
Environmental degradation and management in Ethiopian highlands: Review of lessons learned

Adugnaw Birhanu

Debre Tabor University, Department of Geography and Environmental Studies, Debre Tabor, Ethiopia

Email address:

adugnawbirhanu@gmail.com

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Abstract: About 50 percent of Ethiopia can be defined as mountainous, be it because of altitude above about 1500m, or because of steep slopes. The country's highland areas include about 90% of its arable lands and are occupied by 90 percent of the human population and 60 percent of all livestock (Hurni, et al., 2010). Since 150,000 years ago population has expanded all over the highland parts of Ethiopia as they are very suitable places for living and agriculture than the malaria-infested harsh lowland areas surrounding the highlands. The Ethiopian Highlands, once endowed with rich natural resources, are agriculturally used since millennia and now heavily degraded (Gete, 2010). The interplay between the physical environment and population distribution in Ethiopia explains, to a great extent, the ever worsening problem of environmental degradation (Aklilu, 2001). Environmental management in Ethiopian highlands is therefore not only closely related to the improvement and conservation of ecological environment, but also to the sustainable development of Ethiopia's agricultural sector and its economy at large. In Ethiopia, efforts towards this conservation goal were started since the mid-1970s and 80s (Aklilu, 2006; Wogayehu and Drake, 2001; Bekele and Holden, 1998). However, some of the management approaches were successful and other not. Therefore, the paper identifies opportunities to promote and scales up the successful best management practices and identifies challenges to put into practice different management practices which give preparation for environmental managers.

Keywords: Environmental Degradation, Environmental Management, Ethiopian Highlands

1. Introduction

1.1. Background

Ethiopia extends from 3-15 degrees North latitude and 33-48 degrees East longitude. The country covers an area of 1.1 million km² and has a population of about 80 million; 85% live in the rural areas (CSA, 2007). Ethiopia is a highland country with 65% of its total area having an elevation of more than 1400 m (asl) and a substantial area lying well over 3000 m. This has made Ethiopia to be named as 'Roof of East Africa'. It should be equally stressed that there are extensive lowlands and conspicuous depressions, one of which about 120 m below sea level. The altitudinal contrast has a prominent impact on elements of the physical environment and on the human environment (Aklilu, 2001). About 50 percent of Ethiopia can be defined as mountainous, be it because of altitude above about 1500m, or because of steep slopes. The country's highland areas include about 90% of its arable lands and are

occupied by 90 percent of the human population and 60 percent of all livestock (Hurni, et al., 2010).

The highlands of Ethiopia offer excellent conditions for natural diversity and human development, be it on the one hand as the 'cradle of mankind' with early hominids some 3-4 million years ago, or on the other hand as the origin of Homo sapiens who started to spread over the globe from this region some 150,000 years ago. Since then population has expanded all over the highland parts of Ethiopia as they are very suitable places for living and agriculture than the malaria-infested harsh lowland areas surrounding the highlands. The Ethiopian Highlands, once endowed with rich natural resources, are agriculturally used since millennia and now heavily degraded (Gete, 2010).

The agrarian population prefers to stay in higher altitudes though the declining soil quality and general environmental degradation is often reported to drive the farming population into lower altitudes. The interplay between the physical environment and population distribution in Ethiopia explains, to a great extent, the ever

worsening problem of environmental degradation and the problem of land degradation in particular (Aklilu, 2001).

1.2. Purpose and Objectives of the Review

The purpose of this paper is to review the nature and severity of environmental degradation, practices and experiences in environmental management as well as to identify opportunities and bottlenecks for the adoption and scale up of appropriate technologies in environmental management. The review also provides some remarks to manage and plan effective environmental management practices. The specific objectives are to:

1. Summarizes the causes, nature, severity and consequence of environmental degradation in Ethiopian Highlands;
2. Appraise management measures being taken to trim down environmental degradation in Ethiopian Highlands and
3. Identify constraints and opportunities to Scale Up and promote best environmental management practices in Ethiopian Highlands.

1.3. Scope of the Review

The conceptual scope of this paper deals with environmental degradation and management in Ethiopia with particular emphasis on deforestation and farm and grazing land degradation. While the geographical scope of the review paper is delimited to Ethiopian highlands.

2. Major Environmental Problems in Ethiopia

Environmental degradation is extensive in Ethiopia. But not all areas of the country are equally suffering. Both the extent and severity of the problem manifest spatial variations depending on difference in relief, ecology, rainfall, land use, land cover and soil types. Land degradation in Ethiopia is especially severe in the highlands where the average soil loss from farmland is estimated to be 100 tons/hectare/year (FAO, 1986). Environmental degradation in Ethiopia replicated in the form land degradation and degradation of water resources as well as loss of biodiversity (Demel, 2001).

