Full Length Research Paper

Community perception on rangeland degradation: a case study in two differently settled areas of northern Ethiopia.

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The study was conducted in 2013 in western zone of Tigray regional state in northern Ethiopia in two settlement areas that differed in terms of duration of settlement from = 8 years (hereinafter referred to as 'New') to =18 years (hereinafter referred to as 'Old'). The objectives of the study were to assess and analyze farmers' perceptions about rangeland degradation and investigate farmers' conservation strategies in the new and old settlements. The farmers' perception was studied through semi-structured questionnaire (a total of 90 households for both settlements) and group discussions (containing seven to twelve members) in six peasant associations (three from each old and new settlement). The entire respondents of both settlements replied that the current condition of the rangeland declined severely overtime. Some important and palatable grasses such as Rottboelia cochinchinensis, Topaz (local name), Dinebra retroflexa, Pennisetum spp, Echinochloa spp and Setaria pallide-fusca which were dominant species of the rangelands mentioned to be in threat of extinction from most of the grazing lands. Following the reduction of these palatable species, unwanted and unpalatable plants for livestock such as Acanthospermum hispidum, Xanthium abyssinicum and Senna obtusifolia started to dominate most of the grazing lands and the main problems were expansion of cultivation, overgrazing and population pressure. The study confirmed that rangeland degradation is more pronounced around settlements. Therefore, in order to improve the condition of the rangeland, extension service must be given to the community on proper rangeland management and improvement measures.

Keywords: Cover, Cultivation, Overgrazing, Re-settlement, unwanted species, vegetation

INTRODUCTION

Community perception plays an important role in natural resource management. Since herders are in close contact with their environment and livestock, they have rich knowledge about their environment, livestock and resource (Tafesse and Kassaye 2004). Through herding, they understand the ecological process and the relationship with the environment. Local communities assess changes in rangeland condition overtime using different indicators. Habtemichael (2010) indicated that local communities in the highland of Tigray regional state used reduction in herbaceous biomass as indicator of rangeland degradation and this community observation was similar to the scientific rangeland degradation indicator studied by (Holechek et al 2001). Therefore, it is important to understand the differences between perceptions of scientists and local communities in order to find out how these gaps can be linked to bring about sustainable use of natural resources (Geofrey 2006).

Based on the cumulative knowledge they have, local communities use different strategies to tackle rangeland degradation. For instance, in the low land areas of Ethiopia, livestock herders use traditional knowledge to

tackle the arid condition of the environment, ensure sustainability of the resource base and avoid overgrazing (Alemayehu 2004).

Pastoral development projects were implemented in major pastoral areas of Ethiopia (Borana, Afar and Somali) with the aim of raising the standard of living of the pastoralists through restructuring their traditional system of extensive livestock production. These development projects have been described and addressed in terms of the official's perceptions without consideration of the perceptions of the local communities (Tafesse 2001).

This state of affairs has led to the failure of the projects to achieve sustainable development in pastoral areas of the country. The major reason contributing to the failure of the projects was lack of understanding the importance of traditional technical knowledge of the people for management of un-predictable environment (Tafesse 2001). Scientists now recognize that indigenous people have managed the environments in which they have lived for generations, often without significantly damaging local ecologies. Thus, indigenous knowledge provides the basis and opportunity for the development of resource management plan and conservation of rangeland biodiversity (Ayana 1999). Though indigenous knowledge provides a powerful basis to develop alternative ways of managing resources, they are not recognized in western zone of Tigray, northern Ethiopia. Therefore, the objectives of the study were to assess and analyze farmers' perceptions about rangeland degradation and investigate farmers' conservation strategies.

MATERIALS AND METHODS

Study site location

The study was conducted in western zone of Tigray National Regional State in Ethiopia in 2013. Its geographic location lies within the co-ordinates of 13^0 40'-14^0 27' north latitude and 36^0 27'-37^0 32' east longitude. The agro-ecology of the Zone is hot to warm semi-arid lowland plains which are characterized by hot temperature, erratic rainfall, vast area of plain lowlands suitable for large scale and subsistence agriculture including crop and livestock. It has unimodal rainfall pattern and the annual rainfall is 448.8.5mm. The mean annual temperature of the area is 25°C to 27.5 °C (EARO 2002).

Site selection and sampling

In the study district, there are 20 peasant associations

(PAs) (Tabia). Eleven of the PAs are established long time ago (=18 years) (Personal communication with elders) where as nine of them are newly established settlements (=8 years) (WoARD 2009). For this study three PAs from the old settlements and three PAs from the new settlements were chosen using simple random sampling.

