Working Paper

Improving land management in eastern and southern Africa

A review of policies and practices

Gathiru Kimaru and Bashir Jama

East Africa

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

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Abstract

The economies of the three East African countries of Uganda, Kenya and Tanzania are heavily dependent on agriculture. It is therefore critical that soil, water and forest resources are properly managed to sustain this important sector. One of the biggest threats to agricultural productivity is land degradation, especially erosion and reduction in soil fertility. Over the years, a number of programmes have been implemented in a bid to control soil erosion, conserve rainwater and promote afforestation. Sweden, through the Swedish International Development Agency (Sida), has supported some of the key conservation programmes in the three countries, focusing on development of policies, approaches and technologies. Some of the support was channelled through the Regional Soil Conservation Unit (RSCU), which evolved into the Regional Land Management Unit (RELMA), now part of ICRAF.

This paper reviews the experience of RSCU/RELMA in the three countries, drawing on soil conservation and land husbandry practices since the 1970s. It captures lessons learnt and makes recommendations for future action. Three Sida projects have been selected to illustrate this rich experience. These are: Uganda Soil Conservation and Agroforestry Pilot Project (USCAPP), the Soil Conservation and Agroforestry Project Arusha (SCAPA) in northern Tanzania and Kenya's National Soil and Water Conservation Programme (NSWCP). The main focus is on policies, and approaches.

Keywords

Land degradation, soil and water conservation, agroforestry

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Acronyms and abbreviations

CIGs	common interest groups
ICRAF	World Agroforestry Centre
KARI	Kenya Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
NRM	natural resource management
NSWCP	Water Conservation Programme
MoA	Ministry of Agriculture
RELMA	Regional Land Management Unit
SCAPA	Soil Conservation and Agroforestry Project Arusha
SFIs	soil fertility initiatives
TSBF	Tropical Soil Biology and Fertility (TSBF) Institute
ULAMP	Uganda Land Management Project
USCAPP	Uganda Soil Conservation and Afforestation Pilot Project

* To more fully reflect our global reach, as well as our balanced research and development agenda, we adopted a new brand name in 2002 ‘World Agroforestry centre’. Our legal name – International Centre for Research into Agroforestry – remains unchanged, and our acronym as a Future Harvest Centre – ICRAF – likewise remains the same.

Introduction

Improving agricultural productivity is central to achieving the Millennium Development Goals in sub-Saharan Africa. However, widespread land degradation, exemplified by soil erosion and declining soil fertility, which in turn leads to falling production, remains a big challenge in the region.

In a bid to reverse land degradation, new policies were put in place after the 1972 UN Conference on the Human Environment in Stockholm (Republic of Kenya, 1971). These policies led to successive soil and water conservation programmes and projects.

In Kenya, the National Soil and Water Conservation Programme (NSWCP) was started in 1974 as a pilot project in a few small areas with limited funds from the Swedish Embassy in Nairobi. The project was gradually upgraded into a bilaterally funded programme covering the whole country. Its success inspired creation of the Regional Soil Conservation Unit (RSCU) of the Swedish International development Agency (Sida) to spread useful experiences to the rest of East Africa.

Since then, Kenya, Uganda and Tanzania have received support from Sida for land management projects. RSCU and its successor RELMA (the Regional Land management Unit) implemented these projects at the regional level. The aim of the projects was to improve land management by promoting innovative technologies and approaches that lessen land degradation and have a lasting on productivity.

In Tanzania, RSCU/RELMA helped to establish the Soil Conservation and Agroforestry Project Arusha (SCAPA) in 1989. Like in Kenya, SCAPA started off as a pilot project. In 1993, it was expanded to cover Arusha and Arumeru districts of northern Tanzania. SCAPA promoted innovative participatory approaches to conservation and agroforestry. It provided a good learning ground for projects in many other areas in Tanzania.

