

Innovation Lab for Small Scale Irrigation

Results and Impact of IDSS workshops in Ethiopia

Introduction

The USAID Feed the Future Innovation Laboratory for Small-Scale Irrigation (ILSSI) was formed to undertake research aimed at increasing food production, improving nutrition, accelerating economic development, and contributing to the protection of the environment in Ethiopia, Ghana and Tanzania. Texas A&M University leads the project in collaboration with the International Water Management Institute (IWMI), the International Livestock Research Institute (ILRI), North Carolina A&T State University, and the International Food Policy Research Institute.

ILSSI is currently working to generate actionable recommendations for strategic investments in agricultural development in the three target countries by integrating: natural resources, agricultural, and socioeconomic data; input from local farm families; local agronomic research and demonstrations; and the Integrated Decision Support System (IDSS), a powerful suite of natural resource, agronomic, and farm-scale economic models. ILSSI also emphasizes capacity development at multiple levels of scale, including training university faculty and students, and representatives from government agencies, non-governmental organizations, and the private sector, to continue using ILSSI tools and methodologies after this five-year project is completed.

As part of its training mission, ILSSI has conducted multiple training sessions in the IDSS and its three component models: the Soil and Water Assessment Tool (or SWAT, at <http://swat.tamu.edu>), the Agricultural Policy/Environmental eXtender (or APEX, at <http://epicapex.tamu.edu>) and the Farm Income and Nutrition Simulator (or FarmSIM, at <http://afpc.tamu.edu>).

The IDSS team has led three IDSS training workshops in Ethiopia. A workshop was held June 6-13, 2014, on the ILRI campus in Addis Ababa. A workshop organized and hosted by the School of Civil and Water Resource Engineering at Bahir Dar University (BDU), and supported by the Geospatial Data and Technology Center and the Blue Nile Water Institute, was held February 2-6, 2015, in Bahir Dar. Finally, multiple workshops and clinics were held in February 2016 in Addis Ababa. A 5-day introductory IDSS workshop was held February 8-12. An Advanced SWAT workshop and a separate FarmSIM clinic were conducted on February 15-17, and a SWAT clinic was held on February 18-19. The 2016 workshops and clinics were to be sponsored by Jimma University; however, due to security concerns in the Oromia region, the workshops and clinics were moved to the Addis Ababa offices of ILRI. IWMI helped in arranging workshop facilities and accommodations for the trainers.

This report summarizes the content, participants, evaluations, and effectiveness of the Ethiopia workshops.

Workshop content and structure

The first half-day of the introductory IDSS workshops consisted of an overview of the IDSS and its three component models. From the afternoon of the first day through the fourth day, participants attended individual model trainings in either SWAT, APEX or FarmSIM. On the fifth day, participants came back together as a group for an in-depth case study of the integrated capabilities of the IDSS (drawn from ILSSI studies in Ethiopia) and a hands-on integration exercise. Finally, participants were divided into groups (each consisting of at least one trainee for each of the three models) to work together on the integration of their individual modeling results.

The 2016 Advanced SWAT workshop provided participants with additional training in model calibration, sensitivity analysis and uncertainty analysis, and learned strategies for manually calibrating the SWAT model. Participants also received training in the automatic SWAT Calibration and Uncertainty Program (or SWAT-CUP, at <http://swat.tamu.edu/software/swat-cup/>), using a case study from the Gumera watershed in the Lake Tana basin.

The 2016 FarmSIM and SWAT clinics were convened to provide one-on-one support to those using FarmSIM and SWAT in their projects. Issues of general interest were raised by the participants and discussed in the clinics, with one-on-one support provided thereafter.

Number of participants and their affiliations

A total of 65 participants, including 7 women, attended the 2014 workshop. Of the 65 participants, 45 were students, and the remaining 20 participants represented a range of research institutes and government ministries. A total of 73 participants attended the 2015 workshop, of which 38 attended the SWAT workshop, 21 attended the APEX workshop, and 14 attended the FARMSIM workshop. Eight of the 73 participants were women, with 3 attending the SWAT workshop, 4 attending the APEX workshop, and 1 attending the FARMSIM workshop. Most of the participants were affiliated with a university in some capacity (whether as students, professors, lecturers, or researchers). There was 1 participant from the private sector and the remaining participants represented a range of research institutes and government ministries.

