



# Improving water security through Sustainable Land Management



Story of change: Key findings & emerging impacts

## Summary

- Sustainable Land Management techniques can improve water security and agricultural productivity in rural areas, with water availability and reliability appropriate measurable outcomes of SLM success
- Increased groundwater development without consideration of water quality can increase consumption of unsafe water
- Women face more barriers to uptake of SLM than men, including access to information, time and energy constraints.
- Consideration of gendered barriers to SLM and access to clean water and sanitation have been integrated into SLM in a new project which will benefit up to 65,000 people in the Kunzila region of Ethiopia

## Introduction

Agriculture is a vital part of the economy in Ethiopia, and a source of livelihood for 78% of households, with the majority involved in subsistence agriculture (World Bank, 2015). However over 85% of the land is estimated to be moderately to severely degraded at an estimated cost of \$4.3 billion annually (Gebreselassie et al. 2016). Beyond the loss of fertile land, soil erosion also contributes to increased sedimentation in streams and surface water reservoirs. Land degradation can affect farmers' livelihoods, reducing land productivity through decreased soil fertility.

 Northwest Ethiopia





In 2012, the Water and Land Resource Centre (WLRC) established six Learning Watersheds in the Central and North-Western parts of Ethiopia. They sought to demonstrate how land degradation could be effectively reduced and land restored over a relatively quick period through integrated sustainable land management (SLM) investments and practices, including approaches to reduce the flow of rainwater and soil downslope through physical measures and planting, and to rehabilitate and protect degraded areas. These activities are complemented by approaches to improve soil productivity, diversify planting to support environmental outcomes and economic productivity (including irrigation), diversity income streams, and to support sustainability of these programmes through capacity building at the individual and institutional levels.

While the main objectives of the SLM program focused on land restoration, REACH's work in the Fragile Environments Observatory, through the collaboration between WLRC, the University of Oxford, IFPRI and IRC since 2015, has been investigating the role of SLM activities in securing water for livelihoods and household use. The research has provided key insights around benefits for small holder farmers, while highlighting challenges in terms of gendered uptake and water quality. These learnings are shaping regional and national level agendas on land restoration, leading to improvements in rural and urban areas.

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## Key findings from REACH's research

### Improved soil moisture availability for crop growth

WLRC conducted a study to assess how SLM affects in-situ moisture availability, comparing soil moisture regimes in agricultural areas under traditional and improved management in Ethiopia's Blue Nile Highlands. The research found that areas under improved management have more stable soil moisture regimes over time, as well as a more uniform spatial distribution of soil moisture, than traditionally managed areas.

Consistent levels of soil moisture mean that crop roots are more evenly served with water, increasing crop yield. In tests, improved management increased soil moisture content by 15.6 to 800%. Overall, results suggest that improved management of agricultural catchments through SLM can play a crucial role in benefiting agricultural water security by improving soil moisture availability and storage. The study also indicates that SLM promotes the infiltration of rainwater into the soil, enhancing groundwater recharge. Where SLM is underway, home gardens, a source of cash income, are expanding, and more people are constructing wells to access groundwater for irrigation and domestic use.

### SLM activities provide direct benefits in terms of water availability, agricultural productivity and household income.

