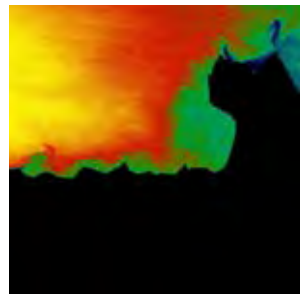
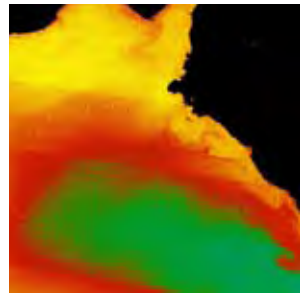
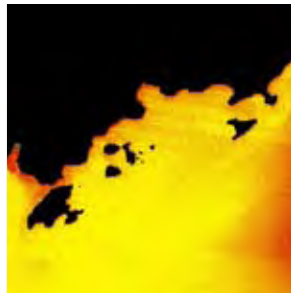
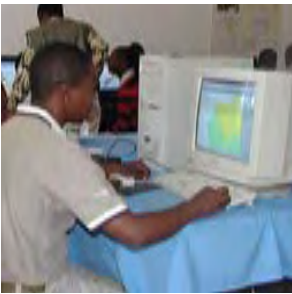


Linking Research to Extension for Watershed Management

The Nyando Experience



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The Nyando Experience

by John Mbaria



World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Titles from the Technical Manual series synthesize the outcomes and practical implications of Agroforestry research activities and projects that are ready for scaling up. Other publication series from the World Agroforestry Centre include: Agroforestry Perspectives, Occasional Papers and Working Papers.

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ICRAF House, Gigiri,

P. O. Box 30677-00100, Nairobi, Kenya

Tel: (+254 20) 722 4000, Fax: (+254 20) 722 4001

Email: icraf@cgiar.org

www.worldagroforestry.org

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Editing: Helen Vanhouten/Chin Ong/Rebecca Selvarajah/Kris Vanhoutte

Design and Layout: Gikang'a John

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How this report was prepared

In 2005, ICRAF contracted a consultant writer, John Mbaria, to prepare a summary of the TransVic project activities in the Nyando basin, an area characterized by severe soil erosion.

To prepare this report John read many of the project reports and interviewed ICRAF staff involved in the project. He also interviewed farmers and Ministry of Agriculture staff, our partners in the project. The report summarizes the major achievements, problems and opportunities the TransVic project presents in the Nyando basin including the expectations of the local population.

Foreword

In 1998, the Government of Sweden through the Swedish International Development Cooperation Agency (Sida) made a long-term commitment to support the East African governments for a coordinated approach to sustainable development in the Lake Victoria Basin. Sida realized that it was vital to link research to extension for this huge endeavour and invited the World Agroforestry Centre (ICRAF) to join hands with the National Agriculture and Livestock Extension Programme (NALEP) to develop sustainable solutions to the lake's problems. This led to the TransVic Project. At the same time Sida facilitated a separate project to support lakeshore communities in Kusa, implemented by RELMA and called the Kusa Pilot Project.

The TransVic project employed state-of-the art methods, such as remote sensing with satellite imagery and spectral reflectance to detect large-scale land degradation because conventional methods were not suitable. The challenge was how to translate key findings of the research to field extension staff of NALEP as well as policy makers at various levels.





The results of TransVic's finding were surprising in two ways. First, it was assumed that we could identify hotspots where we should target our interventions using NALEP's focal area approach. In-

stead, the research showed that land degradation was so widespread that a major investment was called for—well beyond the reach of a single farmer or community. Second, the restoration effort required on these fragile lands was considerably more complex than could be dealt with by the improved fallow technologies developed in the relatively high-potential areas in western Kenya. In other words, there was to be no quick fix.

This booklet by John Mbaria describes some of the problems facing such a daunting task and the opportunities the task presents, including the high expectations of people living in the basin. I hope that the lessons learned and the huge challenges that lie ahead will inspire you, because the work has just begun. Finally, I wish to thank our NALEP partners and farmers for their close collaboration and friendship in this endeavour.

Prof. Chin Ong
Plant Physiologist & RELMA Project Manager

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I owe much gratitude to all the people who sat at various times informing me and discussing with me some of the materials contained in this booklet. Special thanks go to all the farmers who, with smiles, welcomed me to their homes and took time to narrate how they participated in the project and how it changed their approach to agriculture.

I am also grateful to staff from the Ministry of Agriculture—James Ang'awa, David Nyantika, Dismas Ogola Oyugi, Edwin Mwangi, Margaret Amakobe, Edward Mudavadi and Simon Oyatsi (working with the Ministry of Water in Siaya)—who at short notice made themselves available for interviews and accompanied me to visit farmers in some of the focal areas.

At ICRAF's Kisumu Office, I received valuable information from Markus Walsh, Quresh Noordin, Eva Gacheru and Leah Onyango.

Lastly, my thanks go to Alex Awiti and Brent Swallow for providing me with information and documents, and to Chin Ong and Warwick Easdown for the discussions that helped me have an overview of the activities before and during TransVic's implementation.

John Mbaria

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Abbreviations and acronyms

CGIAR	Consultative Group on International Agricultural Research
COSOFAP	Consortium for Scaling-up Options for Increased Farm Production in Western Kenya
Danida	Danish International Development Agency
DFID	UK Department for International Development
EAC	East African Community
GEF	Global Environmental Facility
GIS	geographical information system
GPS	global positioning system
ICRAF	World Agroforestry Centre
KARI	Kenya Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
KES	Kenya shilling, valued roughly at 75 to the US dollar at the time of the project
LVDP	Lake Victoria Development Programme
LVEMP	Lake Victoria Environment Management Programme
NALEP	National Agriculture and Livestock Extension Programme
NEMA	National Environmental Management Authority
NGO	non-governmental organization
NSWCP	National Soil and Water Conservation Programme
NTU	normalized turbidity unit
PRA	participatory rural appraisal
PRSP	Poverty Reduction Strategy Paper
RELMA	Regional Land Management Unit
Sida	Swedish International Development Cooperation Agency
TransVic	Improved Land Management in the Lake Victoria Basin
USAID	United States Agency for International Development



Chapter 1

Introduction

This chapter highlights the geography where the Improved Land Management in the Lake Victoria Basin (TransVic) Project took place. It presents a brief overview of the socio-economics in the Nyando Basin and the underlying crisis that necessitated the project. In an area where the earth has been stripped of vegetation, years of heavy rains have made it susceptible to erosion. Large livestock herds have overgrazed the fragile land and competed with a large and growing human population. With the basin's population rising, people disregarded sound land management counsel and farmed along steep slopes and on riverbanks.



Consequently, much basin land lost nitrogen, phosphorus, organic carbon and organic matter. Scientists estimate the Nyando Basin has lost as much as 3.2 million tonnes of soil since 1963.

'If the basin's destructive trend continues, we should expect much more loss in the future,' says Markus Walsh, ICRAF's leading scientist in the Lake Basin.

The biggest percentage of the nutrient-laden runoff has been deposited into the lake, giving rise to a 'nutrient plume'. Today, scientists estimate that the plume extends over 45 kilometres into the lake and has become fodder for the water hyacinth. At its peak, hyacinth expanded by 3 ha a day and colonized hundreds of square kilometres of the lake. It stifled and strangled many lake life forms and affected lake transportation, electricity generation and the multimillion dollar fish industry.

International, national and local institutions and organizations decided to take action because the local economy had lost much of its natural resources. The soils became extremely poor, farming frustrating, fishing dwindled, while 'old' and newer diseases such as HIV removed thousands of young and active local people. Poverty became the norm rather than an exception, with millions living on less than a dollar a day. Indeed, hardcore poverty now affects between 40% and 50% in the basin's Bungoma, Busia and Kericho Districts.

Nature's capacity to sustain the population in the basin is diminishing daily as people and their livestock continue to wreak havoc on its resources through environmentally unsustainable production. Today, huge gullies show the degradation goes on largely unchecked. Torrents of storm water from heavy rains drive thousands of tonnes of soil into Lake Victoria each year. Numerous media reports narrate sad stories of flooding, especially in Bundalangi, where entire villages are repeatedly submerged by raging floods. And, as if this were not enough, thousands of acres where maize and sorghum once thrived with little competition from weed are now entirely colonized by striga ('witchweed'), a vigorous parasite that chokes off crop plants by sucking their vital nutrients.

Nevertheless, the basin has high potential for progress. Its rivers and streams carry millions of cubic metres of fresh water into the lake: water that is suitable for human use, developing industry and tourism, and generating electricity. Further, Lake Victoria is a gigantic natural basin full of fresh—but increasingly polluted—water that directly and indirectly supports 30 million people. It is also the source of the White Nile, a lifeline for much of Uganda, Sudan and Egypt. From it, 170,000



tonnes of fish are caught each year — in an industry that employs tens of thousands, and generates as much as USD 100 million from the sale of Nile perch alone.

Within the lake's basin is a big and growing human population, which although undergoing considerable difficulties is a resource in its own right. And with a little imagination, consistent hard work, sizeable investment and a slight rethinking of the country's development, local people can convert the dwindling diversity of life in the basin into goods and services to keep hunger at bay and relegate poverty to an unpleasant memory. This potential continues to be a dream. But a growing body of information on the basin's crisis, a rising awareness of what needs to be done, the testing of some agroforestry in the Nyan-do Basin and the receptiveness of many local farmers to new farming techniques offer hope that the damage can be healed and that the devastating poverty and environmental degradation need not be permanent.

An ICRAF researcher noted: *'During a visit organized for journalists in mid 2005 to Katuk-Odeyo, many of us were amazed at the sheer size of the gullies and the apparent helplessness of the local people whose social life had been negatively affected by gullying. But in the Kalacha area, we met a local resident, Mzee Peter Oleng, who exuded admirable optimism. Among other things, Mzee Oleng kept on saying that the devastated land in the area could actually heal. As he narrated his experiences as a resident of the area, we observed that a thin layer of soil that had been washed from somewhere else had been deposited at the bed of one of the gullies where, with assistance from local ICRAF staff, local people had planted euphorbia, aloe and cactus to prevent further gullying. We could hear pigeon cooing and other birds singing while colourful butterflies circled endlessly as they sucked nectar from wild flowers. The pleasant scene not only drew our attention away from the desolate landscape but was also a reminder that all might not, after all, have been completely lost.'*

Indeed, ICRAF scientists share this optimism that the precarious situation, presently epitomized by the huge gullies and the crippling poverty, can be reversed.

'The degradation can be stopped if conscious and consistent landscape-wide efforts are made to conserve the environment and make the lives of people better,' says Walsh.



The basin's environmental and human crisis

Named variously over the ages by locals and people from afar, Lake Victoria lies prominently in the heartland of eastern Africa. It is perched at a height of 1100 m above sea level—an impressive expanse of fresh water that covers a surface area of 68,000 km² and is surrounded by a catchment of about 184,200 km². The basin is shared unevenly by Tanzania (44%), Kenya (22%), Uganda (16%), Rwanda (11%) and Burundi (7%). The lake is the world's second largest fresh-water body and the largest in the tropics. Despite its size, Lake Victoria is so shallow it barely reaches 80 m in depth and is about 2760 km³ in volume. Being the water lifeline for much of Uganda, the Sudan and Egypt and being the source of the White Nile, the lake sustains millions of inhabitants.

But this important lake is facing a crisis that grows more serious each day. Since the 1930s the lake has undergone ecologic changes. The human population in the basin has been doubling every 22 years, increasing the pressure on resources. Many of East Africa's principal cities are located within the basin. They have created mountains of uncollected garbage and pumped raw sewage into the lake. Other pollutants find their way into or close to the lake. For instance, phosphorus from the atmosphere and from overland has doubled the amount of phosphorus in the lake over the last 50 years, while algae concentration is now 3 to 4 times higher than it was in the 1960s. The predatory Nile perch, introduced in the 1950s, has led to the extinction of many of the estimated 400 fish species that thrived in the lake.

The worst problem since 1989 has been the floating mass of water hyacinth that has colonized the lake. Originally at the mouth of the Kagera River in Rwanda, the hyacinth had covered about 680 km² of the lake by 2000, when it was reportedly growing at the rate of 3 ha a day. Since the late 1980s, the plant has had a profound effect on the fish industry. It once blocked up to 80% of the fish landing sites and slowed down commercial transportation. It also decreased dissolved oxygen and prevented light from penetrating into the lake's waters, hampering the growth of phytoplankton—fish food. In Uganda, it damaged bridges and dams, and a huge operational outlay was needed to keep the Owen Falls hydroelectric power plant running.



Above all, ecological problems have led to a rapidly degenerating quality of life for many people. Today, between 50% and 70% of the people live in absolute poverty. The loss of soil nutrients combined with poor farming methods and lacklustre land management has led to low agricultural production. The basin is now one of Africa's most severe hunger spots. To all these problems can be added a high mortality rate from malaria, tuberculosis, typhoid, cholera and AIDS, especially among the Luo people.

