A discussion paper on the proposed demonstration intervention sites in Ethiopia for the Innovation Laboratory on Small Scale Irrigation

Simon Langan, Gebrehawaria Gebreziabher, July 2014

Introduction

Smallholder irrigation technologies that lead to sustainable intensification and integration of 'system components' such as livestock through piloting and promotion of irrigated fodder, enables smallholder farmers to maximize the economic and social benefits from land and water resources. From the stakeholder consultation, the Feed the Future Innovation Lab for Small-Scale Irrigation project consider that a mixture of factors such as, water availability (both ground/surface water), experience in irrigation and improved fodder development, adoption experience of smallholder water lifting and application technologies, size of landholding, and livelihood systems are important indicators of areas suitable for piloting and demonstration of smallholder irrigation technologies and sustainable intensification. Based on these the project has identified the following sites as its potential for piloting and demonstrating 'bundles' of interventions of selected smallholder irrigation technologies. Where bundles refers to going beyond single technical considerations and recognises other aspects related to capacity, value chain, multiple benefits/use etc.

1. Dangila woreda, Amhara

Dangila is one of AGP and Feed the Future woredas in the Amhara regional state. It is located at 36.847 degrees longitude, 11.254 degrees latitude and 2140 masl altitude about 80 kilometers south west of Bahir Dar. In the woreda, there are 27 rural Kebeles among which 16 of them have access to perennial rivers. It has a sub-tropical ("Woina Dega") climate with 8.4 degree Celsius of average daily temperature.

IWMI have recently been working in the woreda on shallow groundwater (AMGRAF project). From which we have compiled the following existing 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. Current status of groundwater use for domestic and irrigation is presented below.

	Depth below ground surface (m)	Current Use	No. of Wells in Dangila woreda	Remark
Hand dug wells	< 25	Irrigation and Domestic water supply	2281	Excavated by human labor
Shallow wells	25-75	Domestic water supply	3	Well drilling need machinery
Deep wells	>75	Domestic water supply	11 (includes non-functional)	Well drilling need machinery

Groundwater mapping by iDE also shows that Dangila woreda is one of the potential areas for manual well drilling. All these indicate that the woreda is suitable for piloting and demonstration of smallholder irrigation technologies for sustainable intensification.

Currently, a number of households are practicing irrigation using motor pumps mainly from rivers. Traditional river diversion and hand-dug wells are the main source of water for smallholder irrigation. In 2012/2013 cropping season, about 8629 hectares of land was irrigated to benefit about 13,555 small holder farmers. The woreda agricultural office promotes the use of hand dug well for irrigation and target that every farm household has to irrigate at least 0.125 ha of land using hand dug wells. Although, there was an attempt to introduce drip irrigation for smallholder irrigation, it was not successful because the drip emitters were not properly functioning, which ILSSI may contribute in addressing capacity and technical needs.

Since the depth of hand-dug wells is shallow and water yield is low, they are not appropriate for motor pump use. Almost all shallow wells are currently used for drinking water rather than irrigation, but the woreda has a plan and have selected eight kebeles to promote the use of groundwater for household irrigation. It is proposed that ILSSI intervenes to:

Study the combination of optimum well depth, water balance and suitable water lifting and water application technologies to maximize benefits from investment in groundwater development could be another area where ILSSI can contribute. More specifically this will mean implementing a series of manual wells with design and use of associated lifting technology (manual) and use of this increased water availability to support household use through kitchen gardens (possibly including irrigated fodder) trialling drip irrigation as well as domestic use. This has been agreed with Bahir Dar University who will work up a more detailed experimental design. Current thinking is that approximately 5 wells will be installed (dug) and these will be used to supply 10-15 kitchen gardens.

We are also aware that ATA and Water Aid have work in the woreda the detail and extent of which we are currently collating to see how much synergy and additional information we may be able to share.

2. Robit-Taba Kebele, Bahir-Dar Zuria Woreda, Amhara

Robit-Taba is one of the rural kebeles in Bahir-Dar zuria woreda of Amhara regional state. It has a sub-tropical ("Woina Dega") climate. It is one of AGP and Feed the Future woredas in the region. 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%) was irrigated using motor pumps. There are about 3861 individual wells in the kebele. 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 kilometers far 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 own consumption which can be developed into business for market.

In discussion with Bahir Dar University we are proposing this site for trialling groundwater recharge and together with in-situ roofwater harvesting, its use in kitchen gardens and for irrigated fodder. Increasing shallow groundwater recharge will be tested through interventions in the form of both deep tillage and biological Intervention. Current thinking is that 3 each of mechanical and biological interventions will occur. These will largely be towards the top of slope so as not to disrupt downslope passage/transmission of water and reduce the risk of slope failure (see also discussion). As with Dangila current planning is for 10-15 kitchen gardens will be implemented according to official and community consultation results.

