The U.S. Government's Global Hunger & Food Security Initiative

Innovation Lab for Small Scale Irrigation (ILSSI) Stakeholder Consultation Workshop Report: Ethiopia

Identifying and prioritizing constraints and opportunities

Addis Ababa, Ethiopia

14th June 2016

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1 Introduction and background

The ***Feed the Future Innovation Lab for Small-Scale Irrigation*** (ILSSI) project aims to enhance food security, improve nutrition and reduce poverty. The project team is achieving this by developing and introducing promising, context appropriate, small-scale irrigation systems into food and agriculture production on small farms in Ghana, Ethiopia and Tanzania. The project is piloting and modelling high potential interventions in small-scale irrigation and irrigated fodder production through development, and use of, an *Integrated Decision Support System* (IDSS).

The project, funded by USAID, is led by Texas A&M University (TAMU) in collaboration with the International Water Management Institute (IWMI), International Livestock Research Institute (ILRI), International Food Policy Research Institute (IFPRI) and North Carolina A&T State University.

In Ethiopia the project is also partnering with Bahir Dar University, Send a Cow - Ethiopia, Omo Microfinance, Amhara Regional Agriculture Research Institute, and the Southern Agricultural Research Institute. Strong engagement with research institutions and non-governmental organizations such as these, as well as with the government of Ethiopia and other stakeholders active in the country, including farmers, is a key component of the project. The project, which runs from October 2013 – September 2018, is comprised of five major interrelated components:

- Assessment of promising small scale irrigation technologies
- Small-scale irrigation interventions in the field
- Stakeholder consultation at multiple levels of scale
- Engagement with national partners and farmers in order to conduct field studies
- Surveys of farming families in the area surrounding the field test sites
- Analysis of the production, environmental and economic consequences of small scale irrigation options, including but not limited to interventions in farmers' fields, using the Integrated Decision Support System (IDSS)

Capacity building and training at multiple levels of scale are also substantive elements of the project.

Background to this workshop

Consultation with national stakeholders, to assist in planning, implementation and validation of results, forms a key part of the activities of the ILSSI project. This approach to partnerships is an ongoing process conducted throughout the 5 year duration of the project in all three countries. In the first phase of the project, initial engagements at local, regional and national levels helped to identify and define the most promising small-scale irrigation (SSI) scenarios that, with the support of further research, could potentially lead to sustainable adoption and significant development impact.

Over the past two and a half years researchers, through a combination of field surveys, analysis and modelling, have generated a set of initial results that focus on high potential interventions in small-scale irrigation and irrigated fodder production. These results, and corresponding experiences in the field, have been used to identify a number of constraints that affect the adoption of these small-scale irrigation interventions (both those studied in the field and a broader set evaluated using models).

This one day participatory stakeholder workshop provided an invitation to national experts in Ethiopia (see Annex 1 for participant list) to share their knowledge and experience, and draw on the institutional interests and priorities they represent, in order to evaluate and prioritize the constraints that have been identified so far by the ILSSI research team. The workshop took place at the International Livestock Research Institute (ILRI) Campus in Addis Ababa.

Through this stakeholder consultation and evaluation process the research team aimed to collaboratively prioritize a short-list of these constraints specific to Ethiopia, as a guide for further analysis. It is anticipated that this in turn will result in concrete, context specific proposals emanating from the project to mitigate these constraints and so make the most of opportunities to scale out solutions. The Integrated Decision Support System (IDSS) will be used in this analysis for each of the three countries of the study. A representative of the ILSSI External Advisory Committee, Dr Getachew Gebru, was invited to provide perspectives, during the workshop, on the evolution of the project.

2 Objectives and planned outputs of the workshop

The workshop had three key objectives, namely:

- To share research and experiences on small-scale irrigation and irrigated fodder interventions in Ethiopia.
- To collaboratively prioritize the key constraints to successful and productive small-scale irrigation and irrigated fodder interventions in Ethiopia that the Integrated Decision Support System can help to address.
- To continue and expand participatory consultation with stakeholders to foster dialogue, networking and enhance partnerships.

The main planned workshop output was to produce a consensus based, prioritized list of constraints to successful and productive small-scale irrigation and irrigated fodder interventions in Ethiopia, that the next phase of work with IDSS can focus on with a view to out-scaling small scale irrigation for transformative livelihood benefits in rural communities.

3 Participants

Participants of this latest ILSSI project Stakeholder Consultation Workshop included representatives from relevant agencies of the Government of Ethiopia, research and academia, non-governmental development organizations and donors active in Ethiopia. Please see the full participant list in **Annex 1** for further details.

ILSSI project Ethiopia stakeholder workshop participants, Addis Ababa
Photo: IWMI

4 Workshop proceedings

In advance of the workshop, participants were provided with a brief set of background documents to review in order to further familiarise themselves with the project, its aims and approaches, the IDSS and most importantly the set of constraints, identified through the project, that would be discussed and prioritized during the workshop. These documents included:

- An ILSSI project and IDSS background summary

- An example of the IDSS gap and constraints analysis for small scale irrigation systems developed by, and used in, the ILSSI project
- The rationale and agenda for this workshop

The workshop was split into two main sections (please see the workshop agenda in **Annex 2** for further details) providing opportunities to:

- Share the latest developments, findings and approaches of the ILSSI research project team through presentations from project partners.
- Discuss high potential interventions in small-scale irrigation and irrigated fodder production in Ethiopia, and collaboratively work to prioritize a set of constraints to the adoption and success of these interventions, that represent a synthesis of workshop participant expertise and those identified by the ILSSI project through field work, household surveys and the use of the Integrated Decision Support System (IDSS).

Following a morning of presentations from representatives of TAMU, IWMI, ILRI and IFPRI the second half of the workshop involved a group exercise to collaboratively prioritise the constraints to adoption of small scale irrigation interventions studied in Ethiopia. The objective was to develop a consensus based, prioritized list of constraints to successful and productive small-scale irrigation and irrigated fodder interventions. These will then provide the focus for the next phase of work with IDSS with a view to out-scaling small scale irrigation for transformative livelihood benefits in rural communities in Ethiopia, as well as in Ghana and Tanzania.

4.1 Opening

Mr Amare Haileselassie, interim head of IWMI East Africa and the Nile Basin office, welcomed participants to the workshop and gave a brief summary of how the ILSSI project fits within the portfolio of projects that IWMI is conducting, and a partner of, in East Africa. Mr Haileselassie also introduced Dr Getachew Gebru, External Advisory Committee member for Ethiopia, who said a few words to introduce the ILSSI project and the role of the project's External Advisory Committee.

The facilitator, Thor Windham-Wright, then led workshop participants in a round of introductions followed by a brief review of the workshop agenda and short icebreaker exercise.

4.2 Presentations

Below is a brief summary of each of the presentations given by project partners. Please see **Annex 3** for further details and copies of the full presentation slide decks.

1) Introduction to Feed the Future Innovation Lab for Small Scale Irrigation - Ethiopia

Dr Neville Clarke, ILSSI Project Leader, Texas A&M University, led the first presentation introducing the ILSSI project. Mr Clarke provided a summary of the project's background, funding organisation, objectives, partners and introduced the key research questions that the project aims to address. This was followed by an overview of research conducted by the project partners in each of the three countries to date and details of the research components and methods. Mr Clarke then introduced the stakeholder workshop objectives and intended outcomes.

2) Field level pilot interventions in small-scale irrigation and agricultural water management

Dr Petra Schmitter, Agriculture Water Management Specialist, IWMI, gave a presentation on research conducted by IWMI into field level pilot interventions in small-scale irrigation and agricultural water management, as part of the project. Petra introduced the main activities including: manual and motorized water lifting devices, gender aspects of irrigation, irrigation management, crops, improving groundwater recharge and credit constraints and opportunities. She also introduced the research sites in Ethiopia, local project partners and the IWMI research team. Petra concluded her presentation examining some of the findings on crop productivity, economic water productivity, the technical efficiency of manual water lifting technologies, details of farmer's preferred technologies, and a summary of the constraints to small-scale irrigation in Ethiopia identified to date through IWMI research. The key constraints she identified were:

- One dry season irrigation of vegetables might not be sustainable when using groundwater resources as it exceeds (depending on recharge characteristics of the watershed) the annual groundwater recharge.
- Supplementary irrigation of fodder (e.g. Desho and Oats & Vetch) using groundwater is sustainable.
- The technical efficiency of manual water lifting technologies is different for male and female irrigators. For female irrigators the technical efficiency is lower if the total irrigation volume to be applied, and the crop management, increases.

3) Field Level Pilot Interventions in Small Scale: Fodder Cultivation

Dr Michael Blummel, Operating Project Leader, ILRI, gave a presentation on research by ILRI into field level pilot interventions in small scale fodder cultivation. His presentation examined the cultivation of fodder and forage using irrigation with a focus on improving on farm meat and milk production for improved nutrition and income, evaluating fodder and forage production as a cash crop, and growing forage and fodder using irrigation as a way of diversifying, intensifying and improving the sustainability of small scale farming in Ethiopia.

Michael mentioned that ILRI is partnering (through the ILSSI project in Ethiopia) with the Amhara Regional Agricultural Research Institute (ARARI) and the Southern Agricultural Research Institute (SARI).

