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Flood Based Farming Practices in Ethiopia: Status and Potential

Overview Paper Spate Irrigation

Spate Irrigation Network

1. Introduction

This note is meant as an introduction to the status and potential of flood recession agriculture in Ethiopia. Flood recession agriculture is inextricably linked to areas that are prone to annual flooding, making use of the moisture left behind after the floods and sometimes even using the water of the rising floods as well. This paper presents a first inventory of such systems in Ethiopia. Flood recession agriculture is a resource management type of flood based farming system that is often 'forgotten', even though the area covered by it is extensive – in Africa alone it may amount to over 20 M ha.

Annual floods occur in different environments in Ethiopia. The existence of a distinct wet and dry season in Ethiopia allows these fluctuations of the water level in these areas. Floodplains of rivers, the margins of lakes and (seasonal) wetlands are the environments where the water level changes over a year and are therefore suitable for the practice of flood recession agriculture. These environments exist in the high and lowlands in Ethiopia and are distributed all over the country.

Flood recession areas are often classified as wetland areas – and there may be both competition and symbiosis in fact with other wetland functions. The spread of the wetland areas gives a first indication where flood recession farming occurs. The land use inventory done by The Woody Biomass Inventory and Strategic Planning Project (WBISPP, 2002) contains estimates on the location and occurrence of different types of wetlands in Ethiopia, suggesting the total extent of wetlands in Ethiopia to be around 1.5%. It is not certain how seasonal wetlands are accounted for in this estimate.

The map by the Ethio Wetlands and Natural Resources Association (figure 2) indicates the spread of wetlands over the country.

2. General Features

In the flood recession areas the seasonal inundation brings fertile topsoil from the upper catchment. The soils in the inundated areas generally consist of fine-grained sediment that settles when water is moving slowly over the floodplains. In several cases the floods also bring fertile organic material that is flushed from the surface in the upper catchment. This organic material is also allowed to settle by the slow moving water in the inundated areas.

The most common types of soil that develops on the fine-grained material are Eutric and Chromic Vertisols. Depending on the location and conditions in the flooded area also other soils like Fluvisols, Gleysols and Cambisols can develop too. Because of the annual deposit of sediment and organic material no additional fertilizer is needed on these lands. The major drawback of the flooding is that the crops cannot be grown in the optimal growing period, but that planting has to start after the water recedes, at the start of the dry season, using residual moisture. If there is rain at the end the wet season, after the flood recession crops are planted, it will boost yields.

Rain-fed farming is often practiced in elevated

Regions	Total area (ha)	Wetlands (ha)	% out of total area of the Region	% out of total wetland area of the country
Tigray	5,085,784	8,053	0.16	0.49
Afar	9,526,567	131,000	1.38	7.98
Amhara	15,764,744	431,695	2.74	26.29
Oromiya	35,961,996	397,853	1.11	24.23
Somali	29,151,596	250,612	0.86	15.26
B-Gumuz	5,033,592	22,466	0.45	1.37
SNNPRS	11,064,200	152,900	1.38	9.31
Gambela	3,203,280	247,556	7.73	15,08
Total	114,791,759	1,642,135	1.43	100.0

Figure 1. Size and percentage of wetlands in Ethiopia. (source: WBISPP, 2002.)

