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Land Degradation in Tanzania

Perception from the Village

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Elieho K. Shishira
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Alemneh Dejene is a consultant and Coordinator of the Soil Fertility Initiative in the World Bank's Africa Region. Elieho K. Shishira is Director of the Institute of Resources Assessment, University of Dar-es-Salaam. Pius Z. Yanda is a Senior Research Fellow at the Institute of Resource Assessment, University of Dar-es-Salaam. Fred H. Johnsen is Associate Professor at Noragric, the Agricultural University of Norway.

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FOREWORD

Inadequate farming practices, deforestation and overgrazing are the primary reasons for declining agricultural productivity in Sub-Saharan Africa. These factors, driven by socio-economic forces, manifest themselves in market, policy and institutional failures.

This study examined the dynamics of the loss of soil fertility and low productivity at the village level. In addition, it looks at the perception and response gap between officials and local land users in the diagnosis and remedy of land degradation. This gap often results in conflict, and is a major constraint to the successful implementation of policies and projects to address land degradation.

The study's findings underscore that sustainable use of land resources and successful policies and programs require appropriate enabling policies and institutional arrangements to encourage intensification of smallholder farming systems. This would, for example, include, increasing the proper use of inorganic and organic amendments, the development of low-cost soil cover and moisture management techniques, and expanding draft power. Policies would also require incorporating proven indigenous practices and knowledge into technical approaches, and ensuring local participation in decision-making.

This study was undertaken by the Environment Group, Africa Region, as a component of the Africa Region's Soil Fertility Initiative. Its findings will help shape investment programs to enhance land productivity in Sub-Saharan Africa.

Kevin Cleaver
Technical Director
Africa Region

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Alemneh Dejene

ABSTRACT

Local land users often have different perceptions and responses than officials to the land degradation problem. This has resulted in conflict with officials in diagnosing and solving the problem and is a major constraint to the successful implementation of policies and projects to address land degradation.

The study's findings underscore that sustainable use of land resources and successful policies and programs require appropriate enabling policies and institutional arrangements to encourage intensification of smallholder farming systems. Policies would also require incorporating proven indigenous practices and knowledge into technical approaches, and ensuring local participation in decision-making.

EXECUTIVE SUMMARY

Official and local land users often have quite different perceptions and responses to land degradation problems. This situation impedes successful implementation of policies and projects to address land degradation. Land degradation is also influenced by local ecological and socio-economic forces, and understanding the dynamics of these interactions at the local level would contribute to remedy the problem. Hence, this study examines the most significant issues affecting levels of productivity and land quality at the community and village level, where local land users take decision on cropping and livestock management.

The specific objectives of the study were to examine farmers' perceptions, particularly their understanding and interpretation of factors and indicators which they link to soil erosion and fertility decline, the level of degradation of crop and pastureland, and the institutional capacity to implement soil conservation and fertility measures -- with particular regard to land tenure policies, local organizations and extension service. The investigators also sought to identify the technologies, best practices and indigenous knowledge used by households to control erosion, enhance soil fertility, and increase crop and livestock productivity among smallholders.

Restoration of Soil Fertility

Farmers are aware that soil degradation, in various forms, is taking place on their farms as well as in the surrounding areas. This is based on their perception and interpretation of indicators that reveal certain conditions regarding crop and pastureland. The major indicators farmers cited included rill and gully erosion, water absorption capacity (level of run-off), exposure of roots, crop yield, change in color of crop leaves, stunted crops, emergence of weeds and unpalatable species, appearance of termite mounds, and the disappearance of grass. Most physical and plant species indicators are local and site-specific.

One approach to mitigate land degradation involves intensification of farming using sustainable production systems (such as intercropping, composting, farmyard manure, strip cropping, ploughing crop residue, and agroforestry), and increasing productivity on the same unit of land. The proper use of chemical fertilizer is important for the restoration of soil fertility as well as in the intensification of smallholder farms. Macroeconomic factors, particularly pricing policy, have eliminated fertilizer subsidies, and drastically reduced the demand for and use of fertilizer. There is a linkage between high population density and greater incentives to improve soil productivity since investment in soil fertility and measures to maintain productivity becomes more rewarding and profitable as the scarcity value of land increases with respect to labor. Another approach involves extensification of agriculture by clearing new land, often in an unsustainable way. Extensification is also a means of gaining ownership to new land. Poverty can be a disincentive to undertaking improved land management practices and intensification. Poor farmers living in villages are often engaged in cash labor at the time

of field preparation and their land tends to suffer most from soil erosion and fertility decline.

