The Impact of Wetland Degradation and Conversion on Socioeconomic Values: The Case of Amhara National Regional State Tekuma Wetland, Lake Tana Sub-Basin, Ethiopia

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Abstract: Wetlands provide flood and erosion control, providing economic and social benefits to communities living around the wetlands (Yilma Delelegn and Geheb, 2003). Although wetlands have many known characteristics that are important to the livelihoods of local inhabitants, they are degraded and lost due to a lot of triggering factors. Similar to other wetlands in the country, Tekuma wetland has been affected by different factors. Wetlands and their value remain little understood and their loss is increasingly becoming an environmental disaster (Yilma Delelegn and Geheb, 2003). Thus, a study was conducted in Tekuma wetland, south western part of Lake Tana in Ethiopia to investigate the impacts of the loss of wetland on socioeconomic values. In order to select the research site and respondents, purposive and simple random sampling techniques were applied. Socioeconomic data, collected using structured questionnaire, were analyzed using descriptive statistics, paired and one sample t-test techniques. The analysis of the result showed that major land use change has occurred from 1999 to 2008 followed by 1989 to 1998. Among the triggering factors for the loss of wetland direct conversion of wetlands to cultivated land was considered to be extremely high followed by overgrazing and vegetation clearance. Although Tekuma wetland has been providing different socioeconomic and ecosystem benefits to the society, the benefits of Tekuma wetland as a source of water was considered great, which has significantly improved the livelihood of the community. As the level of wetland degradation increases their benefit is reduced. As to the local people, if Tekuma wetland is lost the whole benefits that have improved their livelihood through irrigated agriculture will be lost. Hence, government has to provide special attention to minimize the loss/conversion of wetlands and maximize their socioeconomic and ecosystem benefits.

Keywords: Wetland conversion; wetland degradation; socioeconomic benefit; socioeconomic impact

1. Introduction

The research site, Tekuma wetland, is found within Lake Tana sub-basin, sub-basin of Abay River basin, Ethiopia. Tekuma wetland comprises different levels of wetlands (from intact to highly degraded wetlands). It is non-tidal wetland, which has a characteristic of marsh wetland (Ramsar Convention Secretariat, 2006). Tekuma wetland, similar to other wetlands, is providing numerous ecosystem and socioeconomic benefits to the society living around the wetlands (Yilma and Geheb, 2003). It is considered to be one of the major carbon sinkers that have significant positive effect on reducing the impact of climate change (Crooks *et al.,* 2011). Wetlands provide flood and erosion control service. Although these wetlands have many known characteristics that are important to the livelihoods of local inhabitants, they are threatened by massive encroachments. Agricultural development into wetlands through either the use of drainage systems or change of land use to hydrophilic plants is among the causes for wetland loss (Yilma and Geheb, 2003). Other scholars had also assured that increasing agricultural incomes at the expense of wetland resulted in loss of wetlands (Jorge *et al.,* 2014).

Similarly, Tekuma wetland has been negatively affected mainly due to agricultural development. For instance, about 85 ha of wetlands were distributed to landless youths in Wonjeta *Kebele* (the smallest administrative unit in town or rural area) in the last five years (Tigist Asfaw, Wonjeta, *Kebele*, personal communication, 2013). However, there is no recent and comprehensive study made on the status of wetlands in the sub-basin. Wetlands and their value remain little understood and their loss is increasingly becoming an environmental disaster (Yilma and Geheb, 2003; Murdiyarso *et al.,* 2012).

With this background, this research was designed to carry out an in-depth study on the impact of wetland conversion and degradation on socioeconomic values in Tekuma wetland. The main objective of the study is to examine the impacts of conversion and degradation of wetlands on socio-economic values in Tekuma wetlands.

The findings of the research can assist decision makers and developers to take appropriate actions with regard to the rehabilitation and conservation of wetlands. It also enables the developers to provide focus to wetland management.