Nyando epitomizes the crisis

Lake Victoria gets 85% of its water from rain falling directly on its surface. The balance comes from rivers draining the surrounding catchment (Ong'ang'a and Munyrwa 1998). The entire catchment has up to 20 river basins, the main rivers being the Nzoia from Kenya, the Mara from both Kenya and Tanzania, and the Kagera from Tanzania, Uganda, Rwanda and Burundi. Although many of the other river basins have problems, the Nyando Basin epitomizes the crisis.

'Nowhere else is the environmental crisis as severe as in the 3517 km² of the Nyando Basin, which is made up of three relatively small rivers—the Nyando, the Awach and the Sondu,' says Chin Ong, a principal scientist and hydrologist at ICRAF.

Nyando is where most of the TransVic Project was implemented between 1999 and 2004. The basin is on the Kenyan side of the Lake Victoria catchment. It is divided into the northern and the southern sub-basins (Thenya 2006). The northern has the Sio, Ewaso Rongai, Kotoibos and Kuywa Rivers from Mt Elgon; from the Chelangani Hills the Nzoia River and from Tinderet Forest the Yala River. The southern sub-basin is drained by the Nyando River, which gets its headwaters from Tinderet Forest, the Sondu River from the south-western Mau escarpment and the Gucha, Migori and Moita Rivers. Draining into the 1300-km² Winam Gulf of Lake Victoria, the Nyando carries a heavy load of pollutants, sediments and nutrients that contribute to the eutrophication of the lake, shown by the growth of the water hyacinth.



How water hyacinth affects Lake Victoria's ecology

The water hyacinth has negatively affected the lake's ecology and biodiversity through a natural process, eutrophication, which leads to reduced oxygen and sunlight penetration into the water. Owing to the high nutrient inflows from the Nyando Basin, the lake has experienced a tremendous increase in algal biomass over the 1990s and well into the 2000s. This has created a high demand for oxygen, which is necessary to decompose the dead hyacinth. But at the same time phytotoxins from algal bloom have depleted the lake's oxygen and degraded its waters (Ong'ang'a and Munyrwa 1998). The continual loading of the water with nutrients accelerates the water hyacinth infestation; the loss of oxygen has worsened incrementally; while floating mats of the plant have greatly impeded light penetration—so necessary for phytoplankton to grow. Consequently, the survival of fish, especially those found in the lake's shallow water, as well as other fresh-water life forms, is under serious and rising threat.

A related problem has been the unsustainable use of the basin's wetlands, cutting down on their ability to filter out pollutants and prevent them from flowing into the lake. The Kenyan side of the basin has two major swamps, Nyando and Yala, which provide local people with forage vegetables, firewood and material for thatching, mats and papyrus ropes. Comprising mixed grass, papyrus and isolated stands of swamp forests, the swamps are also used for small-scale farming and grazing, for sand and soil for making bricks, and as a water supply (Thenya 2006). But the exploitation of these resources goes on with little regard for the ability of the swamps to supply the future needs of a big and growing population. The swamps provide a habitat for various bird species; a number of rare mammals, such as the situnga antelope; reptiles (the famous 'omieri' python is mythically associated with flooding) and some endangered fish species. More significantly, the current mode of swamp use, especially the clearing of vegetation, affects the role the swamps play in filtering pollutants and preventing them from finding their way into the lake's water. Consequently, the entire Nyando Basin's biodiversity is under serious threat.

Flooding has been a perennial problem in Nyando Basin. The Lake Victoria Basin has an equatorial climate that owes its characteristics to the big water mass and the diversified nature of its geographical features. This climate is characterized by high rainfall unevenly spread with the long rains occurring between March and May and the short



rains between October and December. Highlands within the basin receive higher rainfall, 1800 to 2000 mm a year, than the lowlands, 800 to 1600 mm. Evidence from past studies shows the rivers had increased their discharge between the 1950s and 2000 (Thenya 2006). This is attributed to the soil cover being washed away after the indigenous forests were destroyed, annual crops that did not provide adequate cover, and overgrazing. Experiencing the brunt of this accelerated discharge are communities living downstream on the basin's rivers, especially within and around such areas as Bundalangi in Kenya. Whenever it rains, floods cause fatalities, displace thousands of people from their homes, and destroy much of their livelihoods.

But nothing is as severe as the massive soil erosion and land degradation in the Nyando Basin. Severe soil erosion is estimated to affect more than 120,000 ha within Nyando and is believed to have started about 100 years ago. Today, as much as a 1.5 m layer of soil, worth millions of dollars, has been washed away. The direct results of the erosion are huge, gaping gullies, some tens of metres deep and extending for miles on end. The erosion continues to deplete much of the soil in Nyando of its nutrients, especially phosphorus and nitrogen.

Partnering to save the lake

These problems have become a major preoccupation of local, regional and international organizations, including the three East African governments. The governments in Kenya, Tanzania and Uganda realized the deteriorating conditions in the lake and the surrounding basin were the root of the crisis and have attempted to address them through the East African Community (EAC) and the World Bank. The three countries reached an agreement on 5 August 1994 in Dar es Salaam, Tanzania, which led to a commitment by the three heads of state to start a joint development programme in the lake region. It also led to forming the Lake Victoria Fisheries Organization and the Lake Victoria Environment Management Programme (LVEMP). Funded by the World Bank and the Global Environmental Facility (GEF) to the tune of USD 77.7 million, LVEMP is a 5-year project that started in July 1997. Its principal goal was to restore the lake to a healthy, stable, productive ecosystem that can support the many human activities within the lake and outlying areas (Sida 2000).

Locally, hundreds of institutions, projects and organizations set up shop within the basin, each doing, or purporting to do, something to save the lake. The flurry of activities revolved around creating environ-



mental awareness, setting up pilot (often unsustainable) projects and enhancing the capacity of the affected communities to tackle some aspects of the crisis. Activities, many of which either duplicated or competed with each other, were harmonized and coordinated in the late 1990s. It was also realized that to reduce pressure on local resources and stem the unsustainable exploitation of the lake, local communities would have to cooperate (Aketch 1996). This belated shift in 'development' recognized that participation of the people, the beneficiaries, is critically important if a project is to succeed.

To encourage community participation, the United Nations Development Programme (UNDP) commissioned OSIENALA, a community NGO whose Luo name translated into 'Friends of the Lake', to organize a series of workshops in Siaya, Homa Bay, Kisumu and Busia Districts. The workshops, forming the preparatory phase of LVEMP, brought together civil servants, local authorities, fishermen, farmers, women's group representatives, community leaders and industrialists to discuss what ailed the lake, fisheries, water hyacinth, wetland destruction and pollution. Participants also tried integrating traditional knowledge and practice with resource use and conservation to solve the monumental crisis facing the lake. The workshops identified broad problems and listed recommendations for projects to fix the problems.

The basin's environmental crisis attracted the attention of foreign governments and international agencies that traditionally cooperated with East African governments on developmental matters. Deserving special mention, the Government of Sweden, through Sida, expressed a long-term commitment to support the East African activities for the lake basin. Sida funded a regional workshop in Arusha, Tanzania, convened by the secretariat of the Commission for East African Cooperation. During the workshop, participants agreed on a coordinated approach to sustainable development in the basin. In mid-1999, the Community established the Lake Victoria Development Programme (LVDP), whose committee is composed of permanent secretaries from partner states dealing with the lake basin. In addition, efforts were made to establish strategic partnerships between EAC and donors to help exploit the basin's potential and address its problems. It was also realized that research, capacity building and support for institutional change needed to be coupled with, or precede, investments. (Sida 2000)

Sweden's support was founded on more than 30 years of successful cooperation with the three East African states and its participation in a largely successful programme addressing environmental threats with-



in and surrounding the Baltic Sea. The Baltic Sea faces problems similar to those of the Lake Victoria Basin. However, unlike in the lake basin where East Africans are yet to get a grip on the situation, a 25-year international effort in the Baltic led to the Baltic Sea Joint Comprehensive Environmental Action Programme, which enabled the states to address problems related to human resource development, eutrophication, harmful persistent substances, oil pollution and poor management of marine resources in a comprehensive manner (Sida 1999).

Since the early 1980s, many organizations in East Africa have invested resources, time and expertise to address the situation in the lake basin. Many of the initiatives have had to do with advocacy or promoting environmental awareness. Few efforts have been backed by information acquired through hard science. Serious research was needed to understand the problems before attempting to solve them. For instance, research was needed to pinpoint, to policy makers, planners, extension providers and farmers, causes of soil erosion and land degradation within the basin. An investigation was needed as to how land-use changes might have altered nutrient deposits. More importantly, it was necessary to develop sound techniques for basin assessment studies, since past studies were mainly restricted to plots.

How TransVic commenced and progressed

Before the TransVic Project, ICRAF and its partners had developed a number of agroforestry methods for tackling the degradation on slopes. Techniques included vegetative strips and contour hedgerows (Young 1997). Whether farmers widely adopted them depended on how effective they were in minimizing soil erosion and increasing food production and whether they cost more in money and labour (Garrity 2001).

TransVic was inspired by the known ecological role of trees and riparian zones in protecting water quality. Forested riverbanks and other buffer zones in New Zealand have been highly effective in preventing sediment and nutrients from finding their way into rivers. Their roles in protecting eutrophic lakes had, unfortunately, received little attention in developing countries. What was needed, therefore, was to seek ways to introduce high-value, fast-growing trees that could generate income in the riparian strips of the project.

Shortly before TransVic commenced, scientists from ICRAF and officers from the Conservation Branch of the Kenya Ministry of Agri-



culture and Rural Development held discussions, visited the Lower Nyando Basin several times, and conducted a participatory rural appraisal (PRA). The proposal spelled out individual activities and the results that could be expected in a schedule with a detailed work plan and budget. ICRAF was commissioned to cooperate with the Kenya government through the Ministry of Agriculture and Regional Development, now called the Ministry of Agriculture.

Once the proposal was developed, ICRAF and the ministry's Conservation Branch formed the project's steering committee. The committee met quarterly to review plans and progress reports, with the meetings coinciding with officially scheduled meetings of the National Soil and Water Conservation Programme (NSWCP). In addition, national, district and division staff of the National Agriculture and Livestock Extension Programme (NALEP, successor to NSWCP) were completely involved in the project. The partners set out to train ministry staff, carry out a series of research studies, and develop several interventions, including agroforestry options that would be tested on farms, supported by ministry staff and farming communities.

ICRAF supported Mwangi Hai, a senior staff member from NALEP's headquarters in Nairobi, to pursue a doctorate with Stockholm University, Sweden, using studies that contributed directly to the project. Much of the field work was conducted in Nyando and nearby districts. A ministry staff member from each district was selected as the main contact for the project, and other staff periodically collected data. Project staff also benefited from a number of training schemes conducted by ICRAF. Detailed work plans were developed quarterly and approved by the project's steering committee.

Sida provided the bulk of the funds for the TransVic Project. The Rockefeller Foundation provided additional resources for work on reflectance spectroscopy. The UK Department for International Development (DFID) supported studies on communication and information systems. The European Union and Danida paid for workshops and further work on policy. Other help came from students of various universities in Europe and the United States who were studying erosion and wetland functions.

TransVic goals

From the onset, the TransVic Project was meant to provide extension workers, policy makers and researchers with information, technology and approaches that could help improve land and enhance the local



and regional environment. With information from scientific research and interventions developed from ICRAF's agroforestry expertise, the project was to aid other stakeholders working for solutions to the monumental environmental and socio-economic crisis facing the Lake Victoria Basin.

The project had several stated objectives:

- To identify and evaluate land management 'hotspots' in the basin and propose interventions needed to prevent or mitigate them
- To identify and evaluate technology, institutional arrangements and policies to alleviate poverty and protect the local and regional environment in the basin
- To quantify the land management options with the potential to raise human welfare and protect the environment
- To establish strong, mutually beneficial research–extension links to improve land management in the basin

ICRAF and NALEP strove to achieve these objectives through research, dialogue, partnering with stakeholders and working with farmers in many focal areas.

ICRAF as a partner

ICRAF is one of the Future Harvest Centres supported by the Consultative Group on International Agricultural Research (CGIAR). It is mandated to advance and promote the science and practice of agroforestry and other tree-based systems, including watershed management. Over the last decade, the centre has worked on such systems in the Philippines, Indonesia, Thailand and the Lake Victoria Basin. Before the TransVic Project, the centre's team of scientists had a significant presence in the basin beginning in 1988, when they worked to develop scientific solutions to soil fertility and erosion problems.