Farming Practices

Several important aspects of farmer behavior were revealed through the examination of farming practices. For example, deforestation was primarily a result of increasing the area under cultivation, not fuelwood gathering. The use of fire as a land-management tool is widespread. It is a means of reducing the incidence of livestock disease and is also used in clearing new land for agricultural expansion. But it has negative effects -- the destruction of vegetation cover, soil organic matter, lowering the diversity of soil fauna, and increasing erosion. The government's efforts to initiate communal tree planting were not widely accepted, and farmers indicated their preference for individual tree planting on their farms.

Overgrazing

Officials view large herd size and overgrazing as major causes of land degradation. Villagers see livestock as a sign of wealth, and would like to maximize their herd size for their own social, cultural, and economic reasons. This perception tends to encourage overgrazing and land degradation. Officials and extension agents have attempted to solve this problem by enforcing destocking policies. This policy has been unpopular among farmers and difficult to implement. Livestock were temporarily moved into another area, thereby merely transferring the problem. Another unintended outcome of the removal of livestock was a substantial increase in the incidence of malnutrition. Officials tried to alleviate this program by introducing the zero grazing method which focused on improved dairy cows for milk production, and a stall-feeding system. However, this alternative has not been well received since it does not take into account the multiple roles and value of livestock in the farming system.

Land Tenure

The majority of farmers feel secure about the land they cultivate. Customary land tenure authority is vested in local leaders. It is not subject to regulation and can be held in perpetuity by farmers, and thus has not been an impediment to investing in land. Indeed, most farmers have invested in, or improved their land in terms of tree planting, buying fertilizer, using farmyard manure, constructing terraces and water ways, etc. The lack of investment has been more influenced by poverty rather than an unwillingness to invest because of any insecurity of tenure. A more pertinent issue seems to be conflict over grazing rights involving predominantly crop producers and pastoralists. This conflict is more acute where large-scale operators are expanding into traditional pastoral and grazing areas. In areas where there is a large tract of common property resources, the current laissez-faire approach is enhancing conflict and the degradative process.

Extension and Local Organizations

Farmers are reluctant to participate in local associations mainly due to their negative experiences with government-initiated, top-down conservation efforts (such as destocking and labor-intensive conservation measures) and the belief that such an association could be used as a rubber stamp to promote unpopular measures. Furthermore, there are few extension agents at the village level and visits from the extension service are infrequent. Farmers are suspicious of extension agents as they often see their objectives as being the conversion of communal lands into government managed protected areas, which they will not be able to use.

The crucial challenges facing extension services are (a) developing a technical package in improved crop and livestock practices tailored and fine-tuned to a specific farming system and agro-ecological conditions; (b) incorporating tested indigenous knowledge and land management practices into the technical packages; (c) increasing nutrient uptake efficiency by developing the best combination of organic and inorganic fertilization methods; (d) involving civic society and the appropriate local organizations before launching conservation measures; and (e) working closely with research institutions in developing and introducing early maturing and drought-resistant crops.

Conclusions

The sustainable use of land resources and the successful implementation of policies and programs to address the land degradation problem would require enabling policies and institutional arrangements to encourage intensification of the smallholder farming systems. This would include such means as increasing the proper use of inorganic and organic soil amendments, provision of permanent watering points, development of low-cost soil cover and water harvesting techniques, expanding draft power, and strengthening local organization and extension services. At the same time, there is also a need for policies that discourage environmentally damaging land use practices, such as uncontrolled extensification in communally-held land and pastoral areas. An improved system will also require taking into account land users' perspectives, local variations in ecology and socio-cultural conditions, incorporating proven indigenous practices and knowledge into technical approaches, and ensuring local participation in decision-making.

CONTENTS

CHAPTER 1

BACKGROUND AND RATIONALE FOR THE STUDY

The Context

Fertile land is crucial to provide a livelihood for most people in Sub-Saharan Africa (SSA). Agricultural land is under enormous pressure from soil degradation, deforestation, inappropriate farming and grazing practices, population growth, fuelwood shortage, land tenure conflicts, lack of effective extension service and local organization, and other institutional and policy shortcomings.

Agricultural production in SSA increased at about 1.5 percent per annum between 1965 and 1990, while population growth averaged close to 3 percent over the same period. This agricultural growth rate is well below the estimated 4 percent per year which is essential for many SSA countries to reduce poverty and attain sustainable growth (Cleaver 1994; Badiane and Delegado 1995). The dismal performance of the agricultural sector (which must be the engine for overall economic development) is being increasingly attributed to the land degradation problem facing many African countries. A recent study (Scherr and Yadav 1996) has identified several subregions in Africa (such as the densely populated highlands in east and central Africa) as "hot spots" where land degradation -- in terms of nutrient depletion and erosion -- pose a serious threat to food security and local economic activity.