Some forms of land degradation are the result of normal natural processes of physical shaping of the landscape and high intensity of rainfall. The scale of the problem, however, dramatically increased due to the increase in deforestation, overgrazing, over cultivation, inappropriate farming practices, and increasing human population. Removing vegetative cover on steep slopes (slopes ranging between 15 and 50 percent) for agricultural expansion, firewood and other wood requirements as well as for grazing space has paved the way to massive soil erosion (Yihenew, et al., UD1).

Understanding the state of environmental degradation with its root causes, nature and consequences as well as previous management practices is critical to look for options to mitigate the problem and its impact. Therefore, this review focuses on the major environmental problems prevail in the highlands of Ethiopia with emphasis on its cause, nature, consequence and management practices implemented to reverse the problem. Here the focus will be on the three major aspects of environmental degradation in Ethiopia: depletion of forests, and degradation of farm land and pasture land.

2.1. Deforestation and Forest Degradation

Deforestation and consequent land degradation are global menaces, and so are they in Ethiopia. The forest degradation in Ethiopia is closely linked to the ongoing population growth. More people generally lead to an increasing demand on land for living and for agricultural production. The situation got more severe in the eightieth when large numbers of people moved to South West Ethiopia in scope of organized resettlement programs. Consequently the pressure on the forest resources themselves increased due to a higher demand on fuel wood and construction timber. Finally, uncontrolled logging and the illegal export of wood stems to urban centers like Addis Ababa is a threat for the natural high forest of the country. The natural regeneration of the forest resources is difficult due to high populations of grazing and browsing livestock within the forests (Reusing, 2000). However, similar to the problem with forest statistics, there is no reliable source for data on rates of forest degradation and deforestation in Ethiopia. While some historians argue that deforestation has been taking place over thousands of years in Ethiopia (Melaku, 1992; Pankhurst, 1995; Nyssen et al., 2004), foresters are arguing that deforestation has accelerated over the last 150 years driven largely by the high growth in the population of the country (Breitenbach, 1962; Pohjonen and Pukkala, 1990; Reusing 1998). According to several reports Ethiopian forest covered approximately 40% of the land a century ago but now has shrunk to only 3% (Berry, 2003). The extensive deforestation has also led to the extinction of various biotas resulting in significant biodiversity loss. Additionally, accelerated soil erosion on the landscapes without vegetation washed fertile top-soils leading to infertile and shallow soils with poor water storage capacity (Hurni, 1988; Bishaw, 2001).

2.2. Degradation of Farm and Grazing Land

Since 95% of the cultivated land is under small-holder peasant agriculture..., it is clearly the cumulative impact of the actions of these land users that has eventually led to the degradation and depletion of these resources Shibru and Kifle (1999)

Almost 75% of Ethiopian highlands are known to have been so degraded that their future use depends on the application of conservation measures (FAO, 1986). Soil

erosion in Ethiopia is attributable to a combined effect of the rugged configuration of the landscape and the torrential rains; deforestation, cultivation of steep slopes and centuries of mismanagement (Mesfin, 1984 cited in Aklilu, 2001).

The aspect of land use affects soil erosion. It could be seen that under forest the amount of soil eroded is less. The loss of soil on cultivated slopes in the drier and warm Lower Kolla zone (below 900 m) is reported to be about 2.3 mm/year while in the moister and cooler highlands of the Upper Kolla and Woina Dega zones (900-2600 m) the rate is about 4.3 mm/year. The rate of soil loss is still higher on the cold and wet highlands above 2600 m in the Dega and Wurch zones about 4.9 mm/year (Daniel, 1988).

3. Causes of Environmental Degradation in Ethiopia

The cause of environmental degradation can be grouped in to proximate and underlying causes. The proximate causes are the indicator of inappropriate resource management practices and the underlying causes of environmental degradation include a complex of social, political, economic, technological, and cultural variables that constitute initial conditions in the human-environment interaction. In Ethiopia both causes are the reason for farm and grazing land degradation and forest degradation.

3.1. Factors Associated with Proximate Causes

In Ethiopia proximate causes for deforestation and land degradation can be grouped into three broad categories: agricultural expansion, harvesting or extraction of wood, and expansion of infrastructure.

3.1.1. Agricultural Expansion

Ethiopia's economy is primarily based on agriculture, which accounts for 50 percent of the gross domestic product (GDP) and employs about 85% of the labor force. Agriculture accounts for 90 percent of total foreign exchange earnings with coffee contributing about 60% of the total value of exports. Ethiopia's coffee exports, however, is only about 2 percent of the world coffee market. Agriculture provides about 70% of the raw material for food processing, beverages and textile industries. Hides and skins account for 20 percent of the total value agricultural exports followed by pulses, chat and animal products in that order of significance (MoARD and WB 2007).

