ASSESSING THE IRRIGATION WATER MANAGEMENT ELEMENTS IN AMBA 1 IRRIGATION SCHEME IN ASSOSA WOREDA, WESTERN ETHIOPIA

Bekalu Melis Alehegn[1], Kassegn Asnakew Seyoum[2]
[1,2]Assosa University Soil and Water Resource Management Department

ABSTRACT: *-The aim of this study was assessing water management mechanisms used by water users in Amba 1 irrigation scheme. Amba 1 irrigation scheme located in Assosa woreda having a total area of 90 ha irrigated land. Total of 120 households was purposively selected at the head, middle and tail of the irrigation scheme. The required data were collected by interviewing about Amba 1 irrigation management issues. The crop water requirements of the major irrigated crops were calculated by CROPWAT version 8 and the social data were analyzed by SPSS version 20. Water scarcity, conflict, and allocation problems, weak participation, and management challenges were increased from the upper to the lower part of the command area. In Amba 1, 82.2% of irrigators were the dominant user of irrigation water at the head of the scheme. 14.1%, 63% and 74.1% of the respondents said that unfair water distribution and allocation were big problems at the head, mid and tail of scheme respectively. The role of irrigation users in the committee at all scheme classes was generally very low according to farmers' opinion. This perception of farmers on the participation of water user committee was highest at the lower users of the Amba 1 irrigation scheme. The presence of conflict was 23.9%, 79.8% and 88.9 % at the upper, middle and lower class of the scheme respectively. This study found that the presence of conflict increased from the upper part of the irrigation scheme to the lower with the integration of water scarcity, and water management problems.*

KEYWORDS: crop water requirement**,** major irrigated crops, water scarcity

INTRODUCTION

Water plays a pivotal role in economic activity and in human well-being particularly, irrigation and in domestic use (Crow & Sultana, 2002). Irrigated agriculture is the main consumer of freshwater as compared to other water users in a basin. A "water short" basin tends to have more conflicts if water is not properly allocated among different users (Lecler, 2004). Water flows in natural basins by gravity and those who live upstream could technically control the flow of water. This can be the basis for water conflicts (Gasteyer & Araj, 2009). It has been reported that water conflicts are results of the competition for water resources mainly during the dry season (Gichuki, 2002). Conflict can be defined as disagreement over the appropriate course of action to be taken in a particular situation(Robles, 2011). Importance of water in sustaining human livelihoods can indirectly link it to conflict and conflict is a usual part of life (Dabelko & Aaron, 2004). Many social, cultural and economic factors determine a person's access to water (Kulkarni, 2011). Gender is one of the major factors which determine access to water (Zwarteveen, 1997). Water conflicts can be classified according to the parties and sectors involved and the level of conflicts . Water is a finite vulnerable resource and which is under pressure; and when it is available in adequate quantities and in good quality it becomes a primary input for a whole array of productive activities (Knapp, 2007). Water is a public good of a very high value for all competing uses, and thus it requires careful conservation and sustainable utilization. According, to water is a common good because it flows naturally from one place to another which makes it difficult to establish "ownership". Over two billion people in 40 countries live in river basins which are underwater stress (Namara et al., 2010). Agriculture in Ethiopia is mostly based on rain-fed small holder system (IWMI, 2005).

MATERIALS AND METHODS

The study will be conducted at Amba one in Assosa district, Assosa Zone of Benshangul Gumuz Regional State, North Western Ethiopia. The district administrative town is known as Assosa. It is 680 km away from the capital city of the country Addis Abeba to the North West direction