The terms "land degradation" and "soil degradation" are often used interchangeably. However, land degradation has a broader concept and refers to the degradation of soil, water, climate, and fauna and flora. Soil degradation refers more to water erosion and wind erosion, as well as chemical, physical, and biological (loss of organic matter) degradation (Hurni, 1996). This study addresses various forms of both land and soil degradation, which is crucial to any real effort to ensure productivity, food security and environmental sustainability.

Declining agricultural productivity and the increasing number of countries devastated by drought in SSA over the past two decades have raised serious concerns among African policy makers about whether the land can support the expanding population, and produce enough to combat poverty and food insecurity. Hence, at the 1992 Earth Summit in Rio de Janeiro, African leaders appealed for an International Convention to Combat Desertification. The Desertification Convention, which is now being ratified by the United Nations member countries, focuses on combating land degradation in the dryland areas of Africa. African countries are now faced with the urgent task of addressing land degradation problems in both marginal and high potential areas.

Major Causes

Socio-economic and political factors have forced many countries in SSA to bring new land under cultivation and to reduce fallow periods to meet the food and fiber needs of the rapidly increasing population. This extensive approach is reflected in low cropping intensity and poor yields per hectare (ha) in SSA. Cropping intensity is 55 percent in SSA -- compared with 110 percent in South Asia -- and the average yield of cereals is about 1 ton per ha in SSA while it is 2.3 tons per ha for the rest of the developing countries (World Bank and FAO 1995). Much of the unutilized land in many parts of SSA is of marginal quality in fragile ecosystems, and extensification of agriculture often results in depletion of soil fertility and in land degradation.

In the densely populated areas of SSA, intensification of agriculture is reducing fallow periods and increasing the farming intensity on crop land. A major part of the cultivable land in SSA (72 percent) suffers from low fertility, loss of soil nutrients, poor soil drainage and steep slopes, and is unlikely to support the population (FAO 1993). Soil degradation is widespread in SSA: about 320 million ha of land have been degraded moderately or severely by overgrazing, deforestation, and poor farming practices, while about 5 million ha are degraded beyond rehabilitation (Oldeman, Hakkeling, Sombroek 1990).

The land degradation process is not well understood, and most studies have centered on the physical aspects of this process. The most significant study on extent and nature of land degradation was that of the Global Assessment of Soil Degradation (GLASOD) study by Oldeman, Hakkeling, and Sombroek. GLASOD defines land degradation as a process that lowers the present or future capacity of the soil to produce goods and services. The most significant single contributor to soil degradation in all regions, including SSA, is water erosion. Other damage comes from wind erosion, chemical degradation, and physical degradation -- in order of importance (Oldeman, van Engelen, and Pulles 1990). Degradation occurs over time, and could have either a negative or a positive impact on land productivity. Certain types of soil degradation, such as geological erosion, are part of the natural process. This study focuses on degradation caused by human activities, and, which, therefore, can be prevented.

In sum, the major causes of land degradation in SSA are overgrazing, inadequate farming practices, and deforestation. Dryland areas, which cover 65 percent of the total land area in SSA, are highly susceptible to erosion and various forms of land degradation. In the dryland areas, overgrazing affects 49 percent of the land, poor farming practices 24 percent and deforestation 27 percent (Oldeman, Hakkeling, and Sombroek 1991). These causal factors, driven by socio-economic and political forces, manifest themselves in market, policy and institutional failures, inadequate technologies and practices, population pressure, poverty, cultural values, and individual behavior (Sharma, Denning, and Cleaver 1995).

Nexus of Poverty, Loss of Soil Fertility, and Low Productivity

In many localized areas of SSA, there is a synergy linking declining food production, high population growth, and natural resource degradation. This nexus dynamic creates a negative synergy that depletes soil productivity and results in a vicious cycle of poverty and food insecurity (Cleaver and Schreiber 1994).

Nutrient loss on arable land is significant in areas strongly affected by the nexus dynamic. Estimates show a net loss of 700 kg of nitrogen(N), 100 kg of phosphorus (P), and 450 kg of potassium (K)per ha in 100 million ha of cultivated lands over the past 30 years (Sanchez, Izac, Valencia, and Pieri 1995). Crop residue and manure, which were once a major source of enriching soil fertility, are being used as fodder and fuelwood. This considerable nutrient loss is reflected in the widening gap between the actual and potential yield for all the major food crops in SSA. For example, average farm yield for maize, sorghum, and wheat is 1.6 mt/ha (metric tons per hectare), 0.5 mt/ha, and 1.5 mt/ha, while the potential yield is 5mt/ha, 2.5 mt/ha and 3.5 mt/ha respectively (Sharma, Denning, and Cleaver 1995).

