LAND DEGRADATION
IN
ETHIOPIA:
ITS EXTENT AND IMPACT

L. Berry

Commissioned by Global Mechanism
with support from the World Bank
TABLE OF CONTENTS

Preface .......................................................................................................................... 1
Executive Summary ..................................................................................................... 3
The Scope And Impact Of Land Degradation In Ethiopia ......................................... 4
The Cost Of Land Degradation In Ethiopia ............................................................... 6
Apparent Root And Proximate Causes Of Land Degradation .................................... 8
Economic Returns From Land Degradation Investments .......................................... 11
Conclusions ................................................................................................................ 13
References ................................................................................................................ 14
Annex 1. Background .................................................................................................. 17
Annex 2. Findings of Local Studies on Land Degradation ....................................... 18
Annex 3. On-going Land Degradation Related Projects in Ethiopia ....................... 21
Annex 4 ...................................................................................................................... 25
Major Issues And Priority Areas In Combating Land Degradation And Poverty..... 25
LIST OF TABLES

Table 1. Forest Reduction........................................................................................................ 5
Table 2a. Calculated Loss In Grain Yield Due To Losses In Nitrogen Through Erosion .. 7
Table 2b. Monetary Values Of Crop Yield Losses As A Result Of Soil Degradation ...... 7
Table 3. Summary of Scenario Results .................................................................................. 8
Table 4. Estimates Of Consumption Of Household Energy (percent)................................. 9
Table 5. Current And Optimum Livestock Stocking Densities (hectares/TLU)................. 10
Table 6. Multilateral and Bilateral Assistance for Sectoral Projects/Programmes in
   Agriculture and Natural Resources .................................................................................... 22
Table 7. Regional Assistance For Agricultural And Natural Resources
   Programmes/Projects.......................................................................................................... 23
Table 8. World Bank Projects: IBRD/IDA Projects Related to Natural Resource
   Management ...................................................................................................................... 24
LAND DEGRADATION IN ETHIOPIA: ITS EXTENT AND IMPACT

Preface

This paper is part of a series of case studies, which attempt on a pilot country basis to examine the costs of land degradation. This stage of the work involves a desk analysis of:

- Impacts of land degradation
- Costs of land degradation
- Costs of land improvement measures
- Costs of policy reform and institutional development.

In general there is reasonable, though not comprehensive, information on the impacts of land degradation and a good assessment base of the proximate and root causes. Linkages with poverty are well established and current remedial programs can be identified.

There is much less information on the impact on the ground of these actions. It is clear that the impact of land degradation is a drain on economic growth in rural areas and has an affect on national economic growth patterns. Investment in remedial action is hard to quantify, but appears an order of magnitude smaller than the scope of the problem. Actual in country joint assessment with national stakeholders will be necessary to provide specific analysis of the countries concerned.
ETHIOPIA
LAND DEGRADATION IN ETHIOPIA: ITS EXTENT AND IMPACT

Executive Summary

In Ethiopia 85% of the population are directly supported by the agricultural economy. However, the productivity of that economy is being seriously eroded by unsustainable land management practices both in areas of food crops and in grazing lands.

The direct costs of loss of soil and essential nutrients due to unsustainable land management is estimated to be about three percent of agricultural GDP or $106 million (1994 $). Other modeling work suggests that the loss of agricultural value between 2000-2010 will be a huge $7 billion. None of these estimates takes account of the indirect impacts of land degradation in Ethiopia.

A number of factors contribute to unsustainable land management in Ethiopia. With steady growth in population, clearing of woodland for agriculture has been a continuous process at an estimated rate of 62,000 ha a year; methods of cereal production are conducive to soil loss and dung and crop residues are needed for fuel, reducing their use as fertilizers.

Root causes of these problems include historical and changing patterns of land ownership and government control, low levels of investment in agriculture and animal husbandry, poor rural infrastructure and markets and low levels of technology.

Remedial measurers have in the past focused on physical structures including terracing and bunding. Donor support has provided new levels of fertilizer input, but the difficulties of transportation and marketing has reduced the impact of improved productivity in the areas affected.

Policy, institutional and participation issues are not usually highlighted in remedial measures and these directed to the regional issues and needs within Ethiopia could be an important component of future actions.
The Scope And Impact Of Land Degradation In Ethiopia

Ethiopia is among the poorest of countries and poverty and land and resource degradation appear to feed off each other. The irony is that Ethiopia is a country with high biodiversity and distinctive ecosystems and the natural resource base is critical to the economy and the livelihood of a high percentage of the population. Agriculture accounts for 50 percent of GDP, 85 per cent of foreign exchange earnings and supports, albeit insufficiently, 85 percent of the workforce. Estimates vary considerably but direct losses of productivity from land degradation are minimally 3 percent of agriculture GDP. With a population growth rate of 2.3 percent this is a critically important figure (Annex 1).

All physical and economic evidence shows that loss of land resource productivity is an important problem in Ethiopia and that with continued population growth the problem is likely to be even more important in the future. There are several studies that deal with land degradation at the national level in Ethiopia. These include the Highlands Reclamation Study: Ethiopia (EHRS-FAO 1986); studies by the National Conservation Strategy Secretariat (Sutcliffe 1993), the Ethiopian Forestry Action Plan (1993), and Keyser and Sonneveld (2001); Effect of Soil Degradation on Agricultural Productivity in Ethiopia.

Conclusions from these studies vary in detail. The EHRS concluded that water erosion (sheet and rill) was the most important process and that in mid 1980’s 27 million ha or almost 50% of the highland area was significantly eroded, 14 million ha seriously eroded and over 2 million ha beyond reclamation. Erosion rates were estimated at 130 tons/ha/yr for cropland and 35 tons/ha/yr average for all land in the highlands, but even at the time these were regarded as high estimates. Sutcliffe produced new lower estimates for soil erosion, but emphasized the much greater importance of nutrient loss.

