An Analysis of IDRC-Funded Projects Relevant to Desertification

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1. INTRODUCTION

This report reviews a number of IDRC-funded projects in Eastern and Southern Africa that are relevant to desertification control. This review includes the broad disciplines of forestry, animal production, crop production and post-production, and the social sciences. In selecting the projects, the word "Desertification" is taken in its widest sense as defined by the United Nations Conference on Environment and Development (UNCED). According to the conference, desertification is the degradation of Arid and Semi-Arid lands due to human activities and climatic changes.

Many experts who have given serious thought to the issues surrounding the topic of desertification concur that it is often facilitated by human activities intended to provide basic needs. Poverty and environmental degradation are intertwined and efforts to alleviate poverty in arid and semi-arid lands have a direct bearing upon the successful control of desertification. Poor land use systems, which are not based on sound policies or scientific and social realities, lead to land degradation. This is a situation which is different from the natural process of desert expansion.

Broadly speaking, many of the projects reviewed here were not intended to prevent desertification but are related to its control. While most of the projects are multidisciplinary they can be grouped into three main categories: projects that prevent the advance of deserts; projects whose activities are designed to generate knowledge relevant to controlling or investigating desertification; and projects whose main function is the development of drought coping mechanisms.

Following the line of thought that desertification is primarily caused by human activities, this report examines projects aimed at developing environmentally sustainable land use systems in the arid and semi-arid parts of Africa. One evidence of desertification is loss of vegetation and timely intervention to ward off land degradation can be achieved through participatory and integrated afforestation. This is a field of considerable research. In this respect, the forestry projects are aimed at conservation, management and utilization of vegetation on a sustained basis without the loss of biodiversity that is often associated with tropical deforestation.

The forestry related projects that are relevant to soil improvement through the addition of organic matter and the prevention of top soil loss are also considered to contribute to combatting land degradation. Under this category are projects that include agroforestry and dryland forest management. Most of

these projects directly support agricultural production by increasing soil productivity.

Animal production projects address the issue of overgrazing, a notoriously difficult problem in communal lands and one which has led to considerable desertification in semi-arid lands. On the premise that livestock is the mainstay of the pastoral economy, these projects attempt to address the issue of low livestock productivity and to develop the necessary techniques to improve pastures. Poor animal nutrition also adversely affects land preparation by draught animals, leading to a vicious cycle of low crop yields and subsequent poverty.

Efforts to introduce agriculture into areas otherwise suited for nomadic pastoralism have led to land degradation. The projects under livestock production deal with improvement to pasture productivity through the selection of appropriate pasture species, both exotic and indigenous.

Crop production projects may appear to be irrelevant to desertification and drought control. However, most land degradation in arid and semi-arid areas is due to the expansion of cultivation brought about by the need for food production to support an ever increasing population. The improvement of crop yields, accompanied by sound agronomic practices, could considerably reduce the expansion of cultivated areas. Such tactics also conserve the soil and water resources in areas already under cultivation.

The projects under this last category therefore deal with the development and promotion of drought tolerant, pest/disease resistant and high yielding seed and root crops. Additionally, post-production projects supplement activities aimed at securing more produce by improving storage methods and by the integrated utilization of crops by both people and livestock. Land degradation is often associated with increases in both people and livestock population. Degradation can be checked if crop and livestock management techniques are considerably improved to cope with increased population densities without substantially increasing the area of land under cultivation.

The above projects are technical in nature. Experience has shown that often farmers have failed to adopt beneficial technologies simply because social issues are not taken into account. The social issues relevant to desertification therefore give additional insight into human behaviour. It must be recognized that people have survived in harsh environmental conditions for generations simply because they have evolved ways of coping with their environment.

There are many constraints and problems associated with legislation, land tenure, politics and planning all of which can

negate efforts to combat desertification. The projects, which have tried to understand and incorporate socio-economic, cultural and political factors, are the most instructive.

One issue that cuts across the whole topic of desertification is that the communities most affected by it are not adequately involved in planning, designing and implementing environmentally friendly technologies. Progress is usually obtained from small participatory projects based upon the needs perceived by the local community. Large projects, which fail to take into account delicate and fine issues leading to environmental degradation, often fail despite the good intentions of the various development agencies involved.

The successful projects, funded by IDRC, are implemented by local scientists and are usually small enough for local people to be intimately involved. The projects are basically aimed at uplifting the standard of living of the poorest communities who are often the first victims of desertification. The projects are also in response to problems defined by both the researchers and the local communities. However, not all the projects achieved their intended objectives due to a number of problems that were encountered in the course of project implementation. Notwithstanding this, each project has useful lessons for researchers and policy makers that can contribute to environmentally sustainable development.

The lessons learnt from these projects are an important basis for analyzing the problems and the constraints in the struggle against desertification. Awareness of the issues needs to be passed on to policy makers whose approach to development may need radical modification in order to evolve an environmentally sustainable development process. Prioritization of strategies to combat desertification is an urgent matter considering that the resources available to the African countries are rather limited.

This review is made in accordance with the following format:

1. Data of the project: funding, location, implementing institution and project leader and duration.

2. Intended project objectives and the methodology used.

3. Actual project output (outcome) and the activities that were carried out. Some comparison of intention and the outcome.

4. Lessons learnt and the relevancy of the project to desertification

2. REVIEW OF COMPLETED PROJECTS

BAMBOO PROJECT (KENYA) - 86-0244

The Bamboo Project was implemented across Kenya but specific project sites were in the highlands, the lake region of the Rift Valley and on the coast. Rainfall in the highlands amounts to about 1500 mm per annum while the lake sites received about 500 mm. The drier sites on the coast received about 500 mm while the wetter sites received 1000 mm.

The project started in July 1987 and ended in July 1991. It was implemented by the Kenya Forestry Research Institute (KEFRI) with Dr. Bernard Kigomo as the Project leader. Funding amount was CAN$90 800 for a period of 36 months.

Bamboo species are important resources for the conservation of soil and water particularly in fragile mountain ecosystems. Additionally, bamboo provides important material for handicrafts and fencing. In Kenya, there is one bamboo species and it is restricted to mountain ecosystems. For quite some time it has been exploited to the level where its utilization has been banned by the government to avert ecological destruction.

