Discussion brief, April 2024

Policy and practice recommendations on flood risk management in the Awash basin

Meron Teferi Taye, Alemseged Tamiru Haile, Mengistu Dessalegn, Likimyelesh Nigussie, Tilaye Worku Bekele, Alan Nicol, Ellen Dyer & Sirak Tekleab

Taye, M.T., Haile, A.T., Dessalegn, M., Nigussie, L., Bekele, T.W., Nicol, A., Dyer, E. & Tekleab, S. 2024. Policy and practice recommendations on flood risk management in the Awash basin. REACH Discussion brief.

Background

In the Awash basin flooding is a frequent occurrence during the main rainy season in July and August. The changing climate patterns are intensifying extreme rainfall conditions and causing floods in unexpected locations and seasons. Added to which, narrow channel width, land cover changes and land degradation can all exacerbate flood impacts.

Recent exceptional wet extremes in 2020 caused massive flooding and severe damage to property in parts of the basin. A displacement of 144,000 persons and over 5 billion Birr damage was reported in Afar Regional State alone (ENA, 2020). With support from the REACH program, the International Water Management Institute (IWMI) examined characteristics of extreme rainfall and associated drivers of flooding, comparing previous flood occurrences, and investigating non-climatic drivers including differential impacts on social groups.

Photo: Genet Alazaron Unsplash

Key points

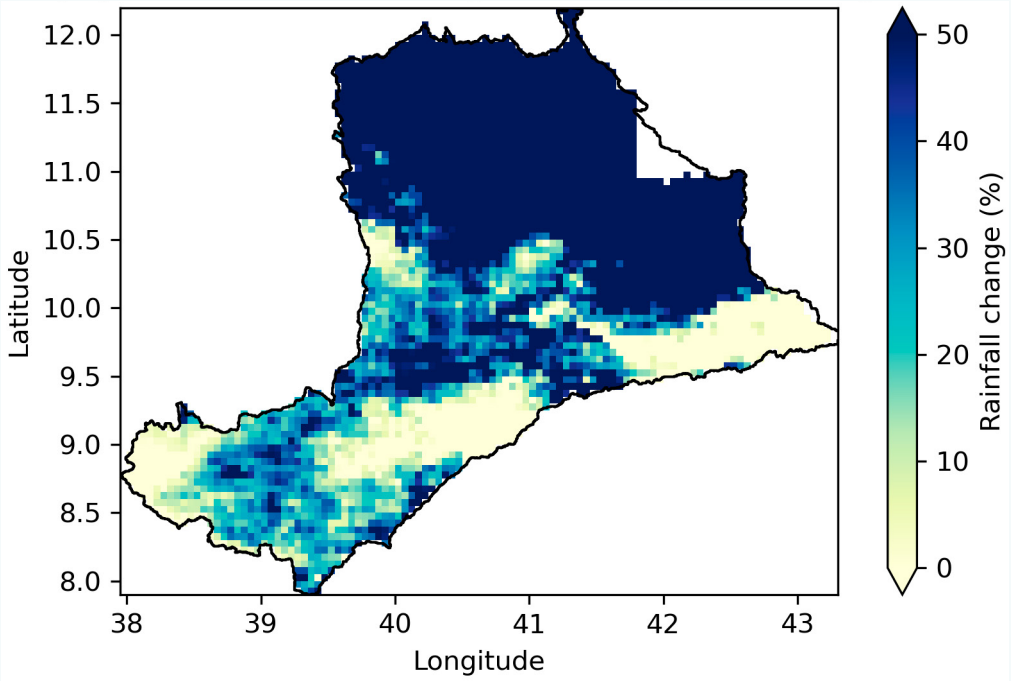
Unusual rainfall in terms of location, magnitude, and timing was the major cause of flooding in 2020

High rainfall in the lower basin and western escarpment early in the rainy season was unusual.

A rainfall anomaly of more than 75% was observed for 2020 compared to the long-term average (1981-2010) for the lower basin. Compared to previous wet years that caused flooding, the 2020 rainfall anomaly (by volume) was more than 50% (Figure 1). Moreover, antecedent rainfall conditions were also wetter than average by about 62%, which could have contributed to existing high soil moisture.

The atmospheric drivers of the 2020 July-August extreme rainfall events are a combination of climate factors which are, however, not fully understood. The occurrence of a weak La Niña and positive Western Indian Ocean dipole likely contributed to the intense rains. Rather than relying on standalone drivers to predict severity, a better understanding of how multiple compounding drivers can interact and lead to more extreme impacts in a changing climate is necessary for future adaptation (Taye and Dyer, 2024).