Map 1 illustrates the regional extent and intensity of soil degradation.
The Ethiopian Forestry Action Plan outlines the pattern of deforestation. The current rate of deforestation is estimated at 150,000 ha per year (Ethiopian Forestry Action Plan) or 62,000 ha/yr (World Bank 2001). Forests in general have shrunk from covering 65% of the country and 90% of the highlands to 2.2% and 5.6% respectively (Table 1).

Table 1. Forest Reduction

<table>
<thead>
<tr>
<th>Original Extent of Forest</th>
<th>1950’s</th>
<th>1990</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>65%</td>
<td>16%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Highlands</td>
<td>90%</td>
<td>20%</td>
<td>?%</td>
</tr>
</tbody>
</table>

Keyzer and Sonneveld (2001) attempted a detailed national assessment of soil degradation on the basis of UNEP/grid DATA. The inventory was detailed, but the assessment was qualitatively carried out by experts on the region and physiographic zone.

These authors also attempted a regional analysis of the extent and impact of land degradation. The modeling compared yields in relation to soil degradation and soil fertility. The analysis identified the following:

- Soil degradation has its major impact on soils of lower fertility and where population density is low.
- On fertile soils, soil degradation tends to be compensated by fertilizer application
- Many areas, populated by a large percentage of the people are in a critical state, where fertility loss needs urgently to be compensated by new external impacts and/or soil conservation measures need to be implemented. The most vulnerable areas are in North Ethiopia

In addition to these general assessments, current reports on specific issues show:

- A loss of 30,000 ha annually due to water erosion, with over 2 million ha already severely damaged (National Review Report 2002)
- A total loss of 4,000 ha of state farms due to severe salinization
- An estimate of 1 billion tons of top soil lost per year (Tefetro 1999)
- Nutrient depletion of 30 kg/ha of nitrogen and 15-20 kg/ha of phosphorous (UNDP 2002)
- Loss of 62,000 ha of forest and woodland annually (World Bank 2001)

In the highlands of Ethiopia, the area of most intense population density, the area of greatest livestock density and the area of greatest land degradation, recorded measurements of soil loss by water erosion range from 3.4 to 84.5 tons per ha per year with a mean of 32.0 tons/ha/year. While losses are uneven this represents a loss of 4 mm of soil a year, twenty or more times replacement rates. Some of these measurements do not allow for the benefits of redeposition of eroded material. Some redeposition is far away in Sudan and Egypt but some is more local partly reducing these losses. However, the effects of physical soil loss is accompanied by the impacts
of nutrients lost by erosion especially nitrogen and phosphorus. Estimates of losses from soil and nutrient loss are considerable (Bojo & Cassells 1995, Sutcliffe 1993).

**The Cost Of Land Degradation In Ethiopia**

The costs of land degradation in Ethiopia include:

**Direct Costs** -
- Costs of nutrients lost with top soil erosion (or the replacement costs of these nutrients)
- Lost production due to nutrient and soil loss
- Costs of forest removal
- Loss of livestock carrying capacity

**Indirect Costs** –
- Loss of environmental services
- Silting of dams and river beds
- Increasing irregularity of stream and rivers and reduced groundwater capacity

Other indirect costs relate to social and community losses due to malnutrition, poverty and migration, while poverty is compounded by the lack of economic marketing structure. Some of these costs can and have been quantified, others are more difficult (Bojo and Cassells. 1995).

As estimates of the severity of land degradation in Ethiopia vary so do cost estimates. Almost all estimates of cost relate to the loss of soil and of nutrients from agricultural or grazing lands. They do not take into account the impact of soil redeposition which may be harmful such as the cost of silting of lakes, reservoirs and rivers, or may sometimes add productivity to depositional areas. Bojo and Cossells (1995) modified earlier estimates by Sutcliffe and the EHRS to reduce estimates of the cost of soil erosion, but to greatly increase the estimates of losses due to nutrient removal from agricultural areas. In 1994 they estimated a loss of $106 million a year or about three percent of agricultural GDP from a combination of soil and nutrient loss. The gross discounted cumulative loss was calculated at $1.948 billion U.S. The estimated other losses on an annual basis include $23 million a year on forest losses due to deforestation and $10 million a year due to loss of livestock capacity the equivalent of almost 1 million livestock units. This total loss of $139 million annually is almost 4% of agricultural GDP.

None of these cost estimates takes consideration of a whole range of costs which cannot at present be quantified. These include the human capital costs of drought and malnutrition, the costs and benefits of migration streams within and outside Ethiopia partly driven by rural poverty and the environmental services costs due to the impact of heavy sediment streams on the rivers of Ethiopia and on other countries such as Sudan, Somalia and Egypt.

The estimated range of losses through soil degradation for two important crops is shown in Table 2a. The data in the table are derived from nutrients studies in areas of high and low nutrient loss. Table 2b shows the losses in those two situations. The total loss per hectare of wheat is about 400 birr ($46) per hectare in areas of low loss and 4736 birr ($544) per hectare in areas of high soil loss. The comparable data for maize is $31 and $379. If we applied the lowest level of loss ($31 ha to the 54 million hectares of cropland in the highlands, we have a total of $1.674 billion.
Table 2a. Calculated Loss In Grain Yield Due To Losses In Nitrogen Through Erosion

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield lost (kg) per kg N lost</th>
<th>Range of nutrient loss N (kg/ha)</th>
<th>Range of nutrient loss N (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Crop response ratio)</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Maize</td>
<td>9.6</td>
<td>36</td>
<td>429</td>
</tr>
<tr>
<td>Wheat</td>
<td>6.9</td>
<td>36</td>
<td>429</td>
</tr>
</tbody>
</table>