The Uganda Soil Conservation and Afforestation Pilot Project (USCAPP) was started by the RSCU and the Ministry of Agriculture, Animal Industry and Fisheries to improve land management and agricultural production in Bugamba sub-county, a hilly area in Mbarara District of south-western Uganda.

USCAPP pioneered the development of a number of useful approaches. These include those that promote effective farmer participation in decision-making and articulation of demand, formation and organization of farmers' groups and business training. It also encouraged local savings besides developing participatory monitoring and evaluation (M&E) approaches to ensure efficient implementation of workplans (Regional Land Management Unit 1999).

RELMA later played a key role in the scaling up USCAPP to become the Uganda Land Management Project (ULAMP). The project, which covered five districts, was absorbed into the National Agricultural Advisory Services (NAADS) in 2001.

These country and regional initiatives have generated a tremendous amount of technical and institutional knowledge that will advance land management in eastern Africa. This paper synthesizes key lessons from technological, policy and institutional innovations

that have emerged from the programmes. It also identifies research and development gaps.

Land degradation

Soil and water conservation in the eastern and southern Africa region has a long history going back almost 70 years (Hall 1929, Beckley 1933). In the three East African countries of Uganda, Tanzania and Kenya, the colonial authorities used coercive approaches to introduce new land-use and conservation methods, such as terracing and forced destocking, resulting in negative attitudes to conservation. This led to widespread neglect of conservation work after independence in the early 1960s. By the end of the 1960s, these countries were experiencing increasing land degradation.

Significance of the problem of land degradation

The economies of the three East African countries are heavily dependent on agriculture, which accounts for between 30 and 40% of national Gross Domestic Product (GDP). The sector provides 80% of employment, over 50% of export earnings and the bulk of the nations' food.

Agriculture in these countries is dominated by millions of smallholdings that generally operate far below their potential. Many small-farm zones have unacceptably high levels of erosion and land degradation (Gachene and Kimaru, 2003) attributed to various factors. These include frequent ploughing for seedbed preparation without incorporating soil conservation measures, cultivation of steep slopes and hillsides, extending cultivation too close to watercourses and encroaching on wetlands, and turning of vital forests into farmland and settlements.

In the drylands, overstocking in the pastoral areas and introduction of annual crops in marginal zones have increased soil erosion in ecologically sensitive areas (Christianson et al. 1993). These factors are in turn linked to macro-level issues such as national policies on support to agriculture, markets for inputs and farm produce, rural infrastructure, rural credit, research and extension services.

Estimates and costs of land degradation

Various estimates of the economic losses from erosion justify the need for continuous investment in conservation. For instance, in Uganda, it was estimated that land degradation resulted in annual losses of up to 12% of GDP. The value of soil lost to erosion alone has been conservatively estimated at US$400 million a year (Government of Uganda 1991).

Large areas of Tanzania, especially the drier zones, have suffered a significant degree of land degradation and soil loss. Christianson et al. (1993) estimated that up to 1-2 mm of topsoil is lost each year in the semi-arid areas on slightly sloping land with some vegetation and average grazing pressure. On overgrazed or cultivated land on sloping ground, as much as 10 mm of soil is lost to erosion every year.

Such losses are not directly reflected in the national accounts. They, however, have a serious negative effect not only on total GDP and overall economic development, but also

on agricultural and food production, family incomes derived from land and natural resources, and poverty in rural areas.

Box 1. Rehabilitation of degraded areas: An example of RELMA's approach

In February 2000, RELMA supported a regional *Integrated Land Management Training course* at the East and Southern Africa Management Institute (ESAMI) in Arusha, Tanzania. As part of the training, participants conducted a quick survey on land degradation in three villages -- Ngorbob, Mkonoo and Sakila. They found indications of extensive loss of agricultural land through erosion and widespread gullying, often down to the bedrock. The communities confirmed that land productivity had decreased and this was the main cause of low rural incomes and poverty.

To address the problem, the following remedies were suggested: gully control, better grazing management, improved tillage practices, intensified soil and water conservation, and better collection, storage and use of animal manure.

