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RESEARCH ARTICLE

Impacts of agricultural land expansion on vegetation cover in Tanqua Abergele Woreda, Northern Ethiopia

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ABSTRACT

The main objective of this study was to assess the causes of Agricultural land expansion and its impacts on vegetation cover in Tanqua Abergele Woreda, in Tigray, northern Ethiopia. Both primary and secondary data were used in this study. The primary data was collected from the households of Limat, Sheka-Tekli and Selam Kebeles using a questionnaire, interview, field observation and Focus group discussion methods. Secondary data was collected from the Woreda agricultural and rural development office published and unpublished reports. After collecting all the necessary information, data analysis was carried out. Descriptive data analysis, table, bar graph, chart, and inferential statistical techniques such as correlation, regression, chi-square, and paired sample t-test have been used. The result shows a strong positive correlation between the agricultural expansion and the number of population, which was statistically significant (r= 0.919, n = 10 years, P < 0.000) and 85% of the variance in population size was influenced for actual agricultural expansion is due to change in population size (r2 = 0.85). This shows that the farmers and their demand for farmland followed by farmland expansion has adversely affected the land resulting in land degradation in the study area. Similarly, a positive weak correlation between hectare covered by crop and harvesting time was obtained (r = 0.26, n = 135, p < 0.002). It was a statistically significant association between before and after water availability in m3 ((t = 1.83), r-0 .914, df = 9, p< 0.05)), it was a strong positive correlation between the agricultural expansion per hectare and the rate of deforestation, which was statistically significant, based on r is 0.817 in the last 10 years and at a significant level of 0.004. The major impacts of farmland expansion include education in agriculture plot size, loss of fertility, crop land-use change in bare land, and soil degradation. Therefore, the researcher can put a recommendation on land use and land cover will free that the households from the negative impacts of agricultural land expansion on vegetation cover.

Key words: Agricultural land expansion; vegetation cover; land degradation

1) INTRODUCTION

Vegetation cover is contributing in many ways to a wealth of products and services that may be used to improve the well-being of populations of countries [1].

Forestry, besides its direct contribution to the national economy through wood and non-wood products, it contributes significantly to various sectors of the national economy such as energy, agriculture, food, industry, health, environment, tourism and the like. In general, the economic contributions of forestry at national scale can be seen from various angles such as employment generation, earning of foreign currency through export, savings through import substitutions as well as the indirect contribution through support to another sectors of the economy, particularly agriculture [2].

The steadily growing population pressure and agricultural expansion in Ethiopia will inevitably increase the forest resources utilization (construction and fuel wood), and hence, different forms of unsustainable forest utilization

will take place (fires, encroachment, logging, cultivation, urbanization) in coming decades ultimately leading to the total forest depletion. Based on the most recent estimates of the rates of deforestation, and assuming that 75 per cent of forest losses are attributable to agricultural expansion, it is estimated that over the next 25 years the agriculture sector will require an additional 250 to 300 million hectares of new land to accommodate the demands of commercial farming, subsistence cropping, pasture and range development. Most of this increase in land area will come at the expense of forests lands [3].

The total forests area in the world estimated at 3, 952 billion ha and 29 percent of the land surface was under forest cover. Presently, however, it is only a fifth of this original remains undisturbed [4]. It is estimated that in Ethiopia, 40 percent of the country was covered with

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forests at the beginning of the 19th century [5]. According to Betru [6] only 2.7 percent of Ethiopia's land mass was covered by forest, with a loss of 150,000 to 200,000 hectare of natural forest per annum. One of the problems regarding forest cover in Ethiopia is lack of reliable and accurate information. According Young et.al., [7] the country's forests cover in 1989was 12.9 percent. A decade later, in 1997, the forests cover was estimated to be only 4.2 percent [7]. The estimates of the rate of deforestation have also been variable. For example, the annual rate of deforestation estimated by Betru [6] ranged between 150,000 and 200,000 hectares per annum.

However, Young et.al., [7] reported a much lower estimate of about 40,000 hectares per annum. This is probably due to lack of consistent definition of what "forest" represents in the different studies and the lack of first-hand information for generating these estimates. From aerial photo interpretation of forest cover changes, it is remarkable to note the difference between the past and the present forest cover in Ethiopia. According to FAO, Ethiopian forest cover information is 11.2% or about 12,296,000 ha are forested. Of this 4.2% (511,000 ha) is classified as primary forest. Ethiopia had 511,000 ha of planted forest. Ethiopia lost an average of 140,900 ha or 0.93% per year between 1990 and 2010. In total, between 1990 and 2010, Ethiopia lost 18.6% of its forest cover or around 2,818,000 ha.