Source: Sertsu 1999. Integrated soil management for sustainable agriculture and food security in Southern and East Africa

Table 2b. Monetary Values Of Crop Yield Losses As A Result Of Soil Degradation

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield lost (Mg/ha)</th>
<th>Grain Price (Birr/kg)</th>
<th>Total loss (Birr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Wheat</td>
<td>0.248</td>
<td>2.960</td>
<td>1.60</td>
</tr>
<tr>
<td>Maize</td>
<td>0.345</td>
<td>4.118</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Source: Sertsu 1999. Integrated soil management for sustainable agriculture and food security in Southern and East Africa

Sonneveld (2002) developed a complex model for the assessment of current and future impact of water erosion on food production in Ethiopia. The model developed several scenarios for the potential production from agricultural land in Ethiopia (Table 3).

In Scenario 1 no additional land and water conservation measures are adopted. Under this scenario total national agriculture remains stagnant. Water erosion reduces potential production by 10% by 2010 and 30% by 2030, but during this time period additional labor from rural population growth more or less compensates for the decline. Obviously agricultural value per capita drops from $372 U.S. in 2000 to $162 in 2030, while food availability per capita drops from 1971 Kcal per day in 2000 to 685 Kcal per day in 2003. This is a disaster scenario.

Other scenarios all assume greater flexibility for migration and for technology impact. Each scenario points to the need for a sustained focus on rural production together with conservation of natural resources. However, a vital agricultural sector will also depend on “the accelerated growth of non-agricultural activities” in rural areas. This study emphasizes the need for a combined conservation investment and infrastructural approach.

Sonneveld estimates that the loss of agricultural value due to land degradation between 2000 and 2010 would be $US 7 billion; a huge sum in relation to current investments in sustainable land management.

These varied estimates reflect the uncertainty of the data but all illustrate the magnitude of the problem. Whether direct losses are in the lower end of the range at $139 million a year or at the upper end at over $1 billion a year, the costs of unsustainable land management are an important element in recurring food shortages and famine in Ethiopia.
Table 3. Summary of Scenario Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Soil Conservation</th>
<th>Net Food production (in billion USD; PPP)</th>
<th>Food per Capita (in Kcal)</th>
<th>Value added per capita: rural population (in USD; PPP)</th>
<th>Value added per capita: total population (in USD; PPP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stationary</td>
<td>No</td>
<td>12.4 12.0</td>
<td>1083 685</td>
<td>218 162</td>
<td>627 1267</td>
</tr>
<tr>
<td>2. Control</td>
<td>Yes</td>
<td>17.8 18.7</td>
<td>1611 1085</td>
<td>324 260</td>
<td>709 1330</td>
</tr>
<tr>
<td>3. Migration</td>
<td>Restricted</td>
<td>15.9 16.1</td>
<td>1242 786</td>
<td>263 198</td>
<td>662 1290</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>23.2 25.0</td>
<td>1801 1213</td>
<td>383 307</td>
<td>754 1360</td>
</tr>
<tr>
<td></td>
<td>Free</td>
<td>16.9 17.1</td>
<td>1317 833</td>
<td>279 210</td>
<td>674 1298</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>24.2 26.0</td>
<td>1878 1264</td>
<td>399 320</td>
<td>767 1368</td>
</tr>
<tr>
<td>4. Technology</td>
<td>Stationary/UN</td>
<td>43.5 42.9</td>
<td>3978 2681</td>
<td>706 519</td>
<td>1004 1497</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>65.4 42.1</td>
<td>6228 5852</td>
<td>1060 1038</td>
<td>1277 1833</td>
</tr>
<tr>
<td></td>
<td>Stationary/AccUrb</td>
<td>43.5 46.4</td>
<td>3968 2605</td>
<td>705 508</td>
<td>1021 1661</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>65.3 84.4</td>
<td>6212 5682</td>
<td>1058 1021</td>
<td>1366 1992</td>
</tr>
</tbody>
</table>

Source: Sonneveld 2002 p 192.

Stationary: No soil conservation – current technology – continued in-situ population growth
Control: Investment in soil conservation halting/reducing decline–continuing in-situ population growth
Migration: Restricted – indicates movement within orbit of traditional ethnic groups
Free – indicates movement within and across ethnic boundaries
Technology: Assume better quality produce and higher potential levels of production

Apparent Root And Proximate Causes Of Land Degradation

There are multiple interacting forces, which have caused and are causing land degradation in Ethiopia. The proximate causes include clearing of woodlands and forests, unsustainable arable farming techniques, the use of dung and crop residues for fuel and overstocking of grazing lands.

PROXIMATE CAUSES

Woodland Clearing
The clearing of forests has been a long historical process in Ethiopia and it continues at a conservatively estimated rate of 62,000 ha per year. This is mostly converted into cropland with a greatly reduced vegetative cover and accelerated soil erosion. Also importantly the change in land use can change the hydrological pattern of run off, reducing infiltration and increasing stream flow during and after rain.

Arable Land Management
Most arable land (70%) in the highland is in cereals, with wheat and barley in the higher ground and teff, sorghum and maize in the lower elevations. All these crops leave bare areas of soil
during some or all of the growing season exposing soil to erosion. Twenty percent of the cultivated area is in perennial crops including coffee, enset (similar to banana), oil seeds, fruit trees and cotton. Pulses occupy the remaining ten percent. Enset (found only in Ethiopia) in particular provides good ground cover, needs manure, and is a good crop to maintain fertility.

The annual crops are mainly planted after the rains begin, allowing early rains to directly impact the soil contributing to high erosion levels. Additionally, as a population grows more fragile marginal lands are used. A further result of population growth is the reduction in fallow periods in some areas from a five-year rotation to a two-year or even shorter rotation.

