

The variability of runoff and soil erosion in the Brazilian Cerrado biome due to the potential land use and climate changes

Jamil Alexandre Ayach Anache (1), Edson Wendland (1), Lívia Malacarne Pinheiro Rosalem (1), Anurag Srivastava (2), and Dennis Flanagan (2)

(1) São Carlos School of Engineering, University of São Paulo, São Carlos, SP, Brazil (jamil.anache@usp.br; ew@sc.usp.br; liviamp@usp.br), (2) National Soil Erosion Research Laboratory, ARS-USDA, Purdue University, West Lafayette, IN, USA (srivas42@purdue.edu; flanagan@purdue.edu)

Changes in land use and climate can influence runoff and soil loss, threatening soil and water conservation in the Cerrado biome in Brazil. Due to the lack of long term observed data for runoff and soil erosion in Brazil, the adoption of a process-based model was necessary, representing the variability of both variables in a continuous simulation approach. Thus, we aimed to calibrate WEPP (Water Erosion Prediction Project) model for different land uses (undisturbed Cerrado, fallow, pasture, and sugarcane) under subtropical conditions inside the Cerrado biome; predict runoff and soil erosion for these different land uses; and simulate runoff and soil erosion considering climate change scenarios. We performed the model calibration using a 4-year dataset of observed runoff and soil loss in four different land uses (undisturbed Cerrado, fallow, pasture, and sugarcane). The WEPP model components (climate, topography, soil, and management) were calibrated according to field data. However, soil and management were optimized according to each land use using a parameter estimation tool. The observations were conducted between 2012 and 2015 in experimental plots (5 m width, 20 m length, 9% slope gradient, 3 replicates per treatment). The simulations were done using the calibrated WEPP model components, but changing the 4-year observed climate file by a 100-year dataset created with CLIGEN (weather generator) based on regional climate statistics. Afterwards, using MarkSim DSSAT Weather File Generator, runoff and soil loss were simulated using future climate scenarios for 2030, 2060, and 2090. To analyze the data, we used non-parametric statistics as data do not follow normal distribution. The results show that WEPP model had an acceptable performance for the considered conditions. In addition, both land use and climate can influence on runoff and soil loss rates. Potential climate changes which consider the increase of rainfall intensities and depths in the studied region may increase the variability and rates for runoff and soil erosion. However, the climate did not change the differences and similarities between the rates of the four analyzed land uses. The runoff behavior is distinct for all land uses, but for soil loss we found similarities between pasture and undisturbed Cerrado, suggesting that soil sustainability could be reached when the management follows conservation principles.