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Post-fire soil erosion on vineyards and canary pine-stands on the subtropical island of La Palma: scope of application of TLS?

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Land use is considered as a main factor regarding post-fire soil erosion. Especially in the subtropical climate with extreme rainfall events in winter and drought periods during summer times, soil erosion can clearly exceed the soil reproduction rate. On the Canary Island of La Palma frequent wildfires and steep slopes contribute to a high likelihood of post-fire soil erosion. For a quantitative measurement of the erosion rate a terrestrial Laser Scanner with high resolution in combination with a dGPS is used.

The main target of this study is to quantify the post-fire soil erosion rates on study sites with a different land use on the island of La Palma (Canary Islands). The investigation focuses on two land use forms; both are very common and widespread on the island: canary pine stands and vineyard areas. The study sites are characterized by a varying steepness, a different fire history (wildfires in 2000, 2009 and 2012) and different stages of soil development. Both denudation and gully erosion processes are spread over the sites. Intense precipitation events can trigger debris flows and extensive soil erosion on post-fire sites, like in the year 2009 in the south or in 2012 on the west and east side of La Palma. Regarding that, erosion is not just a problem for agriculture, but for the infrastructure. For our project we assume, that different topography, different land use and different forest fire history can result in a different soil erosion rate and type (gully incision, denudation processes).

To calculate the post-fire erosion rates of the two land use forms, 24 study sites – 10 sites in vineyard areas, 14 in canary pines stands – were selected. By means of a 3D terrestrial Laser Scanner (Riegl LMS Z420i), high resolution digital terrain models of the study sites were compiled. The data acquisition was carried out in October 2011, May 2012 and December 2012 and subsequently the terrain models were compared. With this method not only erosion rates can be detected, but areas with erosion and areas with accumulation can be identified. As additional information precipitation data of the measured time periods were acquired.

For a better differentiation of the soil properties, soil profiles and soil samples of each study site were analyzed. Supplementary the occurrence of considerable erosion forms shall be detected by the comparison of aerial images of former years and analyzed in consideration of possible fire events.

One target of our investigation shall be the answer of the question if the chosen methods can model the erosion rate and the distribution of erosion and accumulation in a satisfactory manner.