

Semi Annual Report
April 1 – September 30, 2014

I. Feed the Future Innovation Lab on Small Scale Irrigation in Ethiopia, Tanzania and Ghana

II. Research Progress Summary

Year one of this project was focused on stakeholder engagement and planning and included three major meetings. Initial focus was on Ethiopia but stakeholder meetings and engagement with national partners occurred in all countries. Detailed plans on innovations and locations of field research and related surveys and sub contracts with national partners in Ethiopia were completed. Field research is being initiated in the fall of 2014 as a result of these engagements. The Integrated Decision Support System (IDSS) was employed in an early assessment of small scale irrigation in the Jeldu area of Ethiopia to develop and demonstrate the linkages between field research, related natural resources databases and the IDSS modeling system. A week-long training workshop on the IDSS was held in Addis Ababa in June with 65 participants, including students, researchers, and private sector participants. An external advisory committee was established and actively participated in the annual meeting for stakeholders in June. These results are important because they set the stage for implementation of the overall plan for the ILSSI. Plans done in year one will establish and set in motion the activities needed to implement the overall ILSSI strategy. Successful engagement with stakeholders in three countries ensures a demand driven agenda. Agreements with national university partners and in turn with local government and farmers provide the details for initiating field research. Training workshops on the IDSS initiate a process for sustainable delivery and use of the methods after this project is completed.

A. Research progress made during reporting period

Component 0: Plan, coordinate, and organize multi-institutional activities. This component is designed to plan and coordinate activities among the five partner institutions, Texas A&M AgriLife Research (TAMAR), International Water Management Institute (IWMI), the International Food Policy Research Institute (IFPRI), the International Livestock Research Institute (ILRI), and North Carolina A&T State University (NCA&T), as well as coordination with national collaborating institutions (Activity 0.1.5). TAMAR has primary responsibility for Component 0, but it must work closely with the other partners, who have primary responsibilities in the areas of data acquisition needed to implement the Integrated Decision Support System (IDSS) and develop agreements with collaborating national organizations (Activity 0.1.4).

The EAC held its first meeting in advance of the annual meeting in Addis Ababa in June 2014 with four of the five members. The committee members were active participants in the ensuing annual stakeholder meetings and provided their advice in a post-meeting session with the Program Management Committee and later in their written comments. After the meeting, the EAC was asked to comment on the overall structure of the agreement and on the plans for year two. In general, the committee was enthusiastic about the ILSSI agenda; they urged continuing stakeholder engagement, and they felt the agenda for year two was on target but they thought the scope of work was challenging.

The Program Management Committee of ILSSI met a third time in June 2014 to review progress and make additional plans for interventions and locations for field trials with emphasis on Ethiopia as the pilot country. A format for detailed experimental design was developed. These plans established the innovations and locations for field research in Ethiopia, related surveys and ex ante analysis of the impact of innovations in an area surrounding the field test sites.

The stakeholder meetings for Tanzania held in August 2014 were well attended with farmers, university collaborators, government officials and USAID staff. The desk paper prepared by Sokoine Agricultural University (SUA) was reviewed and formed the basis of discussions that helped define interventions to be studied in Tanzania. The draft report for this meeting is being finalized. SUA has proposed options for innovations and sites for field research which they will undertake under a sub-award from IWMI. These are being finalized and the contract with SUA is being negotiated.

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Detailed planning and related subcontracts with national university partners have been completed in Ethiopia and are well underway in Tanzania. University partners and their students will be the main linkages to farmers selected for participation in the field studies. Protocols for engagement, data collection, and reporting are in place. Linkages between these detailed experimental designs and the related ex ante analyses to be done with the IDSS are firmly established and communication channels have been established for the ongoing flow of information as field studies and analyses concurrently emerge.

In September, Simon Langan and Prossie Nakawuka from IWMI met with the Texas A&M IDSS team in College Station, Texas, to continue detailed planning of the ILSSI component parts and the integrated product. In addition, Drs. Nakawuka and Tracy Baker attended training on IDSS at Texas A&M. The following week, Drs. Langan and Clarke met with IFPRI scientists in Washington to solidify the ILSSI engagements involving this group. Detailed discussions were conducted on the location of field tests and survey sites; on the experimental design for the survey and their relatively independent product from the farm scale studies; and on the interaction between IFPRI's SPAM and DREAM models and the IDSS FARMSIM model. As a result of the latter, in-depth meetings between IFPRI and IDSS teams will be held in October 2014 to solidify the details of the joint modeling effort. Following these meetings, it was agreed that monthly Skype calls would be held for the Program Management Committee (PMC) to maintain close coordination as field studies, surveys, and IDSS analyses get underway. It was agreed that the next face-to-face meeting of the PMC will be held in February, 2015 in conjunction with the IDSS training workshop to be held in Bahir Dar, Ethiopia.

