

2020 Annual Report Executive Summary

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Project Title

Agricultural Water Security through Sustainable Use of the Floridan Aquifer:
An Integrated Assessment of Economic and Environmental Impacts

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FACETS Year 3 Report (July 2019-June 2020)

Executive Summary

Project Goals and Objectives:

The goal of the USDA-NIFA Floridan Aquifer Collaborative Engagement for Sustainability (FACETS) project is to promote economic sustainability of agriculture and silviculture in North Florida and South Georgia while protecting water quantity, quality, and habitat in the Upper Floridan Aquifer (UFA) and the springs and rivers it feeds. Specific objectives to achieve these goals include:

1. Integrated Modeling Platform Development - Build a comprehensive modeling platform within a Participatory Modeling Process (PMP) to predict farm/forest-scale and regional-scale impacts of alternative land use and production practices on the water quantity, water quality, and economy of North Florida (FL) and South Georgia (GA).
2. Stakeholder Engagement and Social Science Research - Integrate stakeholders' experience with scientific data and models to explore economic-environmental tradeoffs among current and potential future climate, land use, technology, Best Management Practice (BMP) adoption and policy scenarios to understand changes needed to achieve agricultural water security and environmental protection.
3. BMP Research and Extension Demonstrations, Tools and Training - Conduct BMP field research. Develop and deliver innovative Extension BMP demonstrations, digital decision toolkits and training programs for diverse stakeholders to bring about preferred changes in production systems and incentive programs.

For more information about project goals and objectives, [click here](#).

Click on the following links for more information on [Year 1](#) and [Year 2](#) project activities.

Summary of Year 3 Project Activities:

In Year 3 of the project (July 2019 to June 2020), in addition to the project research, modeling and engagement activities, the project team made significant efforts to keep interested parties apprised of project progress and to consider stakeholder interests and input. Forty-three presentations of the project and its findings were presented to local, state, national and international communities of interest, ten papers were published or are under review in peer reviewed journals and 13 additional papers are in preparation.

Challenges were encountered during Year 3 due to the Covid-19 pandemic which affected student recruitment; imposed restrictions on the conduct of field research; eliminated the ability to have face-to-face interactions to conduct surveys, interviews, extension activities, project team meetings and stakeholder workshops; and limited presentation of the results of the project at professional meetings and other venues. Despite challenges, the first three years of the project have proceeded along the expected trajectory in research, Extension, and participatory model development.

The first three years of the project have primarily focused on implementation of experimental field trials of different crop management systems, development of an irrigation and nitrogen application Mobile App for Corn, farm/forest-scale and regional-scale biophysical and economic model development, stakeholder engagement through meetings and interviews with the PMP stakeholder group, communications and social learning research, In-Service-Trainings (ISTs) and development of water schools. Details regarding project activities by objective are included below.

Integrated Modeling Platform Development

In Year 3 of the project, biophysical models (SWAT) at the farm/forest scale were calibrated/validated with project-supported data and literature-derived field data for a range of stakeholder-informed management systems and priority crops in FL and GA. Farm/forest scale enterprise budgets were developed for the same production and management systems to evaluate net returns. The resulting biophysical and economic farm/forest scale model outputs were used to explore differences among water balances, nutrient balances,

and net returns across these production and management systems in each state, namely producer net returns, nitrate leached to UFA, and net recharge to the UFA. The preliminary farm/forest-scale yields, water balances, nutrient balances, and net returns and farm/forest-scale economic-environmental tradeoffs plots were presented to stakeholders for feedback and discussion at one in-person meeting and several webinars in Year 3.

SWAT and SWAT-MODFLOW biophysical models and IMPLAN economic models are in development for the Santa Fe and Lower Flint River Basins (regional scale). Three simplified land use/land management scenarios are initially being used to exercise the regional models. These scenarios all assume a baseline land use (2015 for GA and 2017 for FL). The simplified land use scenarios include: 1) all production systems use management system 1 (lower input system); 2) all production systems use management system 2 (medium input system); and 3) all production systems use management system 3 (higher input system).

The framework and plans for regional scale biophysical and economic modeling were presented to stakeholders for input and discussion in two webinars. Results of the simplified scenarios will be presented to stakeholders at a PMP workshop anticipated to be scheduled in early 2021.

A dynamic land use change model is currently under development for the Little River Experimental Watershed to evaluate how the limits set by the water quality regulations might affect the future land use change. Once developed for the Little River Watershed, the feasibility and utility of extending the analysis to the Santa Fe and Lower Flint watersheds will be determined.