Michael's presentation then provided a brief overview of a number of preliminary findings including those from research into: meat and milk from oats-vetch mix, meat and milk from Desho grass, fodder marketing, and fodder water use efficiency. He then went on to outline some of the constraints to adoption of small scale irrigation that have come to light from ILRI's research. Michael concluded with three key initial findings, namely:

- Irrigated fodder is a serious proposition for small scale irrigation in Ethiopia
- Feeding irrigated fodder to a farmer's own livestock is economically attractive where there is genetic potential for a response, particularly in dairy (however there are labor/drudgery issues)
- A value chain approach is required (*feed/fodder value chain*) with attention given to off-farm actors, activities and transactions

4) Small-scale irrigation technologies and agricultural water management practices - analyzing nutrition, health and gender outcomes

Dr Tekie Alemu, an economist from Addis Ababa University and a member of the Association of Ethiopian Microfinance Institutions (AEMFI), gave a presentation, on behalf of IFPRI, on analysis of the impacts, tradeoffs, and synergies of small-scale irrigation technologies on health, nutrition, rural livelihoods, and women’s empowerment. The analysis followed household surveys conducted in the 4 ILSSI intervention villages and 11 control villages, totaling 439 households. Early findings presented by Tekie indicate that:

- Irrigators have 3 times higher income from agriculture
- Irrigators grow more fruits, vegetables, and other cash crops
- The diets of irrigators are slightly more diversified

- Irrigators are less food insecure
- Irrigation vs non-irrigation appears not to make a significant impact in women's empowerment in Ethiopia

Tekie then provided a summary of some of the constraints to the adoption of small-scale irrigation that have been identified through IFPRI's research.

5) Overview of Integrated Decision Support System (IDSS)

Dr Yihun Dile, Research Scientist in the Spatial Sciences Laboratory, Texas A&M University, presented an overview of the IDSS model approach, demonstrating that it is an integration of APEX, SWAT and FARMSIM models. He then went on to present an example of using the IDSS to analyse the Robit Watershed in Ethiopia, and the associated scenarios, results, impacts, crop yields and net present value of using various water lifting technologies for small-scale irrigation.

6) Candidate constraints from research experience and a preview of the constraints analysis method

Dr Yihun Dile then gave a presentation on the candidate constraints identified through the ILSSI project to date, and also on the methods used for constraints analysis. Yihun used the example of research conducted into the Robit watershed of Ethiopia to show how the IDSS is used at the watershed scale to analyse resource and environmental constraints. He included a map of Ethiopia that's been produced showing land suitability for irrigation, details of available water in the Robit watershed, and the impacts of SSI at the watershed scale. He also showed how IDSS can be used to; analyse nutritional and economic constraints at the household level, examine field scale irrigation water management and investigate the impacts of fertilizer use on agricultural productivity.

4.3 Plenary discussion and comments and questions from participants

A number of questions and comments were raised by participants both immediately after each presentation and at the end of the workshop's presentation session. These included:

Comments:

- The research and constraints analysis should take a value chain approach.
- Constraints need to be classified according to: biophysical, social, economic (finance/credit), behavior, and culture, and linked to specific actors.
- There should be a focus on how to scale up irrigation in Ethiopia.
- The research team should consider water conflict (as a constraint).
- The evaporation rate mentioned in the constraints analysis presentation may be exaggerated for the rainy season.
- The costs of irrigation technologies for farmers need to be considered. If it's too expensive farmers just won't use it.
- There is a need to package these findings suitable for development implementers.
- The simulated recharge rate in Robit watershed is high so incorporating this may be risky.
- The sustainability of shallow groundwater use needs to be determined.
- Water pricing is represented well in policy but not in implementation and enforcement.
- There is the potential for conflict over regional development priorities versus national development priorities. Likewise between large scale irrigation and small scale irrigation.
- The high value crops, in terms of economic return from irrigation investment, are not always the crops best for improving nutrition or food security.
- Use of fodder by farmers is different depending on whether they are rearing traditional, indigenous breeds or new, improved breeds. This should be considered in assessing suitability of irrigated fodder.

Questions:

- Was the data sex disaggregated? And did researchers consider male vs female headed households in the surveys? *In response the comment was made that the research considered women's use of technology whether they were from male or female headed households.*
- Did the research team consider upstream/downstream issues and challenges, ie whether and how much water is still available downstream?
- Why was there a big effect on income but a small effect on nutrition? What was the diet baseline?
- Were both surface and subsurface water lifting devices considered?
- Is the project team now able to recommend, to practitioners, specific areas of Ethiopia for irrigation?
- What tools did the research team use or what would they recommend for assessing the sustainability of aquifer abstraction?
- Should the focus be on new irrigation or on improving existing irrigation?
- Where do the elements of risk and risk aversion come in?

4.4 Group work

4.4.1 Group work assignment: prioritization of constraints

Workshop participants were divided at random into 4 groups of around 5-6 individuals. A member of the ILSSI project research team was assigned to each group. Each group was provided with a flipchart and paper, colored cards, pens and guidance on the group work process.

All four groups were then given one and a half hours in which they were asked to:

- Consider from their knowledge and experience what they believe to be the key constraints to small-scale irrigation in Ethiopia.
- Review the list of provisional constraints identified by the ILSSI project and see where the synergies/differences/gaps are (referring to the list of identified constraints on page 4 of project overview document if required)
- Discuss as a group and prioritize these constraints (based primarily on national considerations). Suggested criteria for prioritization include (but are not limited to) those with the:
    - biggest positive development impact
    - least negative environmental impact
    - biggest potential for scaling up
    - greatest opportunities to result in improved productivity and incomes
- Aim for group consensus on the top ten constraints (representing the most appropriate synergy of constraints from a) participant's experience and knowledge, and b) those already identified by the ILSSI project.
- Write the group's top 10 constraints on colour cards (individually) and stick them to the flip chart paper in two groups of five:
    a) top priority
    b) very important but secondary priority
- Choose a representative to present these findings back to all workshop participants in plenary.

The group work sparked energized discussions about what the key constraints to adoption of small-scale irrigation in Ethiopia are, as group members made the case for constraints they felt should be in the top ten and subsequently in the top priority five, based on their expertise, experience and knowledge.

4.4.2 Results of group work

Group 1

Top Priority

- Water and land availability (use and source at all scales)
- Market demand drivers - population/urban, shelf-life of perishable agricultural products, price fluctuations
- Climate and water availability (extreme events)
- Crop vs livestock, inputs vs outputs (intensification)
- Gender and nutrition

Secondary Priority

- Upstream/downstream conflict (quantity and quality of water)
- Community use of source and technologies
- Initial investment (cost) of for lifting and access
- Water and land practices for fodder production (competition with crop production)
- Enhancing and ensuring product value (post harvest storage)

Group 2

Top Priority

- Access to affordable improved seeds, pesticides, fertilizers for irrigated agriculture
- Access to market for high value irrigated crops such as fruit and vegetables
- Availability and accessibility of water (surface and groundwater)
- Access to appropriate, affordable technology options (lifting, storage, application), spare parts and maintenance
- Limited extension support and limited knowledge of irrigation agronomy

Secondary Priority

- Women headed households lose out in water sharing arrangements in communal schemes
- Access to affordable credit
- Female headed households have labour shortages
- Conflict between up-stream and downstream water users for surface water
- Groundwater depletion and over extraction

Group 3

Top Priority

- Access to irrigation water
- Access to irrigation technology (of quality and gender and environmentally friendly)
- Access to microfinance
- Lack of improved livestock breeds
- Irrigation value chain (inputs, cropping calendar, post-harvest and markets, pests and diseases)

Secondary Priority

- Access to information
- Climate and rainfall variability

- Skills and knowledge gaps among farmers and the extension system
- Labor and mechanization
- Policy implementation and enforcement

Group 4

Group 4 chose to focus only on agreeing on the top priority 5 constraints.

Top Priority

- Water: There is plenty of water during the year overall but it is currently scarce between January and June when all available water is being used.
- Market: Without a market irrigation will only be used at the household level.
- Organization: Scaling up of small-scale irrigation is problematic because; no water user associations, instability of infrastructure, no data sharing between regions.
- Knowledge and skills (farmers and experts), access to technology: lack of understanding of how to use irrigation technologies and practices effectively.
- Management: access to technology, access to inputs, improved fertilizers, optimization of water, awareness and information at the local level, lack of meaningful farmer input into irrigation planning, technologies and practices.

Consensus-based consolidated list of top priority constraints

After a representative from each of the four groups presented the group's findings (detailed above) back to all workshop participants, the facilitator asked them to put the cards detailing the 5 top priority constraints from each group onto a whiteboard. The facilitator then led the group in consolidating these 20 constraints. This was done by recognising duplication, or constraints that were very similar, and thereby reducing the total number of top priority constraints to six. These are detailed below. The facilitator then led participants through an exercise to tease out specific elements in each of these six constraints that should be considered in the next round of IDSS modelling, where possible and appropriate. These are likewise detailed below. These six constraints reflect a consensus among the workshop participants on the top priority constraints to the adoption of small-scale irrigation in Ethiopia.

