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Unlocking the potential of flood farming to reduce flood risks and boost dryland production in Ethiopia

Gizaw Desta
Gizachew Legesse
Tilahun Amede
Andre van F.Rooyen
Anthony Whitbread

IN PARTNERSHIP WITH:

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Acronyms

MCDA	Multi-Criteria Decision Analysis
NDRMC	National Disaster Risk Management Commission
NFTF	National Flood Task Force
NMA	National Meteorology Agency
SAR	Synthetic aperture radar
SC1	Suitable class
SC2	Moderately suitable class
SNNPR	South Nations Nationalities People Region
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs

1. Introduction

Ethiopia is experiencing extreme weather variability with some areas being vulnerable to drought, while others are impacted by flooding. Despite being given relatively less attention as compared to drought, flooding has long been recognized as one of the major disasters affecting the lives and livelihoods of the people. Flood disaster has been limited in the past in terms of frequency and scope. The recent trend of increasing incidents of floods in Ethiopia is disrupting the livelihoods of the population residing in the lowlands. Flood hazard is part and parcel of living for a large number of people in the lowlands such as districts in Afar located along Awash River, in the Somali region along the Wabi Shebele River, in the South Omo along Omo River, in Gambella along the Baro and Akobo Rivers, and floodplains surrounding Lake Tana. The humid highlands that are characterized by steep ad rugged terrain and heavy rainfall features pose the lowlands prone to floods during the rainy seasons. Often, floods occur in the country as a result of intense and sustained rainfalls in the highlands causing rivers to overflow and inundate areas along the riverbanks in lowland plains. On the other hand, these regions have one of the highest potentials for flood farming as the runoff generated from the highlands of Oromia, Amhara, SNNPR, and Tigray can be available in the immediate lowlands.

2. Challenges

Flood-based farming is characterized by unpredictable flash floods (timing, frequency, and magnitude) from ephemeral and perennial streams resulting in high uncertainty to determine the extent and duration of farming. Furthermore, to utilize riverine floods, the river courses are changing from season to season leading to change in riverbed levels and sediment accumulations. Moreover, despite the growing flood events and seasonal flood hazards reported over years, there is no account of the extent of flood occurrence and lack of national strategies and aspirations to convert flash floods into an opportunity for mitigating drought and boosting dryland agricultural production. Traditional experience in recession farming and some pilot development actions of spate irrigation revealed the significance of flood farming to copping shocks and alleviating livelihoods in drought-affected areas. However, these opportunities are overlooked in the agriculture and water development strategies as potential solutions for drought management and reduction of flood risks. This information gap leads to low policy support to technical, financial, and legal aspects to respond to the development of flood risk management measures and flood-based farming and on-farm agricultural production practices.

3. Extent and frequency of flood occurrence

Flood hazard assessment is conducted by the National Flood Task Force (NFTF) coordinated by the National Disaster Risk Management Commission (NDRMC). However, the assessment of flash floods was conducted based on reports from local authorities without backup through hydrological analysis. The historical records on flash flood data collated from United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) flood flash update reports and remote sensing approach (i.e., using Sentinel-1 (Synthetic aperture radar) SAR images and satellite measured soil moisture) suggests that more than 390 districts faced flood hazards at least once in the period between 1960 and 2020. Before the 1990s, the flood incidence occurred in 23 and 17 districts in the 1970s and 1980s, respectively. The trends of flood incidents increased in the 1990s (247 districts), 2000s (306 districts), and 2010s (540 districts) (Figure 1). Exceptionally, a large number of flood incidents occurred in 1994-1997, 2004-2006, 2010, 2013-2016, 2018, and 2020. High frequency of flood incidents appeared along the Wabi Shebele (Mustahil, Kelafo, Ferfer, Gode, East Imay districts), Lake Tana (Fogera and Libo Kemkem, Dera), lower Awash valley (Gewane, Dubti, Aysaita), Rift Vally (Alaba, Shashogo, Loka Abaya), and Baro and Akobo (Itang and Lare). Since 1960, close to 6.54 million people affected by flash floods, of which 934000 people were displaced. Floods in 2020 were the most disastrous which affected 2.2 million people. Floods in 2006, 2015, 2016, and 2018 affected 1.93 million people, annually ranging from 435,000 to 525,000 people. Based on the historical records of flash flood hazards, areas prone to a significant risk of floods with a variable frequency of occurrence are illustrated in Figure 2.

