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Nitrogen deposition effect on soil CO_2 efflux in a Mediterranean semi-arid Juniperus phoenicea L. macchia

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Soil respiration (SR) represents the largest flux in the global carbon cycle after photosynthesis. As soil carbon pool is two times as big as the atmospheric carbon pool, even a small change in soil respiration could significantly intensify or mitigate current atmospheric increases of CO_2, with potential feedbacks on climate change. Carbon and nitrogen cycles are strongly coupled in many terrestrial ecosystems, especially in nitrogen-limited ones. Thus, changes in nitrogen availability can drastically alter the cycling of carbon.
Mediterranean-type ecosystems are frequently reported as nitrogen-limited, although primary production and responsiveness to extra nitrogen are mostly limited by water and conditioned by phosphorous. Moreover, despite the predicted increase in nitrogen inputs to the Mediterranean Basin, very few studies analyse the effect of an increased nitrogen availability on soil respiration in these ecosystems.
Here, we analyse the effect of an increased nitrogen availability (24 kg N ha-1 yr-1) on total soil CO_2 efflux and on its heterotrophic component along a 9 month period. The treatment was applied in a Mediterranean semi-arid Juniperus phoenicea macchia, and SR was measured both on bare soil (absence of litter) and in the under canopy (abundant litter). We hypothesized that the application of nitrogen leads to an initial transient increase in soil respiration, followed by a reduction of CO_2 fluxes below the control levels.
Our results demonstrate that the increased nitrogen availability did not cause an initial transient soil CO_2 efflux compared to control conditions, nor a reduction in the following months. Water availability is the main limiting factor for C fluxes in these ecosystems, however N had a transient positive effect on SR in the under canopy after the first Autumn rainfalls.