

## MINI GRANT PROJECT SUMMARY

Please complete the project summary and return the completed form to Alyssa Johnson, Administrative Assistant at the Institute on the Environment, at [joh10074@umn.edu](mailto:joh10074@umn.edu). Paper copies will not be accepted. Please also attach any photos, publications, brochures, event agendas or other materials that were a result of the mini grant summary.

<b>Date of Report Submission:</b>	4/15/16
<b>Project PI &amp; Dept/School</b>	Kate Brauman, Global Water Initiative, Institute on the Environment
<b>Project Title:</b>	Does Smallholder Use of Improved Irrigation Save Water?
<b>Grant Amount \$:</b>	\$3000

### Project Context & Purpose

*Please include the original project purpose statement and revise for any changes that occurred in the project after the start date with a short explanation of the changes.*

To feed the world sustainably, and to ensure long-term water security for farmers and other water users, it will be critical to increase crop productivity and resource use efficiency (Foley et al. 2011). Smallholder farms are widespread, so engaging smallholders will be integral to meeting these goals (FAO 2014). Irrigation technologies that improve the efficiency of on-field water application are often heralded as win-win solutions for farms of all sizes. (Gleick et al. 2011). However, the water saving potential of improved irrigation for smallholder farmers remains unclear. In particular, it is unknown whether access to water-saving technologies currently limits production and how farmers might respond to access to improved technology.

We propose to explore the potential for water savings by smallholder farmers in southern India. India is home to 24% of the world's farms, so it provides broad insight. More importantly for our purposes, we can build on an existing network in Tamil Nadu to obtain access to farmers. We will partner with MyRain, an Acara-incubated irrigation technology distributor, to contact and work with farmers to whom they have sold drip irrigation systems. In return, we will provide MyRain with crucial data for their environmental performance reports. We will also work with the Acara program, which has an extensive network in Southern India, and the Ashoka Trust for Research in Ecology and the Environment (ATREE; based in Bangalore, with field offices in Tamil Nadu), where colleagues of Dr. Brauman have expressed interest in this project.

Evaluating the biophysical water-saving potential drip irrigation technology is one key element of our proposed study. It is frequently stated that drip irrigation uses 30-50% less water than conventional flood or furrow irrigation. Preliminary work undertaken by Rachel Brown reviewing studies of drip irrigation efficiency support the hypothesis that drip technology can substantially reduce water application to crops and can increase yields, but also indicates that water consumption may increase as yield increases. It is critical to distinguish between water application and water consumption because, while a reduction in water application (water withdrawn from a well or stream) may be beneficial to a farmer, it generally does not reduce water stress at the watershed scale because runoff is reused by others within the watershed. Only reducing water consumption (evapotranspiration from crops and soil) can effectively make additional water available. This pilot study will focus on laying the groundwork for a biophysical study to quantify the potential watershed scale water savings of drip irrigation. To

do this, we will begin designing a study to measure water consumption (evapotranspiration) on sugarcane farms using drip irrigation, comparing this to farms using furrow irrigation.

Understanding farmers' reasons for switching to drip irrigation technology, and their likely responses to having it in place, are a second critical element of the proposed study. We will explore whether production by farmers in the study region is currently limited by access to water, the extent of production increase necessary to offset the cost of improved irrigation, if farmers have the interest or opportunity to expand production, and if so, whether improved irrigation technology might lead to a perverse outcome such as a net increase in water consumption. This pilot study will help us identify appropriate survey questions and strategies for eliciting reliable responses from interviewees.

With this IonE Mini Grant, Dr. Brauman and Mr. Iversen will travel to Madurai, India and undertake the exploratory study on smallholder farming in southern India described above. We will engage local farmers, organizations, and community members to determine possible study designs, specifically focusing on identifying potential field sites and practical measurement equipment and also building connections necessary for a full-scale study. Prior to traveling to India, Mr. Iversen will work with Acara, MyRain, and ATREE to identify local stakeholders and set up meetings.

## Work Completed

*Please provide a summary of the work that was completed for the mini grant project.*

In June 2015, Adam Iverson traveled to Madurai, India. With Aruna Raman, India Director for Acara. Iverson met with MyRain staff, visited 4 separate farms where drip irrigation had been installed, and met with a researcher who works with small farmers to adopt organic practices.