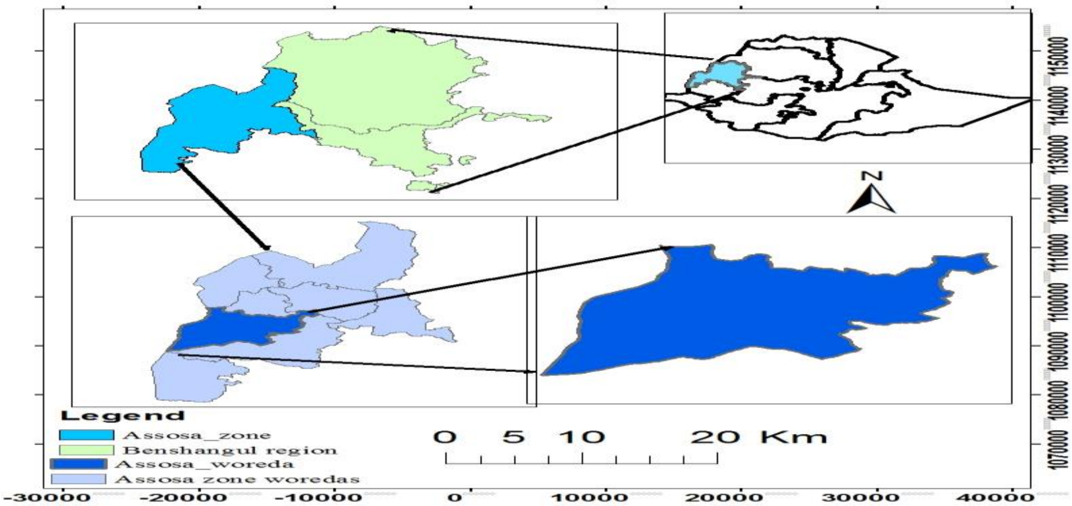

Figure 1. Location map of the study area

Conceptual Framework

Water resource management is a process of becoming aware of the actual or potential conflicts, diagnosing their nature and scope and analyzing the appropriate methodology to diffuse the emotional energy involved and to enable disputing parties to understand and resolve their differences.

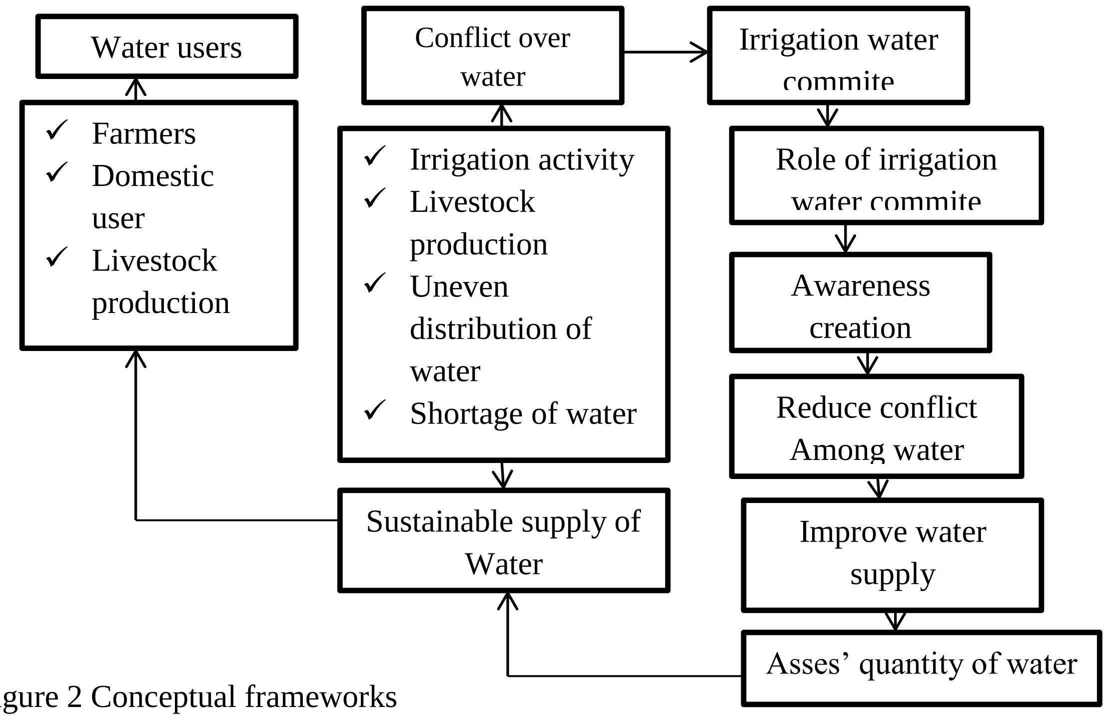

Figure 2 Conceptual frameworks

Crop water requirement

The variable amount of water contained in soil and its energy state are important factors affecting the growth of plants (Kloss, 2012). The crop evapotranspiration (ETc) was calculated using the equation.

$$ETc = ETo \times Kc \qquad (3.1)$$

Where: ETc=crop evapotranspiration (mm), Kc =crop factor from FAO and
ETo= is reference crop evapotranspiration (mm).

