

The Soil Water Assessment Tool to estimate the spatial and temporal patterns of soil erosion in the Vertentes do Rio Grande Watershed, Minas Gerais State, Brazil

Rogério Resende Martins Ferreira^{*1}, Vinicius Martins Ferreira²

1. Doctor, Embrapa Acre. Email: rogerioferreir@yahoo.com.br (corresponding author)
2. Master, NGO Instituto Voçorocas.

Abstract

The water quality of Vertentes do Rio Grande Watershed has been impacted by sediment from pasture lands. The water storage capacity of generate hydroelectricity necessary for water use during the dry season deficit is compromised by sedimentation, the result of erosion. Given this context, tools must be developed to support conservation and sustainable resource use planning, watershed management activities and risk forecasting. The Soil and Water Assessment Tool (SWAT), a physically based distributed simulation watershed model, is cost effective tool to analyze the quantity of water resources, in the planning, design and operation of water use, distribution systems and management activities.

To assess the ability of SWAT application for use in the context of the Vertentes do Rio Grande Watershed, the model was calibrated and validated for streamflow and sediment yield over a two year period (2011-2012) in the 40 km² pilot study area of the das Mortes River subbasin, an area of pasture lands. The model demonstrated good performance for weekly average simulated streamflow and baseflow (all Nash Sutcliffe coefficient = 0,72), generated little significant error, and demonstrated highly accurate predictions of annual cumulative water yield. Although SWAT was also able to simulate cumulative sediment yields with acceptable precision, the model was a poor predictor of monthly average sediment yield (calibration Nash Sutcliffe coefficient = 0,41). A qualitative and quantitative sensitivity analysis reveals that this is likely owing to the compound effects of a number of imprecise input parameters and data uncertainties, namely apropos the Modified Universal Soil Loss Equation (MUSLE) parameters for pasture lands. Overall, this study illustrates that SWAT could potentially be a beneficial support tool for use in the Vertentes do Rio Grande Watershed. However issues of data scarcity in the area will need to be resolved, including that of soil survey data, the spatial and temporal representativeness of streamflow and sediment yield field data, and estimates for MUSLE parameters.

Keywords

Soil erosion, sediment, watershed, pasture lands



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