Natural Resource Management Options for Sustainable Farming in Highland Ethiopia

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1. Background

In Ethiopia, agriculture constitutes the largest share of the national economy; it accounts for about 45 percent of the GDP, 85 percent of exports and 80 percent of the total employment (FDRE 1997). However, the country is facing severe problems of agricultural stagnation and decline, high population growth rate, and degradation of the natural resource base (Hurni 1987, Shiferaw 1997). Of the natural resources, the degradation of agricultural land is a serious environmental, socio-economic and policy challenge to the country. The problem is particularly severe in the highlands (>1500 m a.s.l.) which constitute over 43 per cent of the country's total area, 95 per cent of the cultivated land, and about 88 per cent of the human and 75 per cent of the livestock populations.

Land degradation due to soil erosion and nutrient depletion has remained a predicament to agricultural production over the past many decades. As a result, the country is precariously affected by recurrent food shortages that claimed the lives of thousands of its population and that made the millions underfed. Although data on the extent of the problem are quite thin and patchy, available studies highlight the severity of the problem. According to FAO (1993), about half of the highlands (270,000 km2) are already significantly eroded. Of this, 140,000 km2 are seriously eroded and have been left with relatively shallow soils. Estimates from plot level studies have also shown that the rate of soil loss is high from cultivated areas (42 t/ha) (Hurni 1987). Assessment of soil nutrient depletion in sub-Saharan Africa (SSA) indicates that Ethiopia is among the countries with the highest rate of nutrient depletion (Stoorvogel *et al.*, 1993). The assessment estimated a negative balance of the major nutrients (NPK) for arable soils in the country; that is: – 41 kg N, – 6kg P and –26 kg K ha^{-1} yr^{-1}. This decline in soil fertility has caused annual loss in grain production of 40,000 tons (Azene, 2001). To compensate for the losses, there has been a substantial increase in the use of chemical fertilizers, mainly DAP and urea. Total fertilizer (DAP) consumption increased from 80,000 tons in 1991 to 200,251 tons in 1996 (Croppenstedt, 1999).

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In part, destruction of the natural vegetation resources contributes to the decline in soil fertility. Forests have been cleared mainly for firewood and house construction, for consumption and/or for trading. In general, deforestation in the country has been quite high. Though not based on reliable evidence (Dessalegn, 2001), it is believed that about 40 percent of the country's total area was covered with forests at the beginning of the 20th century. The extent of deforestation over the decades was so severe that the area of land under forest cover is estimated to have been reduced to 16 % in 1950, 3 % in 1980 and only to 2.7 % in 1990 (Krauer, 1988). Estimates of deforestation, mainly due to expansion of rain-fed agriculture, vary from 80,000 to 200,000 hectares per annum (FDRE, 1997). Deterioration of forest resources caused shortage of firewood, which is the main source of energy in rural Ethiopia. The use of animal dung and crop residues largely replaced firewood to counterbalance the deficit. The burning of these sources of soil humus and fertility in turn, led to a progressive deterioration in soil structure, infiltration capacity, moisture storage, and fertility (Wood, 1990).

The estimates on the extent of soil erosion and fertility depletion show the seriousness of the land degradation problem in the country, albeit there remains a lot to be researched in order to gain a better understanding of the local variations in the rate and magnitude of degradation, the causative factors, and land-users response to them.

2. Problem statement and objectives

Recognizing land degradation as a major environmental and socio-economic problem that jeopardizes the development of the country, the government of Ethiopia has made several interventions. Large-scale conservation schemes have been embarked on, particularly after the famine episodes of the 1970s. Governmental and non-governmental organizations took part in the conservation interventions. However, it is widely recognized that the conservation works have succeeded little, if not failed completely, to meet the anticipated objectives. This is mainly attributed to a wide range of technical, socio-economic, and policy constraints that make the recommended technologies inappropriate to local conditions. In particular, conservation plans and strategies have been designed and implemented in a "top-down" process without the consent and full participation of the land-users who possess indigenous knowledge and practices, which they have developed and consequently to which they have become accustomed. Direct incentives were used to encourage farmers to adopt the recommended conservation measures. However, the instruments lack continuance and were finally found out to be ineffective. Therefore, the need for a new approach to deal with the matter is

indispensable. The good use of indigenous knowledge and practices in developing, with end-users, best management practices is proposed in this research project for effective technological transfer and the development of sustainable solutions.

The overall objective of this study is, therefore, to assess and evaluate the technical and socio-economic suitability of indigenous and introduced conservation practices in a case study of a watershed in the Ethiopian central highlands, and to identify the best management practices for enhancing sustainable land use. The specific objectives are:

1. to assess and determine the extent of land degradation in the area;
2. to understand farmers' perceptions of the causes, extent and effects of land degradation and their conservation knowledge;
3. to evaluate effectiveness and efficiency of existing conservation measures and identify best management practices;
4. to investigate the determinants of land users' adoption decision for improved conservation technologies; and
5. to examine policy and institutional factors influencing land users' conservation decisions.

3. Research Questions

In accordance with the objectives, the study will address the following questions:

1. What is the extent of the land degradation, as manifested in soil erosion and nutrient degradation in the area?
2. What is the perception of the land users on the extent, causes and effects of land degradation in their locality?
3. Which conservation practices used in the area are effective and efficient in combating the problem of land degradation?
4. What are the determinants of land users' adoption decision of conservation practices?
5. What policy and institutional factors influence land users' conservation decisions?