Loss of soil productivity leads to reduced farm income and food insecurity, particularly among the rural poor. Over 60 percent of the world's poorest people live in marginal areas and face a trade-off between short-term needs and the long-term conservation of natural resources (Leonard 1989). In managing land resources, the poor often have a "short time horizon", and will resort to maximizing their immediate gains and overexploitation of natural resources to secure their basic necessities (World Bank 1992; Holmberg 1991). The poor also face financial and socio-economic constraints. These factors seriously impede improved land management practices and innovations, which lowers the productivity and income of the poor and reinforce the "vicious cycle". Hence, narrowing this productivity gap between actual and potential yield is essential to avoid the poverty and natural resource degradation trap.

Soil degradation incurs substantial loss to productivity. The average loss in crop yields due to erosion for SSA is estimated at 6 percent, and in 1989, 3.6 million tons for cereals, 6.5 million tons for roots and tubers, and 0.36 million tons for pulses were lost by erosion (Lal, 1995). If this erosion level continues, yield loss by the year 2020 would be 14.4 percent (Scherr and Yadav 1996). Based on the data generated by Dregne and Chou on the areas of dryland by categories of land use and degradation level (Dregne and Chou 1992), the average productivity loss for irrigated land is 6.8 percent, for rainfed cropland, 14 percent and for rangeland, 45 percent (Crosson and Anderson 1995).

Data Availability

Until recently, there was no reliable data on the rate and extent of land degradation. Part of the problem has been measuring the impact of change on land productivity. GLASOD completed the most significant assessment, which indicated that cropland and pasture degradation are more widespread in Africa than other regions. About 65 percent of the cropland area and 31 percent of the pastureland in SSA are affected by degradation (Oldeman, Hakkeling, and Sombroek, 1991). These figures, however, are only indicative, since the methodologies for such assessment are still under development. There is also very little data available on lands being improved or rehabilitated. A new initiative coordinated by the University of Berne is under way, the World Overview of Conservation Approaches to Technologies (WOCAT), which attempts to assess soil and water conservation experience worldwide using a decentralized approach (Hurni and others 1995).

Land degradation is often inferred from other features (such as soil characteristics, land use, rainfall, slope) which may have an impact on land degradation. This method is plagued by sampling, extrapolation, and calibration errors. Some of the advanced methodologies used to assess land degradation, such as remote sensing, GIS, and aerial photography, emphasize easily observable features and indicators of change (such as gullies, landslide, encroachment of undesirable species), and link these changes to the active process of land degradation. Approaches that compare existing land use practice with "ideal" utilization assumes the ideal to be better. For example, the concept of carrying capacity is derived from such a comparison and has been used by officials to formulate policies and implement projects on rangeland degradation. Yet, the notion of carrying capacity does not explain the variation in local circumstances and has resulted in conflict with local land users (Biot 1991; Abel and Blaikie 1989; Behnke and Scoones 1993; Bartels, Norton, and Perrier 1993).

Many countries in SSA lack a systematic framework in assessing soil and land degradation. Data on land resources are not reported periodically, making assessment difficult. This is partly due to the lack of institutional capacity and is a serious impediment to formulating conservation projects and restoring soil productivity. At the Earth Summit, nations agreed to implement the *Agenda 21* document (blueprint for Sustainable Development) which makes several references to monitoring, reporting, and taking appropriate action regarding land (UNCED 1992). This has sparked a corresponding interest in developing indicators and several studies are underway on environment and land quality indicators (Pieri and others1995, Hammond and others 1995; OECD 1994; Adriaanse 1993).

Need for a Practical Approach

The diagnoses of and the solutions to the land degradation problem vary greatly across disciplines and among stakeholders. The literature shows at least three major policy paradigms (Biot and others 1995). The first is a classic approach which assumes

that technical solutions to land degradation are available and that the problem is implementation-related. The emphasis of this approach has been on technical fixes and expert opinions, and little merit has been attached to local land users' practices and participation (Clay and Schaffer 1984). The second paradigm, often referred to as populist, links poverty and environmental degradation. It emphasizes the participation of local people by using their knowledge and practices as a guide for policy and action (Chambers 1983; Blaikie and Brookfield 1987; Mascarenhas and others 1991; Richards 1985; Hudson 1991).