By 1995, ICRAF had partnered with national research institutions and, in particular, the Kenya Forestry Research Institute (KEFRI) and the Kenya Agricultural Research Institute (KARI) to develop agroforestry options, such as biomass transfer systems, vegetative strips, contour hedgerows and short-duration improved fallows to protect the fragile sloping lands of western Kenya from erosion. This joint effort proved that such systems can minimize soil erosion and increase food production without imposing additional labour and financial costs (Garrity 2001). In addition, plot studies have demonstrated these inter-

ventions are effective in reducing soil movement from erosion. More recent larger assessments and hydrologic modelling have shown that parts of the landscape, especially wetlands and river lines, act as sinks for nutrients and sediments eroded and transported from elsewhere.

The centre's scientific advantage became important during the elaborate gathering of scientific information. On this basis, both ICRAF and NALEP were able to test a number of agroforestry options in many of the basin's focal areas. ICRAF decided to concentrate its watershed work in the Lake Victoria Basin partly because of the scale and significance of the basin's problems. The centre had made several scientific advances in detecting and diagnosing large-scale land degradation and needed to test them. To develop a proposal for the TransVic Project, the centre's scientists linked up with representatives from Sida and from Kenya's Ministry of Agriculture to make extensive and intensive field visits, conduct brainstorming sessions and, later, a participatory rural appraisal. The project's start-up activities, beginning in July 1999 and ending in June 2000, were designed to produce tangible results and immediate benefits for the basin's environment and the local farming communities and lead to the development of methods and techniques that could be applied in the entire Victoria Lake Basin and throughout Kenya.

In 2000, Sida changed its support programme in the lake basin. Rather than continuing to offer financial assistance to sectors or projects, the Swedish agency embarked on a programme that supported communi-



Abandoned land in Katuk-Odeyo



ties taking collective action to improve resource management. Among the beneficiaries of this programme was RELMA, whose project in Kusa worked to build capacity, change institutions and convert the local farmers into agents of development. The Kusa project covered two locations bordering the Nyakach Bay, where the Nyando and Sondumiriu Rivers converge in Winam Gulf. This was before RELMA was integrated into ICRAF.

Everyone knew massive soil erosion was taking place in the lake basin and had seen or experienced its effects. Yet it had not been possible to pinpoint the severely affected areas, called erosion hotspots, and it was not easy to provide scientific solutions to existing problems. ICRAF's science and scientists were needed to fill this gap. Primarily, this meant determining the hotspots using a combination of satellite imagery, field measurements, and a new technique, called reflectance spectroscopy. These showed the erosion and sedimentation problems of the Nyando Basin were more severe than anywhere else in the basin. New ways to tackle the environmental problems were necessary because previous efforts to contain and control erosion had largely failed.

It is natural to proceed from the known and the tested. At the onset of the project, ICRAF's scientists attempted to use soil fertility technology developed around the Maseno area for the highland districts of Vihiga and Siaya. However, it soon became apparent that many of the low-lying areas of the Nyando Basin had problems that could not be handled by techniques developed elsewhere. While Vihiga and Siaya are rolling upland areas with relatively high and uniform rainfall, the Nyando Basin contains different soil types, its soils are severely degraded, and its climate is harsher. The scientists realized that the soil fertility technology developed in Maseno could not cope with problems in the Nyando Basin. For instance, none of the existing agroforestry techniques developed to enhance soil fertility was suitable for controlling gully formation or protecting riverbanks. It became apparent a more patient approach was needed to identify and test new agroforestry options for the huge land degradation problems of the Nyando Basin.

ICRAF worked with the East African Secretariat on Lake Victoria, government departments, national research institutions and national universities. Communities, and particularly local farmers living in NALEP's focal areas, were important clients for the centre's scientific options, innovations and technology. ICRAF also partnered with regional research institutions and local and foreign universities in carrying out extensive research, while NGOs and community organizations



also played a crucial role in taking the scientific messages into the field and promoting agroforestry and farm enterprises beyond the pilot areas into larger and bigger groups of farmers who were suffering the brunt of the basin's problems.

NALEP as a partner

In Kenya, the Ministry of Agriculture, and partly the Environment and the Water ministries, are charged with conserving soil and water resources. Close to 80% of the country is either arid or semi-arid. It is characterized by unreliable rainfall that barely surpasses 600 mm, spread over two seasons annually. Apart from a few big rivers, many of the country's rivers are low in volume, while thousands are seasonal. Fresh-water lakes are few, small and unevenly distributed. To compound these inadequacies, the country's five principal water towers, the Mau Forest complex, Chelangani Hills, Aberdare Forest, Mt Kenya Forest and Mt Elgon, are under serious and growing threat from commercial loggers, charcoal traders and farmers. All this is taking place with a growing demand for water from expanding horticultural production, growing urban areas, and large and increasing human and livestock populations.

The Kenya government has long realized the country's water resources are under serious threat and has taken a number of measures. It has deployed armed personnel from the Forestry Department and the Kenya Wildlife Service to guard the principal catchments, conservation officers in every division and extension providers in every location. Between 1974 and 2000, the Soil and Water Conservation Branch of the Ministry of Agriculture implemented the National Soil and Water Conservation Programme (NSWCP) with support from Sida. NSWCP activities were in selected catchments or focal areas from about 150 to 200 ha. In the focal areas, technical assistants from the ministry worked closely with local elected catchment committees for one year before transferring to new catchments, leaving behind the extension providers to follow up. This approach has been widely credited with forging a relatively successful system of reaching out to farmers, mobilizing investments in soil and water conservation management and stemming land degradation (Longley et al. 2006). The TransVic Project relied on this system and built upon it.



In July 2000, a decision was made to replace the NSWCP with another Sida-sponsored programme, NALEP. NALEP was designed and mandated to bridge the gap between research and extension to help alleviate poverty and aid Kenyan farmers by coordinating the activities of the many extension providers—government, private and non-governmental organizations. To achieve this, NALEP helped form focal area committees, common interest groups, and assisted community groups form links with agencies and markets. Through the focal-area approach, NALEP helped develop community action plans that respond to the immediate and longer-term needs of local residents through participatory planning and appraisal.

NALEP was further mandated to integrate gender into its extension approach, empowering farmers by using participatory and democratic procedures, giving them leadership training, and thus engendering self-reliance among farmers. These were packaged in its regional action plans and farm-specific action plans for resource-poor farmers. In addition, NALEP worked to protect the Kenyan environment by making community leaders and other stakeholders aware of environmental rights and laws, and through training its staff on environmental impact assessments and environmental audits.

The focal area system took into account both the physical and the cultural environment of relevant watersheds. This system was used by ICRAF scientists and NALEP staff for the interventions introduced during the project.



Chapter 2

Researchers' View of the Basin's Crisis

The guiding principle of the project since its inception was to find workable solutions to the basin's crisis, such as stemming erosion by building on past agroforestry approaches, rather than conducting research for research's sake.



Everyone concerned—farmers, government officials and NGO operatives—had an idea as to the nature of the crisis facing the Lake Victoria Basin. Fishermen who had seen a progressive decline in fish they caught over the years, farmers whose crops wilted following striga infestation, commercial transporters whose businesses had almost ground to a halt at the peak of the water hyacinth growth, universities, the Kenya government, quasi-government institutions, international agencies and bilateral institutions all seemed to have reached consensus that something needed to be done.

And many did do something. There were those who saw solution in terms of sensitizing local communities on the danger of the ongoing environmental destruction. They did this with the apparent assumption that if each person were to make an effort, the collective effect would be significant. Some saw a solution in building the capacity of the large number of farmers who struggled to earn a living from the impoverished soils in the basin. Others saw the solution in digging extensive canals not just to stem the flow of storm water, but also to render it harmless by redistributing its energy.

The pessimists, especially local politicians, looked at the huge gullies in Katuk-Odeyo and lost any hope that the situation could ever be rectified. They urged instead that people be relocated out from the affected areas.

Many people looked at the symptoms and not the root causes of the crisis. According to many ICRAF scientists, the systematic loss of soil fertility, the extensive water hyacinth growth, and the progressive gullying in Katuk-Odeyo, Ragen and elsewhere were systemic problems with no simple solutions. Working from this perspective, the research team, comprising ICRAF senior staff, NALEP staff, visiting scientists from local universities, and students studying at local and international universities, carried out individual and joint research that sought to identify and pinpoint the detrimental causes. Studying the problems, they said, was necessary if effective solutions were to be worked out. It was essential to thoroughly understand the problem before seeking to solve it. And with the bulk of financial support from Sida, the Rockefeller Foundation, Danida, USAID, the University of Florida and ICRAF's core funds, the team just went out to do exactly that.



Studying the Nyando Basin

'The Nyando is meandering and temperamental. It has a mind of its own.'
—William Oneya, a farmer who has lived close to the Nyando River since 1947.

ICRAF's suitability to implement TransVic had to do with its scientific edge, especially its experience in working in watersheds in the Philippines and indeed in the lake basin. The centre had been working in Kenya for almost 30 years. As an international science centre, ICRAF was well placed to handle the project because its science was needed to accurately identify areas in the basin where erosion, pollution and deforestation were more manifest.

Serious work on the TransVic Project began in 1999. The partnering organizations helped locate and characterize areas within the basin where the land was degraded. Scientists employed new techniques to assess and diagnose degraded areas, including reflectance spectroscopy, remote sensing, molecular dating and extensive field measurements. These techniques enabled the team to find areas where erosion was occurring rapidly, those where it was moderately slow, and areas where sediments lay and continued to accumulate. Thus the team could estimate the net erosion in the basin.

The team developed and employed interventions that offered hope for improving farmers' livelihoods and halting degradation. Applying these techniques farm by farm went well enough, but team members soon realized large-scale efforts were needed to achieve widespread effect. Evidently multilateral donors such as the Global Environmental Facility were in agreement with this approach. Through the World Bank, the Global Environmental Facility supported a joint initiative between ICRAF and KARI with USD 4.1 million. Termed the Western Kenya Integrated Ecosystem Management Project, the initiative sought to use technical and institutional approaches in addressing environmental problems in the Nyando, Yala and Nzoia River Basins. Plans are to expand the results of this project through a USD 60 million project that the Kenya government is preparing with support from the World Bank.

Wetlands surrounding Lake Victoria have long filtered out sediments and nutrient loads borne by the rivers flowing into the lake. But over the years, large areas of wetlands have been converted into farmland and irrigation schemes. ICRAF was involved in a scientific enquiry that studied the current state of particular wetlands and how human activity affected their well-being, aiming to provide strategies



for using wetlands more profitably, efficiently and sustainably. Giant bamboo was introduced in 2003 to see if it will enhance the filter function of the wetlands and at the same time serve to raise household incomes.

Throughout much of the TransVic Project, agroforestry and other farm interventions were introduced and tested through NALEP's focal areas. More recently, ICRAF contracted a scientist from the Jomo Kenyatta University of Agriculture and Technology to develop a model that predicts soil loss in the event of major climate change and how conservation agriculture could reduce it. The model shows that doing nothing would lead to catastrophic loss of millions of tonnes of soil because rainfall is expected to increase and become more variable. Currently ICRAF is working to get the government and policy makers in the region to embrace conservation agriculture in the entire basin, especially along the steep slopes of Kericho and Nandi Districts.

1999/2000

During and after the start-up in 1999, researchers addressed a host of issues. Initially, the research was broad and focused on identifying basin soil erosion risks. The aim was to set priorities, using large-scale maps and GIS databases, on the river basins that showed the most widespread degradation. The larger Nzoia–Yala and Kagera River Basins appeared to be the biggest sources of sediment into Lake Victoria while the relatively smaller Nyando basin had the most severe degradation problems.

Start-up activities concentrated in the Nyando and Sondu–Miriu River Basins that drain into Winam Gulf near the town of Ahero, covering about 7000 km². Indeed, the 3517-square kilometre Nyando Basin, spanning from the shore of the lake to upland areas of Nandi, Londiani and Kericho, was seen to be the most degraded and the major source of pollutants flowing into Lake Victoria. Here erosion resulted in severe rills, huge, deep gullies, and riverbank erosion, especially in the lower reaches. The basin's soils also faced widespread physical and chemical degradation; 46% of Nyando was thus degraded. The erosion had its roots in the unsustainable land management system that was identified as 'the proximate cause of both the lake's environmental problems and major livelihood concerns of communities' (Shepherd et al. 2000). This manifested itself in massive deforestation of stream catchments, overuse of fragile lands, and encroachment of wetlands. Nyando was the bedrock of the crisis and was to remain the focus of phase 1 of the TransVic Project that ended in June 2004. Some research was conduct-



ed in the Sondu-Miriu and Yala River Basins as well.

In their recommendations on what needed to be done, scientists pointed out the advantages of reducing pressure on fragile lands, particularly the hill slopes with fragile soils, on the plains and the Nyando escarpment. They recommended that corrective action be taken to restore the wetlands' filter functions and raise agricultural productivity. It was hoped that activities undertaken in this start-up year would be the basis for a long-term project extending beyond Kenya into Uganda, Tanzania and possibly Rwanda.

