Effects of a wildfire on soil and water chemistry of the Marão watershed, NE Portugal

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The purpose of this study was to assess changes in the chemical composition of soils and surface water as a result of a wildfire, by comparing pre- and post-fire hydrochemical data and burned/unburned soil data, and to examine the recovery of vegetation with time. This wildfire was ignited by an airplane crash in June 2006, burning about 255 hectares in the Marão River watershed.

This area is located in the Marão Mountain (centroid: 41º 15′ 16″; 7º 53′ 40″, NE Portugal). Soils are classified as humic cambisols soils with an underlying bedrock of schist's, greywackes and some granite outcrops. Before wildfire, the landscape was dominated by *Pinus pinaster* and various shrubs such as heather (*Erica scoparia*), gorse (*Pterospartum tridentatum*) and genista (*Cytisus striatus*). Samples of ash, soil and water, from within and outside the burned area, were collected 5 and 13 months after the fire, for chemical analysis.

The wildfire effects on the Marão River water quality, resulted in an increase in the total mineralization of water. Five months after the wildfire the electrical conductivity (E.C.) at the mainstem was about 56% higher than pre-fire values (E.C. increased from 25 to 39µS/cm) and still higher one year after (36µS/cm). Cations of Ca, Na, Mg and Mn showed the greatest increase. This increase was probably triggered by the movement of ash to the watercourses. This disturbance had already attenuated one year after wildfire to values closer to pre-fire data except for manganese. Manganese had anomalous concentrations in the water within the burned area. The concentration of manganese in ash samples reached values up to 5 times more than values found in underlying soils. This result probably stemmed from the combustion of pine needles, which were transported as part of the ash to the stream, and thus, may explain the high concentration in stream water. Mn tended to persist in solution for greater distances than Fe due to the particular Eh/pH conditions necessary for precipitation of oxides or hydroxides of Mn. Concentrations of Mn downstream the burned area diminished with distance from the fire but were still higher than the pre-fire value of 1.4 µg/L of Mn, one year after. There was also a substantial increase in the concentration

of dissolved silica and values of pH in the stream water downstream from the wildfire between 5 months and one year after the wildfire. This seems to indicate an increase in the rate of dissolution of the silicate minerals from the bedrock (mainly alkaline granites and metassedimentary rocks) caused by the removal of the overlying ash and burned soil.

One year after wildfire, green vegetation (shrubs) recovered almost all area. Soil analysis showed that chemical elements concentration returned to normal values, included Mn. However, water Mn concentration remaining higher than normal values.

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