The bamboo project was therefore started with the objective of screening and establishing other fast-growing bamboo species to meet the ever growing demand from village craftspeople. Specifically, the project set out to identify and propagate suitable bamboo species from Africa and Asia as well as improve the economic utilization of bamboo in Kenya. The broad methodology, which was envisaged, included travel to other countries for germplasm importation and to study nursery and field propagation as well as marketing.

The project had three main outputs: Firstly, useful information on bamboo establishment and propagation methods in the nursery and in the field was generated and there was evidence that some farmers have adopted these techniques. Secondly, the introduction of several exotic bamboo species and rattan that can grow well in the arid and semi-arid lands of Kenya. Thirdly, scientists were trained, through study tours and workshops, on the various methods of bamboo propagation and utilization.

The main activities carried out included the importation of bamboo germplasm from a number of countries. In particular, bamboo germplasm was obtained from Thailand, Malawi, Rwanda, Indonesia, Tanzania, India, Philippines and Japan. The germplasm was procured in the form of seeds, rhizomes, cuttings and offsets. With correct climatic and altitude matching, different materials were tried initially at the nursery and subsequently in

the field. Staff at KEFRI, who were involved in the project activities, also visited other countries on study tours. Maintenance of field planting and growth monitoring was carried out in the course of the project. A few farmers were also given material to plant on their farms.

On the whole, the project achieved its objective of the limited introduction of bamboo species able to cover a wider range of ecological zones in Kenya. However, a major lesson learnt from the project was that although a total of 22 bamboo species were introduced into the country, only eight of them were successful. The successful bamboo species were *Bambusa arundinacea, B. tulda, B. hamiltonii, Dendrocalamus strictus, D. membranacea, D. aspera, Arundinaria alpina* and *Oxytenanthera abyssinica*.

The project also encountered considerable problems in the importation of the bulky germplasm and there were several delays occasioned by, for example, requirement of quarantine. This delay led to death of some of the germplasm, a technical problem that might be overcome by the application of biotechnological propagation. Further, termite attack was found to be the main constraint in resource multiplication in semi-arid lands.

The literature published by scientists is full of complaints that the indigenous bamboo is extremely difficult to propagate through seeds because of infrequent seeding. In the course of field visits to various tree nurseries, it was found that in some places, local people are succeeding quite well in identifying, collecting and germinating bamboo seeds in sharp contrast with the scientists assertions. This calls for the greater involvement of local people in research in order to overcome several technical and social problems.

Utilization of the bamboo resource is mainly confined to fencing and the making of handicrafts. People in Kenya are not aware of the potential of bamboo as a food resource. Similarly extension agents, particularly in dry lands, are not aware of the suitability of bamboo for use in the reclamation of drylands. The few people who have come into contact with project activities are, however, quite impressed as can be judged from the numerous inquiries on possible sources of planting material.

Although the project was not designed to prevent desertification as such, it falls under the categories of projects that prevent the advancement of deserts because appropriate bamboo species have successfully been used for the rapid reclamation of degraded semi-arid lands. The project demonstrates the potential of the plant for halting land degradation resulting from human activities. Bamboo trees also grow quite fast

The project also introduced mountain bamboo species that have the potential of supplementing the only bamboo species in Kenya

Arundinaria alpina. These bamboo species are effective tools for conserving fragile mountain ecosystems that are very vulnerable to desertification in the widest sense.

On balance, the project has the potential to control advancement of degradation of fragile mountain ecosystems and subsequent desertification. It is due to such potential that there is a growing regional interest in the creation of a bamboo network, particularly in the drought susceptible countries of Kenya, Ethiopia, Sudan and Chad. Preliminary regional bamboo activities have already been started drawing using experience gained by the bamboo project. If the regional bamboo network materializes, the practical experience generated by the project will enhance the potential for the use of bamboo in desertification control in the region.

References: Project proposal, Final Report by B.N. Kigomo, Project Leader, discussion with the Project leader and visits to the project sites.

DRYLAND AGROFORESTRY PROJECT (KENYA) - 87-0114

The project was located in Machakos District, Kenya, one of the most densely populated districts in the semi-arid parts of the country. Specifically, the on-station project activities were located at the National Dryland Farming Research Centre, Katumani, while the on-farm activities were at Katangi location in Machakos District. The sites receive between 600 and 800 mm of rainfall per year.

The project was implemented by the Kenya Forestry Research Institute (KEFRI) with technical backstopping from the International Centre for Research in Agroforestry (ICRAF) and Spencer Muthoka was the project leader. The first phase of the project started in 1983 while the second phase ended in 1989. The level of funding for Phase I was CAN$386 300 and for Phase II was CAN$345 200.

Agroforestry research has mainly been concentrated in high-potential areas where scientists have the best chance of success with their experiments. Dryland areas often have low livestock and crop yields due to a variety of problems ranging from low rainfall to inappropriate and expensive land husbandry practices that are often transplanted from high potential zones without any modification. The Dryland Agroforestry Project was thus designed to develop appropriate agroforestry systems in the semi-arid areas of Kenya, and similar areas in East Africa, with a view to improving the quality of life of the inhabitants.

Specifically, the project was designed to screen multipurpose trees for use in alley-cropping and on grazing lands and the dissemination and implementation of research results. To achieve these objectives, both on-station and on-farm research work was envisaged. Interviewing of farmers was also planned with a view to identifying problems and finding solutions applicable to dryland development.

The project had a number of important outputs, namely: the development of low input drylands agroforestry technology packages for increasing soil fertility without resorting to artificial and unaffordable fertilizers; slight improvement of grazing lands; and the development of soil conservation and water retention ditches that assist plant growth. Other important outputs included a number of trained farmers, teachers and students.

The main activities to achieve the above outputs included on-station and on-farm research activities in respect to alley-cropping, and screening of both live-fence tree species and trees/shrubs for use on farms and grazing lands. Development of fodder banks was undertaken in a number of selected farms. Efforts were also made to dig ditches to prevent soil erosion.

On-farm planting of trees and fruits was also initiated in some farms and at a number of schools, an effort which was meant to increase wood resources for income while fruit-tree planting contributed to food security in areas prone to drought and famine. Additionally, the project has facilitated both the formal and informal training of farmers, teachers and policy makers on the sustainable development of arid lands.