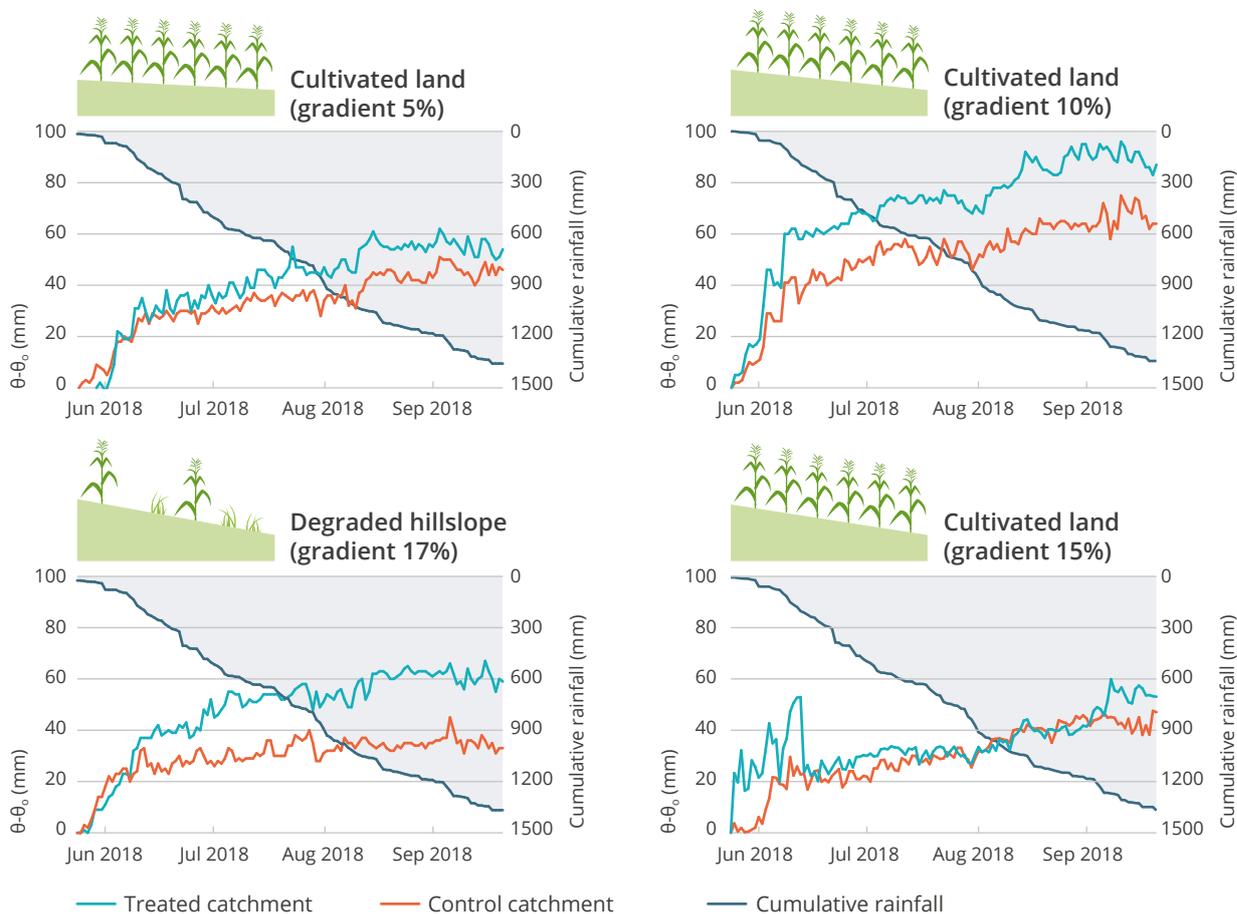
IFPRI conducted a household survey in two WLRC watersheds with SLM programming and two adjacent watersheds without such programming. A total of 561 households with 2,900 plots were interviewed from the four watersheds. Results indicated that compared to households in control watersheds, households in SLM-supported learning watersheds have:

- Increased access to groundwater for irrigation and have experienced improved water availability for livestock production;
- Increased household income from livestock production (+31%) and crop production to a lesser extent
- Higher crop yields, particularly for maize, mango and millet;

### Women face more barriers than men in adopting SLM practices;

Qualitative data collected by the University of Oxford, through gender-segregated focus group discussions, found that time and energy constraints, as well as barriers to information, are experienced more significantly by women than by men.

**Figure 1:** Changes over time in soil moisture compared to baseline levels measured at the start of the 2018 wet season, in 4 paired experimental sites in the Blue Nile Highlands, Ethiopia. Area under SLM, control area under traditional management. Source: Mersha et al. 2022.



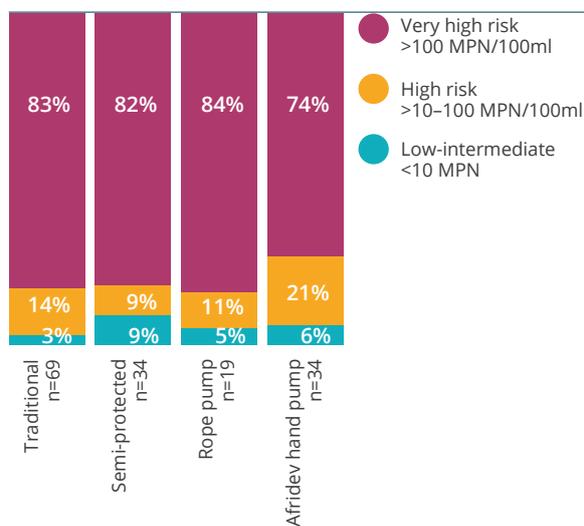
Women face multiple barriers from a lack of engagement in SLM training, to access to productive land, to access to markets, that require consideration to reduce the gender gap in the uptake of SLM, and to access the benefits for water security.

