The Comprehensive Africa Agriculture Development Programme (CAADP)

Sustainable Land Water Management

The CAADP Pillar I Framework

"TOOL" FOR USE BY COUNTRIES IN MAINSTREAMING AND UPSCALING OF SUSTAINABLE LAND AND WATER MANAGEMENT IN AFRICA'S AGRICULTURE AND RURAL DEVELOPMENT AGENDA

DRAFT

FOR COMMENTS – NOT FOR CIRCULATION

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ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
AGRA	Alliance for a Green Revolution for Africa
AU	African Union
CAADP	Comprehensive African Agriculture Development Programme
CILSS	Centre Inter-Etat de Luttre contre la Secheresse au Sahel
CMAWCA	Conference of Ministers of Agriculture of West and Central Africa
COMESA	Common Market for Eastern and Southern Africa
CSO	Civil society organization
DFID	Department for International Development
ECCAS	Economic Community of Central African States
ECOWAP	Economic Community of West Africa Agricultural Programme
ECOWAS	Economic Community of West African States
FAAP	Framework for African Agricultural Productivity (CAADP Pillar 4)
FAFS	Framework for African Food Security (CAADP Pillar 3)
FARA	Forum for Agricultural Research in Africa
FFS	Farmer Field Schools Approach
FIMA	Framework for the Improvement of Rural Infrastructure and Trade-Related Capacities for Market Access (CAADP Pillar 2)
GEF	The Global Environment Facility
GGWI	The Great Green wall initiative
GTZ	Gesellschaft für Technische Zusammenarbeit
IFAD	International Fund for Agriculture Development
IFPRI	International Food Policy Research Institute
M&E	Monitoring and evaluation
MDG	Millennium Development Goal
NEPAD	New Partnership for Africa's Development
NGO	Nongovernmental organization
OAU	Organisation for African Unity
OECD	Organisation for Economic Co-operation and Development
PPP	Public-private partnership
PRSP	Poverty Reduction Strategy Paper
REC	Regional Economic Community
ReSAKSS	Regional Strategic Analysis and Knowledge Support System
RIU	Research Into Use
UNCCD	The United Nations Convention to Combat Desertification
SADC	Southern African Development Community
SAKSS	Strategic Analysis and Knowledge Support System
SFI	Soil Fertility Initiative
SLM	Sustainable Land Management
SLWM	Sustainable Land and Water Management
SSO	Sahara and Sahel Observatory
SWAp	Sector-wide approach

Acknowledgements

Executive Summary

1. INTRODUCTION

1.1 Rationale / Background

The New Partnership for Africa's Development (NEPAD) has identified agriculture as central to poverty alleviation, food and nutrition security and attaining the Millennium Development Goals (MDGs) in Africa. The Comprehensive Africa Agriculture Development Program (CAADP) (*including livestock, Forest and Aquaculture agendas as articulated in the CAADP Companion document*) provides a common framework for stimulating and guiding national, regional and continental initiatives on enhanced agriculture productivity.

Under CAADP, Africa's governments have further identified four continent wide entry points (Pillars) for investment and action in pursuing increased and sustainable productivity in agriculture, forestry, fisheries and livestock management. These include:

- Pillar 1 – Extending the area under sustainable land and water management;
- Pillar 2 – Improving Market access through improved rural infrastructure and trade-related interventions;
- Pillar 3 – Increasing food supply and reducing hunger across the region by increasing small holder productivity and improving response to food emergencies;
- Pillar 4 – Improving agricultural research and systems to disseminate appropriate new technologies, and increasing the support to help farmers adopt them.

Each of these pillars incorporates policy, institutional reform and capacity building and has a framework through which the challenges prioritised by CAADP might effectively and efficiently be achieved.

This document develops the CAADP Pillar I Framework for Sustainable Land and Water Management (FSLWM). The following documents provide its foundation:

i. The SLWM Vision Paper for Africa and the corresponding SLWM Country Support Tool: These documents elaborate both the strategic vision for scaling up the area under sustainable land and water management in Africa and the practical tools and modalities for pursuing this vision at the national level. The Country Support Tool has been developed with regard to the need to provide a clear instrument in ensuring clear and concrete linkages between the CAADP agenda at large with the unfolding demands of the country roundtable processes.

ii. The paper on Investment in Agricultural Water for Poverty Reduction and Economic Growth in Sub-Saharan Africa identifies key priorities and entry points for approaching the agricultural water agenda through sustainable land and water management.

1.2 PILLAR 1 in the CAADP Agenda

The New Partnership for Africa's Development (NEPAD) is both a vision and strategic framework conceived by African leaders to address the socioeconomic and political challenges plaguing the African continent (poverty, underdevelopment and marginalisation). As a program of the African Union (adopted July 2001) NEPAD seeks to achieve its vision of food security, poverty eradication, sustainable growth and development and active participation in the world economy and politics by focusing on five key economic sectors (agriculture, human development, infrastructure, agro-industry diversification and development, and environment). Due to its contribution to the economy the agriculture sector is critical to the success of efforts to reduce food insecurity and poverty[1]. Accordingly, African leaders identified the agricultural sector as one of the key priority areas for intervention in achieving the NEPAD vision. However, the overall performance of the agricultural sector in Africa remains weak and fragile. In response, African leaders developed the Comprehensive Africa Agriculture Development Program (CAADP) as the NEPAD framework for the revitalization of the agricultural sector in Africa.

CAADP is at the heart of efforts by African governments under the AU/NEPAD initiative to accelerate growth and eliminate poverty and hunger among African countries. The main objective of the CAADP is to help African countries reach a higher path of economic growth through agricultural-led development - eliminating hunger, reducing poverty and food insecurity, enabling the expansion of exports and supporting environmental resilience.

CAADP is now acknowledged as not only an African conceived and driven agricultural agenda, but also, it has emerged as a key entry point for both national and international development partner support to the agricultural sector in Africa.

As a program of the African Union, it emanates from and is fully owned and led by African governments. Although continental in scope, it is an integral part of national efforts to promote agricultural sector growth and economic development. It is not a set of supranational programs to be implemented by individual countries. It is rather a common framework, reflected in a set of key principles and targets that have been defined and set by the Heads of State and Government, in order to: (i) guide country strategies and investment programs; ii) allow regional peer learning and review; iii) facilitate greater alignment and harmonization of development efforts.