**Dung And Crop Residues**

As rural populations have grown and woodland is converted to cultivation, the use of dung and crop residues for fuel has become much more important. A 1989-90 study suggests that nationwide 18 percent of energy in rural areas is supplied by dung and crop residues and this percentage has probably grown since then (Table 4).

<table>
<thead>
<tr>
<th>Table 4. Estimates Of Consumption Of Household Energy (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuel</strong></td>
</tr>
<tr>
<td>Wood/Charcoal</td>
</tr>
<tr>
<td>Dung</td>
</tr>
<tr>
<td>Crop residues</td>
</tr>
<tr>
<td>Kerosene, gas</td>
</tr>
<tr>
<td>Electricity</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Source: Ethiopia 1993, annex 6.2, p. 3

Specific studies in two upland villages showed maize and sorghum stalks providing 69 percent of total fuel and use in one, and dung providing 50 percent of energy use in the other. With fuel wood increasing in scarcity these numbers can only have increased.

The situation with energy use is one of the most critical land degradation issues in Ethiopia. Estimates of current demand for fuel wood approach 55 million cubic meters per year with an estimated sustainable production of 13 million cubic meters per year. While per capita use may be reduced and tree-planting programs may meet some of the gap the pressure on the growing use of crop residues and dung for fuel will continue and the pressure on soil productivity will increase.

**Overgrazing Of Pasturelands**

It has been estimated (Melese 1992) that 20 percent of total soil erosion is from pasturelands and livestock density data show that current stocking rates are well above optimum rates though in some areas for example Tigray improvements have occurred (see page 8). The data in Table 5 is from 1993 and some densities may have increased since then.
Table 5. Current And Optimum Livestock Stocking Densities (hectares/TLU)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Stocking Rates</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current</td>
<td>Optimum</td>
</tr>
<tr>
<td>HPP (Highlands)</td>
<td>1.49</td>
<td>1.45</td>
</tr>
<tr>
<td>HPC (Highlands)</td>
<td>1.28</td>
<td>1.51</td>
</tr>
<tr>
<td>LPC (Highlands)</td>
<td>1.51</td>
<td>3.21</td>
</tr>
<tr>
<td>Lowlands</td>
<td>5.44</td>
<td>4.07</td>
</tr>
</tbody>
</table>

Source: Adapted from the EFAP (Ethiopia 1993, p. 49).

Root Causes Of Land Degradation

Among the interacting root causes of land degradation in Ethiopia are:

- The impact of natural conditions especially periodic drought, inaccessibility of rural areas due to topographic constraints
- Steady growth of population and livestock totals without changes in agricultural and other economic systems
- Historical patterns of feudal ownership of land followed by government ownership and despite policy changes uncertain status of land ownership
- Institutional overlap, duplication of effort and shortage of financial resources
- Lack of rural infrastructure and markets
- Lack of participation of stakeholders in management decisions especially at the local level
- Weak extension services
- Low technology agriculture, leading to risk aversion and reliance on cattle as wealth

Natural Conditions

Basic physical conditions in Ethiopia, which impact land 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.

Population Growth

With increasing numbers of people there has not been a related change in the pattern of agriculture, which is still essentially small holder relying on expanding the cultivated area, often into marginal land, rather than adopting intensification techniques. There is still a strong tendency to hold wealth as livestock, often cattle, further impacting grazing resources.

Land Ownership

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.
Institutional Issues
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.

Rural Markets
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.

Participation and Extension
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.

Low Technology 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.

Economic Returns From Land Degradation Investments
Root Causes
Land degradation has been long recognized as a major impediment to economic growth and famine preparedness in Ethiopia, and efforts have been made to address the problem especially in the last quarter of the 20th century. Since 1999 when the TGE obtained power, the national policy has been “Agricultural Development Led Industrialization”. This policy included improvements in agriculture sector technology and management, investment in infrastructure and other impacts to agriculture, and increasing farm size with a reduction of the population depending directly on agriculture.

Conservation and sustainable land management was not a highlight of the original policy, but has received more attention recently (Benin et. al. 2002). Specific programs usually sponsored by bilateral or multilateral donors have been initiated. Many of these have dealt with the physical infrastructure. For example between 1976 and 1985, 600,000 km of soil and stone bunds were constructed on arable land, 500,000 km of hillside terraces were constructed, 500 million tree
seedlings were planted and 80,000 ha set aside for natural regeneration. However, by the mid 80’s conservation activity had impacted only 1 percent of the highlands only 15-20 percent of seedlings had taken root and much of the physical infrastructure was imposed without much input from stakeholders and in some cases involved coercion. Consequently, these structures were not well maintained.

Some insights of the impacts of measures to combat land degradation may be gained from specific studies (See Annex 2).

Ethiopia continues to rely heavily on donor support for sustainable land management activities and that support has varied considerably from year to year. Ongoing and recent projects in 2002 are listed in Annex 3 (Tables 6, 7 and 8). Project assessments and outcomes are not generally available, but an analysis of the types of projects provides some insight into the approaches taken. Of the projects in Table 6, $275m of the total is devoted to the Southeast Rangelands project, $11m is for forest inventory and conservation, $14m in environmental support and the rest are relatively small scale. The regional assistance projects in Table 7 are more directed to agricultural and environmental management support with a prime focus on Amhara ($94.7m) with Oromiya ($32.8m) and Tigray ($10.5m), accounting for the rest. Table 8 lists the most important World Bank agriculture and natural resource management projects. Livestock and range management was a major focus from 1973-1985 with investments of over $71m. Peasant agricultural development mostly focused on fertilizer provision together with some investment in small-scale irrigation and water management. Ongoing projects address food security and agricultural research and training. While few projects address land degradation issues directly, this is a component of several.