Tanqua Abergele Woreda is one of the Woredas in Tigray region which is highly affected by agricultural expansion. Thus, this study was needed to assess the extent and causes of agricultural land expansion and its impacts on vegetation cover in Tanqua Abergele Woreda.

Objectives of the Study:

General Objective: The general objective of the study was to assess the impacts of Agricultural land expansion on vegetation cover in Tanqua Abergele Woreda.

Specific objective: The specific objectives of the study:
- To quantify the extent of agricultural land expansion in the study area.
- To identify the major causes of the existing Agricultural land expansion in study area.
- To analyze the major impacts of Agricultural land expansion on vegatation coverin study area.

2) MATERIALS AND METHODS

The study area (Fig 1) is located in the Central Zone of Tigray Regional State, Ethiopia. The study Woreda is about 120 km far away from Mekelle, the regional capital city of Tigray. Tanqua-Abergele Woreda is bordered on the south and west by the Amhara region, then by the Tekeze River on the west which separate from Amhara region and the North West zone, in the north by Kola Temben, on the east by Degua Temben and on the southeast by south eastern zone. It is situated at 13 ° 14' 06" N latitude and 38° 58' 50" E longitude.

Figure 1: Location map of the study area
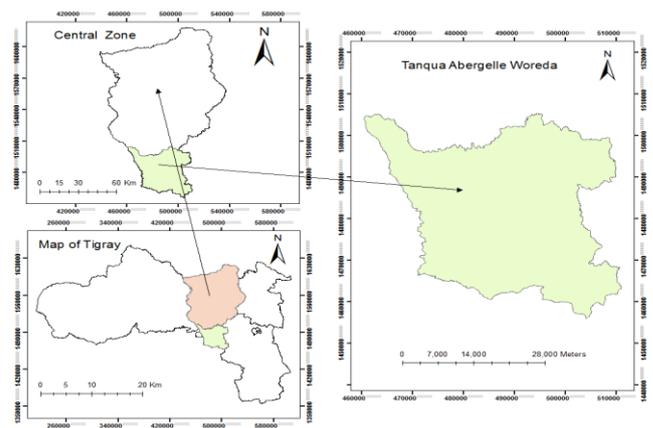
Source of data

As far as the source of data for this study is concerned both quantitative and qualitative data was collected from both primary and secondary sources by using the different techniques of data collection.

- **Primary Sources**

Firsthand data were obtained by designed questionnaire. The questionnaires were completed by the farmer household respondents. Besides, interviews were also made with selected respondents and the DAs experts who head the agricultural office of the study area and also FGD was employed for two groups discussion that have something in common to gather information from DAs and cluster coordinators of agrarian about the impact of agricultural expansion on vegetation cover in Tanqua-Abergele Woreda.

- **Secondary Sources**

The secondary data was collected from an intensive desk review of literature, published and unpublished document reports, internet service on the impacts of agricultural land expansion on vegetation cover which have relevant to this specific research project.

Research Design

A research design provides answer to question; it is a plan or blue print on how the researcher intends to conduct the research. In order to conduct this study, descriptive research type was employed since such type of study is aimed at describing the nature and status of particular issue by making in depth investigation through collection of every necessary data about the subject matter under study. In this study cross-sectional research design was applied to gather data about the impacts of agricultural land expansion on vegetation cover in Tanqua-Abergele Woreda because data were collected at a time.

Sample Size and Sampling Technique

Both probability and non-probability sampling techniques was used to select the sample population. A probability stratified random sampling was used to get information from different kebeles of Tanqua-Abergele Woreda. This technique was preferred because it is helpful in minimizing bias when dealing with the population and due to the heterogeneity of farmlands in each kebeles of the study area. With this technique, the sampling frame was organized into relatively homogeneous strata then the researcher uses simple random sampling technique to

select respondents for the sample with respect to quota size. This step allows a fair representation of the various types of household size of the study area. The researcher was selected the sample size based on a list of the farmer households formally registered in municipality of Tanqua-Abergele Woreda. And the sample size that was selected here is considered as representative of total households. Non-probability sampling technique is helpful to select the study area from the total kebeles of Tanqua-Abergele Woreda because the selected areas are more arable land than the other kebeles based on the statistical data of Tanqua-Abergele Woreda and the DAs will select in terms of purposive sampling.

