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EFFECT OF FIRES ON CERTAIN PROPERTIES OF FOREST SOILS IN WESTERN ALGERIA

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Natural disturbances, such as forest fires, cause significant changes in the structure and functioning of semi-arid ecosystems. After such disturbances, the impact on the soil ecosystem in its entirety is misunderstood. In this study, two years after the last fire, changes in the physicochemical and biological properties of Aleppo pine forest soils in the semi-arid zone were observed. Among all physical properties analysed, only the soil moisture remained significantly lower in the burnt zone in contrast to control zone. Considering the chemical properties, the only negatively affected parameter is the rate of organic matter. In terms of biological properties, results showed that the fire caused a significant decrease in soil microorganisms by decreasing basal respiration and microbial biomass. Conversely, the metabolic quotient recorded higher values in the fire zone than in the control zone. These results indicate that microbial communities in semi-arid soils, already stressed by climatic hazards, are very sensitive to the passage of even low-intensity fires.

Keywords: degradation; organic matter; microbial biomass; semi-arid regions

The forest ecosystems of the Mediterranean basin contain remarkable biodiversity, providing important economic resources in terms of sylvo-pastoral production, as well as tourism and leisure areas. Furthermore, they also provide essential ecosystem services, e.g. water erosion reduction by the retention of water in the soil (Eamus et al., 2005). Drought is one of the most unfavourable and most common constraints in arid and semi-arid regions (Sabaghnia and Janmohammadi, 2014), and the presence of pyrophyte species in these regions, such as Cistus (*Cistus ladaniferus*) or Aleppo Pine (*Pinus halepensis* Mill), can promote fires (Borsali, 2013). Soil degradation by any means represents one of the most significant issues in terms of maintaining the soil quality (Nouraein et al., 2020).

Numerous authors confirm that the origins of fire are mainly related to humans and directly depend on imprudence and insouciance of people, especially in terms of the agricultural and pastoral utilization of land (Meddour, 2014). According to the statistics provided by the Direction General of Forests, Algeria is seriously affected by fires, especially the north of the country. In 2017, the total area burnt by fires was 51,908 ha. Due to the significant evolution of this disaster and observed damage on the forest ecosystem, it is highly recommendable to investigate the changes in properties of these burnt soils.

Certini (2005) synthesizes the effects of fire on the properties of forest soils and shows that the main factor is the severity of fire, which depends on the environmental factors involved in the combustion processes: quantity; nature and moisture of the dead and living combustible; wind speed; and site topography. This severity depends on two factors: the intensity and duration of the fire. High intensity combined with a long duration of fire would cause the greatest damage to vegetation and soil. The decline in soil protection leads to lower stability and, as a result, increased vulnerability to erosion risk (Hart et al., 2005).

The increase in the number of fires and their frequency have reduced the time between the two successive fires to less than 20 years (Vennetier et al., 2008). Their effects on soil biology are both direct – instantaneous destruction of organisms living on the surface – and indirect – environment modification (soil, vegetation cover) (Uroz et al., 2014). In addition to their effect on physicochemical parameters, fires also directly or indirectly affect the soil organisms. Direct effects induce short-term changes that modify species composition and abundance of taxonomic groups (Gongalsky et al., 2012).

Algerian soils are naturally vulnerable, sometimes highly degraded, especially in the semi-arid zone. These soils are highly affected by the issue of forest fires and their impact on soils is not very investigated by scientists. In addition, the difficulty of returning to an optimal performance level after fire must be enlightened by an objective evaluation of the short-term return dynamics of these soil properties. In order to answer the most significant questions related to the state of Algerian post-fire soils, a comparative study of selected physicochemical and biological parameters of a soil after two years of the last fire and a control soil that did not undergo fire for twenty years was carried out.

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