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The Daily Erosion Project: Soil erosion impacts of strategic switchgrass (Panicum virgatum) placement in row cropped watersheds

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Tools to estimate spatially explicit land management alternatives on hydrologic and land degradation processes are limited, but they are critical for addressing site-specific management practice impacts on these processes. The Daily Erosion Project (DEP) exemplifies a process-based modeling tool that uses geo-referenced land and atmospheric inputs to estimate real-time surface soil movement and runoff from agriculturally dominated watersheds. Our study objective was to use DEP for the 2008 – 2016 time frame: 1) to estimate watershed-level interrill and rill soil erosion and runoff for contrasting management scenarios (baseline, which is dominantly row crops, vs. warm season perennial grass such as switchgrass (Panicum virgatum) (WSG)) georeferenced to field areas with $\geq$3%, $\geq$6%, or $\geq$10% slopes; and 2) contrast these results for varying physiographic regions, Major Land Resource Areas (MLRA), having different topographies in the Midwest U.S. The DEP model uses NEXRAD derived rainfall estimates every 2 min to obtain 1- mm intensity variation for each square kilometer across the domain as well as remotely sensed and/or electronically available data bases for inputs. These inputs drive the Water Erosion Prediction Project (WEPP) model, the erosion and runoff model used in DEP. Archived DEP input data for the 2008 – 2016 period was used for all scenario runs. Across Iowa, the test location for this study, altering management on slopes $\geq$10%, $\geq$6% and $\geq$3% resulted in replacing baseline management with WSG on 31%, 47% and 68% of the modeled hillslopes in the domain, respectively. Baseline annual average water runoff and soil erosion estimates were 137 mm and 0.8 mm, respectively for the entire state (across all MLRAs). Placing WSG on slopes $\geq$10%, $\geq$6% and $\geq$3% resulted in statewide annual average water runoff rates of 129, 127, and 127 mm respectively, while it resulted in statewide average annual hillslope soil erosion rate estimates of 0.3, 0.1, and 0.1 mm. The most erosive MLRA (steepest topography) with 2.0 mm/yr soil loss baseline estimate experienced the greatest benefit of management change with new soil erosion estimates of 0.4, 0.2, and 0.1 mm/yr for the $\geq$10%, $\geq$6% and $\geq$3% slopes being treated with WSG, respectively. Treatment-induced runoff change was similar across MLRAs mirroring the change that occurred statewide with the management alterations. Perennial grasses targeted to sloping areas reduced soil loss more than runoff and as anticipated have the largest positive impact on MLRAs most susceptible to soil loss.