Knowledge on prevention, control and rehabilitation of gullies was found to be low in all the villages and among the extension staff. The potential of using agroforestry to rehabilitate gullies was not appreciated.

In response, RELMA worked with the staff of the Soil Conservation and Agroforestry Project in Arusha (SCAPA) and farmers to develop a participatory approach that could be used find the causes of land degradation and locally acceptable solutions. This approach was used more widely in the conservation programmes.

To address land degradation in the region as a whole, RELMA has produced many publications land management and conservation. The publications cover such areas as soil and water conservation, water harvesting, management of rangelands, livestock management in the high rainfall areas, and agroforestry for smallholder farmers.

Soil fertility depletion

Impacts of soil fertility depletion

It has been argued that soil depletion of fertility on smallholder farms is the fundamental biophysical factor leading to the chronic food shortages and poverty in sub-Saharan Africa (Buresh et al. 1997). According to FAO data (FAOSTAT, 2000), the average nutrient use for each hectare in eastern and southern Africa is only 9.57 kg, compared to 232 kg a hectare in the European Union (see appendix 1).

Policies leading to liberalization and the removal of subsidies on farm inputs in the 1990s resulted in a rapid escalation of prices. This, in turn, led to a vicious circle. As prices rose, farmers used less fertilizer or none at all, resulting in lower demand for the input. Falling demand led to less fertilizer being imported and restricted supply, leading to yet higher prices (Fig.1). This trend reduced agricultural production and incomes.

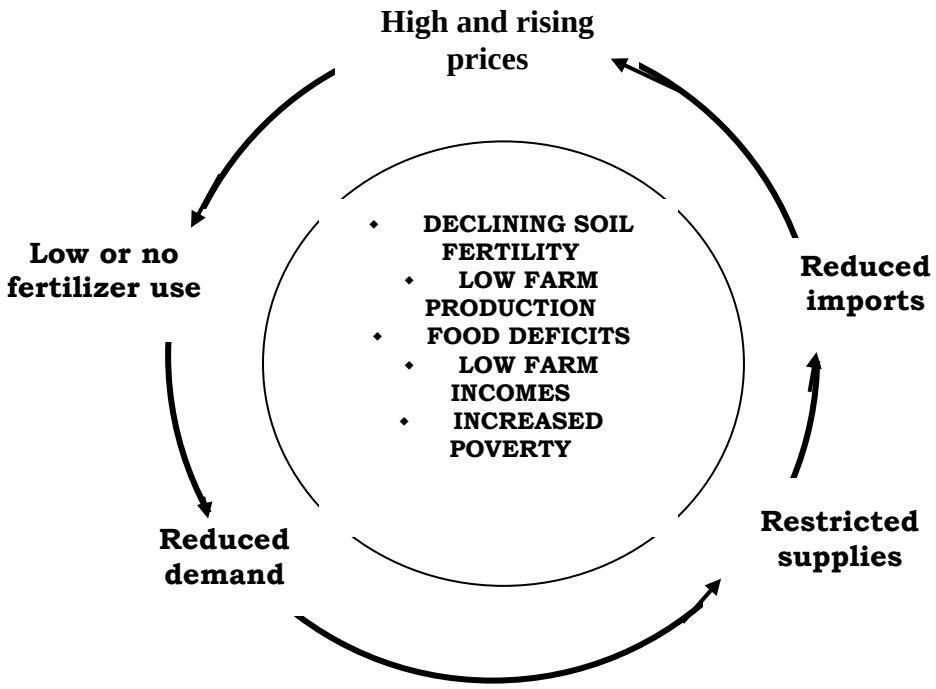

Figure 1: Effect of removal of subsidies on fertilizer use in smallholder agriculture

In the face of rising fertilizer prices, farmers have turned to organic manure, while on-farm research is giving more attention to the complementary interaction of inorganic and organic technologies. A wide range of agroforestry practices have been developed and promoted to mitigate the problem.