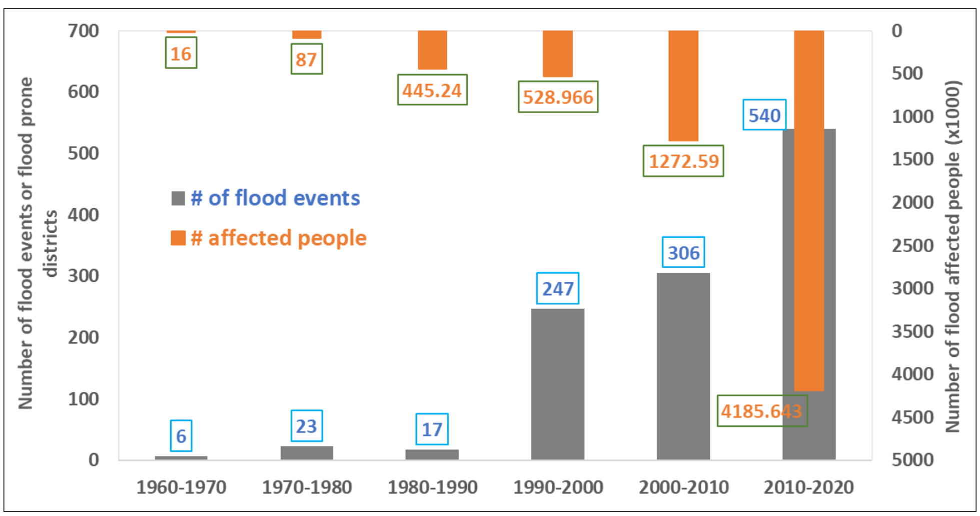

Figure 1. Trends of flood incidents (flood-prone districts) and total affected people over years, re-analyzed from the historical flash flood records.

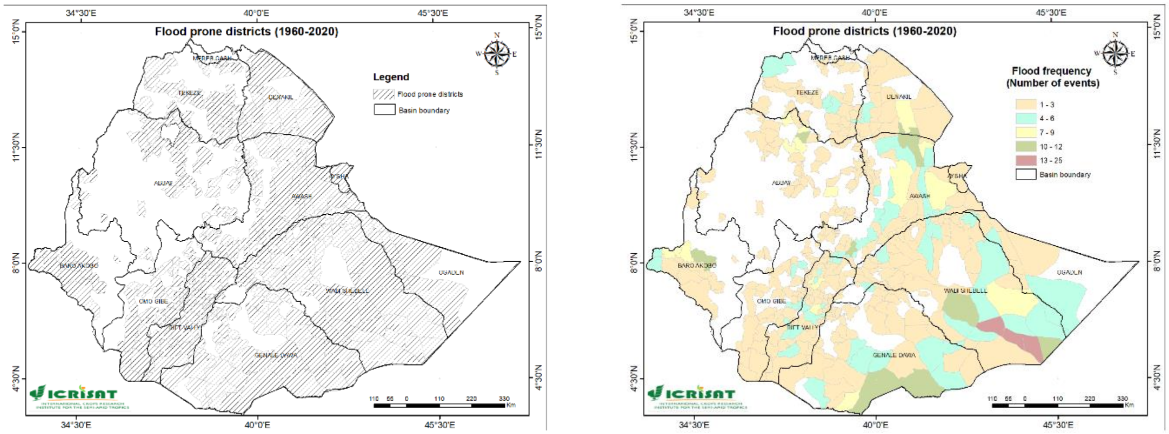

Figure 2. Flood-prone areas (left) and flood frequency/number of observed events (right) in Ethiopia (Source: remapped from UNOCHA seasonal flood snapshots, https://public.emdat.be/data, and Mamo et al., 2019)