2000/2001

Following the extension of the project by four additional years, researchers followed the broad hints made during the start-up year. Research in 2000/2001 concentrated on assessing soil erosion risks in the entire lake basin, studying biophysical aspects of the problems, and collecting district data on the socio-economics of the Nyando Basin. A summary of the main research findings and results during this period are as follows:

- There has been a 3 to 4-fold increase in soil erosion and sedimentation in the Nyando Basin over the last 100 years. This has been punctuated by extreme rainfall. An estimated 1.5-metre layer of soil has been washed away. Today, about 129,522 ha, 35% of the Nyando Basin, is severely eroded. Since 1963, the Nyando Basin has lost 3.2 million tonnes of soil. Each hectare within the basin has lost as much as 40 tonnes of soil a year. Erosion has led to massive loss of soil nutrients, such as carbon, nitrogen, phosphorus and potassium. This was established through elaborate laboratory tests, which also established that eroded soils were infertile because they had little organic matter. Scientists estimated the economics of the lost soil. The findings became the basis of the conclusion that the affected areas were unlikely to effectively support crop production without controlling erosion and replenishing lost soil fertility (Swallow et al. 2001).
- Erosion has impaired the physical properties of the soils, their hydraulic conductivity and water retention capacity, rendering them infertile and unsuitable for subsistence agriculture, particularly for continuous cultivation of maize and other staples; 50% of the original farmlands in the Nyando Basin have been abandoned.
- The eroded soils and the nutrients in them are mainly deposited into Lake Victoria. Over the years, this has formed a sediment plume, mapped out by ICRAF for the first time in 2000 using



satellite imaging. The plume has now extended over 45 km into the lake. Research shows that the plume, which has had a negative effect on the lake's ecology, is related to eutrophication and to the rapid spread of water hyacinth. Besides being a major obstacle to shipping in the lake, the floating masses of water hyacinth seriously threaten the survival of fish and other aquatic animals, thereby threatening the livelihoods of hundreds of thousands of fishermen.

- ICRAF developed a new, rapid and more precise technique to measure erosion and deposition rates and applied it over vast areas in the Nyando Basin. Termed 'reflectance spectroscopy', this analytical technique determines the properties of a substance from the interaction between its surface and light (Vagen et al. 2006). It is a simple, rapid technique, previously used in the pharmaceutical and petrochemical industries and in assessing the quality of grains and forage. ICRAF scientists designed a newer version of the technique to determine soil characteristics from satellite images. The technique enabled ICRAF to establish the precise proportion of the soils in the Nyando Basin that have been degraded. It significantly reduced the time and cost spent using traditional soil analysis methods. This was a major scientific contribution of the project.
- Strong evidence indicated the relationship between erosion status and soil properties. Erosion had a marked effect on infiltration capacity and maize productivity.
- Research improved the understanding of how changes in vegetation affected soil erosion and infiltration. The team measured rates of soil erosion under different vegetation. Scientists placed erosion pins into the soils then later used metal detectors to locate the pins. When uprooted, the pins helped measure how much soil had been carried by runoff. The experiments were done under different vegetation types, from grasslands to shrublands. The most important observation was that wherever vegetation was in direct contact with the soil surface, it was extremely effective in preventing erosion. This was termed 'contact cover'. The finding implied that if a dense contact cover could be maintained in the degraded areas of the lake basin, much of the erosion problems would be addressed. Following these experiments, scientists now know the rates at which erosion had taken place in areas with different types of vegetation and can now better advise farmers, extension providers and the government on the vulnerable areas within the basin that urgently need replanting.



- Scientists could pinpoint erosion hotspots using the global positioning system (GPS). This was achieved through satellite imaging and normal random sampling. It culminated in mapping the areas within Nyando Basin that experienced the greatest soil loss. These were called erosion hotspots. This equipped scientists to advise farmers on what to do in different locales within the basin to raise agricultural productivity.
- Using many methods, including stable isotope analysis, field measurements and reflectance spectroscopy, scientists assessed the effects trees and shrubs had on erosion. Results showed that areas formerly covered by woody vegetation were generally in much better condition, with lower erosion and higher fertility, than areas formerly covered by grass.

Data on population density, poverty and agricultural production were collected by district and from available secondary sources and later complemented with baseline household data from nine villages within the basin. It became apparent that much of Nyando had experienced severe land degradation; the basin had pockets of severe poverty, extensive environmental degradation and extremely low agricultural production. The team determined that the most degraded parts of the basin were those used for open grazing and extracting firewood. Areas under subsistence crop production were not as degraded. There was little evidence that farmers in the basin had engaged in any agroforestry before the TransVic Project. Out of 1000 sites selected for data collection across the Nyando–Awach and Yala River Basins, only 2.7% of the farms had any soil conservation structures. Death and disease were constant visitors, especially in the Luo-dominated areas. In a sample of 1083 households in Lower Nyakach of Nyando District, the ICRAF–NALEP team found few economically active men but numerous widows (25.5%) and orphans (6.4%) heading households.

The findings pointed to specific extension approaches, investments and policies to address the crisis. It became clear that open grazing prevented farmers from trying soil and water conservation measures because livestock normally destroyed them. In Kericho, the team found that water harvesting was attractive as a group investment. For instance, through PRA conducted in 17 focal areas, water harvesting was seen as a means to water livestock, have water for domestic use, produce vegetables and raise trees. Farmers in Burkamach–Rakwaro in Upper Nyakach Division and in Chebitet of Kericho were willing to contribute labour towards constructing water pans. The research team concluded that the entire Nyando Basin needed greater extension and other services. The team called upon local extension and development



agencies to base their investments and efforts on four main problem areas:

- The Kano Plains had extreme poverty, high population density, high incidence of disease and death, low agricultural productivity and fragile soils highly susceptible to erosion. The team recommended reducing pressure on the land and 'alleviating the sad social circumstances of the people living in the area'.
- Some areas within the Nandi and Kericho escarpments were under severe stress from cultivation, land clearing, grazing and fuelwood extraction. The researchers called for better organization of community groups to protect these vulnerable areas. They also said that extension and development agencies should invest in increasing on-farm water, fuelwood supply and livestock feeds, and that they should support community resource management.
- The formerly forested areas of Mau and Tinderet faced soils turned hardpan and low agricultural productivity. Extension and development agencies were advised to help the communities make their lands secure, as they had almost lost them in the politically motivated land clashes of the 1990s.
- The hilly areas of Nandi and Kericho were also problem areas, even though they had higher agricultural potential, less poverty and less resource destruction. The inhabitants showed marked willingness to take extension advice and needed to be advised on how to pool their resources for collective management and investment.

2001/2002

During 2001/2002 the project underwent a number of changes. It benefited from additional resources from the Rockefeller Foundation, REL-MA, Danida, ICRAF's core funds, DFID, Utrecht University, Uppsala University, USAID and the Biodiversity Transect Monitoring Analysis in Africa (BIOTA). It also gained not only new staff but also additional components. David Nyantika, then heading the Nyanza Provincial Soil and Water Conservation Office, was seconded to the project, while Diane Russell, a social anthropologist, was appointed to the enterprise development component. Other staff changes included the appointment of two visiting scientists, David Mungai from the University of Nairobi and Njeri Muhia from Egerton University. In addition, NALEP requested that the following components be incorporated:



- geographical information system (GIS) training for ministry staff
- support for enterprise development
- training for staff on participatory monitoring and evaluation for impact assessment

The emphasis during 2000/2001 had been on large-scale basinwide mapping of areas that showed they were at great risk of soil erosion and decline in fertility. The emphasis shifted in 2001/2002 to the Kenyan portion of the basin. Researchers targeted the most important hotspots. They strove to understand the nature of the erosion and deforestation, the biophysical results of land degradation, which showed up in impaired crop productivity, changes in rainfall patterns, capacity of the soil to retain water and overland flow and the interventions needed to deal with the degradation—the policies on forest conversion, placing and designing water harvesting structures and reforestation (Swallow et al. 2002). The problems led the researchers to concentrate on forest margins, the escarpment dropping onto the Kano Plains and the basin's wetlands. Some of the principal findings and results during 2001/2002 follow:

- For the first time the extent of deforestation was assessed in the Kenyan part of the lake basin. Researchers selected soil samples from ICRAF's extensive soil library to represent a range of soil conditions across the basin. To differentiate between soils historically under forest, bush and grass, they assessed the soils' carbon ration in laboratories at the University of Florida in the United States. It became apparent that forests and bushes had covered 2 to 3 times more land in western Kenya than they do today. Furthermore, soils in former forests are much less likely to erode than former grassland soils.
- The researchers analysed the decline in soil fertility after deforestation. Using the declining but still important Kakamega Forest as the yardstick, the researchers tested soils in the peripheral areas that had been converted to farmland over the last 60 years. It became evident that soil fertility declined gradually the first 20 years after conversion but dropped rapidly the next 40 years, losing 92% of its former fertility after 130 years.
- The degraded part of the Rongo catchment has been eroding at the rate of 90 tonnes per hectare a year over the last 40 years.
- Basing their analysis of deforestation and afforestation in Tinderet and Kakamega Forest between 1986 and 2000, the researchers discovered that forest destruction within the basin came from the expansion of agriculture and the extensive



logging taking place within and outside the forest reserves. It is alarming that the forest ecosystem is shrinking more rapidly than from logging alone.

- A review of the project's progress revealed the need for better coordination and communication of the project's activities and achievements. A newsletter, *TransVic News*, was created and information on the project was published on the Internet.

2002/2003

In 2002/2003, Brent Swallow was appointed to new duties at ICRAF and Chin Ong became the new TransVic Project coordinator. The wetlands component was strengthened through collaboration with Bonn University and the University of Anglia. The GIS training was redesigned to provide practical skills to ministry staff in the districts and divisions where the project was most active. A water management study in two focal areas was undertaken following NALEP's suggestion and a one-year project, *Voices of the Poor in Lake Victoria*, was started in the three East African countries.

The project received additional collaborators. Chief among them were the National Environmental Management Authority (NEMA), the Lake Victoria Development Programme of the East African Community, the Ministry of Water Development, the Survey of Kenya and VI-Agroforestry. Many of these institutions established stronger partnerships and closer collaboration with the implementers of TransVic. The Kenya Organization for Environmental Education established a partnership in Nyanza Province with ICRAF in a school environmental awareness project, dubbed 'Ecoschools'.

The project's policy issues were strengthened after the European Union funded a workshop, *Reversing Agricultural and Environmental Decline in the Nyando Basin*. To disseminate its principal findings the project published brochures and posters and a second issue of *TransVic News*. It made a presentation at the World Summit on Sustainable Development in September 2002 in Johannesburg, South Africa, and another at the World Water Forum in Kyoto, Japan, in March 2003. Local and international media drew attention to the plight of the 184,000-km² basin when the *National Geographic* channel aired 6-minute clips and the United States Public Broadcasting Service 10-minute clips on the crisis facing the lake basin.

The research team continued to make progress in understanding the nature of the environmental and human problems facing the basin.



While part of the research was a carryover from the previous two years, it led to a number of remarkable results. The researchers used the radionuclide technique to measure sediment cores at the Nyando River outlet and found that sedimentation had increased between 3 and 4 times over the last 100 years. The historical sediment profile showed that the average rate of sedimentation over the last 150 years was 0.96 cm a year. Higher levels in the early 1960s and in 1997–1998 were due to El Niño rains. This information will help develop ways to tackle pollution and ensure that water and land ecosystems are maintained.

Using diffuse reflectance spectroscopy, the team could differentiate between areas within the basin that were sediment sources from those that were sediment sinks (Ong et al. 2003). Later, the researchers used satellite images to map the geographical distribution of probable sources. The maps showed that sediment sources occupied 60% of the Nyando Basin and that they were depleted of major soil nutrients: nitrogen, phosphorus and organic carbon. This is partly attributed to their inability to absorb rainwater, making the soils unsuitable for subsistence agriculture.

Researchers continued to monitor water quality along the main rivers draining into Lake Victoria—Nyando, Sondu, Yala and Nzoia. During the rainy season they drew samples at three different points: upstream, midway and at the river mouth. Passing a light beam through each water sample gave the value of the normalized turbidity unit (NTU). Scientists established that the Nyando River carried the highest amount of sediment and was the dirtiest. Between January and November 2001, it had an average NTU value of 527. This was followed by Nzoia at 294 NTU, Yala at 276 NTU and Sundu at 116 NTU. Turbidity in the Nyando River was highest during the long rains when it reached a high of 576 NTU during the first long rains. The Nzoia River had also a high 515 NTU. The next long rains produced less sediment, about 250 NTU from both rivers. The Sondu River bore the least sediment load, averaging 20 to 30 NTU over its entire course.

In general, turbidity in these rivers exceeded what is acceptable for most water use. Water is considered safe to drink if it has turbidity between 1 and 5 NTU. For recreation, turbidity is acceptable if less than 5 NTU, while maintaining aquatic life requires less than 50 NTU. The high NTU indicated extremely low water quality in the basin's rivers, unsuitable for consumption or industry. Scientists also concluded that the water might harbour harmful bacteria, viruses and protozoa. Poor quality water was associated with high levels of blue-green algae and low fish population in Lake Victoria.