The schedule of activities for ILSSI in year two was modified in response to the following. (1) The uncertainty associated with the Ebola outbreak in West Africa and its possible impact on Ghana. While no outbreaks are known to have occurred, Ghana has restricted international meetings and some ILSSI partners are advised by their administration to avoid travel to Ghana unless it is mission critical. (2) The progress made in Tanzania with the stakeholders conference and the very responsive planning by SUA makes it possible to accelerate the schedule for Tanzania. Accordingly, the plan is now to initiate survey and field studies in Ethiopia in the fall of 2014. Ex ante IDSS studies will also be initiated in the fall of 2014 and the IDSS training workshop will be held in February 2015. The plan is to complete detailed experimental design in Tanzania in February and to initiate ex ante analyses of the innovations at selections locations in the spring of 2015. In keeping with seasonal planting dates, field studies will be initiated in Tanzania in June of 2015 and the IDSS training workshop is planned for August of 2015.

The plans for Ghana are currently tentative. The Ebola situation will be evaluated continuously over the next two months and proceed prudently. If possible, selection of innovations and field test sites will be completed in February 2015; field experiments will be initiated in August-September; the first round of ex ante analyses of innovations in areas surrounding the field sites will be completed in October 2015 and the first IDSS training workshop will be held in November 2015.

A seminar entitled "ILSSI – From Plan to Action" was presented by Simon Langan and Neville Clarke to the USAID Bureau of Food Security September 15, 2014, along with individual meetings with key leadership in the Bureau. This was followed by a meeting of the FtF Innovation Lab Directors which provided an excellent overview of the entire portfolio and opportunities for planning cooperation and collaboration between ILSSI and other labs. In particular, the Human Nutrition and Horticulture labs offer promising opportunities. Meetings with staff of the two Texas U.S. Senators were held involving key BFS leadership, the chair of BIFAD and Neville Clarke. The thrust of the meetings was to highlight the work of the ILSSI as an example of the payoff of the FtF Innovation Labs and to show relationships between international and Texas-oriented outcomes.

Component 1: Identify promising, context appropriate small scale irrigation interventions, management, and practices for poverty reduction and improved nutrition outcomes. This component uses the results of recent relevant studies, including those in which the ILSSI partners

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participated, as input to stakeholder workshops which in turn helped define the small scale irrigation technologies that will be used in field studies

Decisions will take into account the impacts of candidate technologies on food production and the economic and nutritional well-being of farm families.

Ethiopia Field Studies: Site selection in Ethiopia has been led by IWMI with inputs from other participating centers. ILRI commented on the initial proposals for site selection and were involved in extensive dialogue in arriving at a set of candidate sites. ILRI staff joined a field mission in August to assess firsthand the potential for livestock feed intervention in the candidate sites. On the basis of this field visit, ILRI recommended introducing livestock feed interventions in two of the four sites proposed: Lemo/Angacha in Southern Nations, Nationalities and Peoples Regional State (SNNPR) and Bahir Dar Zuria/Robit-Bata in Amhara Regional State (Activity 1.3.1).

ILRI also worked with IWMI to develop targeting and monitoring frameworks for assessing likelihood of success of intensive irrigated vegetable and forage production in specific locations (Activity 1.3.2). This involved identifying some key site selection criteria including ground/surface water potential, experience of local stakeholders with irrigation and irrigated fodder, access to market, and history of existing projects. These criteria were then scored for the LIVES woredas through expert consultation with local LIVES personnel to yield a short list of 12 woredas which were subsequently visited for further characterization. This exercise was later reviewed when it became clear that LIVES woredas had zero overlap with FtF woredas and that USAID was keen for ILSSI to focus on FtF woredas for interventions. However the exercise helped to crystallize thinking around key criteria for site selection. These were essentially narrowed down to 3: irrigation potential, market access and presence of promising partners.

As a result of detailed planning, including engagement with national partners at Bahir Dar University, the final selection of intervention (technology) packages and sites for conducting field studies was finalized.

Small Scale Irrigation Technology Packages: IWMI and ILRI, in cooperation with local subcontractors for each site, will be responsible for conducting field experiments/demonstrations of the performance of the selected packages of small scale irrigation technologies. At each site, several farmers will be selected to implement the technology packages (Activities 1.1.1 and 1.2.2). IWMI, ILRI, and subcontractor staff will assist the farmers with training, equipment, and oversight to assure that the technology packages are correctly implemented and managed. Field research/demonstrations of packages of small scale irrigation technologies composed of one or more of the following:

Pump technologies will be tested in all four sites to evaluate the efficiency, reliability, and farmer acceptance of different pumps used to raise shallow groundwater for irrigation of kitchen gardens and small-scale commercial plantings of high-value crops (such as vegetables and forages used for short-term fattening of small ruminants) during the dry season. These technologies may include: rope and washer, treadle, solar-thermal and motor pumps.

Irrigated forages will be grown in two of the four sites on small areas within and outside kitchen gardens to evaluate the possibility of fattening small ruminants during the dry season for sale when prices peak just before religious holidays.

