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Post-Fire Soil Respiration in Relation to the Burnt Wood Management

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Wildfires are the main cause of forests and understory destruction in Mediterranean areas. One of the most dramatic consequences is the perturbation of carbon fluxes. A high percentage of the CO2 emitted by the ecosystem after a wildfire is due to soil respiration, which represents the most important uncertainty in the global carbon cycle. In this study we have quantified the soil respiration and its seasonal variability in reforested pine forests in the National and Natural Park of Sierra Nevada which were burned in September of 2005. Measurement campaigns were carried out along two years in two experimental plots at different altitudinal levels (1500 and 2200 m a.s.l.), in which three post-fire silvicultural treatments of burned wood were established: 1) “Non-Intervention” (NI), leaving all of the burnt trees standing. 2) “Cut plus Lopping” (CL), a treatment where most of the trees were cut and felled, with the main branches also lopped off, but leaving all the cut biomass in situ covering partially the ground surface 3) “Salvage Logging” (SL), all trees were cut and the trunks and branches were removed.

Soil respiration was highly determined by the effects derived of the altitudinal level, with the highest values at the lowest altitude. The seasonal precipitation regime had also a key role. Soil respiration kept a basal level during the summer drought, during this period the response to the altitudinal level and post-fire treatments were reduced. On the other hand, soil respiration boosted after rain events, when the differences between treatments became more pronounced. In general, especially under these conditions of absence of water limitation, the post-fire burnt wood treatment with the highest CO2 fluxes was that in which all the burnt wood biomass remained covering partially the soil surface (“Cut plus Lopping”) while the lowest values were registered in the treatment in which the soil was bared (“Salvage Logging”). Results of this study are especially important for the management of forest areas affected by wildfires, now that they offer key information about the influence of the forest intervention related to the burnt wood after fires in the carbon cycle and about the soil capacity of CO2 sequestration.