**Water quality remains a considerable challenge, with 95% of water sources sampled considered to be unsafe;**

SLM can contribute to increased water availability for wells that can be used for drinking water and other domestic uses. However, the expansion of shallow, unprotected wells for irrigation in an area with limited improved drinking water sources has increased use of water that is of poor quality, including for drinking.

Research led by IRC found that 90-95% of water sources sampled (n=156) in Aba Gerima and Debreyakob watersheds were contaminated by faecal matter; while this was higher for the more prevalent traditional shallow wells, contamination was also high in improved wells (Afridev hand pumps) designed for drinking water. One of the reasons suggested for the lack of focus on and investment in water quality is assumption that wells would be exclusively used for irrigation, rather than for multiple purposes. IRC's survey also highlighted that the poorest were late-entrants into well ownership, gaining access more rapidly after the SLM interventions commenced, possibly due to the increasing accessibility of groundwater.

**Figure 2: *E coli* risk by technology type. Source: Naafs et al., 2020.**



## Pathway to impact

### Cross-learning and capacity development

Despite the well-researched overall benefits of Sustainable Land Management practices, the collaboration between WLRC, the University of Oxford, IFPRI and IRC has shed critical insights on the water security benefits, and the gendered and water quality challenges that remain. In order for communities to fully and equitably benefit from SLM practices, these barriers must be addressed and should be part of the SLM design. REACH internal meetings, notably in 2017 in Bishoftu, Ethiopia, and in 2019 in Oxford, have played a central role in ensuring cross-learning and discussion on these issues.

### Influencing €16M ILMWA project, benefiting up to 65,000 people

- The learning that gender considerations and access to clean water and sanitation should be central components of integrated landscape management has directly shaped the scope of a new €16M project (2021-2025) funded by the Dutch and Ethiopian governments. The project is led by WLRC and implemented with SNV as a consortium member.

The Integrated Landscape Management and WASH (ILMWA) project will support integrated land management and improve WASH in the Kunzila area.

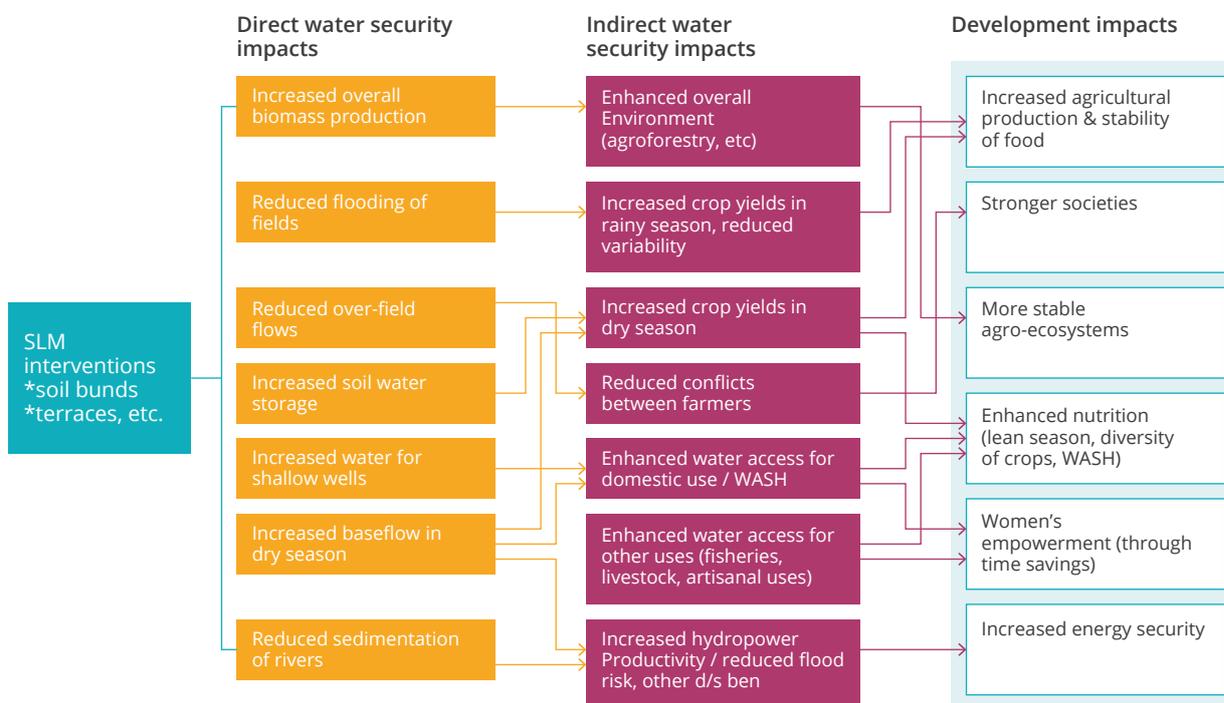
- ILMWA covers 11740 ha and directly benefits 35,000 and indirectly 65,000 people. The project aims to achieve 100% access to clean water and sanitation for rural and urban households, as well as schools and health care facilities. This will be a considerable improvement from the 37% of the population and 50% of the institutions that currently have access to safe water.
- ILMWA is currently set up as a 5-year pilot project, and will be used as a national model for land management approaches that combine WASH and agricultural water security.