For instance, (Berry, 2003) summarizes practices of cultivation that exacerbate the problem of soil erosion in Ethiopia as a result of agricultural activities as follows:

Repeated cultivation: Repeated cultivation (up to six times for teff) increases the risk of erosion. The prevailing practice of making fine seedbed for teff is known to decrease the capacity of the soil to stand the severe erosion at the outset of the rains. Other unacceptable practices are ploughing up and down the slope in order to control weed; and making the last ploughing down slope so as to reduce

water logging. Such practices are necessary, but they lead to degradation.

Single cropping: Single cropping rather than intercropping is also a favourable condition for erosion as there will be few permanent crops whose leaves and roots can provide protection and stability at the start of the rains.

Removal of Residues and dung: The massive deforestation and the resultant shortage of fuel wood led to the use of dung and agricultural residue as fuel. These sources of energy are estimated to provide 58% of total energy needs of Ethiopia (Amsalu et al., 2006). Up to 90% of the total household cooking in some towns of northern Ethiopia is said to be done with dung transported from the rural households. Use of dung and crop residue as fuel reduces the amount of organic matter in the land. It leads to a progressive deterioration in soil structure, infiltration capacity, moisture storage and fertility, resulting in a massive decrease of productivity. According to EPA (1997), some 80% of the crop losses due to land degradation result from breaches in the nutrient cycle.

Planting dates and type of crops: Farmers delay planting or do not plant at the start of the rains partly due to problems of land preparation owing to lack of oxen in many cases. Delayed planting exposes the farm land for repeated rains.

The highlands support close to 80% of the total TLU on about 30% of the total available natural herbage in the country. An apparently paradoxical relationship is noted between grazing land and number of livestock in Ethiopia: "while the feed source declines, livestock numbers tend to increase" (Daniel, 1988). Since animal yield per capita is low due to genetic and managerial problems – the natural reaction of farmers has been to increase their herds, thus encouraging overgrazing. The contribution of supplementary feed is too insignificant to bring about even a temporary relief to the pastureland. It was estimated that "the crop residue and aftermath grazing provide feed for livestock for only about 10 per cent of days in the year.

Given the attitude of Ethiopian farmers and nomads towards their livestock in general and cattle in particular, one cannot help expecting a similar trend of pressure to prevail in the future. Firstly, cattle are justifiably regarded by farmers as saving accounts. Secondly, number is more valued than quality because social status is traditionally associated with 'how many' one owns. The sad thing is, that pasture land is estimated, assuming no major technological change, to be insufficient to maintain the livestock population by 2004 (Hurni, 1988).

3.1.2. Harvesting or Extraction of Wood

Ethiopia is one of the world's most fuel wood reliant nations (Horne and Frost, 1992). The traditional fuel sources (woody biomass, crop residues, dung and charcoal) put together are reported to have claimed 95.3% of the total domestic energy consumption in Ethiopia whereas the modern sources (petroleum and electricity) accounted for only 4.7% in 1990/91 (Mekete, 1996). It was also known

that nearly 37% of the housing units in the urban areas used only firewood for cooking purposes. Another report shows that 97% of the household energy comes from biomass.

Wood and wood products are the prominent materials for construction of houses Ethiopia. About 74% of the housing units in the rural and 72% in the urban areas were reported to be ordinary houses with walls made of wood and mud (Mekete, 1996). In the case of rural houses, practically all the parts of the house are of biomass.

3.1.3. Expansion of Infrastructure

Settlement patterns: In some regions, resettlement is a major driver of deforestation (Behailu, 2006; Mulugeta et al., 2007). Although the objective of the resettlement program is to assist food insecure households get access to productive farmlands, the strategy, in most cases, is taking place through the clearing of natural vegetation, particularly forested areas. For instance, between 2000 and 2004, about 220,000 household heads or 1.2 million people were resettled in the four National Regional States of Amhara, Oromiya, SNNP and Tigray. These households carved out cropland and made settlement housing by clearing areas of their natural vegetation and using the woody resources unsustainably.

Roads and the tracking of livestock and people: In Ethiopia, many areas are densely settled resulting in a tremendous pressure on resources Roads by erosion. The water-ways constructed at road sides are rapidly turning into deep valleys consuming a considerable part of arable land in the vicinity. Tracking of livestock and people is also contributing to formation of gullies (Aklilu, 2001).

