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Editorial: Fire and Soils in a Changing World

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Editorial on the Special Issue

Fire and Soils in a Changing World

Fire is a natural ecological process that shapes many ecosystems (Pausas and Keeley, 2009); however, the distortion of the natural fire regimes can lead to significant additional impacts in soils (Úbeda et al., 2023) but also to alternative geomorphic states (McGuire et al., 2024). Land use changes in the last decades driven by human activity, and changes in climate due to global warming have led to projections of increased fire recurrence and corresponding socioeconomic and environmental impacts (Rogers et al., 2020). During the last decades, an impressive bulk of research has been produced addressing fire impacts on soils (Almendros and González-Vila, 2012; Santín and Doerr, 2016), but the most recent shifts indicate more severe wildfires, as well as novel occurrences in non-fire-prone areas, which are less adapted and more vulnerable to this perturbation (Mataix-Solera et al., 2021), highlights the need of translating the current knowledge to other conditions. This Special Issue aims to contribute with a new series of five articles related to this topic.

García-Carmona et al. make an interesting summary of the main results of the role of biocrust and soil microbial communities in the recovery of Mediterranean soils after different post-fire management, guiding post-fire interventions such as burnt trees management, soil protection, and practices aimed at ecosystem restoration. The authors focus this mini-review in the colonization of biocrust-forming mosses in early successional stages after fire, and how different post-fire management treatments can affect their efficiency and soil microbial communities, evidencing the importance of these organisms and how we have to pay more attention in the short- and mid-term after fires.

Moreno-Rosso et al. assess the effects of prescribed burns of different burnt severity but covering the gap in understanding their effects at the micro-scale level. Prescribed fires are expected to cause low soil burn severity (SBS), but their effects vary due to numerous factors. The study was carried out in managed pine forest in western Mexico. The authors found that generally the top centimetres of soil structure are impacted by low SBS, while high SBS is restricted to the top 2 cm, evidencing disturbed soil structure and reddish aggregates. Immediate post-burn actions are needed to prevent soil erosion before rain even for prescribed fires.

Olivares-Martínez et al. explore the effects of surface and ground fires on the infiltration capacity of volcanic forest soil in pine-oak forests in central Mexico. Five sites with fires in the past 20 years were analysed. Tension-infiltration tests measured hydraulic conductivity and active macropores, revealing moderately high conductivity, with burned plots showing lower

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infiltration capacity than control plots. A non-linear relationship was found between fire recurrence and soil properties, such as water repellency and pore concentration. While changes in soil water repellency and conductivity were observed, they do not necessarily indicate exceeded infiltration capacity. The authors conclude that more research is needed to assess if increasing fire frequency, driven by agricultural activities, could reduce soil resilience and lead to land degradation.

García-Braga et al. question what researchers understand by the long-term effects of fire on the soil. A review of the literature that exposes the impact of fire and residence time in the soil concludes that there are external variables, such as climate or substrate, and internal variables, such as soil type and its properties, that extends such effects through time. One variable that depends on the fire itself is its intensity, which is expressed in the severity of burning of the elements such as vegetation, fauna and soil. Forest management, suitable for each location, can prevent high intensity fires and thus improve the recovery time, understood as a natural system, is shorter and the soil is less negatively affected.

García-Redondo et al. analyse the wildfire-landscape dynamics in Baixa Limia Serra do Xurés Natural Park in Galicia from 2000 until 2020. Due to a change in land use resulting in a change in forest species and because of climate change, there has been a change in the fire regime. This translates into an increase in severity and a de-seasonalisation, that is, a potential extension or change of the fire season. Using available statistical and remote sensing data, authors have verified how there has been soil degradation and potential desertification in areas affected by recurrent and severe fires. The study provides valuable insights into the impacts of wildfires, changes in land cover, and post-fire soil-vegetation dynamics, which can inform management and conservation efforts in fire-prone mountainous regions.

In conclusion, this Special Issue contributes with knowledge about fire and soil and identifying issues that are important to address in future research. Climate change has already modified the fire regime, which translates into an increase in the intensity of fires, which are more severe, which implies a more serious impact on soil properties among others. It has also been proven that the abandonment of agroforestry activities has also induced this change in the fire regime. Given this scenario, it is important to advance in the knowledge of the type of management both pre- and post-fire to achieve less severe fires that in turn produce less drastic changes in soil properties.

AUTHOR CONTRIBUTIONS

This editorial has been drafted by lead guest editor JM-S. All authors contributed to the article and approved the submitted version.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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