4. Theoretical Framework

Land degradation has been a major global issue during the 20th century and will remain high on the international agenda in the 21st century because of its adverse impacts on agronomic productivity, the environment, and its effects on food security and the quality of life (Eswaran *et al.*, 2001). Accelerated erosion due to human activity is one of the major causes of land degradation and declining productivity in many developing countries of the world. During the last 40 years, nearly one-third of the world's arable land has been lost by erosion and continues to be lost at a rate of more than 10 million hectares per year (Pimental *et al.*, 1995). Productivity has declined substantially on approximately 16 percent of the agricultural land in LDCs, especially on cropland in Africa and Central America, pasture in Africa, and forests in Central America (Scherr, 1999). Present trends indicate that land degradation is likely to cause severe decline in agricultural income in the future by reducing yield and raising the cost for inputs, if it is left unchecked.

However, there are differing views on the concept and definition of land degradation as well as on the approaches followed to combat it. Barrow (1992) defined land degradation as the loss of utility or potential utility or the reduction, loss or change of features or organisms that cannot be replaced. Another definition describes it as a process that is caused by both natural forces and human intervention (Blaikie and Brookfield, 1987) resulting in the diminishing agricultural income and economic growth (Scherr, 1999). Tiffen *et al.* (1994) consider degradation as the degeneration of the natural resource base to a point where the costs of restoring it to a level where it can support people at a reasonable standard of living become prohibitively high. Common to all definitions is that land degradation entails deterioration of the resource base and declining production potential.

The problem of land degradation and the failure to combat it is explained from different perspectives. Biot *et al.* (1995) identified three sets of assumptions on which issues of land degradation in many developing countries rest. The first set assumes that the extent of, and solutions to, the problems of land degradation are well known, but the problem is to get people to implement them. The second assumes that the nature and extent of land degradation are imperfectly understood that local peoples often reject conservation technologies for good reasons and, in fact, adopt their own individual and collective approaches that have in the past resulted in sustainable livelihood practices. The third argues that suitable technologies presently exist or can readily come into existence; the problem is to understand the present structure of incentives that prevents land-users from

adopting them, and to design incentives that will induce adoption. Clearly, there exists a mismatch between the perspectives of scientists, technology developers and local professionals, and the views of the land users who are expected to implement the recommendations (Stocking & Murnaghan, 2000). Therefore, in order to answer the question as to why land users 'fail' to invest in conservation practices an understanding of the presently existing agro-ecological, socio-economic, and policy environment is required. For instance, rural economies in LDCs are often far from being competitive, and face pervasive impediments (high transaction costs and imperfect information) and weak enabling conditions (incomplete property rights) (Hoff *et al.*, 1993 cited in Shiferaw and Holden, 2000). Such policy and economic environments negatively influence land users' investment decisions.

The conditions of the land cannot be understood without studying how people use the land and the reasoning that guides their decision about land use (Mazzucato and Niemeijer, 2000). Nonetheless, this limited research on how land users make decisions (Ohlmer *et al.*, 1998) and the conditions that influence their decisions in spite of their imperative decision-making role. In relation to this, Semgalawe (1998) indicates the need for improving the framework for assessing household decision-making behaviour towards the use of land conserving technologies by incorporating both sociological aspects such as attitudes, beliefs, perceptions and intentions and economic factors. In economic terms, the decisions with regard to long-term conservation measures concern investments and usually require a whole farm analysis (de Graaff, 1996). Although there are varied and seemingly conflicting opinions, social institutions play an important role in land users' production and conservation decisions. Muzzucato and Niemeijer (2000) in a research in eastern Burkina Faso found that social networks provide the flexibility that allows land users to choose from a repertoire of technologies. This flexibility, according to them, has contributed to a cultivation system that has been able to adapt to changes without needing to resort to extreme measures. This implies that understanding the decision-making behaviour of the land users requires consideration of both internal and external influencing factors.

Building upon farmers' indigenous knowledge forms an important component of the on-going debate regarding grassroots participation in the design and implementation of effective conservation projects. Indigenous knowledge and practices play a crucial role in the decision making process by farm households. But, since most of the introduced technologies were not making good use of indigenous knowledge and techniques already present among the local people, they often failed to fully effectuate their objectives. This causes conflict between the indigenous knowledge that the farmers have and the learned experiences that have

been communicated to farmers instead of one strengthening the other (Azene, 1997). Although the concept of participation was introduced to involve land-users, it is restricted to either physical participation in terms of labour or social participation in the implementation of externally designed policies and programmes (Gupta *et al.*, 1997). Today, attention shifted from blaming backward farming practices for accelerating degradation, to identifying the constraints that were the primary cause of land-use practices that lead to degradation (Biot *et al.*, 1995). Research on the Andean agricultural systems, for example, reveals that many traditional farming practices, once regarded as primitive or misguided, are now being recognized as sophisticated and appropriate (Altieri, 1996). Recently, a growing number of African governments and international development agencies have recognized that local-level knowledge and organizations provide the foundations for participatory approaches to development that are both cost-effective and sustainable (Warren, 1991). Critchley *et al* (2001) also argue that SWC programmes should be pragmatic and start with what exists on the ground, and should look for evidence of positive local innovation. But little is known at present about the current state of indigenous resource management practices, and as a result it is difficult to design project interventions taking local practices as a starting point. This gap suggests the quest for natural resource management options that build on local knowledge and practices of the land-users.

5. Methodology

The methodology for this research combines field measurements and social research techniques. These include field assessment of erosion and nutrient losses, yield estimates, market survey, socio-economic survey using structured survey forms, participatory techniques, interviews and discussions, and personal observation. In particular, participatory approaches provide the platform for a closer look at the problems surrounding natural resource management, mutual learning and appraisal of existing management practices.

6. Progress

The field research was started in September 2002. Since then I have been mainly engaged in data collection. Alongside, the information obtained is organized and analyses are carried out. Write-up of the dissertation sections is already started and two sections are finalized and sent for publication in an international journal. The

remaining one and half years will be largely devoted for the write-up of the remaining sections of the dissertation.

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