Figure 1: July 2020 first dekad rainfall anomaly compared to previous wet years average rainfall total of the same dekad. Rainfall data source: CHIRPS



The 2020 flood was characterized by early onset, delayed recession and larger extent of floods

Remote sensing analysis using images of 10-m resolution and 6 to 12 days revisit time showed the extent of the 2020 floods around Dubti town were more than previous flood years. The flood extent was 159.22 sq. km in 2020 (Figure 2) showing 26% increased as compared to the flood extent in 2017-2019 and washed away the road near Dubti town (Figure 3). Community consultations and ground truthing of the remote sensing analysis highlighted that the floods from the Logyia river were damaging to the lowland areas of the basin more so than the main Awash River reach. This is a combination of unusually extreme rainfall combined with steep topography and degraded land cover. The remote sensing analysis also highlighted the impact of land use change on exacerbating floods and vice versa for the entire Awash basin, which showed high curve number values that signify the basin's susceptibility to easily produce runoff even from smaller rainfall events.

Figure 2: Flood extent in Dubti town based on remote sensing analysis. Red boxes show sites which were flooded in 2020 but used to be dry before in similar season, and CR refers to parallel access road and canal.

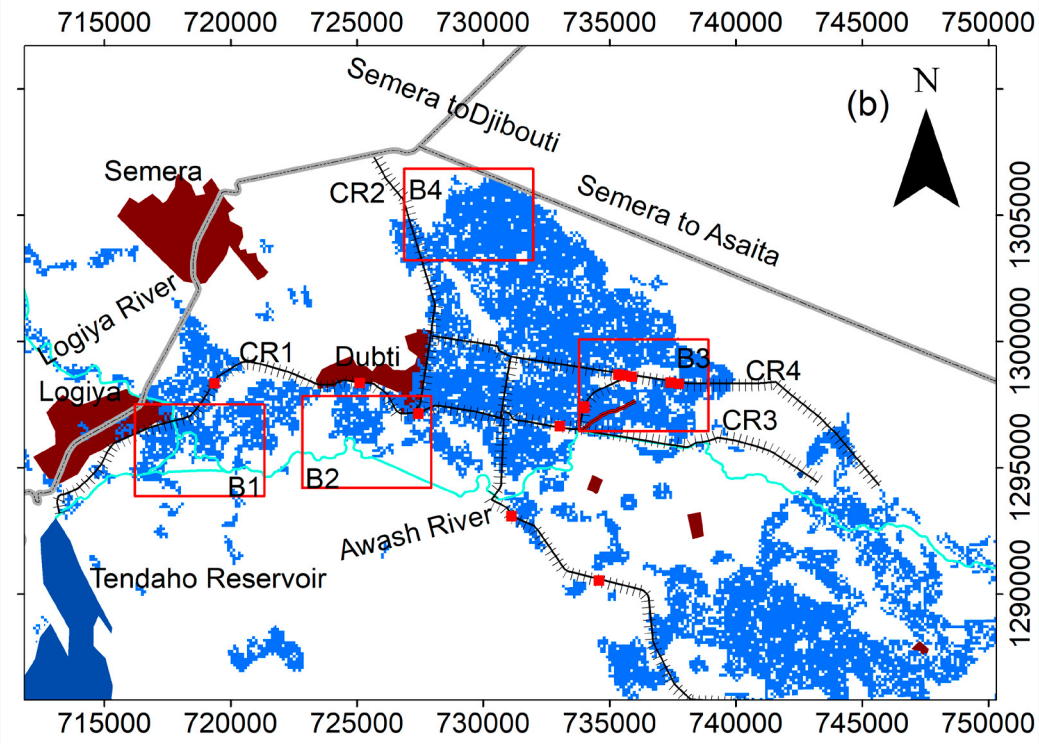


Figure 3: Road washed away in Dubti town due to the 2020 floods, which resulted in abandoning of irrigated land.

Social dimensions of flooding analysis revealed multi-causal factors

Analysis of the social dimensions of flooding revealed that although the initial trigger was extreme rainfall, many non-climate drivers contributed to and exacerbated flooding, as well as the range and intensity of impacts on communities.

