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Spatial-temporal variability of vegetation regrowth and topsoil elements after prescribed fire in the pre-mountain area (Croatia)

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Abstract

Prescribed fire in pre-mountain Croatia is a widespread traditional agricultural practice used in late winter or early spring mainly for weed control. Prescribed fire turns vegetation into ash, the nutrients of which are either leached into the soil or removed by erosion, depending on climatic conditions (rain and wind). The ash contains high quantities of nutrients that depend on the species burned. Although, due to its frequent use in this region, there is a lack of information on the effects of this type of fire on the spatial-temporal vegetation regrowth and soil chemical properties. To address this issue, a prescribed fire was conducted on an experimental plot (30 m long x 35 m wide) with slight differences in slope gradient on March 2, 2021. The experiment is located in the hinterland of Otočac City (44°52'N 15°14'E; 490 m a.s.l.). Soil type of study area is Cambisols. The vegetation cover consisted of various species such as meadow plants, fern (*Pteridium aquilinum*), blackberry (*Rubus fruticosus*), and dogberry tree (*Cornus mas*). Soil sampling (6 points in 5 rows) and vegetation cover monitoring were conducted immediately before fire (IBF), 7 days after fire (DAF), 1, 3, and 6 months after fire (MAF). The variables studied were: vegetation cover (VC), soil pH, EC, and total content of Al, Si, P, S, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Zn, As, Rb, Sr, Y, Zr, Nb, Pb, and Th. After a prescribed fire, VC was gradually increased with full cover on each sampling point 3 MAF. Significantly higher increase in soil pH, EC, and P was observed 7 DAB compared to the other dates. The studied soil elements did not show much variability in spatial distribution, indicating low severity fire and low impact of erosion. Principal component analysis (PCA) was applied to identify the relationship among study soil properties and VC for each sampling date. Overall, PCA showed that prescribed fire changed the relationship between the studied variables at each date, especially in the case of VC, pH, EC, Ca, P, K, Al, Mn, and Co which can be attributed to the effects of rainfall during the study period. Due to the low impact on the spatial-temporal variability of topsoil elements and the rapid vegetation regrowth, prescribed fire can be recommended for land management.

Keywords: agricultural practice, ash, nutrients, fire, management

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