IMPORTANCE OF DTM ACCURACY, PRECISION AND ACQUISITION TECHNIQUE FOR ESTIMATING CONTRIBUTING AREAS OF POST-FIRE EROSION AT THE SLOPE AND CATCHMENT SCALE

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ABSTRACT

Wildfires are a frequent phenomenon in Portugal, affecting over 300.000 ha in dry years like 2003 and 2005. Directly and/or indirectly, wildfires can strongly enhance the hydrological response and associated sediment losses and, thereby, negatively affect land-use sustainability as well as ecosystem functioning of downstream aquatic habitats. Therefore, the EROSFIRE projects aim at developing a GIS-tool for predicting soil erosion hazard following wildfire and post-fire land management practices. Assessment and modeling of runoff and soil erosion rates critically depends on accurate estimates of the contributing areas. In the case of catchments as well as unbounded erosion plots (arguably, the only practical solution for slope-scale measurements), delineation of contributing area requires a Digital Terrain Model (DTM) with an adequate resolution and accuracy. The DTM that was available for the Colmeal study area (Goís municipality, central Portugal) was that of the 1:25.000 topographic map produced by the Military Geographic Institute. Since this study area involves a rather small experimental catchment of roughly 10 ha and relatively short study slopes of less than 100 m long, two different data acquisition techniques were used to produce high-resolution and high-accuracy DTM. One is aerial photogrammetry, whilst the other is terrestrial laser scanning. To produce a DTM by photogrammetric means, a dedicated digital aerial photography mission was carried out. The images had a pixel size of 10 cm. Manual measurements permitted to measure breaklines and were complemented by automatic measurements. In this way, a DTM in a TIN format was produced. This was further converted to grid format using the ArcGIS software system. Signalized control points allowed obtaining the DTM in the same global reference system as that employed for terrestrial laser scanning. The terrestrial laser scanning was done using a Riegl LMS Z360I, stationed in 8 points within the area to provide a complete coverage. The resulting dense cloud of points was filtered – by the company carrying out the scanning mission - to remove the non-terrain points (in particular vegetation). Several grids of different sizes were produced (0.10 x 0.10, 0.20 x 0.20, 0.50 x 0.50, 1 x 1 and 2 x 2 m2). The proposed work will compare and analyze estimates of contribution areas that were obtained with the two above-mentioned data acquisition techniques and for different spatial resolutions. This will be done for selected slope-scale sediment fences as well as for the outlet of the experimental catchment. In addition, different algorithms available in ArcGIS for TIN-to-grid conversion will be compared, since preliminary results have suggested that these procedures produce markedly different results.