Research highlighted land and water-based interventions, including extractive projects, accelerated flooding. For example, stone extraction in upland areas for road and house construction led to the accumulation of stones and soil in river channels, altering the size of riverbeds and natural course of flow (Figure 4). Expansion of houses and settlements also affects natural flood courses. By blocking and altering rivers and stream passages, as well as drainage systems, unmanaged processes of urbanization contribute to flooding. At community and government levels, the breakdown of collective action for natural resource management, including management practices, rules, regulations, and their enforcement, has increased degradation of natural resources including woodlands, thereby hastening processes of soil erosion which can exacerbate run off and, ultimately, the speed and extent of flooding.

Figure 4: Stone extraction in the north Wello Zone.

Impacts of flooding vary across groups within communities

The 2020 flooding affected men, women, and youth in the different communities by disrupting their livelihoods, increasing domestic duties, disrupting access to basic facilities such as health and education, and causing loss of property and/or reductions in property value.

Women (and men) reliant on single livelihoods and with limited assets were most affected as they lacked sufficient income to support their families. The impact was more pronounced on women from diverse social groups because the flood expanded unpaid family care duties whilst adding additional roles specific to flood prevention and recovery.

Disruption of access to health services predominantly affected women (and some men) with non-communicable diseases, and pregnant women and infants, whereas disruption of education services impacted future incomes of young men and women.

Variation in type of flooding and differential impacts requires contextualized interventions

The Awash Basin is a complex geography. The type of flooding that occurs in Upper, Middle and Lower Awash varies greatly. Urban areas experience flash floods and river overflow necessitating a range of interventions. In the Middle Awash there are large, mechanized irrigation systems where the need to maintain dykes, canals, and other structures ahead of the wet season takes priority. The Lower Awash (e.g. around Dubti town) experiences flash floods from the Logiya catchment and requires a multipurpose reservoir to delay flood water intrusion.

Recommended action points for practitioners and policy makers

The research engaged with experts and stakeholders as well as affected communities during various stages. Below are the key action points highlighted.

1. Institutional design to facilitate coordinated management and response to floods

Our consultations highlighted that in Ethiopia there is no dedicated institute that deals with floods, in spite of the growing impact on communities. Different aspects of flooding are handled by different institutes mostly in an ad hoc manner. For efficient prediction, mitigation and adaptation of floods due to a combination of factors, a dedicated institute or a better institutional coordination design that combines resources and information from different groups and stakeholders is recommended. Such institutional coordination for flood risk management, with clearly-defined mandates and responsibilities, would help alleviate the problems faced in the Awash Basin and elsewhere in Ethiopia.

2. Collaboration on operational guidance and improvement in flood early warning

Current practice in providing extreme rainfall forecast data is mainly handled by the Ethiopian Meteorological Institute (EMI) and flood forecasting by the Ministry of Water and Energy (MoWE). There is a room for improvement in these efforts that can be supported by the research community. Given that flood forecasting needs to be localized and as precise as possible, understanding unique rainfall occurrences and how they translate into flood events requires continuous improvement. Including disaster risk management offices in development of flood early warning systems will improve the applicability of the information on the ground and prevent unnecessary damage.

Moreover, communication channels for extreme rainfall and flood warnings requires improvement. Currently, EMI uses formal media outlets such as television and radio as well as phone calls to provide forecast information. However, communities may not receive warnings in a timely or understandable manner, delaying or impeding capacity to take appropriate action. Reaching directly into the community level is an improvement that needs to be considered in flood early warning systems across the country.

Additionally, reservoir operations also depend on effective early warning. When forecasts include the right location of extreme rainfall, how much and when it will fall, this determines how much water is to be expected in the reservoirs. Current practices in the basin face a trade-off between saving water for fear of water shortages in the dry season (due to historically frequent droughts) and protecting the infrastructure from damage when dams are full and can potentially overspill or face structural damage when extreme rainfall occurs. When dam releases combine with high flows in both the main channel and its tributaries, extreme flooding can occur and cause damage in the downstream areas.

3. Revision of studies on the Awash based on recent science and data

Past studies looking at flood mitigation and adaptation measures in the Awash Basin have mostly focused on engineering solutions using old data and information. Given the more recent changes that have occurred in the basin (both climate- and human-related), it is important to look again at these studies, revise where necessary, and to design appropriate measures for flood mitigation across the different flood environments in the basin. For instance, there is a lot of room for research that can explore how dams are managed in light of increasing climate extremes based on improved seasonal forecasts. An expert review of existing studies is recommended. Moreover, studies should focus on developing flood risk management framework and identifying practical tools to enhance resilient flood management system in the basin.

