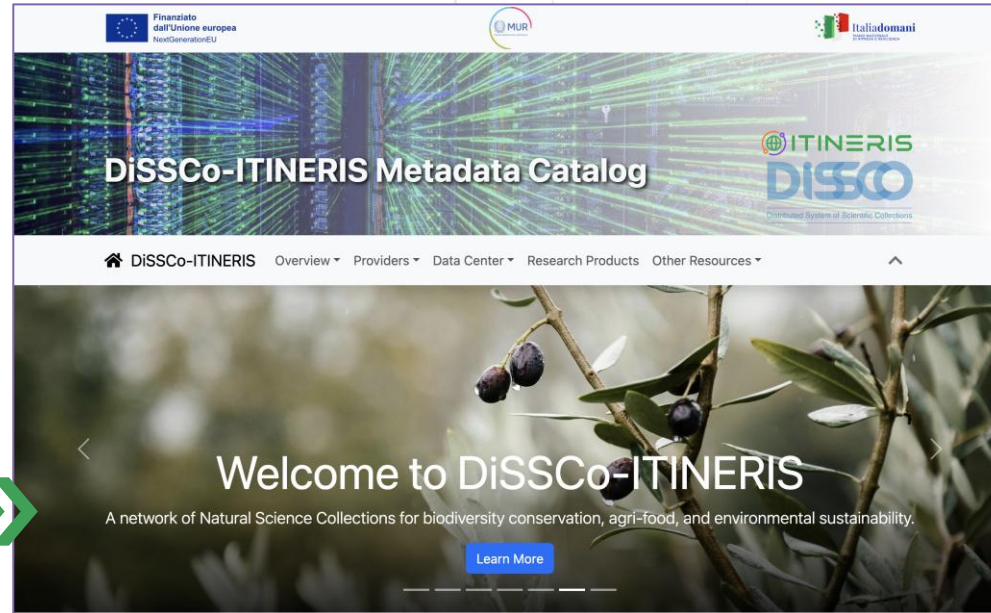
3 | Digitization laboratory



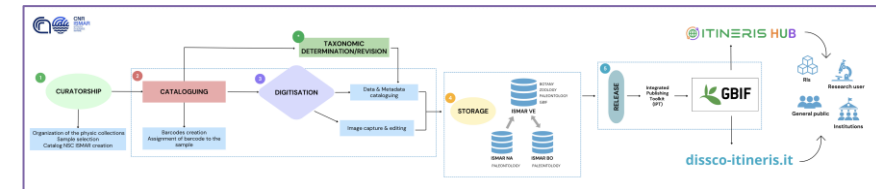
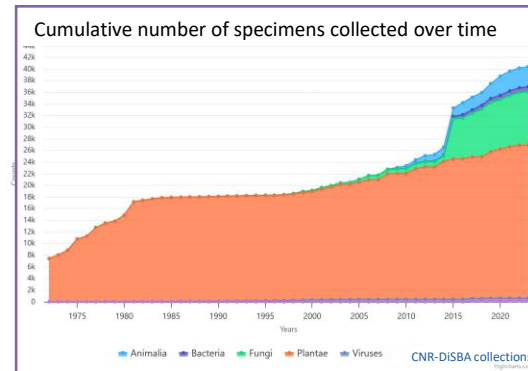
First **FAIR Implementation Profile**



1 | UOs DiSSCo-ITINERIS Meeting



<https://dissco-itineris.it>



SISTEMA MUSEALE DI ATENEIO UNIVERSITÀ DEGLI STUDI DI FIRENZE

Highlights from DiSSCo-IT

July 2025

The DiSSCo-IT Joint Research Unit

- CNR, National Research Council – *Leader*
- UNIFI - University of Florence
- MUSE, Science Museum of Trento
- UNIBO, University of Bologna
- UNICAM, University of Camerino
- UNIROMA1, University of Rome (Sapienza)
- UNINA, University of Naples (Federico II)
- UNITS, University of Trieste

+ Many others in the future...



**EXCITING
NEWS!**

**Unlocking Nature's Knowledge,
Powering Biodiversity Research.
DiSSCo Collections Leading the Way.**

<https://www.dissco.eu/>



ITINERIS

DiSSCO

Distributed System of Scientific Collections



Highlights from IBISBA-IT



The European Research Infrastructure for Industrial Biotechnology and Biomanufacturing

IBISBA provide a **single access point** to researchers from academia and industry worldwide to integrated services for end-to-end bioprocess development.