The lessons learnt indicate that the project attained substantial success as far as farmers involvement was concerned. The project has initiated environmentally sustainable development in zones otherwise susceptible to desertification. Additionally, introduction of several drought resistant tree species has triggered a reforestation trend as was evidenced by about 200 farmers who have planted trees in the vicinity. Hedgerow research, even though not consistent initially, showed considerable increase in crop yields on treated plots versus control plots as a result of the use of leaf mulch.

Visits to the project sites and discussion with the project staff have indicated, however, that a number of the technologies, even though acclaimed as technical and biological breakthroughs, were not adopted by farmers. For example, even though alley-farming showed some incremental crop yields over control plots, the technology was rarely adopted by farmers because of its labour intensity and because of moisture competition with crops particularly in dry spells. Where it was adopted, farmers made their own modifications. Digging of contour ditches was not well accepted again due to the fact that the technology did not consider the local labour constraints.

Equally instructive was the fact that the farmers who were more enthusiastic with the research trials were those who were relatively well off and these were the farmers who did not entirely depend on farming for their livelihood. Most of them had off-farm income obtained by working in other parts of the country. Early selection of contact farmers drew heavily on this category of relatively wealthier farmers but subsequent selection of contact farmers tried to overcome this bias. Notwithstanding this, new, migrant farmers were more interested in trying new technologies than farmers who had been in the area for an extended period.

One conclusion from the project is that to achieve meaningful development in arid and semi-arid zones, scientists have to obtain genuine community participation that involves the very poorest members of society. It is not enough that a technology is biologically feasible, it must be feasible from socio-economic and cultural points of view. Socio-economic issues need to be given more emphasis for increased involvement of farmers than was given by this project.

On the whole, the project has indicated considerable potential toward reversing land degradation in semi-arid areas, albeit on a small scale. Dissemination of research results, particularly to women's groups and school children, has had some impact as can be seen from contact groups and schools. To a certain extent, women's groups have adopted the low-input agroforestry technologies where appropriate and there was evidence that over 200 farmers have had positive contact with the project.

In arid and semi-arid lands the advancement of desertification is often a consequence of poor land use, particularly when agricultural yields are low. This is a situation that does not only lead to extensive cultivation but also to other desert causing activities such as charcoaling from non-sustainable vegetation. Further, overgrazing has led to serious land degradation and in the sense that the project attempted to overcome the above problems in a sustainable manner, it presents a unique case for desert control through low-input agroforestry technologies in dry lands. The lessons learnt from the project could form a basis for development that could be used to halt and reverse land degradation in semi-arid areas.

References: Project proposal, progress reports, site visits to the project and discussions with project staff.

DRY FOREST MANAGEMENT (ZAMBIA) - 86-0093

The Dry Forest Management project was located in Sesheke District, South Western region of Zambia and in the Simungoma East National Forest. On-station activities were based at the Masese Forest Station. The project areas receive less than 800 mm of rainfall annually and the sites are on the interface between the Kalahari desert and the Miombo woodlands of Zambia.

The project was implemented by the Forest Research Division of the Ministry of Lands and Natural Resources with A.C. Mubita as the project leader. The project was started in 1987 and ended in March 1991. Funding amounted to CAN$179 700.

A broad region comprising Western Zambia and North Western Zimbabwe forms the northeastern barrier to the Kalahari Desert. In these zones, vegetation that is able to survive on extremely deep sands, with low rainfall, has evolved. The best known tree species are those often referred to as Zambezi teak and their extent is transboundary. Over the past many years exploitation of these species by local timber companies has not been sustainable and there is very little understanding of suitable regeneration and management techniques.

The Dry Forest Management Project was started with the objective of developing methods for management and regeneration of the Zambezi teak forests of Southern Africa. Specifically, the project was designed to develop appropriate in-situ and ex-situ management and regeneration methods for the species and to promote regional efforts in sustained management. It was envisaged that Management Resource Areas (MRA) would be demarcated in the field and inventoried using both ground and aerial survey for important and lesser species.

The main project output was in-situ and ex-situ conservation of the gene pool of the Zambia teak species *Baikiaea plurijuga* and *Pterocarpus angolensis*. The project presented an opportunity to develop a methods for the regeneration and management of teak forests.

The main activities undertaken in the project included the identification of important concentration areas of teak trees and, in consultation with local people, demarcation of a number of MRAs for manipulative research. The MRAs, whose optimum sizes were 10-50 ha, were managed for genetic conservation and controlled resource use and each contained a minimum 500 breeding trees. Additionally, ex-situ conservation was achieved through seed collection and nursery propagation of material and subsequent planting of stock thus raised. The two main conservation activities were supplemented by education and extension.

The project had many lessons worth noting. In particular, the project brought out the fact that the natural regeneration of teak is not good enough and that it needed assistance in the form of enrichment planting. The other important lesson is that even though such a resource may be very precious economically, local people must be involved for any meaningful conservation work. The lack of genuine involvement by local people led to the burning of two MRAs at Simungoma and Nganga both of which contained valuable *Baikiaea plurijuga* (Mukusi). Arson was suspected because the local people did not care to stop the fire. The sad event emphasizes a need for participatory approach in research activities rather than the stand-alone attitude adopted by many scientists.

Additionally, the project was to demarcate MRAs in consultation with the local companies. There is no evidence that this was done and, if it was attempted, the local companies would most likely shy away from conservation of the most valuable concentrations of teak forests because of commodity interest. The local companies would be interested in regeneration of degraded areas but would hardly be inclined to support activities that would conserve mature timber even though it is useful as a source of seeds for research.

The teak forests are also valuable as a check on the Kalahari desert advancement northwards and northeasterly. The species is highly specialized to grow on the sandy plains and conservation and management of the resource on sustained yield basis is a means of keeping desertification at bay. Past efforts at conservation have failed due to lack of sound methods of regeneration, conservation and because of poor utilization practices.

The species is adapted to growing on sandy soils where opportunities for the establishment of other tree species is constrained by the ecology. At the time of project design, scientists were planning to develop a methodology for teak conservation for commercial purposes. This is the most relevant part of the project as far as combating desertification is concerned as the forests are on the frontiers of the Kalahari desert. Reading through the project proposal, one gets a feeling that the scientists were in fact ahead of their time for they specifically mentioned desertification control as their ultimate aim. Also mentioned was the conservation of all genetic resources, now referred as to biodiversity conservation.