The extremely high amount of sediment in the water was attributed to erosion from cultivated hill slopes and the loss of riverbank vegetation in the lower reaches of the rivers. Big changes in land use and cultivation close to the riverbanks over the last 50 years at Kobongo in the Kano Plains noticeably increased sediment. This blocked the distribution channels of a once-thriving rice irrigation scheme in the Kano Plains. The Yala and Nzoia River Basins also experienced considerable land-use changes, including vegetable cultivation along the valley bottoms. But Yala Swamp remained relatively undisturbed, allowing sediment to be trapped before the river reached Winam Gulf.

The nutrients carried by the Nyando, Nzoia and Yala Rivers during the long rains in April through July 2001 showed high nitrogen and phosphorus concentrations. Phosphorus in the Nyando River was 4 to 5 times higher than in the Sondu. The source of nitrogen and phosphorus in these rivers was not known because chemical fertilizer use in the areas under study was generally low, while the soils had low phosphorus content. Nevertheless, such high nitrogen and phosphorus concentrations in Winam Gulf seriously affected aquatic life and the water quality in the lake. It was not surprising that a heavy water hyacinth infestation returned to Winam Gulf despite costly manual removal in 2001.

Researchers completed two studies on surface infiltration and subsurface hydraulic conductivity in the Awach and Ragen of the lower Nyando Basin. The studies established high infiltration of rainwater above and immediately below the escarpments and low infiltration in the lowlands. 'This soil structure explains the pattern of gully development in the area, the persistence of flooding in the lowland and the failure of a water pan constructed in the mid slope at Ragen' (Ong et al. 2003). The researchers concluded that the Nyando River needed water management structures built where subsurface flows broke out as springs, especially on the slopes.

Implications of the results

For villages with several hundred homesteads to all of East Africa with millions of people, the research carried out during TransVic has relevant policy implications. For villages, PRA highlighted that water management was critical to ensure uninterrupted water for households, raise farm productivity and address erosion, soil nutrient loss and perpetual flooding. Discussions with village leaders pointed out that new by-laws were needed to help construct and maintain water



management structures. The studies pinpointed where such structures could be built successfully and where it would be futile to build.

Open, uncontrolled grazing was a factor behind the degradation, making it necessary to restrict grazing. Research also indicated Kenya's energy policy needed to encourage farmers to produce timber, fuelwood and charcoal to meet increasing wood demand. ICRAF's chief scientists presented the main findings to policy makers, extension providers and other concerned people, giving them ample opportunity to talk with the scientists. The East African Secretariat previewed the project's science, hoping to base new policies on findings that would help salvage the lake and its basin.

The researchers advised farmers in Vihiga, Siaya, Nyando and Kericho on using artificial fertilizer to raise crop yields. These areas required phosphorus fertilizers. But for better output, they recommended that these fertilizers be used with nitrogen, improved fallows or biomass transfer. Livestock keepers were advised to start producing feed and controlling livestock diseases; the poorest were advised to raise dairy goats. The scientists recommended planting trees to improve soil fertility and for commercial production; erecting barriers to restrict livestock, protect springs and stream heads; and finding and working with customers to sell farm products. The recommendations shed light in solving the crisis facing the Nyando Basin and the entire Lake Victoria Basin. They are low-investment options that can help thousands of poor homesteads and return well-being and integrity to the basin's environment.

A different school of thought believes that although research is fundamental in addressing the crisis, it should be backed by a more 'radical' approach. There ought to be a concerted effort at changing attitudes toward the entire farm system in the basin and overhauling policies that guide how Kenyans, particularly those living in the basin, interact with their environment. While it might serve the immediate goals of keeping hunger at bay, subsistence farming, which is complicated by constant subdivision of the land into ever-tinier, 'envelope-sized' plots, has no future. It is time the system was replaced by a more commercial production system on better-managed plots. Many within the local farming communities will need to change their attitudes and to be more independent and confident in their farming approach.

The entire Nyando Basin should be governed by an enforceable land-use plan. Current practice allows anybody anywhere to do whatsoever they like with the land to which they have title. Thousands of Kericho farmers work land along steep slopes, making little effort to stem soil loss. Tens of thousands of farmers in the Kano Plains work the fragile



soils season after season, cultivating staples with minimal or no fertilizer. Overgrazing, deforesting and cultivating riverbanks have done the rest. It is difficult for poor farmers to invest in land improvement. Land-use practices in many parts of the Nyando Basin disregard ecology and sustainability. A land-use plan would delineate areas ecologically suitable for different forms of land use. It would direct land-use options in each zone and enforce rules and guidelines on how farmers should use the land. To be democratic, the plan should be promoted to all and accepted by the majority of landholders in the basin. Before any radical move, farmers, especially the poorest, will need start-up credit to invest in some of the TransVic Project recommendations. While this was not part of the initial goals and objectives of TransVic, it was recently adopted, to a limited extent, by the government in Vihiga District (see subsequent sections) and by other partners, under the auspices of the Consortium for Scaling-up Options for Increased Farm Production in Western Kenya (COSOFAP).

Communicating to policy makers

The TransVic Project ensured the findings, technology and scientific recommendations were compatible with official government policy on the basin and aligned with how local people held and used the land. It was absolutely important that the techniques, findings and recommendations made during the research were appreciated, if not adopted, by politicians and policy makers. It is hoped they will allocate the necessary resources to turn around the problematic environmental situation.

ICRAF painstakingly communicated research findings, results and preferred techniques to address Nyando's environmental problems. The foundation of the project was a working partnership between ICRAF and the Ministry of Agriculture through NALEP. Both parties were involved in implementing the project. Many of the principal findings were communicated through workshops held in Kisumu and Kericho, brochures, the *TransVic News* and a website developed in 2002.

Two major workshops were held with support from the European Union. A workshop, at the Kericho Tea Hotel, was attended by senior administrators, district policy makers and planners and by representatives of other organizations and institutions. Brent Swallow, who then coordinated TransVic, summarized the workshop's aim, 'ICRAF has been gathering data in the last four years. Now it would like to present



this information in a way that will be useful to government officers and other stakeholders working in the region.' Government officers were urged to make known what information they found useful and how information should be packaged to meet their needs.

Though remarkable progress was achieved once authorities and stakeholders understood the Nyando crisis and how it should be addressed, several local politicians have been most discouraging. Some appear to have given up, asserting that that the people living in the hotspots should be relocated.

Despite the pessimism of those local politicians who felt the land degradation and erosion problems too enormous to overcome, ICRAF took its scientific findings from the laboratory into the field, scaling up the interventions and embracing the project's extension. ICRAF is now working on a new project on ecosystem rehabilitation in three blocks of the Nyando Basin—Katuk-Odeyo, Londiani and Nandi—to test the phase 1 results. ICRAF will partner with KEFRI, KARI, and NALEP in applying the scientific methods and the technological interventions developed within the basin and elsewhere to address the widespread problems. The centre has identified nine blocks out of the entire Lake Victoria Basin, about 90,000 ha, as this study's focus.

But TransVic's phase 2 remains at the mercy of the basin's politics and culture. The extent to which innovations and technology are adopted in the basin will depend on how the socio-economical, political and cultural aspects evolve in the effort to solve the crisis in the next few decades. For instance, land tenure in different parts of the basin is likely to influence how agroforestry techniques and conservation agriculture are appreciated, adopted and incorporated on farms. Although these approaches stand a good chance of solving the crisis in the Nyando Basin, whether the government chooses to embrace them fully in making land-use plans, implementing policy, and making future public investments remains as much a political as it is a land management issue.

Although governments are catalysts in development, their input is smaller than that of the individuals who take on the challenge and consistently work to meet diversified needs. Efforts must be guided by norms, laws, policies or unwritten codes that change to suit emerging situations. In the Nyando Basin, ICRAF's research occasionally clearly showed the magnitude and nature of the crisis. It laid the blame where it squarely belonged—unsustainable land-use practices. Through TransVic Project research, ICRAF scientists did make significant progress in understanding the nature of the crisis and in communicating about it. They partnered with NALEP staff, other stakeholders and farmers to propose and test innovations to improve the environment and allevi-



ate poverty. These innovations are not prescriptive but are techniques transferable to other basins within the Lake Victoria Basin and in countries where wetlands face similar problems.

Researchers concentrated on Winam Gulf, a relatively small part of the lake basin. Since scientists have not exhaustively studied what is taking place in about 20 other river basins and this vast area was not touched, the relationship between these basins and Nyando Basin is not scientifically known. It is not clear how much of what is taking place in Nyando Basin affects the rest of Lake Victoria Basin, or the reverse. TransVic might encourage similar research in the other river basins.

The other major challenge is how far the findings, recommendations and prototype solutions made in phase 1 can hold out in the long term, particularly with predicted changes in climate. Although scientists are not universally agreed on global climate change, the continued shrinking of the Mt Kilimanjaro glaciers in East Africa is likely from global warming. In the coming decades, changing climate might translate into extreme weather in other parts of the region. This might mean extensive drought in the drier parts of the region and a massive rise in rainfall in and around Lake Victoria Basin. If the peoples and governments of East Africa do nothing, erosion in the basin could alter its pattern and intensity. Then it is very likely that the parameters as identified and analysed by ICRAF might not hold. With this in mind, ICRAF commissioned a consultant in 2005 to develop a model that utilizes rainfall data to predict likely erosion scenarios in parts of the basin and to predict the role that conservation agriculture would play in reducing erosion, especially along steep slopes. But conservation agriculture is a relatively new approach that has many grey areas, and it will definitely be some time before farmers and policy makers adopt it.

Conclusion

There is no quick fix to the enormous soil and land degradation problems in the Nyando Basin. Nevertheless, ICRAF is optimistic that relocating people out from the basin will not be necessary. The crisis is complex and systemic and cannot be addressed by simple solutions or within a few short years. Walsh, a landscape ecologist with ICRAF, believes the vegetation cover in entire basin must be greater. This would improve the livelihoods and incomes of millions of people living in the basin and help correct the environmental disaster there. Such an intervention will need to be carried out simultaneously in the basin's upper reaches, midlands and lowlands.



Chapter 3

Scouting for workable solutions

From the onset of TransVic, linking research to extension by intervention was as important as the research itself. Important too was establishing scientific policies that the ministry and other stakeholders needed to incorporate to address the Nyando Basin's problems. Working with communities, ICRAF and NALEP staff used participatory rural appraisals to identify and assess initial problems and their solutions. By training the extension providers and farmers, partners set the right conditions for the interventions. TransVic carried out a series of farm trials with communities living in the main hotspots that involved domestication of six fallow species.



NALEP's focal area approach came in handy

By 1999, the project implementers had laid out broad goals for the intervention:

- Reduce pressure on the vegetation cover in fragile lands, within water catchments, on shallow soils on hill slopes and within the Nyando escarpment
- Restore the wetlands filter functions and riverbank buffer strips
- Increase the productivity on high-potential agricultural land to ease pressure on fragile lands

Initially, partners recognized the usefulness of the ministry's catchment extension programme, or focal area programme, in getting farmer participation in the project. As many as 10,600 farmers in 177 focal areas had adopted a ministry recommendation. The programme, however, had flaws that could hinder the stemming of sediment and nutrients from flowing into the lake. It approached soil and water conservation on farms and not beyond. The ministry's soil and water conservation branch had concentrated on areas with high population density and areas where farmers raised cash crops. It had done little work in more marginal areas or within trust lands, especially where people used land extensively for agropastoralism, such as communal grazing.

ICRAF thought the approach needed to be complemented by approaches suitable for diverse land uses—forests, agriculture or trust land—and which encouraged more community participation. ICRAF wanted more emphasis on fragile lands, riparian zones, wetlands and headwaters. ICRAF knew the high cost of rehabilitating marginal areas and recommended testing their potential to regenerate naturally, enacting a suitable policy and restructuring local institutions to improve the management of local resources.

How communities perceived the solutions

The communities were concerned about land degradation, which made interventions easier. The interventions were tailor made to suit specific community's needs. During 1999/2000, 18 PRAs conducted in the Nyando District showed that local people were concerned over the



extensive degradation and had identified uncontrolled grazing of fragile lands as one of the biggest obstacles to overcome in managing their lands. The PRAs sought to identify what hindered better natural resource use. They sought local people's perceptions on causes and effects of erosion, the livelihood options they had, and the problems hindering smooth operations. Conducted by interviewing groups living in different areas within the basin such as steep hills, gently sloping plains and the flood zone, the appraisal helped pinpoint access to water (for domestic use and irrigation) as the biggest problem.