Three stakeholder Willingness-to-Accept (WTA) surveys are planned for implementation in Year 4. The first set of WTA surveys were designed in Year 3 and will be used to determine the willingness of farmers and forest landowners in the Suwannee River and Flint River Basin areas to accept payment for switching from a traditional set of management practices to a new set of management practices intended to improve water quality and quantity. A second WTA study is planned for agricultural producers in the Suwannee River Basin to assess farmers' willingness to accept payment for changing cropping systems and/or management practices given alternative framing of regional environmental outcomes from collective efforts and various policy designs to incentivize changes. A third WTA study is being conducted in Georgia to estimate the willingness of Georgia's tree farmers to accept an annual payment for increasing water flows from their forestlands by changing silvicultural practices (thinning intensity and plantation density).

Results of the WTA surveys will be used to inform a Willingness to Pay (WTP) survey (also to be implemented in Year 4) focused on understanding the public's perceived value of improved water quality and quantity through increased adoption of conservation practices by farm/forest landowners.

Stakeholder Engagement and Social Science Research

In Year 3 of the project, one in-person workshop (Workshop 4) and five webinars were conducted with the PMP stakeholder group to co-develop and co-interpret farm/forest-scale models and results; enhance understanding of project results and incorporate stakeholder feedback on project activities; and initiate discussions on regional modeling scenarios. Given limitations of virtual interactions, modelers proposed three simplified scenarios which will be used to "exercise" the models until the PMP network can meet again in person to develop land use scenarios they are interested in. This plan was discussed with the PMP for feedback and was agreed upon.

Also in Year 3, interviews and surveys were adapted and conducted with PMP participants to gather, track, and analyze perceptions of the modeling development process. Data collection primarily focused on social networking, levels of confidence in modeling results, and group satisfaction. Social learning research findings were communicated to the PMP facilitation team to aid adaptive management of the engagement process and contribute to generalizable knowledge on participatory modeling practices.

Communications research activities in Year 3 included the development of a preliminary water science

knowledge assessment instrument that will enable identification of topics and audiences that could benefit from educational interventions. The media framing of water issues analysis continued, and an interview guide was pilot tested to understand how stakeholder groups vary in the way they connect with the natural world. Findings from communications research will inform development of communication for the public as well as communication tools and curricula for Water Schools.

BMP Research and Extension Demonstrations, Tools and Training

In Year 3, field research continued to quantify crop yield, water savings and nutrient loss across a range of irrigation, nutrient management and cover crop practices in FL and GA.

Three on-farm demonstrations took place in FL including the demonstration of soil moisture sensors and other water saving BMPs/tools, demonstration of blue dye nutrient leaching, and a presentation of results of current on-farm BMP demonstrations. Additionally, a hands-on training with soil moisture sensors and digital decision tools to schedule irrigation and make informed decisions was delivered in FL to farmers, Extension professionals and government agency personnel.

One In-Service Training (IST) was held in FL and four were held in GA on the topics of irrigation decision making, site-specific management of spray or nutrient applications, and fertilizer system calibrations. Additionally, over 30 county level farmer meetings were held in GA to discuss BMPs for irrigation management.

In Year 3, key learning objectives and themes for the Water Schools program were defined, and a Water School Advisory Board was assembled to provide feedback on program content, format, and marketing strategy. The board is composed by members of the PMP and Project Advisory Committee (PAC) as well as external stakeholders. Planning for the first Water School in Florida is underway.

Additional opportunities for training and professional development in Year 3 included mentorship of undergraduate students (2), graduate students (14), and post-doctoral associates (3).

Summary of Year 3 Project Accomplishments:

- 43 project presentations to local, state, national and international communities of interest
- Ten published or under review peer-reviewed journal articles; 13 papers in preparation
- Farm/forest-scale biophysical model and enterprise-level financial model results were used to assess tradeoffs in net returns, water quality, and water quantity across production and management systems
- Ongoing development, calibration and validation of regional-scale biophysical models
- Ongoing development of regional-scale economic models (IMPLAN)
- Ongoing implementation of producer Willingness-to-Accept surveys for forestry and agriculture
- Preliminary land use change models
- Five webinars and one in-person workshop with PMP stakeholders
- PMP Workshop 4 Report and four PMP Webinar Reports
- Analysis of PMP stakeholder perceptions of model development process
- Preliminary water science knowledge assessment instrument and ongoing media framing analysis
- Ongoing field research to quantify crop yield, water savings and nutrient loss across a range of irrigation, nutrient management and cover crop practices in Florida and Georgia.
- A hands-on training with soil moisture sensors and digital decision tools to schedule irrigation
- Five Extension agent In-Service Trainings
- Mentorship of two undergraduate students, 14 graduate students, and three post-doctoral associates