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Wildland fire ash: future research directions

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Ash is a key component of the forest fires affected land (Cerdà, 1998; Bodí et al., 2011; Pereira et al., 2013a). Ash controls the hydrological processes and determines the water repellency (Dlapa et al., 2012) and the infiltration rates (Cerdà and Doerr, 2008;). Moreover, ash is the key factor on runoff initiation and then on the soil erosion. Little is known about the impact of ash in different ecosystems, but during the last decade a substantial increase in the papers that show the role of ash in the Earth and Soil System were published (Bodí et al., 2012; Pereira et al., 2013b).. Ash is being found as the key component of the post-fire pedological, geomorphological and hydrological response after forest fires (Fernández et al., 2012; Martín et al., 2012; Bodí et al., 2013; Guénon et al., 2013; Pereira et al., 2013c).
A recent State-of-the-Art review about wildland fire ash (Bodí et al., 2014) compiles the knowledge regarding the production, composition and eco-hydro-geomorphic effects of wildland fire ash. In the present paper we indicate the knowledge gaps detected and suggest topics that need more research effort concerning:

i) data collection and analysis techniques:
a) To develop standardized sampling techniques that allow cross comparison among sites and avoid inclusion of the underlying soil unless the burned surface soil forms part of the ash layer,
b) To develop standardized methods to define and characterize ash, including its color, physical properties such as particle size distribution or density, proportion of pyrogenic C, chemical and biological reactivity and persistence in the environment,
c) To validate, calibrate and test measurements collected through remote sensing with on-the-ground measurements.

ii) ash production, deposition redistribution and fate:
d) To untangle the significance of the effects of maximum temperature reached during combustion versus the duration of heating,
e) To understand the production of ash by measuring its depth, density, and size fraction distribution compared to that of the underlying soil,
f) To measure the spatial variability of ash at the plot or hillslope scale,
g) To address issues of how much ash stays on site after fire, especially how much is incorporated into underlying soil layers, compared to how much is eroded by wind and water and becomes incorporated into depositional environments located away from the site.
iii) ash effects
h) To study the connectivity of patches of ash to make progress in understanding the role of ash in infiltration, the generation of runoff and erosion,
i) To take into account the role of ash in the fate of the ecosystem immediately after the fire, as well as the combination of ash and other cover, such as the needles, in the post-fire period,
j) To study the amount and forms of C in ash, including studies characterizing its chemical and biological reactivity and degradability in soil and sedimentary environments,
k) To understanding the legacy of atmospherically-deposited elements (e.g. P, Si, Mn) and dust to fully understand

the complex chemistry of ash, and at the same time assess its effects on human health.

iii) enhance collaboration across the globe on the multidisciplinary topic of ash research since research in large areas of the world that burn (e.g., Africa and Russia) is underrepresented.

We are sure that several activities, such as land and water supply management, risk reduction, and planning for societal and ecosystem resilience in the face of a changing climate, will benefit from the insights gained from the ash research community.

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References:
Bodí, M. B., Mataix-Solera, J., Doerr, S. H., Cerdà, A. 2011.The wettability of ash from burned vegetation and its relatioship to Mediterranean plant species type, burn. Geoderma 160: 599-607.
Bodí, M.B. Doerr, S.H., Cerdà, A. and Mataix-Solera, J. 2012. Hydrological effects of a layer of vegetation ash on underlying wettable and water repellent soils. Geoderma, 191, 14-23. http://dx.doi.org/10.1016/j.geoderma.2012.01.006
Bodí, M.B., Muñoz-Santa, I., Armero, C., Doerr, S.H., Mataix-Solera, J., Cerdà, A. 2013. Spatial and temporal variations of water repellency and probability of its occurrence in calcareous Mediterranean rangeland soils affected by fires. Catena, 108, 14-24. http://dx.doi.org/10.1016/j.catena.2012.04.002
Bodí, Merche B., Martin, Deborah A., Balfour, Victoria N., Santín, Cristina, Doerr, Stefan H., Pereira, Paulo, Cerdà, Artemi, Mataix-Solera, Jorge, Wildland fire ash: Production, composition and eco-hydro-geomorphic effects, Earth Science Reviews (2014), doi: 10.1016/j.earscirev.2013.12.007
Cerdà, A. 1998. Changes in overland flow and infiltration after a rangeland fire in a Mediterranean scrubland. Hydrological Processes, 12, 1031-1042.
Cerdà, A. y Doerr, S.H. 2008. The effect of ash and needle cover on surface runoff and erosion in the immediate post-fire period. Catena, 74 , 256- 263. doi:10.1016/S0341-8162(02)00027-9
Dlapa, P., Bodí, M.B., Mataix-Solera, J., Cerdà, A., &, Doerr, S.H. 2013. FT-IR spectroscopy reveals that ash water repellency is highly dependent on ash chemical composition. Catena, 108, 35-43. Doi:10.1016/j.catena.2012.02.011
Fernández, C., Vega, J. A., Jiménez, E., Vieira, D. C. S., Merino, A., Ferreiro, A., Fonturbel, T. 2012. Seeding and mulching + seeding effects on post-fire runoff, soil erosion and species diversity in Galicia (NW Spain). Land Degradation & Development, 23: 150- 156. DOI 10.1002/ldr.1064
Guénon, R., Vennetier, M., Dupuy, N., Roussos, S., Pailler, A., Gros, R. 2013. Trends in recovery of Mediterranean soil chemical properties and microbial activities after infrequent and frequent wildfires. Land Degradation & Development, 24: 115- 128. DOI 10.1002/ldr.1109
Martín, A., Díaz-Raviña, M., Carballas, T. 2012. Short- and medium-term evolution of soil properties in Atlantic forest ecosystems affected by wildfires. Land Degradation & Development, 23: 427- 439. DOI 10.1002/ldr.1078
Pereira, P., Úbeda, X., Martin, D., Mataix-Solera, J., Cerdà, A., Burguet, M. 2013a. Wildfire effects on extractable elements in ash from a Pinus pinaster forest in Portugal, Hydrological Processes, DOI: 10.1002/hyp.9907
Pereira, P., Cerda, A., Jordan, A., Bolutiene, V., Pranskevicius, M., Ubeda, X., Mataix-Solera, J. 2013b. Spatio-temporal vegetation recuperation after a grassland fire in Lithuania, Procedia Environmental Sciences, 19, 856-864. DOI:10.1016/j.proenv.2013.06.095.
Pereira, P., Cerdà, A., Úbeda, X., Mataix-Solera, J. Martin, D., Jordan, A. and Burguet, M. 2013c.
Spatial models for monitoring the spatio-temporal evolution of ashes after fire – a case study of a burnt grassland in Lithuania. Solid Earth, 4, 153-165. www.solid-earth.net/4/153/2013/ doi:10.5194/se-4-153-2013