SCC-IRG Track 1: Connecting Farming Communities for Sustainable Crop Production and Environment Using Smart Agricultural Drainage Systems

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In the US, drained croplands produce a disproportionately large amount of grain but also release a disproportionately large amount of eutrophying nutrients to aquatic ecosystems. Climate change and agricultural intensification cause farmers to increase the intensity of drainage leading to a pressing need to balance productivity, profitability, and environment when making drainage decisions. Also, Drainage systems include individually-owned & community-owned drains, decision-making involves techno-economic social issues and requires balancing the needs of individual farmers, drainage communities, and surrounding regions.

This project will develop an integrated decision-making platform to facilitate community decision making for precise prediction and management of drainage effects on water flow, crop production, farm net returns, and nutrient loss. The platform data will be made possible by new agricultural sensors and robots, innovations in behavioral economics and analytics tools. Development of the platform will be guided by farmer stakeholders. The project will also form a continuous learning environment across scientists and farmers that fosters adoption of new technologies and transfer of the research process to the next generation of engineers and agricultural professionals.

Developing a multimodal sensing infrastructure, including **r**obotic snake sensors capable of monitoring water flow and nitrate concentrations inside drainage pipes, and stationary in-situ soil nitrate sensors with high selectivity.

Developing an analytics tool that fuses multiscale data to predict and understand spatiotemporal distributions of water flow, plant nitrate uptake, soil nitrate loss, and crop yields at the field scale.

Interacting with drainage district participants to understand how existing and new technologies and incentives possibilities affect drainage system sustainability

Immediate impact on society:

Benefit individual farmers (productivity and profitability), drainage communities (environmental quality), and surrounding regions (conservation)

Sustainability:

Provide a platform that can collect farm level and field level data on drainage system efficiency. Provide new policy options to influence and incentivize sustainable drainage systems

Next step:

Complete the sensor infrastructure development.

Continue developing analytics tools.

Continue interacting with a variety of drainage district participants.

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