1) Access to markets

- negotiating power (aggregation of individuals or communities)
- market information
- creation of markets and market linkages
- distance to markets
- infrastructure to get produce to market
- post harvest management and processes
- seasonal price fluctuations

2) Water availability and access

- land suitability
- efficiency of water use (economics and biological)
- watershed management and water storage
- upstream/downstream conflict or collaboration
- ration of availability of water to availability of land
- water quality
- technological access
- sustainability of water use

3) Access to appropriate SSI technology and knowledge

- cost effectiveness of technologies
- supply of technologies
- training
- purchase and maintenance of technology
- gender appropriate
- provision of knowledge and opportunities

4) Access to affordable and relevant inputs

- improved seeds
- fertilizer
- tillage tools
- livestock breeds
- access to credit

5) Risks and vulnerabilities

- extreme climate events
- pests and diseases
- crop mortality
- political instability
- availability of appropriate insurance
- water use conflict

6) Institutional issues:

- organization and regulation
- institutional sustainability
- no water user associations
- no data sharing between regions

5 Significance of the workshop

The stakeholder workshop in Addis Ababa succeeded in bringing key national stakeholders together to; a) share research and experiences on small-scale irrigation and irrigated fodder interventions in Ethiopia, b) foster dialogue, networking and enhance partnerships, and c) to collaboratively prioritize the key constraints to successful and productive small-scale irrigation and irrigated fodder interventions in Ethiopia that the Integrated Decision Support System can help to address. The shortlist of constraints identified, discussed and prioritized represents participant consensus (based on local and national knowledge, experience and expertise) on those most appropriate for the next phase of work with the IDSS, with a view to out-scaling small scale irrigation for transformative livelihood benefits in rural communities in Ethiopia.

6 Annex 1: Workshop participant list

Title	Name	Job title	Organisation	Contact details
Mr	Ato Abiti Getaneh Gebremeskel	Director, Research and Development	Ministry of Water, Irrigation and Energy	abitigetaneh@yahoo.com 911670313
Mr	Hailemichael Ayele Wolde	Senior Watershed Management Expert	Ministry of Agriculture and Natural Resources (MoANR)	hailemichael.ayele@gmail.com 911934066
Mr	Elias Awol Mohammed	Director	Small-scale Irrigation Development Directorate, Ministry of Agriculture and Natural Resources (MoANR)	PO.BOX: 73/1056 Addis Ababa Email: awol.elias3@gmail.com MOBILE: +251-931746510
Mr	Dejene Abesha	National Project Coordinator, Participatory SSI Development	Ministry of Agriculture and Natural Resources (MoANR), Rural Development Planning & Programming Directorate	dejeneabesha@yahoo.com 911246267
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Mr	Olani Witru Wakjira	Program Director	iDE-Ethiopia	o.wirtu@ide.org.et 912188792 or 114672906/ 7/8
Ms	Seblewongel Deneke	Director	Gender Program, Agricultural Transformation Agency (ATA)	Seblewongel.deneke@ata.gov.et
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Ms	Bethel Gebremedhin Terefe	Country Coordinator, Ethiopia	IRC Wash	gebremedhin@ircwash.org
Mr	Dubale Admasu	Pastoralist and Livestock Programs Coordinator	USAID/Ethiopia	dadmasu@usaid.gov
Mr	Tibebu Koji Gangesso	Water program coordinator	Oxfam America (Ethiopia)	tkoji@oxfamamerica.org
Mr	Tekie Alemu	Addis Ababa University and AEMFI	Addis Ababa University	tekiealemu@yahoo.com
Dr	Dereje Assefa	Associate Professor	Mekelle University	derejeaa@yahoo.com
Mr	Yibeltal Tiruneh	Irrigation Engineer	FAO	Yibeltal.Tiruneh@fao.org
Mr	Shewadeg Molla	Senior Technical Expert	ATA	shewadeg.molla@ata.gov.et
Dr	Getachew Gebru Tegegn	Animal Sciences Expert	ILSSI External Advisory Committee	ggebru09@gmail.com

Partner Institution representatives

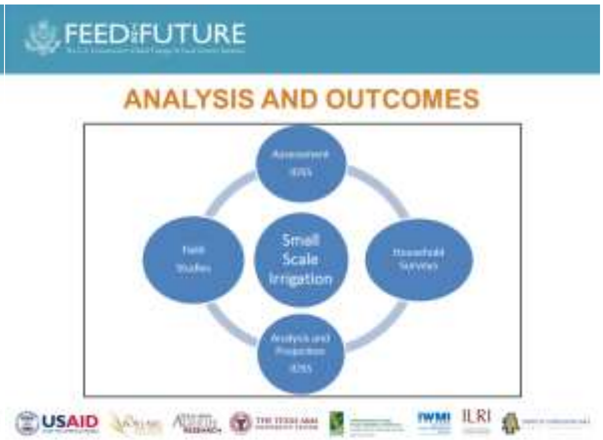
Dr	Gebrehaweria Gebregziabher	Research Economist	IWMI	G.Gebregziabher@cgiar.org
Dr	Petra Schmitter	Agriculture Water Management Specialist	IWMI	p.schmitter@cgiar.org
Mr	Thor Windham-Wright	Workshop facilitator	Independent	thorww@gmail.com
Dr	Michael Blummel	Operating Project Leader	ILRI	m.blummel@cgiar.org
Dr	Aberra Adie	Research Assistant	ILRI	a.adie@cgiar.org
Dr	Tekie Alemu	Economist	Addis Ababa University and Association of Ethiopian Microfinance Institutions (*AEMFI*) (*will present results from IFPRI*)	tekiealemu@yahoo.com
Dr	Yihun Dile	Research scientist in the Spatial Sciences Laboratory	Texas A&M University (TAMU)	yihundile@tamu.edu
Dr	Neville Clarke	ILSSI Project Leader and Special Assistant to The Vice Chancellor	Texas A&M University (TAMU)	Neville.Clarke@ag.tamu.edu
Mr	Matt Stellbauer	Project Manager	Feed the Future Innovation Lab for Small Scale Irrigation	Matt.stellbauer@ag.tamu.edu
Mr	James Ray	Peace Corps Volunteer	Peace Corps Feed the Future	j.ray@cgiar.org

7 Annex 2: Workshop Agenda

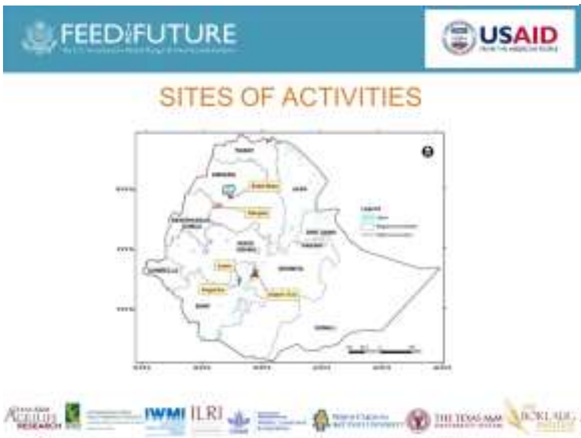
Time	Duration	Activity	Lead person
8.30 - 9.00		Registration	
9.00 - 9.10	10 mins	Welcome – recognize External Advisory Committee member for Ethiopia (Dr Getachew Gebru)	IWMI Head of Office (Ethiopia)
9.10 - 9.20	10 mins	Participant introductions and icebreaker exercise	Thor Windham-Wright, Facilitator
9.20 - 9.30	10 mins	*Presentation:* Overview of the ILSSI project: objectives, partners and activities	Neville Clarke, ILSSI Project Leader and Special Assistant To The Vice Chancellor, TAMU
9.30 - 9.45	15 mins	*Presentation:* Field level pilot interventions in small-scale irrigation and agricultural water management (SSI/AWM)	Petra Schmitter, Researcher - Agricultural Water Management, IWMI
9.45 - 10.00	15 mins	*Presentation:* Field level pilot irrigated fodder and integrating livestock	Aberra Adie, ILRI
10.00 - 10.15	15 mins	*Presentation:* Household level surveys on impacts from SSI/AWM (including gender and nutrition)	Tekie Alemu, representing IFPRI
10:15 – 10:30	15 mins	*Presentation:* Overview of Integrated Decision Support System (IDSS)	Yihun Dile, research scientist in the Spatial Sciences Laboratory, TAMU
10:30 – 11:00	30 mins	Group photo followed by tea/coffee break	
11:00 – 11:30	30 mins	*Presentation:* Candidate constraints from research experience and a preview of the constraints analysis methods	Yihun Dile, TAMU
11:30 – 11:45	15 mins	Q&A on the constraints and the constraints analysis through modelling	Yihun Dile, TAMU and Facilitator
Participants divided into 2-4 groups (depending on total number of participants), supplied with flipcharts, pens and cards in various colours			
11.45 – 12:45	60 mins	*Group Work* Prioritization of constraints to adoption (nationally) of small scale irrigation interventions studied in Amhara, Oromia and SNNPR regions of Ethiopia, for further analysis.	Facilitator
1:00 – 2:00	1 hour	Lunch (time for travel expenses admin.)	
2.00 - 2.15	15 mins	Welcome back, review, icebreaker	Facilitator
2:15 – 2:45	30 mins	Group work continues and finalized	Facilitator
2:45 – 3:15	30 mins	Group representatives present back to plenary	Group reps / facilitator
3:15 - 3.45	30 mins	Consolidate list of prioritized constraints, summarize group work outputs and describe how these will be used for the next steps of the project	Facilitator / Yihun Dile & Neville Clarke, TAMU
3:45 – 4.00	15 mins	Conclusion and thanks, External Advisory Committee – summary/ concluding remarks	Facilitator and Dr Getachew Gebru
	20 mins	tea/coffee break	