The project generated useful technical information that can be used in the transboundary belt of the Zambia teak where deep sand makes the ecology unfit for a big range of agricultural crops and natural vegetation.

References: Project proposal and the final report.

LAND RECLAMATION (TORONTO/KENYA) - 88-1051

The Land Reclamation Project was located in the lowlands of Baringo District in Marigat Division, Kenya, next to Lake Baringo. This is an area with an annual rainfall of less than 650 mm. The District is a typical semi-arid area with serious land degradation problems, particularly on slopes.

The project was implemented by the Faculty of Forest Resources and Wildlife Management, Moi University, Nairobi, Kenya, with active collaboration from the Department of Social Sciences and Geography, University of Toronto, Toronto, Ontario, Canada. Initially, the project leaders were Drs. R.B. Bryan, Al Ul Haq, and F. Sang. Later, Dr. Wilson Kipkore took up the leadership. The project started in 1988 and ended in 1993. The level of funding was CAN$379 150.

The soils of semi-arid lands in Kenya generally have poor structure and are often vulnerable to erosion, degradation and desertification. The situation is made worse by overgrazing and the removal of the natural vegetation that acts as a resource base. Many soil conservation activities in Marigat District have failed because of a failure to understand the processes that lead to erosion. Hence various intervention measures have not achieved their intended results.

The project on land reclamation was designed with the objective of characterizing the specific environmental conditions that make the soils of semi-arid Western Kenya vulnerable to erosion and with a view to designing and implementing appropriate conservation measures. Specifically, the project sought to evaluate previous soil conservation measures, inventory soils and vegetation and to implement a combination of vegetative and physical measures for soil conservation. The project was also intended to improve the research capability of Moi University as well as disseminating useful research findings to local communities. The research combined both a field and on-station approach, particularly on rainfall simulation activities and the measurement of soil loss.

The main outcome of the project was the generation of knowledge about the processes leading to soil erosion on the project's sites. In particular, understanding of sheet, rill and gully erosion was made by the project. In addition, the project gathered important information on soil moisture retention using various mulching regimes. The problem oriented research capacity of Moi University was also considerably increased with the project acting as an outdoor laboratory for many university students particularly in respect to physical and vegetative aspects of soil conservation measures.

The main activities carried out by the project included a trial of stone and vegetative mulching with the interesting finding that stone mulching is more effective at moisture retention than vegetative mulching. Additionally, rainfall simulation, and trapping of sediment from natural storms and simulated rainfall was carried out. The rate of erosion in relation to rainfall was determined and a method of identifying areas of most active gully formation was developed. Furthermore, treatment of gullies with different techniques using physical, vegetative and soil conditioning was developed.

An important lesson learnt from the project is that research results need to be modified drastically before they are adopted by pastoralists and farmers. For example, research showed that stone mulching is more effective at increasing crop yield than is the use of vegetation. Yet, no farmer will import stones onto his land to achieve higher yields. For all practical purposes, the presence of stones is considered a constraint to efficient land utilization.

On the whole, the many research results generated by the project need to be tested further before they are passed on to farmers. In conducting the research, the project did not actively involve farmers and the general feeling of the local people that "the project is theirs" cannot be ruled out with certainty.

Even though it was not the objective of the project, some food crops were grown on-station to show farmers that semi-arid lands have potential for food production provided that some inputs such as water are available. The food crops tried on-station were *Mahito esculens, Cucumis melo* and *Phaseolus vulgaris*. Apparently, this part of the project interested the farmers and it was hoped that it would trigger better management of water catchment areas on the upper parts of Lake Baringo. This would also lead to better soil conservation practices and better appreciation and management of the natural vegetation particularly on hilly sites. The farmers were also interested in a number of plants that though watered initially, could be grown under rain fed conditions provided that microcatchments were used. Other plants tried were *Bixa vernonia*, citronella grass and groundnut

Soil erosion caused by overgrazing, the removal of vegetation and poor cropping practices is one of the most serious desertification processes in arid and semi-arid areas. This project contributed to scientific knowledge on measures to combat desertification and general land degradation in arid and semi-arid areas where soil loss is in the order of 17 tonnes/ha for a single rainstorm of 100 mm. Development of local university research capacity (Moi University) is the surest way of effectively addressing desertification and drought currently through development of well trained human resource, which will subsequently be deployed in all spheres of development.

In the past several land reclamation projects have failed to achieve their intended objectives in the vicinity of the project and indeed elsewhere in the country. Serious thought to the causes that have led to the failure indicate that the biggest constraint to the projects is lack of understanding of soil erosion processes. This project addressed these issues making it useful for generating strategies to halt and reverse the land degradation process.

References: Project proposal, progress reports and site visits.

DRY ZONE AFFORESTATION (ZIMBABWE) - 87-0014

The project was located in Zimbabwe on the communal lands of Agro-Ecological Zone V. This zone comprises one of the harshest and driest parts of southern Zimbabwe with an annual rainfall of less than 450 mm.

The project was implemented by the Chesa Forest Research Centre (CFRS), Bulawayo, in collaboration with the Agricultural Technical Extension Services (AGRITEX) with Jeanette Clarke as project leader. The two phases of the project ran from 1982 to 1992. The second phase of the project started in August 1987 and ended in July 1992. The level of funding was CAN$281 500 for phase I and CAN$297 200 for phase II.

Zimbabwe farming systems can be divided into two categories: commercial farming and communal farming. Commercial farming consists of large farms owned mainly by people of European origin for the large-scale production of livestock and agricultural crops. Communal farming, on the other hand, consists of scattered small-scale farms owned by Africans and used for subsistence farming. The communal farms are on the poorer soils and are usually located in the driest parts of the country where deforestation from overgrazing and cultivation has left most of the land bare. The project on dryland afforestation was designed with the objective of providing farmers with fuelwood and building poles and to integrate reforestation activities with existing communal farming systems.