In November 2015, Kate Brauman and Adam Iverson traveled to Tamil Nadu, India. Aruna Raman accompanied them to Coimbatore, where all three met with K Palanisami, a hydrologist who worked for the International Water Management Institute (IWMI) for many years, and with Dr. Suresh Kumar, an agricultural economist at Tamil Nadu Agricultural University (TNAU). Palanisami took them to visit one farm in Coimbatore.

Brauman and Iverson then traveled to Madurai, where MyRain is based. They interviewed Steele Lorenz, founder of MyRain, and 3 staff members involved in equipment sales. Accompanied by MyRain technical staff, Brauman and Iverson visited 3 farms of differing sizes and growing different crops where MyRain drip irrigation had been installed. Farm visits provided an opportunity to interview farmers and to see and ask questions about specifics of the installation.

While in Madurai, Brauman and Iverson were able to work with Lorenz and MyRain staff to design a preliminary water use monitoring program that had been requested by USAID.

After returning to Bangalore, Brauman spent a day at the Ashoka Trust for Ecology and the Environment (ATREE), where she met with irrigation and agriculture researchers, met with students, and gave a lecture.

## Partnerships & Collaborations

*Please provide a summary of the project personnel, partnerships and collaborations that worked directly on the project or were started as a direct result of the mini grant project.*

### Project Personnel

Kate Brauman, lead scientist for the Global Water Initiative at IonE, coordinated the project and lead interviews in India.

Adam Iverson, Master's student in UMN Civil and Environmental Engineering, worked on project logistics, doing background research and connecting to researchers at Tamil Nadu Agricultural University (TNAU). He visited MyRain staff and nearby farms on two separate trips and helped generate research ideas.

Aruna Raman, India director for Acara, accompanied Iverson on his first trip to Madurai and Brauman and Iverson on their trip to Coimbatore. Raman helped with interviews, doing some translation but more importantly providing critical insight on context and motivation.

Steele Lorenz and MyRain staff shared business and technical knowledge with the project team.

### New Collaborations

K Palanisami, a hydrologist who worked for the International Water Management Institute (IWMI) for many years, spent a day with us and provided candid and critical insight on water resources in peninsular India. He was an invaluable guide sorting through specifics to get to generalities and interpreting a variety of often-conflicting research findings.

Dr. Suresh Kumar, an agricultural economist at Tamil Nadu Agricultural University (TNAU), provided helpful perspective on the type of research on agricultural irrigation that is already occurring. Apparently connections to TNAU are critical for getting buy-in on more in-depth research projects, so this connection was critical.

Veena Srinivasan and others at the Ashoka Trust for Ecology and the Environment (ATREE) are engaged in socio-hydrology work in other contexts in India and could be great research partners. They have very good graduate students, who may prove to be a useful resource.

## Project Outcomes & Impacts

*Please provide a summary of the outcomes and /or impacts of the mini grant project including future plans for the project.*

Brauman and Iverson learned a tremendous amount about the extraordinarily varied types of agriculture and irrigation in Tamil Nadu. This new knowledge was put to immediate use, in that MyRain was asked by USAID to provide additional documentation of the water savings impact of their work just before Brauman and Iverson arrived in India in November. While in India, Brauman and Iverson worked with Lorenz on a preliminary proposal to address this. What being in-country and going on field visits made clear was that traditional US agronomic style research comparing paired flood and drip irrigated fields was both untenable and wouldn't really answer the question.

Working with MyRain presents fertile ground for understanding what happens to water resources when farmers switch irrigation technology. Assessment clearly has to evaluate both biophysical impacts of the technology switch itself (e.g. how does pumping and evaporative consumption change when irrigation technology changes) and simultaneous behavioral changes (e.g. do farmers irrigate more area or plant different things). Working with MyRain also presents the opportunity to begin understanding farmer motivation and thus create better-informed projections of likely future changes. All of this seems to be under-studied right now.

MyRain is taking an approach to measuring impact that includes some monitoring of water flow on farms newly equipped with drip irrigation in conjunction with survey questions about farmer behavior (e.g. change in area? Change in crops?). If these survey questions prove to be effective in this pilot study, we will expand the pilot to add survey questions for his staff to include when they're talking with new customers. We are hoping to complement this with a more robust review of the literature comparing the impact of flood and drip irrigation, and we have applied for a mini grant to pay an undergraduate to do so. We are also monitoring research funding opportunities and maintaining connections with potential collaborators and students so that we are poised to apply for appropriate funding.