The researcher was employ the following sample size determination formula developed by Kothari [8], assuming 95% confidence level and e = 0.5.

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{Nz^2PQ}{E^2(N-1) + z^2PQ}$$

$$n = \frac{5345(1.96)^2(0.9)(0.1)}{(0.05)^2(5345-1) + (1.96)^2(0.9)(0.1)}$$

$$n = 135$$

n- Sample

N - Household unit variables

P- Expected prevalence or proportion (in proportion of one; 10%)

Q - (1-P)

E – Allowable error 0.05 significance

Z – Standardize normal variable and valued that corresponds to 95% degree of confidence, which is conventional, Z value is 1.96.

The 135 household respondents were selected from the total households using simple random sampling technique and proportional from the selected kebeles. Therefore, 135 households are the sample unit or sample size of the study, because the problem is common throughout the study area.

Table 1: Sample size taken proportional allocation from each kebeles.

S. No.	Kebeles	Households size in each kebeles	Sample taken or proportional allocation $(ni = \frac{n}{N} * Ni)$
1	Limat	2000	51
2	Sheka-Tekli	1560	39
3	Selam	1785	45
Total		5345	135

Data collection instrument

The data was collected from farmer who are occupying in the study area and the document which is finding in agricultural office of north Tanqua-Abergele Woreda in the various mechanisms, interview, questionnaire, field observation and FGD.

Interview - under this data collection was apply using face to face communication the researcher and interview in order to obtain a correct data.

The researcher was used direct content interview with the DA respondents in order to correct information and fist and information the researcher was interviewer agricultural.

Questionnaire - The researcher was developed questionnaire to collect data from the farmer household respondents about the impacts of agricultural land expansion on vegetation cover. The researcher was used both close ended and open ended questionnaires and The questionnaire was design both in English and Tigrigna languages to all respondents to create proper rapport and gain better responses from those who cannot clearly understand the English language.

Field observation: was also made by the researcher to collect full information about the research problem as a participant in the study area and it is helpful to identify the major impacts of agricultural land expansion on vegetation cover.

Focus group discussion: The researcher was employed by two groups discussion that have something in common to gather information that have combined perspectives(opinions) and in depth interview between selected individuals (key informants) on a particular topic by choosing the experts and cluster coordinators of agrarian and DAs purposely to participate in detail on the study.

Methods of Data Analysis

Both qualitative and quantitative approaches were used to analyze the collected primary and secondary data. Quantitative approach like the inferential analysis or statistical techniques, such as regression and correlation were employed to evaluate trend of agricultural productivity by association between causes and impacts of agricultural land expansion. Besides, paired t-test was applied to evaluate before and after agricultural land expansion on vegetation covered in the study area, chi-square(x^2) was employed to evaluate the association between variables and NDVI was employed to show the link between agricultural land expansion and vegetation cover by the help of remote sensing.

Qualitative approach is a comfortable method to describe the state of affairs as it exists at present. Specifically, descriptive statistics (mean, median, standard deviation and pie charts, bar graphs) was used to describe mechanisms to control the effects of Agricultural land expansion on vegetation cover. Statistical package for Social Science (SPSS) version 20 was employed to analyze the data.

3) RESULTS AND DISCUSSION

Agricultural land expansion in the study area

In the study, 100% of the household respondents replied that the trend of the agricultural land expansion is increasing from time to time.

The mean of after agricultural land expansion was 711.50 and standard deviation of after agricultural land expansion was 371.91. Since, it was statistical significantly associated between before and after water availability in m3 ((t= 1.83), r- .914, degree of freedom was 9, p< 0.05)), .000 less than .05. That implies that there was sufficient evidence to conclude that the agricultural land expansion in hectare of before and after was different.

