UNIVERSITÀ POLITECNICA DELLE MARCHE

Resistance and resilience of mountain forest ecosystems to increasing abiotic disturbances due to climate change

Fabio Gennaretti

Dept. of Agriculture, Food and Environmental Sciences (D3A)

The **Forest Ecosystems Unit** includes the **ForEcoLab** (Forest Ecology and Tree-Ring Laboratory), which supports teaching and research in sustainable forest and landscape management through multiscale ecological approaches.

Research topics include land use and land cover change, sustainable forest management, forest biodiversity conservation, the effects of climate change on forests, disturbance ecology and landscape restoration, ecosystem services, and environmental compensation. The lab uses forest inventory and tree-ring growth data, as well as remote and proximal sensing data.

The ForEcoLab is equipped with **instruments** for tree-ring analysis and wood anatomy, workstations for data processing, advanced field data collection tools, GNSS survey stations, and drones with both passive and active sensors for high-resolution forest and landscape monitoring.

The Forest Ecosystems Unit

The research group collaborates with several international institutions: IPE-CSIC Saragoza (SP), Universidad de Oviedo (SP); Universidad de Cordoba (SP); Marburg University (D); WSL Birmensdorf (CH); Cambridge University (UK); Auckland University (NZ); Université du Québec (CAN).

- **International projects:**
  - UE CARBO-INVENT (EVK2-2001-00287) "Quantifying carbon stocks and stock changes in European Forests".
  - EU EVK2-CT-2002-00148 ALP-IMP "Multi-centennial climate variability in the Alps based on Instrumental data, Model simulations and Proxy data".
  - LIFE08NAT/000371/RESILFOR "Restoration of mixed Beech-Silver fir forests in the Apennines (Marche and Tuscany)".
  - CRSNG – Canada "Tree-ring anatomy to study two thousand years of climate variability and
  - FRQNT – Canada – "Multiscale forest carbon and albedo modelling for assessing the potential of different forest management strategies on climate change mitigation
  - LIFE-2022-SAP-CLIMA-CCM "Slow growing forests management for Climate Change Mitigation"

- **National projects:**
  - PNRR – Agritech (Ecosystem services in chestnut forest/groves)
  - PSR – Bioseiforte (Ecosystem Services in mountain areas)
  - PRIN – OLYMPUS ("spatiO-temporaL analYsis of Mediterranean treeline Patterns: a mUltiScale approach)
  - Ministry of Agriculture – Inventory of monumental trees and old-growth forests
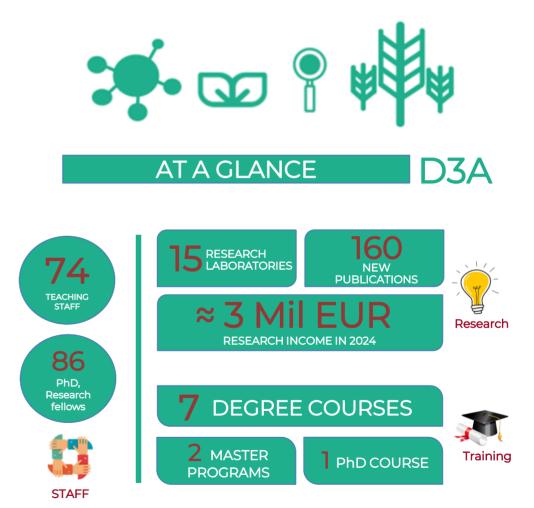
The Department of Agricultural, Food and Environmental Sciences (D3A) Director: Prof. Davide Neri

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The **Department of Agricultural, Food and Environmental Sciences (D3A)** provides research and teaching activities in several subject areas : agronomy, agro-engineering, biochemistry, plant and forest biology, chemistry, tree crops, genetics, plant pathology, entomology, food, forestry, industrial and environmental microbiology, economic sciences in agricultural and territorial systems, physical sciences, food science and technology, soil science and animal production.

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UNIVERSITÀ POLITECNICA DELLE MARCHE | **The project**

Resistance and resilience of mountain forest ecosystems to increasing abiotic disturbances due to climate change

The ongoing rapid **climate change** is forcing the response of **mountain forests in all** biogeographic regions. The increased frequency and intensity of major abiotic **disturbances**, such as fires, late frosts, windstorms together with summer drought stress affects greatly mountain forests productivity and their provision of **ecosystem services**.

Extreme climate events and their potential synergy within globally warmer and more variable climate scenarios need to be considered in the future mountain forest management and planning. Our **multiscale research approach** combining remote sensed (satellite, unmanned aerial vehicle, handheld solutions), and field data (growth-rings series, tree biometrics, regeneration inventories) can assess the **sensitivity** and the **recovery capacity** of these forests after disturbances.

The analysis of their occurrence, dynamics and impact provide necessary information for monitoring and implementing control strategies especially in the current context of climate change. With this research we aim to **improve the forecasting capacity of forest regeneration**, **growth and adaptation to post-disturbance conditions**. The results will provide knowledge and tools for a sustainable and adaptative management of mountain forests.