Nitrogen addition drives decomposition rates in Mediterranean ecosystems via changes in soil properties and microbial attributes

Lourdes Morillas (1), Mauro LoCascio (2), Raúl Ochoa Hueso (3), Javier Roales (4), Manuel Delgado-Baquerizo (5), Silvana Munzi (6), Teresa Dias (7), Esteban Manrique (8), Esther Perez Corona (9), Antonio Gallardo (10), Cristina Cruz (11), Donatella Spano (12), and Simone Mereu (13)

(1) University of Sassari, Department of Science for Nature and Environmental Resources (DipNET), Sassari, Italy (lourdesmorillas@msn.com), (2) University of Sassari, Department of Science for Nature and Environmental Resources (DipNET), Sassari, Italy (maurolocascio@yahoo.it), (3) Autonomous University of Madrid, Department of ecology, Madrid, Spain (r.ochoahueso@westernsydney.edu.au), (4) Pablo de Olavide University, Department of Physical, Chemical and Natural Systems, Seville, Spain (javier.roales@gmail.com), (5) University of Colorado Boulder, Cooperative Institute for Research in Environmental Sciences (CIRES), Boulder, USA (m.delgadobaquerizo@westernsydney.edu.au), (6) Centre for Ecology, University of Lisbon, Evolution and Environmental Changes (cE3c), Lisbon, Portugal (ssmunzi@fc.ul.pt), (7) Centre for Ecology, University of Lisbon, Evolution and Environmental Changes (cE3c), Lisbon, Portugal (mtdias@fc.ul.pt), (8) Spanish National Research Council (MNCN-CSIC), National Museum of Natural Sciences, Department Biogeography and Global Change, Madrid, Spain (e.manrique@csic.es), (9) Complutense University of Madrid, Department of Ecology, Madrid, Spain (epcorona@ucm.es), (10) Pablo de Olavide University, Department of Physical, Chemical and Natural Systems, Seville, Spain (agallardo@upo.es), (11) Centre for Ecology, University of Lisbon, Evolution and Environmental Changes (cE3c), Lisbon, Portugal (ccruz@fc.ul.pt), (12) University of Sassari, Department of Science for Nature and Environmental Resources (DipNET), Sassari, Italy (spano@uniss.it), (13) Euro-Mediterranean Centre on Climate Change (CMCC), IAFES Division, Sassari, Italy (si.mereu@gmail.com)

Although anthropogenic nitrogen (N) deposition has been identified as a major threat to biodiversity and ecosystem functioning in Mediterranean environments, little is known on the role of soil properties and microbial attributes in mediating the response of soil organic matter (SOM) decomposition to N inputs. Here, we used Structural Equation Modeling (SEM) to evaluate the direct and indirect effects of N inputs on SOM decomposition rates across different N loads and three Mediterranean semi-arid ecosystems. Our SEM showed that soil ammonium availability decreases soil pH leading to a reduction of the fungi/bacteria ratio and to an increase in soil enzymatic activity, whereas it also has a negative direct and mayor effect on soil decomposition rate. This increase in soil enzymatic activity, which was conditioned not only by soil pH but also by the fungi/bacteria ratio and inorganic N content, had a positive direct effect on the soil decomposition rate. Together, our results suggest that changes in soil properties and microbial attributes linked to N additions can affect the SOM decomposition rates across three regions from the Mediterranean Basin. These findings improve our understanding of the links between soil chemical properties, microbial communities and function in Mediterranean ecosystems, especially in the context of anthropogenic N enrichment.