Specifically the project sought to identify suitable multipurpose tree species for integration into food/forage/tree farming systems taking into account the existing and working farming methodologies and to develop appropriate establishment and management techniques for use by small-scale farmers. Additionally, the project sought to disseminate results generated by the project during the two phases. The project adopted both on-station and on-farm/on-pasture approaches. Efforts were also made at effective extension of the developed technologies.

One of the most important project outputs was the identification of drought tolerant, fast growing multipurpose tree species coupled with guidelines for the successful introduction of these species into dry-zone farming systems where land is owned communally. Demonstration that limited tree planting is achievable, albeit with many biological, social and climatic difficulties, was an important aspect of the project in an area where the removal of vegetation, through shifting cultivation and overgrazing, has led to desert conditions.

The main activities of the project included dry-climate matching as a factor in species screening for the identification of fast growing tree species for fuelwood production and for introduction

into tree/pasture/food crop systems. Limited plantation establishment and management techniques were also developed in the form of woodlots. Efforts were also made to disseminate results through AGRITEX. This was an important radical deviation from traditional forestry extension systems where the delivery of technical information is carried out by the foresters themselves.

There were many lessons learnt in the course of project implementation. Many failures were experienced with the on-station trials. For example, out of thirteen trials using different tree species, one succeeded, one just survived, one was too slow, five were written off, two were browsed and three failed due to drought. Efforts to set up youth group nurseries in farms failed due to the lack of a strategic approach.

On the positive side at the on-farm level, it was noticed that microcatchments marginally improved growth but were not sustainable due to their cost. However, an innovative method of natural vegetation management (pruning of underbranches and thinning undergrowth) was developed by a local councillor and this method had a positive effect on the conservation of natural vegetation in otherwise overgrazed lands where the carrying capacity was exceeded by a factor of about nine. This result clearly indicates that researchers should work with opinion leaders if they hope to achieve a meaningful adoption of the technologies the develop.

In many parts of Africa, the areas most vulnerable to desertification are the dry communal lands. Overgrazing and efforts to grow crops have led to the loss of vegetative cover and subsequently soil erosion due to a lack of appropriate resource conservation incentives. Such is the case on the communal lands of Zimbabwe where erodible sandy soils are subjected to overgrazing and subsistence farming.

The act of growing drought resistant trees for economic and environmental roles by the project presented, in spite of slow progress, a unique opportunity to halt and reverse land degradation in areas otherwise susceptible to serious desertification and drought. The lessons learnt from the project could be applied to most marginal arid lands in Africa, especially where communal land ownership makes it extremely difficult to conserve vegetation resources.

Ref: Final report by Jeanette Clarke, Project Leader.

OILCROPS (ETHIOPIA) - 87-0255

The Oilcrops Project was located in the lowlands and highlands of Northern Ethiopia. The lowland areas used by the project are the semi-arid lands of Ethiopia. The project was implemented by the Institute of Agricultural Research, Addis Adaba, Ethiopia, with several different project leaders after the death of the first leader.

Essentially this was an amalgamation of two projects: a lowlands project and a highlands project both of which started in 1982. The combined project started in 1987 and ended in 1992. The level of funding for the highlands project was CAN$375 300 and for the lowlands project was CAN$347 600, while the combined project was funded to the extent of CAN$337 500 for a period of 36 months.

Oil crops are an important source of food and a raw material base for agroindustries. The main oil crops that were dealt with were sesame, sesamun, indicum, groundnut, castor and safflower. However, in Ethiopia, growing of oil crops both in the lowlands and the highlands faces enormous problems of low yields, disease and pest attack considerably undermining the agricultural base. The project on oil crops was designed to develop high yielding cultivars and improved agronomic methods.

Specifically the project sought to do breeding and selection, as well as the development of appropriate agronomic measures. Seed multiplication work, dissemination and extension activities were all carried out in collaboration with the Extension Department of the Ministry of Agriculture. The project approach was mainly on-farm.

The main output of the project was the development of high yielding cultivars of oil crops that were drought resistant and suitable for use in the northern part of the country. Improved cultural practices were also developed by the project. The project collaborated in its work with ICRISAT, both regionally and internationally. On the whole the project had enormous problems with its management team as the leader died in the course of the project and one trainee did not return to the country after obtaining a PhD. The subsequent evaluation report noted that the project was probably too ambitious and that it did not really address the issues involved in the on-farm approach that was adopted.

Notwithstanding the above, one lesson that was learnt in the course of project implementation was that efforts to get early maturing varieties of oil crops, which were also drought resistant, resulted in yield penalties. There was also a sacrifice in taste, making the varieties unpopular with local people whom the project was meant to benefit. It was also noted

that the lack of an appropriate extension mechanism was one of the main constraints to the implementation of the project.

The project does not have direct relevance to desertification as such.

Ref: Final evaluation report by Thomas Development Associates Limited, Mallorytown, Ontario, Canada.

SORGHUM AND MILLET (UGANDA) - 84-0219

The project was located at the Serere Research Station, which serves the eastern and northern parts of Uganda. However, the project was relevant to a wider area in Uganda where sorghum and millet are grown. Though the Serere area is not very dry with bimodal rainfall, the crops are grown in the semi-arid lands of Teso and Kumi districts with a rainfall of about 600 mm per annum.

The project was implemented by the Ministry of Regional Co-operation, Uganda, with Vincent Makumbi Zake as the project leader. It was started in 1985 and ended in January 1992. There were several phases of the project. Funding for Phase I was CAN$76 000, Phase II was CAN$132 000, and for Phase III was CAN$307 300. Phases I and II were actually East African programs while Phase III was designated as a Uganda Programme.

Uganda is a lucky countries as far as the threat of desertification is concerned. The area with low desertification potential accounts for only about 30% of the total country. In the dry parts of the country, however, desertification is a reality. The main crops grown in these semi-arid lands are sorghum and millet whose estimated area of coverage is in the order of 950 000 hectares.

These crops are staple foods of the semi-arid areas, and finger millet is the most extensively grown cereal in Uganda. Until recently, finger millet received relatively little research attention. Other crops cannot do well without irrigation in the areas where sorghum and millet excel. The sorghum and millet grown is not high yielding and the crop management practices leave much to be desired.