RELMA's response to soil fertility depletion

RELMA's annual work plans contain various activities designed to improve soil fertility in the region. Prominent among these is support to national soil fertility initiatives (SFIs), which now form a good basis for further action.

In Kenya, the SFI started with RELMA giving technical support to consultative workshops and working groups. There were also 'minor' field studies by selected extension staff as part of on-job training. The studies were done in Kirinyaga, Kenya; two areas in Tanzania, Mikese in Morogoro and Iringa in the southern highlands; and in eastern Uganda. The information they generated was included in a RELMA technical handbook on soil fertility and land productivity (Gachene and Kimaru, 2003).

Earlier, in 1997, RELMA had supported the production of a handbook on integrated soil fertility management on small-scale farms in eastern Zambia (Raussen, ed. 1997).

Choice of technologies

Physical conservation measures

Early conservation programmes in the region emphasized building of physical barriers to control runoff. These measures tended to target the symptoms of land degradation rather than the immediate underlying causes, such as poor land management, overstocking and overgrazing, which may themselves result from other factors, including poor markets and outdated practices. The initial approaches did not link conservation to production and markets, limiting the level of adoption.

At the beginning, programmes gave more attention was given to high rainfall areas than to drier zones. However, in recent years, RELMA has given increasing attention to semi-arid areas, as shown by its emphasis on water conservation. One of the most successful cases is in Machakos, Kenya, where water was used as an entry point in an integrated rural development approach that promoted community participation, use of local resources, training and farmer empowerment.

To improve water supplies to households and for small-scale irrigation, RELMA supported training of farmers and artisans to construct waterholes and pans, rock catchments, sub-surface dams and shallow wells. It also enabled communities to protect natural springs.

Biological and vegetative measures

In many areas, erosion takes place because the land has been left bare of vegetation through clearing, overgrazing, drought, burning and ploughing. In a bid to curb these practices, RELMA has over the years promoted good land husbandry using a combination of physical and vegetative measures to maximize the use of rainfall and control runoff.

It is now common practice to stabilize terraces using napier and other perennial grasses. The fodder creates a link with livestock for in zero-grazing units, which produce manure that goes back to enrich soils for napier and other crops.

In some cases, woody species have been planted along boundaries and on terrace risers. However, the potential of calliandra hedges in the wetter areas has not been fully exploited.

Conservation Agriculture

Although much physical conservation work has been done over the decades, erosion is still taking place in many areas. Indeed, land degradation seems to be accelerating, especially with the reduced emphasis on soil conservation in favour of a broader land husbandry approach (Swallow et al. 2003). Soil conservation has been seen as a ‘treatment’ against degradation, making it difficult to sustain the required repeated (seasonal) conservation works.

On the other hand, conservation agriculture (CA) is seen as a more sustainable solution, partly because it helps to maintain ground cover crucial in controlling erosion. CA is a

land-use practice that incorporates the essential elements of land preparation and planting, but eliminates the need to disturb the soil regularly. Instead, CA ensures the soil is protected by a permanent cover. Besides reducing the cost of crop production, CA increases soil moisture and fertility significantly, leading to higher yields.

These advantages indicate that for arable land, CA is a viable alternative to conventional soil conservation programmes and traditional land preparation.

RELMA has been at the forefront in promoting conservation agriculture in the region. It supported the creation of CA networks that are now involved in research, extension and training as well as development and adaptation of equipment for land preparation.

Agroforestry practices

Higher fertilizer prices have opened up opportunities for wider adoption and application of agroforestry solutions to improve soil fertility. Among these solutions are improved fallows, also known as fertilizer trees, in mixtures or in rotation with crops. This practice has improved crops in soils deficient in nitrogen, such as those in the southern Africa region (Kwesiga et al. 1999). However, the addition of phosphorus fertilizers is essential in soils deficient in phosphorus such as those in western Kenya (Jama et al., 1999).