2. Materials and Methods

2.1 The Study Area

The research site, Tekuma wetland, is found within Lake Tana sub-basin, sub-basin of Abay River basin in Bahir Dar Zuria woreda of Amhara Regionals State, Ethiopia. The wetland is located 19 km Northwest of Bahir Dar city. Tekuma wetland is located 19 km Northwest of Bahir Dar city and 3 km far from Lake Tana (Figure 1). The site is found in Wonjeta *Kebele*, in Bahir Dar Zuria Woreda (government administrative structure equivalent to district) of West Gojjam administrative zone. As it is observed in field visit the topography of the area is flat to moderately flat. The agro-climatic zone of the research area is Woyna Dega (traditionally classified agro-climatic zone equivalent to mid-highland) with an average minimum and maximum temperature of 11.5 ^{o}C, and 26.9 ^{o}C, respectively. The average rainfall of

the area is 1353mm/year (Mulugojjam Taye and Ferede Zewdu, 2012). Harding (2005), classified wetland degradation level into five categories:

a) Severely degraded: very high level of disturbance evident to the extent that wetland values are destroyed or irreversibly modified (e.g. Wetland drained).
b) Degraded: high level of disturbance evident.
c) Moderate: disturbance evident although many natural values remaining.
d) Intact: small amounts of relatively insignificant disturbance evident, with high native species diversity. Native vegetation buffer present for at least some of the wetland perimeter.
e) Pristine: No (or very minor) obvious disturbance, with high native species diversity and cover. Native vegetation buffer present for the majority of the wetland perimeter.

The definition given by Harding (2005), is more related to the situation in Tekuma wetland. Tekuma wetland comprises intact/minimally disturbed (I_WL), moderately degraded (M_WL), highly degraded wetlands (D_WL), converted grazing land (GrL) and cultivated land (CuL) that covered 22, 4, 42, 12, and 8 ha of land, respectively. Tekuma wetland is non-tidal wetland, which has a characteristic of marsh wetland (Ramsar Convention Secretariat, 2006).

The total population of Bahir Dar Zuria Woreda was 182731 with 93643 male and 89088 female (Bahir Dar Woreda Office of Environmental Protection Land Administration and Use, 2012 Progress report).