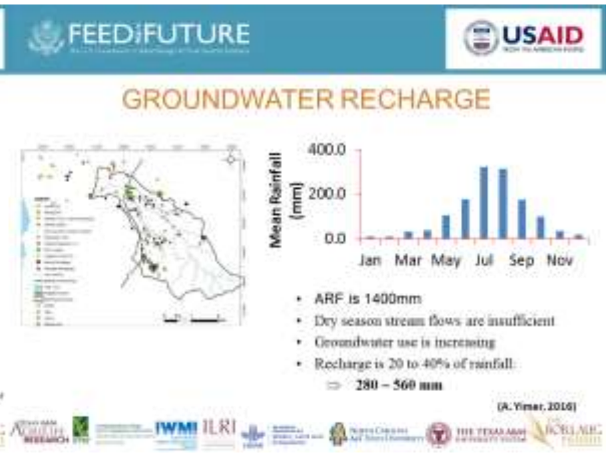
8 Annex 3: Presentation slides

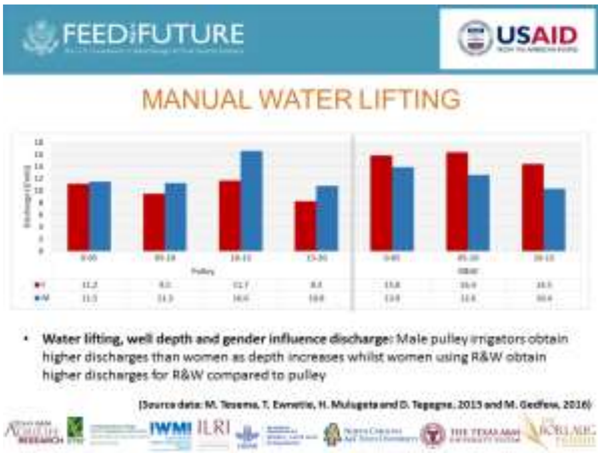
8.1 Presentation 1

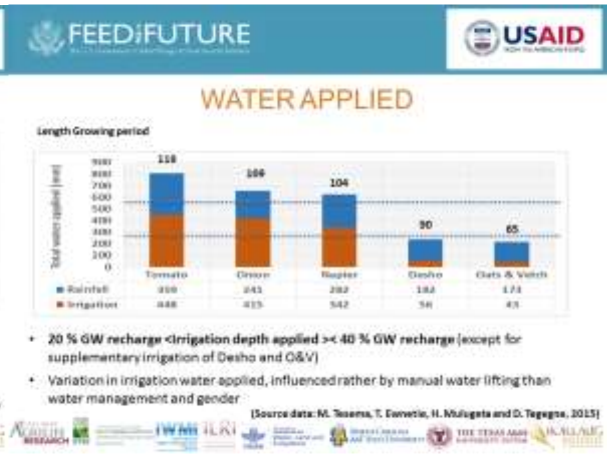


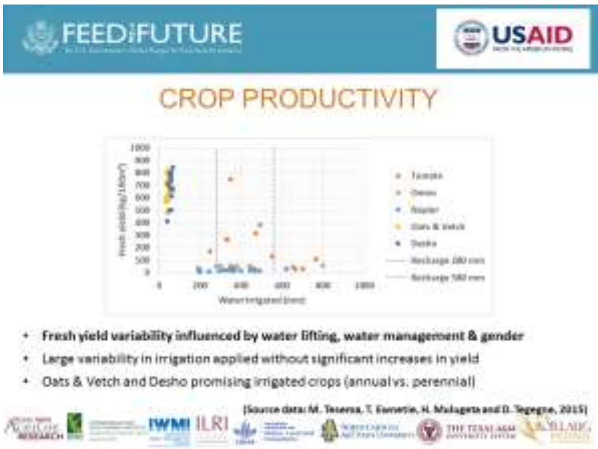
8.2 Presentation 2

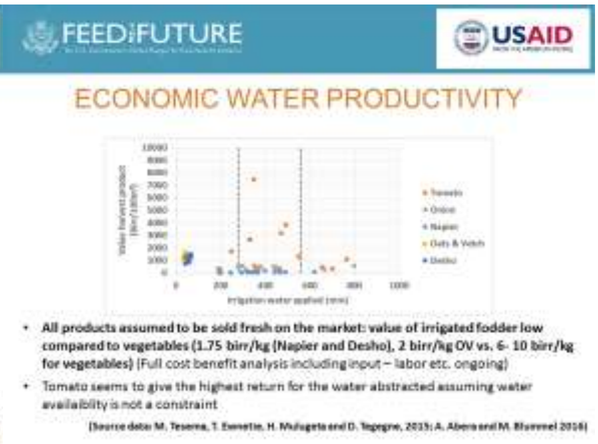


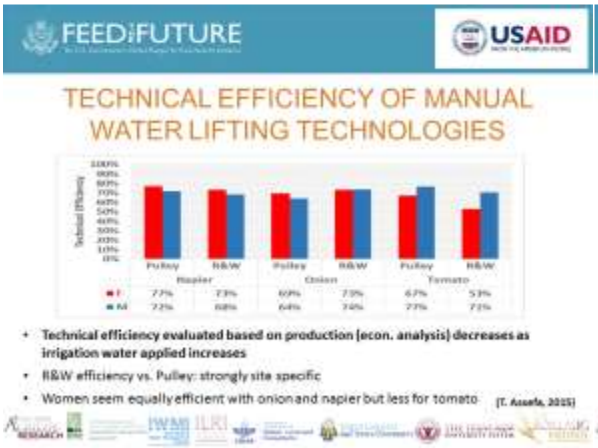


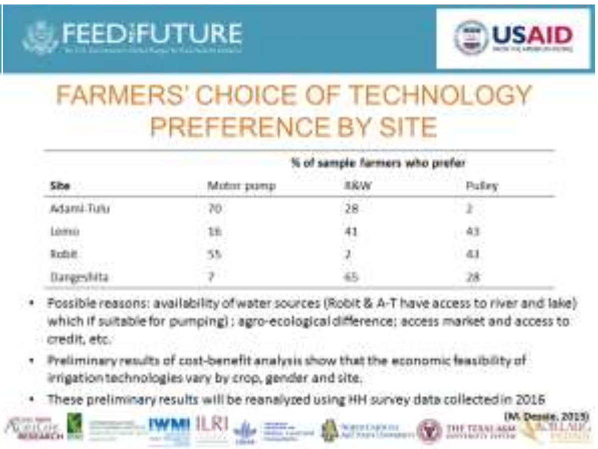




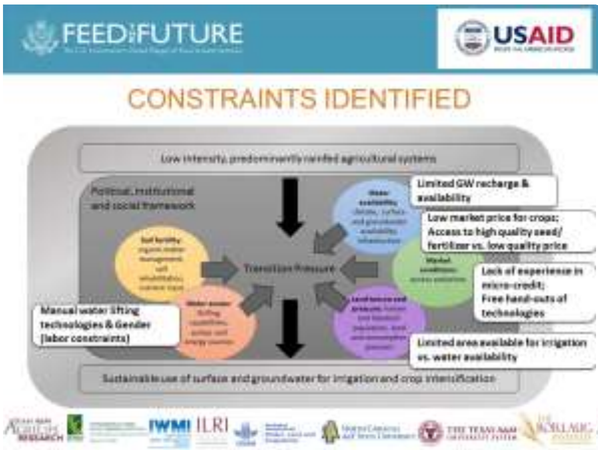








	% of sample farmers who prefer		
Site	Motor pump	R&W	Pulley
Adami Tulu	70	28	2
Lemo	16	41	43
Robit	55	2	43
Dangeshita	7	65	28



8.3 Presentation 3

FEED THE FUTURE

PARTNERS

Amhara Regional Agricultural Research Institute (ARARI)

- A decentralized agricultural research institute for **Amhara regional state**
- Research on crops, livestock, soil & water and socio economics
- Partner with ILRI for implementation of ILSSI's irrigated fodder activities

Southern Agricultural Research Institute (SARI)

- A decentralized agricultural research institute for **Southern regional state**
- Research on crops, livestock, soil & water and socio economics
- Partner with ILRI for implementation of ILSSI's irrigated fodder activities

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EARLY FINDINGS AND LESSONS

- Allocating land and water exclusively for fodder production mostly a new departure
- High demand for fodder and shrinking traditional fodder resources potent driver for new fodder technology adoptions
- Increasing demand for forage planting, more land allocation, more farmer from year 2 to 3
- More attention needed to be given to fodder cultivation as cash crop
- Need for more ex-ante assessments to prioritize interventions

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PRELIMINARY FINDINGS: MEAT AND MILK FROM OATS-VETCH MIX

	Live weight gain (kg)	Milk (kg)
Oats	30.4	185
Vetch	13.2	74
Weed	3.5	21
Total	47	280

Farm gate prices: Milk: 11-13 Birr/kg; Meat: 29-49 Birr/kg; Mutton: 56-100 Birr/kg

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PRELIMINARY FINDINGS: MEAT AND MILK FROM DESHO GRASS

	Live weight gain (kg)	Milk (kg)
Desho	24.5	163

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PRELIMINARY FINDINGS: FODDER MARKETING

Desho prices for supplier: 1.5 – 2.0 Birr/kg

Fresh Desho average farm yield: 677kg /cut/100m²

Land rent value for grass to produce hay: > 30 000 Birr/ha

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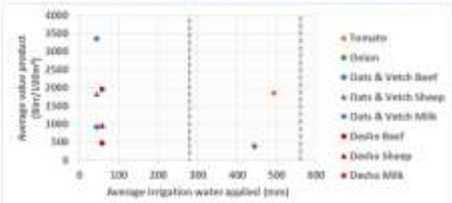
PRELIMINARY FINDINGS: FODDER WATER USE EFFICIENCY



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IWMI-ILRI preliminary data synthesis