A total of 101 participants attended the 2016 workshops and clinics (with some participants attending multiple workshops and clinics). 65 participants (including 7 women) attended the 2016 5-day IDSS workshop, of which 48 (including 6 women) were trained in SWAT, 8 (all men) in APEX and 9 (including 1 woman) in FarmSIM. A total of 30 people (including 2 women) attended the Advanced SWAT workshop. A total of 14 participants attended the SWAT clinic and 3 participants attended the FarmSIM clinic; none of these participants were women. [Figure 1](#) illustrates the makeup of the 2014, 2015 and 2016 workshops by gender.

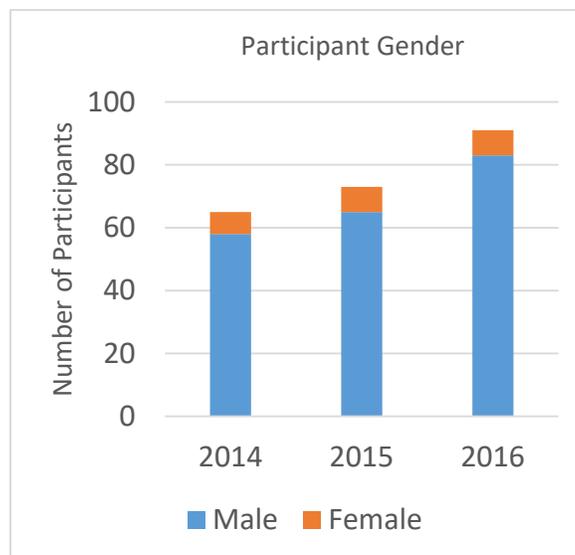


Figure 1. Participation at 2014, 2015, and 2016 workshops by gender

As in 2014 and 2015, most of the 2016 participants represented Ethiopian universities such as Addis Ababa University (AAU) and BDU. A sizeable minority of participants represented local and international research institutions, such as the Ethiopian Institute for Water Resources and the International Center for Tropical Agriculture. Several participants represented government entities such as the Ministry of Water, Irrigation and Electricity. [Figure 2](#) illustrates the affiliations of participants at the 2016 workshops and clinics.

