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Effect of organic matter and roots in soil respiration in a Mediterranean riparian areas in Central Spain

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Soil respiration is one of the largest carbon flux components within terrestrial ecosystems, and small changes in the magnitude of soil respiration could have a large effect on the concentration of CO2 in the atmosphere.

The main objective is evaluating the factors controlling soil respiration on the global carbon cycle in riparian areas of Henares River. We evaluated total soil respiration as it was affected by soil temperature, soil moisture, root respiration and organic matter in four areas differing in vegetation cover. We specifically assessed the contribution of soil organic matter and fine root biomass ($\leq$1 mm.) in soil carbon dioxide flux.

The study area is located on the riverbanks of Henares River where it passes through the municipal term of Alcala de Henares (Madrid) in Central Spain. Measurements were performed in spring and autumn of 2009. The study was conducted on four different types of riparian vegetation: natural Mediterranean riparian forest, reforestation of 1994, reforestation of 1999 and riparian grassland without trees. In each area of study 3, 25x25 m, plots were delimited and within each plot three sampling units of 50x50 cm were selected at random. The temperature of the ground was taken during the measures from respiration using a Multi-thermometer (-50ºC - +300ºC) at 5 cm depth. The moisture content of the ground was measured at 5 cm of depth with a HH2 Moisture meter (Delta Devices, Cambridge, UK). The measures of respiration of the ground were realised in field by means of LCI portable (LC pro ADC Bioscientific, Ltd. UK) connected to a ground respiration camera. We introduced the camera 3 cm into the soil just after eliminating the vegetation grass of the surface of measurement cutting carefully the aerial part, without damaging the roots. Soil CO2 flux measurements were registered after stabilization. Immediately after CO2 measurements, we obtained soil samples by means of a drill of 2.18 cm of diameter taking samples to 10 cm and 20 cm depth. Soil samples were dried to the air with the aim of preserving the roots the sample contained. They were extracted manually by means of very fine tweezers. We separate roots by diameter (Fine roots $\leq$ 1mm; rest of roots > 1mm) and dead from alive using texture and colour as clues. Finally the dry weight of roots was taking with a precision balance +-0.0001. Soil organic matter to 10 and 20 cm of depth were measure in laboratory using the method of Walkley and Black (1934).

Differences in Soil CO2 flux, organic matter, fine root biomass, temperature and moisture between areas were analyzed using one-way ANOVAs.

Our results suggest that fine root biomass present a larger impact than soil organic matter in soil CO2 flux values. Natural riparian forest presented higher values of soil CO2 flux than the rest of areas even when differences in root biomass and soil organic matter were controlled. Between the grassy area and both reforestations there were no differences in soil CO2 flux. In addition, we found that soil CO2 flux in our study area was more affected by soil temperature than by moisture, which could be relevant in the interpretation of the possible effects of global change.

Key words: riparian forest, fine roots, carbon cycle, soil CO2 flux, root respiration.

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