With the exception of some preliminary investigations by Bahir Dar University we are not aware of any other current activity, although this will be subject to further discussion during exploratory phase.

3. Lemo Woreda, SNNPR

Lemo woreda is located in the Hadiya zone of Southern Nations, Nationalities and Peoples Region of Ethiopia, about 185 kms from Addis Ababa. The Woreda and its surrounding Kebeles are characterized by a crop-livestock system with a strong perennial crops component. Lemo has a bimodal rainfall pattern. It is one of the principal sites of the USAID Feed the Future, Africa Rising project.

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. For instance, Enset production has been declining due to disease infestation. The youth and the disadvantage 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. The ground water table of the Kebeles in Lemo, range from 1.90m 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, July and August to the end of the dry season, March and April. Their water use is so small that they only feed their cattle; consume some for household purposes and few farmers use for Irrigation on tiny plot of land. Recent documented visits by Africa RISING project of noted concerns about declining rainfall, long dry spells and periodic flooding from farmers.

The water sources utilized by the community are:

- Piped water to village taps for domestic use, mostly Government provided and maintained through a user charge being levied. These were seen as mostly reliable but occasionally not having water.

- Rivers/streams, used for domestic purposes, livestock watering and sometimes irrigation, through individually owned pumps and / or kebele owned Government constructed diversionary weirs to fields through a canal system

- Ground water (individually owned shallow wells) with water at 5-10 metres used for livestock watering, sometimes irrigation and occasionally for domestic supplies when other sources are not available. Extraction is usually by rope and bucket. In some areas the use of a hand operated rope-washer pump had been promoted by NGOs. Small ponds sometimes with plastic lining collecting rain water run-off for small scale irrigation, often without water in the dry season

- Small dams / large ponds used primarily for livestock watering and occasionally for domestic purposes when other potable water sources fail.

- Springs often protected and maintained by a kebele irrigation committee after initial support from an NGO and used for irrigation, domestic purposes and livestock watering these often dry up in the dry season.

The Africa RISING project has introduced treadle pumps in the first year and monitoring its use and also plans to introduce rain water harvesting structures, building capacity on use of rope and washer and other water lifting technologies including solar pumps. Currently a study on ground water yield evaluation is ongoing to introduce these targeted interventions.

Under ILSSI we will expand the breadth and number of interventions within this woreda. Specifically, irrigation will be introduced in the Lemo kebeles whereas existing irrigation practices will be enhanced in the neighbouring keble of Angacha. Irrigation will be enhanced by assessing the demand and uptake of mechanical and solar pumps (as opposed to existing manual pumps); the use of this enhanced water availability for kitchen gardens and irrigated fodder. In the Lemo kebele our intention is to test and introduce small scale manual irrigation given the number of shallow wells and ground water potential, it has to be coupled with strong capacity building component for the farming community, for maintenance and management of water resources.

4. Adami-Tulu woreda, Oromia

Adami-Tulu 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 International Development Enterprise (iDE) has worked in this woreda in promoting different type of water lifting technologies and small-scale irrigation. According to iDE, communities/Kebeles 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 18 meters depth and lifting technologies, such as Rope & Washer, Treadle Pumps and motor pumps are commonly used by farm households. Almost all farm households who live close to 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 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 would work with iDE to better understand the opportunities and constraints associated with existing and potentially new institutional arrangements and promotion of solar pumps as an option to address problems associated with maintenance of motor pump and high fuel prices may add value.

5. Discussion

Table 1 and Figure 1 summarise the geographical and interventions proposed for the Ethiopian component of ILSSI. Together these provide a mix of intervention 'bundles' drawing on the information provided, distilled and developed from the stakeholder workshop and subsequent discussions with research partners and projects. More specificity for the interventions at the sites will be provided as we draw up the contracts for national partners and engage with government officials and communities to see what would be feasible and acceptable See section 6 below). The sites and interventions represent a mixture of new sites in which ILSSI will be the principal project driver and sites where other projects are already working. In recent discussions with BDU (and more generally with

NCAT) it is our understanding that they have financially written in to their outline work plans that in the event of an intervention failing there will be financial compensation made to the farmers to cover any loss.

To add to these sites of primary data collection from ILSSI it is our intention to collate further data from secondary data sources. Work on compiling this has already been initiated through discussions with other CG projects (Africa Rising, LIVES) as well as with other organisations(ATA, Water Aid, iDE and IRC).

