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EXAMINING THE EFFECTS OF WETLAND DEGRADATION FRAGMENTATION IN SILTE ZONE, SOUTHERN ETHIOPA

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Presentation outline

- **Introduction**
- **Statement of the problem**
- **Objective**
- **Methodology**
- **Result and discussion**
- **Conclusion**
- **Recommendation**

Introduction and Background

- Wetland resources in Ethiopia are considered as an integral part component of the environment in the country and provide a wide range of
  - Social
  - Economic
  - Ecological benefits (Tesserae *et al.*, 2013).
- These wetlands are distributed throughout the country from the lowlands of afar depression to the highlands in the bale mountain (FAO, 2008).
- Among benefits and functions that wetlands provide are
  - Fodder, Fishes & Ecotourism
  - Act as sponges during dry season &Medicinal plant
  - Source of income &Livelihood for human beings

Cont'd

- Ethiopia owns different types of wetlands which have regional, national as well as global ecological and socio economic significances.
- Despite all those and other indispensable values, these wetlands are under severe pressure and degradation.
- The most dominant challenging factors of wetlands in the country are due to human/climate impacts
  - Traditional and modern agricultural expansions,
  - Continuous land degradations,
  - Urbanizations and industrializations
  - Ecological problems
  - Absence of policy and proper institutional arrangements are the key factors limiting affirmative actions against the degradation of Ethiopian wetlands (Legesse, 2007).

Cont'd

- Ethiopia is not yet a part to the Ramsar Convention and has not yet developed wetland policies this result in wetland management under question in the country also suffers from capacity limitations such as lack of skilled manpower finance and technology.
- As a result there is shortage of wetland specialists which result in awareness problem from grassroots up to decision maker level (Shewaye, 2008).
- The effect of Wetland conversion often results in water depletion, the displacement of populations, the destruction of traditional production systems, habitat degradation, salinization, increases of waterborne diseases and other adverse ecological impacts (Zerihun 2003; Yilma 2003).

Cont'd

- There are many reasons for which wetlands are fragmented and degraded either by natural or manmade factors.

- Considering the fact that the wetland is the main livelihood asset of many rural and urban dwellers, coupled with the large sizes of recent wetland degradation and drying.

- This study focuses on the assessing major determinants, effects of wetland fragmentation and degradation in Silte zone, Southern Ethiopia.

Statement of Problem

- Globally, wetlands play important role in ecological, economic, social and cultural functions.
- Wetlands (mainly rivers and their associated flood plains) have been the heart of human civilization (Mateos, 2004).
- Thus, wetland resources have played key role throughout the development and survival of humanities.

Cont'd

- In general, Wetland resources contribute billions of birr to people of Ethiopia every year in the form of
  - Pure air,
  - Soil formation and protection,
  - Crop pest control,
  - Provision of food, fish, fuel, fiber, medicine, recreation, tourism, etc. (Leykun 2003).
- Despite all those and other values, Ethiopian wetlands are under severe pressure and degradation.
- Due to intensive irrigation agriculture, the expansion of human settlement, industrial pollution, pesticides and fertilizers and water diversion for drainage and the construction of dams and also some environmental factors.
- Wetland conversion often results in water depletion, the displacement of populations, the destruction of traditional production systems, habitat degradation, salinization, increases of waterborne diseases and other adverse ecological impacts (Zerihun 2003; Yilma 2003).

Cont'd

- In Ethiopia there is a massive loss of wetlands over time and yet management of these ecosystems didn't get prioritization (Hailu, 2007).

- The reckless attention given by people and policymakers to wetlands is highly damaging these ecosystems.

- A number of studies such as Abera, 2018 studied on 'The effect of wetland degradation on the fish production in Ethiopia; Tafa, 2018 investigated preliminary survey of wetland in Ethiopia, threat, extent, of degradation and future perspective, N.K *et al*., 2010 also investigated anthropogenic drivers on land cover change of kilomber wetland.
- however the associated the major determinants, effects and management practices and associated socioeconomic factors of mendifa wetland have not been adequately examined and Quantified . Even so, these studies mainly dwelt on the effects wetland degradation, but as far as the Mendifa catchment area is concerned, no such study has been conducted.

Cont'd

- while Bekele *et al*., 2018 studied on intervention of local community and wetlands ; the case of lake ziway shore area Ethiopia that they assessed level of communities perception on wetland conservation (all the above) have looked at wetland degradation

- Studies in the country have often focused on the assessed level of community's perception on wetland conservation.

- This research therefore, investigates assessing determinants, effects and management practices of wetland fragmentation in siltie zone.

Objectives of the study

General Objective

- The general objective of this study was to assess determinants of wetland degradation, natural & Man Made effects of wetland degradation, effects of wetland fragmentation and in Silte zone, Southern Ethiopia.

Specific Objectives

- To examine the natural & Man Made effects of wetland degradation
- To assess the determinants of wetland fragmentation in the study area.
- To Assess the associated causes & consequences of wetland degradation?

