Uganda Journal of Agricultural Sciences, 2004, 9: 342-347 ISSN 1026-0919

Water harvesting technologies in ensuring food security: Lessons from the pastoral areas of Gashamo district, Ethiopia

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Abstract

Today most of the chronic food insecure areas of Ethiopia are the pastoralist and agro-pastoralists. The cumulative effect of the historical political marginalization of pastoralists in decision-making and recurrent drought and famine is attributed to the prevailing crisis. Due to shortage of water many pastoralists had been losing their livestock assets and dropping out from pastoralism and migrating to towns. Others are also in the trend of losing their livestock assets to cover the water expenses. Conflicts between clans and sub-clans on the use of natural resources (water and pasture) are also becoming a common phenomenon. One of the success stories in water development and food security in the pastoral and agro-pastoral areas of Somali region in Ethiopia goes to the local NGO Hope for the Horn. The local NGO applies holistic approach where Haffir dams with a capacity of up to 60,000 cubic meters are excavated to collect water for livestock and human consumption under watershed approach. The packages in the holistic approach which have synergic effect include community nursery development, afforestation and closure areas, introduction of fuel saving stoves, fodder banking, use of soil buds, inland drainages, micro-basins, check-dams and the establishment of environment and water committees. Today at least due to such water development interventions asset building, diversification of the economy, access to clean water, addressing gender issues, diminishing of emergency (water and fodder), recovery of degraded lands and minimization of clan and sub-clan conflicts on resource use were made possible.

Keywords: Holistic approach, pastoralists, recurrent drought, sustainability

Introduction

Up to 6 million people in Ethiopia are pstoralists or agro-pastoralists. Their land covers about 61% of the total national area of Ethiopia. Out of the national livestock population about 40 % of the cattle herd, three quarter of the goats and 100% of the camels are found in pastoral and agro-pastoralist areas. Moreover, in the present day Ethiopia, the pastoral and agro-pastoral areas are serving as a major source of irrigation schemes (government and private), settlements, hydroelectric power, live animals for export, and tourist attractions (Fox *et-al.*, 2002, Yohannes *et-al.*, 2002).

Surprisingly today these pastoralist areas are known for their drought, famine and dependency on food aid. Government regimes through history have never integrated them in to the national economy, rather they were considered lawless and conflict -ridden. The development of settlement and irrigation schemes in the name of modernizations which paralyze the dry and wet season's source of pasture and water was the outcomes of such mentality. The cumulative effect of the historical neglect, top down approaches, development of inappropriate technologies, poor marketing and extension system and failure to appreciate the rational behind pastoralism were attributing to the crisis in pastoral areas (Hogg, 1997; Getachew, 2001,). The unsustainable use of shallow and deep wells, ponds and berkas in the emergency projects is not far from this reality. Moreover, such interventions had brought some undesired outcomes of overgrazing, land degradation and conflicts between clans and sub-clans (Sanford *et al*., 2000, Yohannes, 2002B).

Unlike many of the interventions Hope for the Horn a local NGO had implemented Haffir dams in different parts of the Somali region with holistic approach which harmonizes the ecological and human eco-system and attributed to food security of the local community. This study highlights some of the findings of the intervention which has many implications for research and development.

The overall aim of this study was to assure the sustainable use of the Haffir dam with a better understanding of the socio-economic situations of the community and reorient the emergency intervention to development strategy. The specific objectives include the evaluation of the overall impact of the water harvesting technologies and draw lessons for future water development interventions.

Methodology and analysis

The study was cnducted in Gashamo ditrict, Ethiopia. The district is located about 400km east of Jigiga. Because of its remoteness and lack of transport communication, most of its consumable products come from Somaliland. It hosts a semi arid climatic zone with bimodal rain fall in April - June (*Gu*) and October- December (*Dayer*). Usually the rainfall is unreliable both in space and duration. Camel, goats and sheep are the dominant livestock in the district.

The estimated population in Gashamo district was estimated at 130,000 people distributed over 129 villages. The dominant clan in the district is Issaq, which has many sub clans including Haber-Yonis and Haber-Jealo. Generally it has poor transport and communication infrastructures, social services and poor marketing. Drought and famine, livestock disease, land degradation (wind/water), influxes of refuges had plagued the district. As a survival strategy most people depend on livestock sector, while the others are involved in petty trades, daily labor, selling of Berka water and remittances from relatives abroad (Yohannes, 2002A).

With the help of check list focal participatory individual and group discussions were made with the differentiated community (elders, women, water and environment committee, berka owners) and government and NGO staff. Qualitative socio-economic analysis was executed during the evaluation. Additionally, field observations on vegetation cover were made during the dry and wet seasons between March and August, 2002.