Whilst the overall approaches are in line with the stakeholder workshop suggestions, there has been significant refinement to ensure the interventions address a range of issues, contain an innovative approach and provide data for the range of technical and economic models within the IDSS. Therefore the interventions focus on supply and access to water, its use within selected agro-ecologies of Ethiopia.

In developing this paper two other important pieces of work have come to light, firstly the work of IRC 'A hidden resource: household led rural water supply in Ethiopia' http://www.basicwaterneeds.com/wp-content/uploads/qaqc/HWTS%20general/HWTS%20general/Ethiopia%20hidden%20resource%202012.pdf

This is important in relation to a) the findings in relation to multiple use of household wells not only for water supply but their relation to other use, household irrigation, type of well and risk for human health; b) we hope with further discussion to have access to the primary data these findings were based on for use in a modelling framework.

Secondly it is evident from recent discussions with Tufts University that under a FtF grant they have for Ethiopia they also intend to work with NGOs on Kitchen Gardens (http://now.tufts.edu/news-releases/feinstein-ethiopia-agriculture%20grant). Hopefully there is an opportunity to share information and create synergy between these projects. This IWMI are currently exploring with the in country contact.

6. Next steps

Whilst there are a number of steps between now and implementation, these are not mutually exclusive and some of them are quite rapid. The unknown is how long and to what depth the environmental impact assessment USAID may require us to undertake. This should be alleviated as the numbers are small and contracts will allow for financial compensation in the case of interventions not succeeding.

STEPS:

A. Edit and amend this document so that all partners are in agreement. Share updated and modified version with national partners. Reach agreement on sites and interventions as proposed above, by 31/7/2014

B. Get USAID approval, August 2014

C. Work up and national partner contracts; monitoring schedules; order equipment by 30/8/14

D. Initiate woreda official and community consultations to identify form and households for interventions by 15/9/2014

E. Undertake Baseline Studies and surveys (technical, social, economic) by 15/10/2014

F. Implement interventions, initiate from 15/10/2014

G. Review progress December 14; March 2015.

Table 1. Summary of proposed site interventions for ILSSI in Ethiopia

Site	Particular Issue(s) addressed	Intervention(s)[(1)]		ILSSI partner	Main National. Partner	Type of survey and monitoring	Associated Project(s)	Comments/ Notes
		Type	Number					
1. Dangila	Is there optimal balance between available shallow groundwater resources, aces to them and their utilization and benefits?	a) installation of manual wells and associate manual lifting device b) installation of kitchen gardens with and without different application technologies (drip etc.) c) sub component on irrigated fodder	a) 5 b) 10-15 c)10-15??	IWMI/NCAT/ILRI	Bahir Dar University	Raingauge/ AWS Water yield Water use Crop yield/ animal productivity Gender Income Livelihood	ATA; Water Aid, AMGRAF	ATA consider high potential for
2. Robit-Taba	Through the use of improved land management is there potential to increase shallow groundwater recharge for use in the dry season by local households?	a) Shallow ground water recharge b) kitchen garden	a) 3 mechanical, deep plough; 3 biological-tree b) 10-15	IWMI/NCAT/ILRI?	Bahir Dar University	Raingauge/ AWS Soil moisture Dip well? Productivity	None	
3. Lemo	Contrast the	a) in one kebele	a) 5	IWMI/ILRI	Bahir Dar or	Raingauge/ AWS	Africa Rising	Need to better

	acceptance, performance and capacity of communities with little and reasonable exposure to small scale irrigation practices	establish manual lifting technologies in second b) establish mechanical, diesel and solar pumps c) install kitchen gardens and irrigated fodder plots	b) 3 c)15-30		Arba Minch Universities??	Manual well Motorised/solar pump Kitchen garden		identify specific role of ILSSI in contrasting kebeles
4. Adami Tula	Similar to Lemo, understanding opportunities and constraints with institutional arrangements and capacity in relation to improving SSI utilization and performance	a) Estimating installation of 3 pump types manual, diesel and solar b)	To be determined, under discussion with iDE (anticipate approx. 9 pumps 3 of 3 types) b) 15+ kitchen garden and irrigated fodder plots?	IWMI/NCAT?/ILRI ?	iDE	Raingauge/ AWS		Potential to supplement this with data and information from IRC study (see [3])

Notes

[1]. Interventions here are represented in physical/technical form. In actuality will involve consideration of capacity, value chain and multiple use elements as well. Furthermore interventions will only be confirmed after agreement with government and community official representatives.

