

Opportunities for small scale irrigators

Increasing food production through irrigation in the dry season improves livelihoods. Entrepreneurs and farmers are already using groundwater, river or stream pumping, and private small reservoirs and ponds in emerging irrigation systems. The **Innovation Lab for Small Scale Irrigation** is working in Ghana, Ethiopia, and Tanzania, where small scale irrigation can contribute to national development goals. ILSSI aims to identify how to create opportunities for farmers and other actors across scales. Researchers are examining mechanisms to improve access to small scale irrigation technologies for both men and women. When irrigation already takes place, they work with farmers and

extension to pilot ways to improve water lifting, conveyance and field distribution. The project considers scaling the technologies and practices within the context of market and environmental sustainability.



Farmer irrigating tomato using furrow irrigation in Rudewa, Morogoro, Tanzania (Photo: Petra Schmitter, IWMI)

Challenges

Transitioning from subsistence, rainfed systems to commercial irrigation requires upscaling best-bet technologies and efficient water management. Small scale irrigation technologies must be profitable for farmers and investors. Technologies must fit the context of the farm, the biophysical environment, and the market. And market and environmental boundaries must be considered in up-scaling irrigation at landscape scale.

Contributing to solutions

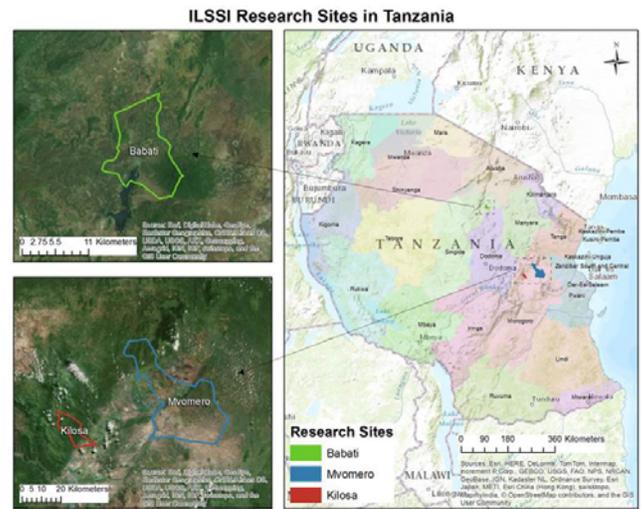
- Piloting small-scale irrigation technologies testing combinations of water sources (shallow, ground and surface water), water extraction technologies (motorized pumps, rope and washer, solar pumps and pulleys), and appropriate water application (overhead, drip, furrow) and irrigation scheduling tools.
- Generating biophysical and socio-economic data to assess opportunities and constraints to scaling.
- Identifying potential business models for access small-scale irrigation by men, women and youth.
- Exploring options for irrigating fodder for livestock production.
- Ensuring the environmental and economic sustainability of irrigation interventions from farmer to watershed scale through an integrated process-oriented modelling suite of SWAT, APEX and FARMSIM.
- Exploring potential pathways between irrigation and improved nutrition.

Project partners working toward impact

The ILSSI team is led by Texas A&M University with IWMI and ILRI leading field interventions and IFPRI implementing household surveys. Continuous stakeholder engagement throughout is a core approach of the ILSSI project. In Tanzania, the interventions are implemented and data collected by Sokaine University of Agriculture

Field level interventions and analysis: Piloting small scale irrigation with farmers

In Tanzania, ILSSI is piloting interventions with around 40 women and men farmers. ILSSI works with university and research partners, extension, subject matters specialists, local irrigation and finance cooperatives, and women and men farmers to pilot technologies and practices that hold potential for scaling small scale irrigation. ILSSI has installed measurement instruments in the watersheds to collect primary data. ILSSI also tests water quality to monitor and analyse different water sources in consideration of multiple uses. Field interventions, instrumentation and sampling in the watershed, socio-economic surveys and farmer field books provide primary data. This is complemented with secondary data from national and international resources. ILSSI uses the data in a suite of models - SWAT, FARMSIM and APEX - to form an Integrated Decision Support System.