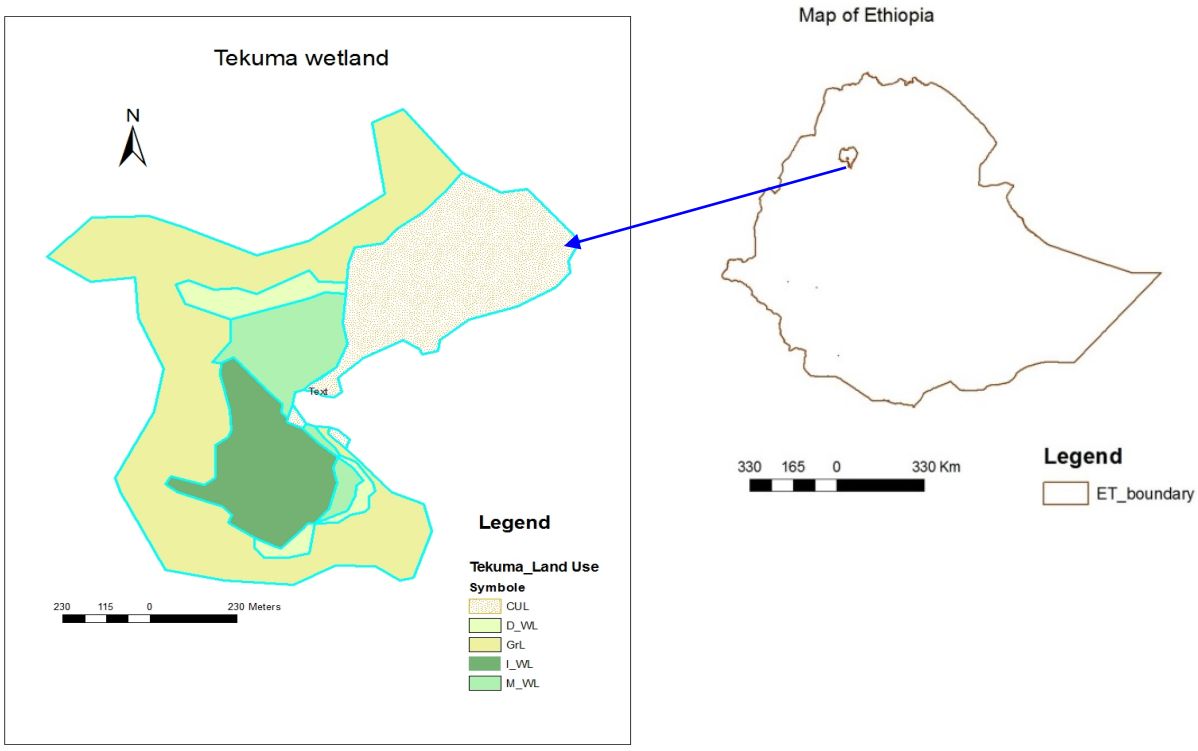

Figure 1. Location of Tekuma wetland.
(Sources: Data analysis using combination of google earth and GIS analysis)

2.2. Data Collection and Analysis Methods

2.2.1 Selection of respondent households

To investigate the perception of the community on the socioeconomic impacts wetland conversion/degradation, household respondents were selected by using simple random sampling techniques. The list of households in Wonjeta *Kebele* was obtained from the *Kebele* manager as a source of information.

Belayneh Ayele (2005) has used single proportion formula, which was designed by Cochran (1977), in his study of land degradation assessment to determine the number of interviewees. Since the socioeconomic aspects of this study is quite similar to the one made by him the same formula and the same "p" value i.e. 10% was used for this study. Accordingly, the total households in Wonjeta sub-*Kebele* who are direct beneficiaries of the wetland were 830.

$$n= ((z^2\ pq)/d^2\ )/(\ 1+1/N\ ((z^2\ pq)/d^2\ -1))$$

Where:

n = number of sample size when population is less than 10,000.

z = confidence limit.

p = proportion of the population to be included in the sample.

q = 1-p.

N = total number of population.

d = margin of error or degree of accuracy desired.

Using the above formula with the assumption of 5% standard of error (d), 95% confidence interval (z =1.96) and 10% variability assumed proportion, the total sample size with 6% additional contingency was 125.

2.2.2 Socioeconomic data collection

Structured questionnaires were prepared to gather information from the selected household respondents on the triggering factors, socioeconomic impact and trends of land use changes in wetlands. The questionnaires were filled by the enumerators. Half day training was organized to the enumerators on how to fill the questionnaires and communicate with the respondent households. The questionnaire was also translated into the local language, Amharic language to easily understand by enumerators.

2.2.3 Data analysis

Collected socioeconomic data were analyzed using SPSS for Windows 20 version. The confidence level for all analyses was selected at 95%. The socioeconomic values were measured with respect to different land uses changed from wetlands and less disturbed wetlands. Descriptive statistics have been commonly used for the socioeconomic data analysis. In addition to descriptive statistics, paired samples test and one sample t-test techniques were applied to check whether the analysis was statistically significant or not. For analysis purposes ranking was also used for some issues. For instance it was ranked as 1, 2, 3 and 4 for very high, high, low and very low damages of wetlands respectively.

3. Results and Discussion

3.1 Trends of Wetland Conversion

The respondents were asked if they have noticed wetland conversion in their *Kebele*. The result of the analysis indicated that 99% of the farmers were aware that

Table 1. Farmers' response on wetland conversion

S/N	Duration when wetlands were converted	Average ranking of respondents	Interpretation of the results
1	From 1979 to 1988	3	low
2	From 1989 to 1998	2	High
3	From 1999 to 2008	2	High
4	From 2009 to 2012	3	Low

wetlands in different parts of their *Kebele* were converted to other land use types (LUTs) mainly cultivated lands. This is a common problem not only in Ethiopia but also in other parts of the globe.