[2]. KG supplement with data/information from Tufts University work (work in progress)

[3]. http://www.basicwaterneeds.com/wp-content/uploads/qaqc/HWTS%20general/HWTS%20general/Ethiopia%20hidden%20resource%202012.pdf

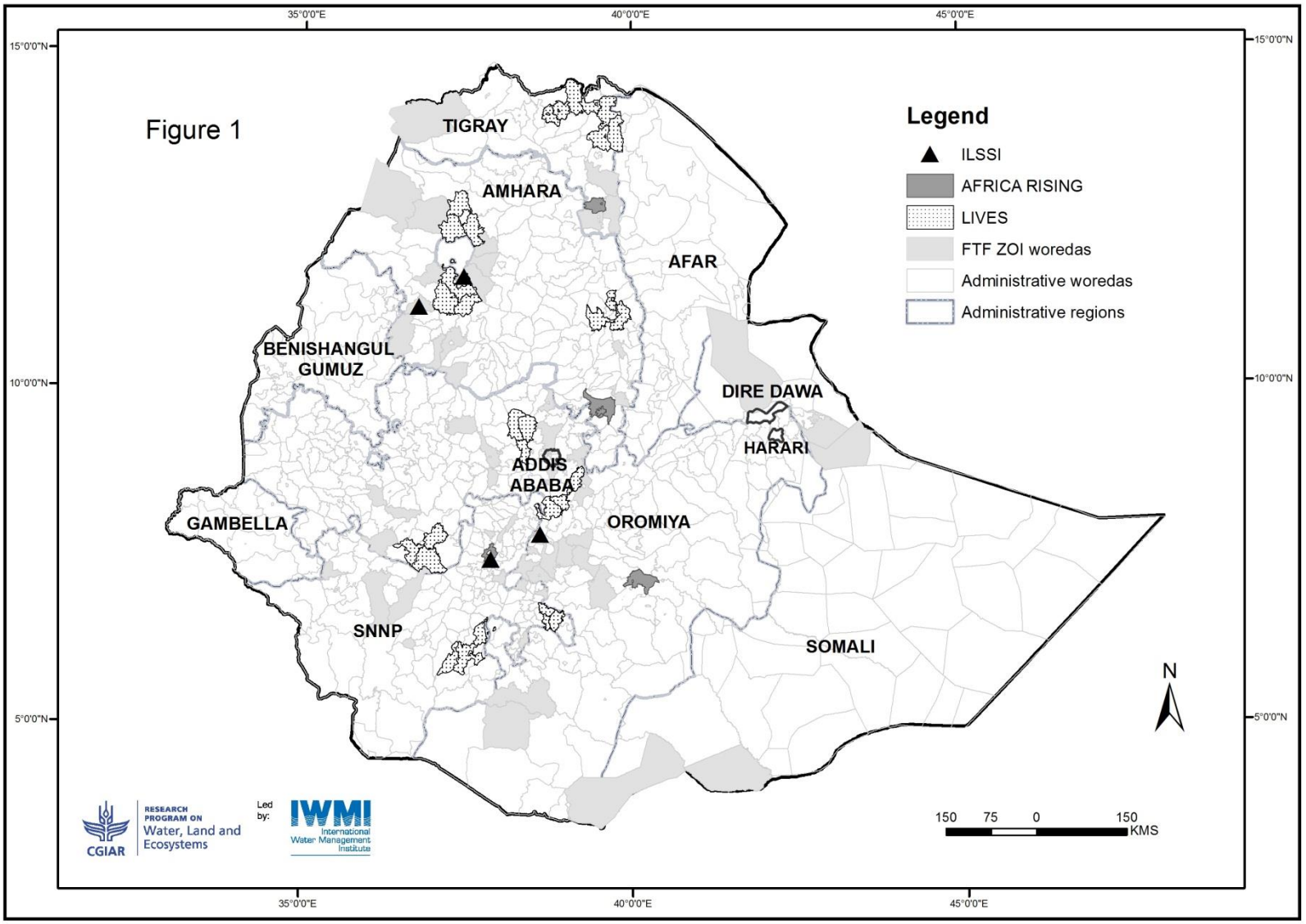
Figure 1
Legend
ILSSI
AFRICA RISING
LIVES
FTF ZOI woredas
Administrative woredas
Administrative regions
TIGRAY
AMHARA
AFAR
BENISHANGUL GUMUZ
DIRE DAWA
HARARI
ADDIS ABABA
GAMBELLA
OROMIYA
SNNP
SOMALI
N
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KMS
35°0'0"E
40°0'0"E
45°0'0"E
15°0'0"N
10°0'0"N
5°0'0"N
RESEARCH PROGRAM ON Water, Land and Ecosystems
CGIAR
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IWMI
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