Another promising agroforestry technology is biomass transfer, which involves a cut-and-carry practice to apply nutrient-rich biomass to crops (Jama et al., 1999).

Farmers have adopted these technologies, especially in eastern and southern Africa. The numbers are, however, way below expectations. There are several reasons for this, including lack of seeds and seedlings, inadequate extension services and poor markets for crop and tree products.

New approaches to technology transfer and adequate support systems need to be created through suitable policies. For instance, farmer research groups and farmer field schools should be used more in agroforestry technology transfer. A good example is the Embu KEFRI/KARI/ICRAF/MoA collaborative project, which promoted calliandra for conservation and fodder.

Frequent droughts are a serious challenge in the marginal farming areas, where many people have become dependent on relief food. The situation is made worse by the officially sanctioned dominance of maize and beans, which are highly sensitive to moisture variations. A change of policy to promote tree crops (fruits and other multi-purpose trees) would increase incomes, reduce poverty and improve food security. This has been demonstrated in Kibwezi, Kenya (Mulatya, 2005).

RELMA has produced a considerable amount of information on agroforestry in publications for extension workers in the region and other users.

Policy environment

Land tenure and sustainable land management

Land degradation can be traced to lack of comprehensive national policies to guide the administration and use of land in East Africa. In all three countries, policies are inadequate to deal with issues such as land tenure, ownership, landlessness and equitable access, especially for the economically and socially disadvantaged.

Other underlying causes of land degradation and soil erosion include:

- Lack or poor implementation of land-use policies and legislation to guide and control the allocation of land to the most appropriate and productive uses. This leads to the over-cultivation of smallholdings in high rainfall areas and opening up of fragile semi-arid areas for annual cropping.
- The low priority and inadequate resources given to land, water and forestry management activities in official development programmes and among farming communities, and by administrators and political leaders. The strong conservation efforts of the 1970s-90s have run out of steam. Today, soil conservation is seen as a minor concern and erosion seems to be accelerating in many areas.
- Inadequate agricultural modernization and minimal orientation to markets, poor private sector participation, ineffective farmer institutions and weak links to service providers.

Security of land tenure is vital to conservation. The term tenure is derived from the Latin word ‘tenere’, which means “to hold”. It defines the right or methods by which individuals or groups acquire, hold or transfer the rights to land or other property. Security of tenure is critical because farmers and other land users will not invest to improve and maintain land if they are not assured of adequate returns through guaranteed access to and ownership of the land.

In many areas, land reform has not moved in tandem with conservation. This has slowed down the adoption and sustainability of improved land management technologies and approaches. The study *More People Less Erosion* (Tiffen et al. 1994) showed a positive correlation between effective land policy, land productivity and poverty reduction. Conducted in Machakos, Kenya, the study found that tree cover and soil conservation during increased during a period when the population increased five times. This demonstrates that where land tenure is guaranteed, people will take the initiative and spend time and resources to improve the land.

The three countries have finalized or are in the process of elaborating national land policies to guide the administration and management and the complex issues surrounding land, including equitable access. The policies also seek to create a socio-economic framework on environmentally sustainable management and land resources that is responsive to markets and farmers’ aspirations. These policies should be followed up with those on agriculture and land use.

Gender perspectives

Deliberate action has been taken to give women a more prominent role in the membership and leadership of local farmer organizations associated with the conservation programmes in the three countries. A majority of the conservation, production and marketing common interest groups (CIGs) are formed and run by women, enabling them to improve their incomes and welfare. RELMA activity reports, for instance, have to show gender-segregated data to ensure proper involvement of women in projects. Training and empowerment of women will have positive impacts on the family, especially on children.

What should now be done is to link women to sources of rural credit and put more resources in business training.