These key principles and targets include:

- agriculture-led growth as a main strategy in attaining targets on food security and poverty alleviation (MDGs)
- exploitation of regional complementarities and cooperation to stimulate growth;
- application of principles of policy efficiency, dialogue, review, and accountability;
- usage of partnerships and alliances, including farmers, agri-business and civil society;
- Shared responsibilities and collective commitment among the various African institutions, from the AU institutions (AUC, NEPAD Secretariat and REC) to national governments, the civil society and private sector institutions.
- Assignment to individual countries the role and responsibility of program implementation, the coordination to designed Economic Regional Communities (RECs) and facilitation to the NEPAD Secretariat.

[1] On average agriculture accounts for 30-60% GDP, 60-90% employment and 25-90% export earnings. Second, the majority (70%) of poor people in Africa live in rural areas and rely on agriculture for their employment and income. Third, Africa's poor spend more than 50% of their income on food,.

CAADP marks two key intermediate targets, namely:

- pursuit of a 6% average annual agricultural sector growth rate at the national level;
- allocation of 10% of national budgets to the agricultural sector;

With the four pillars as its foundation, the CAADP efforts drill down to the national level through the "roundtable" process which focuses on:

- Aligning state policies with regional priorities and the four pillars;
- Exploiting synergies and inclusive discussions on socio-economic bottlenecks and deciding appropriate action on those matters;
- Identifying gaps in the donor funding needed to achieve agreed priorities;
- Initiating work to monitor and evaluate CAADP's progress at the national, regional and continental levels

Land and water are the primary natural resources necessary for agriculture, food production and rural development in most countries. If used in proper association with suitable technologies and related factors such as labour, investment, land and water have the capacity to enable global agricultural production to continue outpacing growing demand despite declining availability of per capita land and water resources. For this trend to take root in Africa and to continue elsewhere, increased output must come mainly from intensified production, as new land for expansion is very limited.

In spite of the inherent fragility of Africa's soils, the continent's climatic variability, and the uneven distribution and availability of both surface and subsurface water resources, there is substantial untapped potential for the development of the continent's water and land resources for increasing agricultural production. FAO estimates that the current area under managed water and land development totals some 12.6 million ha[2]18, equivalent to only some 8 percent of the total arable land. Substantial public and private investments in developing and improving the management of these land and water resources will be essential to enable African countries reach the levels of agricultural production required to meet the targets for poverty alleviation, food production and economic recovery by 2015. Building up soil fertility and the moisture holding capacity of agricultural soils, and rapidly increasing the area equipped with irrigation, will not only provide farmers with opportunities to raise output on a sustainable basis but will also contribute to the reliability of food supplies.

[2] FAO. 2000. Agriculture Towards 2015/30. Technical Interim Report. Rome: http://www.fao.org/docrep/005/y6831e/y6831e-03.htm#P455_107316

2. PROFILE OF LAND RESOURCES AND AGRICULTURAL WATER IN AFRICA

2.1 Profile of land resources

Land and Land Resources refers to a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface, including those of the near-surface climate, the soil and terrain forms, the surface hydrology, the near surface sedimentary layers and associated groundwater and geohydrological reserve, the plant and animal populations, the human settlement patterns and the physical result of past and present human activity (FAO/UNEP, 1997).

Africa's land base is environmentally fragile and easily degraded. A variety of different land degradation processes (see Box 1) are at work, and it is clear from a 'convergence of evidence' and consensus among the expert community that large areas of the croplands, grasslands, woodlands and forests are already seriously degraded.

Box 1: Some of the Key Causes of Land Degradation in Sub-Saharan Africa

The most important *natural factors* relate to the risk of:

- water erosion – steep slopes, high intensity rainstorms, erodible soils;
- wind erosion – strong winds, semi-arid/arid climatic zones with sparse vegetative cover;
- soil fertility decline – strong leaching of soil nutrients, rapid decay and mineralisation of soil organic matter, weathered acidic soils low in organic matter and soil nutrients;
- degradation in soil physical properties – weak structured soils low in organic matter;
- salinization – semi-arid/arid climates with high evaporation rates and low leaching intensity;
- vegetation degradation – low and erratic rainfall limits vegetative recovery following disturbance; and
- climate variability - decline in water quality and quantity –alternating abundance and scarcity according to the season (wet or dry), or natural climatic cycle (El Niño/La Niña).

The *direct (human) causes, or pressures* on the land include:

- inappropriate management (shorter fallows, exposed soil, etc.) of the land for the cultivation of annual rainfed, irrigated and/or perennial crops
- poor management of natural forest and tree plantation/woodlot areas;
- removal and degradation of natural vegetation through deforestation and/or overexploitation of local species;
- overgrazing of natural and planted pastures
- poor management and over use of surface and groundwater resources; and
- poorly planned and managed urban and industrial development (resulting in the physical loss of good farm land, pastures and forest areas as well as on- and off-site pollution).
- Forest Fires
- Population growth

The key *root causes or driving forces* of particular importance in SSA are:

- poverty/economic disadvantage (poor people cannot afford to forgo short term production/resource exploitation to take care of immediate income needs for the sake of long term sustainability);
- lack of awareness of the consequences of land degradation which happens progressively but for which the symptoms are not immediately evident
- population pressure leads to small land holding size, in high potential areas, with traditional fallowing practices abandoned as individual plots are of necessity cultivated on a continuous basis;
- high input costs, low produce prices, and other market failures are disincentives to investing in improved land management practices;
- under nourishment and ill health are interlinked, rural households with food shortages are more susceptible to the ravages of malaria, HIV-AIDS and tuberculosis, which in turn reduces their ability to produce their own food, or earn their livelihoods in off-farm employment;
- rural households with insecure user rights, for their farm plots, pasture and forest resources, are less willing to invest in ensuring future productivity, being unsure as to whether they will be the ones to benefit
- inappropriate development policies driven by short term output targets that ignore long term sustainability; and
- weak/non-existent advisory support services limiting land users' access to improved farm inputs and information on alternative land use enterprises and improved land management practices.

Land degradation is continuing and increasing in severity and impact. If present trends continue two-thirds of Africa's croplands could effectively be non-productive by 2025 (UN 2004). At the same time the total area and productivity of AFRICA's traditional rangelands is decreasing.

Box 2: Summary of Land Degradation Status and Illustrative Consequences

Status of Land Degradation

- Land degradation affects 67 percent of the total land area of AFRICA with 25 percent characterized as severe to very severely degraded and some 4 to 7 percent as non-reclaimable.
- Africa is currently exporting 1.7 billion tons per year of sediment causing productivity losses and contaminated water sources.
- The productivity loss in Africa from soil degradation since World War II has been estimated at 25 percent for cropland and 8 to 14 percent for cropland and pasture together.
- There is a negative nutrient balance in AFRICA's croplands with at least 4 million tons of nutrients removed in harvested products compared to the 1 million tons returned in the form of manure and fertiliser. Soil fertility degradation is considered the single most important food security constraint in AFRICA.
- Some 86 percent of African soils are under soil moisture stress.