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CONSTRAINTS IDENTIFIED

- Intensification/market orientation in an environment just getting prepared for it
- Opportunistic and generally very diverse forage management options make defined entry variables into IDSS difficult (build representative scenario?)
- Interactive mix between biophysical and socio economic constraints
- Many required socio-economic parameter and variables need still to be obtained

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CONCLUSIONS

- Irrigated fodder is a serious proposition for small scale irrigation
- Feeding to own livestock economically attractive where genetic potential for response, particularly in dairy (however labor/drudgery issues!)
- Value chain approach required (*feed/fodder value chain*) with attention given to off-farm actors, activities and transactions

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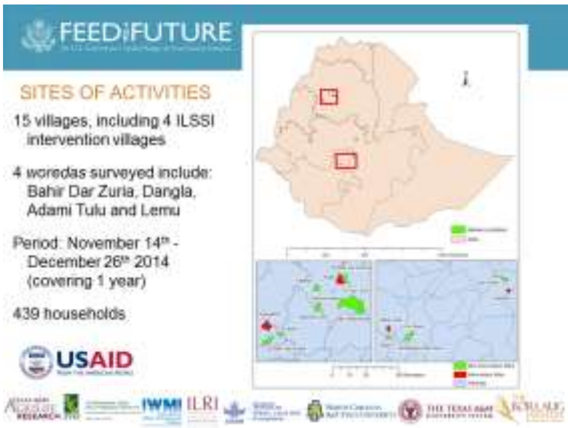
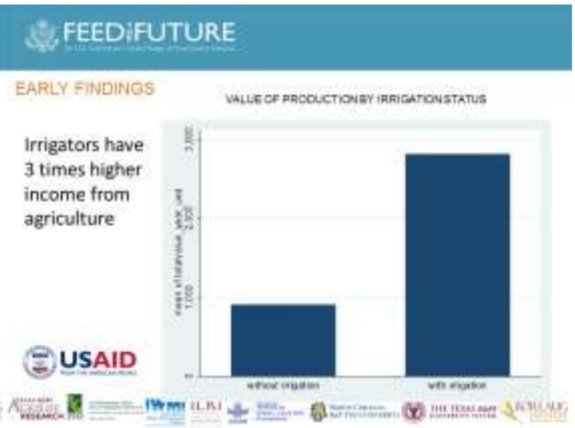
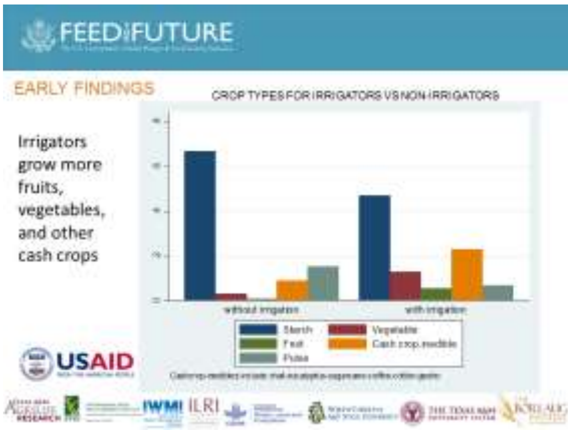
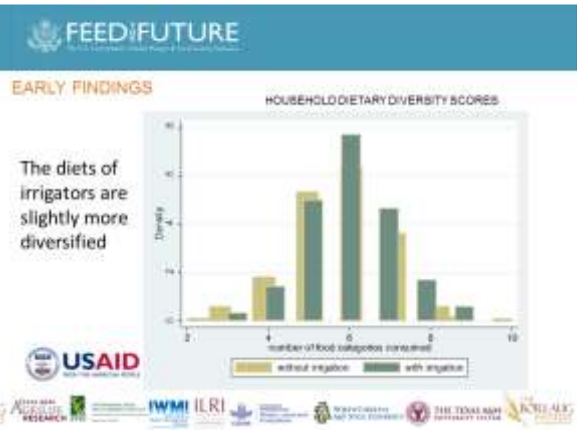
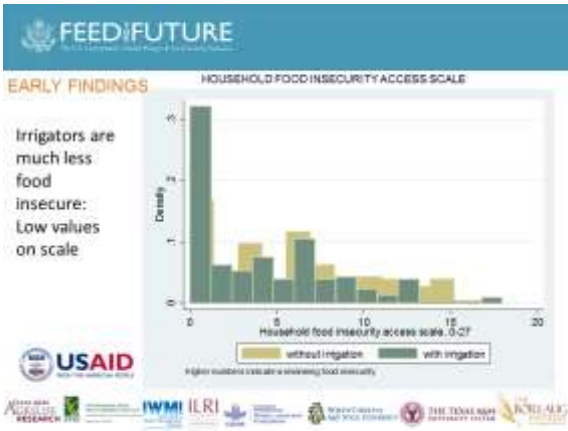
8.4 Presentation 4

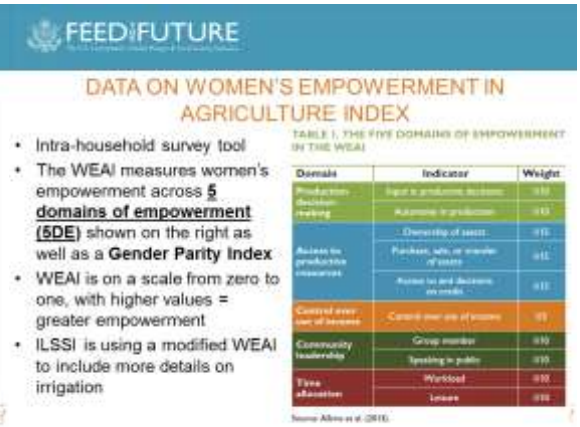












FEED THE FUTURE

EARLY FINDINGS

Irrigators have lower WEAI scores than non-irrigators, which suggests that irrigation is not contributing to women's empowerment in Ethiopia in the baseline

INITIAL RESULTS OF WOMEN-EMPOWERMENT-IN-AGRICULTURE INDEX (WEAI)

WEAI	Irrigators	Gender Parity Index	Non-irrigators	Gender Parity Index	Contributors to disempowerment
Ethiopia	0.82	0.90	0.85	0.91	• Group membership • Leisure time • Speaking in public • Credit access • Control over use of income

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CONSTRAINTS IDENTIFIED: PRELIMINARY ANALYSIS

Irrigators are closer to markets, major rivers and surface water bodies; with irrigated fields located near the homestead and at lower levels of elevation

Variable	Without irrigation	With irrigation	Difference
Average distance to market where crops are sold in minutes	57.21	48.83	-8.377**
	[3.19]	[2.63]	[4.167]
Observations	162	252	414
Average distance to surface water in km	4.71	4.09	-0.625*
	[0.27]	[0.21]	[0.334]
Average distance to major rivers in km	23.81	18.25	-5.565***
	[1.28]	[1.05]	[1.642]
Average depth of ground water in meters	25.62	24.37	-1.255
	[1.69]	[1.31]	[2.107]
Mean elevation in meters	1959.76	1904.15	-55.609***
	[16.49]	[11.66]	[19.614]
Average distance from homestead to plots	3.5	2.61	-0.895***
	[0.15]	[0.14]	[0.207]
Observations	185	254	439

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CONSTRAINTS IDENTIFIED: PRELIMINARY ANALYSIS

- Irrigators are closer to markets: suggesting the need to further explore market access for produce and inputs as a constraint for adoption of irrigation technologies
- Irrigators are closer to major rivers and access surface water bodies: physical access to water as a constraint
- Irrigated plots are closer to homesteads: need to further explore the labor and managerial requirements of irrigation compared to rainfed agriculture as a potential constraint
- There is no statistically significant difference in the availability of groundwater between irrigators and non-irrigators

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CONCLUSIONS

Baseline data shows that compared to non-irrigators, irrigators:

- Earn about 3 times more from agricultural production
- Produce less cereals but more fruits, vegetables, and other cash crops
- Eat slightly more diversified diet
- Are less food insecure
- Don't necessarily have higher women empowerment score
- Are closer to markets, major rivers and surface water bodies

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NEXT STEPS

- However, these results are at best, suggestive, and further in-depth analysis is currently being undertaken.
- With the second round of the survey scheduled for end of 2016, we will be able to make stronger causal statements on the linkages between irrigation, nutrition, health, and gender outcomes; as well as the major constraints hindering access to irrigation.