Luan and Zhou (2013) mentioned that intensified agriculture development has changed wetland into agricultural land. Apart from illegal expansion of farming into the wetlands by individual farmers, wetlands have been officially distributed to farmers, particularly to landless youths by the local government. Land distribution to landless youths was not limited to this *Kebele* but it has been also carried out as a campaign throughout Amhara region in the previous three to four years. In 2010/11, 2011/12, and 2012/13 budget years marginal lands were distributed, to 1,534, 23,583, and 9,789 landless youths, respectively in the region (Bureau of Environmental Protection Land Administration and Use's annual progress reports for 2010/11, 2011/12, and 2012/13 budget years). However, there was no information available on the type of land use and quantity of land that was distributed to youths. Based on field observation, it is safe to say that majority of the land distributed in Bahir Dar Zuria Woreda were wetlands.

Farmers were asked to respond on the trends of land use change in wetlands for the last 30 years based on 10 years interval. The ranking was given from 1 to 4 (1, 2, 3 and 4 for very high, high, low and very low degradation of wetland respectively). According to the farmers' response, extensive change/damage to wetlands was occurred from 1999 to 2008 followed by 1989 to 1998. About 67% and 52% of the respondents rated the value of land use changes that occurred between 1979 and 1988; and between 2009 and 2012 as very low, respectively. Study undertaken by Geberekidan (2012) supported and strengthened the responses received from the interviewed farmers in the study area. The rate of wetland conversion was high between 1989 and 1998; and 1999 and 2008. The rate of wetland conversion was found to be low between 2009 and 2012; and 1979 and 1988 (Table 1).

3.2 Triggering Factors for Wetland Conversion/Degradation to Other Land Use Types

Wetlands have been changed to other LUTs due to a number of factors (Finlyson, 2000; Yilma and Geheb, 2003; BoEPLAU, 2010). The triggering factors may differ from place to place or from wetland to wetland (BoEPLAU, 2010; Gebrekidan Worku, 2012). In this study conversion to cultivated land, overgrazing, vegetation clearance,

sedimentation and lack of awareness were considered as the major causes for the loss of wetlands in Wonjeta *Kebele*.

The respondents were asked to compare that which of these factors had extremely high, very high, medium, low, very low and extremely low impact on loss of wetlands. The survey data indicated that 79 and 11% of respondents considered direct conversion of wetlands to cultivated land to have extremely high and very high impact, respectively. In the past, the benefits of wetland for agricultural production were not fully recognized by the local residents. As a result, large parts of the wetland were changed to cultivated and grazing land. Similar results were also observed on studies conducted by Crecious and Lazarus (2013); Mulatu, *et al.,* (2015); and Stuip *et al.,* (2002) that agriculture is considered the principal factor for wetland loss due to shortage of cultivated land and decline of crop productivity in upland areas.

It was also tried to see the major reasons why wetlands are converted to cultivated land. Based on the current price of grains, on average farmers can make Birr 14,733 per hectare in the research area. Other benefit from agricultural practices is the use of crop residues as feed sources for livestock and other purposes. Intangible benefits of wetlands such as flood attenuation, spawning area for fish and other aquatic life, sediment reduction, pollution reduction, etc. are normally neglected by farmers and some developing agencies. Overgrazing/ free grazing was voted as the second most important factor for the loss of wetlands. About 6 and 52% of the respondents rated that overgrazing was extremely high and very high respectively for the loss of wetland. Only 10 and 15% of the farmers responded that lack of awareness was extremely high and very high, respectively for land use change in wetlands. More than 70% of respondents rated the contribution of sediment for the loss of wetland as being low and very low (Table 2). Overall, draining wetlands for agricultural purposes, overgrazing, overexploitation, and lack of awareness were the major factors recognized by the farmers for the loss of wetlands in the study area.