4. Flood farming practices

The current experiences revealed that flood farming is practiced under two conditions driven by climate characteristics and geomorphological conditions. First, it is practiced in moisture stress areas that prevail rainfall variability and dry spells during the cropping season. In these areas, flood farming is possible if the upstream highlands receive high rainfall as a source of flood that reach low-lying flat areas. The resulting farming system fully depends on the runoff generated from upstream highland areas. Second, flood-based farming is practiced in areas that regularly receive floods, which can form the basis for either inundation or recession farming. In flood based farming, the production system encompasses common and staple dryland crops like sorghum, maize, millet, teff, cowpea, sesame, groundnut, vegetables, and other fodder crops. In addition, flood farming could increase the availability of livestock feed and livestock water which support to addressing the feed shortage in the dry months. Based on the intensity of flooding and the local prevailing conditions, currently, four flood-based farming techniques have been widely practiced. These include spate irrigation, inundation, recession farming, and flood spreading using weir structures. Based on a review of reports and studies, flood farming practices is estimated to cover nearly 120,000 ha of land in drought-prone areas. On the other hand, according to a recent literature survey, the potential flood farming is estimated at 5.5 million ha. Figure 3 illustrates locations where flood-based farming including spate, recession and/or inundation, and flood spreading are currently practiced.

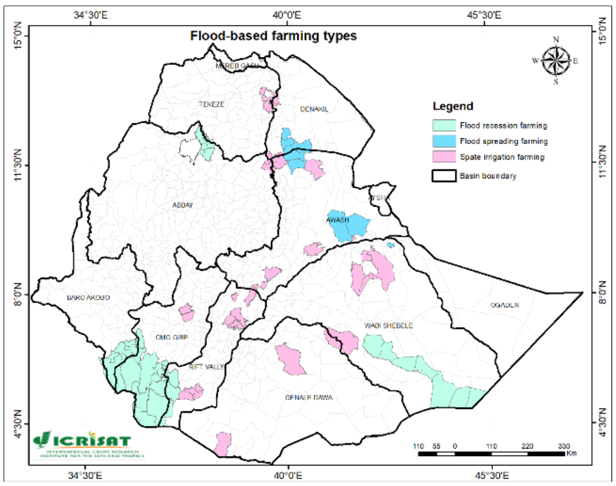

Figure 3. Districts with experiences of different types of flood farming, synthesized from review of studies and research reports.

5. Potential of flood-based farming

Flood-based farming is a type of farming where the water source is neither rainfed nor irrigation. It is a form of runoff water management that applies in areas where rainfed and irrigated systems are not potentially feasible. Although it is an uncertain type of farming, economically it is one of the potential entry points for agricultural production in the drought-affected and drylands. It has the potential to influence local livelihoods, economies, and biophysical systems as it is the only source of water in arid and semi-arid environments. It could have a range of purposes including agricultural production under dryland situations, rangeland management, livestock water supply, and restoring the soil and water resources. Flood farming holds potential at least in the short term to overcome the problem of crop failure. It also serves as a climate-smart practice to adapt to shocks and extremes. A proper understanding of flood occurrence and adaptability of the locations for flood farming will give ample opportunity in drought-prone areas to create resilient livestock and crop production system. Thus, addressing the knowledge and evidence gap on the potentials of flood farming contributes to an informed decision towards unlocking the opportunities of flood farming to support livelihoods and economic development in drought-prone areas.

Out of the identified flood-prone areas, for assessing the socio-ecological suitability of areas for potential flood-based crop-livestock farming (crop farming, pasture production, rangeland management, and livestock watering), we employed a GIS-Based Multi-Criteria Decision Analysis (MCDA) approach with a set of weighted decision criteria. Finally, the suitability mapping revealed that 32.6 million hectares of land of the country (area with rainfall less than 500mm) has met the suitability criteria of which 61 % was classified as highly suitable area (SC1) whereas 39 % was classified as moderately suitable area (SC2) (Figure 4). Basin-wise analysis showed that the Wabi Shebele basin has the largest pflood farming potential coverage which accounts for 10.98 million ha (7.57 million ha highly suitable) followed by Genale Dawa with 8.17 million ha (5.39 million ha highly suitable) and Awash 4.92 million ha (2.63 million ha highly suitable).