Pilot sites under ILSSI and related projects

Site specific interventions

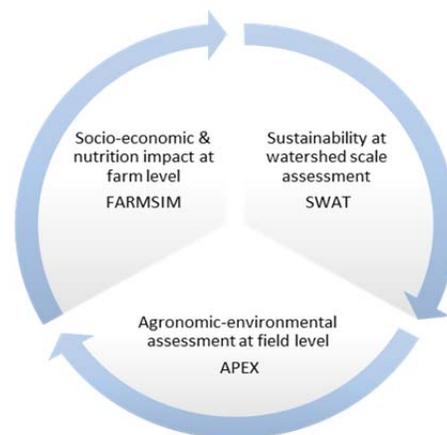
Region	District	Village	Water source	Intervention(s) - technologies
Morogoro	Kilosa	Rudewa	Surface – Rudewa River Basin	Motor pump with furrow irrigation of tomato and African eggplant, irrigation scheduling, pocket gardens, fertilizer application rate in combination with deficit irrigation in furrow systems
Morogoro	Mvomero	Mkindo	Surface Mkindo River Basin	Motor pump with furrow irrigation of tomato and African eggplant, irrigation scheduling, pocket gardens, fertilizer application rate in combination with deficit irrigation in furrow systems
Manyara	Babati	Babati	Surface	Fodder Testing

In the research plot for Rudewa, different trends in water use efficiencies are observed for tomato and eggplant comparing different irrigation scheduling treatments under drip and furrow. For tomato, 80% of crop water requirement produced higher tomato yields compared to 100% and 60% of crop water requirement. Eggplant had higher yield at 60% water crop requirement for both drip and furrow. This suggests that crop water requirement advice could be adjusted for the area. The experiment is repeated in 2017 to validate the 2016 results and translate the findings into irrigation advice for the region.

Results of the economic feasibility assessment suggest at Rudewa suggest that investments in diesel/petrol pumps are profitable regardless of the crop type. Based on a 1 hectare plot, both Net Present Value (at 12%

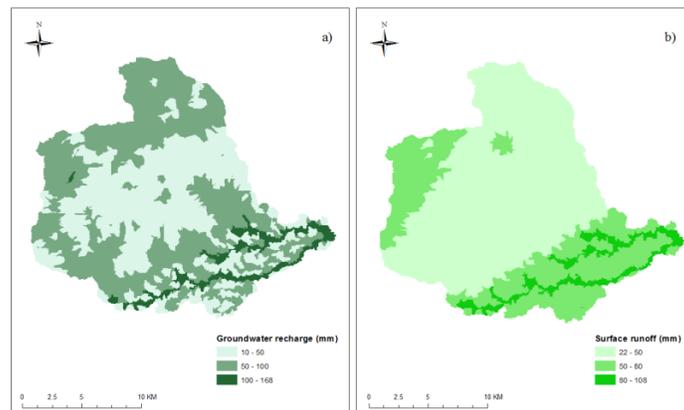
of the official discount rate) and Internal Rate of Return indicate use of diesel/petrol pump to produce eggplant or tomato is financially feasible. The estimated payback period is lower than a year in both cases.

The comparison of water consumption using pocket gardens compared to conventional plots showed a decrease of water application and therefore a decrease in labor input by 50-75% depending on the farmer. Discussions with farmers suggested income generation from pocket gardens, which had enabled them to pay for school expenses and some medical costs, as well as fulfilling household consumption of the vegetables produced. Women note full control over income generated from commercial sales from the pocket gardens.



Modelling scenarios with IDSS

In addition to the primary data collection described above, secondary data are obtained from national and international resources. The project uses a suite of models, SWAT, FARMSIM and APEX as an Integrated Decision Support System. Together with stakeholders and partners, the project is developing scenarios to identify opportunities and constraints at landscape and market levels for upscaling high potential irrigation technologies and practices. Ex-ante scenarios have been developed in early 2016 to test the framework of the models. Initial scenarios with primary and recently collected data are expected by late 2017 following



Sample SWAT model of Mkindo watershed, Tanzania

engagement with key stakeholders to ensure alignment with national goals.