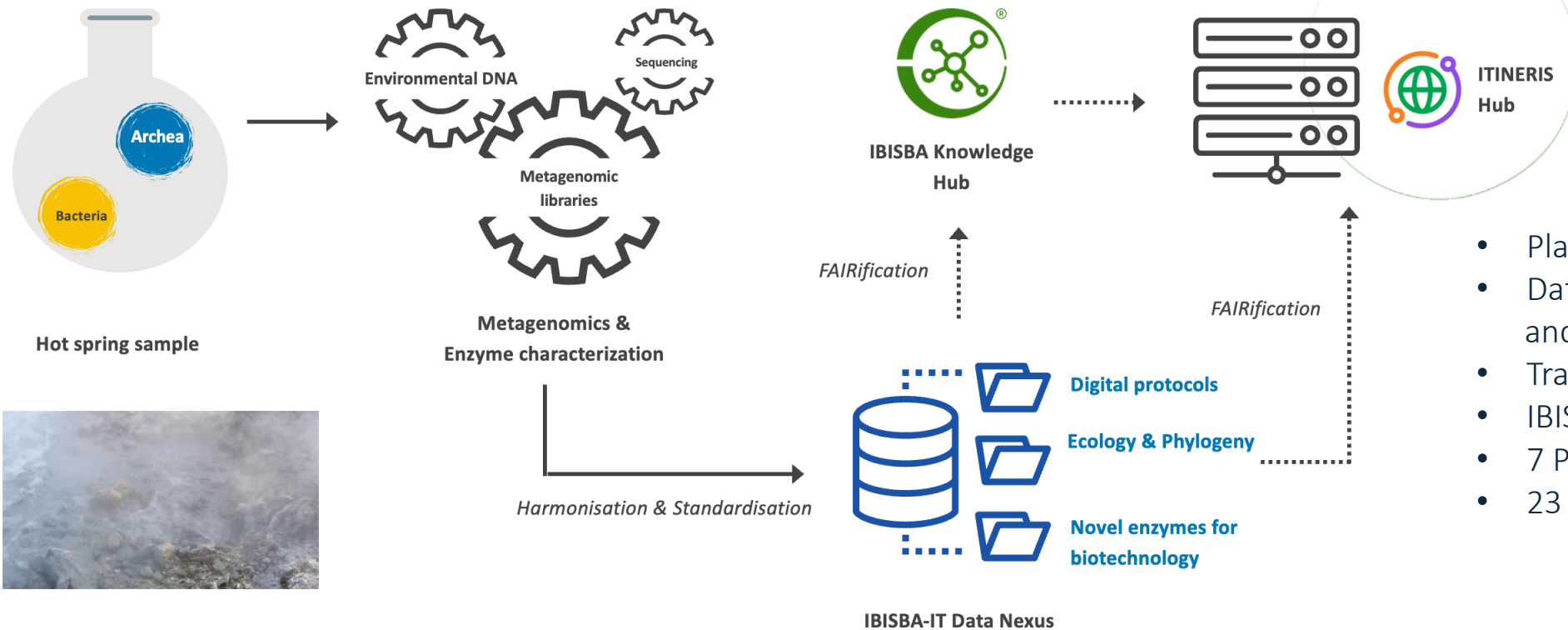
The Italian node **IBISBA-IT** aims to develop new molecules and processes through extremophilic enzyme/protein discovery and engineering, and the development of new biotransformations and bioprocesses for the sustainable use of natural environmental resources.



Highlights from IBISBA-IT

Activity 6.11 IBBR-Naples Harmonised environmental metagenomic and enzyme characterisation datasets to build standardised and interoperable data files to be stored, shared, and used for data integration into process models (D6.13)

Activity 6.19 IBBR-Naples Implementation of the infrastructure and pipeline validation for biomolecule/microorganism discovery, characterisation, and engineering for bioprocess development (D6.23)



Main achievements

- Platforms implementation
- Data and protocols harmonization and digitalization
- Trained RI's personnel
- IBISBA-IT Access Policy
- 7 Publications
- 23 Dissemination activities

Objective: Accelerated generation of customized bioprocesses

Metagenomics Platform

- High-throughput sequencing (Illumina MiSeq, Nanopore GridION)
- Single-cell isolation (B.Sight)
- Microbial community analysis (shotgun, metabarcoding)