3.2. Factors Associated with Underlying Causes

There is multiple interacting of underlying causes, which have caused and are causing environmental degradation in Ethiopia. These are natural conditions, demographic factors, economic factors, technological factors, policy and institutional factors, and a complex of socio-cultural factors.

Natural Conditions: Basic physical conditions in Ethiopia, which impact environmental degradation, include rainfall variability from year to year and place to place, particularly in the drier parts of the highlands. The sequence of drier years with reduced vegetation cover followed by wetter years with heavy rainfall is conducive to high levels of soil loss. Additionally, the physical make up of the Ethiopian Highlands with gorges and other topographic barriers restricts the development of effective internal marketing systems in some areas (Gete, 2010).

Demographic factors: The ever increasing rate of population growth is believed to be the major cause of deforestation. Increase in population led to increased need for farm land. It led also to an increased requirement of wood for fuel and construction. Wood and wood products are the prominent materials for construction of houses Ethiopia. About 74% of the housing units in the rural and 72% in the urban areas were reported to be ordinary houses with walls made of wood and mud (Mekete, 1996). A

widespread belief exist that population growth or "pressure" is a significant driver of deforestation, often even the primary underlying cause of deforestation.

Theoretically, population can affect deforestation through (1) changes in the number of rural families seeking land to cultivate, fuelwood or timber; (2) population's indirect effects on labour markets; (3) demand for agricultural and forest products; and (4) induced technological or institutional change (Geist and Lambin 2001).

Economic factors: An important part of moving to sustainable land management is the development of an appropriate rural infrastructure to encourage alternative livelihoods and to develop local and regional markets. This infrastructure is lacking in Ethiopia greatly restricting the economic movement of produce from areas of surplus to areas of need.

Poverty: Poverty and environmental degradation have two way relationships. In one way, environmental degradation like deforestation, soil erosion, water and air pollution, and loss of biodiversity etc. have a declining impact on the potential production capacity of individual and society, resulting in different degree of poverty. In the other way poverty is the cause of environmental degradation. Poverty together with other factors may foster unsustainable development due to the fact that poor are mostly directly dependent on the natural resources than the rich. Thus, they degrade the natural resources to get food, fuel woods and income as well as to survive since poor people do not have access to modern and, efficient technologies

Low Technology in Agriculture: As illustrated above most of agriculture in Ethiopia is still low technology and is inadequately equipped to deal with drought and famine. Fertilizers because of cost or availability factors are not in general use and traditional organic fertilizer is increasingly being used as fuel. A modest transformation in technology is likely to be an important component of successful sustainable agriculture.

Policy and institutional factors: Ethiopia has seen a number of changes in land ownership, which continue to provide uncertainty to the farmer and to rural communities. The traditional feudal system was followed by a communal form of government ownership and while policies now have changed, there is still confusion at the regional and local level about security of tenure and land and resource rights.

While a number of institutions are charged with responsibility for dealing with land degradation (Ethiopian Agricultural Research Organization, Regional Agricultural Bureaus, the Environment Authority, etc.) budgets for these organizations are inadequate and with the decentralization programme to zonal and woreda levels institutional capacity has been further stressed. Institutional responsibilities are not always well defined and donor programmes are not always well integrated into national efforts.

Because of the weak infrastructure and the shortage of funding extension services are weak and serve only a small part of rural areas. Allied with this problem is the poor historical record of local participation in finding approaches to dealing with the particular local problems of unsustainable land management. As some of the specific studies cited below show understanding local and regional issues on the basis of indigenous knowledge is a key component of successful programmes.

Cultural factors: It is very fortunate that the magnitude and seriousness of the problem of natural resource degradation are duly recognized both by the government and non-governmental organizations. There are, however, divided views as to whether the problem is well recognized by the grassroots population. Some studies and observations at specified areas indicate that people have good knowledge of the hazard of resource degradation. Other studies indicate, to the contrary, that the problem of land degradation is either not appreciated at all by the farmers or not given priority (Aklilu, 2001).

Lack of environmental awareness concerning the linkage between environment and development in general, weak participation of the people and community based organization in environmental management activities are some of the environmental challenges of Ethiopia face now days. In addition poor agricultural practices together with lack of awareness and consciousness contribute a lot to the degradation of natural resources such as destruction of forests, degradation of soil and water resources (Girma, 2001).

Political factors: The political unrest and the civil wars that shook the country during the last three decades have also played their part in the destruction of natural vegetation. In areas where civil war prevailed, grasses and trees were being cleared to reduce cover for guerrilla fighters (Horne and Frost, 1992).