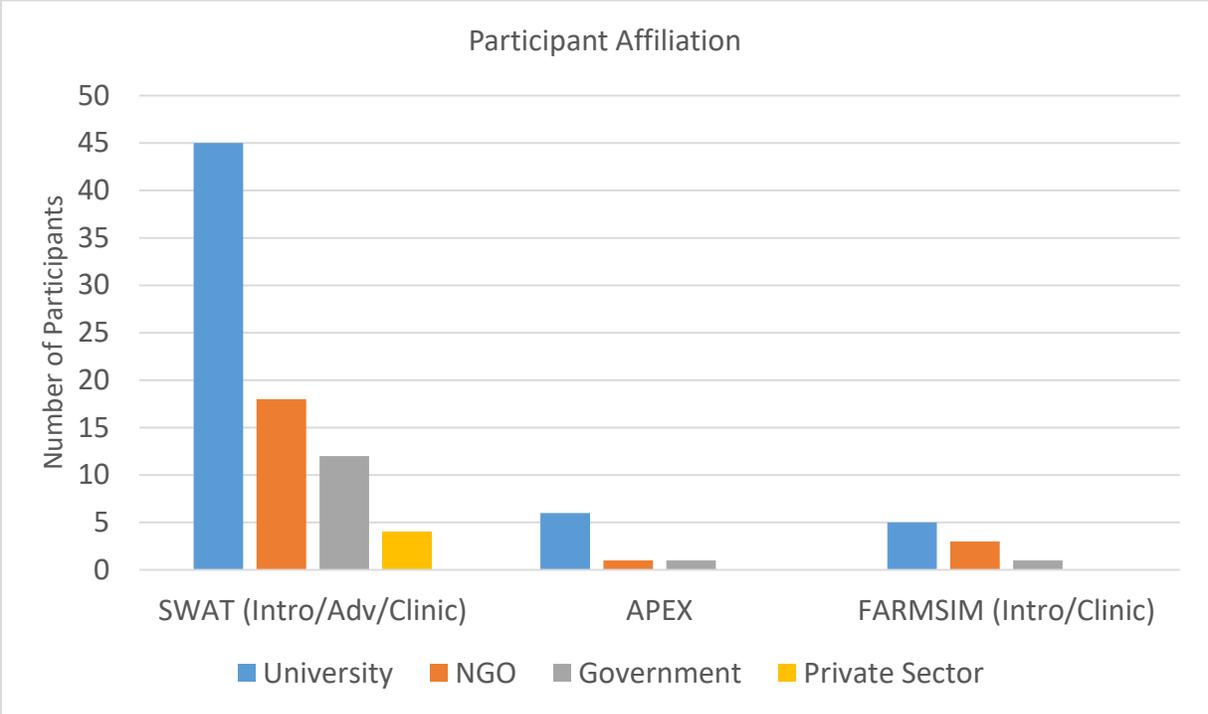


Figure 2. Participation at 2016 workshops and clinics by participant affiliation

Participant evaluations of the workshops

Prior to the IDSS workshops, the IDSS team required each participant to complete an online survey ranking his or her competence in the following areas pertaining to SWAT, APEX or FARMSIM: depth of understanding of the general subject matter; level of experience with relevant software, tools, and databases; and ability to perform certain relevant modeling tasks. [Table 1](#) lists a sampling of these “competence questions” for each of the three IDSS models.

Following the workshops, participants were asked to complete a second online survey ranking their knowledge and competence post-workshop. (The “competence questions” included in the post-workshop surveys were identical to those posed in pre-workshop surveys and listed in [Table 1](#).) Participants were asked to assess whether course content was delivered as advertised and expected learning outcomes achieved. They were also asked to rate course materials, instructor content and presentation, overall quality of the workshop, and how well the workshop met the participant’s particular needs. Finally, participants were asked to make recommendations as to future course content.

Table 1. “Competence” questions in the SWAT, APEX, and FARMSIM workshop surveys

SWAT
<p>SWAT workshop participants were asked to rank their ability to, among other things:</p> <ul style="list-style-type: none"> • prepare spatial and temporal data and soil and land use tables • set up a watershed delineation model and a Hydrological Response Unit definition • write different inputs into the SWAT readable format • edit and update model parameters and databases • define model execution and warm-up periods • use the tool SWAT-check to assess water balance components, nutrient transports, erosion, crop growth • use QSWAT to animate and plot model outputs • simulate different fertilizer rates and types and different tillage practices • select suitable irrigable crops and identify irrigable areas for different crops
APEX
<p>APEX participants were asked to rate, among other things, their:</p> <ul style="list-style-type: none"> • proficiency in file management, text processing software, spreadsheets, and database management • understanding of the purpose, basic setup, structure, and file system of the APEX model, the structure of APEX outputs, and basic concepts of model evaluation • ability to define certain terms (such as relative sensitivity analysis, calibration, and validation) <p>In addition, APEX participants were asked to rank their ability to:</p> <ul style="list-style-type: none"> • run the APEX model using WinAPEX interface and use, modify and update WinAPEX databases • prepare weather data files, soil data, management files, and scenarios using WinAPEX • perform relative sensitivity analysis, and manual and automatic calibration and validation • generate output data for SWAT and FARMSIM
FARMSIM
<p>FARMSIM participants were asked to rate, among other things, their:</p> <ul style="list-style-type: none"> • understanding of farm management, agricultural economics, and statistics • understanding of and ability to use Excel, Excel tools, and risk/data analysis tools in Simetar • understanding of FARMSIM model, model inputs/outputs, how model simulates risk and scenarios • ability to interpret stochastic results in SIMETAR and FARMSIM • ability to interpret, obtain and input data, and to verify data entry • ability to determine and interpret results from the models

Assessment of effectiveness

Following the IDSS workshops, the IDSS team compared the responses on the pre- and post-workshop “competency questions.” These questions were identical in the pre- and post-workshop surveys. Since respondents ranked their abilities from 1-5 (with 1 being the lowest level of competence and 5 the highest), higher scores indicated a higher level of competency, and the difference in scores on the pre- and post- workshop provided a general (though not necessarily objective) measure of the workshop’s effectiveness in achieving advertised learning outcomes.