The depth of water apply to the other treatment was obtain simply multiply the full requirement by percent of deficit and totally deficit at different growth stages.

The irrigation was performed based on the irrigation treatment. The depth of irrigation depends on the gross irrigation water requirement at different application levels. The determination of the net irrigation requirement of the crop was calculated by using the following Equation 3.2

$$\text{NIR} = \text{ETc} - \text{Pe} \qquad (3.2)$$

Where: NIR=net irrigation requirement of crop (mm), and Pe=effective rainfall (mm)

Therefore, the net irrigation requirement equals to crop evapotranspiration minus effective rainfall. In the experimental setup, water was applied with price measurement, furrow was short and have dike. As a result, there is no runoff. Therefore, a higher value of application efficiency of 60% was adopted to estimate the gross irrigation requirement using equation 3.3. Furrow irrigation application efficiency, in general, varies from 45-60 %(Allen et al, 1998)

$$GIR=NIR/\eta \quad (3.3)$$

Where: GIR=gross irrigation water requirement (mm)
NIR=net irrigation water requirement (mm)
η =Application efficiency

Water balance calculation

The water balance determination was conducted by subtracting the summation of the crop water requirement of the major irrigated crop from the total amount of water released from the source over the year. Hence, the water balance of the scheme is the difference between the total amount of water released from the source and the amount of water required by the crops in the whole command of the scheme.

The water balance was computed by considering the amount of released from the source in the year 2019 and by determining the irrigation requirement of the major crops grown in Amba 1 using long year average climatic data and crop characteristics data.

Data collection

Both primary and secondary data were collected. The qualitative data were collected through interviews using questionnaires. A focus group discussion guide was administered to FGD participants comprising people other than those participating in the questionnaire interview. Secondary data were gathered through personal communication with agronomy experts. The quantitative data such as amount of irrigation water released from the source.

Sampling Procedures

Purposive sampling techniques were used based on the selected sites. The sample size for the questionnaire survey was 100 water users, 40 water users, from upper, 30 from middle and 30 from the tail of the command area. According to Bailey (1994), a sample or sub-sample of 30 respondents is bare minimum for the studies in which statistical data analysis is to be done regardless of the population size. Ten Participants for focus group discussion and 10 key informants were selected from 3 sample command area, making a total of 120 respondents.

Table 2. 1 Distribution of all respondents in the study area

Types of respondent	Male	Female	Total
Community member respondents	60	30	90
Key informants	15	5	20
FGD	5	5	10
Total	80	40	120

Method of data analysis

Both quantitative and descriptive analysis techniques were used for data analysis. The data generated through household questionnaire was analyzed by employing the computer software known as statistical package for social science (SPSS vs. 20) and excel calculation.

RESULT AND DISCUSSION

Crop water requirement

The water requirement of major irrigated crops: -, maize, cabbage, pepper, potato were presented below. According to (Table 3.2), high irrigation water application depth occurred in horticultural crops as compared to cereal crops in the irrigation scheme.

Table 3. 2 Crop water requirement of common irrigated crops

Irrigated crops	ETC for crops (mm)
Cabbage	351
Tomato	435
Maize	448
potato	513
pepper	470
Total	2217

Challenges in Amba 1 irrigation scheme

The most common critical challenges assessed during the time of transect walk and evaluation of Amba 1 irrigation scheme in terms of current status of the command area includes; Irrigation water scarcity, existence of conflict among irrigators, management problems, lack of fair distribution and allocation of irrigation water, poor maintenance and operation activities. These challenges were assessed at the head, middle and the tail part of the scheme and well-organized interview questions were raised for the local farmers.