4. Consequences of Environmental Degradation

Origin and effect of environmental problems are often not easily definable. Attempts have been made to quantify the extent and severity of environmental degradation and express it in terms of the amount of resources depleted and population affected or predicted to be affected (Aklilu, 2001). Environmental degradation has already resulted in noticeable and wide ranging effects on the Ethiopian community-both rural and urban. Aggrey-Mensah, 1984 quoted in (Aklilu, 2001) has categorized such effects into non-economic and economic.

4.1. Non-Economic Consequences

The effects of environmental degradation on the individual, the community or the nation as a whole are, according to Aggrey-Mensah (1984), hard to quantify owing to the length of time over which degradation takes

place. Some of the effects of environmental degradation which could be categorized as non-quantifiable (or very hard to quantify) include (Aggrey-Mensah, 1984; Wood, 1990; Berhanu, 1998):

Loss in water resources: Due to depletion of forests and the resultant increase in runoff, the storage of water has greatly diminished and a large number of water points for human and animal use have dried up.

Loss in livestock production: Land degradation leads to decrease both in the quality and number of livestock; any change in livestock sector has tremendous effects on the living standards of the rural people as a whole. First, in places where the wheel has not yet penetrated, animal transport still provides a reliable and well suited mode of transport. Second, oxen are extensively used for traction power.

Unemployment and out-migration: Where agricultural and livestock production reach very low levels as a result of reduced cultivable land and yields, a situation will be created where there is insufficient land leading to shrinkage of average farm size which, in turn, creates a disguised unemployment. Ethiopia may stand number one in Africa (perhaps in the world) to witness the power of land degradation deriving people out of their homes. In 1984/85 more than half a million people were forced to leave their homes mainly in the highly eroded northern regions to the south and south-western parts which are less degraded so far. Though divergent views exist as to the political motives of the then resettlement, there is no doubt that land degradation played the major part. It is frightening to read (FAO, 1986) that 10 million people (or 15% of the highland population) will be left destitute by 2010 unless major changes occur.

Long walking distance: Plots have been abandoned and given up to grazing owing to the persistent erosion. It is reported that "about 20,000 to 30,000 hectares of land in the highlands are abandoned each year because cropping can no longer be supported by the soil" (Berhanu, 1998). The consequence is use of marginal lands on steep slopes or relatively unsuitable soils. New plots tend to be in remote areas, so more time has to be spent for travelling.

Shortage of food-malnutrition: Burning of dung as a result of depletion of forest resources reduces Ethiopia's crop production by 10 to 20% while decline in the humus content of the soil causes a further fall in crop production of about one percent (Hurni, 1988). The consequence is obvious: shortage of food and malnutrition.

Lack of firewood and building material: Where there is no forest resource at all, one can not simply talk about the economic cost of getting fuelwood because there is no possibility to get it even if money is available. The problem is well summarized by (Mesfin 1984 cited in Aklilu, 2001). Over much of northern Ethiopia, according to Mesfin, "most of the land is absolutely treeless, so much so that in some rural areas only stones are used for building houses, and cow dung for fuel. Wood, even for ploughs and other

implements, is very scarce, and farmers have to walk long distances into the more remote valleys to get it”.

Conflicts between Pastoralists: Conflicts between different pastoralist tribes have occurred frequently in history and continue up to date. They can have serious consequences too but are covered even less by the press.

4.2. Economic Consequences

Soil erosion was estimated to have cost nearly Birr 40 million in 1990 in lost agricultural production (i.e. crop and livestock) while the cost of burning dung and crop residues as fuel was nearly Birr 650 million (EPA, 1997). Land degradation is estimated to result in a loss of livestock production equivalent to 1.1 million tropical livestock units (TLUs) in 1990. Approximately 17% of the potential agricultural GDP was lost because of physical and biological soil degradation. Another report indicates that Ethiopia has been losing 6-9% of her GNP due to deforestation (Pearce, 1991).

5. Measures Taken to Reverse Environmental Degradation in Ethiopian Highlands

In the following section, some of the main strategies to reverse the problem are categorized and discussed in relevance to Ethiopian highlands.

5.1. Afforestation and Reforestation

Vegetation has a curative and protective value. The otherwise abandoned land may regain importance as a result of a carefully planned and efficiently administered scheme of afforestation. Girma, (1988) states, that “the most important measure to restore the disturbed rural ecology is the implementation of afforestation and reforestation... on a scale large enough to cope with the problems of soil erosion and water wastage”.

An estimated 500 million tree seedlings were planted and about 80,000 hectares of hillsides closed for regeneration between 1976 and 1985 (EPA, 1997). Despite these and other massive intervention and regulation, natural resource and environmental degradation continued unabated. All efforts to be made in the future in afforestation and reforestation must be viewed in conjunction with continuing deforestation. No effort that aims only at the physical environment will be successful “as long as the lives of the peasants remain impoverished and precarious” (Mesfin, 1991 cited in Aklilu).