The minimum distance between settlements was 12km while the maximum distance was 18km. Information on rangeland degradation of the two settlements (new and old settlement) was collected from individual households. A total of 90 households (45 households from the old settlement and 45 households from the new settlement) were selected using simple random sampling technique to gather the information. A semi-structured questionnaire was prepared for individual households. A simple random sampling technique was employed to select the sample respondents from each PAs.

Before conducting the actual survey, the questionnaire was translated to the local Tigrgna language and was pre-tested by interviewing some households from the community to facilitate the effective convey of the needed information by the selected households. Two enumerators from each PAs were trained for two days to participate in collecting the actual data. Finally, information on farmers' perception on rangeland degradation, causes of rangeland degradation, and indicators of rangeland degradation, major degradation problems, and problems concerning grazing lands were gathered.

In addition to individual household survey, group discussions (involving seven to twelve members) were held with Woreda experts and administrators, development agents of each PAs and elders from the community members of each PAs. Accordingly, discussions on rangeland coverage trend, settlement effect on rangeland, status of the rangeland, causes of rangeland degradation and ways of assessing rangeland condition were made with members of seven to twelve people to acquire their view on the rangeland productivity.

Data analysis

Statistical Package for Social Sciences (SPSS, version 16) was applied for the household survey data and reported using descriptive statistics such as averages and percentages.

Ranking analysis: Household survey data related to causes of rangeland degradation, indicators of rangeland degradation and impacts of rangeland degradation were analyzed using ranking index method (Musa et al 2006). The index was computed as:

Range Area invaded with Acanthospermum hispidum

Degraded area

Index = Rn*C1+Rn-1*C2…. +R1*Cn / Σ Rn*C1+Rn-1*C2…. +R1*Cn;

 Where,

Rn = Value given for the least ranked level (example if the least rank is 5th, then Rn = 5, Rn-1 = 4, R1 = 1);

 Cn = Counts of the least ranked level (in the above example, the count of the 5th rank = Cn, and the count of the 1st rank = C1

RESULTS AND DISCUSSION

Community perception towards rangeland degradation

In both the new and old settlements, the entire respondents and the focus group agreed that the condition of the rangeland declined severely over time. Sever degradation in rangeland resources (herbaceous and woody vegetation) was observed especially since the last five years. Although no evidence was found on the extinction of plant species in the area, 84% of the respondents from the old settlement and 65% from the new settlement indicated that there were herbaceous and woody species that are disappearing over time. Some important and palatable grasses such as *Rottboelia*

cochinchinensis, *Topaz* (local name), *Dinebra retroflexa*, *Pennisetum spp*, *Echinochloa spp* and *Setaria pallide-fusca* which were dominant species of the rangelands mentioned to be in threat of extinction from most of the grazing lands. According to the sampled households, the reasons for their reduction were overgrazing and expansion of cultivation and this was similar to the report of Mustapha et al (2001) and FAO (1993) who cited overgrazing and expansion of cultivation as main causes for palatable species reduction. Following the reduction of these palatable species, unwanted and unpalatable plants for livestock such as *Acanthospermum hispidum, Xanthium abyssinicum* and *Senna obtusifolia* started to dominate most of the grazing lands.

The perception of respondents about the degree of threat on woody species was not like that of the herbaceous species. However, species such as *Pterocarpus leucens, Sterculia africana, Balanites aegyptiaca, Dalbergia melonoxylon, Anogeissus leiocarpa, Acacia Senegal, Acacia abyssinica and Boswellia papyrifera* which play important role in livestock feeding during the long dry season were mentioned to be in threat of extinction. Extensive cultivation expansion and tree lopping were the primary causes listed by the respondents. In both settlements of the study area, all respondents agreed that except

Table 1: Causes of rangeland degradation ranked by respondents.

Causes	Old settlement		New settlement	
	N(Index)	Rank	N(Index)	Rank
Lack of rain	24(0.0211)	7	6(0.0608)	7
Overgrazing	287(0.252)	2	241(0.244)	2
Population pressure	208(0.183)	3	202(0.204)	3
Cultivation expansion	331(0.291)	1	255(0.259)	1
Re-settlement	133(0.117)	4	98(0.0994)	5
Lack of management	93(0.0817)	5	52(0.0527)	6
Park establishment	62(0.0545)	6	132(0.134)	4

reduction in native woody vegetation, emergence of other alien woody species was not observed. According to the respondents of both settlements, degradation is more pronounced in areas near to settlements because people used to cut trees to offer browse to their animals especially during the long dry season from areas near to settlement and do not prefer to travel long distance from settlements as the condition is harsh. The sampled household and the community focus group claimed that though rangeland degradation is becoming sever overtime, the effort undertaken to alleviate the degradation problem by the government officials and at community level was generally weak. The absence of clear border between PAs was the main problem to apply rangeland improvement practices because it created lack of ownership confidence in the community.