Research Questions

- What are the natural & Man Made effects of wetland degradation ?
- What are the determinants of wetland fragmentation in the study area?
- What are the associated causes & consequences of wetland degradation?

Description of study area

- It is located within Lanfuro & siliti districts with 1253ha.
- It is shallow lake with the maximum depth of 9 m.
- located at 160 Km away from the capital Addis Ababa and 170 km Hawassa
- District has 72 PAs in rural areas and 7 PAs in urban settings
- **It is bordered with**
  - Jido Kombolcha Wereda in the East,
  - Garage Zone in the North,
  - Alaba special Wereda in the South
  - Dalocha Wereda in the West

The district is located at 70 37'30"N to 70 0'0" N latitude and 380 9'36" E to 380 31'12"E Longitude with altitude ranges from 1870- 2000 m a.s.l.

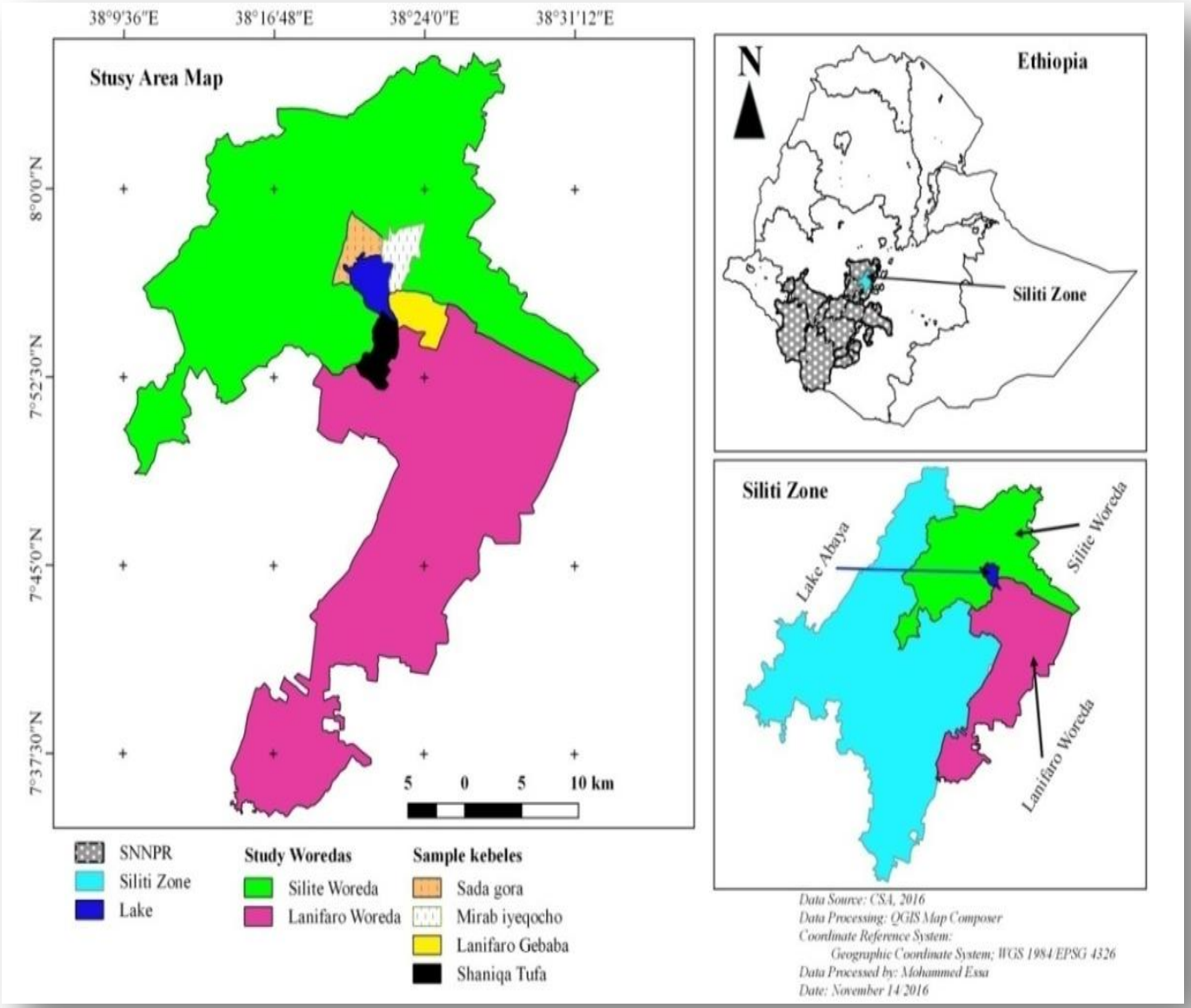


Fig.3.Map of study area

Climate

- Dry Wayne Dega is the agro climatic zone
- maximum mean annual rainfall is less than 900 mm
- The maximum annual temperature is 30 ^{o}C
- The minimum annual temperature during is 18 ^{o}C

❖ Land use

The total area of the District is 100,166 hectare.

The district lies in the altitude range of 1870 and 2000 (m.a.s.l).

