EGU24-13949, updated on 23 Jan 2025
https://doi.org/10.5194/egusphere-egu24-13949
EGU General Assembly 2024

A GIS-modeling strategy to locate vulnerable agricultural fields and prioritize conservation efforts across the Midwest United states.

Eduardo Luquin[1,2], Brian Gelder[2], Daryl Herzmann[3], Emily Zimmerman[1], David James[1], Kelsey Karnish[4], and Richard Cruse[3]

[1]Iowa State University, Dep. of Natural Resource Ecology and Management, Ames, United States of America
[2]Iowa State University, Dep. of Agricultural and Biosystems Engineering, Ames, United States of America
[3]Iowa State University, Dep. of Agronomy, Ames, United States of America
[4]Retired USDA-ARS National Laboratory for Agriculture and the Environment (NLAE), Ames, United States.

To appropriately place soil conservation measures, locating the most vulnerable areas prone to soil erosion is required. Available tools to locate vulnerable areas are tedious to use and time-consuming, and most water erosion estimations are based on empirical models with limited applicability. The present study takes advantage of two large-scale soil and water conservation tools available for the Midwest U.S.: the Daily Erosion Project (DEP) and the Agricultural Conservation Planning Framework (ACPF).

In this study, we will showcase a recently developed large scale modeling approach implemented in the Midwest U.S. that currently downscales DEP from Hydrologic Unit Code (HUC) 12 (~90 km^2) average estimation of hillslope runoff and soil loss into a much finer resolution, a field and pixel scale. The DEP uses the Water Erosion Prediction Project (WEPP) and simulates hundreds of thousands of hillslopes across the Midwest, covering the wide range of factors including topography, climate, soils and land use and management.

This presentation will introduce the newly developed quantitative soil erosion assessment tool (named OFEtool - Overland Flow Element tool) that uses geographic information systems (GIS) and a physical-based model with real climate data (DEP). The OFEtool analyzes a watershed and groups areas with similar attributes, such as slope, soil type, land use, and management practices (information provided by the ACPF). Following watershed analysis, the tool uses DEP simulations to obtain average hillslope soil erosion or deposition rates for these grouped characteristics. Finally, it associates and assigns these rates to the respective areas within the watershed.

The current version of the tool is used by the ACPF to locate the most vulnerable fields across the watershed for conservation planning scenarios to prioritize interventions in fields and specific areas with the highest erosion rates. The applicability of the tool will be shown for the state of Iowa (approximately 145,746 square kilometers). Preliminary results corroborate spatial variability of soil erosion within watersheds and Major Land Resource Areas (MLRA). The presentation will also provide new insights into the main factors governing soil erosion in Iowa (climate, soils, topography, land use and management).

References

Gelder, B., Sklenar, T., James, D., Herzmann, D., Cruse, R., Gesch, K., & Laflen, J. (2018). The Daily Erosion Project – daily estimates of water runoff, soil detachment, and erosion. *Earth Surface Processes and Landforms*, *43*(5), 1105–1117. https://doi.org/10.1002/esp.4286

Daily Erosion Project. (n.d.). Retrieved January 9, 2024, from https://www.dailyerosion.org/

Tomer, M. D., Porter, S. A., James, D. E., Boomer, K. M. B., Kostel, J. A., & McLellan, E. (2013). Combining precision conservation technologies into a flexible framework to facilitate agricultural watershed planning. *Journal of Soil and Water Conservation*, *68*(5). https://doi.org/10.2489/jswc.68.5.113

Agricultural Conservation Planning Framework. (n.d.). Retrieved January 9, 2024, from https://acpf4watersheds.org/