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How geology influences the type and magnitude of postfire effects like landslides

Tomás M. Fernandez-Steeger (1), Tom Maessen (1), Moritz Grenzdörfer (1), Sascha Schneiderwind (4), Ioannis Papanikolaou (2), Georgios Deligiannakis (2), Georgios Migiros (2), Emmanouil Psomiadis (2), Orestis Kairis (3), and Aggelos Pallikarakis (2)

(1) Dep. of Engineering Geology and Hydrogeology, RWTH Aachen University, Aachen, Germany (fernandez-steeger@lih.rwth-aachen.de), (4) Institute of Neotectonics and Natural Hazards, RWTH Aachen University, Aachen, Germany, (2) Mineralogy-Geology Laboratory, Department of Natural Resources Development and Agricultural Engineering, Agricultural University of Athens, Athens, Greece (i.pap@aua.gr), (3) Laboratory of Soils and Agricultural Chemistry, Agricultural University of Athens, Athens, Greece

Today fires are widely accepted to be a natural agent in forest ecosystems. Nevertheless besides direct impacts of fire, secondary postfire effects may have a considerable impact on the welfare and safety of the affected society. Our research is focused on secondary post-fire hazards like landslides, debris flows, flash floods and erosion processes. There are several studies investigating effects of erosion and landslide phenomena like debris flows in burned areas (e.g. in Shakesby & Doerr 2006). Nevertheless, the influence of the geological framework is often neglected in these studies. Furthermore all described effects are related to shallow mass transport.

To study the relevance of geology and to observe such processes, areas in Attica and the western Peloponnese in Greece were investigated. These areas suffered by major wildfires in 2007, 2009 and 2015. Preliminary results show strong indications that most landslide processes even in burned areas are predominantly controlled by geology rather than the effects caused by the fire.

In areas where before the fires no or only few shallow landslides occur after the fire the landslide activity increases and some new landslides develop, but after a short time of 2 -3 years they went back to their normal status. Visiting old landslide sites after 6 years, there was no landslide activity visible since their development. In other areas prone to landslide hazard, the wildfires lead to a dramatic increase in activity, magnitude and number of landslides. As the changes in landslide activity are limited to the burned areas and also deep-seated landslides were activated it is reasonable that the changes in the hydrological conditions like Swanson (1981) predicted due to the destroyed vegetation are the main trigger for the new and reactivated landslides. Now after 8 years still some of the large landslides are active. Finally we compared our results to newly burned areas that occurred in July 2015 close in Athens. Here we can see that the geology with hardrock and favourable engineering geological conditions is not at all prone to landslides. Nevertheless, it is prone to debris flow generation due to low soil cover, steep topography and high debris content on the slopes in the catchments. Even strong rainfall events after the fire did not cause any soil or debris slides.

As a result, it seems to be possible to predict from landslide hazard analysis the intensity and the occurrence of post fire effects related to landslides when considering the geological environment. Moreover, this could help to predict which secondary hazards can be expected in areas which become prone to wildfire under global change conditions.

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