

Mediterranean ecosystems occupy less than 5 % of the Earth's surface, yet they contain about 20 % of the world's flora, including important components in grasslands. In this study, important ecosystem functions (CO₂ exchange, biomass production and nutrient uptake of the herbaceous layer of a Mediterranean grassland ecosystem) at Herdade da Mitra, in Portugal were studied. The main objectives of this project were, to understand effects of grazing and canopy layer (overstory) on ecosystem functioning respectively. The canopy layer consists of some woody species mainly *Quercus ilex* and *Qu. Suber*. Results showed that trees added considerable amounts of nutrients to the soil beneath their canopies, and had the potential to facilitate understory production. Although there was no significant difference in total biomass accumulation between understory and open locations. Analysis of soil N concentration revealed higher soil N under the trees when compared to those in open areas. Although NEE was limited by light intensity in the understory, model projection of GPP showed no difference between the understory and the open locations in their potential assimilatory capacity but depending on the locations (open vs understory), grazing influenced CO₂ exchange processes differently. We found no significant differences in GPP between grazed and ungrazed sites in the open locations, while large differences occurred in the understory, with lower NEE in the grazed as compared to the ungrazed locations. Significant differences, however, occurred between the two locations in ecosystem respiration, showing higher respiration in grazed location in the open site while in the understory site respiration was similar in both grazed and ungrazed locations. Foliar N concentration in understory and open sites showed a different pattern, as the ungrazed location in the understory indicated lower values compared to grazed locations, although in the open sites, ungrazed locations exhibited larger foliar N concentration when compared to grazed locations.