FAO (FAO/AGL – MADS – SEA) 2003 additionally lists the following: Soil Conservation Research Project (Swiss and Dutch ALD), National Soil Service Project (FAO/UNDP), Land Use Project (FAO/UNDP), Vertisol Management Project (Dutch), and Management of Degraded Soils in the Rift Valley (AUCC-CIDA).

If we examine the root causes of land degradation as identified in this document relatively few have been directly addressed by the current range of projects or by government action. A World Bank project is addressing decentralized agricultural research and restoration, and food security issues are the focus of a number of donors. However, at his opening address to a recent conference Vice Minister Belay Ejigu (Minister of Agriculture, Ethiopia) reported on the findings of a research project “Policies for Sustainable Land Management in the Highlands of Ethiopia”. He said,

“Results of the study indicate that population pressure has a negative impact on the natural resource conditions in the highlands. Better market access, credit services, and technical assistance programs can have positive impacts on land improvements and resource and welfare conditions, indicating that ‘win-win’ development strategies can reduce land degradation and poverty, and increase agricultural productivity.

However, the strategies need to be tailored to local conditions. In low rainfall environments such as much of Tigray, responsiveness to fertilizer and improved seeds has been found to be less than in high rainfall areas. Other strategies, such as promoting development have been found to yield substantial returns. Population policy/programs have been identified as one of the priority intervention areas, and efforts made so far in
this regard, together with provision of improved market access, have resulted in encouraging outcomes. Involving local communities in natural resource management has been found to be more sustainable and beneficial in areas with intermediate population that are far away from towns. Literacy will no doubt contribute towards more sustainable development in the highlands.

Although these findings are very useful, it will be important to develop some pilot policy experiments to test ‘on the ground’ some of the findings before we scale up to many regions in the country.”

Annex 4 (from McKonen 2002) outlines the main priority issues from an Ethiopian perspective and links to a substantial degree with the root causes listed above. While sectoral issues are being addressed to some extent the policy, institutional and participation issues are not highlighted. Yet the studies quoted in Annex 2 indicate that these, especially farmers and herders perceptions, are key components of successful approaches. In addition, it seems important that regional approaches, which include policy, land tenure, market development and farmer support might be effective ways to move forward.

**Conclusions**

While the focus of most activities to arrest land degradation and improve productivity have been on the physical parameters of the problem and these are important, the priority issues appear to be the following:

- Developing a long term locally acceptable set of land management rights and responsibilities
- Improving marketing infrastructure both physical (roads) and pricing (Shiferaw & Holden 1997)
- Give high priority to fuel provision on a regional basis through conservation, woodlands, use of conservation technologies
- Improve extension capacity especially with respect to sustainable land management
- Develop diversified rural enterprises in the context of an enhanced pattern of local and regional markets

In addition continued approaches to deal with the proximate causes of land degradation should include:

- Woodland protection
- Improved productivity of the livestock sector.
- Greater participation of local farmers and herders in the identification of local land degradation issues and their remediation.

It could be that the next important step for Government and donors it to take Minister Belay Ejigu’s advice (page 12) and develop projects which will move effective research findings into on the ground projects, but at the same time addressing the key policy issues.
REFERENCES


FAO 1998a. The Soil and Terrain Data Base for north-eastern Africa. Land and Water Digital Media Series 2. FAO, Rome, Italy

FAO 1998b. Cropping Production Systems Zones of the IGAD. Land and Water Digital Media Series 2. FAO, Rome, Italy

FAO 2003. FAO/AGL – MADS – SEA website


Annex 1. Background

Arable land occupies about 10 percent of the total land area but permanent cropland only 0.7 percent. The remaining area is pastureland or infertile and/or severely degraded. Current (2002) population of Ethiopia is estimated at 67 million almost doubling since 1975. Urban population is around 11 million and most of the remaining rural population is represented by over 7 million small farmer-household, which produce 95% of agricultural output on 0.5 – 1.5 ha plots with additional grazing lands. Food crops including 6.8 m ha under cereal production together with oil seeds and pulses are the mainstream of this production sector. Cotton and sugar are produced on state-owned large-scale enterprises. Ethiopia also has large livestock resources including cattle, sheep, goats and camels as well as small stock totaling 32 million TLU’s or 78 million animals. Significantly, the average annual growth rate of major food grains production is 0.6% while the population growth rate is over 2 percent (National Review Report 2002).

Most of the agricultural production system is located on the Ethiopian Highlands where 88 percent of the total population lives at an average density of 144 per Km². Most analyses of the impact of land degradation in Ethiopia are thus focused on the highland zone of the country.

Nationally forest reserves have been heavily depleted sequentially over much of the 20 century from over 40 percent to 2.2 percent in 2000. The annual deforestation rate is 0.8 percent in this greatly reduced forest area.

Ethiopia is noteworthy as the country of famine. Food shortages are endemic and since 1970 severe famine has occurred almost once a decade (1973; 1982 – 1984 early and late 1990’s and 2002 – 2003). Although there are many contributing factors, land degradation is an important underlying cause, periodically highlighted by low and uncertain rainfall.
Annex 2. Findings of Local Studies on Land Degradation

**Highlands Cultivation**

This study analyzed the impact of soil erosion in the region and differential farmer’s perceptions of and responses to the problem. Gully erosion and the removal of fertile topsoil are the major forms of land degradation, resulting in reductions in land productivity and also significant sedimentation in local lakes. This sedimentation reduces water availability, particularly for irrigation of the critical intercropping of sorghum, maize and chat, the later a popular stimulant. In the area provision of incentives are important components of local farmers willing to undertake SWC measures, with fertilizer provision a key incentive.

