Natural Resources Limitations and Potentials in Amhara Regional State: The Case of Lay Gayint Woreda

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Abstract

A survey was conducted in Lay Gayint Woreda, South Gonder Zone of the Amhara Regional State in 1999 to investigate the natural resources base of the area for agricultural development intervention. The survey method used was Participatory Rural Appraisal (PRA) technique. Results of the survey revealed that the area is highly degraded due to severe water erosion, deforestation, continues cultivation and improper farming practices. Drought is regarded as the leading yield-limiting factor. It prevails quite frequently and in some seasons, farmers remain with out crop harvest. The unreliable and erratic rainfall usually accompanied by hail also makes agricultural production a difficult exercise. Very limited surface and underground water is available. Most of the rivers are located in deep gorges and are difficult to be used for irrigation. Natural forests are extinct in the area. Only some remnant traces of natural trees are available on farmlands, on communal grazing lots and riverbanks. From the survey result, it is possible to conclude that Lay Gayint woreda is highly degraded, infertile, overpopulated and drought prone. Therefore, the following recommendations could help to alleviate the problem: practicing physical and biological soil conservation practices on sloppy lands and on active gullies; practicing alley cropping systems on hilly farmlands; area closure of highly degraded lands for rehabilitation; practicing in-situ and ex-situ moisture conservation practices; exploiting available underground and river water; encouraging farmers to use organic and inorganic fertilizers; introducing pulse crops in crop rotation systems; and finally voluntary resettlement of the population to areas with less population, fertile soil and having reliable rainfall.

Key words: Drought, deforestation, erratic rainfall, soil erosion, soil fertility depletion

Introduction

The Amhara National Regional State has 105 woredas, of which 49 woredas are regarded to be drought prone. About 2.5 million people living in these woredas are food insecure or require food aid at least some time in the year.

This number accounts for about 17.3% of the region's population (Akalu Teshome et al, 2000).

According to the first five years development plan of the Amhara National Regional State, top priority was given to the agriculture sector mainly to ensure food security at the household level. However, the effort was not successful in drought prone areas. It is mainly attributed to lack of appropriate agricultural production technologies. Moreover, previous agricultural research efforts focused on high potential areas. Although the agricultural production constraints in drought prone areas are numerous and interwoven with each other, it did not received research patronage and even the problems were not identified and prioritized in a systematic manner. Hence, previous development efforts in drought prone areas did not give the desired results.

Recently, awareness among researchers in the region have grown that with out understanding the natural resources base and the farming systems of the Woreda, it is impossible to think about any research activity or to device any agricultural development intervention. To this effect, a survey was conducted to assess the natural resources base and the farming systems of the woreda to identify the problems and recommend some research, development and policy interventions. In this paper, result of the survey on natural resources potentials and limitations of Lay Gayint woreda is presented. The results and suggestions presented in this paper could be valid to similar degraded and drought prone woredas of the Amhara Regional State.

Materials and Methods

The Study Area

Lay Gayint Woreda is located in South Gondar Administrative Zone of the Amhara National Regional State. It borders with Estie and Farta Woredas in NorthWest, Ebinat and Meket Woredas in the North, Simada and Tach Gayint Woredas in the South and Tach Gayint and Meket Woredas in the East (Fig 1).

The total area of the Woreda is 132, 031 hectare (Woreda Office of Agriculture, 1991 E.C). The altitude of the Woreda ranges from 1300-3500 meters above sea with varied toposequence across the height, which extends from Tekezie basin to Guna peak. Nefas Mewicha is capital of the Woreda. It is located 175 and 75 kms away from Bahir Dar and Debre Tabor towns, respectively. The approximate global position for the capital of the woreda is 11.77^0N and 38.5^0E (Intergovernmental Authority on Drought and Development (IGADD) et. al, 2000). The population of the Woreda is estimated to be 200,951. Of this, 91.8% are living in rural areas (Woreda Office of Agriculture, 1991 E.C).