❖ Population characteristics

Based on the 2022 District based population and house census report the total population 358,835 (50.95%) male while (49.05%) women.

❖ Vegetation and crops

Maize, sorghum, wheat, bean, and barley are the dominant crops grown at the district. Vegetables like cabbage, pepper, potato, tomato and onion are commonly grown in the district.

Sampling Techniques and Sample Size determination

- In Silti District there are more than 15 beneficiary districts that lie on adjacent of mendifa wetland.
- Within these beneficiaries three rural districts were randomly selected and from the list of total households of the 3 rural districts sampling frame were proportionally organized and the sample size were determined. Several rules-of-thumb has been suggested for determining the minimum number of sample households required to conduct logistic regression analysis.

- The study used a method developed by Green (1991) to select the total sample size from the total households.

- He suggested a rule-of-thumb that $N \geq 50 + 8m$, where N is minimum number of sample households required to conduct multiple regression analysis and m is the number of explanatory variables used in the regression analysis. The explanatory variables used in this study were fourteen.

- So that the minimum sample size is $N \geq 50 + 8 \times 12 = 146$. But For analysis, 140 samples were used in the analysis because six observations were with incomplete information

Data Source and Method of Data Collection

Both quantitative and qualitative will be collected in this study. These data will be collected via primary and secondary data sources.

- Secondary data will be also collected from documents compiled in district, district archives, documents, journals, and concerned bureaus.
- Primary data were also collected from
  - Household survey
  - Key Informant Interview
  - Focus group discussions
  - Personal observation

Table 1.sampling Technique and sampling determination

Sampled districts	Total household	Sample Proportionality	Sampled household
Ashuta B.	3952	3952*140/11553	47
Goflela	4765	4765*140/11553	60
Balo K.	2796	2796*140/11553	35
Total	**11553**		140

Both quantitative and qualitative data were used in this study. These data were collected via primary and secondary data sources. To collect these data, different data collection methods were employed. Primary data were collected by using tools used including **household survey** (see plate--); **key informant interviews** and **focus group discussion** were employed to produce primary data. **Questionnaires** were prepared in both open ended and close ended forms and were distributed among 140 households living in and around the wetland.

A group of eight people including community leaders, the elderly, youth and women were randomly chosen to participate in each FGD. Three focus group discussions were conducted one from each kebele. In addition to primary data collection secondary data were collected from different sources. The data that were collected from secondary sources include related documents studies, wetland fragmentation and degradation level and other useful written materials needed for the study from internet sources study reports

- The purposes of using these secondary data were to identify the triggers and impacts of wetland fragmentation due to socio- economic factors and its impacts

Data analysis

- The collected data were analysed by using SPSS/STATA software; the analysed data were interpreted and presented by using tables, figures and percentages. While econometrics model like logit were used to analyse the determinants of wetland fragmentation whereas controlling and management mechanism of wetland degradation was analysed by content analysis or narration

Binary Logistic Regression Model

- Regression models in which the dependent variable is dichotomous can be estimated by logit or probit models. Logit and Probit models give guarantee for the estimated probabilities increases but never lie outside (0, 1) interval and the relationship between probability of event (Pi) and the explanatory variable (Xi) is nonlinear (Gujarati, 2004). Therefore, for this study Binary logit model is used to $Yi = xi\theta + ei$ where, $ei/xi \sim N\{0, \delta 2\}$……2

Willingness to engage in wetland fragmentation = 1 if yi > 0 ……0 if yi < 0

P (willingness to engage in wetland fragmentation e = 1/xi) = P {yi > 0/xi} = P (xiθ+ ei > 0/xi)

P (articipat) =〖 ln〗[〖Pi/(1-Pi)〗] = β0+ β1age+β2sexhh+c+B5educ+B6Fs+B7defot+B8AWA +B9erosion+B10settr+B11inst+B12pps+B12graz +εi.

Result &Discussion

The major causes/factors for wetland degradation and fragmentation

- Most of the interviewed respondents and the participants of the focused group discussion agree that wetlands in the area are being encroached over time by the local community and other investment activities.
- The major determinants of Mendifa wetland to degrade are farming activity along wetland, settlement expansion, overgrazing and deforestation (see figure 2 and plate). From these majority of respondents (93%) agree on farming activity along wetland were the major triggers of Mendifa wetland degradation.
- The results reveal that arable farming is one of the main practices by the indigenous communities living along these areas and which contributes to wetland degradation. Improper cultivation is rampant along the wetland due to inadequate knowledge on how to perform sustainable agriculture within the area; this therefore leads to wetland degradation and the next one is settlement expansion 86% of respondent was agree on this.

- Improper farming methods and poor tillage systems, which contribute towards the erosion of steep cultivated land and human settlement are amongst the most serious of problems in most parts of the country (Illegal settlement in conservation areas of the lakes); Farming along the wetland not only disturbs wetland shore ecology but also exacerbates siltation and increases the turbidity of the bank.