Farmers were asked to rank 1, 2, 3, 4, 5, and 6 for extremely high, very high; medium, low, very low and extremely low respectively. The conversion of wetlands to cultivated land was considered to be extremely high. Farmers' ranking was exactly reflected the reality going on in their *Kebele*. This was also proved by Crecious and Lazarus (2013) studied on wetland conversion and human perception. Next to conversion to cultivated land, overgrazing/ conversion to grazing land and vegetation clearance were considered as medium for the loss of wetlands. The contribution of lack of awareness and sediment for the loss of wetlands were considered to be low (see: Table 3).

One of the major factors why farmers convert wetland to cultivated land may be related to land holding size. Unfortunately, the size of the farmlands owned by all farmers was small (on average 1.4ha/household). Taking into account the average family size of the area, the land holding for each family member would be less than 0.26 hectare of

Table 2. The proportion of respondents on the triggering factors for the loss of wetlands in Wonjeta *Kebele*

Respondents' Opinion	Sediment (%)	Conversion to grazing land (%)	Conversion to cultivated land (%)	Vegetation clearance (%)	Lack of awareness (%)
Extremely high	2	6	79	3	10
Very high	7	52	11	16	15
Medium	19	18	7	43	13
Low	32	18	2	32	18
Very low	39	6	1	6	43
Extremely low	1	0	0	0	2

Table 3. Comparison of triggering factors ranked by respondents.

S/N	Triggering factors for wetland conversion	Average ranking of respondents	Interpretation of the results
1	Direct conversion to cultivated land	1	Extremely high
2	Overgrazing	3	Medium
3	Vegetation clearance	3	Medium
4	Lack of awareness	4	Low
5	Sediment	4	Low

cultivated land that is too small to support the family. Such small landholding size combined with traditional farming systems aggravated food insecurity problem in the research area. The result of analysis, made on livelihood of the community, showed that 99% of the residents depend on mixed faming system (livestock rearing and agronomic practices). Such kind of livelihood would aggravate the loss or conversion of wetlands.

3.3 Socioeconomic Impact of Wetlands Conversion

The benefits of wetlands, as elaborated below, are numerous. The loss of wetlands therefore resulted in the loss of these benefits (Hategekimana and Twarabamenya, 2007). Hagos *et al.,* (2014) witnessed that wetlands are the most productive but the most threatened ecosystems on earth due to human induced factors.

Hardlife *et al*. (2014); Wasswa *et al. (2013)* showed in their study that the degradation of wetland have negatively affected the livelihood of the community. Almost all interviewed farmers (97%) responded that they identified something of value that they felt it was lost as a result of wetland degradation. Only 3% of the interviewees responded that their benefits were not affected by the loss of wetlands. Interviewed farmers stated that intact wetlands were more important and valuable compared to other wetlands and converted land use types. Converted grazing land, cultivated and highly degraded lands were rated as less valuable compared to intact wetlands.

Table 4. Farmers' response on the benefits of wetlands.

Benefits	Opinion of the respondents (%)					
	Very good	Good	Medium	Low	Very low	Total
Sources of water	99	1	-	-	-	100
Source of animal feed	76	19	4	1	0	100
House construction	3	6	13	18	60	100
Maintain microclimate	8	35	39	14	5	100
Source of medicine	0	3	7	36	54	100
Source of income	0	11	9	12	68	100
Fasten different things	13	25	30	21	12	100

Table 5. Animal feed sources in the research area.

Response	Grass from private lands (%)	Crop residues (%)	Grass from communal lands (%)	Grass from wetland (%)
No	26	2	50	22
Yes	74	98	50	78
Total	100	100	100	100

3.3.1 Loss of different benefits gained from the wetland

According to the respondents, wetlands are considered as a major source of water, animal feed, medicinal plants, income and house construction material. Farmers rated the benefits of wetlands as very good, good, medium, low or very low. About 94% and 100% of respondents rated that wetlands are very good source of livestock feed and irrigation water respectively.

