**“Mediterranean” is different; in terms of ecosystem responses to N deposition too! Understanding why through temperate-like relic, circum-Mediterranean fir forests.**

J. A. CARREIRA1\*, B. VIÑEGLA1, M.T. SALIDO1, P. TORRES-CAÑABATE1, M.C. BLANES2, B.A. EMMETT2, J.A. MERINO3

*1 Department of Botany, Zoology and Ecology, University of Jaén, Jaén, Spain*

*2 Department of Physic, Chemical and Natural Systems, University Pablo de Olavide, Sevilla, Spain*

*3 Centre for Ecology and Hydrology, Environment Centre Wales, Bangor, UK*

Contact: [joseantonio.carreira@ujaen.es](mailto:joseantonio.carreira@ujaen.es)

Current biogeochemical theory on the consequences of N deposition in forest ecosystems has mainly developed from studies on temperate regions. However, research on the issue in mediterranean regions is scarce and strongly biased toward Californian. Nevertheless, these limited studies point out to remarkable singularities in the way mediterranean ecosystems respond to N deposition (eg, leaky N-cycle and high nitrification under relatively low N inputs even in aggradative forests), which do not easily fit within prevalent conceptual models on N saturation. Atmospheric N inputs are expected to increase in some Mediterranean regions in the coming decades. In order to better assess N critical loads, forecast impacts and develop mitigation strategies for Mediterranean ecosystems, we urgently need to improve our understanding of the mechanisms underlying this “mediterranean oddity”. For this task, an ideal approach would be to apply “mediterranean seasonality” treatments to N-saturated temperate forests, to check responses. As a surrogate of this disparate experiment, we employ relic, circum-Mediterranean conifer forests. They represent remnants of temperate/boreal forests, more widely distributed in the Tertiary, that became isolated at high altitude, N-facing slopes of coastal mountains, forced by Quaternary glacial cycles and “mediterraneization” of climate in the Mediterranean basin. Despite mean annual rainfall and temperature in the range typical for temperate regions (1000-2000mm; 9º-12ºC), climatic conditions in their current locations are “mediterranean” regarding seasonality and long summer droughts.

We have mainly focused on *Abies pinsapo*-fir forests, endemics from southern Spain (west-Baetic range), where an N deposition geographic gradient exist around the industrialized area of Campo de Gibraltar. We are now extending our studies to *Abies pinsapo* and *Cedrus atlantica* forests in northern Morocco, and planning to expand to other relic conifer mountain forests near industrialized and/or heavily urbanized areas (eg, *Pinus sylvestris*,Sierra Nevada, Granada, Spain; *Abies cephalonica*, Athens, Greece). In our studies, we compare stands along N deposition gradients in terms of biogeochemical budgets (bulk deposition, throughfall, soil leaching and stream water chemistry), N saturation indicators in soils (N pools and fractions, microbial N mineralization and inmobilization, nitrification and denitrification) and vegetation (N and aminoacid profiles in tissues, N use efficiency in physiological processes, differential gene expression/N metabolism), including 15N natural abundance. We have also performed nutrient-addition experiment at plot and stand scales, using 15N-labelling to track the fate of added-N. Finally, we have examined the role of N and P interactions in the development of the N saturation syndrome (P limitation in trees induced by chronic N deposition, remediation management through compensatory P fertilization).