Illustrative Consequences

- Over 3 percent of Africa's agricultural GDP is lost annually - equivalent to US$ 9 billion per yet - as a direct result of soil and nutrient loss.
- By 2015, AFRICA will host half of the world's poor.
- The World Food Programme has spent US$12.5 billion (45 percent of its total investment since its establishment) in Africa and 50 percent in 2001.
- Africa spent US$18.7 billion on food imports in 2000 alone.
- In 2000 Africa received 2.8 million tons of food aid, over a quarter of the world total.
- In 2001 28 million people in Africa faced food emergencies due to droughts, floods and strife, with 25 million needing emergency food and agricultural assistance.
- Hunger and malnutrition in AFRICA and degradation of water resources has increased susceptibility to life threatening diseases.
- In sub-Saharan Africa, 15 percent of the population or 183 million people will still be undernourished by 2030 – by far the highest total for any region, and only 11 million less than in 1997-99. Malnutrition is expected to increase by an average of 32 percent.
- Land degradation has led to forced migration of individuals, rural households and whole communities.
- Conflicts (between settled farmers, herders and forest dwellers) over access to land resources have increased as households and communities search for productive land for their crops and/or livestock.

The GLASOD project (Oldeman, 1994) was the first comprehensive effort to map land degradation globally using standardized criteria[3]. The GLASOD map for Africa (see map 1) revealed that by 1990 some 67% of AFRICA was affected by slight to extreme land degradation. Evidence of degradation is widespread and 17% of AFRICA's total land area was shown to be degraded to such an extent as to directly affect its productive potential.

More recent studies (FAO, World Soils Report, 2000 and TERRASTAT) confirm that evidence of land degradation can be found in about 67% of the total land area, i.e. about 16.1 million km^2. This has been further defined in terms of degree of severity into light (24 percent), moderate (18 percent), severe (15 percent), and very severe (10 percent). While the total affected area has not apparently changed since the GLASOD assessment, the area affected by severe and very severe degradation (i.e. negatively affecting production potential) has increased[4].

Soil nutrient depletion in the fields of AFRICA's small-scale farmers is severe with inadequate replenishment of the nutrients lost due to soil erosion, leaching and removal in harvested products. Nutrient depletion in Africa represents a significant loss of natural capital valued at an estimated US$1 to 3 billion per year. If most of the nearly 70 million smallholder families

[3] GLASOD data is based on "expert opinion" (i.e. the perception of experts on the kind, extent and severity of land degradation in a country or region that they know well) rather than field based measurements.

[4] These aggregated regional figures mask significant differences amongst countries, with Rwanda and Burundi (57%), Burkina Faso (38%), Lesotho (32%), Madagascar (31%), Togo and Nigeria (28%), Niger and South Africa (27%), Ethiopia (25%) seriously affected by soil degradation, while the Central African Republic (2%), and Equatorial Guinea (1%) are virtually free from degradation.

in Sub-Saharan Africa (AFRICA) fail within the next decade to adopt sustainable integrated soil fertility and land and water management practices on their farms, they will seriously jeopardise their long-term food security, productivity and incomes while environmental degradation will accelerate. IFAD reports for Western and Central Africa[19] indicate that land degradation from extensive agriculture, deforestation and overgrazing has reached alarming levels and that about 50 percent of the farmland suffers from soil erosion and up to 80 percent of rangelands are degraded in some way due to use beyond carrying capacity.

Apart from inefficient uptake of nutrients, the total input of fertilisers is very low: fertiliser use in Africa is only 21 kg (nutrients) per ha of harvested land per year, and is even lower in Africa South of the Sahara at 9 kg per ha of arable land. The corresponding figures are 100 kg/ha for South Asia, 135 kg/ha for east and Southeast Asia, 73 kg/ha for Latin America and 206 kg/ha for the industrial countries.

Box 3: The Dominant Types of Land Degradation within Sub-Saharan Africa (after Douglas 1994)

Soil degradation – decline in the productive capacity of the soil resources as a result of adverse changes in their biological, chemical, physical and hydrological properties, which in turn increase the vulnerability of erosion prone areas to accelerated soil loss through both water and wind erosion.
Vegetation degradation – decline in the quantity and quality of the grasses, herbs and woody species found in grasslands, woodlands and forest, combined with a decrease in the ground cover provided by such plants.
Biodiversity degradation – loss of wildlife habitats and decline in genetic resources, species and ecosystem diversity.
Water degradation – decline in the quantity and quality of both surface and ground water resources and increased risk of downstream flood damage.
Climate deterioration – adverse changes in the micro and/or macro climatic conditions that increase risk of failure of crop and livestock systems and impact negatively on plant growth in rangelands, woodlands and forests.

Land conversion – decline in the total area of land used, or with potential to be used, for crop, livestock and/or forestry as a result of land being converted to urban, industrial, mineral extraction and infrastructure purposes.

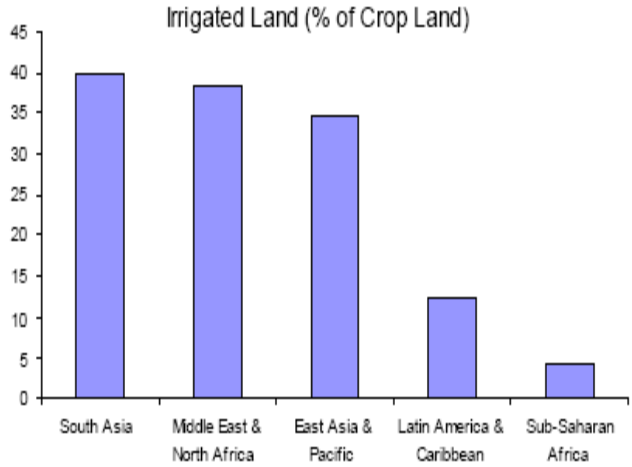
2.2 Profile of Agricultural water in Africa

According to the FAO 2005 AQUASTAT Survey report (FAO, 2005a), there are about 9.1 million hectares of land in sub-Saharan Africa under some form of water management today. The main characteristics of Agricultural water in Sub Sahara Africa can be described as following:

There has been less agricultural water development to date in sub-Saharan Africa than in any other region. At just 4.9 percent of the total cultivated area of 183 million hectares, the area developed is by far the lowest of any region of the world (Fig. 1). Three countries (Sudan, South Africa, and Madagascar) account for two-thirds of the irrigable area developed.

