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Vegetation fire impacts on carbon stocks in a scrub oak ecosystem

M. A. Alexis (1), D.P. Rasse (1), C. Rumpel (1), G. Bardoux (1), N. Péchot (1), P. Schmalzer (2), B. Drake (3), A. Mariotti (1)

(1)Laboratoire de Biogéochimie de Milieux Continentaux, Centre INRA Versailles-Grignon, 78850 Thiverval-Grignon, France, (2)Dynamac corporation, NASA, Mail Code DYN-2, Kennedy Space Center, Florida 32899, USA, (3)Smithsonian Environmental Research Center, PO Box 28, Edgewater MD 21037, USA

Fire events in terrestrial ecosystems lead to both an instantaneous loss of carbon to the atmosphere in the form of CO_2 and to the production of black carbon, which contributes recalcitrant compounds to stable soil organic matter pools. Fearnside et al. (1999) estimated that about 2.2% of all ecosystem C is transformed into black carbon by fire.

Given the recalcitrant nature of black carbon compounds, the net effect of fire events on carbon sequestration in terrestrial ecosystems remains uncertain. The objective of the present research was to simultaneously assess the loss of CO_2-C and the production of black carbon induced by a fire event in a subtropical scrub oak. The study was conducted at the *Merritt Island National Wildlife Refuge*, Florida, in an 11-year old stand dominated by *Quercus myrtifolia, Q.chapman, Q. geminata, Serenoa repens, and Lyonia ferruginea*. Pre- and post-fire C contents of soil organic matter, litter, stems and leaves were assessed on twenty 1-m^2 plots laid out across the 30 ha burned area. Standing biomass was determined with allometric relationships before fire, and by harvesting after fire. Litter and surface soil (5cm) were collected before and after the fire. Standing dead vegetation remaining after fire was divided into burned (mostly stem surface) and unburned (mostly stem inside) fractions. Litter was separated into five size fractions, and the proportion of burned (black) and unburned (brown) particles was visually estimated by grid-interception counting. All samples were analysed for C and N elemental composition. Maximum air and soil temperatures reached during the fire event were recorded within each plot with thermo-sensitive paints.

Maximum air temperature ranged from 250 to more than 800˚C during fire. Mean pre-fire living biomass averaged 6300 g m^{-2}. Standing dead biomass after fire represented 35% of the pre-fire value, and contained 5% of visually-identified black carbon. A positive relationship existed between the percentage of black carbon in standing dead biomass and the maximum fire temperature reached within each plot. About 50% of the remaining litter was visually identified as black carbon. Detailed C and N elemental composition of all burned and unburned soil, litter and plant fractions will be presented, allowing us to assess the effect of fire on total C and N budgets, and on their fluxes in the scrub oak ecosystem. The work that will be presented is a first step towards evaluating the long-term effect of fire in this ecosystem, which will require assessing the long-term degradability of the black carbon through incubation and fire-chronosequence studies.

Fearnside P.M.; Graça P.M.L.A.; Filho N.L.; Rodrigues F.J.A.; Robinson J.M. *Tropical forest burning in Brazilian Amazonia: measurement of biomass loading, burning efficiency and charcoal formation at Altamira, Para*. Forest Ecology and Management 123, 65-79, 1999