Results and discussion

Traditional resource management and land degradation

To cope with the wide ranges of risks and uncertainties pastoralists had develop a deep rooted strategies as indicated below,

Mobility as a rational use of resources

Generally, mobility under the traditional nomadic pastoralism is characterized by efficient use of variable and fluctuating range of resources, relying on the principles of flexibility, complementarity's, multi-functionality, reciprocity and sustainable communal use of resources. Before any mobility is undertaken, the community sends selected groups to investigate the status of pasture and water in the proposed locations. The investigating group considers indicators such as the availability of water, pasture, prevalence of disease and security situations. Therefore, water development schemes in pastoral areas are incomplete if they are not complemented with availability of pasture**,** control of livestock diseases and prevailing peace and security situation.

Harmony of water, pasture and livestock

In line to the principles of utilization of different ecological niches, pastoralists classify their livestock herds into grazers and browsers, with different threshold of pasturing and range of traveling. These are further divided into young and old, female and male in line to water demand capacities. Usually cattle are watered every 2 days, shoats (sheep and goats) every 3 days and camels from 15 to 30 days. Mixed herds can therefore considerably increase productivity, minimize production risk and reduce environmental impact compared to raising only a single species (as practiced in ranching). The trend in settlement and specialization on cattle might be a threat to the multiple advantages of diversification.

Local institutions

Elders primarily administer local institutions, are responsible for natural resource management, conflict resolution and social welfare. These elders usually include religious people (*Shekes*) and the rich who are seen as representing generosity, credibility and power. The sharing of elders' deep-rooted knowledge and experiences makes a difference to the livelihood of the community. However, women's role in such communal decision-makings is minimal.

Social safety nets

Social networks, mutual support and reciprocal arrangements between the clans and sub clans are a solid foundation for sustainable development of the system. The Somali culture is highly dependent on mutual support mechanisms at the household, sub-clan and clan level.

On contrarly, the discussions with pastoralists on the perceptions of land use dynamics in their locality was skewed to a negative trend (Table 1). Moreover, pastoralists were well aware of the land degradation problems due to the accelerated water and wind erosion and accumulation of silt in many water bodies (natural ponds and Berkas). According to them the critical areas of land degradations are around settlements, water points and roads.

Source of water

The community in Gashamo district have different source of water for both livestock and human consumptions. The traditional source of water are discussed below.

Natural ponds

Usually natural ponds are located on depressions or concave slopes. The small ponds are locally known as *Qayder* and the relatively bigger ones are the *Harro*. Usually the life span of the natural ponds extends from one week to three weeks. These depend on the size of the pond, on level of seepage, surrounding vegetation cover and on the number and type of livestock consuming water. When the ponds

Table 1Perceptions of community on resources use dynamics

Indicators	Trend*
Family size per household	+
Livestock size per household	-
Livestock diversity per household	-
Marketing access	-
Mobility of livestock	-
Expansion of livestock disease	+
Expansion of human disease	+
Frequency of drought and famine	+
Social safety net	-
Availability of pasture	-
Availability of water	-
Settlement	+
Overgrazing	+
Land degradation	+
Availability of natural ponds	+/-
Availability of Berkas	-

*+ increasing trend, - decreasing trend

dry up gasses easily grow by the moisture residue and serve as a source of pasture.

Balliyo

These are very old man -made ponds; even the pastoralists no longer know who originally excavated them. Also small in number they are widely distributed in a range of 100 to 200kms thought Degahbour zone to prevent over concentration of animals in one spot and minimize also conflicts. Still the system is functional but in a diminishing trend with the introduction of Berkas and Haffir dams (Yohannes *et al.*, 2002).

Earth dams

Historically with the help of the government and some NGOs some of the natural ponds were excavated by machinery in a semi-circle form all over Somali region. An observation in Gashamo area indicates that by and large such ponds are now silting up as they do not integrate the water management and catchments rehabilitation. Still such intervention is prevailing under emergency interventions by NGOs and government due to their inability to learn from past errors.Generally the traditional source of water is characterized by lack of cost managements, absence of water management committee, water pollution, siltation and overgrazing.

Individual berkas

Berkas are in-ground tanks lined with stone and concert, used to collect and store run-off rainwater for human and livestock consumption. In the Gashamo area it was introduced in the 1950s from the British colony and considerably increases in the 1970s following the drought and 1980s following the civil wars in Somai and incoming refuges. This existance to-date is probably explained by adaptive capacity of pastoralists to their production system. The local administration of Gashamo estimated more than 20,000 berkas in the 129 villages. However, currently 30 to 40% of the berkas are not functional. Some are too old and become expensive to be maintained, others were cracked due to plant roots and some were initially bad in quality of construction and did not stay long and the construction of Haffir dams did not encourage Berks as a source of income.