Irrigation application methods will be tested in kitchen gardens at all four sites. Methods will include traditional (mostly furrow) irrigation currently applied by farmers and drip/trickle irrigation. Economical drip/trickle methods will be applied with and without conservation agriculture practices consisting of residue management and minimum tillage.

Recharge enhancement methods will be evaluated on up to three fields at one site (Robit-Taba Kebele) to determine the feasibility of increasing recharge of shallow aquifers and limiting surface runoff and soil erosion during the wet season. Benefits of successful recharge enhancement would include increased groundwater availability for dry season irrigation, reduce runoff and soil erosion from fields

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and stream banks. Comparisons will be made of tractor- and bullock-power for deep ripping. The effects of deep ripping on infiltration and recharge will be compared with the effects of planting deep-rooted woody plants whose root systems are known to penetrate plow pans.

Groundwater recharge will be evaluated at three slope positions (plots): upper, middle and lower. Subplots will be zero tillage, deep tillage, normal tillage, and planting of trees. Three sites x four sub interventions equals twelve sub interventions total.

Field Experiments/Demonstrations: Simple criteria were used to screen sites selected through dialogue at the Annual Meeting held in June (Activity 1.3.3). Provisional sites (woredas) selected in Ethiopia are:

- Lemo/Angacha (SNNPR) – Africa RISING site with some existing SSI and good market access.
- Dangila (Amhara) – Bahir Dar University site with ground water potential.
- Robit (Amhara) – Bahir Dar University site with good market access for dairy and existing SSI.
- Adami Tulu (Oromiya) – drier site with extensive SSI potential which has already, to some extent been realized.

Adami-Tulu Woreda is located in the rift valley of Oromia region about 150 kilometers south of Addis-Ababa and is one of the Feed the Future woredas. The temperature ranges between 15°C to 20°C. The average annual rainfall is 800 mm (Beshir, 2004). The annual water deficit in Adami Tulu is between 750 and 1000 mm Beshir (2004) defined water deficit the difference between annual potential evapotranspiration and rainfall. Therefore, the PET is between 1550 and 1800 mm.

The International Development Enterprise (iDE) has worked in this woreda in promoting different types of water lifting technologies and small-scale irrigation. According to iDE, communities/kebele close to the lake Ziway are more experienced in small-scale irrigation using shallow groundwater and lake pumping. Shallow groundwater is available within the reach of an 18 m depth and lifting technologies, such as rope and washer, treadle pumps and motor pumps are commonly used by farm households. Almost all farm households close to the lake have adopted different types of lifting technologies and small-scale irrigation. However, the frequent breakdown of technologies coupled with lack of spare parts and maintenance services is the main deterrent factor. Rising fuel prices and limited access to credit and financing mechanism further aggravates the problem. In addition to high value irrigated crops, dairy and animal fattening is likely to be promising business implying high potential for irrigated fodder.

At this site ILSSI will work with Send-a-Cow and iDE to better understand the opportunities and constraints associated with existing and potentially new institutional arrangements; promotion of solar pumps as an option to address problems associated with maintenance of motor pump and high fuel prices may add value.

The following small scale irrigation packages will be evaluated for at least three households each:

- Rope and washer lifting technologies for shallow wells.
- Irrigated fodder to fatten small ruminants in the dry season prior to holidays.
- Kitchen garden irrigation with conventional and drip irrigation.

Robit-Bata Kebele is one of the rural kebele in Bahir-Dar Zuria woreda of Amhara Region. It has a subtropical (“Woina Dega”) climate. It is one of AGP and Feed the Future woreda in the region.

As Robit-Bata is close to Bahir Dar, this preliminary analysis uses the average annual rainfall and PET values for Bahir Dar. The average annual rainfall value for Bahir Dar is approximately 1400 mm (Dile & Srinivasan, 2014). The mean annual potential evaporation is about 1666 mm (Daniel, 2007).

The livelihood system is based on cereal and high value irrigated crop production. Groundwater potential and experience in smallholder irrigation is relatively high. Motor pumps together with manual water lifting devices are widely used in the kebele. Shallow groundwater, river diversion and lake pumping are the main source of irrigation water. In 2014, about 1820 ha of land was irrigated, among which 1569 ha (86 percent) was irrigated using motor pumps. There are about 3861 individual wells in the kebele.

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According to iDE, Bahir-Dar Zuria is one of the potential areas suitable for manual well drilling. Average land holding is about 1.5 ha per household. It is about 10 km from the main market (Bahir-Dar) along the main tarmac road to Gondar. Given its proximity to the regional capital, dairy is one of the emerging businesses implying that demand for improved livestock feed is high and growing. For example, about 53 households are currently producing irrigated fodder for their own consumption, which can be developed into commercial businesses.