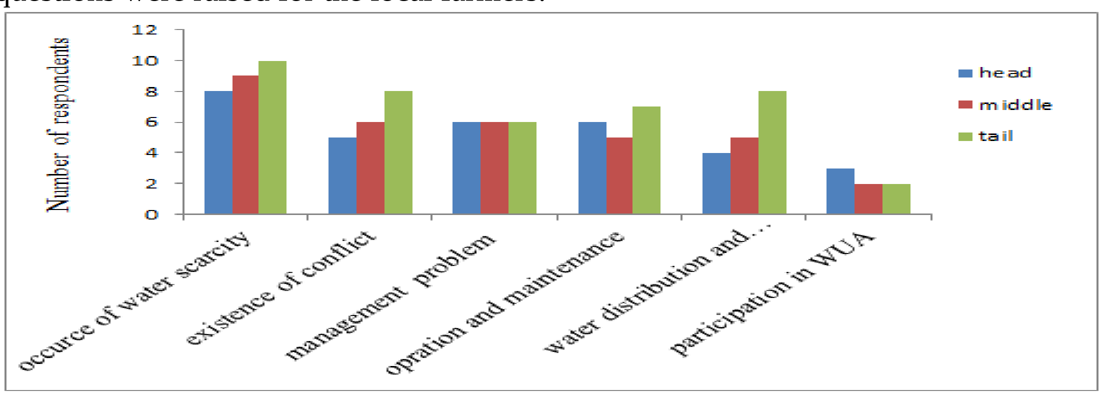

Figure 3. Challenges versus number of respondents at the head, middle and tail of the scheme

The occurrence of irrigation water scarcity was observed over the three classifications of the Amba 1 irrigation scheme but much severe problem of water shortage was occurred at the tail command area as compared to the head and middle classes of the scheme respectively. Based on the answers of local farmers and actual observation conflict, unfair water distribution and allocation, were huge obstacles to produce optimum yield of crops at the tail command area. The result also showed that the irrigation water management problem was a headache and a very critical component of the scheme the irrigation scheme. In addition to those irrigation core problems market linkage was the big issue as the local farmers talked during the transect walk.

Analysis of challenges of Amba 1 irrigation scheme

Irrigation water scarcity

The presence of scarcity was 14.1%, 70.4%, and 74.1% for the head, mid and tail of the scheme respectively. In the irrigation command area, 85.2% of irrigators were the dominant user of irrigation water at the head of the scheme. They had a chance to get an excessive amount of water due to their location nearest to the water storage structures.

