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for sustainable resource management"

Assessing the Effect of Different Spatial Resolutions in Soil Erosion Modelling - Case Study in a Highland Tropical Watershed in Southeast Mexico

Sergio Naranjo[1], Georg Cadisch[1], Francelino Rodrigues[2]

[1] *University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany*
[2] *International Maize and Wheat Improvement Center (CIMMYT), Sustainable Intensification Program,*

Abstract

Cuauhtemoc watershed, subject of this study, is located in the Santa Catarina Tayata municipality in the Mixteca Alta region in southeast Mexico. The municipality is characterised by low population density, smallholder land tenure (bienes comunales), and diverse land cover (e.g., mature forest, grass-dominated areas, arable land, eroded land). The region combines culturally diverse history, complex geology, diverse topographical relief, and moderate precipitation regime. Some areas in the region, experience a soil erosion problem termed as "ecological disaster" as a consequence of dynamic interactions of these conditions coupled with a long history of anthropogenic influences.

Aiming to predict soil erosion at the study unit / landscape level, a watershed of 2.5 km^2 was chosen. Sediment yield per precipitation event was measured using a collection station at the outlet of five study units under different land cover (i.e. forest -SUFO-, maize cultivation -SUM1 and SUM2-, fallow -SUFA-, and eroded lands -SUEL-). Soil properties, biological and topographical influences, and precipitation from May to September 2017 were measured, together with a Digital Surface Model (DSM) derived from an unmanned aerial vehicle (UAV) flight and a Digital Elevation Model (DEM) derived from public sources (INEGI).

High resolution UAV´s DSM (0.2 m) was the basis for study unit level modelling. This dataset provided the most realistic topographical conditions given its level of detail. Study unit parameters (e.g. soil properties, biological influences) were the input to OpenLISEM, a physically-based soil erosion model. Using measured soil loss, a validation set was derived and model performance parameters evaluated for adequacy of the model.

The availability of high-resolution DSM provided the opportunity to assess the effects of six different spatial resolutions on hydrologic / soil erosion processes. Validated parameters derived for the 0.2 m resolution set previously derived, were the input for other five resampled resolutions (0.4, 1.0, 4.0, 8.0, and 15.0 m) sets to assess the effect of different spatial resolution in soil erosion modelling at the study unit level.

Keywords: Deposition, detachment, eroded land, forest, infiltration, runoff

Contact Address: Sergio Naranjo, University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Stuttgart, Germany, e-mail: naranjosa@gmail.com