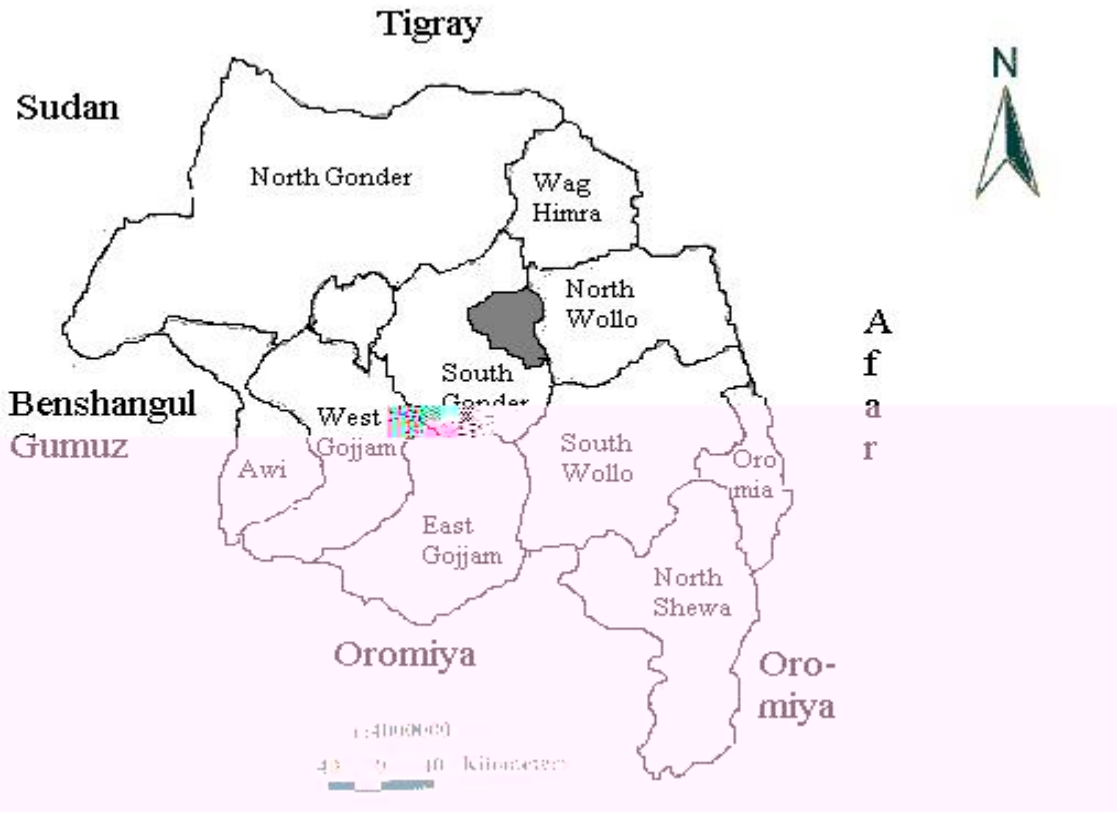

Figure 1. Approximate location of Lay Gayint Woreda (shaded) in the Amhara Regional State (ANRS)

Based on altitude, the Woreda can be divided in to four major climatic zones. These are low land (Kola), intermediate (Woina Dega), high land (Dega) and extremely high land (Wurch). Kola, Dega and Wurch, and Woina Dega contribute 28%, 41% and 31% of the total area of the Woreda, respectively. With regard to topographical distribution, about 70% of the Woreda is rugged terrain, 15% is mountainous, 10% is flat land, and the remaining 5% is valley (Woreda Office of Agriculture, 1991 E.C). The most rugged topography is found in the Kolla and Woina Dega areas while relatively plain topography is found in the Dega and Wurch areas. Although much of the land is rugged and unsuitable for cultivation, farmers continued to cultivate it for the last several years. Therefore, the topsoil of most lands is washed away by water erosion and land sliding.

According to the Woreda Office of Agriculture, the average annual rainfall ranges from 600-1100 mm and the average minimum and maximum temperature is 9 and 19^0c, respectively. The effective rainy season extends from mid June to first week of September. If the rainy season starts in March, farmers grow potato and barley in woina dega and dega areas, and sorghum in kolla and Woina Dega. Belg rainfall is crucial to overcome seasonal food shortage. According to farmers' report, if rainfall fails to happen in March and May, farmers encounter serious food shortage. The rain shower from September to October is also crucial to grow residual moisture crops such as chickpea, grass pea and barley. However, the rainfall is erratic in distribution and the amount and duration is not dependable for crop production. Late onset, uneven distribution and early cessation are some of its features. The climate varies from year to year and favors pest and disease development.