- As it was concluded by Dereje, (2008), inappropriate agricultural activities in the catchment and cultivation of buffering zones have adversely affected wetland ecosystems. It is clear that catchment degradation and cultivation of wetland buffering zones enhance the rate of soil erosion and aggravate the discharge of pesticides, herbicides, agricultural runoff and sediments into the wetland and thereby affects its ecological integrity and reduces the various services of wetlands.

- This problem also takes place in the wetlands of the study area for further agricultural expansion imposed by rapid population rate. Runoff from surrounding agricultural areas are moved and piled in to wetlands due to clearing of trees and vegetation by the local communities.

- As trees are cleared, the wetlands are prone to agricultural activities and diverted through digging some ditches to take the water from wetlands to other areas for further cultivation.

- The other problems of the wetlands pertaining to cultivation is double cropping and intermixed cropping which further degrade the ecology of these wetlands .
-

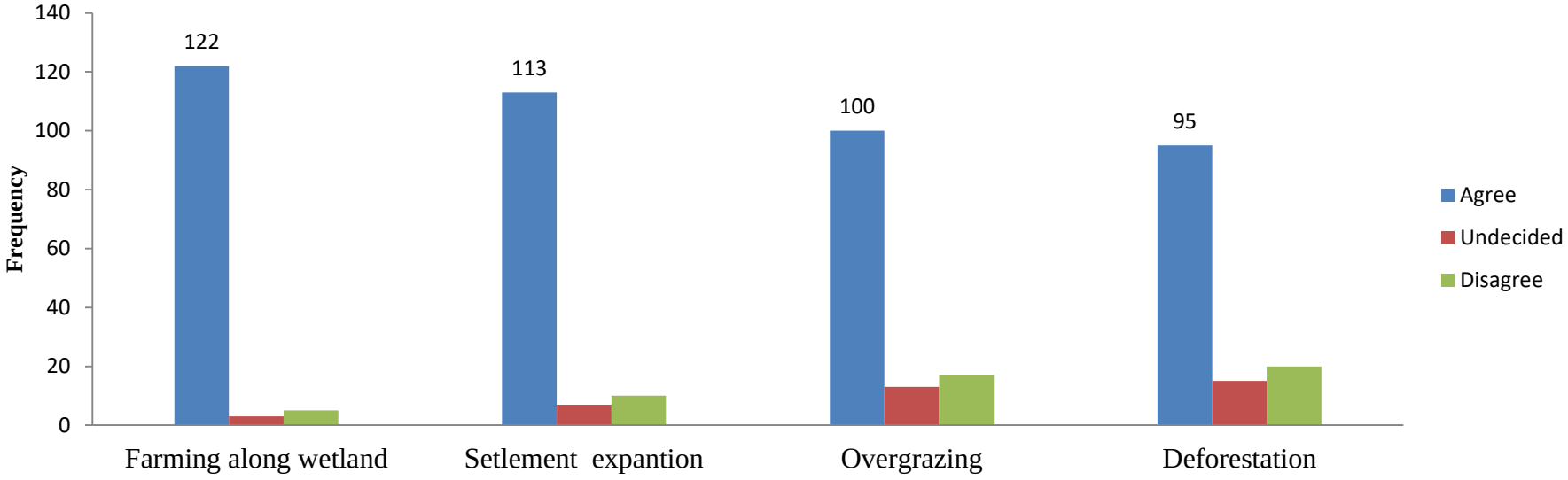
Continued

- The other major determinants are overgrazing and deforestation accounts (77% and 73%) respectively. The findings is also supported by those in a study conducted by Ngana et al. (2010) which reported that pastoralism is wide spread in Ruvu sub-basin due to large livestock migration that has been taking place over the years from various regions to Ruvu basin due to the availability of good pasture and water.

- Wetlands are presently faced serious ecological problems due to deleterious anthropogenic activities in the catchment. Clearing of forest, double cropping and use of fertilizers, herbicides and pesticides all contribute towards the damage of these indispensable ecosystems.

- As the respondents confirmed cultivation within the wetlands mostly during the dry season are common. This study inline with Dereje (2008), who reported that inappropriate agricultural activities in the catchment and cultivation of buffering zones have adversely, affected wetland ecosystems.

- It is clear that catchment degradation and cultivation of wetland buffering zones enhance the rate of soil erosion and aggravate the discharge of pesticides, herbicides, agricultural runoff and sediments into the wetland and thereby affects its ecological integrity and reduces the various services of wetlands.


