

HE Mission 5: Soil health and food



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

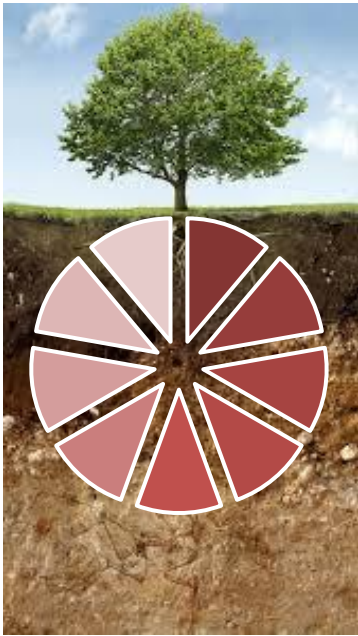
**Expertise of
SOIL Thematic Group
(DISTAL)**

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Nine research groups

- Geophysics & Soil hydrology
- Forest and Soil health
- Soil quality & Nutrient use efficiency
- Management/conservation of agricultural soils
- Fruit Science & Arboriculture
- AgroEcology - Earth in Transition
- Biotech4agrowaste
- Agricultural and biosystems engineering
- Agricultural economics





Forest and Soil health

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Expertise

- **Pedological survey** and **GIS** representation, spatial analysis and geostatistics, soil mapping
- **C and N cycles** and **stocks** in forest soils and ecosystems (SUOBO, CASTANICO)
- Impact of **forest management** on **ecosystem services** and **soil health** (Castagni Parlanti)
- Impact of **Global Change** (Climate Change, N deposition etc) on forest ecosystems
- Land **suitability** and identification of **sustainable** forest management practices (AGRIFORESTER, TSECAAPPMO)

LAB equipment

^{13}C - ^{15}N isotopic and ICP elemental analyzers

IR gas (CO_2 , N_2O , CH_4) analyzer, VP-FTIR and DRIFT spectrometer

GIS software, Cdendro software for dendrochronology





Geophysics and Soil hydrology

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Expertise

- **Geophysical methods** in agriculture (cosmic-ray neutron sensing and gamma ray spectrometry)
- Spatial analysis and geostatistics
- Deterministic models for supporting agricultural water management
- Uncertainty and sensitivity analysis of environmental models
- Monitoring and modelling **water fluxes** at the **soil-plant-atmosphere system**

LAB equipment

Soil texture, retention curve, saturated hydraulic conductivity
Soil moisture by gravimetric, FDR, CRNS, gamma-spectrometry
Groundwater levels





Soil quality & Nutrient use efficiency

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Luciano Cavani

Claudio Ciavatta

Giampaolo Di Biase

Ornella Francioso

Claudio Marzadori

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Expertise

- **Soil quality (bio)-chemicals indicators** as a function of soil-use change and soil management systems
- **Cycle of nutrients** in the soil-plant system and **soil C-sink**
- **Nutrient use efficiency** of **(in)organic fertilizers**, biostimulants, digestates, and **biowastes**
- **Persistence** and **transformation** of organic pollutants (i.e.: pesticides, **antibiotics**, **microplastics**) in soils (PRIN, REFLUA)
- **Bioavailability** and **plant translocation** of PTEs and pollutants (FoodE, ZeroResidue food)
- Environmentally friendly abatement of **antibiotics** and **ARM** in **animal wastes** (REFLUA)

LAB equipment

^{13}C - ^{15}N Isotopic & ICP elemental analyzers, enzymatic activities assay, TG, FTIR, DRIFT, E-nose, photoacoustic gas detector, HPLC





Management and conservation of agricultural soils

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@LabA60IST



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Expertise

- Long-term trials assessing **N,P fertilization** regime and **crop successions** on the agroecosystems
- **Soil fertility** and conservation as a function of **tillage systems**
- **Microplastics** in soil: recovery technologies and practical solutions (EIP-AGRI: reducing the plastic footprint of agriculture)
- Atmospheric **CO₂ sequestration** in tilled soil for **climate change mitigation**
- **Seed treatment** solutions for improving **crop establishment**, and minimizing **dust-off** and detrimental effects of **seed protectants** on soil

LAB equipment

Conventional and molecular tools for soil analysis , seed dust-off analyzer, seed germinability and seed vigor, field plots under long-term agronomical experiment (since 1966)





Fruit Science & Arboriculture

Moreno Toselli

Maurizio Quartieri

Elena Baldi

Margherita Germani

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Expertise

- **Improvement of plant nutrient efficiency** by monitoring soil nutrients availability and biological fertility (BIOFERTIMAT)
- Effect of fertilizing techniques on **root physiology**
- **Nutrient balance** in **orchard ecosystems** by plant uptake dynamics and nutrient partitioning in vegetal tissues (BIOFERTIMAT)
- **Soil improvers** from biodegradable by-products in orchard, floriculture, cereals and on **soil fertility**

LAB equipment

Mini-rhizotrons, rhizoboxes, Kjeldahl titrator, continuous flow autoanalyzer, microwave digester, IR gas (CO₂, N₂O, CH₄) analyzer





AgroEcology - Earth in Transition

Adamo Domenico Rombolà

Anna Maria Bregoli

Alessandra Lombini

Arleen Rodriguez Declet

Beatrice Meluzzi

Luca Moretti Conti

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Expertise

- Response mechanisms of plants to **abiotic stresses**
- Valorization of **functional biodiversity** (organic compounds at the rhizosphere & plant VOCs) of historic **vineyards/olive groves**
- **Terroir**: influence of genetic, environmental, agronomic and cultural factors on food
- Interactions of plants within the agroecosystems and with the **landscape matrix**
- **Agroecological strategies** (intercropping, cover crops, rotation, implementation of animals, participatory research) in fruit woody systems (silvo-pastoral systems, dry stone walls, millstones)
- Research, educational and practical **training** in agroecology and **systemic thinking** (3rd mission)

