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Vegetation ash erosion. State-of-the-art and future perspectives.

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The ash distributed over the soil surface after a fire is a highly mobile material. The mobility of ash depends on the temperature attained during the fire and fire severity, topography of the burned area, slope position, soil microtopography, and post-fire meteorological variables, such as wind and rainfall intensity and frequency, and vegetation recovery. In the immediate period after a fire, the burned material is easily transportable, especially after high severity fires, where the intense combustion produces easily erodible fine ash particulates. During this period ash can be transported many kilometers outside of the burned area, inducing indirect impacts on unburned areas. Ash response to rainfall it is very variable and precipitation intensity plays an important role in ash transport. Intense precipitation can quickly export ash from burned areas, reducing the amount of nutrients available for vegetation recovery, and can also affect soil hydrology. Low intensity precipitation can wet ash, enhancing its capacity to bind to the soil surface, and providing valuable soil protection in the immediate period after the fire, crucial for soil erosion reduction and vegetation recovery. However, this relation is not linear, and the topography of the burned area, slope characteristics and soil micromorphology (that can also change in the immediate period after the fire as a result of soil exposure and impact of raindrops) will have important implications on ash erosion. The types of ash produced also have important implications. Ash can be wettable, but also can be water repellent, and this will have effects on the soil hydrological response after the fire, especially infiltration, runoff, sediment transport and water storage capacity. In addition, rapid vegetation recovery can prevent ash from being eroded and the retained ash can improve the nutrient status of these areas. Independent of the ash characteristics, it is well known that the ash layer thickness is reduced in the immediate period after the fire and this evolution depends mainly on the above mentioned variables. After the fire the ash produced at higher severity is easily transported, and migrates quickly into the soil profile. However due to its high mobility, ash can have variable effects on different places. The type of ash and amount of leached nutrients can be different, with consequently different implications on soil properties. Despite of this general knowledge, it is necessary to improve methodologies for ash layer measurements and implement experimental designs with more accurate spatial and temporal resolution to increase our understanding of ash dynamics, starting with the microplot scale. It is important to extend our studies on the effects of soil properties on ash erosion, vegetation recovery, the changing hydrological effects of ash characteristics during the aging process (e.g. successive leaching, wetting and drying cycles), and the soil binding capacity of ash from different plant species and fire severities.

Keywords: ash erosion, topography, soil properties, vegetation.