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GENDER-IRRIGATION TECHNICAL WORKSHOP SERIES

- **Three technical workshops** were organized with IWMI and national partners in Ethiopia (March 9-10), Ghana (April 13-14), and Tanzania (April 20-21)
- **Training and knowledge exchange:** gender training from IFPRI/IWMI and interactive presentations/case studies from government, NGOs, researchers, donors, and private sector sharing lessons learned on gender in irrigation interventions
- **Focus:** how to consider gender dynamics in various irrigation schemes for smallholder farmers (e.g. household irrigation, multiple use systems, small-scale, large-scale/PPP) and at different project stages (e.g. project design, M&E, impact evaluation)
- **Outputs:** validated, elaborated set of gender indicators for the irrigation sector
- **Resources** from the workshop available here

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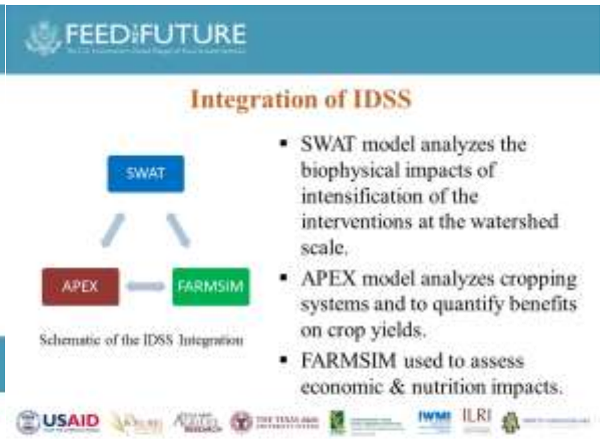
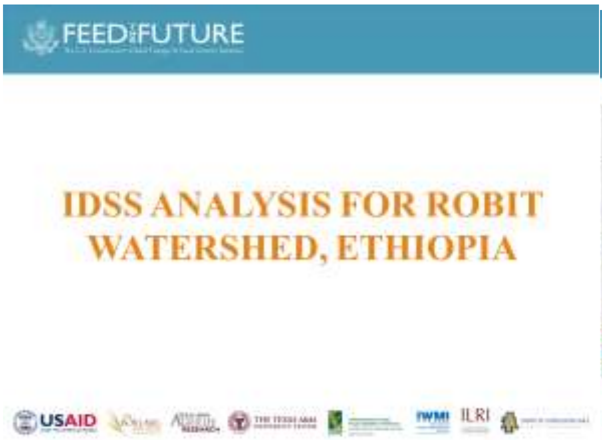
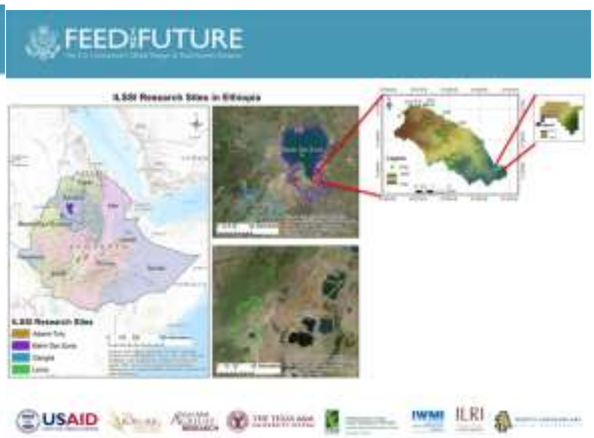
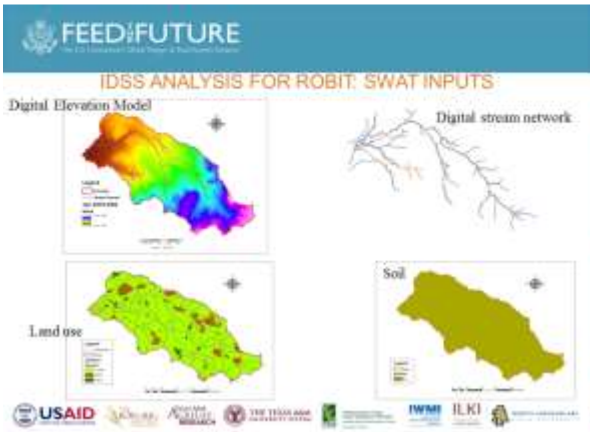
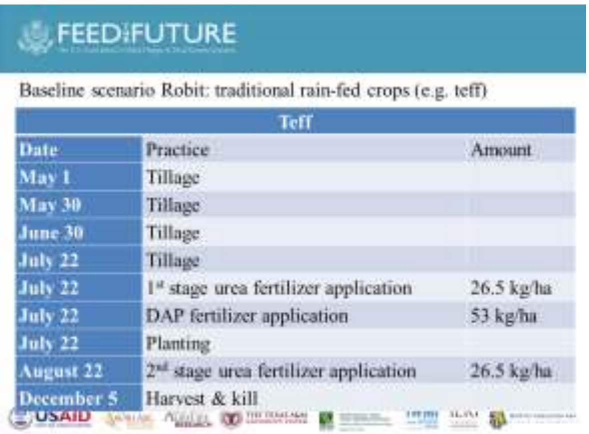
8.5 Presentation 5



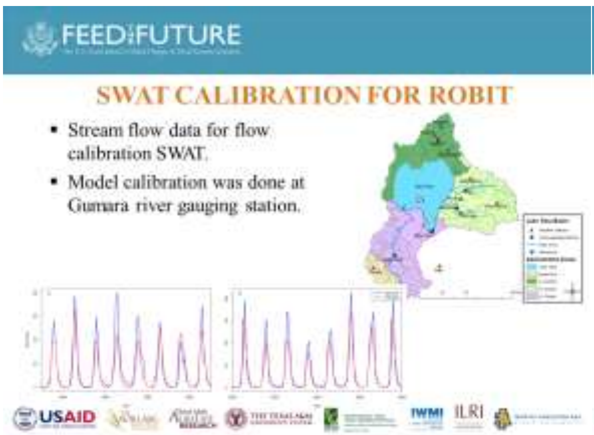


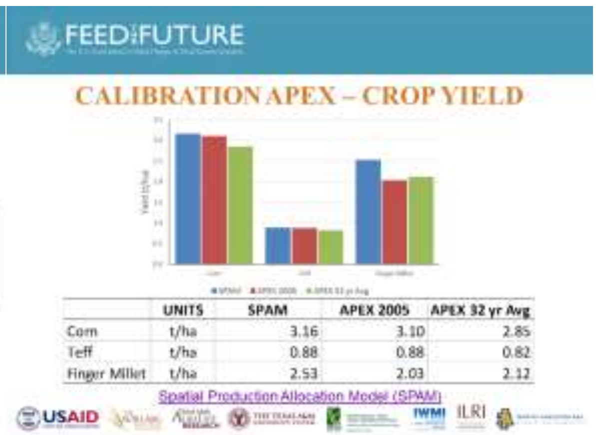






Teff		
Date	Practice	Amount
May 1	Tillage	
May 30	Tillage	
June 30	Tillage	
July 22	Tillage	
July 22	1st stage urea fertilizer application	26.5 kg/ha
July 22	DAP fertilizer application	53 kg/ha
July 22	Planting	
August 22	2nd stage urea fertilizer application	26.5 kg/ha
December 5	Harvest & kill	





	UNITS	SPAM	APEX 2005	APEX 32 yr Avg
Corn	t/ha	3.16	3.10	2.85
Teff	t/ha	0.88	0.88	0.82
Finger Millet	t/ha	2.53	2.03	2.12


FEED THE FUTURE
STUDIED SCENARIOS
Double cropping of onion production using irrigation water from shallow groundwater aquifer and rainfed crops
Different Fertilizer scenarios and tillage practices
Water lifting technologies:
Pulley/bucket
Rope pump operated by hand
Rope pump operated by animal power
Motor pump
Solar pump
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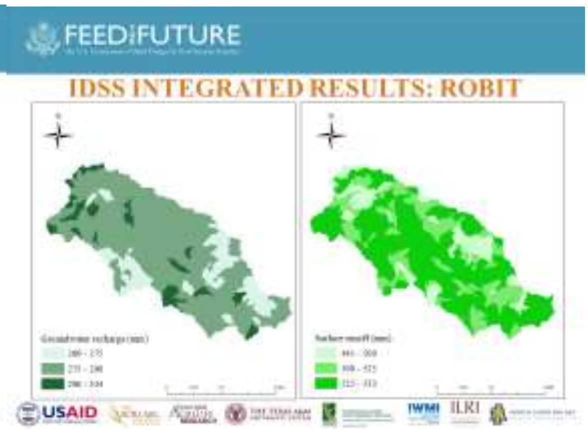
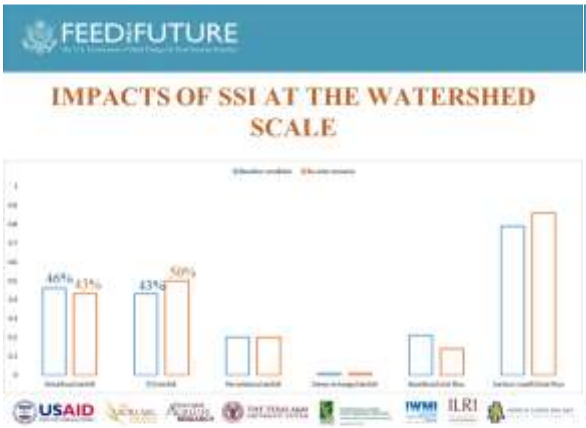
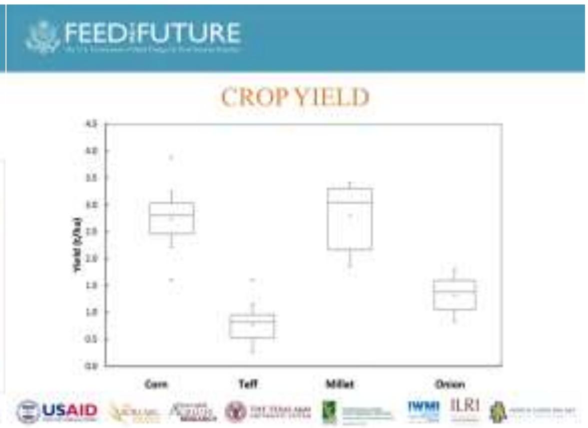
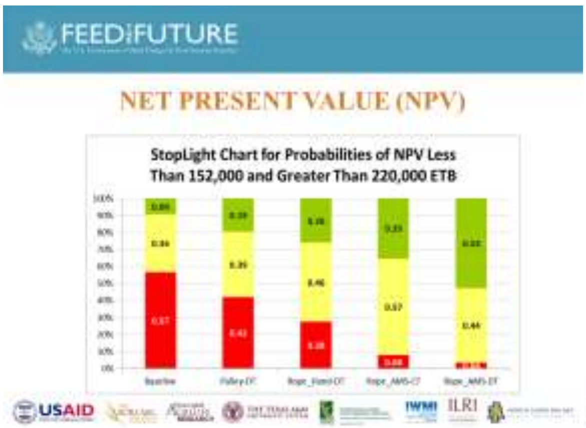