4. Implement web-based systems for data and information sharing including "data-free-of-charge" policy for researchers and research users

Readily-available research data specific to Ethiopia is limited. This forces researchers and other data users to resort to open data sources which may be of poor quality. Improvement in data request systems and the accessibility of data through web-based systems should be the norm to support knowledge advancement in the country.

In order to streamline types of data and information, a common digital dashboard is recommended. Furthermore, there should be a common platform through which relevant stakeholders can collaborate and work together.

5. Integration of indigenous knowledge into flood risk preparedness and research

Research and consultations with communities highlighted that in most flood risk preparedness activities and structural solutions, indigenous knowledge and local practices receive inadequate attention. For instance, dykes built to prevent overflowing of floods did not consider local practices of livestock grazing and movement, thereby discouraging community protection. This led to wastage of resources to build the dykes without meeting their intended target of protecting communities from floods.

6. Gender-responsive interventions are critical

The differential impacts of flooding highlighted the importance of gender-specific vulnerabilities and challenges that marginalized groups, including women (and some men) face during and after flood disasters. Local governments and community support systems in Ethiopia have played a crucial role in preventing and rehabilitating after the flood events. However, gender-inclusive and responsive interventions that can operate in the face of persistent structural barriers are needed.

7. Inclusion and strengthening of Awash flood-related research themes in universities' water-related programs

There are a number of universities and higher education institutions in the Awash Basin, including Addis Ababa University (AAU). Depending on their location, different aspects of floods can be better researched. For instance, one could focus on the climate-related aspects of extreme rainfall and flooding while others could focus on flood governance. Including different thematic areas in these universities will be helpful to the communities and authorities that are closer to the universities and can best assist in solving problems faced by communities.

References

Ethiopian News Agency, ENA (2020). Flood displaces 144,000 persons causes over 5 billion Birr Damage in Region.

Taye, M.T. and Dyer, E. (2024). Hydrologic Extremes in a changing climate: A review of extremes in East Africa. *Current Climate Change Reports*,10, 1-11. doi: 10.1007/s40641-024-00193-9

Haile, A.H., Bekele, T.W., and Rientjes, T. (2023). Interannual comparison of historical floods through flood detection using Multi-temporal Sentinel-1 SAR images, Awash River Basin, Ethiopia. *International Journal of Applied Earth Observation and Geoinformation*, 124, 103505. doi: 10.1016/j.jag.2023.103505

Contacts and acknowledgements

- Dr. Meron Teferi Taye, IWMI, Addis Ababa | meron.taye@cgiar.org
- Dr. Alemseged Tamiru Haile, IWMI, Addis Ababa | a.t.haile@cgiar.org
- Dr. Mengistu Dessalegn, IWMI, Addis Ababa | m.dessalegn@cgiar.org

Authors

- Meron Teferi Taye | International Water Management Institute, East Africa and the Nile basin office, Addis Ababa, Ethiopia
- Alemseged Tamiru Haile | International Water Management Institute, East Africa and the Nile basin office, Addis Ababa, Ethiopia
- Mengistu Dessalegn | International Water Management Institute, East Africa and the Nile basin office, Addis Ababa, Ethiopia

- Likimyelesh Nigussie | International Water Management Institute, East Africa and the Nile basin office, Addis Ababa, Ethiopia
- Tilaye Worku Bekele | International Water Management Institute, East Africa and the Nile basin office, Addis Ababa, Ethiopia; Water Technology Institute, Arba Minch University, Arba Minch, Ethiopia
- Alan Nicol | International Water Management Institute, East Africa and the Nile basin office, Addis Ababa, Ethiopia
- Ellen Dyer | School of Geography and the Environment, University of Oxford, Oxford, UK
- Sirak Tekleab | Ethiopian Institute of Water Resources, Addis Ababa University, Addis Ababa, Ethiopia

This brief was prepared as part of the REACH programme. REACH is funded by UK Aid from the UK Foreign, Commonwealth and Development Office (FCDO) for the benefit of developing countries (Programme Code 201880). However, the views expressed, and information contained in it are not necessarily those of, or endorsed by FCDO, which can accept no responsibility for such views or information or for any reliance placed on them.

The authors would like to acknowledge the individuals below who participated in an expert workshop and provided inputs on recommended action points for both practitioners and policy makers.

REACH expert workshop participants March 20, 2024. Photo: Rahel Mesganaw

Supported by:

REACH
Improving water security for the poor

UK International Development
Partnership | Progress | Prosperity

University of Oxford

IWMI
International Water Management Institute

Addis Ababa University

Water Technology Institute
AWTI