



# Participatory water resource management



Story of change: Key findings & emerging impacts

## Summary

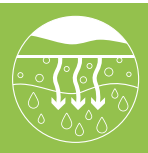
- A para-hydrology initiative in two regions of Ethiopia trained citizen scientists to collect quantitative data on rural hydrological systems
- Citizen science hydrometeorological data has been successfully used in several peer-reviewed studies to predict and assess the impact of sustainable land management interventions
- The research has informed approaches to participatory monitoring in two major sustainable land management programmes run by Ethiopia's Ministry of Agriculture & Natural Resources
- A gender-sensitive approach is required to address the current barriers to women's involvement in citizen science and water management decisions

## Introduction

Future water security for the rural poor in Ethiopia is strongly connected to initiatives which aim to deliver improved natural resources management through participatory watershed development. The Ministry of Agriculture & Natural Resources (MoANR) have promoted this approach through the World Bank funded Sustainable Land Management Programme (SLMP) and subsequent Resilient Landscapes and Livelihoods Project (RLLP).



Amhara and SNNP regions, Ethiopia



REACH funded research designed and led by Newcastle University and IWMI has focused on developing a novel approach to water security and poverty research through participatory monitoring at community scale (ie. citizen science). Public participation is nothing new in this context; however, the focus to date has been on qualitative data and the challenge is to use participatory methods to generate quantitative data. Uncertainty over the quality of such data collected by non-experts leads to concerns within government institutions over the legitimacy of citizen science. Women in the community were specifically included in this initiative as citizen scientists.

## Key findings

REACH has demonstrated the reliability of the data gathered by local citizen scientists and explored its value and use in developing their understanding of hydrological processes affecting groundwater availability.

Women and men used groundwater differently, with men mostly responsible for institutional management of water resources and irrigation; women were less willing than men to participate as citizen scientists for multiple reasons, including low literacy rates.

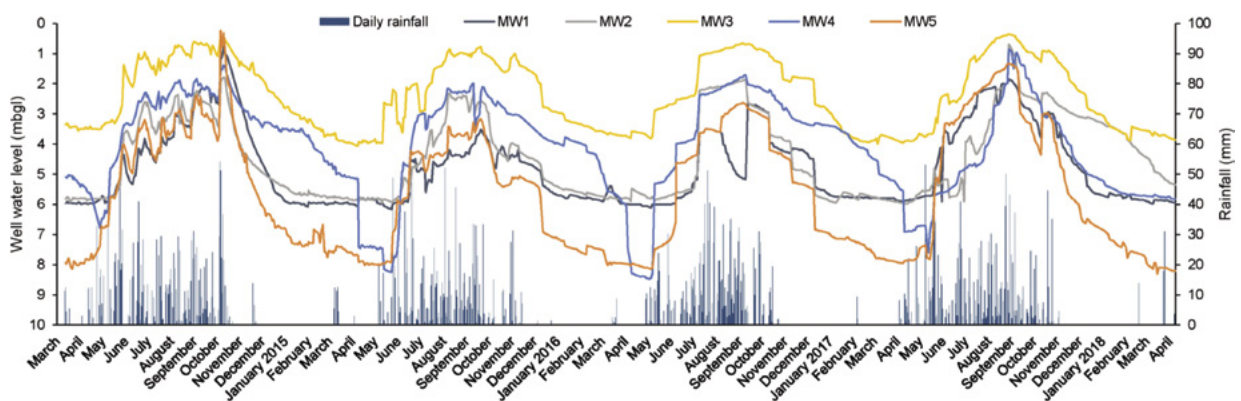
Researchers worked closely with staff at different levels within MoANR who are responsible for implementing a national programme of sustainable land management interventions. This has resulted in recognition of the value of citizen science and led to the joint preparation of guidelines for embedding this approach within future MoANR activities.

## Scientific impact

Using data from the citizen scientists to provide detailed information on rural hydrological systems, a parameter efficient hydrological model has been developed to provide better prediction of the impact of sustainable land management interventions. The methodology for groundwater recharge estimation has been documented and published through two peer-reviewed journal papers.

These papers confirmed both the utility of citizen science hydrometeorological data and the availability of shallow groundwater to support small-scale irrigation. A further peer-reviewed journal paper has been published summarising the Ethiopia research and concluding that arguments previously put forward against the promotion of shallow groundwater use for agriculture in sub-Saharan Africa appear exaggerated.

**Figure 1:** Daily community observed rainfall and groundwater level data for 2014–18 (well depths are: MW1 6.0 m; MW2 6.9 m; MW3 4.2 m; MW4 9.2 m; MW5 8.4 m). Source: Gowing et al, 20221.