Major sources of animal feed in the study area were grass from wetlands, crop residues, communal grazing lands and private lands. The result of analysis indicated that 78% of the respondents have used grass from wetlands as one of the sources of animal feed for their livestock (Table 5). According to the information, received from the *Kebele* administration, currently about 400 motor pumps were in use for irrigation of agricultural lands around Tekuma wetland. The size of the wetland is relatively small (about 88 hectares) and the number of pumps might be too large, compared to the capacity of the wetland to sustainably provide irrigation water. Ajibola *et al.* (2012) found in their study that abstraction of water from wetland for irrigation purposes was a major factor for the loss of wetland. The degradation of wetland has also negatively affected the flow of rivers (Nonga *et al.,* 2010). Similarly, unplanned irrigation activity in Tekuma area may cause mining of groundwater, causing drying of the wetland unless proper catchment treatment is undertaken. The pumps are irrigating up to a distance of 200 meters away from the edge of the wetland.

Farmers were becoming aware of the importance of wetland as source of water for irrigated agriculture. Thus, farmers have recently started to prevent further agricultural expansion to the wetland and

started fencing around the wetland. The result of the interviews indicated that 64% and 35% of the farmers strongly disagreed and disagreed, respectively on the conversion of this wetland to agricultural land. Respondents were also asked to rank the benefits of converted cultivated land for different purposes as good, medium and low. About 87% of the respondents ranked the benefits of converted cultivated land, for production of annual and perennial crops as good while the remaining 12% ranked it as medium. As to the local people once wetlands are converted to grazing land, due to overgrazing, both quality and quantity of grass is reduced very quickly. Therefore, the converted areas were mainly used for simply keeping the animals. Farmers were asked whether these converted grazing lands are used for grazing purposes or for simply keeping animals. The farmers were asked on the benefits of converted grazing land. Accordingly, half (50%) of the respondents ranked the benefits of converted grazing land for keeping animals as good and the remaining 50% ranked them as medium.

Wetlands, as mentioned above, are providing benefits to the society. There are also other benefits wetlands are providing to the society like spawning area for fish, pollution control, and climate change mitigation (Crooks *et al.,* 2011, U.S. Water Resources Council, 1979). Thus, the loss of wetlands means the loss of these benefits. If Tekuma wetland is lost those farmers who are using the water for irrigation purposes would be negatively affected and their farming system would also be changed from irrigated to rain-fed agriculture.

3.3.2 Comparison of benefits among LUTs

More than 71% of respondents rated the benefits of intact wetlands as very high. More than 63% of the respondents rated the benefits of moderately degraded wetland as high. About 57% of the respondents ranked the benefits of highly degraded wetlands as very low (Figure 2). More than 51% of respondents ranked the benefits of grazing land as low and 38% of respondents ranked the benefits of cultivated land as very low.

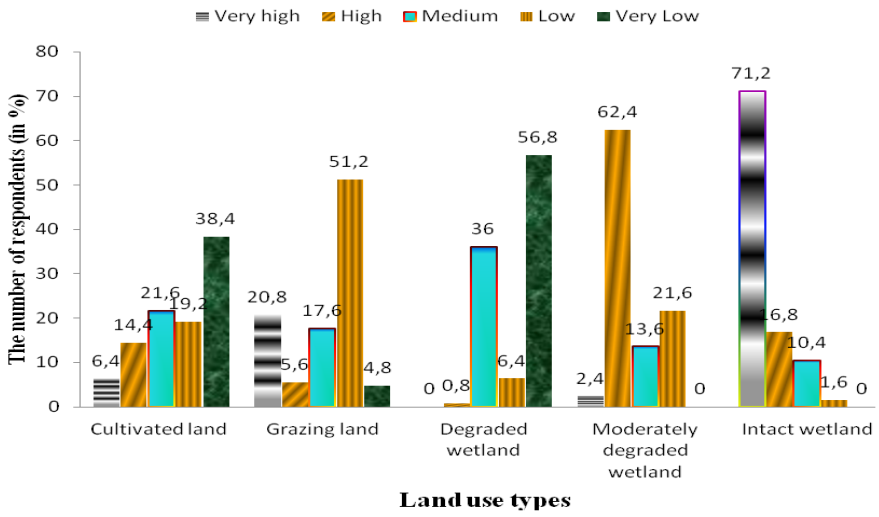

Figure 2. Comparison of benefits among the level of wetlands.