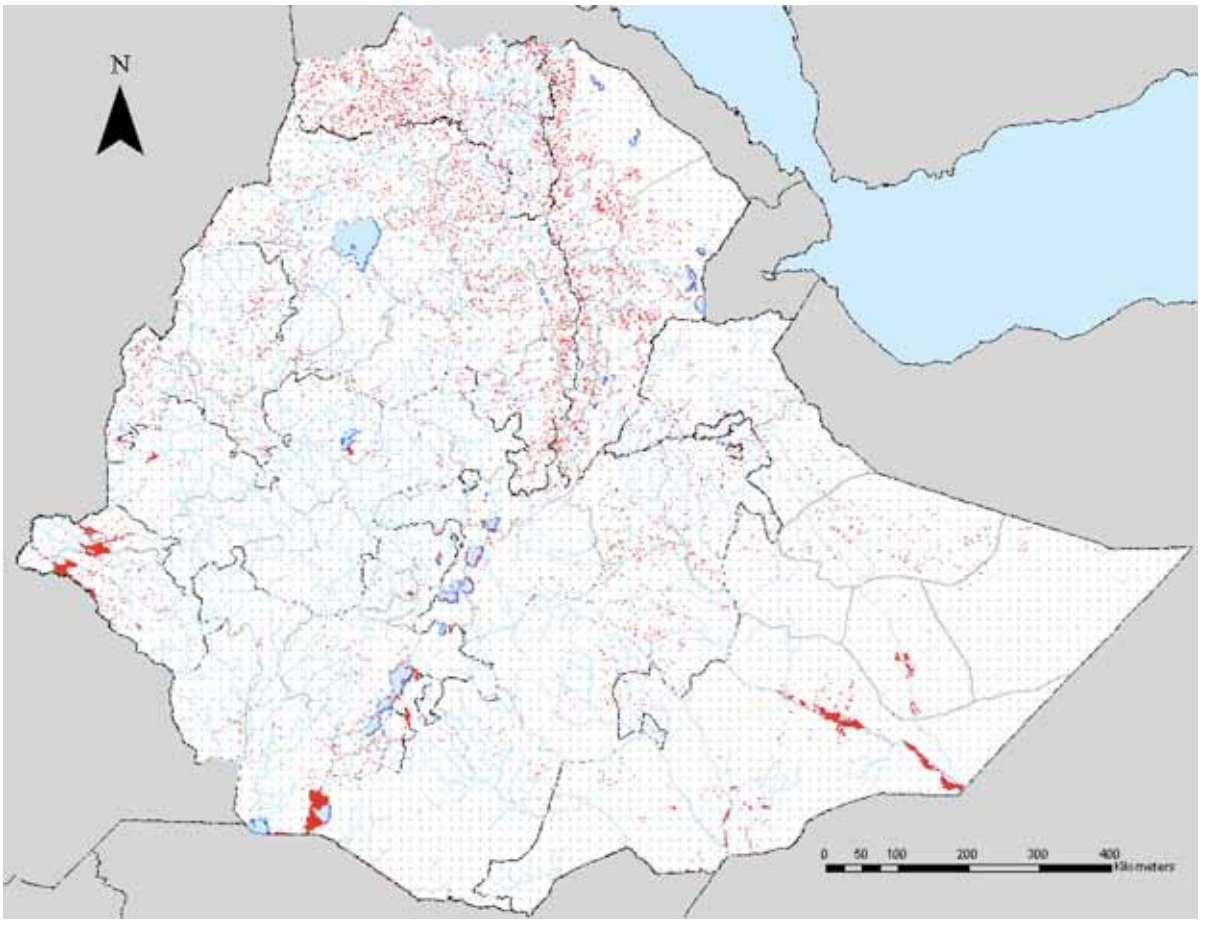

Figure 2. Map of Ethiopia where red zones indicate presence of wetlands.

areas adjacent to the flooded fields. Sometimes farmers own land both in the low-lying and the more elevated areas, so they can farm in the rainy and the dry season.

The flood recession areas often relatively densely populated, even though the flooding can also bring damages to property. Every area where flood recession agriculture is in practice has different characteristics and management systems. The timing, duration and size of the floods are always unpredictable. While it is as good as certain that there is a water level rise in the rainy season, the time that the water recedes is uncertain. Crops that are planted at the end of the rainy season when the water is expected not to rise again. Some farmers take more risks than others with the timing of the plowing and sowing. When the water level rises after the plowing and sowing of flood intolerant crops, crops can be destroyed. Other farmers wait longer with the planting of their crops to be certain that no re-flooding of their cultivated land occurs.

3. Flood recession areas in Ethiopia

The areas in Ethiopia where flood recession farming is practiced all have their own history and agricultural methods. Differences concern the types of crops that are cultivated, the planting techniques, combination with other sources of income related with the flood (fishery for instance) and the methods to deal with the involved risks, are not similar all over Ethiopia. Below a characterization of main regions where people are known to practice flood recession agriculture is given: Lake Tana, Baro-Akoba, Omo Valley, Wabi Shebelle and Upper Awash. In addition there are scattered small wetland areas where during the dry season vegetables and other crops are cultivated on the drier sections.

