



## **Effects of a large scale nitrogen and phosphorous fertilization on the ecosystem functioning of a Mediterranean tree-grass ecosystem**

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Recent studies have shown how human induced N/P imbalances affect essential ecosystem processes, and might be particularly important in water-limited ecosystems. In this contribution we will present results from an ecosystem scale nutrient manipulation experiment on a Mediterranean tree-grass ecosystem (Majadas del Tietar, Spain). Specifically, we will show how ecosystem functioning (e.g. light use efficiency, water use efficiency - WUE, albedo) changes as consequence of N and NP fertilization.

A cluster of eddy covariance (EC) flux towers has been set up beside a long-term EC site (Control site) to measure high temporal resolution C and water fluxes between the ecosystem and the atmosphere. The sites were selected in a way to have similar pre-treatment conditions. Two out of three EC footprint areas (18 Ha) were fertilized with N and NP at the beginning of 2015 and 2016. To interpret the variations in C and water fluxes measured with the EC systems we monitored spatial and temporal variations in phenology, plant traits, species richness, and tree transpiration by using sap-flow meters, digital repeat photography, as well as soil sampling.

The results show a consistent increase (~15% compared to the Control site) in net ecosystem production (NEP) observed both in the N and the NP treatments. An increase of evapotranspiration (ET) of about 15% and 10% is observed in the N and NP site, respectively, indicating an increase of WUE in the NP treatment. The partitioning of the NEP into its gross components, the gross primary production (GPP) and the total ecosystem respiration (TER), show that the fertilization stimulated more GPP rather than TER, increasing therefore the capability of the ecosystem to act as carbon sink. The effects of fertilization are pronounced in spring and autumn and negligible in summer. This indicates that grass reacted much more than trees to N and NP addition. An increase of greenness and also an earlier green-up of grass in the N and NP sites in autumn after the first rainfall are observed. In particular we observed an enhanced response of NEP and greenness to onset of precipitation in fall for the NP treatment. No systematic differences are observed in summer during the dry-out period.

These results suggest that an increase of N availability can have a relevant impact on the studied tree-grass ecosystem. The attempt of compensating the N/P imbalance, by adding P, impacted marginally the C fluxes, while increased the WUE of the ecosystem. Differences in temporal variations of ecosystem level greenness also might indicate an impact of N and NP availability of the temporal variability of surface albedo.