Biomolecule Production Platform

- Micro- and photobioreactors for microbial and algal cultures
- Strain engineering and metabolite production
- Purification and characterization of high-value compounds

Structural / Functional Characterization Platform

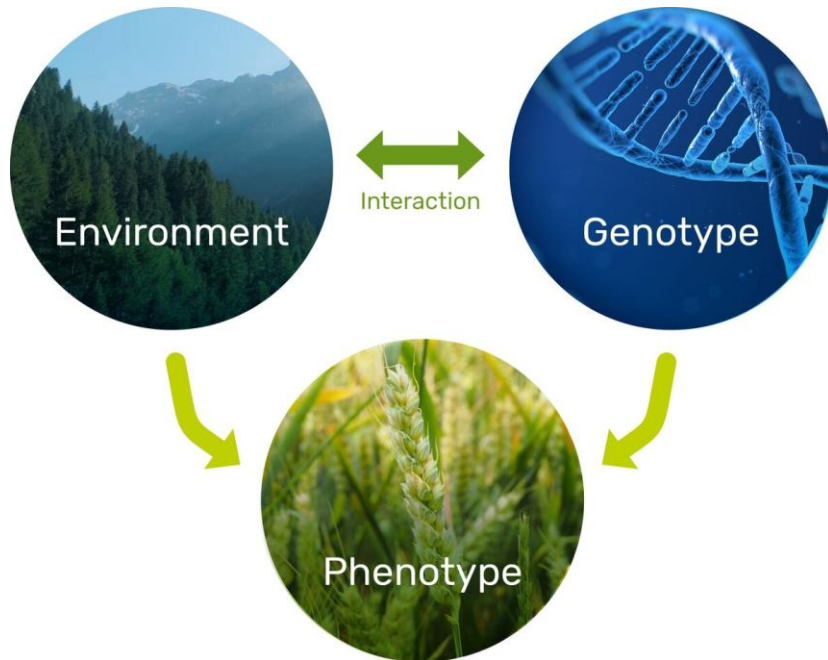
- Recombinant protein expression (bacterial, mammalian, plant)
- Purification technologies (FPLC, HPLC)
- Advanced structural analysis (Microscopy, Mass Photometry, etc)



Data Storage & Harmonization

- High-performance server at CNR-IBBA
- FAIR data principles
- Integration with ITINERIS Hub

Highlights from Emphasis-IT



6.09 Development of novel nondestructive phenotyping platforms to optimize the agricultural use of natural and biological resources

6.10 Novel phenotyping platforms for agricultural and forestry sustainable use, valorization and optimization of water, soil, and biodiversity resources

6.18 Sustainable Agriculture and environmental biotechnology

Highlights from Emphasis-IT



Real Time Measurements of VOCs

Vocus

The image shows a silver, rack-mounted electronic device with a yellow cable. The background is a collage of images related to environmental science and technology, including a globe, a field, and a person working with equipment.



Highlights from AnaEE

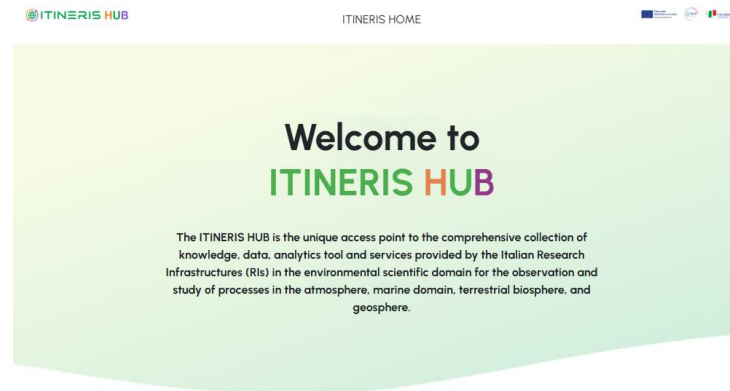
FO₃X - (Free-Air Controlled Exposure)

Elena Paoletti, Elena Marra, Leonardo Lazzara, Andrea Viviano, Giulia Giberti, Alessandro Montagni, Tiziana Di Lorenzo, Yasutomo Hoshika

IRET-CNR Firenze



An innovative infrastructure for studying the effects of O₃ on vegetation in real environmental conditions and is the only experimental facility in the Mediterranean area.