### Influencing the national agenda on SLM

WLRC is leading policy change in Ethiopia to recognise water security as a critical development outcome of SLM.

- WLRC is advocating for inclusion of water availability as one indicator of SLM success at national level in the design of the SLM Knowledge Management and Information System (SKMIS). The SKMIS is a software designed by WLRC for the national SLM programme financed by the World Bank, KfW and other consortium members worth 200 million USD. In principle agreement has been reached.
- WLRC is coordinating the national project design for the National SLM technical committee on behalf of the Ministry of Agriculture, Ministry of Water, Irrigation and Electricity, and the Environment, Forest and Climate Change Commission. One of the objectives is to ensure water security improvements are formally recognised as a measurable outcome indicator from SLM interventions.

**Figure 3: Linkages between SLM and water security.** Source: Kato et al, 2019



## Outputs

Kato, E., Mekonnen, D.K., Tiruneh, S. and Ringler, C. 2019. Sustainable land management and its effects on water security and poverty: Evidence from a watershed intervention program in Ethiopia. IFPRI Discussion Paper 1811. Washington, DC: International Food Policy Research Institute (IFPRI). doi: [10.2499/p15738coll2.133144](https://doi.org/10.2499/p15738coll2.133144)

Kato, E., Mekonnen, D.K. and Ringler, C. 2022. Gender gaps in sustainable land management and implications for agricultural productivity: Evidence from Ethiopia. IFPRI Discussion Paper 2136. Washington, DC: International Food Policy Research Institute (IFPRI). doi: [10.2499/p15738coll2.136361](https://doi.org/10.2499/p15738coll2.136361)

Mekonta, L., James, A. and Butterworth, J. 2018. [Baseline report of groundwater development in pilot watersheds Amhara, Ethiopia](#). The Hague: IRC.

Mersha, B., Zeleke, G., Alamirew, T., Dejen, Z. and Gebrehiwot, S. 2022. Soil moisture spatio-temporal variability under treated and untreated catchment conditions in a fragile tropical highland environment: implication for water security. *Arabian Journal of Geosciences*, **15**(8): 696. doi: [10.1007/s12517-022-10016-6](https://doi.org/10.1007/s12517-022-10016-6)

Mersha, B.D., Zeleke, G., Alamirew, T., Dejen, Z.A. and Gebrehiwot, S.G. 2022. Assessing the effect of sustainable land management on improving water security in the Blue Nile Highlands: a paired catchment approach. *Environmental Monitoring and Assessment*, **194**(3):197. doi: [10.1007/s10661-022-09837-5](https://doi.org/10.1007/s10661-022-09837-5)

Naafs, A., Mekonta, N., Butterworth, J. and Addisu, G. 2020. [REACH water security in fragile environments observatory summary research report](#). Oxford and The Hague: REACH and IRC.

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## Story of change themes



Groundwater



Land



Coasts



Gender



Schools



Services



Health



Climate



Cities



Basins

REACH is a global research programme to improve water security for the poor by delivering world-class science that transforms policy and practice. The REACH programme runs from 2015–2024 and is led by Oxford University with international consortium of partners and funded with UK Aid from the UK Government's Foreign, Commonwealth & Development Office. Project code 201880.