Gender and nutrition analysis

The Tanzania endline survey will be launched in June. The survey covers issues related to household and farm level production, economics, microfinance and technology access, as well as an intrahousehold module that addresses nutrition and gender. The analysis of baseline data showed that total agricultural income increases significantly with access to irrigation, total land holdings, total number of livestock owned and the use of chemical fertilizers and improved seeds. Qualitative research on intrahousehold adoption of irrigation technologies drawing on insights from Ethiopia, Ghana and Tanzania focused on what happens after adoption to better explain low adoption rates by women farmers and identify entry points for enhanced adoption developing a framework that can increase intra-household understanding post-adoption and thus increase



Pocket garden managed in Rudewa, Morogoro, Tanzania (Photo: Petra Schmitter, IWMI)

sustainability of adoption of technologies by both women and men. In 2016, ILSSI trained 150 stakeholders including USAID mission staff on gender and irrigation during three workshops in Ethiopia, Ghana, and Tanzania. A project note with guidelines on gender-responsive irrigation was produced as a result of these workshops. In addition, in Tanzania, the National Irrigation Policy is going under review and the director expressed interest in improving attention to gender in the new policy. Further information on the workshops is available here: [What should we be asking to understand gender dynamics in irrigation](#)

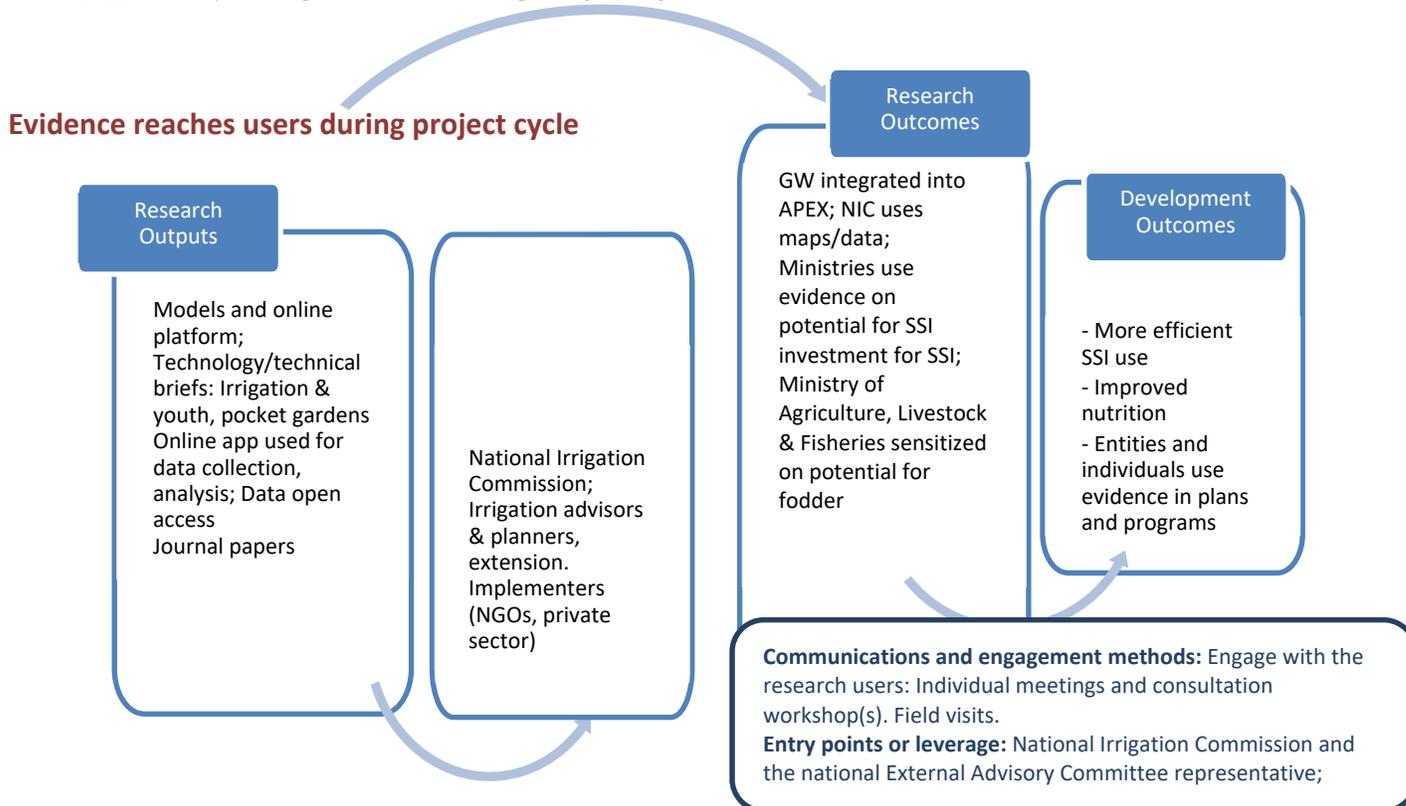
Pathway to Impact: Stakeholder engagement and Capacity development