Lake Tana

In the North of Ethiopia flood based farming is practiced on the shores of Lake Tana as well as along some of the tributaries feeding the Lake. Approximately 15000 ha is affected by annual flooding. Since the installation of the Chara-Chara

weir in 1996, the outflow of the lake is regulated. The maximum water levels are not supposed to be affected by the installation of the weir, according to the design criteria, but the duration of the low water levels is shortened. This influences the potential for flood recession agriculture along the shore (BCEOM, 1999). McCarthey et al. (2010) cite figures of a World Bank report of 2008 that estimates the extent of lakeshore flood base farming of maize and rice production to be 6000 ha.

Apart from the lakeshores low-lying plains near the lake are influenced by the flooding regime of the tributaries entering the lake. These areas are cultivated with the use of floodwater too. The prime examples are the Fogera plain east of Lake Tana, where the Ribb and Gomara rivers drain the catchment, and the Dembiya plain in the north where the Dirma and Megech rivers enter the lake.

In these areas for a long time flood recession agriculture has been practiced with maize and sorghum grown on the residual moisture after the flooding period. Yet in the last decades the system has changed from a flood recession to a flood rise system. Around the early 1990's farmers started growing rice in the wet season under flooded conditions – using the rising floods. Small bunds are constructed to retain water, they also allow regulation of the water entering and leaving the rice plots. Typically, the water is retained inside the bunds for 3 to 4 days. If the water is retained longer, it might warm up and increase the risks of the occurrence of diseases. Figure 3 shows the different phases of the rice cultivation.

After the rainy season the previously flooded land is used for the cultivation of maize, teff, oats, lentil and chickpea depending on the local conditions. In this second planting phase there is often additional small-scale irrigation from shallow groundwater or diversion of stream water.

Then in some locations even a fully irrigated third phase of planting can be performed. In the dry season the shallow groundwater in the plain can be pumped to irrigate vegetables, cereals and pulses.

Besides agriculture there is around 4000 ha

Figure 3. Rice production under flooded conditions using small bunds in the Fogera plains near Lake Tana

of communal and individual grazing lands for livestock.

The productive potential of the area is recognized and there are several plans for irrigation schemes. Flood recession farming along the direct lakeshore is discouraged, in order to preserve the habitat for migrating birds.

Baro-Akobo

Another area where flood recession farming is practiced is in the Baro-Akobo region in the Gambela regional zone. The low-lying lands in the western part of the country near the Sudanese border are inundated for long periods of the year. The Anuak people practice different forms of farming. Besides rain-fed farming they grow crops on elevated riverbanks just after the floods retreat. There are several reasons why riverbank farming (figure 4) is important. The fertile soils that are deposited with the floods are easily workable. The lands are close to water and fish resources, and river vegetation provides the picking of fruits in the dry season (Mengistu, 2005). Anuak use the backswamps mainly for dry season grazing, although they would be suitable for rice and godere production (TAMS, 1997). In January many Anuak also prepare some land in the dried up backswamps for the cultivation of the spring crops. The crops use the spring rains and the residual soil moisture for their growth (Mengistu, 2005). The Anuak often slash and burn these previously inundated areas, to enhance the fertility of the soil and make it easier to work in it. The main crops produced are maize and sorghum, but also mango, papaya, semi-wild fruits and root crops, as well as legumes are produced (Mengistu, 2005).

Omo River Valley

In the valley of the Omo River flood recession agriculture is extensively practiced. (Adams, 1992). In a water resources study on the Omo Gibe River Basin, flood recession is as a land use class associated with the delta of the river, and is also mentioned to occur in narrow bands along the banks of the Lower Omo Valley (Woodroofe, 1996). In this study, the total area under flood recession is set at 11037 ha, but this includes riverine woodlands, open bushland and bare soil as well. Maize, sorghum and finger millet are the main crops. They are planted on the banks of the Omo River as the annual flood retreats. The crops use residual moisture for their growth. A common

Figure 4. Flood recession farming on the riverbeds in Gambela. Adjacent to the river are marsches that can be partly cultivated later in the dry season.