Development of ITINERIS database:

The main parameters provided are:

- **meteorological data** and soil parameters (hourly basis)
- **air pollution data** (ozone and NO_x levels, hourly data)
- **critical level** (species-specific) **based on stomatal flux for ozone damage** risks development of ozone-type leaf damage symptoms



WP6 – Collelongo (eLTER-AnaEE-ICOS site)



N passive sampler
Atmospheric input



Tree Talker
Tree responses

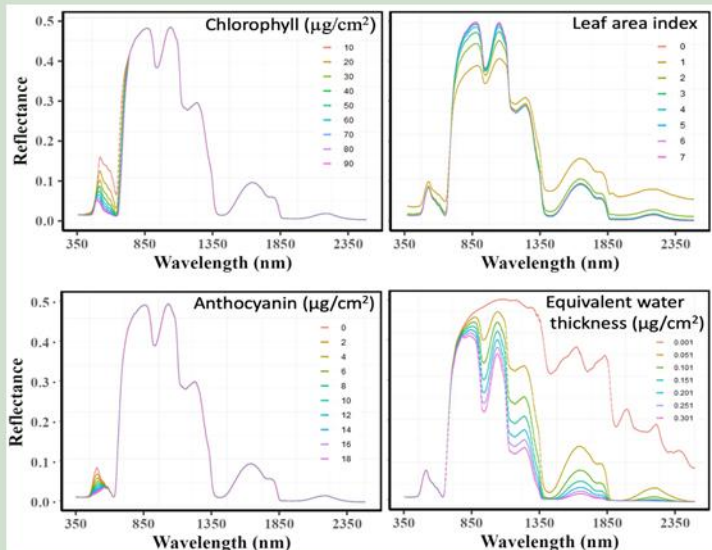


Camera Trap – Audio Recorder
Biodiversity monitoring

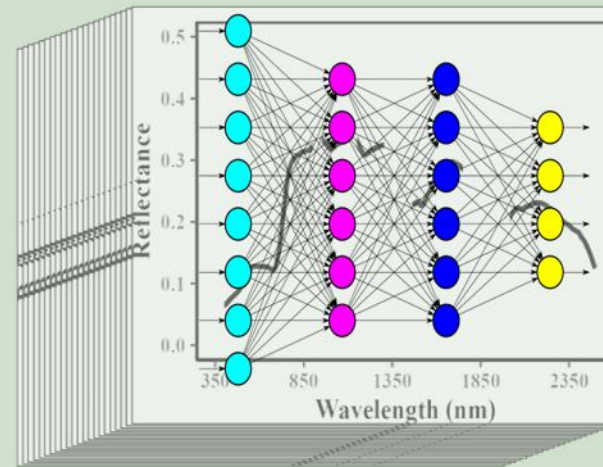
WP6 - Cross-RI dataset provision of UAV multi platform hyperspectral data and site level measurements over different RI ecosystem sites (eLTER, ICOS, ANAEE) and comparison with satellite products

Hybrid Machine Learning – Radiative Transfer Model

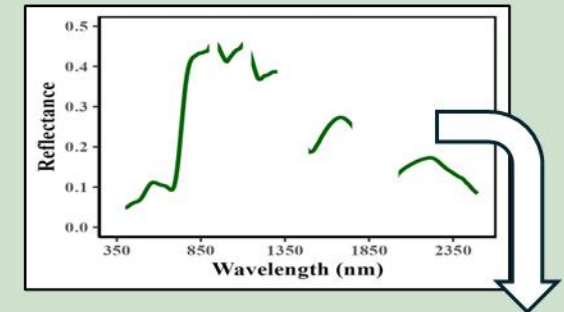
i) Simulate spectra with RTM



ii) Train Machine Learning Model



iii) Estimation of plant traits



Plant traits

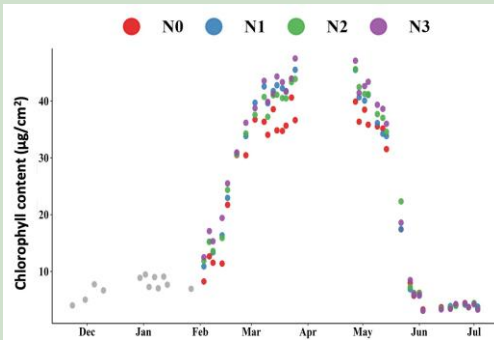
Chlorophyll = 10 ($\mu\text{g}/\text{cm}^2$)
Leaf area index = 2
Anthocyanin = 4 ($\mu\text{g}/\text{cm}^2$)
Water content = 0.001 (g/cm^2)