The answers of each respondent to all of the “competency questions” in the pre-workshop survey were totaled, creating a pre-workshop competency score for that respondent. The scores of each of the respondents were then

averaged to produce the average pre-workshop competency score for respondents. The same process with respect to post-workshop survey responses produced an average post-workshop competency score for respondents.

For example, [Figure 2](#) compares the average pre-workshop and post-workshop competency scores for each IDSS model training session at the 2016 workshop. A total of 66 respondents completed the pre-workshop survey, of which 45 attended SWAT training, 12 attended APEX training, and 9 attended FARMSIM training. A total of 79 respondents completed the post-workshop survey, of which 63 rated the SWAT training, 8 rated the APEX training, and 8 rated the FARMSIM training. These results indicate improvements in average post-workshop scores ranging from almost 30% to over 60%. The team did not perform any statistical analysis (test of significance for difference in averages, etc.) of the survey responses.

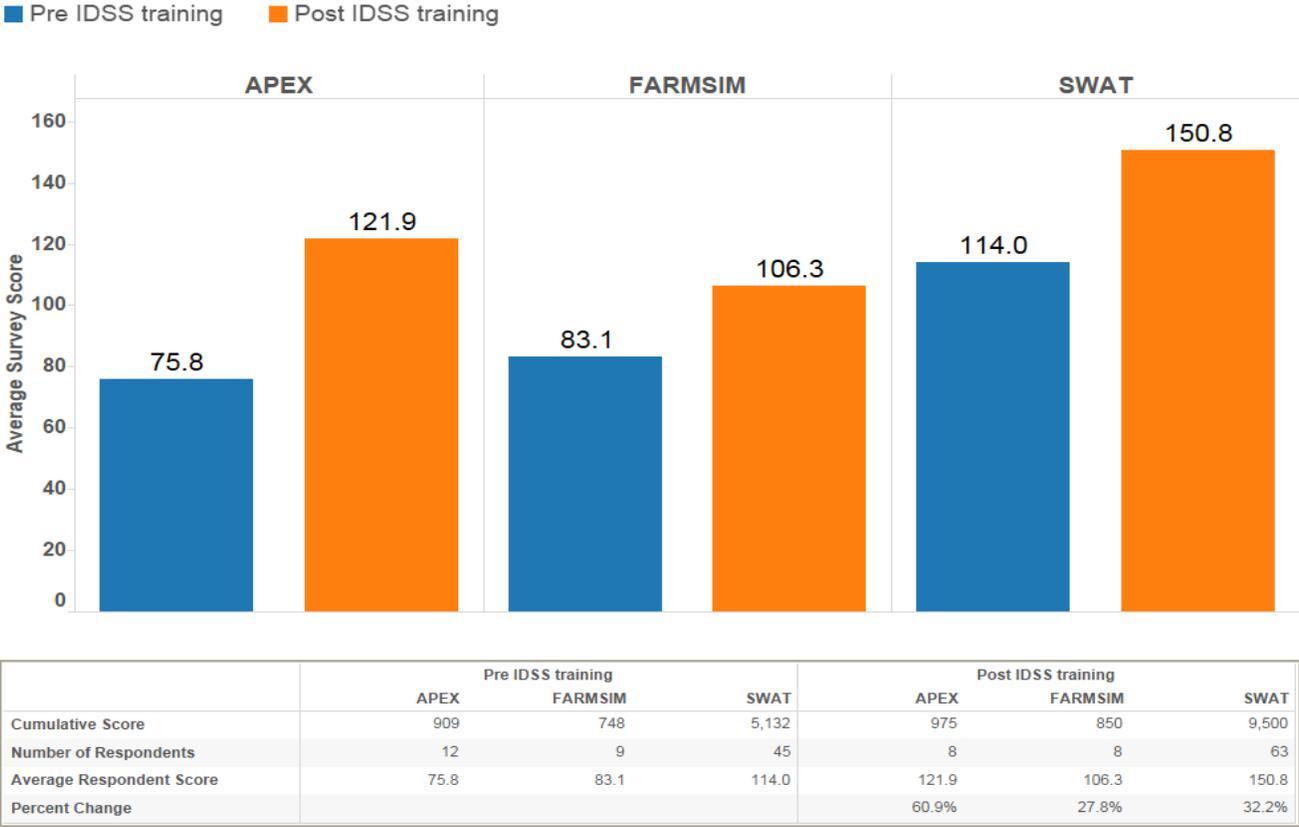


Figure 2. Comparison of average pre-workshop and post-workshop competency scores for SWAT, APEX, and FARMSIM training sessions at the 2016 workshops.

