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Changes in soil respiration after thinning activities in dense Aleppo pine forests

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Forest fires are a widespread perturbation in Mediterranean areas, and they have tended to increase during the last decades (Pausas, 2004; Moreno et al, 1998). Aleppo pine (Pinus halepensis Mill) is dominant specie in some forest landscapes of western Mediterranean Basin, due to its capacity to colonize abandoned fields, and also due to afforestation practices mainly performed during the 20th century (Ruiz Navarro et al., 2009). Aleppo pine tends to die as consequence of forest fires, although it is able to disperse a high quantity of seeds which easily germinates. These dispersion and germination can result in dense forests with high inter and intra-specific competition, low diversity, low growth, and high fuel accumulation, increasing the risk of new forest fires. These forests of high density present ecological problems and management difficulties that require preventive treatments. Thinning treatments are common in these types of communities, but the management has to be oriented towards strengthening their functions. In the context of global change, better understandings of the implications of forest management practices in the carbon cycle are necessary. The objective of this study was to examine the evolution of seasonal soil respiration after treatment of selective thinning in dense Aleppo pine forests.

The study area covers three localities placed in the Valencian Community (E Spain) affected by a forest fire in 1994. Thinning activities were done 16 years after the fire, reducing pine density from around 100,000 individuals per hectare to around 900 individuals per hectare. Soil respiration was measured in situ with a portable soil respiration instrument (LI-6400, LiCor, Lincoln, NB, USA) fitted with a soil respiration chamber (6400-09, LiCor, Lincoln, NB, USA). We installed 12 plots per treatment (control and thinned) and locality, being a total of 72 plots. We carried out 13 measurements covering a period of one year. We also estimated other related variables (i.e. soil characteristics, potential soil heterotrophic respiration, plant biomass surrounding each plot, soil temperature, and soil moisture).

Main results showed a seasonal variation of soil respiration as related by other authors (i.e. Almagro et al., 2009), being soil respiration restricted by drying during summer, and by low temperatures during winter. On the other hand, thinning significantly diminished soil respiration, its decrease was around 33% (from 5.3 micromole CO_2 m-2 second-1, to 3.6 micromole CO_2 m-2 second-1). Our results suggest that autotrophic respiration could be highly responsible of this decrease: we found significant and positive relationships between soil respiration and vegetation surrounding plots, and we did not find differences in potential soil heterotrophic respiration between treatments.

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