Survey Methodology

The survey was conducted in a sequential fashion using the following steps: secondary data collection and analysis, representative site selection, participatory rural appraisal (PRA) and individual and group interviews on general themes.

Collection of secondary data was carried out by reviewing several reports and interviews of representatives of the Woreda Office of Agriculture, Woreda Administrative Council, Woreda Cooperative Office and non-gove-

rnmental organizations (NGOs). After analyzing the secondary data, the previously designed checklists of the participatory rural appraisal was readjusted by incorporating new findings.
To study the agroecology and physical characteristics of the area and select a representative site for each ageoecological zone, transect drive was made together with representatives of the Woreda Office of Agriculture. Based on this, Kola, Woina Dega, Dega and Wurch climatic zones were identified in the Woreda. Two representative peasant associations (PAs) from each Dega and Woina Dega and one PA from each Wurch and Kola climatic zones were selected. Transect walk was made from the highest to the lower point of the village. Along the route, observation on soil types, existing vegetation cover, settlement, crops grown and other relevant information were gathered.

Problem identification and prioritization were made in each climatic zone by using pair-wise ranking. Farmers identified and prioritized their problems logically and systematically with out external interference.

Participatory rural appraisal (PRA) technique was used to collect and analyze primary data. This method gave a chance for the community members to participate in problem identification and prioritization. After PRA technique, small groups were formed and thorough discussion was made which helped to generate basic data and cross-check the available information.

Results and Discussion

Soil and Water Degradation

Kola Domain

The kola domain is the leading one in the intensity of erosion among all the four domains studied (kola, woina dega, dega and wurch). About 95% of the area are vulnerable to erosion. Farmers speculate the following causes of erosion in the area:
1) Deforestation: The area is highly deprived of vegetation cover and this situation generally exposed the area to serious water erosion.
2) Topography: Steep slopes and ruggedness of the topography accelerates speed of run-off collected from the uphill.

3) High and erratic rainfall: Heavy and erratic rain, which is usually coming after the land is tilled, causes the soil surface to be eroded. This situation besides eroding lands on the uphill causes heavy siltation on the bottomlands and makes production a difficult exercise.
4) Population pressure: Average family size is nine people and a household has two "Timad" of land (1 Timad =50x25m). The high number of human population per unit area brought about continues cultivation and eventually loosening of the soil surface. Moreover, hilly areas are always intensively grazed by animals and the grass cover is totally absent. Therefore, the area is vulnerable to erosion.

Some activities are being undertaken by the government and non-governmental organizations like CPAR, FHI and GTZ to conserve soil and moisture in the area. The soil and water conservation practices focus on constructing physical conservation structures like stone and soil bunds, cut-off drains, check dams on gullies and waterway ditches. Only some "Imbacho" and "Ret" plants are seen on the bunds. The effort on conservation using physical structures is encouraging. This intervention was started after much of the topsoil was washed away in many instances, which suggests that biological conservation activities should be integrated with the physical ones to rehabilitate the soil fertility of the area. This will assist in supplying the farmer with organic fertilizer (which will restore the soil fertility status), fuel to the family and feed to his animals.

Woina Dega Domain

The woina dega area is less degraded than the kola area but more degraded than the dega and wurch. In this domain, soil degradation is regarded as major production constraint next to drought. About 90% of the area is exposed to erosion. Causes of soil degradation in this area remain to be the same as that of the kola area. However, two more causes are added here. The first one is, drainage ditches opened during road construction are dissecting farm lands and cause serious gully formation. The other one is land sliding, which in some cases is taking away the entire village, is reported to be serious treat to the farmers of the area. As soil and water conservation methods, soil and stone bunds, check dams, cut-off drains, drainage ditches and planting grass stripes like vetivar grass are practiced in the area.

Dega Domain

Soil erosion in the dega area is less severe than the Kola, Woina dega and the Wurch areas. It is mainly because there are more flat lands in this domain which minimize the intensity of erosion. In kebele 4 for example, 75% of the land is flat or has gentle slope, 23% is sloppy and 2% is stony. Moreover, the relatively intensified livestock husbandry in the area paved the way for leaving more grass covered grazing lands. Nevertheless, about 75% of the total land area are still exposed to erosion. Among soil conservation methods, stone and soil bunds, fanyaa juu, cut-off drain, check dams and biological soil conservation methods like planting vetch and tree lucern are practiced.

