

Assessing tree ecophysiological responses to the combined effects of nitrogen deposition and climate extremes on European forests by using a dendroecological approach.

The ability of forests to continue providing important ecosystem services and mitigating climate change depends on their ability to cope with - and adapt to - global change components, such as more frequent climate extremes (specifically drought and heatwaves) and changes in atmospheric pollutants (namely carbon dioxide, CO₂, and reactive nitrogen, N, compounds). The 2003 heatwaves cannot be considered as an exceptional event anymore, as prolonged summer droughts and temperatures anomalies are becoming more common and frequent across the whole European continent, due to the human-induced climate change. Frequent droughts and hot extremes are not the only challenge forests need to face. Since the industrial revolution, atmospheric chemistry has been altered, with steadily increases in CO₂ concentrations, but also to changes in reactive N in the oxidised and reduced forms. While almost half of the CO₂ emitted by fossil fuel combustion remains in the atmosphere (and hence contribute to global warming), reactive N compounds are deposited back to terrestrial and aquatic ecosystems, directly altering the N cycle, but indirectly also the carbon and water cycles. While N deposition could stimulate tree growth in a CO₂ richer world, excess N could result in forest dieback, through soil acidification and nutrient imbalances but also by making trees more vulnerable to climate extremes. How do these global change components interact and affect forest carbon, water and N cycling? What are the ecological mechanisms involved? Are those mechanisms synchronized (in space and time) at tree and ecosystem scale? Answering these questions is of paramount importance to reduce the uncertainties on the sustainability of the CO₂ fertilization effects on forest carbon sink and hence, to predict future forest function and climate mitigation potential. In order to answer these fundamental questions, 12 forests along a climate and N deposition gradient (from 3 to 42 kg ha⁻¹ yr⁻¹) in Europe will be considered, and four of the most widespread species in European forests: *Fagus sylvatica*, *Quercus ssp.*, *Picea abies*, *Pinus sylvestris*. Forests sites were selected within established networks, namely ICOS and/or Fluxnet (for the ecosystem scale measurements of carbon and water fluxes with eddy covariance technique) and ICP Forests (for atmospheric nitrogen deposition). The postdoc will be hired within the NEXTRES project (PRIN2022 project funded by Italian national funding), and he/she will specifically contribute to the sub-tasks related to tree level responses by using dendroecological analyses, both at the whole ring or intra-annual scale.

The activities will include:

- Organizing fieldwork for sampling wood cores at the investigated forest sites (months 1-3);
- Being responsible of the lab work to prepare samples for isotope analyses (including dendrochronological measurements, separating and gridding annual rings, stable isotope measurements in the isotope facilities at the UNIBO and external institutions) (months 4-12);
- Coordinating sample preparation for intra-annual scale isotope analyses (in an external lab) (months 8-14);
- Presenting results at international conferences (the second year of the postdoc);
- Leading the data analysis and publication of results (months 12-18).

Le attività previste includono:

- Pianificare ed organizzare i campionamenti nei siti forestali inclusi nel progetto (mesi 1-3);
- Essere responsabile del lavoro in laboratorio di preparazione dei campioni per le misure isotopiche (incluso le misure dendrocronologiche, la separazione degli anelli di accrescimento e misure

isotopiche sia nel laboratorio di isotopi stabili presso il DISTAL che in laboratori esterni) (dal mese 4 al mese 12);

- Coordinare la preparazione dei campioni per le misure isotopiche a scala intra-annuale (dal mese 8 al mese 14);
- Presentare i risultati a conferenze internazionali (secondo anno dell'assegno di ricerca);
- Coordinare l'analisi dei dati e la pubblicazione dei risultati in riviste scientifiche internazionali (dal mese 12 al 18).