Figure 5. Groups of sorghum that are planted on temporarily inundated land in the southern Omo River valley.

practice is for sorghum to be planted in groups of ten seeds together to make sure that one in these groups will grow fully mature (figure 5). In certain areas inundation canals are developed that distribute the water over a more extensive area as the water level rises in the river. Cases where up to 1000 ha have been irrigated in this manner have been reported (Woodroofe, 1996). The fluctuation of the flood size over the years makes it difficult to precisely quantify the flood recession area, but it is estimated that 100 000 people depend on the system (Woodroofe, 1996).

Wabi Shebele Catchment

Annual flooding occurs in areas around Kelafo, Mustahil and Ferfer woredas in the downstram reach of the Wabi Shebele River (WWDSA, 2003). WWDSA (2003) refers to a study by WAPCOS that Wabi Shebele inundates 600 km2 annually, of which 140 km2 is flooded throughout the year. The same report indicates an area of seasonal swamps in the more upstream part of the river. An area of 68 km2 is flooded annually and is an important dry grazing area and crops are grown on residual moisture. The wetlands exist in the Bale zone in the Gasera, Gololcha, Gihir and Sweina woredas (WWDSA, 2003). The report does note that indigenous irrigation involving the diversion of spate floods is practiced in the river basin too. Though the Wabi Shebelle is one of the largest areas under annual flooding very little is known with regards the extent of flood recession farming. It is known however that further downstream in Somalia (see Overview Note 2) flood recession farming is well-known.

This is similar to the Gelana, Denakil and Tekeze River Basins: in several reports on the river basins seasonal swamps or wetlands are identified, but no information on the use of these areas is presented. The reports do report the use of flash floods in these areas. But similar to the information on flood recession agriculture there is only limited information on the extent, productivity and history of spate irrigation in the reports.

Upper Awash Catchment

Flood recession is also practiced in the Upper Awash Catchment – particularly in the Becho Plains and around Lake Koka.

Figure 6. Different stages of flood retreat near Lake Koka. The bottom right picture shows the start of plowing.

Near Lake Koka, where the Awash Rivers splits into several branches as it enters the plains surrounding the reservoir farmers wait longer for the inundated area to dry before they start plowing and sowing. In the meantime the land is accessible for livestock that is an important source of income for the people of this region. Typically farmers have one hectare under flood recession and 5-10 units of livestock. With the drier soils, it is necessary that additional water from shallow groundwater wells is supplemented to the residual soil moisture. With this additional water the farmers are able to grow onions, tomatoes and maize, although the main crops are haricot bean and chickpea. In the Koka plain, certain parts of the previously inundated lands are covered with sea lilies. These plants are removed and burned before the land is cultivated. The fibrous root of the plant collects fine soil and therefore enhances the fertility of the land.
Besides the income generated from livestock or flood recession farming, there is also sand mined in this area. When the flood recedes from the floodplain, the sandy soil is dug and sold.

In the Becho plains – further upstream - there is no supplementary use of groundwater. Next to the main rivers there are some pumps used to irrigate the adjacent lands, but there is no development of wells. Most of the crops grow solely on residual moisture after the inundation period. The duration of the inundation determines the type of crops that can be cultivated. Areas that are inundated for a short duration, and where the last rains of the rainy season can supply extra water are suitable for teff cultivation. The areas that are inundated areas for a longer period are used for lentil and grass pea. In both areas ploughing is critical for good yields. Ploughing is done prior to the floods to have more sediment settle in the furrows and increase fertility and moisture deposition. Ploughing is done also as areas fall dry to conserve moisture by ploughing it to larger depth. The shortage of land does not allow the livestock to graze on the lands like on the plains near Lake Koka where not all inundated lands are used for cultivation.