The more general message is that SWC and sustainable land management is most effective when specific farmer perceptions and priorities are taken into account. In this case water scarcity is a prime problem affecting farm productivity and a comprehensive rather than sector approach to land use planning is critical.


**Tigray Cultivation**

In Tigray the rate of return on investment in stone terraces was about 25% and terraces were correlated with increased use of fertilizer. Reduced burning, reduced tillage and application of manure and compost had even more positive results. “Promotion of such conservation practices and exploitation of complementary livestock production show more promise to boost crop production than large applications of modern inputs.

High Mountain Grazing Lands

In North Ethiopia land degradation is centuries old due to cultivation on steep slopes and intensive grazing. As a result the area is characterized by shallow soils, diminished water-holding capacity and greatly reduced herbaceous and woody vegetation cover. In Eastern Tigray, North Ethiopia 65% of the open grazing lands are severely degraded and in Northwest Ethiopia forest cover reduced from 27% to 0.3% between 1957 and 1995 (Tekh 1999).

In response to these severe levels of degradation land rehabilitation funded mainly by food for work program in Hauzien Wereda allowed some 143,000 ha to be restored by adopting area enclosures and stone terracing. The enclosed areas were protected from grazing and interference for three years, during which period grass and herbaceous plants covered 60 – 80% of the area. After three years grass harvesting took place yielding 2 – 3.5 times as much dry matter as in the continuously grazed areas. An additional benefit in the older protected areas was the production of harvestable woody vegetation.


Livestock, Livelihood and Land Management

Population growth has led to deforestation and the conversion of pastureland to crops leading to overstocking and further degradation. Crop residues are increasingly used for fuel rather than mulch. Dung is used as fuel rather than manure. All these factors lead to nutrient loss and increased erosion. Studies of Amhara, Tigray and Oromiya regions, show decline in livestock population for different reasons between regions. Pastureland decreased in quality over the past ten years except in Tigray where common grazing land management improved quality slightly. While in general the traditional nutrient cycling has been broken, this is not so in Oromiya. Use of dung and crop residues for energy are common in the High and Low potential cereal zones not in intermediate perennial zone.

Soil erosion and fertility problems are more serious in the HPC and LPC zones Semi-subsistence smallholder crops – livestock system facing problems; – 49% of population below the absolute poverty line so the cereal crop is the major priority.

**Policy Issues**

“To the extent that investments in land improvement are necessary for conservation purposes, it appears that ending future land distributions alone will not have much impact on reducing land degradation. However, ending redistribution in addition to allowing the current rental market to operate freely and encouraging longer leases may have more impact on the land degradation problem.” pp 94


---

**Southern Highlands**

A case study on responses to land degradation provides data and insight from the Southern Highlands. As elsewhere yields and farm incomes have declined, while the poorer farmers particularly have fewer resources to invest in soil conservation and/or fertilizers. The decline in fertility and responses to potential responses varied across the five socio-economic groups, but with fertility in remote fields declining more rapidly than the more nurtured close fields.


---

**Health and Sustainable Land Management**

The adoption of more efficient farming practices and technologies that enhance agricultural productivity and improve environmental sustainability is instrumental for achieving economic growth, food security and poverty alleviation in sub-Saharan Africa. Our research examines the interaction between public investments, community health, and adoption of productivity and land enhancing technologies by households in the northern Ethiopian state of Tigray.

Agricultural technology adoption decisions are modeled as a sequential process where the timing of choices can matter. We find that time spent sick and opportunity costs of caring for sick family members are significant factors in adoption. Sickness, through its impact on household income and labor allocation decisions for healthcare and other activities, significantly reduces the likelihood of technology adoption. Our findings suggest that agencies working to improve agricultural productivity and land resource conservation should consider not only the financial status of potential adopters, but also their related health situation.

From: Ersado, et.al., 2003 IFPRI
Annex 3. On-going Land Degradation Related Projects in Ethiopia
Table 6. Multilateral and Bilateral Assistance for Sectoral Projects/Programmes in Agriculture and Natural Resources

<table>
<thead>
<tr>
<th>No.</th>
<th>Sectoral Project</th>
<th>Implementing Agency</th>
<th>Funding Agency</th>
<th>Project Budget (in millions US$)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental Support Project</td>
<td>MoWR</td>
<td>Netherlands Gov’t</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>The Woody Biomass Inventory and Development Project – WB.II</td>
<td>MoA</td>
<td>Netherlands Gov’t</td>
<td>9.35</td>
<td>4 years</td>
</tr>
<tr>
<td>3</td>
<td>Ethiopian Forest Conservation in High Priority Areas</td>
<td>MoA</td>
<td>WWF</td>
<td>1.74</td>
<td>4 years</td>
</tr>
<tr>
<td>4</td>
<td>Strengthening Forest Fire Management in Ethiopia</td>
<td>MoA/FAO</td>
<td>FAO</td>
<td>0.35</td>
<td>2 years</td>
</tr>
<tr>
<td>5</td>
<td>South – East Rangelands Project Phase II</td>
<td>MoA</td>
<td>ADB</td>
<td>275</td>
<td>5 years</td>
</tr>
<tr>
<td>6</td>
<td>National Fertilizer Development Study Project</td>
<td>MoA</td>
<td>ADB</td>
<td>1.8</td>
<td>3 years</td>
</tr>
<tr>
<td>7</td>
<td>Rehabilitation 15 Small Scale Irrigation in Four Regions of Ethiopia</td>
<td>MoA</td>
<td>-</td>
<td>4</td>
<td>3 years</td>
</tr>
<tr>
<td>8</td>
<td>Honey and Beeswax Production and Market improvement Project</td>
<td>MoA</td>
<td>FAO</td>
<td>0.31</td>
<td>2 years</td>
</tr>
<tr>
<td>9</td>
<td>Accelerating the Impact of Agro-forestry Research and Development in East and Central Africa</td>
<td>EARO</td>
<td>EU</td>
<td>2.8</td>
<td>5 years</td>
</tr>
<tr>
<td>10</td>
<td>Research and Transfer of Technology for Sustainable Barley Production in Ethiopia (Phase II Project)</td>
<td>EARO</td>
<td>Netherlands Gov’t</td>
<td>2.7</td>
<td>3 years</td>
</tr>
<tr>
<td>11</td>
<td>Southern Wello Agricultural, Productive and Water Resources Activities</td>
<td>EARO</td>
<td>Italian Gov’t.</td>
<td>2.0</td>
<td>18 months</td>
</tr>
<tr>
<td>12</td>
<td>Tigray RSA, Productive and Water Activities</td>
<td>Lrc-Italian Agency</td>
<td>Italian Gov’t.</td>
<td>-</td>
<td>18 months</td>
</tr>
<tr>
<td>13</td>
<td>Farmers Utilization of Biodiversity in Agro-Ecosystems in Ethiopia</td>
<td>Mekele University</td>
<td>Netherlands Gov’t</td>
<td>1.1</td>
<td>5 years</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>317.98</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 7. Regional Assistance For Agricultural And Natural Resources Programmes/Projects