Wurch Domain

The wurch area is the starting point for most of the rivers. Therefore, there is always downward movement of soil and water resources from this area. This eventually caused serious degradation of land. The topography is unique in that there is no flat land surface and about 85% of the area are exposed to erosion. Some soil conservation structures such as stone bunds are available. Farmers reported that, soil bunds are not effective in this area. Because, the topography is very steep and such structures cannot withstand the runoff coming down with very high velocity.

Soils and Soil Fertility

Kola Domain

Soils in the kola area can be classified into three major groups:

1) "Walka" soils. These are heavy black soils (Vertisols) distributed in the valleys, near rivers and springs. On such soils farmers grow tef and chickpea. These soils are regarded as the most productive soils of the area.

2) "Serbola" soils. These soils are a mixture of red and black soils (Cambisols). These are situated in the middle of the hillsides. On this soil types major crops grown are wheat, faba bean and field pea. These soils are regarded to be second after walka soils in their fertility status.

3) "Keyatie" soils. These soils are loam red soils (Luvisols) found on the top of the sloppy catchments. On such soils lentil and linseed are cultivated. They are identified as the least fertile soils of the area.

Soil fertility problem is a serious problem, which attributed for low crop

productivity in the area. Some times, even rock fragments that do not satisfy the criteria to be called "a soil" are being cultivated. Major causes for poor soil fertility status of the Kola area of Lay Gayint Woreda are: physical erosion of the top fertile soil, continues cultivation of the same land with out fallowing, high mineralization rate of organic material (which is related to high temperature), mono cropping, and overgrazing (which causes low nutrient return).

Farmers do not use artificial fertilizers. They have many reasons for it. Among others, farmers speculate that burning effect of fertilizers on dry seasons, high cost of artificial fertilizers and absence of subsidy when crops fail due to unfavorable weather conditions and the steep nature of the cultivated land are regarded as the major ones. They apply some manure in their homestead farms to produce maize if at all left after satisfying their fuel demand. Farmers apply ash and some decomposed feed leftovers on some fields.

Woina Dega Domain

Soils of the woina dega area can be classified into four major groups:
1) "Walka". On such soils crops like tef, sorghum, grass pea and chickpea are cultivated.
2) "Serbola". On such soils crops like barley, fababean, wheat, barley and lentil are the major ones.
3) "Keyatie". On such soils farmers grow crops like linseed, lentil and noug.
4) "Nechatie". This are sandy loam gray soils (Regosols), which cover the top of mountains and contain many stone and gravel particles. These soils are usually used to produce linseed and lentil.

Most of the soils of the woina dega area are virtually infertile. Linseed and noug are the dominant crops in this area. The change in the farming system from "Magie" barley to barley varieties like "Embudiy", "Nechita" and "Embedat" which can survive on degraded lands are good sines of soil fertility deplition. However, in relative terms, "Serbola" soils are regarded as the best soils of the area followed by black, red and gray soils. In area coverage, the 'Walka" soils dominate followed by "Serbola", "Keyatie" and "Nechatie". Unlike the Kola domain where artificial fertilizers are rarely used, in woinadega domain urea and DAP fertilizers are applied for tef and

wheat production. However, due to high purchasing cost and the risk of crop failure when rain fails, farmers have some reservations in using mineral fertilizers. Besides artificial fertilizers, farmers apply some manure on potato, onion, and barley, which are cultivated as homestead crops. Ash is also used as fertilizer on waterlogged soils.

The soil types in the dega area are also classified into four, i.e., "walka" (produces tef, guaya, and fenugreek), "serbola"(produces barley, wheat, and faba bean), "nechatie"(produces linseed, field pea, wheat and lentil) and "keyatie"(produces wheat and linseed).