Causes of rangeland degradation

According to the information obtained from the respondents of both settlements (new and old settlements), expansion of cultivation, overgrazing, population pressure, re-settlement, establishment of Kafta Sheraro National Park, lack of management and erratic distribution of rainfall were the major causes of rangeland degradation in the study area (Table 1). In both settlements, the respondents agreed that expansion of cultivation, overgrazing and population pressure were the three leading causes of rangeland degradation. This result was in line with the findings of different authors (Imbamba 2003; Coppock 1994; Robert 1997 and Beruk 2003) who indicated chronic overgrazing, inappropriate cultivation, population pressure and settlement without consideration of the capacity of the area as main sources of deterioration in range condition.

Expansion of cultivation which is the primary cause for rangeland degradation in the study area is increasing from time to time. For instance the total cultivated area in 1994 was about 150, 175 hectares (TRG 1994) which is currently expanded to about 317,000 hectares (WoARD 2009). According to the focus group discussion and sampled respondents, the main crop grown in the area is *Sesamum ilbicum L.* which sometimes called "white gold" by the local community whose demand at international level is increasing from time to time. The existence of lucrative business for such cash crop is one of the reasons that initiated residents and non residents alike to legally and illegally encroach the prime rangelands of the study areas. The competition between legal re-settlers and illegal re-settlers to have cultivable land within the rangeland illegally was also set as second reason for cultivation expansion. All the sampled households agreed that the illegal immigrants were the main cause of cultivation expansion because they establish agricultural plots within the rangeland which caused severe degradation.

The sampled respondents and the focus groups noticed that over grazing was a series problem in relation to rangeland degradation. They agreed that the rangeland is decreasing in size from time to time. However, livestock population engaged on the available rangeland for grazing is increasing from time to time. The livestock number of the area raised from 157740 to 205696 between 1999 and 2009 (BoANRD 1999; WoARD 2009). Thus, this situation resulted in the concentration of large livestock number in the available grazing land which in turn causes over utilization of palatable species.

According to the respondents, population pressure also contributed more to rangeland degradation of the study area next to cultivation expansion and overgrazing. The area is becoming populous from time to time. For instance about 4093 households have been re-settled during the re-settlement scheme under taken during 2003 and 2004 re-settlement programmes (WoARD 2009). In addition to these legal re-settlers, illegal re-settlers are also becoming populous from time to time. For instance

Table 2: Indicators of rangeland degradation ranked by respondents.

Indicators	Old settlement		New settlement	
	N(Index)	Rank	N(Index)	Rank
Reduction in herbaceous biomass	242(0.311)	2	220(0.344)	2
Poor vegetation cover	255(0.326)	1	227(0.355)	1
Decrease in livestock productivity	126(0.161)	3	87(0.136)	3
Soil erosion	46(0.0588)	6	44(0.0688)	4
Emergence of unwanted plants	49(0.0627)	5	27(0.0422)	6
Poor body condition	64(0.0818)	4	25(0.0547)	5

Table 3: Impacts of rangeland degradation ranked by respondents.

Impacts	Old settlement		New settlement	
	N(Index)	Rank	N(Index)	Rank
Human and animal food shortage	170(0.401)	1	160(0.453)	1
Death of livestock	40(0.0943)	4	35(0.0992)	4
Low animal productivity	114(0.269)	2	87(0.247)	2
Decline in animal body conation	46(0.109)	3	44(0.125)	3
Decline in livestock holding/HH	33(0.0778)	5	27(0.0765)	5

the number of illegal re-settlers recorded in 2008 was 2342 but the number raised to 4300 and 5015 in 2009 and 2010, respectively (WoARD 2009). The respondents and focus groups noticed that the increase in human population damaged the rangeland since people in the area depend on range resources for different purposes. For instance woody vegetations were the only sources of firewood and construction materials in the area. Thus, excessive clearing of woody vegetation for firewood and construction purposes resulted in rangeland degradation.

Indicators of rangeland degradation

The local community used different indicators to assess rangeland degradation. Poor vegetation cover, reduction in herbaceous biomass production, reduction in livestock productivity, poor animal body condition, soil erosion and emergence of unpalatable species were indicators of rangeland degradation listed by the respondents (Table 2).