J. L. Pancorbo, G. De Luca, F. Carotenuto, L. Genesio, A. Montaghi, B. Gioli

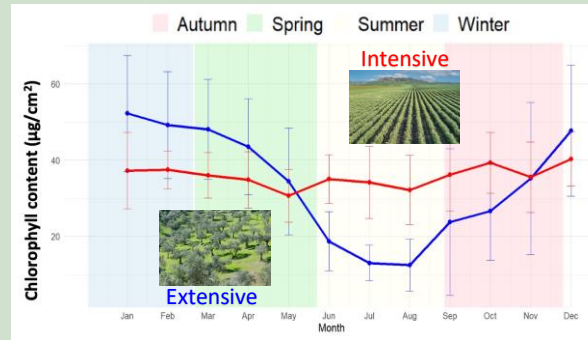
Study Cases

Agriculture (model and data collected with Aerolab instrumentation)

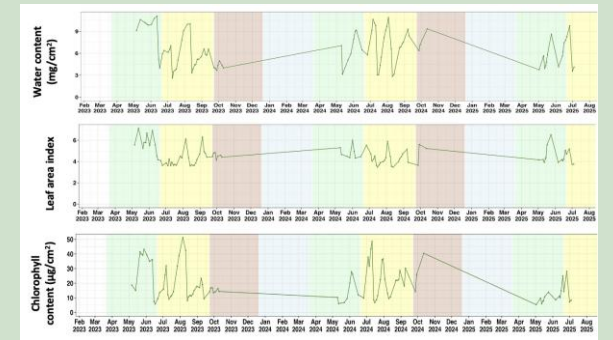
N Fertilization adjustment



Identification olive management

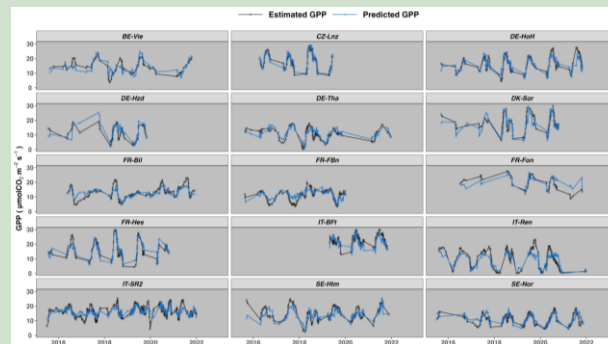
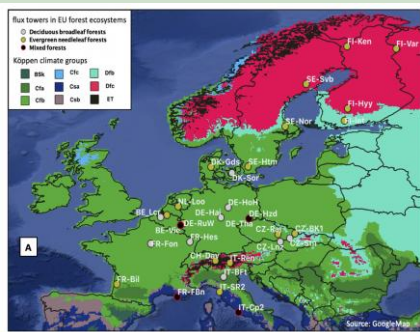


Optimizing alfalfa yield

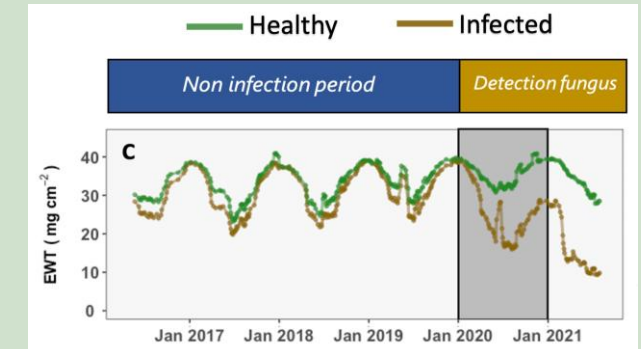
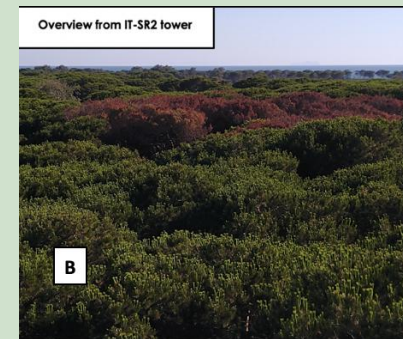


Forest (model tested on sites of the ICOS and eLTER infrastructure)

Gross Primary Production



Early fungus infection detection



Highlights from ICOS

Improvement in the number of sites, data collection, and data sharing

Xymenian Observatory (Florence) The Eddy Covariance system was upgraded with enhanced instrumentation to improve CO₂ flux monitoring, data accuracy, and system reliability

