NRCS CONSERVATION INNOVATION GRANT
Semi-annual Progress Report

Grantee Entity Name: Whatcom Conservation District	
Project Title: Demonstration and Implementation of a Nutrient Management Risk Advisory System for Protection of Water Quality in Runoff Prone Climates	
Agreement Number: 16-046	
Project Director: Nichole Embertson	
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Six Month Period Covered by Report: April 2019 – October 2019	
Project End Date: September 30, 2019	

A. Project Status

1. Summary of progress status to date, highlighting activities since submission of previous semi-annual report.

Objective 1 - Qualitatively and quantitatively compare existing runoff advisory tools – COMPLETED
This task has been completed.
The model comparison was written up and published in JEQ:
Easton, Z.M., P.J.A. Kleinman, A.R. Buda, D. Goering, N.M. Embertson, S. Reed, P.J. Drohan, M.T. Walter, P. Guinan, J.A. Lory, A.R. Sommerlot, and A. Sharply. 2017. ***Short-term forecasting tools for agricultural nutrient management****. Journal of Environmental Quality. 46(6):1257-1269.*

Objective 2 - Identify needs and quantify stakeholder adoption of the advisory system – COMPLETED
This task has been completed.

Objective 3 - Coordinate efforts of project partners to develop a runoff advisory system – COMPLETED
A base platform for a national runoff advisory tool was developed by US National Weather Service and NOAA partners. This platform will allow an individual State to host an advisory model. The State will still need to create the landing webpage and customize the interface to meet their audience and needs.

The work by NWS and NOAA was conducted in collaboration with this project, but also independently. This may change the output of the project, particularly for certain regions where this model is being implemented, as it may not be able to be directly linked to USDA-NRCS. However, USDA-NRCS can help assist with location and instruction on model platform adoption and guidance on integration into the State advisory system and

interface. Additionally, USDA-NRCS can assist with outreach and integration of the tool into existing technical assistance programs/opportunities.

In addition to the runoff model and forecast information, a field level risk runoff assessment worksheet was developed by Whatcom CD (WCD) for use with the forecast system. The worksheet was evaluated by other partner project regions (WI, OR, BC) for applicability.

Objective 4 - Implement and demonstrate effectiveness of advisory system – COMPLETED
An effort was made to run all four models in a single watershed. The watershed, WE-38 in Mahantango Creek Watershed in New York, was selected due to the available historical and current data, as well as the complexity of landscape and weather. All four models were to be compared with a single data set for evaluation of risk output, user friendliness, and applicability. This exercise demonstrated the significant differences in the models input and output variables and verified that they are indeed unique in their complexity and usefulness. The agreed outcome was that each would retain its contextual usefulness and individuality. It was also determined that the tool that was originally developed by NWS and NOAA is the best platform to promote and advise to other States looking to adopt a runoff advisory forecast tool.

One critical area of the forecast models and field assessment worksheet is soil moisture, which has been determined as a vital predictor of runoff by the project.

Sub-contractor Washington State University, has conducted predictive modeling work to test the runoff models under changing/future climate conditions as well as test their ability to accurately use a single variable, such as precipitation, to predict runoff volume in different rainfall areas. This work is vital for better understanding of NRCS conservation practices related to the 4Rs such as Nutrient Management and Waste Storage and how we will need to adapt them. This is particularly important for engineering practices that have a long life span such as Waste Storage (PS 313). Preliminary work can be found at: agclimatetools.cahnrs.wsu.edu/users/mpruet/test/.

Objective 5 - Develop supporting toolkit documents and educational materials – COMPLETED
Current states with an advisory tool include (WA, OR, WI, MN, MI, OH):

- Wisconsin: http://www.manureadvisorysystem.wi.gov/runoffrisk/index
- Minnesota: https://www.mda.state.mn.us/protecting/cleanwaterfund/toolstechnology/runoffrisk
- Washington: https://www.whatcomcd.org/msa
- Ohio: https://agri.ohio.gov/wps/portal/gov/oda/divisions/plant-health/resources/ohio-applicator-forecast
- Oregon: https://www.oregon.gov/ODA/programs/NaturalResources/Pages/MSA.aspx
- Michigan: https://enviroimpact.iwr.msu.edu/Resources.aspx

No further information will be developed by this project, but ongoing work by partners will continue as the platform expands to other areas of the country.

Objective 6 - Adapt, transfer and implement decision support tools – COMPLETED
The project has been shared by each individual partner at local, regional, or national project meetings and conferences. Special consideration to presentation was provided at:

- The project was presented as a special poster presentation at the 2018 SWCS conference in Albuquerque, NM in July, 2018.
- The project was presented in special panel session at the 2019 Waste to Worth conference in Minneapolis, MN April, 2019.