The IDSS team also reviewed respondents’ evaluations of course content and overall quality, instructor content and presentation, and how well the workshop met the participant’s particular needs, as well as respondents’ suggested adjustments to course content in subsequent courses. In general, reviews were very favorable. At the 2016 workshop, 96% of respondents agreed or strongly agreed that the course content was as advertised. 95% of respondents rated instructor content as very good or excellent; likewise, 95% of respondents ranked instructor presentation as very good or excellent. 96% of respondents rated the overall quality of the course as very good or excellent, with 4% rating it as good, and 85% of respondents said that the course exceeded their expectations.

In the comments section of the post-workshop survey, many participants were enthusiastic about the training. One SWAT course participant stated, “IDSS is excellent tool to provide meaningful contribution to R&D for sustainable national development.” A FARMSIM course participant noted, “It was very interesting [to study] individual tools and integrated tools for decision support system for agricultural investments.” A SWAT course participant commented, “Excellent training, very disciplined professionals and they are eager to share what they know to participants.” Another SWAT participant stated, “The IDSS workshop for the Advanced SWAT is very interesting and keep on giving trainings based on actual projects.”

Many participants recommended extending the timeframe of the workshop. A FARMSIM course participant commented, “The workshop needs more time to capture the topics in more detail.” A SWAT participant noted, “If possible extending the training time helps us to get lots of information and also it improves our skills.”

Several participants also expressed an interest in additional training sessions. A SWAT course participant commented, “It would be best if would grow into an online forum for further learning and communication.” Another SWAT participant found room for improvement “if the workshop is organized regularly (on annual or bi-annual basis).” Similarly, a FARMSIM participant stated, “a follow up workshop should occur frequently so that more people should learn and use it.”

Following completion of the Addis Ababa workshop, the IDSS team has also continued to provide ongoing support to workshop participants, including assisting:

- a scientist at the Water and Land Resource Center and Wollo University in Ethiopia with questions on the collection of soil data, scenario design, and calibration of the SWAT model for studies of land degradation and siltation reduction in the Abay (Upper Blue Nile) basin;
- a GIS analyst at International Center for Tropical Agriculture with making use of limited data for model warm up, calibration, and validation, in modelling watersheds;
- a hydro-geologist at the Ethiopian Water Works Design and Construction Enterprise with resolving software installation issues related to estimating groundwater recharge for multiple projects;
- a Ph.D. student at AAU who is working on “Watershed Management Scenarios under Changing Climate in Jemma Sub Basin, Blue Nile Basin” using the SWAT model;
- a PhD. Student at AAU who is working on evaluating the land use change effect on soil loss and stream flow in Andassa watershed, Ethiopia;
- a MSc student at AAU who is working on “Analysis of soil moisture response to climate change and adaptation in the Borkena watershed, Ethiopia” using APEX and SWAT;
- a MSc student at BDU who is working on assessing water use efficiency of crop production in Robit watershed, Ethiopia;
- an Ethiopian PhD student at the University of Bonn who is using FARMSIM to analyze issues related to risk perception and food security;
- a former assistant professor at BDU (now a PhD student at the University of Connecticut); and
- an employee of ILRI-LIVES project who is pursuing admission into a PhD program and is using FARMSIM in research on the production efficiency of dairy farmers, using household data from the LIVES project.

Expected impact

Most of the participants at the Ethiopia workshops represented universities, international and local research institutions, and government ministries. We hope they will apply the knowledge they gained over the course of the workshop in their current and future research activities. The post-workshop interactions of the IDSS team with participants, like the survey responses noted above, indicate that many of the Ethiopia workshop participants will

use or have already begun using knowledge gained in the IDSS workshops in future and current research activities. Some of the participants are already engaged in ILSSI activities, and are now ready to apply what they have learned in the project.