Efforts to work with Bahir Dar University will continue in order to evaluate the following small scale irrigation packages for at least three households each:

- Rope and washer lifting technology,
- Irrigated fodder to sustain dairy production through the dry season
- Kitchen garden with conventional and drip irrigation, and
- Enhancing shallow groundwater recharge using deep tillage and deep rooted woody plants to break the hard pan. Groundwater recharge will be evaluated at three slope positions: upper, middle and lower. Sub-interventions will be zero tillage, deep tillage, normal tillage, and planting of trees. Three sites by four sub interventions equals twelve sub interventions total.

Lemo and Angacha Woredas are located in the Hadiya zone of Southern Nations, Nationalities and Peoples Region of Ethiopia, about 185 km from Addis Ababa. They are characterized by a bimodal rainfall pattern and a crop-livestock system with a strong perennial crops component. Lemo and Angacha Woreda are principal sites of the USAID Feed the Future, Africa Rising project.

The annual mean minimum, and mean maximum temperatures in the Lemo Woreda are 13°C and 23°C, respectively. The rainy seasons are Belg (January to April) and the main rainy season (June to August). The annual PET of Lemo Woreda is about 1225 mm (Gennoro, 2009). IWMI and ILRI have recently been working in the woreda on shallow groundwater (Africa Rising project). From this study, the following information was compiled: Average annual rainfall is about 1600 mm, but varies from 1180 to 2000 mm. Peak monthly rainfall occurs in August, while the lowest is in December. About 75 percent of the annual rainfall occurs during the main rainy season (June-September). The mean annual potential evapotranspiration (PET) is 1245 mm which is less than the mean annual rainfall; however, monthly PET during November to April exceeds monthly rainfall implying the importance of dry season irrigation.

The livelihood of the communities is based mainly on crop and livestock production and off-farm activities and consists mostly of small land holding farmers. The status of most of the sources of livelihood enterprises has been changing due to various climatic, edaphic, socio-economic and anthropogenic factors. The youth and the disadvantaged women groups are landless in most cases.

Wheat, teff, potato and faba bean are the most important cash crops whereas enset, vegetables, teff, wheat and potato are main food crops. However, enset production has been declining due to disease infestation.

The ground water table in Lemo Woreda ranges from 1.90 m to 5.40 m and is about 3.6 m deep in an 'average' dry season. The farmers use water from their hand dug shallow wells mostly from November after the end of the major rainy season to the end of the dry season in March and April. They use little water, primarily for household use and to water their cattle. A few farmers irrigate tiny plots of land. Recent visits by the Africa RISING project noted concerns about declining rainfall, long dry spells and periodic flooding from farmers.

The Africa RISING project has recently introduced treadle pumps and is monitoring their use. It also plans to introduce rain water harvesting structures, to build capacity for use of rope and washer and other water lifting technologies, including solar pumps. A study on ground water yield is ongoing and could target such interventions.

ILSSI will work with Bahir Dar or Arba Minch University to expand the breadth and number of interventions within these woreda.

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At Lemo/Angacha, work with Africa Rising partners will continue to evaluate:

- Rope and washer groundwater lifting technology
- Irrigated fodder to fatten small ruminants in the dry season prior to holidays

Dangila Woreda is one of AGP and Feed the Future woreda in the Amhara Region. It is located at 36.847 ° longitude, 11.254 ° latitude and 2140 MASL altitude about 80 kilometers south west of Bahir Dar. In the woreda, there are 27 rural kebele among which 16 of them have access to perennial rivers. It has a sub-tropical (“Woina Dega”) climate with 8.4°C of average daily temperature.

IWMI scientists, recently working in the woreda on shallow groundwater (AMGRAF project), have compiled the following information. Average annual rainfall is about 1600 mm, but varies between 1180-2000 mm. Peak monthly rainfall occurs in August, while the lowest is in December. About 75 percent of the annual rainfall occurs during the main rainy season (June-September). The mean annual potential evapotranspiration (PET) is 1245 mm which is less than the mean annual rainfall; however, monthly PET during November to April exceeds monthly rainfall implying the importance of dry season irrigation.

At Dangila Woreda, work with Bahir Dar University will continue to evaluate:

- Rope and washer pumps to lift groundwater,
- Introduction of motor pumps to pump from river (not groundwater as source too small),
- A diagnostic tool to predict the likely presence and access to shallow water, and
- Kitchen gardens with conventional and drip irrigation.

Household survey instrument: The IFPRI Household Survey Instrument was developed, distributed and finalized for Ethiopia. The baseline survey was initiated in the fall of 2014 in the areas related to the sites selected for farm studies. The sampling design has been finalized following characterization of all the kebeles in the five woredas the ILSSI is operating in Ethiopia. The surveys have been approved by the IFPRI institutional review board and the Ethiopian Public Health Institute (EPHI) provided detailed comments on the nutrition and health related modules of the survey. The EPHI also prepared and submitted a first draft of a background paper on nutrition status in Ethiopia and nutrition-related policies and interventions. A discussion paper that reviews the linkages between irrigation, nutrition, and gender was written. A survey firm has been hired to administer and analyze results of the household and community surveys in Ethiopia beginning in November 2014 (Activities 1.1.2, 1.2.1 and 1.2.2).