140
120
100
80
60
40
20
0
Frequency
122
113
100
95
Agree
Undecided
Disagree
Farming along wetland
Setlement expantion
Overgrazing
Deforestation

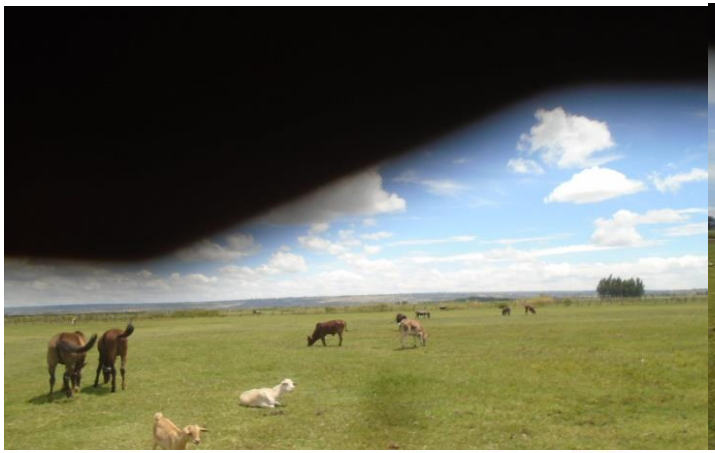


Table 5 Areas of wetlands fragmentation in ha during 1975s to recently

Year	Area (ha)	Percentage (%)	Remarks
1975	66,970	30	
1987	49825.68	25.6	
1992	37120.1	25.5	
2001	27283.3	26.5	
2010	25155.3	7.8	
2019	24274.57	3.5	

- Indirect determinants of Mendifa wetland degradation
- As figure below shows indirect drivers of the Mendifa wetland degradation. Most of the respondents (94%) agree that poor watershed management is the major indirect factors of Mendifa wetland degradation.

- The hydrological balance of the wetlands can be kept for long-term through proper management of watershed; however, due to lack of well-planned watershed management Mendifa wetland degradation.

- This is inline with Mekonnen and Yared (2018), who reported that due to lack of proper watershed managements, it is quite common to observe when the upstream users divert or excessively use the water and abuse the right of the downstream users, and this ultimately lead to the over exploitation or unwise use of the water resources within the watershed this causes wetland degradation.

- According to the respondents' views, population increase was also the major triggering factor for wetland loss in the study area it accounts (87%). The population growth and wetland loss of the study area have direct relationship.

- When population growth increased, wetland loss also increased. In this regard, Girmay (2003) stated that the Ethiopian highlands have experienced a serious LULC dynamics for the last hundred years due to continuously growing population.

- This study also approved that population pressure adversely degrade wetland resources and it is the means for other related factors. The number of population in the area was increased however, the agricultural area remains the same so that the community is forced to convert and clear wetlands to other land use forms/modifications in an unsustainable way.

- Similarly, Kameswara et al., (2011), on their study on southern part of Lake Tana basin (Gilgel Abay watershed) reported that, the population is growing rapidly and is over- utilizing the resources and brought the scarcity of land, deforestation, over use of lake's water and soil erosion from the catchment.

- So this could result in immediate effect on the livelihood of the community either through reduced agricultural productivity or through depleting wetland resources which can further result in high climatic variability in the area (IFAD, 2004)

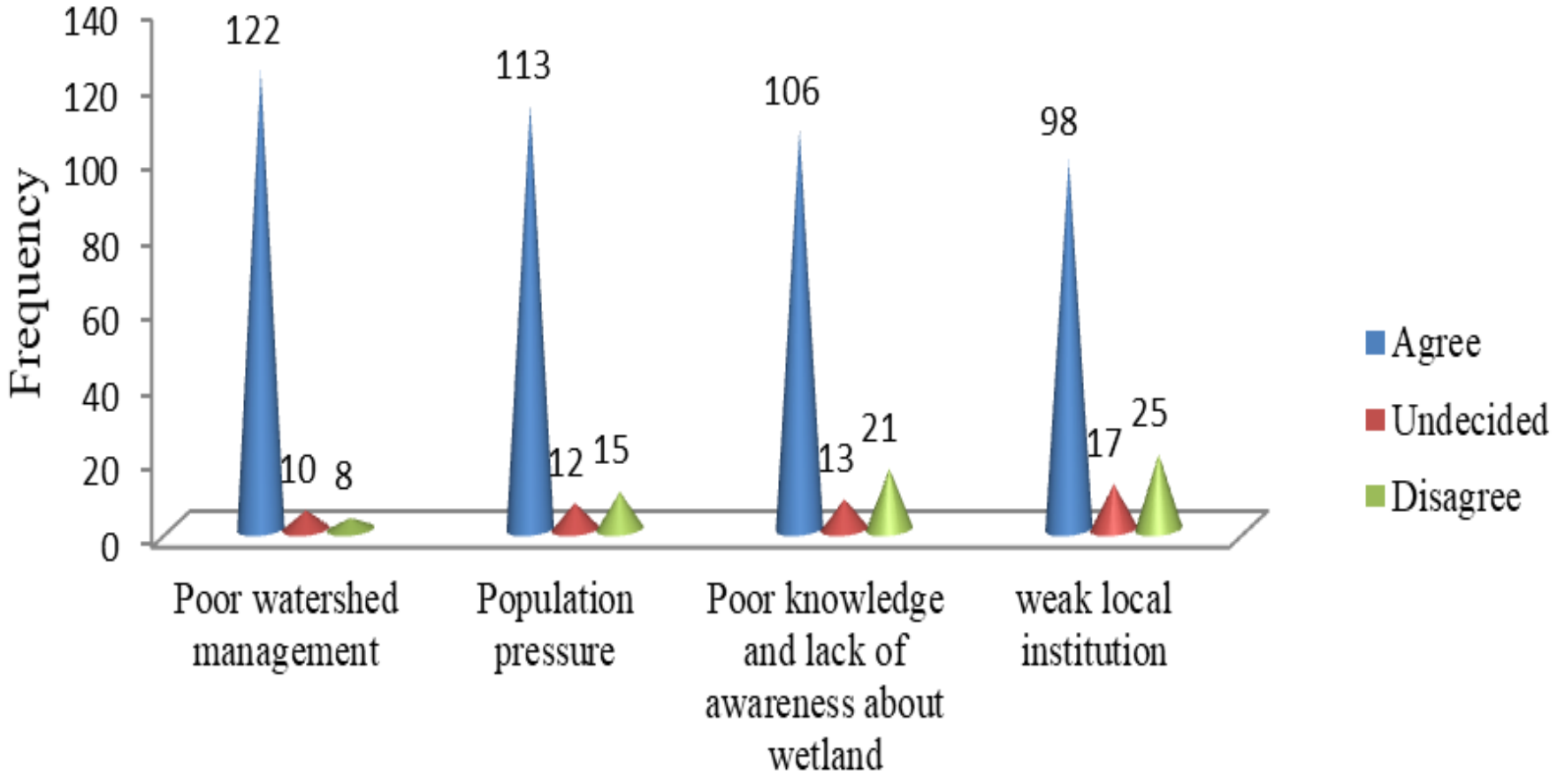
- On the other hand poor knowledge and lack of awareness about wetland and institutional factor are also indirect determinant of wetland degradation in the area it accounts (81% and 75 %) respectively.