The third approach, often called neo-liberal, draws from both the classic and populist approaches. From the classic approach, it takes the idea that technology to control land degradation exists, and from the populist approach, it borrows the notion of empowerment of the people. It then argues that the major degradative causes are institutional failures, and the lack of adequate incentives for the adoption of appropriate conservation technologies among land resource users (Binswanger 1989; Repetto and Gillis 1988; World Bank 1992). Many soil conservation and land reclamation projects have been influenced by the classic approach, which has often resulted in conflict between technology and local farming and socioeconomic conditions.

Official and local land users often have different perceptions about the land degradation problem. This continues to be a serious impediment to successful land degradation control projects (Blaikie and Brookfield 1987; Fortman 1989; Biot, Lambert, and Perkins 1991). A great deal of literature supports the idea that indigenous knowledge and practice are often well-informed and should be seriously considered in the development of technologies and intervention measures to address land degradation (Chambers, Pacey, and Thrupp, 1989; Fujisaka 1989; Toulmin 1991; Huijsman and Savenije 1991; Critchely, Reij, and Willcocks 1994; Sconnes 1993; Kruger and others 1995). While the official view is drawn from references to the little data available (often derived from science), farmers' views are based upon their observations, values, and experiences. These factors help them to interpret changes on indicators of soil and land degradation and to make decisions about specific actions.

Land degradation symptoms must be seen within the political, institutional and socioeconomic forces under which local land users operate. The "short-time horizon" of the poor is often due to policy and institutional failures such as absence of clearly defined property rights, limited access to markets and credit, and lack of safety nets. For example, the drought and environmental crisis in SSA in the 1980s is partly attributed to high military spending, government-dominated marketing and distribution systems that squeezed the surplus from peasants, and inappropriate land and forest management policies which stifled incentives for production and protection of the environment (Timberlake 1986). Such broader analysis offers deeper insights into the land degradation problem, suggesting appropriate policy measures that should be applied before the process becomes irreversible. The cost of rehabilitating already degraded land is prohibitively expensive -- about ten to fifty times higher than that of preventive measures taken at an earlier stage (World Bank 1992).

The interpretation of change in some indicators, and the assessment of its impact on land resources, adds to the perception gap. For example, there is a common assumption among officials that land degradation is widespread. This perception is not shared by local land users. Local technical knowledge is based on experience and tradition, and has low risks and external inputs. It is accumulated slowly and cannot keep pace with changes that impact the farming system (Ravnborg 1992). Thus, enhancing farmers' ability to interpret changes according to the new circumstance, and improving local knowledge and integrating it with scientific knowledge, is a significant challenge.

Soil and land degradation has diverse effects on individual farmers, local communities, society, economic activity, and the environment (Hurni 1996; Glantz 1987; Brown and Wolf 1985). This study will present various options that could bring positive synergies to restore soil productivity, enhance food security, and avert the vicious cycle of poverty and natural resource degradation. Some of the key elements will include: (a) technical innovation based on proven practices and indigenous knowledge, e.g. increasing biomass production through intercropping, manure, composting, minimum tillage, agroforestry, improved soil cover and moisture management, strip cropping, contour tillage and planting, low-cost erosion control and soil conservation techniques; (b) enabling policies, e.g. pricing policy, fertilizer subsidy, incentives to ensure farm-level profitability; (c) institutional capacity, e.g. extension service, local organization, land tenure and conflict management, and data generation and reporting; (d) implication for policies and investment programs; and (e) priority areas of research to restore soil productivity and increase food security.

Policies and actions to address land degradation are enacted at various levels (farm, community, district, regional, national, and international). Most conservation and land resource management projects are initiated, administered, and managed at the district level (Izac and Swift 1994; Pieri and others 1995). The success of such investment programs partly depends on capacity and effective management at the district and village level. The most significant linkage between levels of productivity and land quality is observed at the village level where local land users take decisions on cropping and livestock management, with these decisions having a direct impact on land productivity. Insights about farmer perceptions about land degradation, response to changes, technologies and best practices, and indigenous knowledge are gained at the village level. Understanding the dynamics of these interactions at the village and farm level enhances the success of policies and programs to address land degradation. Hence, the level of intervention selected for this study is at the district and village level.

Because land degradation is influenced by local ecological and socioeconomic forces operating in a society (Spooner and Mann 1982; Chambers 1983; Watts 1985; Blaikie 1982; Hare 1985; Anderson and Grove 1987; Little and Horowitz 1987; Dejene 1990; Biot and others 1995), the study tries to examine this complex process (in Chapters 2, 3 and 4) through case studies at the district and farm (village) level. The implementation of policies and projects to address land degradation has generally faced