Expansion of irrigation has been slow. Over the last 40 years, only 4 million hectares of new irrigation has been developed in the region, by far the smallest expansion of any region. Over the same period, China added 25 million hectares and India added 32 million hectares (FAO, 2003a).

Figure 1: Sub-Saharan Africa has a far lower share of its arable land under irrigation than other regions



Source: World Bank (cited in Synthesis Report*)*

More than 33 million people derive their main income from agricultural water managed areas. Although there are no reliable data, it is estimated that at least 6 million households, representing more than 33 million people, live directly on earnings from the subsector. These are almost certainly significant underestimates because AQUASTAT probably under-reports areas under individual private smallholder irrigation (including urban and peri-urban irrigation), micro-scale irrigation (including water harvesting), and 'other forms of water management'. Furthermore, the estimates take no account of those households engaged in wage labour for agricultural water management, including those employed in large-scale private commercial irrigation.

Until recently, investments in agricultural water in the region have been declining. Levels and trends of donor financing are conventionally taken as a proxy for investment levels. In the most recent three-year period for which partial data are available (1994-1996), the total cost of projects funded by all donors for irrigation and drainage was less than 10 percent of levels of 20 years previously — just $127 million from all sources.

Investment in agricultural water has received only a small proportion of that for the water sector as a whole*.* For example, African Development Bank lending for agricultural water over the period 1968-2001 was $630 million, which was only 14 percent of its lending to the water sector as a whole ($4,574 million).

Water withdrawals for agriculture are very limited — just under 2 percent of the total renewable water resource — and water storage is well below levels in other regions. Total withdrawals for agriculture in sub-Saharan Africa amount to 105 billion m^3, less than 2 percent of the total renewable water resource (see Summary Table 3). Most countries in the region have low levels of water storage infrastructure, averaging 543 m^3 per capita, compared to 2,428 m^3 in South America and well below the world average of 963 m^3 per capita. In Kenya, for example, total storage capacity per capita is only 126 m^3, less than 4 percent of the level in Brazil (based on ICOLD data and on IWMI 2005a, World Bank 2004a).

The major challenge in West Africa is the optimum use of water in the goal of increasing the internal pastoral and agricultural production. This can be possible by the control of the important renewable water potential existing in Western African space. For example in the Sahel, the total annual renewable water resources are nearly 278 million m3. However, the storage of water per capita is less than 100 m3 in Africa against 3000 to 6000m3 in developed countries.

Surface water is overwhelmingly the water source for irrigation. FAO (2005a) indicates that 90 percent of the area under full or partially controlled irrigation in sub-Saharan Africa is supplied from surface water. There is a concentration of irrigation directly linked to water courses in the Nile, Niger, Orange, Senegal, Volta, and Zambezi river basins.

Groundwater irrigation is also locally important. FAO (2005a) also indicates that approximately 10 percent of the area under full or partially controlled irrigation is supplied from groundwater. However, because groundwater is used extensively by private individual small and micro-scale irrigators, many of whom would not be included in AQUASTAT survey data; this too is almost certainly an underestimate.

Large-scale irrigation schemes have generally been developed and managed by governments. Large-scale irrigation schemes have generally been developed by public agencies in several sub-Saharan Africa countries, particularly Sudan, Madagascar, and Nigeria. On almost all these schemes, public agencies have been responsible for operation and maintenance, often with little or no recovery of costs from farmers. However, in recent years farmer organizations have been increasingly involved in management and operation and maintenance.

Development and management of smaller schemes increasingly involves farmers. Many of the small- to medium-scale schemes were also constructed by government and are managed by public irrigation agencies, although they are increasingly being turned over to farmer-management, for example, in Zimbabwe, Senegal, Mauritania, Niger, Mali and South Africa. In recent years, most small-scale development by the public sector has been done in partnership with farmers, and with the understanding that farmers will take over the scheme's operation and maintenance.

At least one-half of the water managed area is privately developed and operated. Privately developed and operated areas include some large-scale sugar estates in Southern Africa, thousands of smaller schemes operated by large-scale commercial farmers, and numerous informal smallholder schemes — as well as many thousands of individually owned and operated areas (mainly gardens).

The total extent of in-field rainwater management in the region is unknown but adoption is thought to have been limited. In-field rainwater management practices such as minimum tillage and other methods of water conservation farming have been promoted in the region, but details of how widely these have been adopted are difficult to find. Nevertheless, it is known that 7.8 percent of smallholder farmers in Zambia, for example, adopted planting basins in the 1999/2000 season (Hageblade et al., 2003). It was also reported that 97 percent of all households in 27 villages surveyed in one district of Niger in the 1990s adopted planting pits, stone bunds, or *demi-lunes* under the Indigenous Soil and Water Conservation in Africa Program (Hassane et al., 2000).

Cereals, largely rice, are the principal irrigated crop. High-value horticulture and industrial crops — largely cotton and sugar — are also important irrigated crops. Cereals are the predominant irrigated crop in sub-Saharan Africa, accounting for almost 50 percent of the harvested irrigated crop area. Rice is the principal crop for 25 percent of the harvested irrigated crop area, and is especially important in the humid and sub-humid zones. Other irrigated cereals cover 24 percent of the harvested crop irrigated area and include irrigated maize and irrigated wheat. High-value horticulture, roots, tubers, and industrial crops — largely cotton and sugar — are also important irrigated crops covering 33 percent of the harvested irrigated crop area. Fodder production and fruit trees together account for 12 percent, largely in Southern Africa, particularly South Africa.

Peri-urban lands are often used for production of vegetables for better market accessibility and higher prices. However, most of these lands are contaminated with heavy metals through industrial effluents, sewage and sludge, and vehicular emission. Vegetables grown in such lands, therefore, are likely to be contaminated with heavy metals and unsafe for consumption.

Irrigated cereals yields achieved by smallholders are generally low by global standards and have improved only slowly in recent years. In 1997/99, the average paddy yield in sub-Saharan Africa was 1.6 t/ha, compared with 2.9 t/ha in South Asia and 4.2 t/ha in East Asia. Essentially, Green Revolution intensification of paddy cultivation has not yet occurred in sub-Saharan Africa. However, in a few large-scale well managed sub-Saharan Africa schemes like the Office du Niger in Mali, yields have attained 'Asian' levels (5-6 t/ha). Low yields in irrigated production in sub-Saharan Africa can be attributed to unreliable water supplies, poor water control and management, low input use, poor crop husbandry, and to difficulty in accessing profitable output markets. However, perhaps the single most important factor is access to markets: the correlation of low irrigated productivity with remoteness from markets is very strong in sub-Saharan Africa. It is probably the market factor, which most influences other determinants of productivity.

