EGU22-10684
https://doi.org/10.5194/egusphere-egu22-10684
EGU General Assembly 2022

Evaluation of the Effectiveness of Soil Conservation Practices in Agricultural Watersheds in Tennessee, USA

Racha Elkadiri, Henrique Momm, John Simpson, and Katy Moore
(racha.elkadiri@mtsu.edu)

Conservation agriculture has proved to be beneficial in terms of securing yield, sustainability of natural resources, and biodiversity of the natural and cultivated ecosystems. The effectiveness of existing and planned conservation practices in targeted watersheds in Tennessee, USA, were evaluated. Two watershed systems were selected in coordination with the U.S. Department of Agriculture - National Resources Conservation Service (NRCS) including four watersheds in Northern Middle Tennessee and six watersheds in West Tennessee.

Our objective was accomplished using the Annualized Agricultural Non-Point Source (AnnAGNPS) watershed pollution model to generate watershed simulations for our study areas. The main inputs databases needed include: (1) a 3-m LiDAR based Digital Elevation Model (DEM), (2) weather data from 23 NOAA stations and from AGNPS Climate Generator (agGEM), (3) soil data from the Web Soil Survey (WSS) and complementary soil description of physical and chemical properties from the USDA Soil Data Access website, (4) land use and land cover data describing crop type from 2009 to 2019 from the National Agricultural Statistics Service's Cropland Data Layer (CDL), and (5) typical farming management practices that were generated by integrating spatiotemporal crop type information at raster grid cell scale (from CDL), average crop yield at county scale (from USDA-NASS), and one-year farming management schedule (from USDA-NRCS). In addition to the AnnAGNPS simulation representing existing conditions, 34 additional AnnAGNPS simulations representing alternative scenarios of conservation practices were evaluated. Eight scenarios depicting the effectiveness of sediment retention ponds under various stream order, stream length, and sediment yield conditions; 4 scenarios were run to depict the effectiveness of crop rotation under various sediment yield-based conditions; 4 scenarios were run to depict the effectiveness of the conservation reserve program (CRP) under various sediment yield-based conditions; and 18 scenarios were run to depict the effectiveness of riparian forest buffer under various buffer width, and sediment yield- based conditions.

Preliminary results indicate that the vegetative riparian buffer is a very effective practice that could eliminate up to 80% of the total watershed sediment yield if implemented in every stream of the watershed. Alternatively, creating and maintaining a riparian buffer in just agricultural fields could decrease the sediment yield by 42% to 50% depending on width and by 5 to 6% when implemented in the top sediment producing fields. The projected reduction from sediment retention ponds of sediment yield is 95% in the case of 233 ponds strategically placed across the

Western TN watershed system. Crop rotation simulations show that this conservation practice could decrease sediment yield by up to 12% in the extreme scenario of applying it in every soybean agricultural field in the study area, making it less effective than the other simulated conservation practices. CRP decreases the sediment yield by more than 81% percent in the most optimistic scenario and by 10% in the least optimistic scenario.

Findings from this study support efforts in guiding future conservation strategies development contributing to water quality and sediment erosion improvement in the state of Tennessee and across the US.