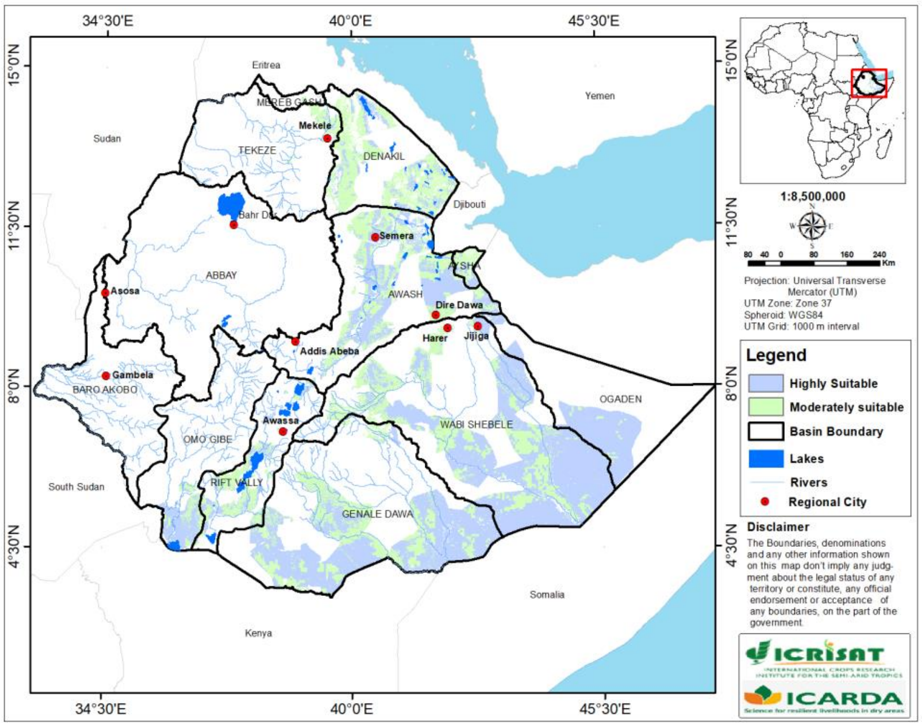

Figure 4. Newly developed socio-ecological suitability map for flood-based crop-livestock farming in Ethiopia

6. Key messages

1. **Flood risk management should be responded by formulating an integrated approach embedded in the context of integrated water resources management and land use planning**. The uncertainty of the flood incidents or sudden nature of occurrence, the local scale of the event, and the very short flood concentration time should be taken into consideration when developing a risk and agronomic management strategy. Due to these special characteristics, flash floods are best managed by the local authorities with active and effective involvement of the people at risk who have experienced the local trends and nature of flood occurrence over years. Thus, flood management measures and intensification practices should be encouraged and supported with regular communication and technical backup on the rainfall forecasts, flash flood inventories and flood frequency information, and

coordinated land management and land use plans which will enable the scaling-up of good practices. Flood database and decision support tools can further facilitate the decision-making and implementation of flood risk management as well as flood farming.

2. **Realizing the potential of flood farming implies a shift from a project-oriented approach to a process-oriented holistic approach based on the inclusion of stakeholders and communities in the process**. Natural flood risk reduction and utilizing the flash floods for boosting agricultural production requires more than just designing and financing the construction of engineering measures. It requires a concerted effort and dedicated finances to support a process-oriented approach based on the coordinated efforts of stakeholders and communities at local and higher levels. Financial mechanisms to undertake mitigation measures against flash floods and flood farming should be clearly defined.
3. **Special emphasis should be placed on conducting pilot projects with a particular view to flash floods**. The pilot will aim at increasing the response capacity of the local authorities and communities in flash flood-prone areas. This will provide an insight into information and capacity requirements of local communities, closer cooperation and coordination for flood information services of institutions based on local community needs, and the development of solutions adapted to the socio-economic realities.
4. **The National Flood Response Plan aims to provide preparedness and emergency precautionary measures and develop an emergency response to flood-affected people with the coordinated effort of multiple stakeholders**. Beyond the emergency flood response plan, there is a need for a National Strategy to deal with flood risk management and flood farming within the overall integrated basin water management strategy that aims to unlock potentials of floodwater management and facilitate and coordinate the actions of different actors. The National Strategy to manage floods should be focused on providing the necessary technical, financial and legal framework for the competent authorities to play their legitimate role.

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Contacts: Gizaw Desta, ICRISAT (G.Desta@cgiar.org)
Gizachew Legesse, ICRISAT (G.Legesse@cgiar.org)
Tilahun Amede, ICRISAT (T.Amede@cgiar.org)
Andre van F.Rooyen, ICRISAT (A.vanRooyen@cgiar.org)
Anthony Whitbread, ICRISAT (A.Whitbread@cgiar.org)