FEED THE FUTURE
IDSS INTEGRATED RESULTS: ROBIT
USAID
IWMI
ILRI


FEED THE FUTURE
IMPACTS OF SSI AT THE WATERSHED SCALE
46%
43%
43%
50%
USAID
IWMI
ILRI


FEED THE FUTURE
CROP YIELD
Yield (t/ha)
Corn
Teff
Millet
Onion
USAID
IWMI
ILRI


FEED THE FUTURE
NET PRESENT VALUE (NPV)
StopLight Chart for Probabilities of NPV Less Than 152,000 and Greater Than 220,000 ETB
USAID
IWMI
ILRI


USAID
FEED THE FUTURE
Conclusions with the IDSS analysis in Robit
There is huge water resources potential in the Robit watershed. The average annual irrigation was ~40% of the annual shallow groundwater recharge.
An additional onion production of about ~1.5 ton/ha was produced using irrigation from shallow groundwater.
Use of rope pump operated by animal power was the preferred water lifting technology – less maintenance cost and affordable.
The IDSS can assess most of the common horticultural and agronomic crops and technologies.
IWMI
ILRI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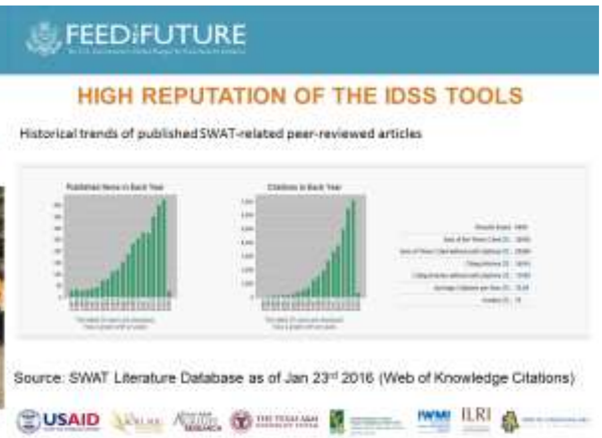
CAPACITY BUILDING
Year | Ethiopia: Males Females Total | Tanzania: Males Females Total | Ghana: Males Females Total
2014 52 5 57
2015 68 8 76 66 8 74
2016 95 9 104 27 11 38 65 6 71
382+
USAID
IWMI
ILRI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HIGH REPUTATION OF THE IDSS TOOLS
Historical trends of published SWAT-related peer-reviewed articles
Source: SWAT Literature Database as of Jan 23rd 2016 (Web of Knowledge Citations)
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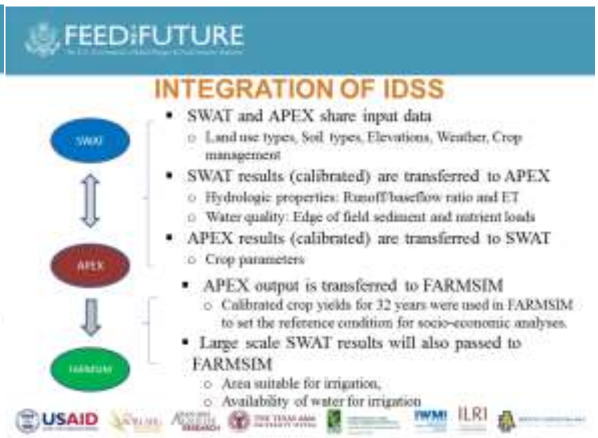

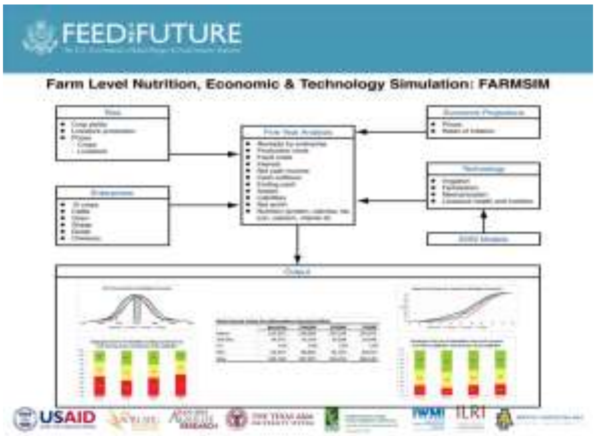

8.6 Presentation 6

FEED THE FUTURE

Gap and constraint analysis

- The following presentation is an **example** of how the IDSS will be used for constraint and gap analysis
- The example involves only a watershed scale assessment – the full analysis is at larger scales
- The highest priority constraints identified by stakeholders will be analyzed using this method
- Initial results will be developed by October 2016.

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Candidate Constraints and Gaps from Research

- Constraints and gaps are factors that limit the use of small scale irrigation.
- Candidate list of identified constraints and gaps:
  - Low land area/land availability per capita
  - Land ownership vs. rental
  - Costs related to water access
  - Access to seeds for agricultural intensification
  - Access to fertilizer for agricultural intensification
  - Water lifting technology access (market, prices, export, tax, interest/discount rates)
  - Labor requirements/costs
  - Micro-finance access for irrigation technologies and inputs (fertilizer, seeds)
  - Access to market for products (vegetables, fodder, livestock)
  - Energy cost
  - High numbers of low producing livestock
  - Low levels of mechanization
  - Gender sensitive evaluation of all the constraints mentioned above

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Gap and constraint analysis

- IDSS was used to assess the gaps and constraints on the **production**, **economic**, and **environmental** consequences of the interventions at multiple scales
  - SWAT model was used to study the ***environmental gaps and constraints*** of the use of SSI at the **watershed scale**.
  - APEX model was used to assess the ***resource constraints and knowledge gaps*** preventing optimum agricultural production at the **field scale**.
  - FarmSIM model was used to assess the ***economic and nutritional gaps and constraints*** at the **household level**.
- Alternative mitigations for the identified gaps and constraints were also discussed.

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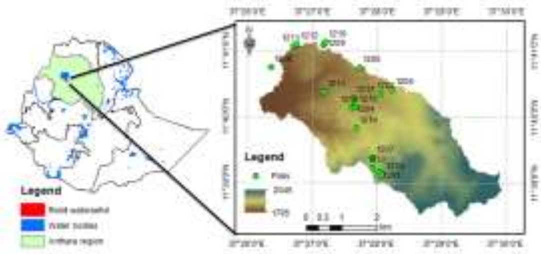
Robit watershed case study



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Watershed-scale analysis of resource and environmental constraints

- **Suitability of an area for irrigation and availability of water** were studied using the SWAT model based on:
  - Land use type
  - soil characteristics
  - land slopes within the watershed
- SWAT simulates the Small-Scale Irrigation (SSI) interventions and evaluates their **environmental impacts** and **availability of water** resources at different sources (surface *vs* groundwater) at the watershed scale.

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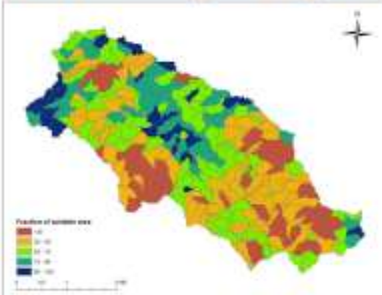
Land suitability for irrigation – Robit watershed



- ~50% of the watershed (1,506 ha) is suitable for irrigation.
- Major rainfed crops were maize, teff and finger millet.
- Dry season irrigated crops were tomato and onion (others can be considered also)

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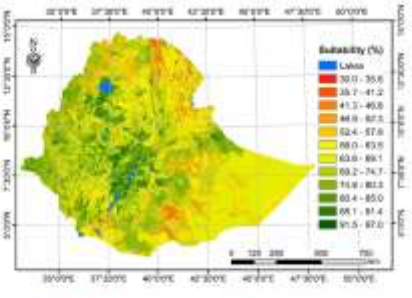
Land suitability for irrigation – Ethiopia

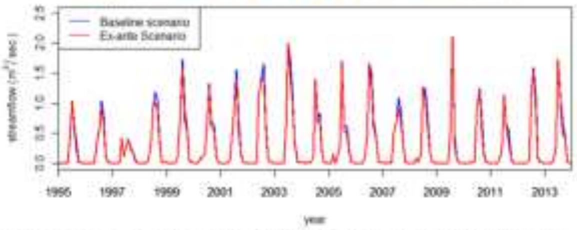


- Factors considered in the analysis were:
  - Land use
  - Soil
  - Slope map
  - Evaporation
  - Rainfall
  - Population density
  - Road network
- The suitable areas account 5% of the land mass (60,000 km²)

Available water resources in Robit Watershed

- Average annual rainfall = 1,400 mm
  - Average annual groundwater recharge = 280 mm (~4,000,000 m³ over the watershed or 20% of the rainfall)
  - Average annual surface runoff = 520 mm (~7,000,000 m³ over the watershed or 37% of the rainfall)
- Amount of water required for dry season irrigation for tomato = 1,500,000 m³
  - ~40% of the **groundwater recharge**
- At the watershed scale, groundwater recharge can support irrigation for vegetables (in suitable areas) in a sustainable manner.