Use of incentives

A mix of incentives has been used to create a more positive attitude to conservation and help accelerate conservation (Sanders, D.W. et al., eds., 1999; Bridges, E.M. et al., eds., 2001). Initially, some of the programmes paid for diversion ditches that cut across several farms and conservation groups were given hand tools for the job. Farmers were also taken on study tours, and competitions organized to promote a sense of achievement. These incentives varied over time (and were finally removed), depending on rate of adoption and in line with the training of farmers and progress in organizing them for leadership and ownership of the programme.

RELMA has also used small amounts of seed money to start activities that are then included into existing programmes.

To create a clear link between conservation and higher productivity and to improve farmers' access to markets and market information, high-value crops, particularly horticulture, were introduced in many conserved areas.

Approaches used

Individual vs group approach

Kenya's initial request for Swedish assistance resulted in the design of a 'conventional' engineering-type project with emphasis on use of heavy machinery. But the government opted for a more modest process-oriented approach that better fitted the prevailing socio-political environment. Since then, conservation programmes in the three countries have progressively engaged the farmers in conservation work using local resources.

The initial approach of working with individual farmers proved to be slow and ineffective. In its place, a "catchment" or focal area approach was developed adopted starting 1987. In the new strategy, farmers fully participate in a process that examines local resources in relation to their aspirations. This process becomes the basis of plans for individual farms and the entire catchment.

Farmer participation

Farmer participation has evolved into a key extension approach in the country programmes. Participatory methods developed since the 1980s are used to engage the farmer in the change process, and to incorporate local knowledge in planning and carrying out activities. People take part in various activities through low-level (grassroots) organizations, elected focal area conservation committees or farmers' groups such as the traditional Mwethya groups of the Ukambani region in Kenya and common interest groups promoted by RELMA in USCAPP and ULAMP in Uganda, and in SCAPA in Tanzania.

In many areas, farmers were trained to lay out conservation works using simple equipment. There was also intensive training on managing tree nurseries, which have supplied large quantities of seedlings to farmers in the region.

Multi-disciplinary collaboration

Much of the success in the conservation programmes has been attributed to an integrated approach that brought together key institutions and organizations, both government and non-government. This ensured effective multi-disciplinary collaboration to create a good mix of related disciplines such as forestry, agricultural and livestock production, environment conservation and farmer organization.

Emphasis on land husbandry

The initial vision of the early programmes was "to conserve the environment and save the land". The focus was on macro-level goals as opposed to the farmer's own immediate concerns (social and economic benefits). However, there was a gradual shift of emphasis from soil conservation per se to a broader land husbandry and land management approach (Lundgren, L. 1993). The RSCU and RELMA after it were instrumental in the development of the new approaches and the adaptation of technology.

RELMA worked directly with institutions that constituted its primary network. These networks would, in turn, reach out to the smallholder farmers and livestock keepers, the ultimate target groups.

Support systems

Effective government support over the past three decades has allowed the development of a conservation culture and attracted resources from many development partners. Conservation became a high profile activity at national level, promoting effective public mobilization and attracting significant resources. Creation of separate soil and water conservation sections in the agriculture ministries raised the profile of land resources management.

Conservation programmes typically started off as small pilots run on limited funds from RELMA. They then gradually expanded to cover all the target areas. The process approach adopted was also flexible enough to allow the programme to grow, change, adapt to new needs, build on lessons and respond to emerging challenges.

In addition, the programme design included a long-term perspective with a strong focus on public education and sustained efforts to popularize new ideas and approaches. For

example, programmes worked with schools and colleges to promote conservation by producing books and improving curriculum content.

Key impacts and lessons

Economic assessment

Field investigations in the 1980s gave different estimates of the benefits of conservation on smallholder farms in Kenya. Hedfors (1983), working at Tuloi in Nandi District, found that the average yield of maize and beans was 62% and 77% higher, respectively, on land where conservation had been done. Figueiredo (1986), also working in Machakos, found that the yield of maize was on average 47% higher on terraced land than on non-terraced farms. Holmgren (1987), in yet another study in Machakos, reported similar results. The average yield of maize and beans on terraced land was 33% and 65% higher, respectively, than on farms without terraces (Thomas et al, eds. 1997).