Previously installed water-harvesting structures on steep hills and gentle slopes tended to dry up during dry spells and where rainwater runoff was immediate. Communities in the plains identified flooding as a major problem. Other problems identified were damage by free-grazing animals; overuse of common resources; erosion on steep slopes, livestock tracks, footpaths and riverbanks; gully formation; and less land available for farming. From PRAs, the team compiled a list of local institutions that could catalyse the interventions.

The appraisal reinforced community involvement and helped restructure local institutions to cope with managing environmental problems over large areas. This was necessary because the farmers who had adopted at least one ministry recommendation occupied a mere 8% of the basin. These farmers were where cultivation had been going on. Farmers in marginal lands had little incentive to invest in soil and water conservation. Resources that communities depended on for off-farm enterprises—river buffers, wetlands and public land—needed management. Other recommendations included adopting agroforestry approaches.

The development of a new technique for rapidly assessing land degradation, erosion risk and soil quality made the interventions easy. Reflectance spectroscopy can scan several hundred soil samples a day and predict several of their attributes. ICRAF scientists were able to map areas with soil erosion, areas with soil that eroded easily, areas with infertile soil, and areas that were intact but were at risk of degrading if not carefully managed. The technique needs to be modified to a format that extension providers and farmers can easily use.

The implementing team classified different approaches to address different degradation problems within the basin—law enforcement, reforestation, land adjudication, controlled access to grazing areas, riverbank vegetation, soil conservation on farms. The best-bet interventions were credited with raising agricultural productivity and reducing pollution into Lake Victoria.



Training

Since the start-up year, the interventions were associated with an elaborate training scheme that benefited farmers and different cadres of ministry staff. As mentioned earlier, Mr Mwangi Hai, a senior ministry staff member, was encouraged to pursue a doctorate at the University of Uppsala in Sweden. Thirty-four district and division staff members were trained in agroforestry, participatory development, adopting of beneficial technology and practices, and development of monitoring and evaluating techniques. The staff received information on producing fodder, fuelwood, timber and fruit, improving soil fertility, controlling soil erosion, managing water, collecting tree germplasm and propagating trees. This training equipped them to assist farmers improve their use of the land.

In 2002/2003, ICRAF staff gave hands-on training in the use of GIS to staff of six districts and divisions. Farmers received some training, including tours and exchange visits. In 1999/2000 farmers were taken to Ombaka, the KARI/KEFRI/ICRAF station at Maseno, Pap Onditi, Kusa and the semi-arid areas of Kibwezi in eastern Kenya. In the start-up year over 73 farmers learned the importance of farm committees and toured farms using new techniques, raising high-value fruit trees, practising soil and water conservation, and integrating improved fallows and biomass transfer into farming.

Participatory research

Since 1999/2000 ICRAF, the ministry and communities conducted joint research to deal the basin's main hotspots, deforested areas, degraded riverbanks, gullies, roadways and footpaths. The research used a different format for each problem zone but evaluated whether the interventions affected some of the basin's problems. In Kabongo-Miwani, villages perched on each side of the Nyando River set up riverbank committees to protect 1 km of the river each by planting six tree species (see box).



Stabilizing the Nyando riverbanks

Demand for some of the activities to stabilize riverbanks came from the communities themselves. Kabongo residents, in the lower reaches of the Nyando River, had petitioned the then Ministry of Agriculture and Rural Development in 1999 to assist them in protecting riverbanks. Six kilometres from Ahero Township and 28 km from Kisumu City, this area contains one of the most thoroughly degraded portions along the Nyando River. After PRA the area was selected for a study on riverbank deterioration and on stabilization measures. A focal area development committee later converted into a community interest group for riverbank stabilization.

Stabilizing the riverbank involved the following:

- staging meetings to inform the community about the importance of preserving riparian land
- replanting a section 4 m wide along 1 km of the Nyando River with reeds, fast-growing shrubs and aquatic grasses
- encouraging the community to protect 10 m of the riverbank along a 1 km stretch
- mobilizing the community to use thorn trees to fence off 300 m of the river to experiment with natural vegetation
- encouraging 20 farmers living on both sides of the river to establish 6-m-wide mango and banana orchards

In Rakwaro in the Ragen catchment, the focus was on community land management to tackle hillside deforestation and gullying. ICRAF and NALEP evaluated the intervention that would help reduce runoff and erosion in Ragen. The research used earlier showed that badly degraded areas and footpaths contributed to much of the runoff, soil and nutrient loss. The exercise involved selecting and evaluating interventions over a year, including planting *Tephrosia candida* fallows, fencing off plots and managing runoff. With assistance from RELMA in March 2002, a 191 m³ water pan was constructed. Numerous households followed suit and built smaller pans, 15 to 50 m³.

In the Awach catchment, researchers used nine cultivated plots to study how minimum tillage affected runoff and soil loss. They first stratified land-use types in relation to slopes and soils. Then they assessed the land-use interventions for human welfare and environmental well-being in Nandi, Kericho and Nyando Districts. The results shaped NALEP's interventions, particularly for disadvantaged households.

Initially, farmers were somewhat reluctant to use TransVic recommendations. This attitude gradually changed. By the beginning of 2002, 88% of households sampled were using farm plans. In the 10 fo-



cal areas, 61 common interest groups had formed, averaging 17 people, totalling about 1037 members. By July 2002, the interest groups had increased to 81, averaging 20 farmers each, totalling 1607 members. These groups worked on water management (387 farmers), agroforestry (342), livestock (276), diversifying crops (202), cereal production (200), energy-saving stoves (113) and enhancing soil fertility (87).

Development of agroforestry options and technology

The most important form of participatory action research, which has been dealt with here at considerable length, had to do with developing agroforestry options for alleviating poverty while protecting the environment within the Nyando Basin. This revolved around identifying and evaluating best-bet options for land conservation and introducing the fallow species that had been observed to be more profitable than continuous cropping and natural fallow practices in other parts of western Kenya.

Beginning from 2001, activities in this component of the project revolved around two main areas:

- striga management activities that addressed the large-scale infestation of the weed
- improved fallows that addressed issues of depleted soil fertility in the focal areas

Known to the local people as 'kanyongo' or witchweed, striga is a parasitic weed that sucks nutrients and water from maize, sorghum and sugarcane plants, thereby stunting their growth and causing massive loss of yields—losses from the severest infestations ranging from 80% to 100%.

Striga has rapidly been spreading in the lake basin, where it is estimated that about 80,000 ha are currently infested and another 40,000 more in the neighbouring Rift Valley Province are under rising threat. A survey carried out in 1974 showed that 77% of the farms in the region were infested by striga. The problem is bigger in the Nyando Basin and especially serious in the four focal areas of Katuk-Odeyo, Kabong'o, Burkamach–Rakwaro and Chebitet.



The weed spreads easily, with each plant producing between 50,000 and 200,000 seeds in a season. These seeds can live up to 20 years until they host a plant; they are also easily dispersed from farm to farm by wind, soil and water or even by adhering to farm implements like ox ploughs.

Massive infestation of striga in the Nyando Basin is associated with low soil fertility, as the soils are critically deficient in nitrogen, phosphorus and organic matter. When TransVic was implemented, ICRAF and NALEP sought to address this deficiency by introducing fertilizer trees and other fallow species such as *Sesbania sesban*, *Tephrosia candida* and *Gliricidia sepium* in both drier and wetter sections of the basin. Selection of the species heavily relied on the centre's earlier work in the relatively wetter Maseno area, where improved fallows are effective in controlling striga and in improving the soil's nitrogen content. It had already been established that improved fallow practices are more profitable than continuous cropping or natural fallow practices. Indeed, returns to land in a farming system that employed improved fallows and to which no phosphorus-based fertilizer was added were USD 350 per hectare as compared to USD 244 for a continuous cropping system.

Though the species had proved effective in Maseno, their effectiveness had to be tested in the identified focal areas of Katuk-Odeyo, Kabong'o and Burkamach in Lower and Upper Nyakach of the Nyando District, in Singowett–Chebitet areas of Kericho District, and in Tinderet area of Nandi District. The choice of these focal areas related to the serious incidence of striga infestation and the fact that residents had formed focal area development committees.

Selecting farmers who were to participate in the trials started with meetings held with all members of the relevant focal areas. During the meetings, farmers were given general training about fertilizer trees and ways to control striga infestation. Indeed, it took some convincing before farmers would accept the idea of growing these species on their farms. The next level of training was how to conduct the trials and select volunteers. The remaining farmers were provided with extra seeds to plant. ICRAF had distributed a total of 54.3 kilograms of fallow species seeds to the relevant focal areas and to other areas chosen for expansion of the project. The centre had also prepared an extension brochure on improved fallows in western Kenya.

The research had farmers participating at two levels: one group started their fallows in 2001, and the other established them in 2002. The former group cut the fallows in January and February of 2002 and planted maize in the plots. The Ministry of Agriculture and Rural Development and ICRAF had settled for the sets of trials shown below.



What the trials entailed

Type 1 trials

Trials of this type were designed and managed by the researchers. They involved testing out different farm management strategies by introducing six soil-enrichment fallow species on selected farms: *Cajanus cajan* (pigeon pea), *Crotolaria grahamiana*, *Desmodium distortum*, *Gliricidia sepium*, *Sebania sesban* and *Tephrosia candida*. These were either planted alone or were intercropped with such herbaceous legumes as *Desmodium uncinatum* (silverleaf desmodium) or *Macroptilium atropurpureum*. The trials were initiated in eight farms at different periods and distributed in different focal areas. After harvesting was done in February and March 2002, maize was planted and soil samples were collected for striga analysis at the Kibos striga laboratory.

Type 2 trials

Initiated in March 2001, these trials were designed by researchers but implemented by farmers. They involved single or mixed improved fallow practices. Initially, 39 farmers from different focal areas of Nyando, Kericho and Nandi Districts were involved. The researchers collected data on the survival rates of improved fallow species and assessed the resultant biomass that was harvested in February and March 2002. Generally, the growth of fallow species was observed to be poor in Kobong'o and Katuk-Odeyo focal areas due to lack of water. This necessitated subsequent experimentation in early 2002 so as to take advantage of the rains. The number of farmers participating went up from 39 to 62.

Type 3 trials

By the time researchers were conducting type 3 trials, in which farmers both designed and implemented the trials, 186 fallow plots had been established in the long rains of 2002. This was an increase of more than 150 plots; the plots constituted part of the overall 247 experimental plots. The aim here was to determine how effective the various fallows methods were in managing striga infestation and in raising maize yields in different soil types in Nyando District. It involved planting a number of improved fallow species as well as mixing them with herbaceous legumes. Then the herbaceous legumes were either continually harvested or left to grow until the end of the fallow period. The green manure and fuelwood productivity of the species was also assessed. Later the green manure was used during land preparation and a test crop of maize planted. The status of the striga seed bank in the soil and the amount of striga manifestation were then monitored.



Effects of improved fallows on striga infestation

That the improved fallow system had a significant effect on striga infestation cannot be overemphasized. For instance, in the Kapsiti focal area, managing striga by incorporating silverleaf desmodium and *Cajanus cajan* (pigeon pea) led to a 138% reduction in the striga seed population. In general, researchers observed a reduction in striga infestation in Kapsiti and Bur-Kamash focal areas when fallow systems were introduced. But in Chebitet, the effects of improved fallow system were not apparent due to the high initial infestation. In addition, attempts to establish silverleaf desmodium failed in the Kobong'o focal area (see box below).



Maize crop heavily infested with parasitic striga (pink flowers), Nyando district.



Significant experiences from the trials

- Within the focal areas of Nyando District, it was established that if livestock found fallows edible, they were not suitable due to the free-grazing system of livestock keeping. Animals kept on interfering with the trials, especially where the species selected also turned out to be fodder. ICRAF recommended the use of non-fodder fallow species in dry areas, especially *Gliricidia* (a fertilizer species) and *Cajanus cajan*.
- Generally it was observed that farmers stood a better chance of controlling striga by using an integrated approach rather than by merely using hybrid seeds.
- Fallow species had to be planted early in Nyando due to low rainfall. But in the focal areas of Kericho and Nandi, the planting time did not matter as the rainfall there is adequate.
- Though ICRAF preferred to use indigenous species, they were not popular in Nyando District, where fallows that were food related were widely adopted. In Kericho, the species farmers readily accepted were those that could also be used as fodder.
- One of the main obstacles in upscaling activities was to find an adequate supply of seeds. This was a big problem as high-quality seeds for the fallow species were not available from local seed dealers. In some cases ICRAF introduced coppicing fallows, which had to be introduced only once. Livestock keepers preferred these fallows, as they grew back after they had been harvested to feed the animals.
- Another problem had to do with the fact that scaling up relied heavily on trial and error, since the team engaging in the exercise lacked maps that could indicate where certain fallow species were suitable. Also, many incremental activities that were not part of the original project were introduced, thus affecting the project's initial performance. But as time went by, ICRAF and NALEP were able to integrate agroforestry activities with enterprise development.
- Some of the community organizations were loosely organized groups that were not effective in taking up the responsibilities the TransVic Project required of them. This was especially so in such focal areas as Chebitet in Kericho District. To overcome this weakness, the project's partners had to spend time strengthening the capacity of such organizations and in particular to convert the many merry-go-round groups into effective common-interest groups.
- One of the many lessons learned is that there is a major link between environmental conservation, improved agroforestry and household economic development.