Usually the berkas site selection is guided by basin or sloppy area, rocky and relatively far from the village to minimize environmental pollution. The berka differ in size between 40 x 10 X 6 meters and 20 x 7 x 4 meters. Usually group of extended family or individual households owned the Berkas. The price of berka construction ranges from 30 million to 60 million Somalia Shillings, which is the average cost of 200 Shoats or 20 camels. Basically the berkas are constructed for self- consumption (human and livestock) and for sale. There are few individuals who have two or more Berkas on the same village or different villages.

Haffir dam

Historically haffir dam in Somali region was introduced from Sudan through UNHCR in the refuge camps of Aware. As of its original design it was meant to collect water only for human consumption. However, Hope for the Horn a local NGO closely working with pastoralists had been continuing to modify the technology by accommodating some of the feedbacks of the pastoralists. The haffir dams made by machinery were to serve both livestock and human beings. The main dam and the silt trap were supplemented with outlet canal attached to two shallow wells where water is pumped to the elevated distribution cistern and further through gravity distributed to the livestock troughs and human collection points. The cost of constructing an average haffir dam with a capacity of 60,000 cubic meters of water accounts about 1.4 million Ethiopian Birr (one dollar is about 8.5 Birr).

Table 2 Comparison among the different water sources in Gashamo area as perceived by thepastoralists

Indicators	Ranking of importance		
	Natural ponds	Birkas	Haiffir dams
Cost of construction	3	2	1
Volume of water consist	2	3	1
Longer water reserve	3	1	2
Source of conflict	2	3	1
Wider beneficiaries	2	3	1
Better sanitation & hygiene	3	2	1
Demand labor	3	1	2
Multi-functionality	1	2	1
Malaria infestation	2	1	1
Management difficulty	2	3	1
Spread of livestock disease	3	2	1
Siltation problem	1	2	2
Settlement development	3	1	2
Short distance traveled	2/3	1	2/3
Better vegetation cover	1	3	2

As a system the haffir dam is integrated with environmental rehabilitation where the command area is closed, afforestated and complemented by site specific soil and water conservation techniques like micro basins, soil bunds and check dams were applied. Therefore, the biological and physical measures were facilitating as a silt trap and fodder banking.

The check dams were made from the locally available materials of dead branches and living trees. The nurseries were also producing dominantly indigenous multi-purpose trees (fodder, fruit and medicinal values) and few fast growing exotic pants were also introduced to the system. For the introduction of the different Soil and water conservation technologies Food for Work approach supported by World Food Program was executed. For those who plant tress privately around their settlements energy saving stoves had been distributed as incentives supported by UNHCR. Pastoralists had also ranked the different sources of water under different indicators as indicated below in Table 2

Multiple impacts of haffir dam construction

The out come of the discussions both in dry and wet seasons with the differentiated community of Gashamo area and field observations helped achieve the following with regard to the impact of the water harvesting interventions;

Addressing the felt needs

To the Gashamo pastoralists drought and famine and emergency interventions had been a rule rather than an exception in the couple of previous years. Fortunately, after the construction of the dams the two rainy seasons of *Gu* and *Dayer* the three haffir dams were able to harvest some water and serve the community. The vegetation growth was not also very bad. Moreover, most of the individual berka remained untouched water reserves and thus no need for any emergency intervention.

Community participation in planning

Through the existing local institutions usually led by elders the location of the haffir dam sites is determined. A minimum of three dam sites are requested by the community which are on an average of 50 km apart from each other (The village of Gashamo, Galka and Haye-yere). The dam sites were mostly located on natural ponds with high storage capacity and low problem of seepage. Moreover, the elders considered the dry and wet grazing pattern and the reciprocity among the different clans and sub clans.

Introduction of innovative principles

To many of the private Berka owner's de-siltation expenses are serious problems. This is also compounded by the contamination of the water, as they are not far from the villages. After observing the site of the Haffir dams some of them had proposed to use small silt traps and expand their closure area to minimize the contamination of the water.

Asset building

Over coming the scarcity of water stimulates restocking. Many pastoralists sell their livestock to cover the cost of livestock watering. " I had more than 50 camels and more than 100 shoats. During the very serious drought (between January and April) I had sold two camels with 3 million Somali shillings to cover the 4-5 months water coste. Today the cost of water in the Haffir dam is almost free "A pastoralist from Gasahmo. A barrel of water was cost up to 30,000 Somali Shillings and now is less than 4,000 Somali Shillings per barrel.