Data on yields from flood recession farming of two districts in the Upper Awash Catchment and

Crop	Yield (kg/ha)		
	Ilu District	Bora District	Fogera District
Beans	410 - 1050		
Field peas	300 - 950		
Lentil	50 - 2600		600
Chickpeas	250 - 1800	800 - 1200	1500
Rough peas	190 - 4290		
Maize		1600 - 2200	
Haricot beans		800 - 1050	
Rice			6170

Figure 8. Range of yields of major flood recession crops in three districts over the last years. Ilu district for the last 17 years, Boru district the last 7 years and Fogere from 2010. All data was collected through the agricultural departments of these districts.

the Fogera plain west of Lake Tana, show that the area under flood recession fluctuates considerably from year to year (figure 8).

In 2010 a first rice trail has started in the inundated areas next to the Awash River near Awash Belo in the rainy season. The results of this trail are not available yet.

Both Koka and Becho have problems with pests in the moist areas where the crops grow on residual soil moisture. Hence though no fertilizer is required, pesticides are a considerable expenditure item.

Figure 9. Different stages of flood recession agriculture in the Becho plains

4. Potential

It is hard to estimate the area under flood recession agriculture in Ethiopia – but a reasonable estimate is for it to touch 100,000 ha. The actual area under flood recession agriculture particularly in the Wabi Shebelle area is unknown. So far flood recession agriculture has received as good as no attention, but there is scope to improve the productivity of these systems and improve and broad-base the livelihoods of the people depending on them. There are several opportunities that should be explored.

Better water management: use of dikes, inundation canals and drains to better guide and control water

Flood based farming system occur in different parts of the world and can sustain large population. A prime example probably is Bangladesh, where over centuries a sophisticated system of bunds, dikes, canal and drains has developed that spread the inundation over a large area, avoids standing water and generally retains the water for a longer time. The systems around Lake Tana are an example of starting with a higher level of water control in flood recession areas that can be adopted elsewhere too.

Shift to rice-based flood rise agriculture

The transformation from flood recession to flood rise culture around Lake Tana has permitted double cropping: first of rice growing on the rising flood and subsequently of other crops – such as chickpeas, on the residual moisture. This transformation may offer opportunities for other areas too – depending on the pattern of flood rise. In some areas the introduction of floating rice varieties maybe considered - very fast growing varieties that keep up with the speed of the rising flood and can reach 3-5 meters in height. Floating rice varieties grow in areas as varied as Mali and Cambodia.

Use shallow groundwater

Most flood plain areas are also areas with ample shallow groundwater resources. As there are continuously recharged from either the floods and the river flow, they constitute a highly dependable resource that is relatively easy to exploit. It requires the use of shallow tubewells – that can be sealed during the flood season – rather than dugwells that will inevitably damaged when inundated. Unlike Asia the skills in manual drilling of shallow wells is not widespread in Ethiopia yet however.

Diversification – fishery, livestock

Flood based farming system provide the basis for diversified livelihood systems – not just farming, but also fishery and livestock keeping. Also the wetlands in and around flood based system often offer opportunities for non-timber products, medicines and other products. Market chains are however not well developed.

5. Conclusion

So far little attention has gone into flood recession farming systems worldwide, and the same applies for Ethiopia. Therefore it is not exactly known where flood recession farming is practiced and how productive the current systems are. The inventory shows that the systems can be very productive, especially in relation to the initial input needed for the crops to grow. Moreover it appears that different areas have developed different promising practices (Lake Tana: flood rise farming; Lake Koka: use of shallow groundwater; Omo: inundation canals) that can be introduced elsewhere too.

More attention should go into flood recession farming to make use of its potential within perimeters of sustainable use. Area of attention are:

- Get better understanding of flood recession in Ethiopia, particularly in the Wabi Shebelle basin.
- Explore and promote appropriate technology improvements – such as better water management, the development of shallow tubewells and the introduction of varieties that are particularly suited to the peculiar environment of flood recession;
- Developing and balancing a broad range of functions in the flood recession areas – livestock, fisheries and wetland management.

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The Spate Irrigation Network supports and promotes appropriate programmes and policies in spate irrigation, exchanges information on the improvement of livelihoods through a range of interventions, assists in educational development and supports in the implementation and start-up of projects in spate irrigation.

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