A successful implementation of afforestation and reforestation schemes requires an ability to form pressure groups in the community or involve existing local groups. Activities like starting nurseries in villages, planting and protecting multipurpose trees along roads, on farms, and around houses, etc., for instance, call for an ability to garner the knowledge, support, and energy of rural people (Postel and Heise, 1988).

5.2. Conservation Oriented Crop Combination Land Management

The underlying principles include making conservation part and parcel of the farming work cycle; and making farming practices involve not only a few new inputs but also provide farmers with short-term economic benefits (Wood, 1990; Nair and Muschler, 1993). This method appears to combine the three broad techniques of controlling soil erosion referred to by Belay (1992): agronomic methods, which aim at controlling erosion by improving the vegetative cover; soil management techniques, which try to control erosion by improving the aggregation of the soil particles; and structural soil conservation methods, which control erosion by shortening the length and minimizing the gradient of the ground slope. This technique involves construction of tied ridges, bunds, fanya juu terraces, bench terraces, hillside terraces, diversion ditches (cutoffs) waterways and special water harvesting structures (Thomas, 1984; MOA, 1986).

Certain farming practices which are believed to conserve the natural resource base and at the same time raise productivity are noted (Blackwell, 1991; Wood, 1990). These include intercropping and relay or sequential cropping; crop rotation; integration of livestock farming with arable cultivation; the cut and carry method of using degraded pasture, controlled grazing and tethering; widespread use of semi-permanent crops like enset (false banana) and cassava or self-seeding and volunteering crops, such as legumes and sweet potatoes. It is not surprising that emphasis has now been put on agroforestry (Nair and Muschler, 1993; Blackwell, 1991; MOA, 1986) which, in broader terms, includes most of the land management practices described above.

5.3. Agroforestry

Agroforestry is described as a new name for a set of old practices (Nair and Muschler, 1993). It is a collective term for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboo, etc.) are deliberately used on the same land-management units as agricultural crops or animals, in some form of spatial arrangement or temporal sequence. Agroforestry, according to Nair and Muschler, represents an interface between agriculture and forestry and encompasses mixed land-use practices that have developed in response to the special needs and conditions of the tropical developing countries.

Agroforestry denotes practices ranging from simple forms of shifting cultivation to sophisticated hedgerow intercropping systems. All the diverse systems have something in common: the purposeful growing or retention of trees with crops or animals in interacting combinations for multiple products or benefits from the same management unit (Nair and Muschler, 1993). This is believed to be the essence of agroforestry. The advantages of agroforestry are many fold including conserving and enriching the soil, protecting crops and animals against

wind and extreme temperatures, and provision of wood, fuel and fodder. Since trees are dispersed on farms rather than concentrated in plantations, agroforestry makes trees more accessible and spreads their benefits more widely. Furthermore, agroforestry programmes are known to cost only 10-20% as much as government-established fuelwood plantations (Postel and Heise, 1988).

5.4. Controlling the Rate of Population Growth

All efforts will bear little fruit or no fruit at all if population growth in Ethiopia continues at its present pace. Any improvements introduced will be nullified by a fast growth of population. Concrete suggestions have repeatedly been put forth with respect to controlling the rate of growth. An appropriate population policy aimed at reducing fertility is one of the proposals often underscored (Markos, 1990).

Intensive education on population and family planning are part of the recently issued population policy. There is also a lesson to be learned from the experience of the Family Guidance Association of Ethiopia (FGAE) (Jansson et al., 1990). Through a cautious policy emphasizing the value of child spacing and the welfare of the entire family, the FGAE has, according to these writers, sensitized the government and religious authorities to the need for family planning

6. Constraints and Opportunities to Scale Up and Promote Environmental Management Practices in Ethiopia

6.1. Constraints

The gaps as well as constraints that fostered the problem of environmental degradation and inhibited the implementation of successful practices for better environmental management have been identified by Pender et al. (2002), Mahmud et al. (2005), Gete et al. (2006), MoARD and WB (2007). The following are the key gaps and constraints that negatively affect the quality of intervention and up-scaling of successful practices for sustainable environmental management in Ethiopia.

Lack of awareness: Lack of environmental awareness concerning the linkage between environment and development in general, weak participation of the people and community based organization in environmental management activities are some of the environmental challenges of Ethiopia face now days. In addition poor agricultural practices together with lack of awareness and consciousness contribute a lot to the degradation of natural resources such as destruction of forests, degradation of soil and water resources (Girma, 2001).