Livestock are an integral part of most irrigated production systems. In irrigated agriculture in the region, livestock are important for animal products and for draft power and manure in irrigated crop production (IWMI-ILRI, 2005e). Irrigated agriculture also interacts with pastoral systems: crop residues on the Gezira scheme maintain animals during the long trek to the Khartoum market. However, irrigated fodder production is generally not viable in the region. Livestock production in sub-Saharan Africa depends more on grazing than in other regions of the world. FAO estimate that fodder currently accounts for only 3.5 percent of all crop output in the region (FAO, 2006). Irrigated fodder production is rare except in South Africa.

Integrated use of water bodies-Construction of dams for irrigation and/or generation of electricity has created surface water bodies and reservoirs, globally estimated to be 750,000 km2. FAO (2002) estimated that current total aquaculture production from small water bodies could be 7 million tons per year, equivalent to 14% of total global production. Riparian and private company's communities have utilised these water bodies by catching the wild fish stocks, in the case of Lake Kariba, Cabora Bassa and Volta. Recently, aquaculture has emerged as the most popular method of raising fish in these water bodies, example of which are the intensive rearing of tilapia in cages on Lake Kariba. Therefore, steps have been undertaken to reconcile water management for fish production. FAO and WARDA (2003) defined integrated irrigation and aquaculture (IIA) as a strategy to achieve agricultural productivity from every drop of water while improving the financial sustainability of investments in irrigation. FAO & WARDA (2003) adopting integrated irrigation and aquaculture as part of Integrated Inland Water Resources Management programmes aimed at contributing to improved food security in drought-prone West African countries.

3. FRAMEWORK FOR SUSTAINABLE LAND AND WATER MANAGEMENT

Box 4: Taking account of livestock in agricultural water investments

Crops and livestock are closely linked components of irrigated production systems, and both can be potentially fast growing and profitable enterprises where rapid urban growth generates demand. Growth in associated irrigated crop and livestock production is most likely in countries and areas with large animal populations and good access to urban markets.

To exploit possible complementarities between agricultural water development and livestock production, planners should work with stakeholders to assess ex ante the likely impact of irrigation development and correlated changes in land use on livestock keepers. Taking account of livestock in this way will minimize costs to livestock keepers of lost access to land and water resources and passageways, and mitigate any social
tension or risk of impoverishment. In most cases it will also allow complementary investment and management that can improve livestock productivity — access to watering points, land and paths zoned for livestock, and encourage the adoption of cropping patterns that have significant quality residue for use as animal feed or the
development of zero-grazing systems based on irrigated crops and residues. Beyond the irrigation scheme itself, it may be possible to integrate management of upland catchment areas with downstream agricultural water service, which may involve investments and management to ensure that upstream pastoral systems remain
profitable while conserving soil and water resources.
Source: IWMI-ILRI 2005e

3.1 Definitions and Principles of Sustainable Land and Water Management (SLWM)

There are a number of definitions for SLWM many of which indicate the scope and complexity associated with the SLWM approach, for example:

Sustainable land and Water Management (SLWM) is the foundation of sustainable agriculture and a strategic component of sustainable development, food security, poverty alleviation and ecosystem health. SLWM can be defined as 'the use of land resources, including soils, water, animals and plants, for the production of goods and services to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions' (UN Earth Summit, 1992).

Sustainable Land and Water Management (SLWM) is a knowledge-based procedure that helps integrate land, water, biodiversity, and environmental management including input and output externalities) to meet rising food and fibre demands while sustaining ecosystem services and livelihood (World Bank 2006)

For the purposes of discussion, definitions of closely related approaches are also shown:

Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way - the use of an ecological approach to achieve productive resource management by blending social, physical, economic and biological needs and values to provide healthy ecosystems.

Integrated Natural Resources Management is the responsible and broad-based management of the land, water, forest and biological resources base--including genes--needed to sustain agricultural productivity and avert degradation of potential productivity[5].

Integrated Water Resources Management is "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".[6]

[5] From ICARDA, http://www.icarda.org/INRMsite/index.htm
[6] From GWP TEC Paper 4

Sustainable Land and Water Management is considered an imperative for sustainable development and plays a key role in harmonizing the complementary, yet historically conflicting goals of production and environment. Thus one of the most important aspects of sustainable land and water management is this critical merger of agriculture and environment through twin objectives: i) maintaining long term productivity of the ecosystem functions (land, water, biodiversity) and ii) increasing productivity (quality, quantity and diversity) of goods and services, and particularly safe and healthy food.

SLWM encompasses and contributes to other established approaches such as sustainable agriculture and rural development, integrated natural resources management, and ecosystem management (as noted above) and involves a holistic approach to achieving productive and healthy ecosystems by integrating social, economic, physical and biological needs and values. Thus, it requires an understanding of:

- the natural resource characteristics of individual ecosystems and ecosystem processes (climate, soils, water, plants and animals);

- the socio-economic and cultural characteristics of those who live in, and/or depend on the natural resources of, individual ecosystems (population, household composition, cultural beliefs, livelihood strategies, income, education levels etc);

- the environmental functions and services provided by healthy ecosystems (watershed protection, maintenance of soil fertility, carbon sequestration, micro-climate amelioration, bio-diversity preservation etc); and

- the myriad of constraints to, and opportunities for, the sustainable utilisation of an ecosystem's natural resources to meet peoples' welfare and economic needs (e.g. for food, water, fuel, shelter, medicine, income, recreation).

SLWM recognizes that people (the human resources) and the natural resources on which they depend, directly or indirectly, are inextricably linked. Rather than treating each in isolation, all ecosystem elements are considered together, in order to obtain multiple ecological and socio-economic benefits.

3.2 Lessons learned

With considerable experience upon which to draw from in the past, there are substantive lessons emerging that can increase the prospects for success. A recent review into the local level drivers associated with the development of SLWM success stories and bright spots in Africa and the *collaborative program of AfDB, FAO, IFAD, IWMI, and the World Bank* on agricultural water development identified, among others, the following as essential key elements :

- ***Quick and tangible benefits***. Immediate tangible benefits to the community or individual are a prerequisite for the development of a bright spot. This may include increased yields within the first year of implementing changes or a reduction in the costs of labour or other inputs.

- ***Low risk of failure***. Resource-poor farmers, by their very nature, are risk adverse; hence, any change to the current *status quo* must have a low level of risk associated with it.

- ***Market opportunities***. If there is to be a change in practices that are contingent on the production of new or alternative crops/products, then markets need to be present and assured.

- ***Aspirations for change***. This reflects an internal demand by an individual or community for change that may be driven by faith or wish to try something different.