Continuing research at Katumani in Kenya also shows the importance of enhancing soil moisture through conservation. Saving an additional 50mm of water above the effective rainfall of 200mm raises maize yields by 200kg, 400kg and 800kg for low, medium and high level of management, respectively (Thomas et al, eds. 1997).

Farmer empowerment

An important achievement of RELMA's work is in empowering farmers. As a result of various interventions, farmers are better organized. Farmers' groups are the basis for conservation work, production and marketing. In many areas, it is the farmers who plan and construct conservation works.

Other activities undertaken by farmers include establishing and managing nurseries for fodder trees and other species that can be used on farms.

Impacts on farm production

Conserved farms in Kenya generally obtained higher yields. In Uganda, USCAPP and ULAMP projects showed notable banana yield increases, from 18-32kg a bunch on unconserved farms, to 35-49 kg a bunch on farms with soil conservation and management practices. The higher yields significantly increased family income.

Socio-economic impacts

In the Uganda case, increasing crop yields resulted in the reorganization of labour and sharing of the money accruing from sales. For example, in USCAPP, banana farms had had previously been managed by women, who provided most of the labour. The men only came in for heavy duty work such as uprooting old banana stools. Women also did most of the marketing and decided how to use money earned from sale of surplus bananas.

The dramatic change in the banana yields and a corresponding increase in income led to a visible improvement in the community's standards of living. For example, parents were able to buy various items to improve the home and to pay fees, leading to higher school

enrolment and many started new family businesses. The men were attracted to work on the farms and started to take part in managing production and sales of produce.

However, many cases the men later started investing earning from the farm in small businesses at the local market centres, reducing the money available for use in the households, especially for non-food expenses. In some cases, the businesses kept the men away from the farms. This led to a shortage of labour and a heavier workload for women. In some instances, diversion of cash away from the farm led to reduced inputs and lower yields.

Increased diversification and enterprise development

Farms in the conserved areas show a good measure of diversification. Most notable features include farm forestry and agroforestry, keeping of livestock, especially dairy animals and small stock, and fruit production.

The agroforestry and farm forestry programme has proved to have been a good investment. Public forests are increasingly unable to meet all the needs for wood and the trees planted in the programme areas in the 1970s and 1980s are now meeting some of the demand.

In many areas, however, trees are harvested without adequate new ones being planted, creating a situation like that before conservation programmes started. The central and eastern areas of Kenya around Mt Kenya are among the most affected. Action needs to be taken to replace trees cut down and to expand planting to new areas.

In many cases, farmers who have conserved their land are also receptive to new technologies and approaches that improve crop and livestock production (Regional Land Management Unit, RELMA, 1999). For example, many of the farmers have adopted intensive fodder production in the higher rainfall areas. They have planted napier and other grasses and, lately, calliandra, along conservation lines to feed dairy cows. Manure from the zero-grazing sheds is recycled back to the farm.

In the drier zones, farmers have planted different types of trees on terraces, but there is room for a research and development programme to introduce fodder bushes.

Market failures are, however, a major setback in efforts to introduce high-value crops are introduced to increase incomes and promote better adoption of soil conservation and soil fertility interventions. Much smallholder production is also subject to control by traders, while farmers are not organized well enough to have effective bargaining power.

Yet reducing rural poverty requires growing of more high-value crops, which, in turn, require policy initiatives that provide longer-term solutions to the problem of marketing produce from for small-scale farms.

Environmental benefits

Experiences from the three countries show that there has been an improvement in soil management as indicated by reduced erosion. The conservation programmes also promoted increased on-farm tree planting through many tree nurseries managed by individuals and groups in the rural areas and in the main urban centres. For example, in

Kenya, much of the *Grevillea robusta* planted on small farms in Eastern, Central and Rift Valley provinces and elsewhere from the late 1970s emanated from the programme. Other species included *Azadrachta indica* (neem), *Cupressus* species, *Senna siamea*, *Eucalyptus* species and some indigenous dryland species.