Tanzania Innovations and Locations: Sokoine Agricultural University (SUA), under sub contract with IWMI, has been actively engaged in three planning activities in Tanzania: (1) a comprehensive desk study on irrigation in Tanzania with focus on options for technologies to be considered by ILSSI; (2) with IWMI and ILRI, planning and conduct of the Tanzania Stakeholders Workshop, held at Morogoro on August 26, 2014; (3) post workshop discussion and later proposal for intervention and sites for field research in the Mbeya, Iringa and Njombe Regions of Tanzania. IWMI and ILRI are responding to the proposals made by SUA to refine the plan and make it consistent with those for other countries. As noted in the previous section of this report, progress made here has exceeded expectations and provided the opportunity to accelerate the time table for Tanzania to accommodate the need for a more cautious schedule in Ghana (Activity 1.1.1 and 1.3.1).

Component 2: Evaluating impacts, trade-offs, and synergies of small-scale Irrigation technologies and practices. This component will use the IDSS, in conjunction with field experimental data collected in Ethiopia, Tanzania, and Ghana, to evaluate the production, environmental, economic, and gender/labor impacts of selected small scale irrigation technologies and practices.

Pilot study on the Jeldu site (IDSS) – Refine models and model-data interfaces for the IDSS: Initiated in the first half of year one, this pilot study was conducted to gain experience in acquiring data and user opinions from an existing IWMI field site in Jeldu woreda and using them as input to the Integrated Decision Support System (IDSS) to perform an ex ante analysis of the production,

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environmental, and economic impacts of small scale irrigation innovations Activity 2.1.1). The usual challenges of data paucity were encountered and overcome by application of expert opinion where necessary. Methods for acquiring, storing, exchanging, and communicating about the interpretation of data and results were exercised and refined for future studies (Activity 2.1.2). The results of the Jeldu study were used as examples in the subsequent training workshops on the three elements of the IDSS held in June 2014. This early study is being refined for papers that will be submitted for publication.

Pilot study on livestock-fodder in Lemo: ILRI completed the study initiated in the first half of year one at the Africa Rising Lemo site, involving irrigated fodder in small kitchen garden plots that was used to fatten sheep that were sold for consumption during the Ethiopian New Year. Prototype irrigated forage interventions involved thirteen farmers (six in Lemo woreda and seven in the neighboring Angacha woreda). Farmers grew small plots (5x5 m) of an oats-vetch mixture. Side-by-side, the farmers planted perennial grasses (Desho grass and Napier grasses) using irrigation. In the middle of the forage growth period, a one-day “experience sharing and training” program was organized for all participant farmers in collaboration with national partners. A field day was held in August 2014 for participating farmers, local officials, other interested farmers and researchers to review the ongoing intervention. Farmers showed considerable interest in pursuing the irrigated forage option and committed to planting larger areas in the coming season, possibly targeted at fattening of oxen rather than sheep (Activities 2.4.2 and 2.4.3).

Ex ante IDSS analyses for Ethiopia: Following the Jeldu pilot study, collection and interpretation of baseline data for the three IDSS models has been ongoing with active participation by two new post-doctoral fellows and others at IWMI and TAMUS/Borlaug. Consistent definition of exact geographic coordinates of test sites and surrounding areas has been challenging as official maps of the area are being revised. This assures that the analysis done by the IDSS and the IFPRI surveys are congruent around the actual test sites selected for field studies. Data from multiple studies done by the ILSSI partners, the World Bank, and others, along with the data from the TAMAR existing databases are being acquired, stored in readily accessible formats and locations, and prepared for the initiation of ex ante analyses of the area consequences of the selected interventions used in field research. This sets the stage for future ex post studies based on data from field studies and informs the environmental monitoring and mitigation reporting required by USAID.

Plans are well underway to establish collaboration with USAID and other projects where smallholder irrigation is a shared experimental objective. Africa Rising and LIVES are examples where common CG Center partners are involved, and relationships with iDE are also being considered, *inter alia*. As noted in a previous section of this report, ILSSI is establishing collaboration on field testing at joint locations and on use of the IDSS to assess the consequences of results of other studies involving small scale irrigation. Communication is also underway to share survey results done by IFPRI for common projects.

IFPRI and IDSS modeling tools: In addition to the survey studies being done by IFPRI on the influence of small scale irrigation on variables such as farm family nutrition and gender issues, this partner is also involved in joint research with the IDSS team that (1) informs the FARMSIM model on economic baseline data such as prices and elasticities of demand with data at subnational and national levels (2) enhances the capability to scale up and scale out from sites where field studies are conducted (Activity 2.2.1). The SPAM, EMMP, and DREAM models were developed and their currency is maintained by IFPRI. This includes providing current and historical data to support the use of these models. These models are enriched by interface with the SWAT and APEX models in developing a quantitative basis for defining areas of geographic equivalence within the watersheds that encompass the field test sites; and through this to estimate the areas suitable for adoption of the innovations under study at larger areas of scale. As noted above, the detailed planning for this collaboration was the subject of a meeting between partners in Washington in September; this was followed by another meeting between IFPRI and IDSS teams in October. The integration of these modeling methods is deemed by all partners as being of very general utility in future, broader systems studies.