- Innovation and appropriate technologies. External and internal innovations, new technologies and information are important components in change. With respect to internal innovation and appropriate technologies this would include the revival of traditional/local knowledge while external innovations reflect new developments in techniques and technologies, including associated skills and knowledge that, if adopted, effect a positive change to the production system. The increase in precipitations, the control of surface water by the creation of water levels and the mobilization of the underground water resources allow to ensure to population availability of water for animals, drinking water for the humans and agricultural water.

- Leaders***, champions and innovators***. Often, a single individual or group may become the champion(s) for change. In addition, the initial involvement of an external facilitator such as an NGO or government agency may be required to take on this role.

- ***Social capital***. Community organisations, networks and partnerships (private as well as public) that develop in order to promote change.

- ***Participatory approach and empowerment of land and water users***. Deliberative processes that actively involve the community in the decision making process. This has been shown to have a strong element of collective learning among farmers and development workers and involves the establishment of a trusting and equitable partnerships.

- **Supportive policies**. Changes in policies at the local, regional and national levels will facilitate the development of bright spots. Of particular importance is enhancing individual property rights and ownership to increase the willingness of individuals to invest in and facilitate change. However, reforms require time and consistent approaches by both governments and donors. Decentralizing development responsibility can also enhance impact. Reforms need to be accompanied by effective capacity building to equip the actors to cope with new roles and responsibilities

- ***Integrated Approach****.* Beyond promoting technological improvements, an integrated approach is needed that addresses soil and water productivity problems as a core element of SLWM in the context of improved crop, livestock, forestry production and maintenance of biodiversity

- **Farm-level profitability, viability, and sustainability.** SLWM in sub-Saharan Africa can make an important contribution to poverty reduction and growth. It can, however, only do so when investments are profitable at the farm level, economically viable, and sustainable.

Box 5: Farm level profitability and viability

Without farm-level profitability, income poverty reduction cannot be achieved, and without financial, social, and environmental sustainability, there can be neither economic viability nor farm level profitability. Investments for so-called 'social' or 'strategic' purposes — for example, to increase national production of staples — cannot contribute to growth or poverty reduction if they are not economically viable.

Future designs and investment decisions — including those for major infrastructure — should be based solely on considerations of economic viability, farm level profitability, and sustainability. However, where 'downstream' benefits can be quantified these should taken into account in the analysis. Similarly, where there are opportunities for multipurpose investments these should be taken advantage of and accounted for in project costs and benefits.

Source : AfDB, FAO, FIDA, IWMI and World Bank collaborative program :Investment in AWD for Poverty reduction and Economic growth in AFRICA

- **Targeting the poor, women and marginalized communities like pastors.** The design of SLWM investments should address all strata within the community, ensuring that all benefit to their mutual advantage. Exclusively targeting the poorest socioeconomic stratum is not necessarily effective in reducing poverty, although specifically targeting women can be. Similarly, targeting the driest agro-ecological zones is not necessarily 'pro-poor'.

- **Implementing and managing public investments:** Organizational arrangements for project design, implementation, and management are more efficient when they reflect the comparative advantages of the public sector, farmers, NGOs, and the private sector. Sustainability is best achieved by involving farmers throughout and by handing over schemes to farmer organizations once complete. In many cases, it can be more efficient to obtain implementation services from the private/NGO sector than to build public sector institutions for the purpose, even where local private/NGO sector capacities are weak.

- **Monitoring and evaluation.** Monitoring and evaluation of project performance has been neglected in the past and needs to be improved in future to inform future strategic planning and project design, as well as to measure the contribution of SLWM to achievement of the MDGs.

- **Building in incentives for all partners to change** The design of programs for institutional reform should recognize that time and sustained commitments are required. All partners involved in sector need to work to a harmonized common agenda, to align support on national programs and institutions, as well as to invest in capacity building.

3.3 Building on Key Baseline Experiences

Within AFRICA, there is a significant body of experience with the development and adoption of different SLWM technologies, practices and approaches aimed at promoting more sustainable products and reducing the occurrence of land degradation. Emerging through different entry points, important baseline experiences come from programs that have promoted one or more of the following:

Crop Production and Management

- *Soil Fertility Improvement Through Better Land Husbandry* – was advocated by many of the national strategies and action plans of the Soil Fertility Initiative for AFRICA[7]. Better

[7] The Soil Fertility Initiative was launched during the 1996 World Food Summit as a joint programme sponsored by the World Bank, FAO, International Agricultural Research Centres (represented by ICRAF), the fertiliser industry and bilateral donors.

land husbandry is a broader concept than soil and water conservation as it addresses the totality of the farm household livelihood system with the aim of improving both the productivity and sustainability of its natural resource based land use activities. At its core is the belief that farmers have the ability to better manage and improve (husband) their land resources, thereby enabling their use for productive purposes on a sustainable basis. In the Sahel, 250 000 hectares of degraded land have been reclaimed since the early 80s by the projects and the communities, through simple anti-erosion and water harvesting techniques, such as land cuttings, zaï, half moons and rock bundles. These lands are now crop and grasslands. The land management projects have an internal rate of return that is above 30%

- *Conservation Agriculture (CA)* – aims to restore, sustain and enhance agricultural production through the integrated management of locally available soil, water, and biological resources, combined as required with cost-effective use of external inputs. It is a holistic approach to agricultural production based on enhancing natural soil biological regeneration processes involving: (i) improved soil organic matter management for the efficient use of rainfall, soil moisture and plant nutrients; and (ii) the maintenance of soil physical properties through keeping mechanical tillage to the absolute minimum required for direct planting/seeding. The following interrelated criteria distinguish CA from conventional agricultural systems: (i) reduced or zero tillage; (ii) permanent soil cover (plant residues and/or cover crops); (iii) crop rotation; and (iv) minimum in-field traffic. CA has been widely adopted by small to large scale farmers in Latin America, North America, Australasia and central Asia. Although not yet widely adopted within AFRICA the area under CA is expanding in South Africa, Zambia, Uganda, Tanzania, Kenya and in Madagascar (where it is known as (systeme de couverture vegetale). CA systems are also being piloted in Burkina Faso, Niger and Mali. In Cameroon, the Agriculture of conservation allowed:
    - Raise of 20% of the outputs cotton and 15% of the outputs sorghum
    - Less working time and incomes in rise;
    - A carbon fixation per ha going from 500 kg to 2 T per year during 10 years
    - Rice growing in Madagascar: 3000 ha - 20.000 ha around the lake Alaotra envisaged in SCV by 2010

- *Integrated Plant and Pest Management (IPPM)* – has evolved from a single-crop-pest focus to more comprehensive efforts that combine investigations into various production related problems and includes a variety of focus areas ranging from integrated pest management (IPM) to integrated plant nutrient management (IPNM). The emphasis is on providing farmers with the skills required to grow healthy crops. Recently programs have expanded the range of crops covered to include staple food crops such as bananas and cassava and to consider wider social and cultural factors (nutrition, HIV/AIDS, labour, business skills and marketing). The FFS approach is the principle vehicle for farmer learning and adaptive IPPM management. The 12 AFRICA countries: Benin, Burkina Faso, Burundi, Ethiopia, Kenya, Mali, Niger, Senegal, Tanzania, Togo, Zambia and Zimbabwe have developed country-specific recommended plant nutrient practices using guidelines from the FAO IPNM Information System.