Lack of professionalism and technical standards: Another very important constraint, not only among policy makers but also among many experts, is that construction of physical soil and water conservation measures is

considered as the main solution to halt land degradation. In almost all cases, the results are hastily evaluated and criticized without understanding their purpose. Moreover, the technical requirements for the effective maintenance and use of these measures are often forgotten. Unfortunately, attention is mostly given to the number/quota of interventions but not their quality, standard, sustainability, and integration with other soil and land management practices. These 'mistakes' have sparked disillusionment among local experts and development agents as well as resentment among farmers so that both develop a tendency to disregard professional opinions (Gete et al., 2006).

Top-down planning approach to technical assistance: Although overcoming the current level of poverty in the country is a pressing concern, technology dissemination requires time and a careful approach to address community needs, build capacity and trust, and to demonstrate flexibility and share risks. Long-term sustainability is more likely to be achieved if development is driven from the bottom-up and if it addresses farmers' and communities' immediate needs and constraints. Quick solutions rather than sustainability, quantity rather than quality, area coverage rather than impacts, command and control rather than participation, are the approaches that have dominated the extension system (Gete et al. 2006).

Weak linkages among various disciplines: According to Gete et al. (2006), although the government has invested huge sums of public money in setting up the institutional framework for the national agricultural research, education, and extension systems, there seems to be no strong functional linkages among them. Poor coordination among research, extension and education has affected formal technology development and the transfer of technologies from researchers to local experts and local communities, particularly the farmers. Even following the decentralization of the administration system down to woreda level, no clear and strong linkages, and hence a formal and inbuilt system for information exchange and sharing, has emerged among all the actors. The federal and regional research institutes participate in annual reviews of their research agendas, but the active involvement of other stakeholders is very weak and there are no efficient feedback mechanisms (MoARD & WB, 2007). Hence, the weak linkage among the various disciplines, institutions as well as others stakeholders and the end users is a decisive constraint that undermines the proper implementation and up-scaling of successful sustainable environmental management practices in the country.

Limited information flow and networking: Appropriate information on the resource base, the extent of environmental degradation, the costs and benefits of applying sustainable environmental management as well as information on the nature of the different practices available is required to make decisions at different levels. Although there are some efforts here and there, either they are poorly organized, do not address the full picture, or

they are too old to be able to represent the current situation. Most studies address only a piece of the dilemma, and even then are not formulated in such a way as to help policy makers and beneficiaries make informed decisions (Mahmud et al., 2005, Gete et al., 2006).

Policy, legislation and implementation constraints: Ethiopia has designed a number of important policies and strategies related to the environment. However, setting sound policies and strategies is not an end by itself. The goals stated in the different policies can only be achieved if, and only if, that policy is properly implemented. Although poor implementation of policies and strategies remains a major constraint, some other policies and strategies are hindering proper implementation of effective and sustainable practices for resource management, for example, the investment policy or policies of the regions. There is still a need for more policies and strategies to be developed or some to be modified (Pender et al., 2002; Gete et al., 2006).

Socio-economic and bio-physical constraints: There are many socio-economic and bio-physical constraints that hinder decisions to invest and sustain appropriate practices for overcoming environmental degradation. To begin with, poverty is one of the fundamental problems affecting environmental resources management, which most of the Ethiopian population continues to face. It is a chronic problem which causes enormous environmental damage as the poor are forced to mine the rapidly deteriorating natural resources in their surroundings. Thus, there is a strong nexus between environmental degradation and worsening poverty in the country (MoARD & WB, 2007). Rural poverty is typically linked to loss of soil productivity and forces the poor to depend on scavenging the remaining natural resources, inducing more degradation and damage to the ecology.

Of the biophysical constraints, climate variability is a significant factor. The dry lands (arid, semi-arid, and dry sub-humid areas) of Ethiopia, which cover some 70 percent of the total area of the country, are particularly vulnerable to climate change, desertification and drought. Climatic variability causes recurrent droughts and this is associated with high rainfall variability (both in space and time), which contribute to the decline in vegetation cover, loss of biodiversity and worsening land degradation. Climate variability worsened by human induced environmental degradation in turn negatively affects the sustainability of practices for better management of the land (Gete et al., 2006).

Frequent restructuring of government institutions: According to Gete et al. (2006) and MoARD & WB, (2007), even though tackling land degradation through the rehabilitation of degraded lands has been a priority for the country, institutions dealing with natural resources management have frequently been restructured, and this undermines a sense of ownership by program staff, results in high staff turnover, wastes institutional capacity, and causes discontinuity of activities and initiatives and loss of

institutional memory. The frequent restructuring not only erodes all the above functions but the stage has been reached where nonprofessionals are often assigned to initiate activities in natural resources management, particularly at woreda level. Whenever restructuring is planned, it is often done without serious consideration of the consequences, and, as a result, many important documents, established linkages and joint activities, site specific information of high value, skills and methodological approaches resulting from years of experimentation etc get lost.