<table>
<thead>
<tr>
<th>No.</th>
<th>Sectoral Project</th>
<th>Implementing Agency</th>
<th>Funding Agency</th>
<th>Project Budget (in millions US$)</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Southern Region Agricultural Support Service Project</td>
<td>SNNPR</td>
<td>ODA/UK</td>
<td>4.8</td>
<td>5 years</td>
</tr>
<tr>
<td>2</td>
<td>IFAD Special Country Programme</td>
<td>Oromia</td>
<td>IFAD</td>
<td>32.8</td>
<td>6 years</td>
</tr>
<tr>
<td>3</td>
<td>Sida Support to Natural Resources Management and Environmental Protection</td>
<td>Amhara</td>
<td>SIDA</td>
<td>2.3</td>
<td>5 years</td>
</tr>
<tr>
<td>4</td>
<td>Sustainable Agricultural and Environmental Rehabilitation of Drought Prone Ethiopian Highland</td>
<td>Tigray</td>
<td>SIDA</td>
<td>2.3</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Integrated Watershed Management in the Amhara Regional State</td>
<td>Amhara</td>
<td>Netherlands Gov’t</td>
<td>3.4</td>
<td>4 years</td>
</tr>
<tr>
<td>6</td>
<td>Sustainable Development Project Adi-ArKay</td>
<td>Amhara</td>
<td>UNCDF</td>
<td>9</td>
<td>5 years</td>
</tr>
<tr>
<td>7</td>
<td>Agricultural Research Intervention for Food Insecured Woredas</td>
<td>Amhara</td>
<td>USAID</td>
<td>5</td>
<td>5 years</td>
</tr>
<tr>
<td>8</td>
<td>Water Harvesting and Institutional Strengthening</td>
<td>Tigray</td>
<td>CIDA</td>
<td>6</td>
<td>6 years</td>
</tr>
<tr>
<td>9</td>
<td>Agricultural Extension and Training Project</td>
<td>Amhara</td>
<td>USAID</td>
<td>70</td>
<td>5/7 years</td>
</tr>
<tr>
<td>10</td>
<td>An Integrated Participatory Watershed Management and Sustainable Water Resource Development Erosion Prone Areas</td>
<td>Amhara</td>
<td>Netherlands Gov’t</td>
<td>2.8</td>
<td>4 years</td>
</tr>
<tr>
<td>11</td>
<td>Low-Pressure Drip Irrigation in Arbaminch Water Technology</td>
<td>SNNPR</td>
<td>Governments of Israel</td>
<td>-</td>
<td>5 years</td>
</tr>
<tr>
<td>12</td>
<td>Improving Nutrition and Household Food Security</td>
<td>Tigray and Amhara FAO</td>
<td>Belgium Survival Fund</td>
<td>4.4</td>
<td>4 years</td>
</tr>
<tr>
<td>13</td>
<td>Biodiversity of Lake Tana and its Watershed Project</td>
<td>Amhara</td>
<td>GEF</td>
<td>0.036</td>
<td>1/2 years</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td><strong>145.8</strong></td>
<td></td>
</tr>
</tbody>
</table>

## Table 8. World Bank Projects: IBRD/IDA Projects Related to Natural Resource Management

<table>
<thead>
<tr>
<th>TITLE</th>
<th>$ MILLIONS</th>
<th>PERIOD</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peasant Agricultural Development Program</td>
<td>85</td>
<td>1988–1997</td>
<td>70% for fertilizer, the rest for inst support for peasant sectors</td>
</tr>
<tr>
<td>Livestock Project</td>
<td>5</td>
<td>1973–1979</td>
<td>Stock Routes &amp; Marketing</td>
</tr>
<tr>
<td>Rangelands Development Project</td>
<td>27</td>
<td>1975–1985</td>
<td>Land Planning &amp; Range Management for Gradual Control of Numbers, Boreholes, Marketing Infrastructure</td>
</tr>
<tr>
<td>Water Supply Development &amp; Rehabilitation</td>
<td>35.7</td>
<td>1996–2003</td>
<td>Urban &amp; Rural Water Supply Infrastructure</td>
</tr>
<tr>
<td>Agricultural Research &amp; Training</td>
<td>60</td>
<td>1998–2005</td>
<td>Building an Effective Agricultural Research System on a Decentralized Basis</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>1.8</td>
<td>2001–2006</td>
<td>Medicinal Plants &amp; Health Care</td>
</tr>
<tr>
<td>Conservation &amp; Sustainable use of Medicinal Plants</td>
<td>2.6</td>
<td>2001–2005</td>
<td>Medicinal Plants &amp; Health Care</td>
</tr>
<tr>
<td>Food Security</td>
<td>85</td>
<td>2002–2009</td>
<td>Build Resource Base of Poorer Rural Households</td>
</tr>
</tbody>
</table>
## Annex 4.