The project on sorghum and millet was designed with the objective of developing acceptable and productive varieties of sorghum and millet as well as improving crop management practices. Specifically, the project aimed at assessing production methods, developing higher yielding disease resistant finger millet varieties, improving management practices and the training of research scientists for employment by the Uganda Government. The intended methodology included on-station and on-farm trials as well a survey of about 50 farms.

The main project output included an awareness of the importance of sorghum and millet varieties and some on-station trials.

The activities that were carried out included trials of several varieties of sorghum and millet as well as intercropping trials. In addition, the effect of fertilizer on the different varieties was monitored.

The project had many administrative problems. There was a delay in the release of funds and, due to problems with transportation and security, travel to carry out the intended surveys was not possible.

The lessons learnt from the project were fairly standard as would be expected at on-station trials. It was noted that intercropping reduced yield while fertilizer increased it. The project is relevant to desertification in so as far as it has the potential to provide food to the people in drylands who would otherwise engage in activities that are conducive to desertification such as overgrazing and extensive cultivation in semi-arid lands.

Ref: Final Report by Joseph Oryokot.

ROOT AND TUBERS II (ZANZIBAR) - 85-0192

The project was located in Zanzibar on infertile and drought susceptible coral-rag soils. These are located in the drier parts of Zanzibar. The Ministry of Agriculture was the implementing agency with Mwinyi Haji Makame as the project leader. The project started in 1985 and ended in 1992. The level of funding was CAN$175 000 over 36 months.

Zanzibar has a high potential for agricultural production but there are some dry patches with coral-based infertile soils and low rainfall where many agricultural crops cannot grow. Cassava has been an important food crop in such soils and it rates second in importance to rice. The cassava yield is, however, low and the varieties grown are often subject to pest attack. On the whole the utilization of these soils has been difficult. This project was designed to develop drought resistant and palatable varieties of cassava.

One of the outcomes of the project was information on raising the productivity of root and tuber crops and improved cropping practices for dry lands and infertile soils. In addition, a higher yielding cassava variety, which was pest and drought resistant with an acceptable palatability, was produced.

The main activities of the project included the identification and multiplication of high yielding, pest and disease resistant sweet cassava varieties. The yield obtained ranged from 20 to 30 tonnes per hectare. Moreover, improved varieties of sweet potato, yam and cocoyam were developed. Other than the biological research, the project fine-tuned cropping practices and the control of cassava pests as well as developing methods of using cassava for livestock feed. Training at the on-farm level was conducted for both the farmers and scientists.

One of the important lessons learnt from the project was that rather than use an expensive acaricide, efforts should be made to promote disease and pest resistant varieties. Further, such varieties can do well in infertile soils where the application of fertilizer does not significantly increase the final yield. The project benefitted 24 villages affecting about 250 farmers.

The development of root and tuber crops is a particularly effective strategy for food security in dry lands. It is an example of drought copping mechanism because food is provided at critical times when seasonal food crops are not available. Such crops provide food for consumption and cash in addition to limited livestock feed. The other important feature of roots and tuber crops is their durability and longer shelf life in situations where crop loss during storage is quite considerable.

These farming systems can effectively minimize other activities such as charcoal burning and extensive cultivation, all of which are meant to meet the needs of the local population living in areas of dry and poor soils. On the whole, strategies to produce crops, which can be stored easily for use in the dry season, is an effective way of preventing land degradation particularly in dry seasons.

Ref: Final Report by Mwinyi Haji Makame.

FARMING SYSTEMS RESEARCH (TANZANIA) - 85-0255

This project was located in Tanzania's Morogoro District where rainfall is low and generally unreliable. This is a semi-arid region of Tanzania where shifting cultivation has been practised since time immemorial.

This was a second phase of a project the first phase of which concentrated on mountain sites. The project was implemented by the Sokoine University of Agriculture with A.N. Minjas as the Project leader. The project started in 1986 and ended in 1990. Funding amount was CAN$178 100 for 36 months.

In Tanzania, people living in dryland areas face enormous problems with food supply. In the drylands, shifting cultivation has been practised and the farming systems that have been developed are not well understood by researchers or extension workers. Low rainfall, poor soils, soil erosion and lack of appropriate early maturing crops are some of the basic constraints of these farming systems. Vegetation in these areas is predominantly bushland and characterized by species of Acacia, Commiphora and a variety of grasses such as panicum, Echinochloa and Eragrostis. Charcoal burning is a common off-farm activity that has led to serious land degradation.

The project was designed to develop low input technologies of farming suitable for semi-arid lands and to undertake the dissemination of these systems. The approach was to be field oriented and some training of university staff was envisaged.

Some of the research outputs included improved farming systems specifically for the northern plains and some deeper understanding of the technical problems that were constraints to farmers. Limited involvement of some farmers was also undertaken by the project as well as the training of university staff.

On the whole, the project followed conventional farming system research wisdom with an added extension element for the most feasible and acceptable technologies and innovations. One of the important findings of the project was that farmers failed to adopt the recommended varieties of crops because they found them too expensive. Further, the farmers only gave the researchers the worst plots on which to carry out their research trials. This indicated a problem with the level of the farmers' involvement in the field portion of the research activities. By implication, if the scientists used only the poor parts of the farms, the research results were probably biased and any advise given to the farmers may not have been very useful.

The project was concentrated in the northern plains where poor farming systems have led to land degradation. Despite administrative problems such as high staff turnover and general

lack of coordination, improvement of farming systems lands showed a potential to stem desertification in semi-arid regions. The project has the potential to provide an alternative resource and hence minimization of land degradation occasioned by charcoal burning and general vegetation clearing in areas otherwise susceptible to soil erosion.

Ref: Final technical report by A.N. Minjas, Project Leader.

DROUGHT AND RESETTLEMENT (ETHIOPIA) - 86-0215

The Drought and Resettlement Project is a collaborative undertaking dealing with emergency resettlement schemes that were initiated after the 1984-1985 Ethiopian drought. The new settlers were moved to the better watered region of Western Ethiopia from drought prone Northern Ethiopia. The project was implemented by the Central Statistical Office, Office of the National Commission for Central Planning, Addis Adaba and was funded to CAN$160 000 for a period of 18 months.

The most important output of the project was the collection of critical baseline data on the newly settled people in respect to health, agriculture and social services. It was estimated that about one million people were relocated in response to the drought but there was very little information upon which sound planning to avert land degradation could be based. The project's objective was to generate this information. The information obtained on the new settlers could also be used in other settlement schemes in this country and elsewhere.