However, researchers complained that the time allocated for screening the species was inadequate. Indeed, they said that screening and fertilizer tree trials went hand in hand between June 2001 and 2003 and were immediately followed by coppicing fallows being introduced between 2003 and 2004. The problem, they said, was exacerbated by lack of prior biophysical data on degradation as mapping the problem zones took a lot of time, and meanwhile every aspect of the TransVic Project was taking place simultaneously. Thus, researchers had to introduce the species identified and developed in Maseno without prior knowledge as to their suitability in the new sites.

Clearly, the timing of establishing the fallow is important and particularly so in the drier areas of Nyando District where rainfall is low and short in duration. Here, the fallows had to be planted in such a way that their growth would coincide with the onset of the rains. But in the wetter highland areas of Kericho and Nandi Districts, the fallows were established more flexibly and at different times.

Scaling up the techniques

During each planting season, ICRAF set aside a field day for farmers engaged in type 2 trials, during which its staff would introduce to the farmers other agroforestry techniques. The field days were also critical in scaling up the fallow techniques to other interested farmers living in other focal areas. Farmers were also taken on exchange visits to Maseno and Yala areas where ICRAF had previously done work on improving soil fertility. But owing to limited finances, the visits were few and infrequent. Another method used to popularize fallow techniques was by preparing brochures and posters that were distributed to local farming communities.

ICRAF also established partnerships with a number of other institutions and organizations for purposes of scaling up the techniques. Besides working closely with KARI in the trials, ICRAF scientists partnered with such NGOs as VI-Agroforestry and with staff from the Social Services and the Forest Departments. Most importantly, ICRAF was represented in COSOFAP, a network of 62 community-based organizations, schools, civil society organizations, faith-based groups, research institutions and the private sector that had been working in 25 districts in western Kenya and in 150 learning sites. COSOFAP is represented in 5 districts in Rift Valley Province, 8 in Western Province and 12 in Nyanza and has a regional coordinating committee and a secretariat chaired by ICRAF representatives. The body had trained its



members in agroforestry technologies, livestock keeping, and income-generating activities. It had also sponsored farmer tours to Tanzania and Uganda and organized trade exhibitions in 2003, 2004 and 2005 at Tom Mboya College in Kisumu. These exhibitions have proved vital for information exchange as they enable farmers to showcase what they have been doing and to learn from their counterparts.

As part of scaling up adoption of fallow techniques, ICRAF had also teamed up with 10 other partners to make a proposal to FARM-Africa that targeted two focal areas in Nyando District among other areas. In addition, Kusa, a village-based community organization, requested ICRAF to train its members on how to improve soil fertility and use fertilizer trees. Important too for scaling up the fallow techniques was the Lake Victoria Schools Agroforestry and Environmental Network, which has membership from 30 schools in six districts and links schools to communities.

Involving politicians had also proved worthwhile, even though during National Tree Planting Day in 2002 at a ceremony held in the Katuk-Odeyo area one local politician still insisted that trying to rehabilitate the degraded sites was futile and that the local community should be moved out of the area altogether.

Institutional restructuring and policy

One of the paramount objectives of the TransVic Project was to evaluate how the interests of different stakeholders could be mobilized into more effective management of land and watershed in the lake basin. While trying to meet this objective, it was important to have different stakeholders participate and collaborate through a number of approaches. Before this, several studies had been carried out to analyse existing institutional structures in the Nyando Basin and workshops had been organized to disseminate and discuss suggestions made about the existing institutional structure.

Although this was an important component of the TransVic Project, it had not been built into it from the onset and became part of the project only during its latter period. However, since the project's start-up phase in 1999, the need for working with local communities had actually been realized, and ways and means of bringing communities on board had been charted out. At the same time, making the focal-area approach that had long been developed by NALEP was early acknowledged as the entry point for making institutional suggestions and innovations. This realization was to prevail throughout the project's implementation. Local institutions and organizations such as



churches, self-help groups and women's groups established by the different communities spread across the basin became the basis for the interventions.

However, one of the basic inadequacies of community groupings was that although they were suited to solving simple local problems, they were ill equipped to tackle complex, basinwide problems independently. It was therefore felt that they needed to be restructured to jointly handle some of the basin's issues together with other TransVic's partners.

In 2000/2001, ICRAF-NALEP commissioned three different studies whose results were presented in a one-day workshop convened to identify what was needed to make local institutions and organizations involved in land management, more effective (see box next page).

ICRAF and NALEP organized another workshop on 23 May 2001, hosted by NEMA, Kenya's Agriculture and Water ministries, and ICRAF. The workshop had participants from both Kericho and Nyando Districts to link science and scientists with planning and policy making. From the workshop emerged the SCALES project—Sustaining Inclusive Collective Action across Economic and Ecological Scales in Watersheds—which brought together the consortium of WWF-Colombia and CONDESAN in the Andes, the University of Andes in Bogotá, Maseno University, ICRAF and local NGOs to assess the links between local collective action and broader basin management. Funded by the Water and Food Challenge Programme of CGIAR, it involved studying the incentives that enable collective water-point management, and supported between six and eight communities to develop local water supply systems.



The Katuk-Odeyo workshop

Over 70 international and national research and development specialists from international foundations and development organizations, ICRAF, national research institutes, NGOs, government ministries and departments, local universities, local authorities and parastatals engaged in the following:

- NALEP's approach involved all stakeholders and gradually shifted from a mostly government-supported programme to one where the private sector could play a key role.
- A study reviewed lessons learned from watershed management in other tropical areas. It identified similar challenges and opportunities for western Kenya. This was done by staff from the African Centre for Technology Studies (ACTS) in 2000/2001. It analysed all policies covering watershed management in the basin.
- Landcare is an extension strategy developed in Australia and adopted in other countries of South-East Asia. ICRAF's Landcare work in the Philippines helped with suitability of low-labour and low-cash buffer strips to conserve uplands and restructure farmer organizations.
- A socio-economic study highlighted both deterrents and opportunities that local cultures imposed on developing watershed management in the Nyando Basin. Conducted by a team of three people in the Awach area of about 300 km³ in the Nyando Basin, the study analysed the history of soil and water conservation and the customary conservation that the Luo and Kipsigis people had developed. Using secondary sources, participatory methods, mapping and historical resource trend analysis, the study found that until 1800, the area had been an unsettled grazing area. Between 1900 and 1920 pioneers began settling. The study discussed the conservation institutions that had emerged out of the complex clan arrangements among the Luo and Kalenjin peoples. It concluded that existing institutions are not well suited to effectively manage watersheds in Kenya. It raised issues with the existing land tenure, and highlighted possible upstream and downstream collaboration.

The workshop resulted in forming an umbrella committee, with representatives from Katuk-Odeyo and Chebetit, to link with upstream and downstream communities in managing the watershed, rehabilitating dams and water pans, and sharing views and ideas on how to tackle problems affecting the areas.



Alongside these initiatives, especially between 2003 and 2004, major institutional changes took place in Kenya. NEMA gained sharper and more effective teeth when it began to implement the Environmental Management and Coordination Act (EMCA) enacted in 1999. Besides enforcing environmental impact assessments and environmental audits, it posted district environment officers in all 71 districts of Kenya and attempted to apply EMCA to protect the country's watersheds. The Ministry of Water was restructured, enabling closer collaboration between it and ICRAF. In the meantime, ICRAF, collaborating with Maseno University and the International Food Policy Research Institute (IFPRI), embarked on the three-year Safeguard Project to safeguard the rights of the poor to critical land, water and trees in Nyando Basin Project. Designed to end in October 2005, the project conducted community studies in 14 villages from 12 problem areas around the basin to describe the 3500 km² Nyando Basin. It was funded by the Comprehensive Assessment of Water Management in Agriculture.

All these initiatives led to three instruments:

- extension policies
- land management policies
- water management policies

TransVic's achievements in institutional restructuring

- Forming an umbrella committee for different focal areas
- Forming protection groups for springs, to manage water resources
- Establishing environmental steward groups, especially in Katuk-Odeyo
- Forming larger focal areas and developing techniques to identify groups of the poor to help them get resources. Kenya's Ministry of Agriculture adopted this pro-poor PRA strategy after ICRAF trained the ministry's staff from six districts in Nyanza and the Rift Valley on it
- Raising the Ministry of Water's awareness on the capacity of local communities to manage water resources and on the limitations that the current regulations in the ministry imposed. This is expected to exert some influence on the next LVEMP phase.



ICRAF contributed towards improving Kenya's Poverty Reduction Strategy Paper (PRSP). An analysis of district poverty reduction strategies found they do not contain provisions on how to manage natural resources locally nor do they consider the importance communities attach to managing local resources. Conducted by Brent Swallow of ICRAF in 2004, the study, 'Potential for poverty reduction strategy to address community priorities: case study of Kenya', applied simple weighting methods to analyse how closely Kenya's PRSP matched with the problems and priorities articulated by residents of 80 rural communities in 10 districts in western Kenya. The results showed the priorities in the country's PRSP corresponded with the priorities of the 80 communities but failed to allocate resources accordingly. However, the PRSPs the districts developed are complete mismatches from what communities needed and those listed as priorities in these papers.

Dr Swallow found that agriculture, water for domestic and livestock use, and human health emerged as clear priorities in both the district PRSPs and the communities. Livestock disease, fuelwood supply and soil degradation were priorities in many communities but were not priorities in the district plans. Likewise, education and roads were not priorities in the focal areas but were given preference in the districts. This situation was particularly poor for Nyando District, where many top priorities from the focal areas were not included in the list of 57 problems identified in the district PRSP. There was a glaring mismatch between budgetary allocations in the national PRSP and focal areas' priorities. Though agriculture, rural development and human resource development got 87.8% priority score by communities in western Kenya, they had been allocated a paltry 19.6% of all PRSP resources. The research indicated that current institutions and processes did not identify the needs of any group of the poor. NALEP, ICRAF, the World Bank and the Ministry of Planning and National Development explored additional methods and institutions to listen to the poor and identify their problems.



Chapter 4

Lessons learned and future challenges

This chapter gives the views of farmers, extension providers and the Ministry of Agriculture staff of the achievements of the Improved Land Management Project in the Lake Basin. It showcases some of the most successful farmers and points out how cadres of ministry staff in the basin benefited from training programmes. Nevertheless some challenges need addressing to rehabilitate the basin.



TransVic's achievements in a nutshell

The TransVic Project run from 1999 to 2004. In those years, physical and social scientists scoured the Nyando Basin for information and solutions to a monumental environmental and human crisis. Their paths crossed with farmers, herders and fishermen who had sought answers to issues that affected their livelihoods. They met with civil servants, NGO operatives, international development agency staff, and with clergy and laity from different churches who had also been seeking answers.

A body of information emerged about the woes afflicting the basin. Basin residents and all Kenyans can now know where to look for sustainable solutions to the basin's many problems. People can access considerable information on the basin's crisis and its root causes, why the lake appears dirtier and what ails the area's farming.

A relatively new approach to farming emerged: how to reinvigorate soils, do away with striga, and use a farming system that provides significant dividends. Farmers interviewed were grateful for the technical training they received from ICRAF on producing crops, keeping livestock and practising agroforestry. They are more aware that low crop and livestock yields and fuelwood scarcity are linked to environmental degradation.

There are now documented suggestions on establishing more focused institutions and farm organizations to handle the basin's large problems. A sizeable number of farmers in the focal areas pioneered these initiatives. That they did so and kept on with the practices shows that some of the livelihood problems can be solved. They are good examples for the hundreds of thousands of farmers who have not used the interventions. Indeed, some of their neighbours already are emulating them and reaping dividends. From Siaya to Vihiga, from Kericho to Nyando, these farmers tell sweet tales of how their lives have been transformed by doing things the agroforestry way. Many farmers in the area have planted trees that will eventually provide them with fuelwood, charcoal and timber. Others have been gradually converting their farms into commercial establishments by engaging in enterprises they learned about from TransVic. Many in Chebitet in Kericho and Burkamach–Rakwaro in upper Nyakach of Nyando are nurturing tree nurseries. Others proudly show off gardens planted with improved sweet potato, disease-resistant cassava and high-value fruit trees. And others have beehives and traditional chickens reared in a more modern way. Clearly, all has not been lost, as table 1 shows.