In the three countries, the conservation programme also significantly contributed to wide adoption of fruits, especially mangoes, avocado, citrus, macadamia, passion fruit, pineapple, pawpaw and others, through a network of nurseries (Jaenicke, 1999).

Water is becoming increasingly scarce in the face of fast-growing demand. In response, RELMA has been promoting various technologies for collection and storage of rainwater around homesteads and on farms. These technologies ranged from small pans, masonry tanks, retention ditches and different types of rock catchment tanks. Water is captured from all available surfaces including runoff from roads. Springs have also been protected and provide a regular flow of clean water.

Conclusions and recommendations

Opportunities, gaps and challenges

Policy and financing aspects

The main gap is lack of a strong policy and institutional framework to guarantee a healthy flow of resources, integrate the many scattered activities and give context to soil fertility and soil conservation work. Countries in the region have formulated or are formulating consolidated national land policies to provide direction on land administration and efficient use of natural resources. However, there is need for clear land-use and agricultural policies to guide researchers, extension workers and farmers on the use of land and land resources.

Research programmes

Much more attention has been given to the higher rainfall areas compared to the drylands and pastoral zones. A key challenge is how to focus research and development on the vast drylands of the three countries, especially adopting available technologies to the different conditions and changing demographic demographics in these areas.

Market-oriented agroforestry approaches are necessary to create a more receptive environment for ICRAF's own scientific and development work.

Checking accelerating erosion

All three countries have adopted a broader land husbandry approach. They are putting less emphasis on soil and water conservation, and giving even less attention to soil fertility. The long-running conservation programmes have been phased out or absorbed into larger extension programmes. As these changes take place, there is danger of renewed erosion in areas previously covered by intensive conservation activities. New approaches are required to effectively reach the millions of smallholdings that have highly mixed farming systems. This would renew conservation with better attention to increased production and marketing and use lessons from the 1980s and 1990s.

Agroforestry development

Agroforestry as a science and a practice has developed practical, people-oriented approaches that have a clear focus on markets and seek to incomes and reduce poverty. There have been commendable achievements in soil conservation and farm forestry over the past three decades, thanks to various national programmes.

But there are still many challenges. For example, trees planted on farms from the late 1970s are now being harvested due to an acute shortage of fuelwood and timber. Yet there are no widespread activities to produce and distribute seeds and seedlings for replanting. Although there are many private companies the seed trade, they mainly produce cereals and vegetable seeds. The supply of seed for green manure crops, new varieties of fruits and other high-value tree crops for both high and low rainfall areas, remains a problem.

Recent activities by ICRAF to promote fruit trees, bamboo and other species give some hope, but more substantive research and development programmes are required.

Soil fertility improvement

Much research and development work on soil fertility has been done over the past three decades. Soil fertility initiatives (SFIs) have been formulated for Uganda and Tanzania, while Kenya's is being developed. The Kenyan initiative is being developed. The SFIs have taken advantage of research on soils and soil fertility already done through international research institutions such as ICRAF and Tropical Soil Biology and Fertility Institute (TSBF). All these can form the basis for new policies and programmes to further improve soil fertility and land productivity and to reduce poverty.

Appendix 1

Table 1: Fertilizer consumption 1998/99 (selected countries) kg ha^{-1}

Country	Kg ha^{-1}	Country	Kg ha^{-1}
Zimbabwe	50.97		
Malawi	32.86		
Kenya	22.66	China	259
Zambia	13.00	India	99
Tanzania	11.35	Indonesia	89
Ethiopia	11.08	Philippines	63
Burundi	2.82	Thailand	82
Rwanda	1.09		
Uganda	0.28	European Union	232
Eastern/southern Africa	9.57		

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