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Factors controlling CO_2 efflux under different land uses in a Mediterranean semi-arid area of Southeast Spain.

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Soil respiration represents the main carbon efflux from ecosystems to the atmosphere and is therefore an important component of the global carbon balance. Although semi-arid ecosystems may not be so relevant in terms of the amount of C stored in them, they occupy one third of the land surface of the Earth and are highly vulnerable to climate change. Land-use change can dramatically alter ecosystem function. Particularly well documented are changes in nutrient cycles, soil structure and carbon sequestration that occur when native ecosystems are converted to agricultural use. Due to spatial variability in CO_2efflux, which is especially important in semiarid areas where conditions and organisms are markedly patchy, it is necessary to identify the major environmental factors controlling soil respiration under different land uses.

This work presents the results obtained during 15 months of soil respiration measurements (using a portable soil respiration rate measuring system) in three different land uses in a semiarid area: (i) a typical Mediterranean semiarid shrubland with scattered Aleppo pines, (ii) a non-irrigated olive grove, and (iii) an abandoned agricultural field. Measurements of soil CO_2efflux were carried out with monthly periodicity. Simultaneously, soil temperatures and soil water content were measured to correlate them with CO_2 efflux.

Total annual C loss through soil respiration (SR-C) was 3852, 8296 and 6213 Kg C/ ha in the non-irrigated olive grove, natural vegetation and abandoned agricultural field, respectively. There were significant differences ($p<0,01$) in CO_2 efflux among land uses and among months, with a significant land use x month interaction. In the olive grove, soil respiration had a significantly positive correlation with soil water content

and soil temperature. However, in the shrubland and the abandoned agricultural field, soil respiration was positively correlated with soil temperature, and negatively but not significantly correlated with soil water content. Seasonal variation in soil respiration was largely explained by seasonal changes in soil moisture and temperature, but these could only partially explain observed differences among land uses.

In order to better understand spatial variability of CO_2 efflux and to identify the major environmental factors affecting it, an additional experiment was designed. In December 2006, soil CO_2efflux, soil temperature, soil water content, soil C and N contents, fine roots biomass, and microbial biomass were measured in the most common plant cover types at each land use.