- Majority of the societies in the study area are not well informed on the socio-economic benefits and ecosystem services of the wetlands and considered as waste lands.

- This is similar with Mafabi, (2000) one of the most prominent factors underlying wetland management problems in Kenya as observed elsewhere has been the lack of or insufficient awareness of the functions and benefits of wetlands leading to inappropriate use of their resources.

- This is also supported by a study by Finlayson et al. (1999) shows lack of adequate information and awareness on national inventories on wetland degradation that indicates the real extent and loss of wetlands as well as consequences of that degradation as the main reasons for persistent wetland degradation.

- Local communities, governmental and non-governmental organizations use wetlands in uncoordinated manner and this approach is affecting the vigor of wetlands and speeding up their degradation. The absence of an institution duly empowered to issue and implement wetland laws and coordinate management activities is the underlying determinant factors.



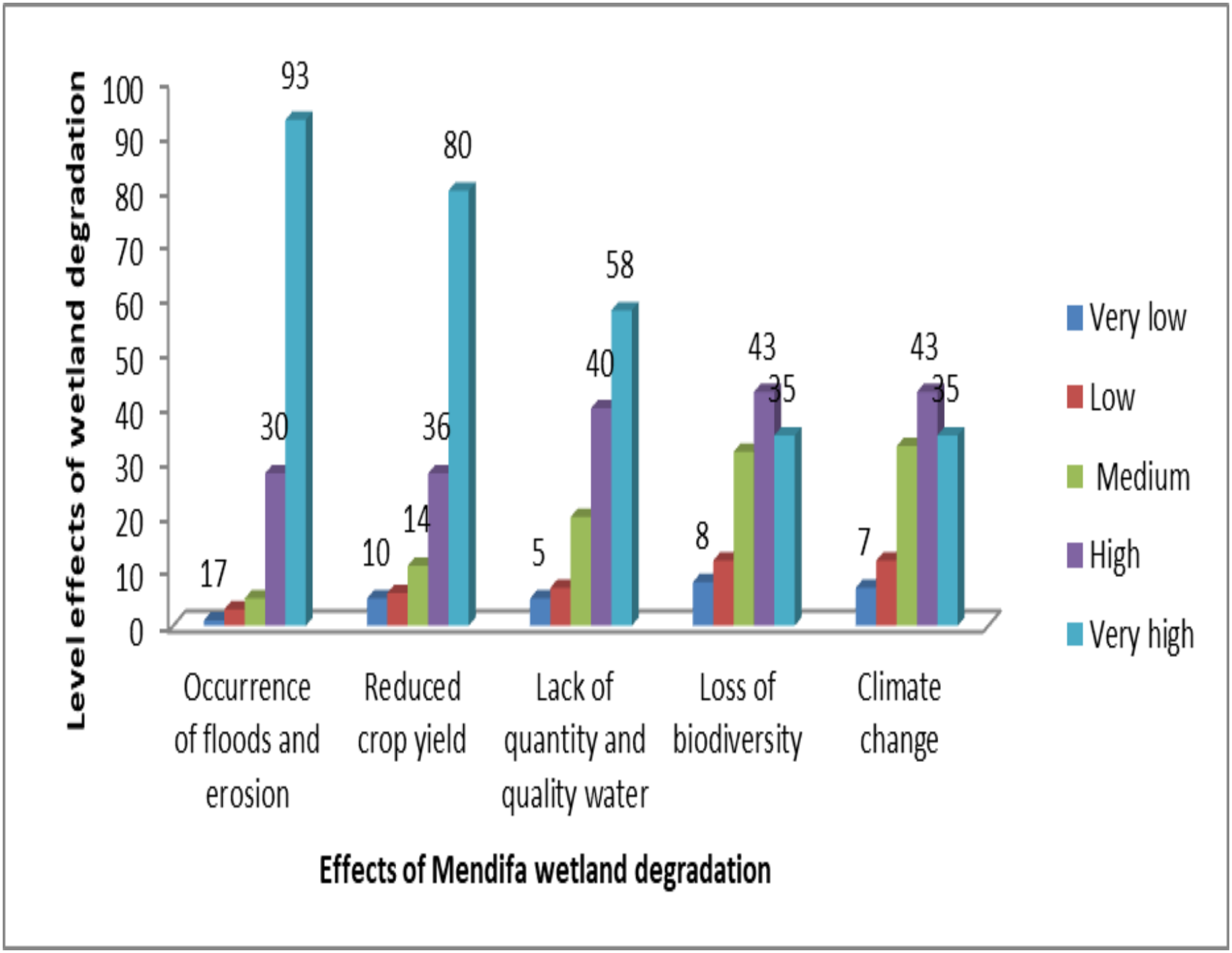
Indirect determinants the Mendifa wetland degradation