**Table 1: Activities and Membership of Common Interest Groups (CIGs)**

Primary CIG activity	No of CIGs involved	No. of Members	Achievements
<i>Agroforestry/trees and crops</i>			
Nursery management groups	20	170	200,000 seedlings
Fruit tree management groups	6	60	30,000 assorted fruit seed
Farm forestry groups	16	200	40 hectares
Subtotal	42	430	
<i>Crop diversification</i>			
Bananas	12	260	6500 bananas planted
Cassava	6	10	10 hectares
Horticulture	20	270	10 ha tomatoes, 5 ha local vegetables
Rice	4	50	60 hectares planted
Cereal crop production	6	131	70 ha maize, 80 ha sorghum
Subtotal	48	721	
<i>Water management</i>			
Water harvesting	6	100	6 water pans, 110 water holes
Spring production	6	300	6 springs protected
Micro-irrigation Total	4	60	20 farmers practicing
Subtotal	16	460	
<i>Soil fertility enhancement</i>			
Composting	10	80	60 farmers making compost
Green manure	4	67	50 farmers using tithonia
Striga control	6	65	100 farmers with legumes
Subtotal	20	212	
<i>Livestock improvement</i>			
Bull scheme	4	75	4 bull scheme in place
Artificial insemination (A.I)	1	85	1 A.I scheme in operation
Fodder production	10	140	100 farmers producing fodder trees
Dairy goats	2	40	30 farmers with dairy goats
Poultry	4	37	
Milk processing	1	6	Just started
Chicken production	2	25	
Subtotal	24	408	
Total number of common interest groups	150	2,231	

Source: Improved Land Management in the Lake Victoria Basin 2000-2004: Extension Liaison Phase Report -D.O. Nyantika.

Many farmers are using the techniques shown them during Trans-Vic, with various degrees of success. One farmer was Johannes Odhia-mbo Nyamulo, who also served as vice chairman of the lower Nyamulenge B focal area committee. Nyamulo lived in the low-lying area within Yala Swamp in Siaya District. This area had 400 to 500 farmers



who faced many problems, including alternating drought and floods and perpetual food insecurity. However, flooding might be a thing of the past as the US-based Dominion group of companies has sought to control the floods in a rice-growing project. Mr Nyamulo, one of the most successful farmers in the area, raised vegetables, cultivated improved sweet potato, cassava and millet, farmed fish and kept traditional poultry. Though he was offered seeds and seedlings from the project, the most important thing he gained was the training in farming techniques such as how to acquire, raise, transplant and space seedlings, dig trenches and use agroforestry to prevent flooding.

'Before the training, my family used to suffer from occasional food shortages, but this is no longer the case, even when we get droughts.'

— Johannes Odhiambo Nyamulo

He earned as much as KES 73,000 each year selling tomatoes, and he said other people adopted the techniques. The amount of food stolen from local farms declined in a big way because many people had now become independent and no longer felt they had to steal to survive. With other farmers, Nyamulo farmed plots according to the seasonal shift in the swamp, moving them as the land dried up.

Many farmers were still struggling but becoming somewhat more successful, largely owing to the techniques, training and handouts offered during TransVic. Such was the case of Rasto Ombija, as told in the box.



The story of Rasto Ombija

At 34, Rasto Ombija is probably one of the youngest assistant chiefs in a country where age is associated with wisdom and leadership. Rasto owes his being appointed to government service in late 2004 to his enthusiasm and consistency in implementing farming skills imparted to him during TransVic. He owns 2 acres but leases almost 3 acres elsewhere within Achege in Nyando District. Shortly after TransVic started operating in the area, Rasto got down to work. After attending a training session, he implemented what he was taught with gusto and encouraged his neighbours to use the techniques. 'He was actually ahead of us,' says James Ang'awa, the Siaya District soil conservation officer. For his efforts, Rasto has gained a lot of respect from his fellow farmers. His farm, where he grows tomatoes, onions, cowpeas, cotton and improved mangoes and raised poultry, has become a showcase and receives a lot of visitors. He started being invited to address barazas—public meetings. Then the area's assistant chief died and the post fell vacant. Rasto was nominated by members of the community and recommended by the district soil conservation officer. Ang'awa says that since Rasto's appointment, he has been instrumental in getting the agroforestry message out and 'has made our work far easier'.

From the provincial director of agriculture to the frontline extension providers, Ministry of Agriculture staff had stories on how the project had influenced those who needed their services. Many said they were now well equipped with the information and the tools they needed to be effective. Nearly all the local ministry staff said that the project had enabled them to operate smoothly and reach out to farmers. They had acquired a more refined way to handle their work. Many NALEP staff liked the new methods of carrying out PRAs that gave farmers a chance to articulate their problems and their ideas on how the problems ought to be solved, the new techniques to identify and set up farm enterprises within focal areas, and the new working methods inculcated during the ICRAF training sessions. Many interviewees fondly mentioned the GIS training, which equipped them to competently identify, describe and map out ecological, climatic, physical and socio-economic characteristics.



‘Previously, I would painstakingly draw sketches of a focal area, but now I can accurately locate phenomena in a map using GIS,’ said Edwin Mwango, the district soil conservation officer in Vihiga District. His only regret was that he was the only one who was able to understand GIS in his station and he had only one computer equipped with the GIS program.

Mwango’s counterpart in Nyando District, James Ang’awa said, ‘Using GPS makes my work easier. Before, I had to do it manually but now I am able to accurately locate points of interest within a focal area.’ But he had difficulties since he was not issued his own GPS, and those who had been issued the equipment had almost personalized it.

The other technique most of the trainees found useful was the participatory analysis of poverty and livelihood dynamics (PAPOLD). PAPOLD proved effective for many in identifying and designing the best approaches for the poorest of the poor within any focal area; many had nothing but praise for the method.

‘PAPOLD equipped me with the skills of analysing the poor in focal areas,’ said Ang’awa, who intimated that before the training, he and colleagues considered poverty a ‘sight thing’ —they merely needed to visit a widow-headed household, or they saw it in percentage and figures. But now he had learned to regard poverty in his area as a dynamic phenomenon that is different for different groups of people. The technique has also enabled him to identify the poorest of the poor ‘even when they do not come up to be identified’.

Clearly, ministry staff had found the agroforestry training quite useful. Through it and the demonstrations on striga management, the staff learned what could improve soil fertility, for example *Tithonia* combined with rock phosphate improved the phosphorus content in the soil, and thus reduced the striga menace on farms. One weakness with the trials, extension providers said, lay in disseminating the results. Ministry staff claimed a lack of feedback on trial results because NALP never put a system in place to disseminate results to staff and to participating farmers. Evidently this was a weakness in the project’s research and extension link. Nevertheless, the most enduring legacy of TransVic, ministry staff said, was they were now able to tackle some



of the environmental challenges they faced in their work, and some farmers in many focal areas were raising and propagating improved mangoes, bananas, sweet potatoes, drought-resistant cassava and fast-maturing eucalyptus.

Future challenges

Although project research managed to highlight what ailed the basin, the partners could not extend the interventions as far as they wished because of cost and time. Nevertheless, many focal areas were covered and farmers adopted many of the farm enterprises introduced. Today, some extension providers and ministry staff have ready information on how to better handle their roles, and many water and soil conservation structures still work. However, for these initiatives to make a difference, especially in eradicating the basin erosion, much more investment in time and resources is needed.

In contrast, considerable progress was achieved by the nearby Kusa project on rainwater harvesting. Why? This may be explained by the high priority that the community gave to access to clean water compared to erosion control. In addition, the benefit of water harvesting is more immediate. This should be taken into account in phase 2 of the project.

The PRAs helped pinpoint problems and formulate some interventions, but also raised too many expectations (some unrealistic) that could not be met. From Siaya to Vihiga, many farmers acknowledged that they now knew how to improve their livelihoods and reduce the degradation, but nearly all felt unable to do it. Many extension providers and senior ministry staff looked back at the project with nostalgia. Many said they had learned a great deal; most were appreciative of the training. But nearly all said they would not be able to use the skills because they lacked computers installed with GIS, GPS equipment, vehicles or even serviceable motorcycles to transport them to farms. This is a common limitation in the extension programme and there is an urgent need to encourage higher investments in computers and provide realistic transport.

The science applied during the studies was impressive. It left no doubt as to what the problem in the 'problem domains' was. Through sophisticated research techniques and by presenting papers at various international forums, ICRAF was able to raise the profile of the problem internationally. Respected media outlets, National Geographic, Sci-



ence and The East African, carried stories on the basin's crisis showing that scientists had succeeded in exposing the roots of the crisis. Most significantly, the new techniques to assess soil erosion risks were a big achievement. It is now possible to quickly identify and diagnose fertility constraints in different areas of the basin. This method has been extended to national laboratories to assess large-scale land degradation in Africa and India.

Many extension providers and farmers expressed satisfaction with the agroforestry training by ICRAF, saying the methods turned out to be a novel way to rehabilitate their farms. Some farmers were still practising the methods learned from ICRAF staff, some enthusiastically. Some had been able to record gains. But these farmers were few. Most continued using the same methods they had always used. Most did not embrace farming as a business. This can be attributed to tradition and culture. It takes time, skills, money, inputs, an element of adventure, and strong inner drive to take up and experiment with new skills. This calls for a consistent campaign and farmer facilitation by all players, particularly the government and those NGOs and faith-based organizations with long-term commitment in the basin. During TransVic, ICRAF and NALEP knew this. So they gave some farmers starter seeds and seedlings for carrying out agroforestry trials and for cultivating improved varieties of fruits and other crops. At the same time, ICRAF sought and received cooperation from other stakeholders to scale up the interventions. Relevant authorities and partners should build on this and enable farmers to effectively contribute to the basin's rehabilitation as they improve their livelihoods. To some extent, this is already taking place in two divisions of Vihiga District. The government started an experimental scheme that offers farmers credit on rotation (see box). In a few other focal areas NGOs have proposed similar schemes.



The NALEP–Sida microfinance credit scheme in Vihiga

The scheme started in 2004 with a KES 500,000 kitty to finance common-interest groups in the district. Every division was allocated KES 75,000. Division teams are expected to scrutinize group operations all over the division and recommend which deserve short-term micro loans. One criterion for consideration is that a group must be able to demonstrate that the enterprises they started are able to generate income. The lucky groups are expected to pay the money back with some interest, so the fund can grow and be loaned out to more such groups. So far, four groups and five poor farmers in Lunyerere focal area have benefited from the loans. Other focal areas have been given the opportunity to prepare proposals for 2006.

The fund is also meant to assist poor farmers. Widow-headed households are not required to pay interest on their loans. To benefit many more common-interest groups, the money in the kitty is raised through fund-raising during stakeholder forums.

Effectiveness in getting the message on the crisis facing the lake basin across to the Kenya government and the other two East African governments was impressive. Major donors are coordinating their support to the riparian countries to rehabilitate the basin. Finally, the potentials of other interventions besides improved fallows need to be examined. Indeed recent experience with conservation agriculture in the basin indicates that it is possible to increase crop production as well as reducing sedimentation. In fact, modelling findings for the whole Nyando River Basin is so encouraging that ICRAF is now expanding the conservation agriculture approach to the Mara and Kagera River Basins with Sida support.



Conclusion

It is necessary to appreciate that there is no such thing as a quick fix to the enormous soil and land degradation problems facing the Nyando Basin. There is ample evidence from the research that it took as many as 100 years for the degradation to reach the scale it is today. It will take many more years, probably decades, to restore the environmental health of a substantial part of the Nyando Basin. The main impact of this project is to create a strong link between research and extension and strong awareness of the widespread land degradation problems, which stem from the cultivation of the fragile ecosystem. The greatest challenge is to raise the level of the vegetation cover in the entire basin. ICRAF is currently exploring the advantages and feasibility of conservation agriculture in the Mara River and Kagera River Basins. Any intervention must improve livelihoods and incomes of the millions of people inhabiting the basin and correct the environmental disaster there. Such interventions will need to be applied simultaneously to the basin's upper reaches, its midlands and in the lowlands.

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There is no such thing as a 'quick fix' to the enormous soil and land degradation problems facing the Nyando River Basin which took according to research as many as 100 years to reach the scale it is today. It will take many more years; probably decades, to restore the environmental health of a substantial part of the Nyando river basin. ICRAF, claims that the primary focus is to raise the level of the vegetation cover in the entire basin. This should be done to serve the goals of improvement of livelihoods and incomes of the millions of people inhabiting the basin and contribute to correcting the environmental disaster there. Such interventions will need to be applied simultaneously to the Basin's Upper reaches, its Midlands and in the Lowlands.

From 1999 to 2004 the TransVic Project has been a vehicle for providing extension providers, policy makers and researchers with information, technologies and approaches that could help in the improvement of land productivity and enhance local and regional environment.

This booklet, written by John Mbaria, summarizes the major achievements, problems and opportunities the TransVic project presents in the Nyando basin including the expectations of the local population.

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World Agroforestry Centre—Eastern Africa Regional Programme
ICRAF Building, Gigiri, P. O. Box 30677-00100, Nairobi, Kenya
Tel: (+254 20) 722 4000, Fax: (+254 20) 722 4001, Email: icraf@cgiar.org

www.worldagroforestry.org