

BIOAg Project Report

Report Type:

Progress

Title:

Quantifying Erosion Reduction from Adoption of Conservation Practices

Principal Investigator(s) and Cooperator(s):

PI's: Drs. Joan Wu and Kirti Rajagopalan (WSU BSysE), Dr. Levi Keesecker (Washington State Conservation Commission)

Cooperators: Jordan Jobe (WSU CSANR), Dr. Dani Gelardi (WA Department of Agriculture)

Abstract:

Soil erosion is a continuous agricultural and environmental problem in the inland Pacific Northwest. Factors contributing to the high erosion rates include hilly topography, highly erodible soils, frequent winter freeze-thaw events that weaken the soil, and tillage and fallow practices that leave soil pulverized and bare. This project will develop a prototype framework to measure success (or lack thereof) of conservation programs. The central hypothesis is that targeted implementation of conservation practices leads to significant erosion reduction. To test the hypothesis we will perform erosion simulations for “Baseline”, “Targeted” implementation, and “Best-case” scenarios. The compilation and synthesis of state-of-the-practice True Cost Accounting in crop production will be a valuable product of this project. The project, led by WSU faculty and State Conservation Commission staff, advances the development of sustainable agriculture in Washington State, informs government agencies and conservation programs, and aligns well with the overall goal of BIOAg.

Project Description:

Conservation practices have been adopted in the inland PNW for over four decades. Programs that have incentivized the adoption of agricultural conservation practices need ways to quantify and prioritize the resulting benefits. This project will develop a prototype framework based on erosion modeling to meet the need for measuring conservation practice effectiveness at the watershed-scale. Our findings will inform government agencies and conservation programs of the benefits stemming from their program policies and activities.

Outputs:

- **Overview of Work Completed and in Progress:** We have successfully recruited an MS graduate student. We have started collecting and synthesizing input data for water erosion simulation using the USDA’s WEPP (Water Erosion Prediction Project) model. We have planned drive-by observations and surveys of soil erosion in the vicinity of WSU and the general areas of Whitman County and select areas of Columbia County.
- **Methods, Results, and Discussion (discussion for final reports only):** We will estimate erosion reduction from implementing conservation practices on wheat-based croplands in eastern Washington via WEPP modeling. Conservation practices considered include conservation tillage, crop rotation, and cover crop. The scenarios of implementation of these practices will be

entirely or targeted vs not at all (baseline). Statistical analyses will allow us draw inferences on of the effects of implementing conservation practices.

- **Publications, Handouts, Other Text & Web Products:** PowerPoint presentation file shared with attendees at the WSU-WSCC-CDs Workshop (June 25, 2024, WSU PACCAR, Pullman, WA)
- **Outreach & Education Activities:**
 - J. Wu, oral presentation on water erosion from cereal-grain croplands in eastern Washington (across 12 wheat-grown counties and long-term trend) at the WSU-WSCC-CDs Workshop, June 25, 2024, Pullman, WA
 - Parham, T.B. et al., poster presentation on maximizing the efficacy of conservation practices by targeted adoption in erosion hotspots, Regenerative Agriculture Showcase, September 26, 2024, WSU, Pullman, WA

Impacts

- **Short-Term:** A systematic suite of simulations using process-based modeling will quantify soil erosion reduction from adoption of conservation practices. Knowledge gained from this effort will have immediate applications for stakeholders within the WSCC's Voluntary Stewardship Program
- **Intermediate-Term:** The framework and modeling approach developed in this study will provide a foundation for the "adaptive management" of erosion-related agricultural activities within the watersheds of eastern Washington. This accomplishment will create ripple effects, informing and impacting policy changes and program improvements to achieve the largest public benefits.
- **Long-Term:** Soil erosion has adversely impacted soil health and the environment in the inland PNW since large-scale wheat production in the late 19th century. Restoring degraded soils requires changes in management operation, policy and regulation, behavior, and sufficient time. There is a decreasing trend in soil erosion in the region due to the adoption of conservation practices since the 1980s, demonstrating long-term (several decades) impacts of soil conservation. In order to be a viable, cost-effective solution to soil erosion in our region and beyond, conservation practices should simply be the normal way of farming, with adaptation as needed to fit unique operations and landforms. Linking conservation practice mapping with erosion modeling will provide a robust approach to several key elements of voluntary environmental stewardship: planning, prioritization, monitoring, education, and outreach. This project will fill an important gap in knowledge for practitioners and scientists working at the nexus of agricultural activities and ecosystems.

Additional funding applied for/secured:

PI Wu is exploring collaborative opportunities for a long-term Edge-of-Field study in partnership with US EPA, NRCS, Idaho Soil and Water Conservation, and local farmers.

Graduate students funded:

T. Burke Parham, MS student, joined the Department of Biological Systems Engineering in the fall semester of 2024.

Recommendations for future research:

(i) Examining region (precipitation-zone)-specific environmental and economic impacts of implementing conservation practices, including feasibility; (ii) research similar in nature to NRCS-sponsored Edge-of-Field studies, with a focus on wheat-based cropping systems in eastern WA (an EoF project funded through the NRCS has been implemented by Whatcom Conservation District since 2016 in partnership with local producers to evaluate the effects of dairy production practices on surface water quality.)