### Major Issues And Priority Areas In Combating Land Degradation And Poverty

<table>
<thead>
<tr>
<th>Important Issues</th>
<th>Main Problems; why it is an issue?</th>
<th>Desired Situation (Objective, aim)</th>
<th>Measures to be taken (Strategy)</th>
<th>Responsible Body</th>
</tr>
</thead>
</table>
| Participation    | - Lack of an enabling environment  
                  - Lack of awareness  
                  - Misconception of partnership | - Enhancing enabling environment  
                  - Enhancing partnership  
                  - Devolution of power | - Awareness creation  
                  - Clear definition of partnership  
                  - Empower local governance | GOs, NGOs, International partners |
| Land tenure      | - Insecurity of tenure               | - Ensure long term use through issuing a sort of title deed | - Proper land use policy and legislation  
                  - Promote proper indigenous practices | Federal and Regional Governments |
| Inappropriate land use system | - Steep slope farming  
                  - Deforestation  
                  - No or short fallowing period  
                  - Lack of modern technologies  
                  - Lack of know-how  
                  - Overgrazing  
                  - Population pressure | - In place land use and ownership policy  
                  - Forest policy  
                  - Availability of modern know-how and technology  
                  - Grazing management policy and legislation  
                  - Population policy (in place) | - Issues appropriate policies and legislation on land use, forest, SWC and grazing management  
                  - Educate the public  
                  - Implement population policy  
                  - Make available modern technology through research | - Federal and Regional Governments  
                  - NGOs/CBOs  
                  - Development Partners |
| Livestock population | - Overgrazing/uncontrolled grazing  
                  - Quantity valued than quality | - Livestock number balanced to the available feed resources | - Increase off-take rate  
                  - Change the mgt system from open to zero grazing | Govt’s, NGOs/CBOs, communities |
| Population pressure | - Man to land ratio incompatible  
                  - Uncontrolled growth  
                  - Women not educated and empowered to control their own fertility | - Population growth balanced to economic growth  
                  - Family planning exercised  
                  - Women empowered | - Proper implementation of the population policy (family planning)  
                  - Alternative employment opportunity created  
                  - Resettlement  
                  - Educate and empower women | - Governments  
                  - NGOs/CBOs  
                  - Development partners |
<table>
<thead>
<tr>
<th>Important Issues</th>
<th>Main Problems; why it is an issue?</th>
<th>Desired Situation (Objective, aim)</th>
<th>Measures to be taken (Strategy)</th>
<th>Responsible Body</th>
</tr>
</thead>
</table>
| Poverty          | - Unbalanced population growth vis-à-vis economic growth  
- High unemployment rate  
- Low productivity (Land/man)  
- Lack of poverty reduction strategy  
- Inequitable share and distribution of resources and services  
- Hunger, illiteracy, etc.  
- Deprivation of basic needs (food, shelter, cloth) | - Economic growth balanced to population growth  
- Access to basic needs  
- Access to social services  
- Equitable sharing and distribution to resources and services | - Integrate economic development with population controlled strategy  
- Encourage labor intensive investment  
- Improve the quality of the population through education, knowledge and skill  
- Promote equitable share and distribution of resources and services | - Governments  
- NGOs/CBOs  
- Development partners  
- Population |

<table>
<thead>
<tr>
<th>Important Issues</th>
<th>Main Problems; why it is an issue?</th>
<th>Desired Situation (Objective, aim)</th>
<th>Measures to be taken (Strategy)</th>
<th>Responsible Body</th>
</tr>
</thead>
</table>
| Institutional failures | - Institutional instability  
- Overlapping of mandates  
- Shortage resources  
- Integration and coordination problem  
- Lack of a common forum | - Stable with clear mandates institutions  
- Adequate resources  
- Clear mechanism of integration and coordination  
- Established M&E | - Establish institution with clear mandate and empowerment  
- Secure appropriate resources  
- Create a mechanism where institutions integrate and coordinate their activities  
- Established M&E | - Federal Govt’s  
- Regional States  
- NGOs  
- Development partners |

<table>
<thead>
<tr>
<th>Important Issues</th>
<th>Main Problems; why it is an issue?</th>
<th>Desired Situation (Objective, aim)</th>
<th>Measures to be taken (Strategy)</th>
<th>Responsible Body</th>
</tr>
</thead>
</table>
| Investment       | - Conflict with NR conservation measures  
- Low investment on off-farm activities | - Proper EIA  
- Labor intensive investment promoted | - EPA should be empowered  
- Labor intensive investments should be encouraged | - Governments  
- Private investors  
- Development partners |

<table>
<thead>
<tr>
<th>Important Issues</th>
<th>Main Problems; why it is an issue?</th>
<th>Desired Situation (Objective, aim)</th>
<th>Measures to be taken (Strategy)</th>
<th>Responsible Body</th>
</tr>
</thead>
</table>
| Infrastructure and market failures | - Lack of access to market  
- Lack of access to services (school, light, clinic, water grinding mill, communication, extension and family planning services) | - Access to services  
- Access to markets | - Improve rural infrastructure and services  
- Promote appropriate energy saving technology  
- Develop alternative renewable energy system | - Federal and Regional Governments  
- NGOs/CBOs  
- Development partners |

Source: MeKonen, G. 2002