The decision support tool / forecast advisory model developed by NWS and NOAA, and WCD's worksheet, will continue to be shared after the project completion in relevant formats by individual agencies.

2. Current problems or unusual developments or delays.

No current issues that have not already been reported in previous progress reports.

3. Reasons why goals and objectives were not met, if relevant.

None this reporting period.

4. Explanation of any cost overruns.

None at this time.

5. A description of any administrative changes during the previous six-month period, including no-cost extensions granted or changes to the scope or budget of the project.

None.

6. Lessons learned that inform future project activities.

Preliminary model runs and discussion have shown that integration of tools assessed in this project is not feasible. Rather, selection of the NWS model is suggested for greatest application and applicability, while improving upon its function and template for use in new areas. Likewise, multiple tools are recommended based on the regional needs. This is a favorable outcome, as customization of tool output variables and formats by individual States was identified during surveys.

7. A summary of work to be performed during the next six month period.

NA

B. Project Results

1. **A summary of results to date and a comparison of actual accomplishments with proposed milestones and deliverables for the period**.

See Project Status, Number 1 for summary of project activities to date. Due to the nature of this project and scope, discrete data or analysis is not available. However, links to work products are provided in context of Objective areas in the Project Status section. Additionally, discussion of work proposed to accomplished/delivered is provided.

Project summary:
Despite decades of efforts to reduce non-point source nutrient pollution, excessive nutrient losses continue to persist from agricultural lands, contributing to water quality impairment. Wet, temperate and/or humid regions of the United States, such as the Puget Sound region, Great Lakes basin, Chesapeake Bay watershed, and Mississippi River basin, increasingly experience frequent runoff events that transport nutrients, pathogens, and/or sediment from recently applied manure and/or fertilizer nutrients to surface waters. Producers and conservation personnel need easy-to-use, real-time tools to help them identify when and where a runoff event may occur, particularly in areas with recent nutrient application. This project qualitatively compared the strengths of four different current runoff advisory tools: the Runoff Risk Advisory Forecast (WI), Application Risk Management System (WA), Fertilizer Forecaster (PA), and the Saturated Area Forecast Tool (VA). By integrating NRCS 590 Nutrient Management needs and the "4Rs" principles, specifically timing and placement, advisory tools can aid farmers and conservation personnel in the prevention of excessive nutrient losses from agricultural lands by providing current and short-term forecasts of runoff risks. Producers and conservation personnel can then use this information to change nutrient management strategies and avoid unintended impacts to water quality. Without these types of science based and defensible solutions to guide conservation planners and agricultural producers towards sustainable environmental management, many producers will be subject to increasing regulation, lawsuits, and potential loss of productive farmland.

2. **Any preliminary results that can be used by NRCS for practice standard revisions, new practice standard adoption, policy changes, program revisions and training opportunities**

Where applicable, suggest promoting the use of real-time runoff advisory tool part of the NRCS Nutrient Management (590) Practice Standard. Particularly for determining the right *time* to apply manure or fertilizers.

Innovation statement:
The reduction and protection of water quality resources from impairments is vital to long-term community and ecological health. Agriculture is implicated as a primary source of nutrient, sediment, and/or pathogen contribution to surface waters in many communities across the United States. Planning for proper nutrient management is important, but without real-time advisory tools to assist landowners and managers with proper implementation, it is difficult for individuals to make knowledgeable decisions. In particular, it is the timing of manure and fertilizer application that is most critical in preventing runoff events from occurring. Provision of real-time, easy to use runoff advisory decision support tools in areas of the US with runoff prone climates is the key to prevention of water quality pollution. This project highlighted existing runoff advisory tools and provided improvements and adoption opportunities to new States for

implementation. By innovating the development and use of runoff advisory tools, we are providing land managers tools they need to implement practices in real-time using best available science and information.

3. **Products, software tools and/or technologies currently ready for adoption and/or transfer.**

See list of websites with available advisory tools.

4. **Potentially promising products, software tools and/or technologies not yet ready for adoption and/or transfer, and a description of what is needed to reach that maturity.**

None.

5. **Identification of any new data or research needs to inform broader efforts in the project's topic area.**

None at this time.

6. **Links (or attachments) to communications products published/released since submission of the previous semi-annual report.**

Model comparison paper published in Journal of Environmental Quality (JEQ):

Easton, Z.M., P.J.A. Kleinman, A.R. Buda, D. Goering, N.M. Embertson, S. Reed, P.J. Drohan, M.T. Walter, P. Guinan, J.A. Lory, A.R. Sommerlot, and A. Sharply. 2017. **Short-term forecasting tools for agricultural nutrient management**. Journal of Environmental Quality. 46(6):1257-1269.

C. EQIP Requirements

Provide a listing of EQIP-eligible producers involved in the project, identified by name only.

Not applicable for this project.