Pastoral and Livestock Management

- *Integrated Crop-Livestock Farming Systems* – have been promoted in the Sahel region using community-based approaches and have led to improved cycling of nutrients between rangelands and cropland, and between ruminant livestock and the soils.

- *Opportunistic management strategies by pastoral communities*[8] – in response to uncertainties over rainfall and feed availability in arid and semi-arid environments. During drought periods this may involve: (i) long distance transport of animals to feed-surplus areas (trekking, truck transport etc); (ii) feed supplementation (lopping, hay-making, concentrate purchases etc); (iii) cereal stores to prevent needless distress livestock sales; (iv) good animal health care as livestock die more of disease than starvation during drought; (v) diversification or changes in the species composition of the family herd; and (vi) supplementing or diversifying income from non animal based livelihoods. After drought may include: (i) investment/re-investment of surpluses from other activities in livestock (especially small stock with high reproductive rates); and (ii) transfers of animals within social networks (whether kinship based or with stock associates) on which individuals have legitimate claims. Further, grazing strategies that improve range productivity and quality that can enhance drought tolerance are being practiced in east and southern Africa (Savory, 1999).

- Livestock production supports food security and the provision of employment, income, food, fuel, farm power, and a variety of merchandise goods. The bulk of animal-source food available to households in the West Africa sub-region is derived from ruminant livestock, which is predominantly produced by pastoralists. A significant proportion of these pastoralists employ (opportunistic) migratory production strategies. For most African pastoralists, mobility is still a key element of production strategy. Pastoralism as a livelihood activity is practiced in a variety of ways as a response to the dictates of the immediate environment and available resources. A greater proportion of the total ruminant population of the region is produced under this system.

- Policies, agreements, treaties and legal texts relating to pastoralist in West Africa: In West Africa countries (Sahel countries in particular), legal texts and pastoral codes were adopted recently (years 2000) and were applied with more or less of success. example the Law of orientation relating to the pastoralist in Burkina Faso, the pastoral Charter in Mali, the pastoral Code in Mauritania and the pastoral Code of Niger (under development). These legal texts are related to the access, durable and peaceful use of the common pastoral resources. The adoption of these legal texts constitutes a significant progress in the management of transhumance. Among the legal, regulatory and medical measures adopted by the States, there are:
    - National legal texts having milked with the practice of the pastoral breeding, animal health and land rural.
    - Agreements or conventions on transhumance between the States: Conceived in a specific way in order to meet needs between two (2) States, these agreements and conventions fix the framework of transhumance.
    - Medical zoo agreements or conventions as regards animal health enter the States: Very often, these texts were designed to answer the concerns of animal health between the States.

Agroforestry and Forestry

- Agroforestry and Soil Fertility Improvement – involving the growing of woody perennials (trees, shrubs, palms, bamboos etc) on the same plot of land used for agricultural crops and/or livestock in ways that permit significant economic and ecological interactions between the woody and non-woody components. Within Africa the World Agroforestry Centre[9] has been instrumental in documenting and promoting both indigenous and derived (i.e. research station) agroforestry systems for soil fertility improvement.

[8] For a detailed review of new directions in pastoral development in Africa see Scoones 1995.
[9] Formerly known as the International Council for Agroforestry Research (ICRAF), with its headquarters in Nairobi Kenya.

- Forestry – afforestation and re-afforestation involves planting trees for shelterbelts, windbreaks, and woodlots to increase fuel wood, timber and fodder[10]. Tree planting has been recognized for its capacity sequester to carbon while conserving soil and water quality and quantity. The Green Belt Movement in Kenya, well known for tree planting, includes indigenous trees in forest catchment areas and riparian reserves to preserve local biological diversity. Programmes such as Farm Africa in Tanzania and Ethiopia promote local community-based forest management for conserving and enhancing forest resources while reducing forest losses and illegal logging[11].
- There are many success stories conducted in West Africa such as; the programme "Sahel vert" conducted in all the countries of Sahel in the years 70-80. Since 1980, many private and local communities' actions have been conducted in the Sahel. In Niger, the regeneration is close to 30 millions hectares. The State of Niger transferred the access, the use and the management of the agro forests to the rural populations. He recognizes also the use of local arrangements and it implies the users of natural resources in the management of the trees. The government of Niger promoted "the contracts of cultures" in the protected areas. The users of the natural resources are encouraged to plant trees for producing wood for buildings, firewood and for ecological purposes. The local species of trees protected are not strictly controlled on the fields, but the users of natural resources are sensitized with their durable use. In addition, a control and evaluation system has been put in place to take care of their durable use. The case of Niger was crowned success because local arrangements were employed to control the use of the trees (ICRAF, March 2008).

Water and Irrigation Management

- *Small scale community managed irrigation.* There have been recent successful project investments in small-scale community managed irrigation. Examples include: Small-scale run-of-the-river rice schemes developed at low cost ($1,070/ha) under the Tanzania Participatory Irrigation Development Project that achieved a rate of return of 22 percent and increased farm incomes by 86 percent (IFAD, 2007); and the Ethiopia Social Rehabilitation and Development Fund, where community based irrigation, supplied largely from earthen dams and river diversions benefited 40,000 households, with visible improvement in the lives of villagers including increased purchase of water pumps, milk cows, and radios, as well as regular schooling for the children (World Bank, 2002a).

- The Sahel countries tried out several strategies of valorisation of the water resources going from the installation of the small family irrigation. This practice of the small irrigation is seen like one of the solutions most appropriate to the resolution of the food insecurity. In Mali, Burkina as in Niger and in all the other countries of the CILSS, small hydro-agricultural installations of 0.25 ha allowed to several poor populations to increase their individual productions by the partial or total control of water. That ensuring several families very poor availability in basic food products.