Poor vegetation cover was ranked first followed by reduction in herbaceous biomass. The interviewed households indicated that before the last five years, they were not traveling long distance to collect firewood but currently they travel up to 5 km to collect firewood which indicates the deterioration of woody vegetation especially in areas near to their settlement. Moreover, all the respondents agreed that before five years the biomass produced during rainy season was beyond the capacity of

grazing animals, as plenty of such biomass remained as standing hay. However, currently the herbaceous biomass produced during rainy season did not last long after the offset of the rainy season. At the time of this study, livestock were forced to move long distance (up to 10 km) in search of feed even during the rainy season.

These listed indicators were more or less similar to the result of Habtemichael (2010) who indicated reduction in herbaceous biomass and reduction in livestock productivity were the main indicators of rangeland degradation in his study conducted in eastern zone of Tigray region. Holechek et al (2001) in his study also indicated biomass as ecological and management indicator. Similarly Ayana and Fekadu (2003) reported decline in total biomass and animal performance were indicators perceived by pastoralists during the study of range condition in southern Ethiopia.

Impacts of rangeland degradation

The respondents of both settlements identified and prioritized the outcomes of rangeland degradation on their livelihood. Accordingly, they ranked first to food shortage for human and animals as the main effects of rangeland degradation followed by low animal productivity and death of livestock. Decline in livestock body condition and Decline in livestock holding per household were also ranked fourth and fifth, respectively in both settlements (Table 3). The view of the

respondents and focus groups suggested that the decline in quality and productivity of range land with a subsequent reduction in herbaceous cover and increase in unpalatable herbaceous species, and decrease in woody vegetation cover and composition had resulted in several negative outcomes. Forage scarcity has imposed severe stress on livestock production.

The respondents of both settlements indicated that feed shortage was not a problem in the last 8 years but at present it became a key problem especially from April to half of June. According to the sampled households of the old settlement, milk production from milking cows declined on average from 3.9 liters per day to 2.4 liters per day since the last 8 years. Moreover, respondents from the new settlement indicated that milk production has reduced on average from 2.9 liters per day to 2.2 liters per day as a result of rangeland degradation.

The difference in milk production observed in the new and old settlements across corresponding periods might be due to the difference in the type of breed they kept. Re-settlers of the old settlements kept Begait breeds which are potential in milk production while re-settlers of the new settlements kept Arado (highland breeds) which are less productive compared to Begait. Thirty two percent of the sampled households from the old settlement and 20% from the new settlement indicated that about 92 and 45 animals were died last year from the old and new settlements, respectively due to rangeland degradation. Similar to this result, food shortage for human and animals, death of animals and a decline in animal productivity were impacts of rangeland degradation perceived by pastoralists during the study of Pastoralists' perception towards range resource utilization in Eastern Ethiopia by Yosef (2007). Belaynesh (2006) also reported that feed shortage, livestock death and decline in livestock productivity as primary impacts of rangeland degradation.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Rangeland degradation is a serious problem in the study area resulting from expansion of cultivation, overgrazing due to the high livestock pressure in a very limited area, population pressure and re-settlement. The deteriorating condition of the communal grazing areas was shown by change in vegetation cover, reduction in herbaceous biomass production and decline in livestock productivity. The vegetation cover and composition changed over time, particularly, herbaceous vegetation and important woody vegetation cover have severely declined over the last 5 years, while invader herbaceous vegetation started

to increase. The influence of low and erratic nature of rainfall, and disturbance primarily by the illegal immigrants, in an effort to prepare agricultural plot within the rangelands through cutting, have also contributed to change in vegetation cover.

Farmers perceived that currently a large portion of the grazing land has been converted into bare land as the result of deterioration, particularly; areas near to settlement have been heavily deteriorated. Grazing lands near to settlement could not produce adequate feed even during the rainy season. As a result, animals forced to move long distance to search feed since grazing land far from settlement are better in condition. Generally the rangeland of the study area is increasingly unable to support the livestock, affecting at the same time the livelihood of the community.

Recommendations

Activities such as area closures, soil and water conservation and afforestation programmes are widely practiced in the high lands of the region to rehabilitate degraded grazing lands. However, such important activities are almost absent in the study district. Therefore, range extension service should be given to the local community on such proper rangeland management and improvement measures.

The degree of invasion of Senna obtusifolia, Acanthospermum hispidum and Xanthium abyssinicum and their suppression effect on the growth and survival of indigenous herbaceous plants as well as their relation to the rangeland degradation should be investigated.

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