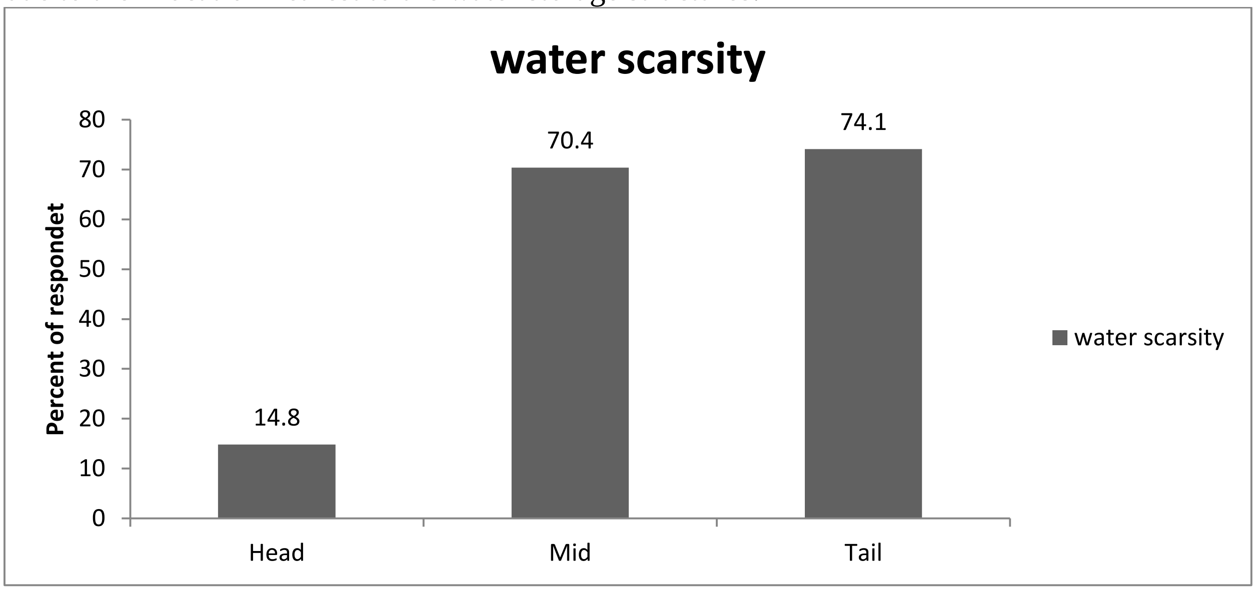

Figure 4. Status of water scarcity in Amba 1 irrigation scheme

Existence of conflict in the irrigation scheme

The existence of conflict among the users and between users and administration bodies was a big issue that made production and productivity in the way of reduction for all major irrigated crops across the irrigation scheme. As described in the figure below the most conflict action was most commonly present at the tail part of the scheme as compared to the head and middle of the scheme respectively. The highest percent of conflict action was found at the lower part of the scheme in which irrigation water scarcity was the difficult state for the existence of this action. The presence of conflict was 25.9%, 77.8% and 88.9 % at the upper, middle and lower class of the scheme respectively. This study found that the presence of conflict was increased from the upper part of the irrigation scheme to the lower with the integration of water scarcity, water management problems and poor participation of farmers in water user associations (Figure 5).

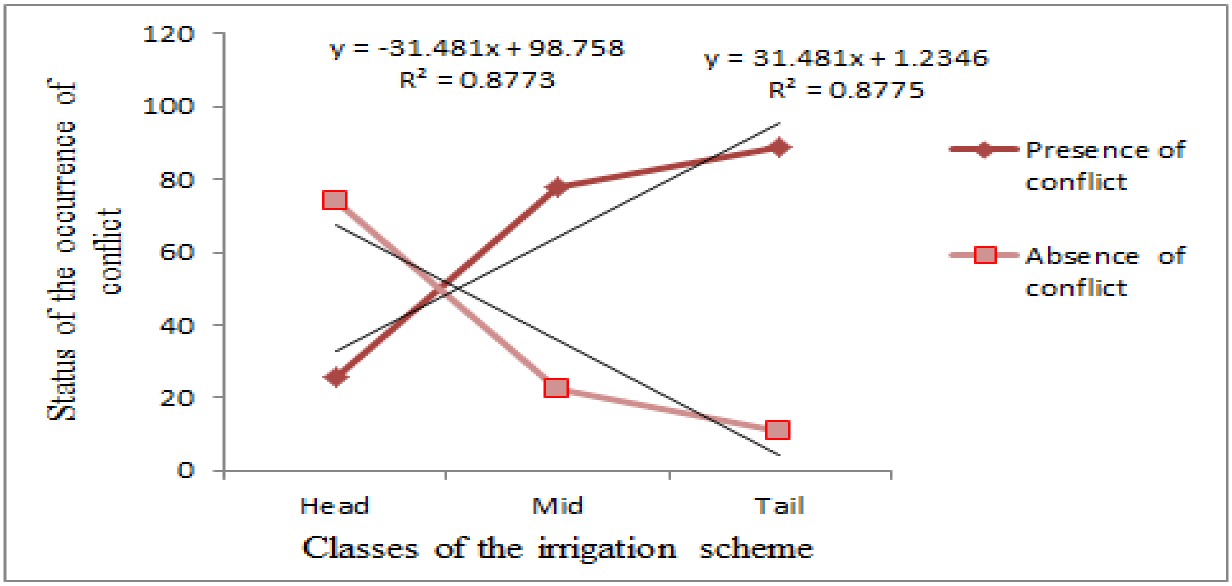

Figure 5. Status of the occurrence of conflicts across the scheme

Discussion with farmers also clearly indicates that water shortages and a lack of comprehensive and documented regulations as well as rules are some of the major causes of conflict between users. This case is substantiated by (Amede, 2015), who suggested water shortages and poor upstream and downstream linkage as one of the major causes of conflict across irrigation scheme

Water distribution and allocation

The maximum number of respondents was obtained at the lower parts of the irrigation scheme that they answered unfairness about the status of irrigation water distribution and allocation. Unfair irrigation water distribution and allocation strategies were the main bottlenecks in the irrigation command area, especially in the middle and the lower part of the watershed. Specifically, 11.1%, 63% and 74.1% percent of the respondents were said that unfair water distribution and allocation was a big problem that makes the cultivation of irrigated crops retard and lack of application of irrigation water at the right time as well as the right amount (Figure 4.3). As discussed with the users about water budgeting and distribution was conducted with the collaboration of illegal actions without considering the principle of distribution and allocation.