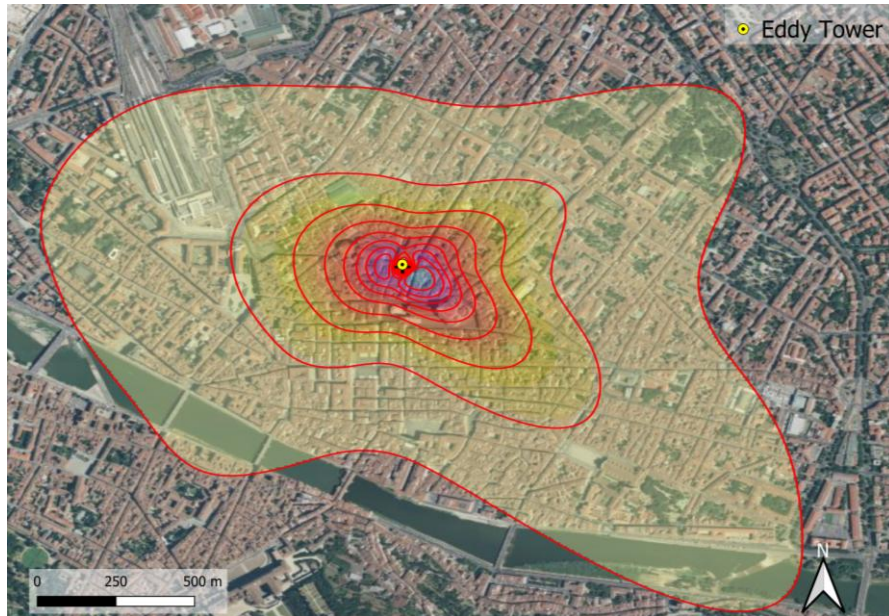


Fig. 1 Eddy Covariance site and footprint area in Firenze.



Fig. 2 Eddy tower in Firenze.

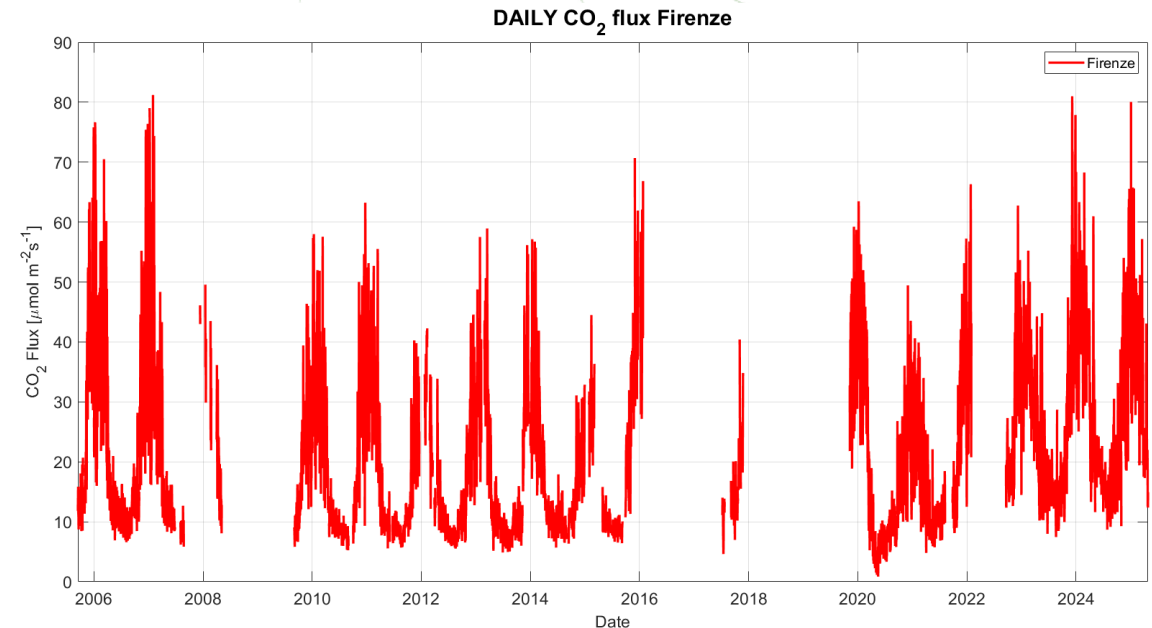
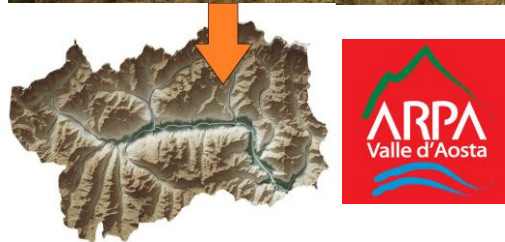


