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# Ecosystem C budget during a scrubland fire

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Vegetation fire is the worldwide disturbance that affects the largest area and biggest biomes variety. Fire instantaneously generates large C fluxes to the atmosphere, as gas and soot particles. In the same time, part of ecosystem organic matter (OM) is converted into charred material that may contribute to the stable pool of soil organic carbon (SOC). The net effect of vegetation fire on C sequestration remains uncertain because the two major impacts operate at very different timescales and C budget is highly dependent on ecosystem and fire conditions. The aim of the present research was to assess fire-induced C fluxes to the atmosphere and as new litter and charcoal production during a prescribed fire in a subtropical oak shrub.

Pre-fire biomass and post-fire charred and unburned biomass were determined for vegetation leaves and stems, litter and soil in 20 sub-plots installed in a 30-ha area prescribed for fire. Concentrations of C were determined, and fluxes among pools and to the atmosphere were derived from these measurements. In a first assessment, charred OM was visually identified in standing biomass and litter using its black and shiny aspect. In a second step, a strong chemical oxidation with $K_2Cr_2O_7/H_2SO_4$ was used to isolate only a highly recalcitrant part of pyrogenic C.

After the fire, standing dead biomass was only composed of stems with charred surface. The leaves transferred from vegetation to litter during the fire represented more than a half of post-fire litter. Percentage of initial C pool that was lost to the atmosphere as gas or particles was $\sim$55 % from vegetation stems, $\sim$80 % from vegetation leaves, and $\sim$70 % from litter. Soil C stocks were not significantly modified by fire, in

agreement with moderate temperature elevation in the soil proper. Total C release to the atmosphere, including gas and particles, was $\sim$2.6 kg C $m^{-2}$. Visually-identified charcoal represented 5% of remaining stem C (i.e. 60 g C $m^{-2}$) and 21% of post-fire litter C (i.e. 80 g C $m^{-2}$). The stem and litter charcoal contained 4$\pm$4 % and 16$\pm$5 % of highly recalcitrant C, respectively. We assessed that a typical scrubland fire may add between 10 and 140 g C $m^{-2}$of chemically stable pyrogenic C to the soil. The conversion rate of ecosystem C to chemically stable pyrogenic C would be between 0.2 and 3.4 %.