According to farmers, the sharp decline in soil fertility status started when redistribution of land was made in 1971E.C. This situation brought fragmentation of land. Small land owning per household caused continues cultivation with out fallowing practices, which generally made the land to be exhausted. There is a limited attempt by farmers to apply artificial fertilizers like DAP and Urea on wheat and tef. However, as in the case of other domains, farmers are complaining of high fertilizer costs. Fertilizer costs in "Kebele 4" for example, was 246.65 and 215.50 Birr per quintal in 1991/92 E.C, and 271.00 and 182.00 Birr per quintal in 1992/93 E.C cropping seasons for DAP and urea fertilizers, respectively. Poor fertilizer use efficiency of crops was also reported usually attributed to limited moisture availability and cold weather condition. In this area, farmers are complaining of poor solubility of white colored DAP than the gray ("guaya melk") one. Some manure and ash are applied in homestead crops like brassica and onion production. Crop residues are not left in the fields because farmers use crop residues as animal feed and to cover the roof of their houses.

The soils of the Wurch area are classified into “Serbola”, “nechatie” and “keyatie” that are covered only by potato and barley. Although the “serbola” soils take the lion's share in area coverage and are considered as the most productive soils in other domains, they are here considered as least productive. This soils occupy the top flat surface of the mountains and permanent freezing during the cropping season generally hinders crop production. Artificial fertilizers are not totally applied in the area. Farmers are justifying it by the coldness of the weather which generally diminishes

fertilizer sue efficiency.

Water Resources

Kola Domain

Moisture is the most serious limiting resource of crop production in the kola area. It is scarce both for human and animal use. Insufficient rainfall, and

above all its erratic distribution, is limiting crop and feed production. Rainfall starts late in June and ends early at the beginning of September. Some small and medium sized rivers are available in the area. However, because of the ruggedness of the topography, most of them are flowing through deep gorges and could not be used for irrigation. Some activities are being undertaken to harvest water. In situ water conservation is practiced using hillside bunds; however, due to sloppiness of the area and poor infiltration rate, it is difficult to maintain as much moisture as needed, which can sustain annual crops. Tree species, however, may successfully grow in this area.

Woina Dega Domain

Rainfall is unpredictable in woina dega area too. In most cases, it comes late and ends early. Besides, rain usually accompanied with hail cause serious damage on crop production. There are some ponds, streams and deep wells dug by the Food for the Hungry (FHI) non-governmental organization which are being used as source of drinking water. Some farmers who have lands in the vicinity of springs also use the water to irrigate their lands. Farmers are reporting that, there are some rivers in the area which can be used for irrigation. However, it was observed that it is very difficult to find large command area for irrigation which may payback the investments to be made. There are some possibilities of implementing in-situ moisture conservation and growing perennial crops. Tie- ridger is demonstrated by Canadian Physicians for Aid and Relief (CPAR) in the area. CPAR also had a plan of introducing hard pan braking plough (sub-soiler) to increase infiltration rate and conserve moisture in the area.

Rainfall shortage is also critical in the dega domain. In this area also rain starts in June and ends in early september. Erratic and heavy rain is sometimes causing serious flooding problems which is devastating large

landmass. Moreover, hail damage and frost are serious problems of the area. However, it seems that there is better chance of developing irrigation schemes in this domain than elsewhere in the woreda. Because, there are more flat lands and rivers which can be used for irrigation.

Erratic rainfall, hail, frost and freezing of soil water are among the most serious problems for crop production in the wurch area. Farmers reported that there are rivers, which start their way from their villages but are unable to use them. Because stopping the rivers means that the down stream people will not have anything to drink and eventually will create a conflict.

Vegetation

Kola Domain

Natural forests are extinct in the kola domain. There are only some remnants of natural trees such as "Dedeho" (*Eulea schimperi*), "akakima", "imbacho", "wanza" (*Cordia africana*), and "imbis" (*Allophylus abyssinicus*). These trees are found on hill sides, river borders and deep valleys, which are in most cases inaccessible. Some eucalyptus trees are planted near homesteads on "Serbola" soils. Farmers use eucalyptus as major source of fuel wood, building material and construction of farm implements. Farmers call eucalyptus "wulletaw beza" meaning a tree with high merits. Agroforestry systems are not practically seen. Most of the farms are cleared from trees and shrubs.