Fig. 3 Average Daily CO₂ Fluxes in Florence (2005–2025)

WP6 - Cross-RI – ICOS eLTER TWO SITES UPGRADE



Torgnon, Valle d'Aosta (2100 m asl)

IT-Tor - GRASSLAND (*Nardus stricta*)

Eddy covariance

- Installation of a new ICOS-compliant station (LI-7200RS, GILL HS-50, Smarflux2)

Meteorological data:

- Installation of a new CNR4 unit

IT-TrF - FOREST (*Larix decidua*)

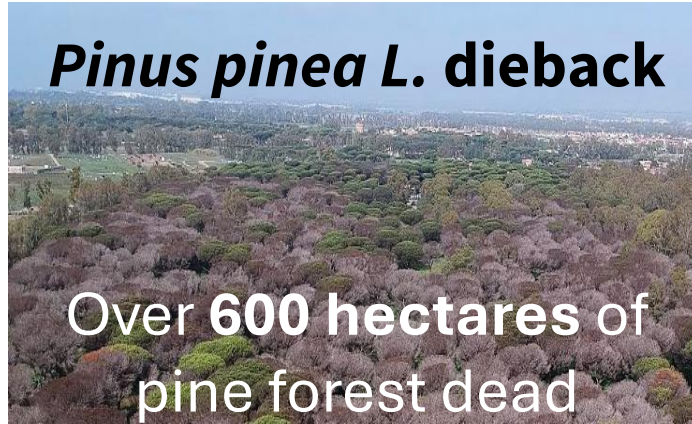
Eddy covariance

- Installation of a new ICOS-compliant station (LI-7200RS, GILL HS-50, Smarflux2)

Meteorological data:





- Installation of a new net radiometer (CNR4)
- Installation of 10 PAR Sensors (Apogee, 2 CR3000 datalogger) and 10 Dendrometers (DR26) in 2 Continuous monitoring plot

WP6 - Cross-RI – Holistic evaluation of ecosystem recovery strategies: the example of Castelporziano cluster network



Ecosystem Recovery Strategies



-  Reference Deciduous Oak Forest
-  Reference Evergreen oak forest
-  Reforestation
-  Natural Evolution



