Long-term changes in nutrient availability after prescribed fire management in a Mediterranean soil

Meritxell Alcañiz (1), Luis Outeiro (2), Marcos Francos (1), Joaquim Farguell (1,3), and Xavier Úbeda (1)

(1) GRAM (Grup de Recerca Mediterrània), Department of Physical Geography, University of Barcelona. Montalegre, 6, 08001 Barcelona. (meritxellalpu@gmail.com), (2) Postdoctoral Fellowship Xunta de Galicia, Dept. Applied Economy, Universidad de Santiago de Compostela., (3) Unitat de Xarxes de Control, Departament d'Infraestructures de Control i Regulació, Agència Catalana de l'Aigua. C/Provença 204-206, 08036 Barcelona.

The study area is located in the Tivissa Ranges (NE Iberian Peninsula) and the slope is ∼35%, at 615 m.a.s.l. The natural vegetation before prescribed fire was composed of the three stratums in which trees (1% of the plot) were Pinus halepensis, shrubs were Ulex parviflorus, Cistus albidus, Rosmarinus officinallis, Erica multiflora and Quercus coccifera (75% of the plot), and herbs (24%) manly composed of Brachypodium retusum. The firemen had two main forest management objectives with the prescribed fire that was carried out on April 2002: (1) to change the dominance from Ulex to Cistus which is less flammable specie, and which would (2) permit the livestock into this area. Nine years after the prescribed fire our study plot was burned again with a low severity fire to manage the accumulation of vegetation. The aim of this study is a) to see the evolution of nutrient availability in the soil during 13 years since the first prescribed fire, and b) to evaluate the use of prescribed fire as a forest management tool. We have five sampling moments: (1) before the first prescribed fire; (2) after; (3) one year after; (4) three years after and (5) thirteen years after. Within the study area was placed a sampling plot with a rectangular 4×18 m structure. The study was carried out with 30 unstructured soil samples which were air-dried and passed through a 2 mm sieve. After that, fine material was prepared to measure different chemicals parameters of soil studied: soil pH [1:2.5], electrical conductivity [1:2.5], potassium, calcium and magnesium. The results show that, while pH is stable during the period studied, electrical conductivity increased after the prescribed fire as it was expected. However, thirteen years after the first prescribed fire the value (167 μS/cm) was markedly lower than before the prescribed fire (326 μS/cm). Changes in nutrient availability depend on the cation valence. Divalent cations (calcium and magnesium) decreased just after the prescribed fire due to the ash convection and increased one year later until the fourth sampling, possibly by the precipitation inputs. However, in the last sampling period we found an important reduction of calcium and magnesium concentration. Otherwise, potassium decreased from 995 ppm in the first sampling to 557 ppm thirteen years later maybe because is a monovalent cation that can be easily mobilized. In conclusion, we think that rainfall was a key factor modifying the cation concentration in the soil after the prescribed fire. In addition, it was observed that calcium and magnesium concentrations did not return to pre-fire values thirteen years after the prescribed fire. Sometimes, prescribed fires don't allow enough time to soils to be completely recovered but doesn't imply a loss of functions.