Woina dega domain

In the woina dega area, the dominating natural tree species are acacia (*Acacia spp*.), "imbacho", "imbis" (*A. abyssinicus*), "woira" (*Olea africana*), "kitkita" (*Dodonia angustifolia*), "bissana" (*Chroton macrostachys*), "kega" (*Rosa abyssinica*) and "agam" (*Carissa edulis*). From artificial plantation eucalyptus, "yabesha tid" (*Juniperus procera*) and "girangire" (*Sesbania sesban*) are dominating. However, the dominant tree species is "imbacho", which is growing on the degraded lands and on terraces. Other trees are located on mountainsides, riverbanks and rarely within the field. Farmers are willing to plant trees in their field boarders. However, the free grazing system prevailing in the area is argued to hinder this intervention. Area closure is being implemented in the area to preserve trees, and some promising results are achieved in some kebeles. However,

desired achievements in this domain generally could not be achieved due to the limited land resources per household and the free grazing system.

Dega Domain

In the dega domain from natural tree species acacia (*Acacia app*.), "kosso" (*Hagenia abyssinica*), "amija", "woira" (*O. agricana*), "imbacho", and "kega" (*Rosa abyssinica*) are available in trace amounts. Among manmade plantations, eucalyptus, "yabesha tid" (*Juniperus procera*), and "gesho" (*Rhamnus prinoides*) are the major ones. There are very few protected forests.

Wurch Domain

In the wurch area among the natural tree species "asta" (*Erica arboria*), "amija" (*Hypericum roeperianum*), and "jibira" (*Jiant lobilia*) are the major ones covering. Some eucalyptus manmade plantations are there. On some mountain tops there are protected forests with asta trees.

Generally, farmers have identified the following to be the major natural resources related problems in of Lay Gayint Woreda in a descending order of importance (Table 1):

Table 1. Major natural resources related problems in of Lay Gayint Woreda in a descending order of importance based on the PRA

Kola	Woina Dega	Dega	Wurch
1) Moisture shortage	1) Land shortage	1) Soil fertility depletion	1) Land shortage
2) Soil erosion	2) Moisture shortage	2) Soil erosion	2) Soil fertility depletion
3) Land shortage	3) Hail damage	3) Hail damage	3) Soil erosion
4) Soil fertility depletion	4) Deforestation	4) Land shortage	4) Moisture shortage
5) Deforestation	5) Soil erosion	5) Moisture shortage	5) Deforestation
	6) Land sliding	6) Deforestation	6) Frost
	7) Soil fertility depletion	7) Frost	

Conclusions and Recommendations

From the survey result, it is possible to conclude that the area is highly degraded, infertile, overpopulated and drought prone area. Therefore, the following recommendations can be drawn to alleviate the problems related to natural resources conservation and utilization.

1) Voluntary resettlement of the population to less populated, more fertile and having reliable rainfall areas.
2) Practicing physical and biological soil conservation practices on sloppy lands and on gullies. Biological measures should focus on planting multipurpose tree and grass species and fruit trees with high cash value.
3) Practicing alley cropping systems on hilly farmlands.
4) Area closure of highly degraded lands for rehabilitation.
5) Development of appropriate excess water disposal technologies like cut-

6) off drains, and accumulating the water for reuse.
7) Giving policy and legal support for the construction of paved drainage ditches in all road construction activities.
8) Practicing in-situ and ex-situ moisture conservation practices including introducing tie-ridger and sub-soiling equipment.
9) Practicing integrated watershed management approach.
10) Introducing treadle pumps to exploit underground and river water.
11) Development of small springs, rivers and ponds for irrigation purposes.
12) Encouraging farmers to use artificial fertilizers by devising mechanisms for securing the farmers not to be disappointed by crop failure due to drought, hail and frost damage.
13) Encouraging the use of compost and other organic fertilizers.
14) Introducing pulse in crop rotation systems.

References

Akalu Teshome, Aklilu Agidie, Birhane Assayehegne, Halima Hassen, Sewagegn Tariku, Tilahun Tadesse, Yigzaw Dessalegn and Yihenew G.Selassie. 2000. Farming Systems Of Lay Gaint Woreda, Constraints and Possible Research and Development Interventions, Adet Agricultural Research Center.

Intergovernmental Authority on Drought and Development(IGADD), Cooperazione Italiana and Food and agriculture Organization of the Untited Nations(FAO).2000. Crop Production System Zones Database Version 1.01.

Woreda Office of Agriculture.1991E.C. Annual report. Lay Gayint Woreda Office of Agriculture, Nefas Mewcha.