Lab and field resources

Vegetal production lab, micropropagation lab, SEM, greenhouse, agroecological lighthouses for field trials, portable kit for VOCs collection, HPLC, GS-MS





Biotech4agrowaste

Soil chemistry

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Botanics

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Food Microbiology

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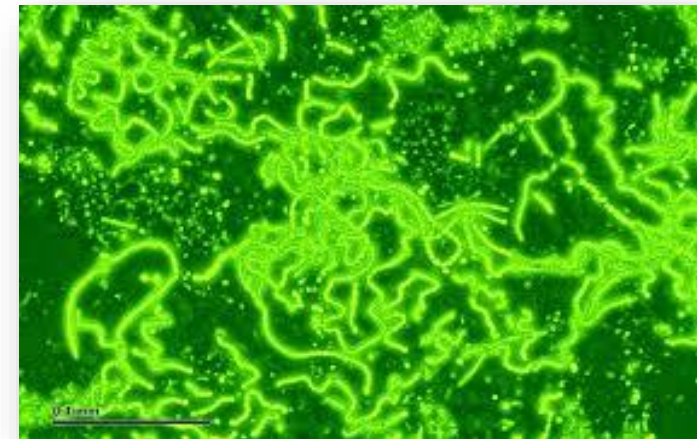
Francesca Patrignani

Lucia Vannini

Plant Pathology

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Hillary Righini



Expertise

- Reuse **agro-industrial biomass** on **soil organic C** dynamics
- **Digestates** as growing media for **bioproducts**
- **Mycorrhizal fungi** for **C sequestration** and improvement of **soil fertility**
- **Plants/fungi** for **bioremediation** of soils polluted by **heavy metals** and **plastics**
- **Safe microorganisms** for the valorization of **waste, residues** and **agro-industrial by-products** into safe **microbial biomass, chemicals, enzymes, single cell oil/protein** for different fields' applications
- **Biocontrol** agents using **yeasts** and **lactic acid bacteria** for **agro-food applications**
- **Bioactive components** from **biomass** (algae and cyanobacteria) for **plants' defense** against **pathogens**





Agricultural and Biosystems Engineering

Patrizia Tassinari

Daniele Torreggiani

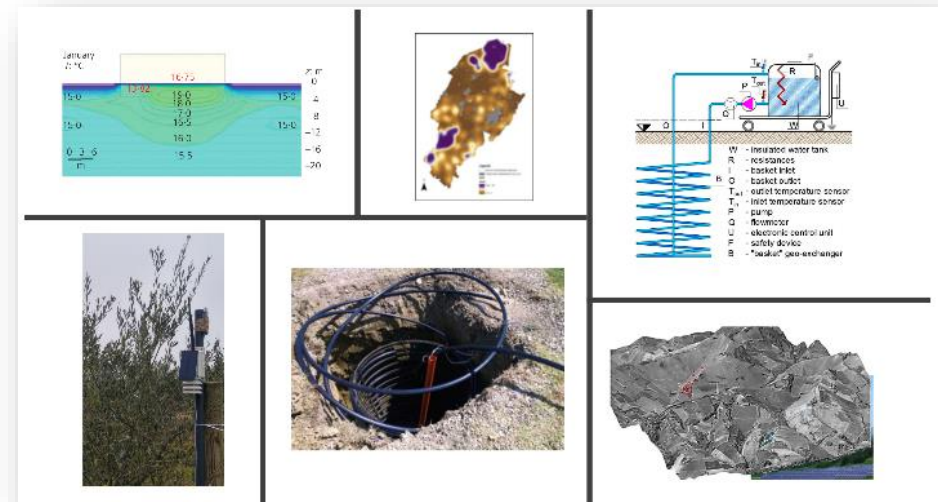
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Expertise

- Soil temperature characterization at different depths
- Soil analysis as a **thermal energy storage** and/or **exchanger**
- Shallow geothermal energy exploitation (low-enthalpy)
- **Multi-criteria landscape analysis:** GIS models and areal sampling strategies for spatial analysis and land-suitability assessment
- High spatial and time resolution land-use change and **soil sealing** analysis, monitoring and modelling
- **Land-use change/soil quality** and **soil carbon stock nexus**

LAB equipment

Lab for monitoring and analysis software

Thermal Response Test machine





Agricultural Economics

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Matteo Zavalloni

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Expertise

- Public goods, landscape and environmental issues **including soil conservation** (CLAIM, PROVIDE, CONSOLE, BIOBIO, SPARD, LIFT, MACSUR, SHOWCASE)
- Legume cropping increase/diversification (LEGVALUE)
- Agricultural **policy evaluation** (CAP-IRE, 7 tender projects EU/JRC)
- Business models (RUBIZMO)
- Water policy evaluation (EPI-Water, Water Cap&Trade, AQUAMONEY, WADI)
- Digitalisation and water resources (FIGARO, MOSES)
- Research, Innovation and Investments (SUFISA, Impresa, Factor markets, Namaste, NETGROW)
- Training and innovation in the food sector (NEXTFOOD)

Methods

Mathematical programming models, valuation of externalities, econometric analyses, cost/benefit analyses etc.



ready to go