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Further refinement of interfaces and interactions of the component models in the IDSS: As the baseline studies using the IDSS are completed for the regions that encompass the field research sites, a comprehensive series of ex ante studies will be done that evaluate additional options to those under specific field tests in the watershed that encompasses the field studies. Model outputs will explore and evaluate far more options for innovation than the limited funds for field studies provide. As this more comprehensive analysis gets underway, there is need to improve and streamline the process of analysis, particularly the interfacing of data and model inputs/outputs between models in the IDSS. A method for semi-automation of the interface between the SWAT and APEX models has been developed and will be used in future IDSS analyses. A similar set of semi-automated linkages is under development for the interface between APEX and FARMSIM. In ongoing planning sessions with IFPRI, methods are being sought to bring in data from their sources for FARMSIM and APEX. Previously, the ability to automatically accept output of the NUTBAL model for livestock as input to FARMSIM has streamlined that integrated analysis as well.

Ex ante analysis-- irrigation, nutrition, and child health: The results of surveys done by IFPRI in areas surrounding the field test sites will have a geographic correspondence to the ex ante studies to be done using the IDSS. The IFPRI survey instruments include information used to inform the FARMSIM model on economic consequences of interventions. The IFPRI and FARMSIM models will combine to produce results on the effects of irrigation on human nutrition and (implicitly) child health. In this reporting period, communication has continued on the interface between these two models and datasets in preparation for ex ante analyses in Ethiopia. Similar methods and interfaces have been planned for the other two countries.

Actions for year two: As noted in other parts of this report, the results shown in this component of the report are actively enabling the overall goals of evaluating tradeoff and synergies of small scale irrigation technologies and practices and are reflected in the integrated annual schedule for year two.

Component 3: Identifying key constraints and opportunities to improve access to small-scale irrigation technologies. A number of climatic, landscape, soil, land use, and socioeconomic constraints are expected to affect implementation of small scale irrigation technologies and related practices. These constraints will vary among sites in Ethiopia, Tanzania, and Ghana. The following activities will gather data and evaluate those constraints and the small scale irrigation technologies most likely to prove successful.

A simple qualitative checklist was developed to guide the Focus Group Discussion for these field studies outlining constraints and irrigated forage interventions. The tool has been piloted in the Lemo site in Ethiopia and will also be applied in Bahir Dar Zuria woreda imminently (primarily Activity 4.2.7 but contributes to Activity 3.1.2). Secondary data sets have been identified and gathered to undertake ex-ante analysis on the linkages between irrigation, nutrition, and child health (3.1.1). Preliminary results of ex ante analysis based on these data, using a weighting method supported the selection of kebeles for household survey design for Ethiopia.

Stakeholder inputs, desk studies, and preliminary analysis with IDSS models during year one suggest that food production in the dry season in Ethiopia is a major limitation to food production and human health, especially production of high-value vegetables. Small-scale dry-season irrigation could both improve nutrition and farm family economic well-being. However, concerns highlighted by stakeholders in all three countries include market, transportation, and irrigation water limitations, which are expected to restrict implementation of this potentially valuable technology. ILSSI field experiments and IDSS modeling activities are expected to provide valuable inputs to local and government decisions concerning possible implementation of small scale irrigation packages. The data identification and acquisition activity will continue to ensure data with best quality will be used in the final analysis.

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Component 4: Capacity Development and Stakeholder Engagement and Dialogue. This component relates to engagement with government, NGO, and private organizations to provide research based short and long term training on small scale irrigation technologies.

IDSS Training -- Addis: A training workshop was held on the ILRI campus in Addis Ababa June 6-13, 2014. As noted above, the pilot study done in the Jeldu woreda provided the case study used for this session. The first half day of the workshop was directed to administrators who might use the output of the IDSS; the remainder of the study was directed to the training of those who might use the IDSS. There were 65 participants, including seven women and 45 students. Staff members from CG centers and others from the government of Ethiopia were also participants. There were several participants from other countries. The last day of the workshop involved a session on evaluation and feedback. Questionnaires were used to obtain individual evaluations. There was a variable level of prior experience among the trainees. Almost all participants found the training useful. Some wanted a simplified version while other wanted more advanced training. The IDSS team benefitted from this experience in which several members of the team worked together for the first time to prepare the Jeldu study and the training course. Guidance for future training included these points:

- Improved pre-planning of data acquisition and analysis for case studies.
- More communication with applicants and some screening for qualifications.
- Methods for involving more national female participants.
- Greater focus on the application of the integrated suite of models.
- Specific sessions on the IDSS at completion of workshops.
- Future workshops will be demand driven – applications will determine if there is a threshold for each model component.
- Canned presentations for each IDSS component, based on common case studies will provide the ability for one trainer to present all three models if demand does not support the full rendition.
- At least one workshop in year two will encompass the full IDSS treatment.
- Provide follow up to those initially trained in the use of the IDSS, including involvement of graduate students in the application of the IDSS to parts of the ILSSI studies in which they participate.
- A relationship with the joint graduate program between Bahir Dar University and Cornell is being explored whereby the IDSS training would be provided to their students either at Texas A&M or Ethiopia.
- Similar active interest exists in providing training for students at the Sokoine Agricultural University in Tanzania and that university has offered to host a training workshop.

Farmer training (Lemo): ILRI, IWMI and NCA&T all have active plans for coordinated training of farmers and local extension specialists on the interventions used in the form of practical on-the-job training (Activity 4.1.5). As noted above, ILRI has held local demonstration field days at their locations at their field research sites in Lemo where the Focus Discussion Group checklist was piloted in Ethiopia and continues to be refined (Activity 4.2.7). ILRI continued their involvement in stakeholder engagement following the first consultation meeting in Ethiopia in January 2014. Following completion the Ghana stakeholder consultation, the stakeholder meeting in Tanzania was held in August 2014, including preliminary identification of participants and preparation of a livestock component to a position paper (Activity 4.2.4). Needs and demands related to interventions and practices were assessed through initial consultations held in identified pilot areas with local stakeholders (Activity 4.2.6). Analysis of community dialogues to identify issues for successful adoption of proposed interventions is pending (Activity 4.2.8).

Workshop planning schedule for year two: The schedule for workshops in year two has been generally set. The first and probably more advanced workshop will be held and hosted by Bahir Dar University in February 2015. Their offer to bear the expense of hosting the workshop is indicative of their interest. The

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workshop in Tanzania will be held in August 2015 and hosted by Sokoine Agricultural University. The tentative plan is to have the third workshop in Ghana in November 2015.

B. Issues or concerns encountered during the reporting period

Ebola in West Africa: As indicated in other parts of this report, a cautious “wait and see” approach will be taken for our start up in Ghana. Because of the good progress made in Tanzania this summer, the team can be fully engaged there and in Ethiopia, bringing in Ghana later in the game. We would like to avoid losing a year in field research in Ghana, if possible. The CDC recommendations will continue to be monitored and as will any guidance from USAID. At this point the lead institution has advised its partners to seek and use the guidance of their individual institutions relative to their approach.

Burn rate and correction: In the startup year, with planning as the main activity the project was forced to carry over approximately \$500 thousand of the planned \$2.2 million. USAID concurred with the plan to use the residual funds to accelerate research in year two, with some stretch out to the out years. It is expected that funds in year two will be spent on schedule to avoid substantial carry over. New funds are still pending which will allow full expenditure of the budget for year two.

Flexibility to take advantage of opportunities: As discussed with senior BFS officials in September, the research team intends to take a proactive approach in seeking engagement with other Feed the Future Innovation Labs, other USAID (missions) and other related sources of funding to expand the scope of the ILSSI activities related to this cooperative agreement. In areas directly relevant to the expansion of products of our research, the team will actively pursue collaboration and cooperation. In anticipation of year three, recommendations will be made for opportunities to expand ILSSI either at the midterm of the agreement or at the end of year five for continuation. The team anticipates and plans to prepare for the external review during year four.

Cross Cutting Obligations: ILSSI is concurrently responding to requirements in three areas that cut across the agreement:

- Environmental Monitoring and Mitigation Plan – where our AOR is working very hard to make this both simple and effective in meeting AID’s intent.
- Use of Human Subjects – working with the TAMUS IRB to determine the extent to which reviews of our partners can be used to simplify and streamline the overall review and approval that our institution is required to do to meet the terms of our agreement.
- Commitment to Accessible and Usable Development Data: Collecting the approaches that are used by our CG Center partners in sharing information and data as well as looking at other professional and scientific societies and associations that have such storage and management of such information as part of their mandate. This is to ensure that, if at all possible, data entry into the federal system is avoided. A response to this mandate will be proposed when possible.