Causes of agricultural land expansion
As it is displayed in the Table 2, 25.20% of the household respondents had practiced intensive of raring animals, 27.40% of the household respondents had practiced intensive of cropping, 16.30 % of the household respondents had practiced Charcoal production,11.10% of the household respondents had practiced climate change such as increasing of temperatures and decreasing rainfall, 10.40% of the household respondents had practiced Misusing of plough system and 9.60% of the household respondents had practiced increasing of fuel woods were the causes of decreasing of vegetation cover or deforestation.

Table 2: Causes of agricultural land expansion on vegetation cover of households respondent

Variables	Frequency	Percent
Intensive of cropping	37	27.4
Intensive of raring animals	34	25.2
Misusing of plough system	14	10.4
Increasing of fuel woods	13	9.6
Charcoal production	22	16.3
Climate (temperature and rainfall)	15	11.1
Total	135	100.0

Impacts of agriculture expansion on vegetation cover in study area
Table 3 shows that 30.40% of the respondents were crop land use change in to bare land, 29.60% of the respondents were Loss of fertility, 27.40% of the household respondents were Soil degradation and 12.60% of the household respondents on the impacts of agriculture expansion on vegetation cover in study area. Thus, the researcher conclude that the impacts of agriculture expansion on vegetation in the study area throughout deforestation, Reduction in agriculture plot and Soil degradation.

Table 3: Impacts of agriculture expansion on vegetation cover in Tanqua-Abergele Woreda

Variables	Frequency	Percent
Reduction in agriculture plot	17	12.6
Loss of fertility	40	29.6
crop land use change into bare land	41	30.4
Soil degradation	37	27.4
Total	135	100.0

4) CONCLUSION

Agricultural productivity of satisfactory amount and adequate quality is one of the essential needs of human being, stile know the availability of agricultural expansion in Tanqua Abergele Woreda is inefficient. The condition is deteriorating because of the population growth and spatial extension of agriculture which distributed its capacity to supply adequate agricultural expansion for its inhabitants. The investigation was used both primary and secondary sources of data collation. Primary data was obtained from questionnaire, field observation and interview. Secondary data was gathered from published and unpublished documents, journals, reports, and web about the subject. The analyst was used both subjective and quantitative methodologies was used to analyze the gathered primary and secondary data.

The current sources of agricultural productivities are both rain fed and irrigational activities which is address to the community through commercial and direct marketing among the seller and buyers. In any case, since the sources diminish in amount, in addition to the above reasons the degree of rainfall is low, that is way the availability of agricultural productivity is not sufficient.

The major causes of agricultural expansion are Intensive of cropping, Intensive of raring animals, misusing of plough system, increasing of fuel woods and Charcoal production. Subsequently, strong positive correlation between agricultural expansions with number of population and strong correlation between agricultural expansion and deforestation ration in the study area. The major impacts of agricultural expansion are reduction in agriculture plot, loss of fertility, crop land use change into bare land and soil degradation in Tanqua Abergele Woreda like maize, Teff and sorghum crop types are more affected by deforestation. The impacts of deforestation in this study were decline crop production, decrease income source, decrease number of domestic animals, increase the cost of fuel wood and increase likelihood of flood. The researcher concludes this paper by the possible means of rehabilitation of vegetation cover such as, planting of trees and soil and water conservation in the study area.

Recommendations
Based on the major finding of the study, the researcher provided useful suggestions were recommended. Awareness about the extreme urgency of natural resource conservation should be increase both among DAs and the farmers, the people as a whole.

- The existing crop lands are being used intensively, steeper slopes and marginal lands are cultivated due to the increasing demand for crop lands to feed the rapidly growth population. Hence the present rapid rate population growth should be using wisely the agricultural productivities in order to minimizing the impacts of agricultural expansion on vegetation cover.
- Incentives such as training and motivation should be given so that the farmers may be encouraged to improve and protect their land from deforestation after all from erosion.
- Local government should give high attention to natural resource conservation as well as agricultural production by providing training on the field, financial supports and public participation should also be increased.

- Water and soil conservation strategies should be done particularly via the construction of soil and stone bands mountains and construction of check dams point on a gulley's of land and water management knowledge by skillful means, with the goal of protecting soil resource from exploitation, destruction arable lands.
- The development agents give attention the advantage or the important of the reforestation and afforestation towards or in order to reduce the impact of agricultural expansion on vegetation cover.
- Other measures, apart from agricultural productivities should be created by which peasants can earn their livelihood so that the pressure on land may be reduced.

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