In fact, farmers employ either rotational water allocation within their quaternary units to their individual farms, which often cause conflict with respect to flow duration, the volume of flows and irrigation turns among farmers. Moreover, farmers can do little to fair irrigation water distribution and change the water delivery schedules at the main levels so as to shift the relatives and close friends. Even the water father and operators could not fairly distribute and allocate the irrigation water for the users.

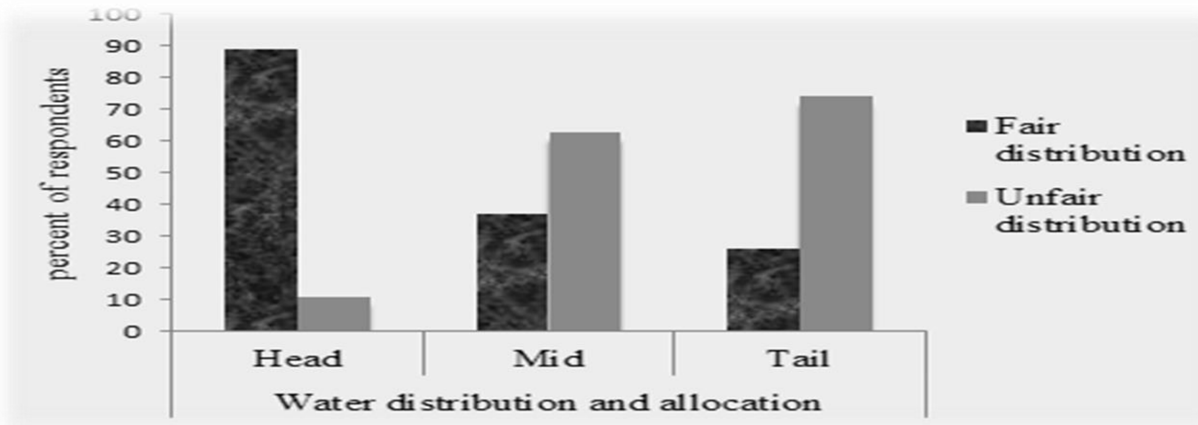

Figure6. Water distribution and allocation of the scheme

The head users of irrigation water in the scheme had fair distribution, uniform allocation and the excess amount of water. Hence, they were generally having generous water supply, causing excessive use on farms at the head while water does not reach the tail users (Yisma & Kebede, 2015). Based on this study also in the upper part of the scheme, the head farmers did not have the problem of water scarcity, distribution, and a little bit of operation and management defects.

Participation of users in irrigation water committee

The role of irrigation users in the committee at all scheme classes was generally very low according to farmers' opinion. This perception of farmers on the participation of users in committee was highest at the lower users of the Amba 1 irrigation scheme. But, it is not possible to draw straight forward conclusions for the scheme concerned, farmers' participation in irrigation organizations was observed to better for the upper part of the scheme followed by the middle class of the command area.

Table 4. 1 Participation of users in water user committee

Classification of the scheme	Total number of respondents	Number of respondents	
		fair	Insignificant
Upper	27	6	21
Middle	27	5	22
Lower	27	3	24

In the irrigation scheme in this study, the society, of course, does not give men and women equal opportunities for decision making in irrigation, farming activities, involvement in meetings and access to land. In this scheme where women are significantly included from economic farm opportunities in terms of access to land, skills, inputs, capital, markets providing irrigation water alone can hardly ensure equitable access to agricultural income.

CONCLUSION

Proper water resources management can be one of the factors that enhance crop productivity when water is a limiting factor for crop production. The water committee is responsible for water allocation and distribution, coordinating maintenance activities and conflict management in Amba 1 irrigation scheme.

The research results revealed that conflict over irrigation water persistently occurs among the irrigators. In this study the interviewed households reported that water scarcity, illegal water abstraction, lack of proper water control and distribution are responsible factors that lead to water competition.

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