The project expects to invest around USD 2 million in research, capacity development and engagement to support investment decision-taking in Tanzania over the project period (2013 to 2018). ILSSI early on engaged stakeholders to identify priority issues in small scale irrigation to support identification of pilot field interventions. ILSSI also engaged with key stakeholders and partners to ensure that model scenarios align with national goals and priorities. In 2016, in a second stakeholder workshop, participants ranked constraints for further analysis by IDSS. Along the project impact pathways, ILSSI research results are being shared with national partners and private sector actors, and more broadly across Africa. Partners are expected to use the knowledge generated from the project for scaling solutions and improving policy and practices for sustainable intensified production.

Ranked List of Constraints for Analysis

1. Lack of irrigation expertise
2. Access to Finance
3. Policy constraints & market value chains
4. Climate change
5. Competing water Users
6. Poor soils
7. Cultural and social practices related to stereotyping crops
8. Fodder Technology
9. Low genetic potential for livestock
10. Source of energy for water lifting

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Capacity development

Capacity development is essential for long-term impact of the project. The project engages scientists and graduate students at different Tanzanian institutions to strengthen research skills and develop international journal articles and conference papers. Technical specialists, planners, students and scholars participate in training on the IDSS suite of models. ILSSI conducted four workshops in Tanzania. To date ILSSI had held four work IDSS Workshops in Tanzania. Conducted nationwide training includes sessions on SWAT, APEX, FarmSIM and Advanced SWAT. Currently ILSSI has trained 170 participants; of those 129 of them were males and 41 females (IDSS participants Figure). The project also strengthens the capacity of farmers, extension and private sector suppliers and service providers. NCA&T and IWMI have trained local agriculture irrigation and microfinance suppliers and service providers.

National stakeholder events

Event	Date	Location	Output
Workshop: Gender and Irrigation	April 20 -21 st 2016	Dar Es Salam	http://ilssi.tamu.edu/media/1186/ftf-ilssi-project-note-1-gender-equality-in-irrigation.pdf
Stakeholder Consultation Workshop	July 25, 2016	Dar Es Salam	http://ilssi.tamu.edu/media/1278/ilssi-stakeholder-workshop-report_tanzania_july2016_final.pdf
IDSS Workshop	Ongoing	Country Wide	http://ilssi.tamu.edu/media/1337/report-on-tanzania-idss-workshops.pdf
Partners planning meeting	August 26, 2014	Morogoro	http://ilssi.tamu.edu/media/1343/ilssi-tanzania_stakeholder-proceedings_2014august.pdf

List of knowledge products for Tanzania to date

1. Report on Tanzania IDSS workshop
2. Small Scale Irrigation Applications for Smallholder Farmers in Tanzania Ex Ante Analysis of Options
3. Ex Ante Analysis of Small-Scale Irrigation Interventions: Babati
4. Ex Ante Analysis of Small-Scale Irrigation Interventions: Kilosa
5. Ex Ante Analysis of Small-Scale Irrigation Interventions: Mvomero

Further information: This handout has been developed by the Feed the Future Innovation Lab for Small Scale Irrigation (ILSSI; ilssi.tamu.edu). For more information on this project in Ethiopia, contact: **Dr. Neville Clarke, Innovation Lab Director**, (Neville.Clarke@ag.tamu.edu) and **Mr. Matt Stellbauer, project manager** (e-mail: Matt.Stellbauer@ag.tamu.edu)

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