C. Data sharing and dissemination

The beginning of FY 2015 brought a significant new U.S. Government mandate to provide open access to project data. Initial discussions have begun with USAID and ILSSI cooperators to define how to respond to this mandate. In response to USAID’s interest in providing free and open-source software, an agreement to develop a QGIS version of the SWAT model has been negotiated, and a beta version is expected in FY 2015. In addition, ILSSI participants have been invited and have agreed to help organize and support the OpenWater 2015 symposium and workshops, to be held in Addis Ababa, Ethiopia in the week of September 15-19, 2015. The OpenWater symposium aims at sharing experiences, tools, training materials and model codes applicable in the water domain. Several open source tools are emerging and initiatives are currently taken to initiate open standards and interfaces. Our participation will include membership in the scientific advisory committee, including support in the evaluation of abstracts, attendance to the symposium, willingness to convene sessions and advertising the event within this network. OpenWater will be organized as a series of invited presentations, dedicated workshops, demos

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and oral/poster presentations in the following fields: interoperability and standards in the water domain, repositories and SDI's, open source developments in water science, open hardware, open access training materials, and environmental modelling using open source tools. OpenWater 2015 organizers have agreed to assist and participate in IDSS training at SUA in August 2015.

Publications and knowledge products (Activity 4.2.9) include the following:

- IWMI Working Paper: “A review of ‘garden kits’ in Africa”.
- Discussion paper: Promising small-scale irrigation and fodder interventions in Tanzania.
- Discussion paper: Promising small-scale irrigation and fodder interventions in Ghana.
- Gebrehewaria, G and Hailelassie, A., 2014. Assessments of key small-scale irrigation technologies and agricultural water management options in Ethiopia; Discussion Paper for the Stakeholder Consultation in Ethiopia.
- Mahoo H.F. S.D. Tumbo, S.D., Kahimba F.C., Kongo V.M and Lukuyu B. 2014 Promising small-scale irrigation and fodder interventions in Tanzania. August 2014 - Discussion paper for stakeholder consultation.

III. Human and Institutional Capacity Development

A. Short-term training

IWMI staff and researchers contributed to organizing and implementing training on IDSS models in Ethiopia and helped to establish a community of practice on IDSS models within the CGIAR. The training workshop was held on the ILRI campus in Addis Ababa June 6-13, 2014. The IDSS team benefitted from this experience in which several members of the team worked together for the first time to prepare the pilot study done at the Jeldu site used as the case study for the training course.

IWMI also provided funding through the Water, Land and Ecosystem program for post-doctoral students to participate in the IDSS training. ILRI trained fourteen farmers on forage establishment, management and utilization.

B. Long-term training

NCA&T admitted a faculty member from Bahir Dar University to start a Ph.D. degree spring 2015 funded through this grant. IWMI has engaged a female post-doctoral student from the Africa region to work exclusively on the project. IFPRI has two post-doctoral students. A post-doctoral fellow has been employed at TAMUS/BI to work on the SWAT model in all three countries (Activity 4.1.6).

C. Institutional capacity development

IWMI staff is working with staff seconded from MoWIE on use and establishment of models in IDSS.

IV. Technology Transfer and Scaling Partnerships

Forage interventions have been introduced in close collaboration with national partners at the Lemo field site (Southern Agricultural Research Institute). There are already plans for more extensive interventions in the site for the coming year but it is too early in the project to describe scaling work beyond the preliminary field site.

V. Future Work

Field studies will be conducted in all three countries in year two. Studies will commence in Ethiopia, progress to Tanzania, and, proceed to Ghana (if possible). Concurrently, the same staged approach will be used in conducting baseline farm family surveys with focus the effects of small scale irrigation on nutrition, gender, and economic results. Ex ante analyses of the consequences of small scale irrigation interventions will be conducted using the IDSS in the area surrounding the field test sites, using the same geographic area encompassed by the IFPRI surveys. Scaling up to larger watersheds will be undertaken with collaboration between IFPRI's models and data and the IDSS. Training workshops will be held in all

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three countries in year three. National universities in all three countries will be employed to conduct field research directly with selected farmers and will host training workshops for the IDSS. Students trained in the IDSS methodologies will participate in field research and data analysis. Ongoing engagement with other FtF irrigation labs will define cooperation and collaboration in relevant areas.

Long-Term Degree Training¹

Name of Innovation Lab: Feed the Future Innovation Lab on Small Scale Irrigation in Ethiopia, Tanzania and Ghana

Name of Student	Gender	University of Study	Degree²	Major	Graduation Date	Home Country	Home Institution³
Prossie Nakawuka	Female	Washington State University	Post-Doctoral	Biological and Agricultural Engineering	May 2013	Uganda	IWMI
Yilhun Dile	Male	Texas A&M University	Post-Doctoral	Hydrology	indefinite	Ethiopia	Texas A&M University
Laia Domenech	Female	Universitat Autònoma de Barcelona	Post-Doctoral	Environmental Sciences	February 2011	Spain	IFPRI
Dawit Mekonnen	Male	University of Georgia	Post-Doctoral	Agricultural & Applied Economics	May 2013	Ethiopia	IFPRI

¹ Include all students (both foreign and U.S. based) who are *currently* enrolled in a degree program funded in full or part by USAID regardless of when they started their program. Include those studying in the U.S., their home country or a third country.

² B.S., M.S., Ph.D., other (specify)

³ Fill out for foreign students only. Specify if the student is from a NARS, an educational institution, the private sector, etc.