The project's activities included a workshop to define the information to be collected and the collection of baseline data on the newly settled population. The workshop recommended using the national census format and the collection of additional information was recommended to reflect changes resulting from resettlement work. Of special interest were human activities that lead to deforestation. This included information on newly constructed houses such as the material used in construction and the number of rooms in each newly built house. Other information collected included health statistics, agricultural crops grown and the availability of natural resources.

The project's relevance to desertification and drought becomes obvious when it is recalled that most of the deforestation in Africa results from new settlements whereby naturally vegetated land is converted permanently to cropping land. As people try to meet their basic requirements for food, energy and shelter, considerable land degradation and subsequent desertification takes place when the land's carrying capacity is exceeded. Proper planning for settlement schemes could minimize environmental degradation and this planning needs concrete data.

3. REVIEW OF ONGOING PROJECTS

DRYLAND ECOSYSTEMS MANAGEMENT (KENYA) - 91-0094

The Dryland Ecosystem Management Project is located in Marigat Division of Baringo District, Kenya. This is a semi-arid area that receives between 300 and 600 mm of rainfall per year. Though the project site is in Marigat Division, the project deals with dryland natural vegetation in all of Baringo district.

The project is implemented by the Department of Forestry, Faculty of Forestry and Wildlife Resources, Moi University, with Dr. Wilson Kipkore as the project leader. The project started in November 1991 and is due to end in November 1993. The level of funding is CAN$144 270 for 24 months.

In the arid and semi-arid areas of Kenya, livestock raising is the backbone of the economy. Serious studies of these arid zones have concluded that livestock raising is the most appropriate land use system and that other agricultural activities are expensive and non-sustainable. By implication, dryland vegetation that provides the habitat and browse for both livestock and wildlife is the most important socio and economic base resource in the arid lands. Yet the dynamics of natural vegetation, even though a very important resource, are not well understood. Lack of understanding of natural vegetation dynamics is a major constraint to sustainable management of this vital resource.

The project on dryland ecosystems has the objective of understanding the dynamics of dryland ecosystems and of fostering appropriate research and management of arid and semi-arid life support systems. Specifically, the project sought to carry out research on species composition, regeneration, growth and the succession of natural vegetation. Additionally, monitoring and evaluation of natural vegetation subjected to different silvicultural treatments was envisaged. The project was also designed to expose Moi University students to the technical and socio-economic issues of dryland vegetation in field oriented research.

The most important output of the project will be a deeper understanding of dryland vegetation and graduates with hands-on practical field experience on the sustainable management of the natural and indigenous vegetation of drylands. The project has greatly enhanced knowledge on the dynamics of natural vegetation and socio-cultural issues in respect to conservation and utilization of drylands natural vegetation.

To understand the dynamics of natural vegetation in the drylands, one of the main project activities included a baseline survey of vegetation on the project site and some silvicultural treatments on different samples as well as the necessary monitoring of vegetation changes with and without treatments. Community values are being taken into account and assessed through regular dialogue with the local community in the course of project implementation. Project activities are being used as field training for Moi University forestry students, giving them the necessary insight into fundamental socio-cultural economic and political factors inherent in arid and semi-arid area development.

The phenological study was also carried out in respect to the tree species that provide dry season fodder. In consultation with the local people, the following tree species were studied: *Acacia mellifera, A. tortilis, A. reficiens* and *A. nilotica*. A novel approach to stopping soil erosion included the selection and use of nonpalatable tree species, a development strategy that did not fence off the area against the local community. Further, the Moi University students have been exposed to the participatory method of dryland ecosystem management.

One important lesson learnt from this project is that farmers in drylands are extremely knowledgeable about many aspects of dryland vegetation. The main interest of farmers was more on how to effectively use some tree species for medicinal and food purposes than on the results of silvicultural research. In fact, during interviews, farmers stated that they understood the need to conserve tree species such as *Acacia tortilis* for fodder and that fuelwood scarcity is a big problem in areas with seemingly abundant wood resources.

The other equally important lesson for researchers is that destructive research in arid and semi-arid lands is viewed with apprehension and should be discouraged because to ordinary people these activities may be viewed as environmental destruction with official consent. The idea to fence off some areas for destructive research was therefore dropped for fear of keeping resources away from the people.

The first sign of the desertification process is normally a loss of natural vegetation but rangeland degradation begins before obvious total vegetation loss. The project has greatly contributed to desertification control through the generation of knowledge on the dynamics of natural vegetation and the necessary manipulative activities that should be undertaken for its sustainable management.

Appropriate intervention measures to halt and reverse environmental degradation can only be effective if the people responsible for implementation have been given down-to-earth

training. In the sense that the project is actively involving local communities, its activities have the potential for application in arid and semi-arid lands where desertification and land degradation is a reality.

Ref. Mid-term report by Dr. W. Kipkore, project leader, and site visits.

SORGHUM/MILLET FOOD/FEED SYSTEMS (KENYA) - 89-0172

This networking project is about the production and utilization of sorghum and millet in arid and semi-arid parts of Kenya. The implementing institution is the Faculty of Agriculture, University of Nairobi. Funding amounts to CAN$189 000 for a period of 36 months.

The expected output of the project is an increased collaboration among scientists and other government officials who are dealing with the development of sorghum and millet in arid and semi-arid areas. Before the creation of the network the agencies were working in isolation.

To promote the use of sorghum and millet for human consumption and for livestock feed from the residues, the networking team's main activities are the identification of persons active in technical, business, policy and research implementation with a view to creating an exchange of information. Additionally, constraints and opportunities in the development of the commodity are being carried out to convince policy makers to allocate more resources to the development of sorghum and millet.

Inappropriate selection of agricultural crops in arid and semi-arid lands leads to very low yields and creates a need for larger per capita cultivated areas. The project deals with food production in arid and semi-arid areas and has the potential to minimize the expansion of cultivation in arid and semi-arid lands. This is a common phenomenon in cases where potentially high yield crops, such as maize, are being grown with very low yields. The provision of livestock feed from residue could also minimize overgrazing, an activity that also contributes to land degradation and the onset of desert conditions.