Table 6. Comparison of land use types on their benefits.

S/N	Land use types	Rated ranking of respondents	Interpretation
5	Intact wetlands	2	high
4	Moderately degraded wetland	3	Medium
2	Converted grazing land	3	Medium
1	Converted cultivated land	4	low
3	*Highly* Degraded wetland	4	Low

Farmers ranked the benefits of different land uses starting from 1 for very high; to 5 for very low. Consequently, the benefits of intact wetlands were ranked as "high", and the benefits of moderately degraded wetland and converted grazing land were medium. Respondents considered the benefits of highly degraded wetland and converted cultivated lands were low.

3.3.3 The reduction of the capacity of grazing lands to support the livestock development

The livelihoods of the community in Wonjeta *Kebele* depend on mixed farming system. In Tekuma area major sources of livestock feed include crop residues and grass collected from wetlands. A study conducted by Lannas and Turpie (2009) showed that the benefits of wetland to livestock development was most important one compared to other values of wetlands. It is a general belief that land use change in wetlands has significantly affected the livestock development by reducing the capacity of wetlands to provide feed material. To determine whether the conversion/degradation of wetlands has negatively affected the livestock development sector, comparison was made on the number of livestock; and the number of months when the livestock was grazing on grazing lands before and after land use change. Both issues have been further discussed in more detail in the following sections:

a) Livestock numbers before and after extensive land use change

As it is clearly indicated in Table 7 it was tried to compare the number of each type of livestock before and after the conversion of wetlands. Thus, the number of cattle, shoat, and equines has reduced by half mainly due to conversion of wetland. Since the feed consumption differs from animal to animal there is a need to use a standardized value called tropical livestock unit (TLU). The result of analysis showed that before wetland conversion the average TLU, owned by a farmer was 12. The average numbers of TLU, owned by a farmer after wetlands were changed was found to be 5.5, a reduction of 5.5 TLUs. Using 95% confidence limit, the TLU after conversion was between 5.2 and 6.8, and between 10 and 12.9 before land use change, indicating statistically significant reduction in TLUs due to land use changes. As clearly indicated in the table below the maximum numbers of livestock before and after land use change in wetlands were 47 and 31 TLU, respectively.

Table 7. The number of livestock before and after wetland conversion.

Livestock	Mean		Minimum		Maximum		Std. Deviation	
	Before LUC	After LUC	Before LUC	After LUC	Before LUC	After LUC	Before LUC	After LUC
Cattle	6	13	0	1	54	33	8.32	4.97
Shoat	4	8	0	1	22	21	4.79	3.6
Equines	1	2	0	1	4	4	0.82	0.57
TLU after LUC	5.5	12	0	0	47	31	7.74	4.6

Table 8. Paired sample test on the number of TLU before and after wetland conversion.

TUL	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
TLU owned before LUC - TLU owned currently LUC	5.5	6.4	.6	4.4	6.7	9.6	124	0.0

Farmers believe that one of the major factors for the reduction of their livestock number was due to the loss or conversion of wetlands to farmlands. However, conversion of wetland to cultivated land mayn't be the only factor for the reduction of livestock number. Dramatic increase in human population and other issues can also be the factors. However, as farmers said wetland conversion can be the major factor for livestock reduction.

