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Sediment settling rate in a water body after a wildfire: ash and soil

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Protecting and improving the quality of water in lakes and reservoirs is critical not only for water ecosystem health, but also for human well-being. One of the major concerns regarding water quality is the degradation of water from suspended sediment loads derived from extraordinary episodes of runoff and erosion in the catchments. A large input of suspended sediments in water bodies usually occurs during major rainfall events, especially in catchments with little vegetation cover, such as arable land, or forests following harvest or wildfire. Several studies and even models exist about the rate of deposition of sediments in water. However, following wildfire, the ash component commonly present in sediments affects their composition and their combined settling behaviour is not well understood yet. The authors are aware of only two brief studies that examine ash behaviour when in contact with water and relate it to the soil surface erosive response (Holcomb and Durgin, 1979; Giovannini, 1994). They concluded that the ash leachate flocculates soil clay particles due to the large amount of cations ash contains.
The objective of the experiment presented here was to ascertain the settling behaviour of a sediment input in a water body after a fire, when it comprises a variety of sizes and includes relatively large quantities of ash. The procedure was similar to that of a standard pipette analysis in a settling column. Wecompared the particle size of sediment without any disaggregation or dispersion treatment with the samesediment usingconventional techniques of dispersion. The sediment used consisted of soil and ash in four different doses: 0%, 10%, 25%and 100% ash. Two different soils and three different types of ashwere combined for a total of 6 different sediments. The soils were collected in a dry and in a wet eucalyptus forest in Victoria, Australia. For the ash, one type of ash has been-sampled immediately after a prescribed fire and the two others have been made in a fireplace. From the ash made in a fireplace, one simulates a low severity fire and the other a high severity burn. The concentration of sediment inthe column was 20 mg/L. Electrical conductivity, pH,carbon andcation content in the column were measured. Preliminary analysis of the sediment that consisted of 100 % ashshows that the fraction < 2 [U+F06D]m is reduced from 10.21 % to 0.63% for the high fire intensity ash, from 4.35 % to 1.42 % in the prescribed fire and there are almost no changes in the low intensity ash made in the fireplace. This implies an increase in the fraction between 50-20 [U+F06D]m and suggests a strong flocculation of the ash burned at high severity because of the high level of cations. These findings may contribute to the understanding andmodelling of the impacts of fires on water supplies.

References

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