SOIL AND WATER MANAGEMENT (TANZANIA) - 91-0010

This project is located in Tanzania and specifically deals with soil and water management in the semi-arid lands where rainfall is below 750 mm per annum. It is implemented by Sokoine University of Agriculture. Funding amount is CAN$196 000 for 36 months. The expected output of the project is effective management technology that will lead to increased moisture retention in soil for rainfed crop growth.

The activities include analysis of rainfall patterns and soil features that determine moisture retention. The project's activities also include developing techniques for improving the infiltration of water into the soil profile as well as for reducing runoff.

The main feature of the project is that soil management techniques aim at higher moisture retention rather than having run off, which is a principle culprit of land degradation in both high and low potential areas. Efficient water harvesting can considerably minimize soil impoverishment.

ARID LAND AND RESOURCE MANAGEMENT NETWORK (EASTERN AFRICA) - 91-0151

This is a relatively new networking project covering the ecologically fragile areas of Eastern Africa (Kenya, Uganda, Tanzania and Uganda). In these areas, arid and semi-arid land typically has a rainfall below 700 mm per annum. The project is coordinated by the African Centre for Technology Studies (ACTS). Networking membership is individual and though initially restricted to the four African countries mentioned above, efforts are being made to have members from the greater East African region that includes Sudan, Djibouti and Somalia. Funding for the networking is CAN$607 600 for 36 months.

The expected output of the project is the creation of awareness that land tenure and the related policy issues in arid and semi-arid lands can be responsible for environmental degradation. After the research has been conducted, results on social issues, policy, land tenure and resource management will be released to members. Publication of the output of the network is desired by policy makers interested in the development of arid lands.

The project's activities revolve around the social problems of land tenure and resource management - basically examining gaps in land laws and land reforms as well as monitoring changes in tenure, land use and pastoralism. Issues of displacement of pastoralists through developmental programmes will be researched and appropriate strategies developed to overcome the identified constraints and problems.

Also to be addressed will be the issue of sedentarization of once migratory communities and the consequent creation of pockets of desertification, and strategies to respond to drought. The project will train the network team. Twenty young researchers from the region are expected to benefit from the project.

In the final analysis, desertification is caused by human activity. The strategies people adopt to meet their needs are highly influenced by the prevailing political, socio-economic and cultural values of the community. Understanding the many social issues associated with land tenure, land management and land use can lead to the development of appropriate intervention strategies that will in turn lead to sustainable land use. Intervention may otherwise lead to more environmental degradation if subtle social issues such as land tenure and use are not well grasped.

IRRIGATION PERFORMANCE (ZIMBABWE) - 88-0137

The project is located in the semi-arid, low-veld region of Zimbabwe. The project is implemented by the Faculty of Agriculture, University of Zimbabwe, in collaboration with the International Food Policy Research Institute (IFPRI). The project was started in 1988. Funding amounted to CAN$197 300 for 36 months.

In most dry parts of Zimbabwe, agriculture is not possible without irrigation. It is a common feature to see several small irrigation schemes irrigating practically all types of grain crops and horticulture. The irrigation schemes are beset with many problems. This is a situation which has made it difficult to apply irrigation technology to smaller farms in communal areas.

It is estimated that Zimbabwe has an area of about 30 000 ha that is suitable for irrigation microprojects and if a number of problems are overcome, these projects could contribute to food security in drought and desert prone areas. This project was designed with the objective of understanding the major problems and constraints of five irrigation types in use in Zimbabwe. Other specific objectives include development of replicable methodologies for appraisal of irrigation scheme performance and the training of nationals.

Project activities include a comparative evaluation of the different types of irrigation methods and the development of a multidisciplinary methodology for assessing irrigation system performance in the SADCC region under varying management practices, policies and hydrological regimes.

The project's relevance to desertification is in the development of drought coping mechanisms in situations of extreme drought in zones vulnerable to desertification. Proper design and implementation of irrigation projects could also minimize the problems associated with siltation and salinization.

SEASONAL HUNGER AND NUTRITION (KENYA) - 89-0241

This project is being conducted in Nakuru District, Kenya. The district has many extremes of climate ranging from semi-arid to very high potential areas. The funding amount was CAN$56 097 over 18 months.

In some parts of Kenya, soil types and rainfall patterns allow for a relatively stable production of surplus food. However, in areas with marginal climatic conditions, production levels are low and tend to fluctuate throughout the year leading to fluctuations in the availability of food. This process is exacerbated by population pressures and the unavailability of arable land. Small-scale farmers and the landless are increasingly vulnerable to the effect of these fluctuations since they are often unable to maintain an adequate nutrient intake. The seasonality of the agricultural cycle may also affect intra-household food distribution patterns.

The study has the objective of identifying which members of the household are most vulnerable to the effects of seasonal hunger and the reasons for their relative vulnerability.

Some of the activities of the study include the determination of the extent of seasonal hunger among small scale farmers and squatter families. An analysis of the factors that determine food distribution practices within these households was also undertaken. The study also identified the strategies used by different households to cope with seasonal food shortages. Understanding of the conditions that lead to hunger in certain households within the same climatic zone could be instructive in designing drought coping mechanisms, a strategy that is relevant to desertification control efforts.

4. SUMMARY

This review has considered a number of past and ongoing projects that have been funded by the International Development Research Centre in the Eastern and Southern Africa region. These projects have some relevance to desertification control in the area and in other parts of the world with a similar environment.

On the whole, the projects make a limited contribution to desertification control. It is clear, however, that the technologies developed by the projects have potential for wider use in efforts to integrate environmental factors into development activities. The problems encountered in the course of project implementation are often a reflection of the problems likely to be encountered during the development and implementation of strategies to halt and reverse land degradation.

The projects reviewed cover various aspects of land use including forestry, agriculture and livestock. One important lesson learnt from these projects is that there is no one single approach that is totally effective in halting and reversing environmental degradation and the subsequent onset of desertification unless they are integrated with other strategies. Further, to attain truly environmentally friendly and sustainable development, there must be a genuine participation of the local people in planning and implementing programs whose basic aim is to improve the welfare of poor people. This level of participation was often not fully achieved in the projects reviewed here and this probably limited their positive effect upon the welfare of the population.