Diversification of investment

To satisfy their needs of water many pastoralists were investing a huge amount their resources on Berkas. The cost of private Berka was an average of cost of 200 shoats or 20 camels. When the Haffir dams were made available some have already invested their resources on small shops

and petty trades. The more the economic diversification the less will be affected by the drought cycle.

Empowering the pastoralist culture and identity
Basically pastoralism is a question of common resource management supported with reciprocity and traditional social safety nets. This strong system had been deteriorating since 1950s when private and profit making Berka was introduced to the community. However, the introduction of the common Haffirs contributes an enabling environment for a communal concern of the pastoralists through the different committees created.

Empowerment in decision making
The big achievement with the development of the dam was that women were empowered to make decisions in both water and environment committees. It creates a foundation for women's involvement in development issues of their locality. Moreover, the long distance traveling of women in search of water was minimized.

Access to clean water
The dams were well protected with closure areas and the distribution is hygienic. Moreover, by making the water available it was reported some were using for washing their bodies and cloths frequently.

Prerequisite for other social services
After the Haffir dams become functional now the community from Gashamo district was asking badly to have schools and clinics. Already Haye-Yere and Galk community had made some initiatives to start the schools by their own contributions.

Biodiversity
Due to the synergetic effect of the different water harvesting technologies quick vegetation cover was made possible to minimize water and wind erosion and stimulated the multiple uses of plants for fodder and other uses. In other words the regeneration of vegetation contributes to the lessening of the impact of drought.

Seed and fodder banking
The command areas of the dams were meant to serve as silt traps, now they are integrated with the principle of fodder banking development and local seed multiplication.

Cost of de-siltation
As of the experience of de-siltation cost in Aware camps was as high as $f 3, 500 per annum. Now with fewer disturbances with the machinery and application of the biological and physical soil and water conservation the de-siltation cost is less than $100 per annum

Down slope stream development
Due to the influence of the dam small streams are being developed down slope of the dam which might be stimulating the continuous availability of grass and water for horticulture.

Minimizing conflicts on resource uses
: The inclusion of the three dams in the water resource network had minimized the pressure on specific water sources and consequent overgrazing and land degradations. Before the haffir dams construction the Gashamo pastoralist used to travel frequently long distances to Aware camps and Somali land, where some times end up with some conflicts when the water becomes scarce. Now when some of the clans and sub-clans have water points at their locality they feel they have some thing to offer and the reciprocity will be with mutual understandings and less room for conflicts to occur. However, this also depends on the distribution of rain and prevailing of peace and security in the neighboring areas.

Problems and challenges
The stakeholder had also mentioned some of the threats from haffir dam development, which is by and large similar to the Berka development which includes the following:

Livestock diseases
Due to the relatively big scale of the water body and reserving longer period, the probability of attracting a wide range of livestock from cross boundary is very high. With the prevailing limited animal health services and vaccinations the risk is high many livestock can die due to some fatal diseases.

Habitats for malaria
Under the Haffirs due to the relatively longer period of water availability the probability of mosquito multiplication is high. Many elders indicated that there is le risk for the private Berkas located around the village the risk from the Haffirs is less than the Berkas.

Attraction of big settlements
Already there are many indications that many people are starting settling around the dams and the size of the old villages had been also increasing. Some of the village dwellers have considered such trend positive as it accelerates the village development of trade and business and yet may not consider the pressure created on the resource use of fuel wood and modifies the dry and wet season mobility of livestock.

Land degradation
Due to the mechanized watering system the Haffirs are attracting a lot of livestock at the same time. If there is unevenly distribution of such dams the pressure will be high on a specific dams, which might result overgrazing and

erosion by wind and water. Moreover, the unbalances of technologies some using rudimentary human labour to water livestock and others use water pumps will have their own push and pull factors.

Source of conflicts

Many of the elders do not consider the conflict issue as a serious problem. Rather they see it positively as the three haffirs have contributed to the evenly distribution of water points where the pressure on specific water points will be minimized.

Conclusions

The promising achievements of food security and sustainable resource management through water harvesting technologies were as the result of a combination of factors which has many implications for research and development. These success stories are attributed to key fundamental factors which include among others, addressing of community felt needs, working with the existing local institutions, empowerment of the community in decision making, synchronization of the different water sources (natural, ponds, berkas and haffir dams), spatial distribution of water sources (representing clans and sub-clans), establishment of strong and devoted water and environmental committee, application of cost management and the use of training as a phase out strategy.

Acknowledgments

The research findings in this paper were carried out as part of series of assessments funded by NOVIB and International Rescue Committee in the operational areas of Hope for the Horn.

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