To check whether there is significance mean difference between TLU before and after land use change, paired samples test was employed. The test result showed that a mean difference of 5.5 and standard deviation of 6.4 is observed (Table 8). The p-value (0.0) is less than 0.05, which shows that the number of TLUs before land use change was significantly different/higher than the number of TLUs after land use change.

b) The reduction of duration of animals grazing on grazing lands

Overgrazed grassland has little value to the animals as feed source and the area is generally used as a pen to keep the animals. The result of analysis showed that the number of months that the animals were allowed to graze was reduced from 9.2 months to 2.8 months after conversion of wetlands to farmlands. Paired sample test showed that there was significant mean difference between the number of months before and after land use changes at 99% confidence limit. Although there can be other factors (e.g. change of grazing land to cultivated land and increasing population number) wetland conversion can take the lion share. If wetlands were not converted to other land use types, livestock could have grazed almost 6 months longer in the same area, having higher carrying capacity. Reduction in the time of grazing would impact on the

number of LUTs, quantity and quality of livestock products.

The analysis result indicated that 88% of respondents rated intact wetlands as very good source of animal feed, followed by moderately degraded wetlands (72%). In general, 44%, 85% and 68% of respondents stated that converted grazing lands, cultivated lands, and highly degraded wetlands, are less valuable for animal feed source.

3.4 Farmers' Recommendations on Sustainable Use of Wetland Resources

As was mentioned in the previous sections the farmers recognized that the presence of this wetland enabled to increase their productivity through irrigated agriculture. Farmers have seen that the water flow was reduced as parts of the wetland were converted to farmland. Therefore, the importance of wetland to the community has become well recognized. The recommendations mentioned by the farmers to conserve wetlands are: (i) protect the wetland from the reach of animals; (ii) fence the wetlands; (iii) develop byelaws and enforce them: (iv) planting appropriate trees; (v) avoid cutting of wetland grass; (vi) aware the community about the importance of wetlands; (vii) assign guards to protect wetlands; (viii) reduce sediment load through catchment treatment; and (ix) avoid conversion of wetlands to cultivated lands. More than 80% of the respondents proposed to protect the wetland from the reach of animals and 64% of them advised to make fence around the wetland.

The community has already started to fence the wetland with stone masonry around the wetland. About 37%, 33%, and 33% of the respondents forwarded their recommendation to avoid the cutting of grasses from the wetland, aware the community on its values and assign guards to protect the wetlands respectively. Even though there is a sign of sedimentation in the western part of the wetland the problem of sedimentation was not yet recognized by most of the farmers.

4. Conclusion

In the research site different levels of wetlands were mapped as intact, moderately degraded, highly degraded wetlands, converted grazing land, and converted cultivated lands. Tekuma wetland is providing tremendous economic and ecosystem benefits to the society. This wetland has contributed to the improvement of the livelihood of the community as source of irrigation water and ultimately improves the productivity of agricultural land. Although wetlands are providing such numerous benefits they are being degraded and/or lost. The major triggering factors, identified for the loss of Tekuma wetland are conversion to farmland and grazing land, sedimentation, vegetation clearing and lack of awareness. The result of this or other studies, made recently within the same subbasin indicate that extensive and significant land use changes in wetlands have occurred from 1999 to 2008. Distribution of wetlands to landless youths for farming practices has been one of such activities and has been done by the local government.

The negative impacts of loss or degradation of wetlands have been highly recognized by the community. Some of the major impacts of wetland loss, identified by the community are loss of water sources for

irrigated agriculture, reduction of livestock quantity and quality, loss of vegetation for house construction and other purposes. The whole irrigated agricultural practices, undertaken around the wetland would be changed to rain-fed agriculture if the wetland, sources of water, was dried up due to the loss of wetlands.

Based on the research findings the following recommendations have been provided: Government should stop the distribution of wetlands to land less youths. Instead a detailed study of the available marginal lands in the area should be undertaken to decide which parcels of land can be distributed to landless youths with minimal social, economic and ecologic impact; Government should give special attention to these wetlands and develop a conservation plan; Although it might be difficult, attempts should be made to rehabilitate the converted wetlands back to their original state; The community should be involved in the wetland conservation and rehabilitation throughout the planning and implementation processes to ensure the sustainability of proposed wetland management activities; Boundary of wetlands should be delineated and ownership should be given to the *Kebele* administrations.

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