Effects of wetland degradation in the study area

- Figure-6 presents results on community perceptions towards effects of wetland degradation.

- As indicated in the Figure, majority of the respondents perceived that occurrence of flood and erosion, lack of water access, decreasing of crop yield, loss of biodiversity and climate change are the major impacts of wetland degradation in the study area. About (93%) of the respondents are said that impacts of wetland degradation in the study area are high to very high in resulting occurrence of flood and erosion. About 83% of respondent perceived that degradation of wetland is high to very high affecting crop yield.

- Wetlands also play an essential role in food security, especially during dry seasons or drought years, when dry land farming, which is limited to the rainfall season, cannot adequately provide for the needs of these households (URT, 2007). Similarly, Mekonnen et al. (2011) reported that wetland losses are affecting the rural food security, water availability, climatic variability, and biodiversity.


Level effects of wetland degradation
100
90
80
70
60
50
40
30
20
10
0
17
30
93
10
14
36
80
5
40
58
8
43
35
7
43
35
Occurrence of floods and erosion
Reduced crop yield
Lack of quantity and quality water
Loss of biodiversity
Climate change
Very low
Low
Medium
High
Very high
Effects of Mendifa wetland degradation

- About 75% respondents said that lacks of quantity and quality water are caused by degradation of wetland in the study area. Few of the respondents are informed that losses of biodiversity and climate change are also caused by wetland degradation. This is similar with Tesfau *et al.*, (2018), reported that the interviewed respondents are also fully aware about the changes that occurred in their local climate.
- The overall findings reveals that the local community believe that degradation of wetland has led to a decline in various services and products that wetland has been offering to them in the past and therefore posing a threat to their livelihood options.

- These findings are similar with the findings from a study by Wasswa *et al.* (2013) who reported that wetland degradation deprives societies of various services including income from agriculture, fish, and wildlife habitat, quality water, water quantity, and recreation benefits, as well as an increase of the cost for replacing wetland services.

- Further the findings are in line with the findings in a study by Zinhiva *et al*. (2014) who reported that degradation of the wetland significantly influences the dwindling of livelihood options which are available to the local households and worsens the plight of the rural poor since the inhabitants experience food insecurity, malnutrition, and water shortages and income loss mostly during the dry season

Estimating factors that affect wetland degradation and fragmentation in the study area

Table 7 Determinants of wetland fragmentation

Variables	Coef	St.er	P>Z	Marg. Eff
Edu	.0031599	.0044654	-0.480	-.003
Dis	-.0538374	.0102868	0.000***	-.053
TLU	.0025693	.003554	0.471	. 0025
Age	.001093	.0017667	0.537	.001
nf. E	-.0976202	.0514738	0.060*	-.097
Aware	-.0642315	.0832395	0.442	-.064
PP	.148053	.0618269	0.017**	.148
Graz	.1194532	.0458369	0.010**	.119
Defo	.169724	.069086	0.015 **	.169
Sett	.1423923	.0661636	0.03 **	.14
Arable	.000047	.047869	0.99	.0005
Errors	.0979479	.0980234	0.320	0 .10
Constant	.3587793	.1489918	0.017	

= Pr (predict) = 75 % R^2 = 85% Number of obs = 140

Note: ***, ** and * significant at 1%, 5% and 10% probability levels, respectively

Distance: As shown in the above distance away from the wetland was statically significant at **1%** probability level. The negative coefficient and significant effect of household distance from wetland indicates its negative influence on wetland fragmentation which was as expected. The marginal effect estimates shows, that keeping the influences of other factors constant, a one Km increase in the a distance of the household head reduces the probability of degrading wetland by 5.3%. This may be due to that the farther the village the household live on about they are getting far there and participation in fragmentation of wetland might not give additional satisfaction. Similar findings were; Sakuria *et al.*, 2015) whom noted a significant and negative relationship between The largest patches of tall arid brush were far away from villages and at low housing density, while patches were more isolated near towns. The patch size of calcareous tall grass steppe was larger close to villages but negatively related to housing density. Patches were more isolated near villages and isolation was positively related to housing density.

