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Ash in the Soil System

P. Pereira
Department of Environmental Policy Mykolas Romeris University, Lithuania. pereiraub@gmail.com

Ash is the organic and inorganic residue produced by combustion, under laboratory and field conditions. This definition is far away to be accepted. Some researchers consider ash only as the inorganic part, others include also the material not completely combusted as charcoal or biochar. There is a need to have a convergence about this question and define clear "what means ash".
After the fire and after spread ash onto soil surface, soil properties can be substantially changed depending on ash properties, that can be different according to the burned residue (e.g wood, coal, solid waste, peppermill, animal residues), material treatment before burning, time of exposition and storage conditions. Ash produced in boilers is different from the produced in fires because of the material diferent propertie and burning conditions. In addition, the ash produced in boilers is frequently treated (e.g pelletization, granulation, self curing) previously to application, to reduce the negative effects on soil (e.g rapid increase of pH, mycorrhiza, fine roots of trees and microfauna). These treatments normally reduce the rate of nutrients dissolution. In fires this does not happen. Thus the implications on soil properties are logically different.
Depending on the combustion temperature and/or severity, ash could have different physical (e.g texture, wettability) and chemical properties (e.g amount and type of total and leached nutrients) and this will have implications on soil. Ash can increase and decrease soil aggregation, wettablity and water retention, bulk density, runoff and water infiltration. Normally, ash increases soil pH, Electrical Conductivity, and the amount of some basic nutrients as calcium, magnesium, sodium and potassium. However it is also a potential source of heavy metals, especially if ash pH is low. However the effect of ash on soil in space and time depends especially of the ash amount and characteristics, fire temperature, severity, topography, aspect, climate/meteorological conditions after the ash spread/fire and soil background characteristics. In addition, after the fire heating can change soil original properties increasing the complexity of the ash effects on soil properties.
After fire, ash is highly dynamic and very easily transported by wind until the first rains. When wetted, ash compacts and binds onto soil surface, and wind has low capacity to transport it. The post-rain ash dynamic is influenced by water erosion (in slope areas), infiltration into soil profile and vegetation recuperation. This means that ash produced in one place will have implications in other areas, including not burned areas (e.g wind transport and water erosion). This is a clear indication that ash effects go much further than the fire affected area. Due the heterogeneity of soil and ash properties and their dynamic across the landscape, the impacts of ash on soil system can be diverse, producing a mosaic of different effects and responses after ash treatment and/ or fire.
In this communication it will be presented and discussed the advances and scientific development of ash effects and dynamic in soil system.