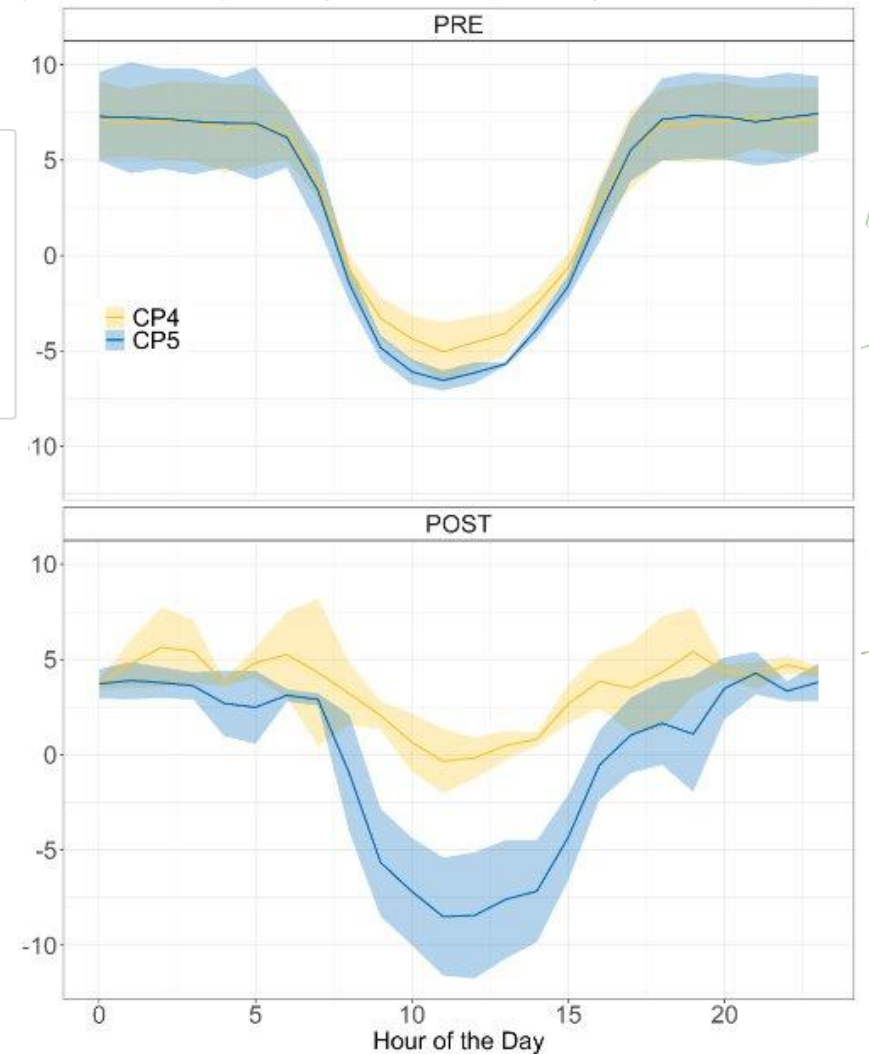
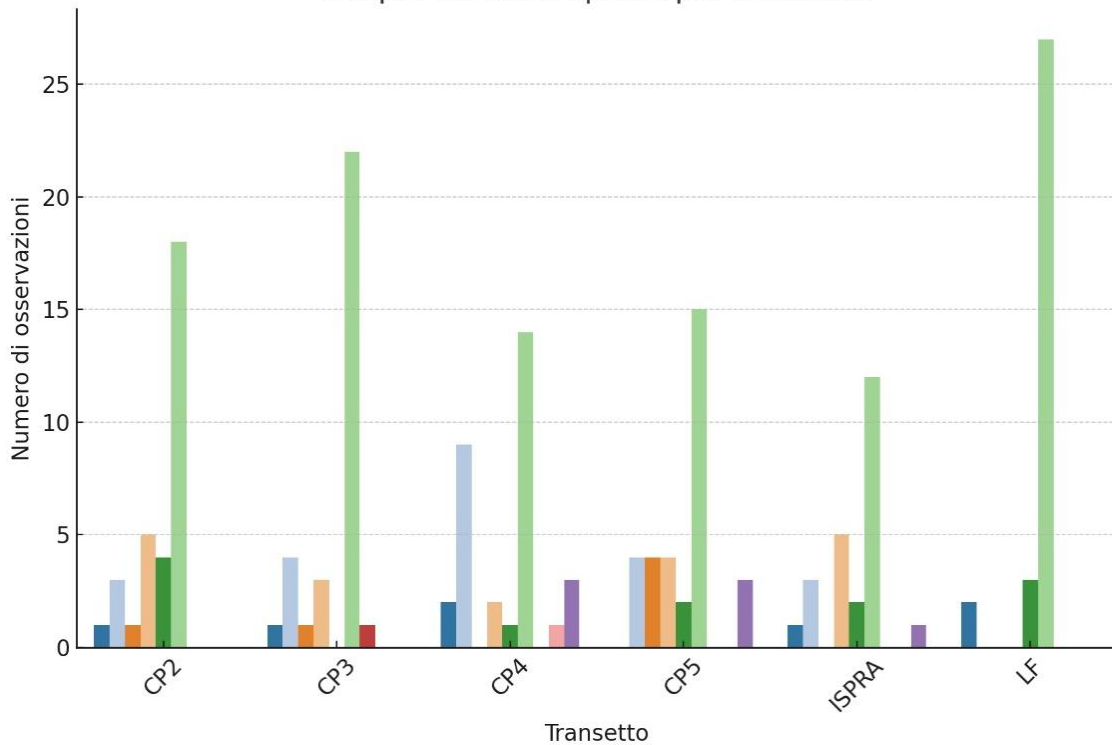
Holistic and Comprehensive Assessment

Fluxes: Carbon, Water, Energy

Biodiversity: plants, lepidoptera, rodents

WP6 - Cross-RI – Holistic evaluation of ecosystem recovery strategies: the example of Castelporziano cluster network

Frequenza delle specie per transetto



WP6 - Cross-RI – Holistic evaluation of ecosystem recovery strategies: the example of Castelporziano cluster network



ICOS

Integrated Carbon Observation System



THANKS!

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