The analysis challenged the view that shallow aquifers were unproductive and that irrigation would have unacceptable impacts on wetlands and other groundwater-dependent ecosystems. In one of the SNNP region watersheds, citizen science data has been used alongside remote sensing data to evaluate the effect of sustainable land management interventions on vegetation cover. The study found that sustainable land management had an overall positive impact on vegetation cover.

### Policy and practice impact

The project has influenced the design of two major national initiatives implemented by Ministry of Agriculture & Natural Resources:

- The [World Bank Resilient Landscapes and Livelihoods Project](#) (RLLP) is ongoing from 2019 to 2024 and is supporting the restoration of degraded landscapes in selected watersheds and helping to build resilient livelihoods on this newly productive foundation;
- The [Participatory Small-scale Irrigation Development Programme II](#) (PASDIP2) is ongoing from 2016 to 2024 and is improving the access of farmers to small-scale irrigation and enhancing climate-smart agricultural intensification in the adjacent watersheds.

Both projects will include hydrological monitoring in selected watersheds and will build upon Newcastle's experience with citizen science.

Other initiatives still under development have expressed an intention to adopt this approach:

- SIWI will apply citizen science to assessment of water quality and quantity impacts of textile factories in Ethiopia
- The Ethiopian Ministry of Water, Irrigation & Electricity is revising the Ethiopian Water Policy; the expert panel is exploring how to incorporate citizen science in the policy document.

### Capacity building impact

- Established four citizen science monitoring sites in the Amhara and SNNP regions. Observers and para-hydrologists were recruited and trained, instrumentation was installed and monitoring carried out.
- Conducted workshops on hydrogeology and hydrometeorological monitoring with MoANR staff. A guidance note was jointly developed as a resource for RLLP and published as a working paper.
- Conducted workshops for para-hydrologists on hydrogeology, and on data analysis and quality-checking. Materials from this workshop were developed into a guidance note and training resource for RLLP and published as a working paper.
- Inclusivity challenges in relation to the participation of women in watershed development decision-making processes were identified. An investigation of gendered understanding of hydrological processes and attitudes to citizen science was undertaken.
- Masters and PhD students from Arba Minch University in Ethiopia worked on this project and conducted their dissertations on this research.

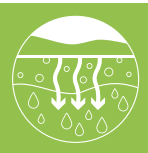
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### Outputs

Book chapter: Scope of citizen science for hydrologic monitoring in small watersheds in Ethiopia. (2019). In: Extreme Hydrology and Climate Variability, Monitoring, Modelling, Adaptation and Mitigation, Melesse, A., Abtew, W., Senay G., (eds). Amsterdam: Elsevier. doi: [10.1016/B978-0-12-815998-9.00034-8](https://doi.org/10.1016/B978-0-12-815998-9.00034-8)

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Walker, D., Haile, A. T., Gowing, J., Legesse, Y., Gebrehawariat, G., Hundie, H., Berhanu, D. & Parkin, G. (2019). [Guideline: Community-based hydroclimate monitoring](#). REACH Working Paper 5, University of Oxford, Oxford, UK.



Walker, D., Haile, A.T., Gowing, J., Forsythe, N. & Parkin, G. [Guideline: Selecting, training and managing parahydrologists](#). REACH Working Paper 6, University of Oxford, Oxford, UK.

Gowing, J., Walker, D., Parkin, G., Forsythe, N., Haile, A. T. & Ayenew, D. A. (2020). Can shallow groundwater sustain small-scale irrigated agriculture in sub-Saharan Africa? Evidence from N-W Ethiopia. *Groundwater for Sustainable Development*, **10**. doi: [10.1016/j.gsd.2019.100290](https://doi.org/10.1016/j.gsd.2019.100290)

Ferede, M., Haile, A.T., Walker, D., Gowing, J. & Parkin, G. (2020). Multi-method groundwater recharge estimation at Eshito micro-watershed, Rift Valley Basin in Ethiopia. *Hydrological Sciences Journal*, **65** (9): 1596–1605. doi: [10.1080/02626667.2020.1762887](https://doi.org/10.1080/02626667.2020.1762887)

Assefa, A., Haile, A.T., Dhanya, C.T., Walker, D.W., Gowing, J. & Parkin, G. (2021). Impact of sustainable land management on vegetation cover using remote sensing in Magera micro watershed, Omo Gibe Basin, Ethiopia. *International Journal of Applied Earth Observation and Geoinformation*, **103**: 102495. doi: [10.1016/j.jag.2021.102495](https://doi.org/10.1016/j.jag.2021.102495)

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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.