Status of institutional arrangements

Effectiveness of local informal institutional arrangements was statically significant at **10%** level. The marginal effect estimates shows, that keeping the influences of other factors constant in cases of where the local institutional arrangements, the effectiveness of institution **9.7%** time less than ineffective institutional arrangement. This means that the ineffectiveness of informal institutions accelerate wetland degradation by 9.7%. This is due to that the institutional arrangement effectiveness in the study area never restricts illegal activities and allows things that are forbidden in fragmenting of wetland resource. This study is contradicts with (Badal*et al*., 2006) who noted a significant and positive relationship between availability and effectiveness of local institutional arrangement of household and the probability of fragmentation on conservation of wetland but it is in line with a study done by study done by **(Hirpo, 2018)** which states that Decision makers at higher levels are required to strengthen sustainable wetland management efforts through effecting policy and legislation, improving institutional arrangements and supporting capacity building initiative.

- **Popn.:** population pressure was statically significant at 5% level. The marginal effect shows that, holding other variables constant; increase in population number (household number) by one person increases wetland fragmentation by 15%. This study is in line with a study done by (Kangalawe and Liwenga, 2005) at Kilombero wetland is one of the wetlands which have been characterized by increased population pressure, high livestock population and increased demand for land resources As the size of the population grows, people are compelled to clear land for agricultural activities to ensure their survival in conditions where alternative means of existence.
- **Deforestation:** Deforestation was statically significant at 5% level. The marginal effect shows that, holding other variables constant; people who didn't perceive the existence of increase in deforestation (**cutting tree**) within the community were 17% times more likely to contribute wetland fragmentation than those who perceive the existence of increase in level of deforestation. This study is in line with study conducted by study done by (Msofe ***etal.***, 2015) implies that when most of the household need to produce more food to sustain their families, consequently results into agriculture expansion into marginal areas, agriculture intensification and deforestation.
- **Settlement:** Settlement was statically significant at 5% level. The marginal effect shows that, holding other variables constant; people who didn't perceive the negative impact of increase in settlement within the community were 15% times more likely to contribute wetland fragmentation than those who perceived the negative impact of increase in settlement. This study is similar with **Study** done by (Derso et al., 2015; Gebretsadik Mereke, 2017). On lake tana and an attempt to convert to farmlands (Settlement) are causing sever deterioration to wetlands and their surroundings in Ethiopia with study conducted by (RuiFeng ZHAO ***et al.,*** 2021).
- **Grazing:** Grazing was statically significant at 5% level; the marginal effect shows that, holding other variables constant; people who didn't perceive the negative effect of increase in grazing on wetland were 12% times more likely to contribute for wetland fragmentation than those who perceive the negative impact of increase in grazing. This study is consistent with study conducted by; T H. Yu et al. B. Kong and H. Yu, 2015) whom developed an estimation model of freeze-thaw erosion and applied it to the Silingco Watershed

Conclusion

- Ethiopia is endowed with a significant number of wetlands, which could contribute to the social, economic and ecological development of the country. However, large shares of these wetlands are under threat due to an immense pressure from anthropogenic as well as natural factors, though the anthropogenic factors contribute a lot.
- The study also shows that local communities in the study area has higher awareness on the direct values of wetland but low awareness on the indirect values of wetland since majority of them ranked most the direct values of wetland.
- Majority of the respondents reported that farming along the wetland and water for domestic use are the most significant values they obtain over years from using wetland while very few respondents mentioned the indirect values that wetland provides to them. This study found the major determinants of Mendifa wetland degradation which includes improper agricultural activities, settlement expansion, overgrazing, deforestation and sand extraction. Through these improper agricultural activities and settlement expansion are the major drivers of wetland degradation in the study area.

- In addition, the survey result shows that there are indirect determinants of Mendifa wetland fragmentation /degradation which includes poor watershed management, population pressure, poor knowledge and lack of awareness about wetland and weak local institution. Due to these, most of the communities are not interested to conserve this fragile resource. As a result of these occurrence of flood and erosion, lack of water access, decreasing of crop yield, loss of biodiversity and climate change are the major impacts of wetland degradation in the study area. Deforestation, population pressure, institutional failure, overgrazing, settlement expansion as a result of increase in the need/demand for agricultural land are the factors that accelerate wetland fragmentation . In spite of the complexity and multifaceted nature of the problems, however, there is no quick and one-off solution to redress the threats being faced to Mendifa wetland.

THANK YOU FOR YOUR ATENTION!!!