Impacts of SSI at the watershed scale



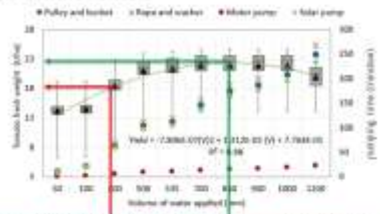
- The average monthly stream flow at the outlet of the Robit watershed reduced by ~6%, minor reductions in high flows.
- No major environmental impact such as erosion due to SSI was observed.

Field-scale analysis of resource constraints

- The APEX model was used to identify major resource constraints using tomato as a case study crop.
- The analysis was centered on **water and nutrient availability/limitation** for tomato production.
- Where available the analysis used the field studies and survey data

Field-scale irrigation water management

Water production function



Avg. annual groundwater recharge = 280 mm 570 mm of irrigation + 270 mm rainfall

Thus, groundwater recharge alone will not provide maximum crop yield at the field-scale.

Fertilizer use

- Current fertilizer application rates are lower than rates recommended by the Ethiopian Agricultural Research Institute (EARI).
- Only 30-40% of smallholders use fertilizer.
- Lower applications of fertilizer inputs kept agricultural production and productivity low.
- However, there is an increasing trend in fertilizer use.

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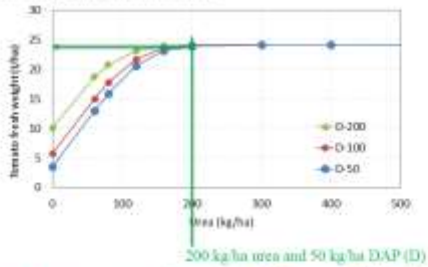
Fertilizer use

Fertilizer production function



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Household-scale analysis of economic and nutritional constraints

- FarmSIM model used information on **costs of agricultural inputs** and **irrigation equipment**, and **capacities of water lifting technologies** (WLTs) and corresponding **labor** to evaluate the economic and nutrition benefits of adopting SSI technologies.
- The WLTs evaluated include:
  - pulley and bucket
  - rope-and-washer pump
  - motor pump, and
  - solar pump
- Based on field data and simulation results from the APEX each WLT was evaluated as to its capacity to pump enough irrigation water to cover the total potential irrigable land.

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Economic gaps and constraints

Table: Water lifting technologies (WLT)

Types of WLT	Operated by	Flow rate (l/min)	Cost WLT (Birr)	Issues/Constraints
Pulley/bucket	Hand	15	1310	require more labor
Rope and washer pump	Hand	14	3700	frequent breakdowns
Motor pump	Fuel	170	8500	high maintenance costs
Solar pump	Solar	16	16000	high capital costs

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Economic gaps and constraints

- FarmSIM analysis was divided into two case studies:
  - low irrigation labor cost, and
  - high irrigation labor cost (3X low cost category).
- The labor was split between hired and family labor to reduce the costs (forgoing the opportunity cost)

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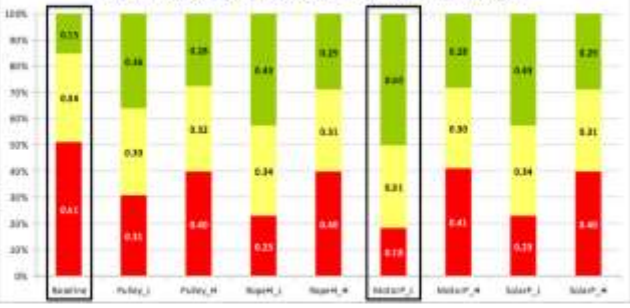
Economic comparison of the different technologies

StopLight Chart for Probabilities of Net Cash Farm Income (NCFI) Less Than 13,000 and Greater Than 22,000 ETB in Year 3



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Studied constraints and gaps of the candidate list
- Land ownership vs. rental (*value for land leased/rented accounted*)
- Costs related to water access (e.g. digging for wells, etc)
- Water lifting technology access (*access limited for solar pumps*)
- Labor requirements/costs
- Micro-finance access for irrigation technologies and inputs (*40% households received loan access, IFPRI survey 2013*)
- Energy cost
- Access to fertilizer for agricultural intensification in the irrigation season

Partially studied constraints and gaps of the partial list
- Low land area/land availability per capita

Constraints and gaps of the candidate list not yet studied
- Access to seeds for agricultural intensification
- Access to market for products (vegetables, fodder, livestock)
- High numbers of low producing livestock
- Low levels of mechanization
- Gender sensitive evaluation of all the constraints mentioned above

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Example of mitigation of constraints and identification of gaps

- Groundwater recharge can support irrigation water requirement at the watershed-scale, but not at field scale.
  - ➢ Locally available **surface runoff could be harvested** and used to support the irrigation water from shallow ground water.
  - ➢ It will also **reduce any potential environmental effects** since the surface runoff is harvested during high rainfall season.

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Example of mitigation of constraints and identification of gaps

- Low soil fertility, coupled with ineffective management practices (e.g. water and nutrient), is significant constraint to SSI.
  - ➢ application of rates of irrigation and fertilizers that provides the best combination of production, environmental and economic outcomes.

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Example of mitigation of constraints and identification of gaps

- high irrigation labor costs are a significant constraint on the profitability of irrigated tomato production and sale in Robit.
  - ➢ use of family labor and less labor-intensive irrigation methods (e.g. drip irrigation) may reduce labor costs.
  - ➢ proper training on the operation and maintenance of new WLTs can save resources.
  - ➢ policy changes to encourage smooth transition into environmentally friendly technologies (e.g. solar pumps).

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Conclusion

- The ability to concurrently assess the production, economic, and environmental consequences of the interventions provides a new, integrated capacity to analyze and inform strategies and specific applications.
- Constraints and gaps were studied based on field experience (and ex-ante analysis) and corresponding mitigation strategies were proposed.
- This example shows how the IDSS will be used in subsequent constraint and gaps analysis identified by this committee.

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Way forward

- We seek your help on identifying and prioritizing opportunities and constraints that apply to SSI interventions for further IDSS analysis.
- A range of scenarios will be studied to show how the constraints can be mitigated and by how much?
- Optimum solutions that consider production, environmental and economic consequences will be looked for.

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Field-scale irrigation management

- Droughts and rainfall variability keep the agricultural production very low in Ethiopia and sub-Saharan Africa.
- The duration of the rainy season was about **three months** that farmers cultivate only once in a year.
- APEX model was used to assess **water and nutrients requirement** for tomato production during dry season using various **irrigation pumping technology tested at the field studies** and amount of **labor and time** required for irrigation.

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Constraints and gaps of the partial list (greens are studied, yellow partially studied, and grays not studied)

- *Low land area/land availability per capita*
- **Land ownership vs. rental** (*value for land leased/rented accounted*)
- **Costs related to water access** (e.g. digging for wells, etc)
- Access to seeds for agricultural intensification
- **Access to fertilizer for agricultural intensification in the irrigation season**
- **Water lifting technology access** (*access limited for solar pumps*)
- **Labor requirements/costs**
- **Micro-finance access for irrigation technologies and inputs** (*40% households received loan access, IFPRI survey 2015*)
- Access to market for products (vegetables, fodder, livestock)
- **Energy cost**
- High numbers of low producing livestock
- Low levels of mechanization
- Gender sensitive evaluation of all the constraints mentioned above

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Economic gaps and constraints

- Constraints related to WLTs include labor, maintenance, and capital costs, as well as equipment breakdowns.

Table: Water lifting technologies (WLT)

Types of WLT	Operated by	Flow rate (l/min)	Cost WLT (Birr)	Issues/Constraints
Pulley/bucket	Hand	15	1310	require more labor
Rope and washer pump	Hand	14	3700	frequent breakdowns
Motor pump	Fuel	170	8500	high maintenance costs
Solar pump	Solar	16	16000	high capital costs

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9 Annex 4: Workshop evaluation

At the end of the workshop participants were asked to fill in a brief, 1-page workshop evaluation questionnaire (18 questions) focusing on both the workshop content and the workshop process. Overall the responses were positive with a few respondents saying they would have liked a bit more time for presentations, group work and Q&A.

Results:

Workshop content	**Agree**	**Strongly Agree**
I clearly understand the aims and work of the ILSSI project	20%	80%
I clearly understand the component contributions of each of the project partners	50%	50%
I clearly understand how the IDSS is supporting the overall objectives of the project	50%	50%
The constraints identified for prioritization were the right ones for the Ethiopian context	40%	60%
The workshop provided a good opportunity to share research and experiences on small-scale irrigation and irrigated fodder interventions in Ethiopia	50%	50%
I would like to be kept informed of further ILSSI project work and developments	40%	60%
I am happy to be involved in future ILSSI project stakeholder engagement activities	20%	80%

Workshop process	**Disagree**	**Agree**	**Strongly Agree**
There was a good balance between presentations and group work		80%	20%
I would have liked more time for the group work	20%	60%	20%
I would have liked more time for the presentations	20%	60%	20%
I clearly understood what was being asked of the participants		70%	30%
There was enough time for discussion		70%	30%
There was enough time for Q&A	10%	70%	20%
The workshop was the right length for the content		70%	30%
I found the workshop a useful learning and information sharing experience		60%	40%
The information materials provided before and during the workshop were relevant and useful		70%	30%
Communication about the workshop was clear and well timed		60%	40%

In response to the question *'What would you like more information about in any follow up from the ILSSI project team?'* respondents replied:

- reports and research findings
- field experiences and outcomes of the modelling
- details of actual changes taking place and the challenges involved