Incomplete technology packages: Lack of proper integration of introduced practices with indigenous knowledge and practices, incompleteness of available technologies to address the requirements of the diverse agro-ecological conditions of the country, and lack of proper consideration of the socio-economic setting of the different communities during introduction of technologies are some of the other factors reported by stakeholders as negatively affecting the success improvements to land resource management (Gete et al., 2006).

6.2. Opportunities

Attempts by the government and non-governmental actors in halting environmental degradation have shown some valuable examples of successful projects and many opportunities. It is believed that making good use of these examples should be the starting point to promote successful initiatives for improving land resource management in the country. The focus of many studies has so far been more on pinpointing problems or constraints rather than capitalizing on opportunities. This section points out key opportunities to help improve the quality of interventions and up-scale successful practices.

Existence of environmental policies and strategies: Ethiopia has made admirable efforts in terms of policy and strategy responses to address environmental degradation (Gedion, 2001). One of the most important umbrella policies is the Environmental Policy of Ethiopia. This policy addresses a wide variety of sectoral and cross-sectoral environmental concerns in a comprehensive manner. The major aim is to ensure sustainable use and management of natural, human made and cultural resources and the environment (EPA, 1997). Moreover, land use and land administration proclamations and strategies have been developed by the different regions and an autonomous organization has been established to implement them. Very recently, the federal government also approved the national land use and land administration policy.

Rich experience on participatory watershed management: The need for genuine participation of communities at all levels of the decision making process is one of the key requirements for successful land resource management undertakings. Although there are many issues which need further study, there are very good experiences in the country. The government has recognized the need for participatory watershed management and recently the

MoARD developed a national guideline known as the Community Based Participatory Watershed Development (Lakew et al., 2000). This is one of the most important steps taken by the government for effecting good resource management in the country with the full participation of the local communities.

Organizational setup of MoARD and National Research System: The organizational set-up of the MoARD, with regional and local bureaus of agriculture extending down to the kebele level with three development agents in each kebele have taken the process of decentralized governance to the local community level. The national agricultural research system, which is composed of one federal and regional institutes with research centres that cover almost all the major agroecological zones, and the system of higher learning institutes together offer key opportunities that could be exploited to successfully implement sustainable land management in the country. The existence of international research organizations in the country is another opportunity to bring in international experience (MoARD & WB, 2007).

Availability of both indigenous knowledge and scientific technologies: Local communities are rich in indigenous knowledge and practices that can be further enhanced to maintain sustainable land resource management. Moreover, over the last four decades, many technologies for land resource management have been introduced or generated by research in the country (Yeraswork, 2000, Gete et al., 2006), including many new and innovative measures for soil and water conservation. Hence, the task ahead is to take note of the different indigenous and introduced land management technologies and practices in the country, as well as those generated by the national research system, and characterize them including possible integration within and across different ecologies. Disseminating this information and devising systematic technology introduction could be regarded as one of the immediate tasks.

Existence of donor support and development partners: According to Pender et al. (2002) and the MoARD SLM Secretariat (2008), there are several donors and development partners interested to assist interventions for improving land resource management. The key issue here is the effective utilization of the resources available. This is related to the high level of bureaucracy in using resources, most of which emanates from donor procedures and requirements, and lack of donor resource harmonization. Beyond this, additional resources are needed to arrest land degradation.

7. Conclusion Remarks

In this paper an attempt has been made to review the nature and extent of environmental degradation with particular emphasis on deforestation and land degradation along with their causes and consequences as well as existing constraints and opportunities which would help in

planning and implementing appropriate protective measures to address environmental problems in Ethiopia. Knowing all the causative factors is critical to find alternative solution for economic and social development of the country. However, the country continues to face environmental degradation unless we put together our handprints to our surrounding for improving environment in a sustainable way through integrating legal instruments, economic instruments and education.

Legal and economic instruments have often been proposed and accordingly implemented to manage the environment. The last years showed us that such instruments are good but not sufficient to bring about lasting solutions to the problems related to the use of natural resource and resultant degradation of the natural environment. In recent years more focus seems to have been put on education, public awareness and training as an instrument with proven capacity to shape people's attitudes in such a way that they would use environmental resources without damaging the resource base and compromising the ability of next generations to make use of the same resource base (Aklilu, 2010).

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