- In West Africa, for the rational management of water a common policy of the water has been initiated by CEDEAO with the support of the CILSS and the UEMOA. This policy allowed an integrated management of the resource, its diversified and equitable use and

[10] Afforestation Project in Kano and Jigawa States, Nigeria, UNEP Success Story, http://www.unep.org/desertification/successstories/8.htm
[11] Farm Africa http://www.farmafrica.org.uk/ and Green Belt Movement, Kenya http://www.greenbeltmovement.org/

its protection, which constitute pledges of durability and a shared valorisation of the resource water.

- In accordance with this policy, the CILSS currently develops an initiative called "world coalition on water in the Sahel". This initiative is a recommendation of the Heads of State of CILSS's countries aiming to federate internal and external energies in the Sahel in order to fight against the hunger and poverty by the control of water in the Sahel. The coalition will allow CILSS to bring a support to the states in their strategies of increase in the rains, to propel the small irrigation and to bring drinking and pastoral water to the farming populations in the most underprivileged rural environments. The coalition on water is one of the direct answers to the concerns of the PDDAA and the objective to evolve/move within a common framework in order to stimulate and to direct the initiatives and national and regional plans towards the reinforcement of the agricultural productivity.

Box 6: Successful public large-scale irrigation in Mali: the Office du Niger

The Office du Niger (ON), located in the heart of Mali, is one of oldest and largest smallholder irrigation schemes in sub-Saharan Africa. When development of the scheme began in 1932 it had been intended to develop about 1 million hectares over a period of 50 years. By 1982, however, only 60,000 hectares had been developed, of which a large part had been abandoned due to poor maintenance and operation. Cotton production had ceased, and average paddy yields had slumped to 1.6 t/ha. Attempts to rehabilitate the scheme proved successful when physical investments to improve water security were matched with institutional reforms. An impressive turnaround has been achieved: in addition to the 50,000 hectares that was still in use at the time, about 10,000 hectares of previously abandoned land was reclaimed and put to productive use, and average paddy yields have increased to 6 t/ha. O&M cost recovery has reached 97 percent.

These results are attributable to a combination of factors, including:
• irrigation system improvement and modernization;
• improved water control and management;
• adoption of improved technologies –such as high-yielding varieties, fertilizers, and improved husbandry practices;
• liberalization of paddy marketing and processing, facilitated by an improved macro-economic climate;
• improved land tenure security;
• institutional restructuring, including: privatization of most commercial functions, contracting out of maintenance works to the private sector, downsizing of the management agency and concentration on its core activities of bulk water supply, land administration, and agricultural extension; and
• more participatory approaches that engage farmers in management decisions, e.g., on O&M fees.

Underpinning this success were the long term commitment of government and managers, and the sustained support of external partners. The work at ON is, however, not yet complete: there is more to be done on strengthening farmer organizations, improving land tenure security and making the agency more accountable to farmers.

Source: Aw and Dejou, 1996; Couture et al., 2002; Aw and Diemer, 2005

- *Individual market-driven investments by smallholders with low-cost technology.* The Niger Pilot Private Irrigation Project spread a variety of both manual and small-scale mechanized irrigation technologies. Manual pumping technology allowed a doubling of the cultivated area and earned a 68 percent ERR (World Bank, 2002b). The DFID-funded Micro-Irrigation Pump Promotion Project (MIPP) and its predecessors created both a demand and a supply chain for treadle pumps in Kenya and Tanzania. The private sector was then able to manufacture and distribute the pumps at a profit but still at a price affordable to farmers (IFAD, 2007).

- *Market links combined with reliable water supplies.* Under the IFAD-funded Zimbabwe Pilot Market Linkage Project, an NGO facilitated the establishment of grower associations and production of crops under contract to a local canner. Farmers also produced an irrigated crop of grain maize in the summer for home consumption and local sale. With an assured market and reliable groundwater supplies, farmers risked investment in inputs to obtain higher yields and achieved a 265 percent increase in farm income (IFAD, 2007).

- *Large-scale irrigation***.** There are few examples of successful public investment in large-scale irrigation, owing to top -down planning, shaky economics, and institutional failures.

Transparent, accountable, efficient, and financially self-sustaining institutions are key for successful improvement of large-scale irrigation: the improvement conducted by the Mali Office du Niger is a good example of the impact of comprehensive but gradual institutional reforms. The Office has achieved a turnaround from a dirigiste approach to one that is more service-oriented and which, by combining selective investment in hardware with institutional change, has produced impressive results — paddy yields increased from 1.6 t/ha to 6.0 t/ha (Box 6). This experience is a beacon that can show how other large-scale irrigation schemes may be turned around, provided that the underlying economic profitability is there. One reason for the success of Office du Niger was that institutional reforms were introduced gradually, allowing time to overcome resistance to change and allowing time for adjustment, adaptation and fine-tuning.

- *Water harvesting*. It involves the combination of new and indigenous technologies as well as mechanisms to enhance rainfall capture (e.g. v-shaped micro-catchments). These technologies are increasingly being promoted within AFRICA by a number of national and regional programs as reliance on irregular and unreliable rainfall for agricultural production is seen as a major constraint on crop productivity, and many high-yielding crop varieties are unable to achieve their full production potential under rainfed conditions. Although a wealth of academic and research literature on the topic exists, there has been a dearth of investment analysis however the knowledge base is thin in respect to investment performance analysis and evaluation.

- *One frequent feature of recent investments has been the use of a decentralized 'program approach'*, in which the criteria for sub-project selection are agreed up-front but the process of selection is decentralized, typically to the level of a joint identification and appraisal process between a project unit and irrigator organizations. The 'program' may be restricted to irrigation investments — for example, the Nigeria National Fadama Development Project — or irrigation may be offered as an item on a broader menu of investments, as in the Batha Rural Development Project in Chad. However, there is a risk of poor investment decisions being taken if adequate provision is not made to build capacity for sub-project appraisals and subsequent cost control and supervision.

Community-Based Natural Resource Management

- *Community-based land or watershed planning and management* [12] – a number of different projects and programs in east, west and southern AFRICA have successfully used participatory approaches to identify local priorities and develop community level action plans for tackling land degradation and low agricultural productivity, through improved ecosystem resource management (soils, water, vegetation, forestry, wildlife etc) within locally recognized landscape or watershed units.

- The regional solar programme implemented by CILSS in Sahel countries allows some 5 million sahelians to satisfy their requirements out of drinking and pastoral water. It also has contributed to the environmental protection and the reduction of the poverty of the sahelians.

- For the rational management of water a common policy of the water has been initiated by CEDEAO with the support of the CILSS and the UEMOA. This policy allowed an integrated management of the resource, its diversified and equitable use and its

[12] In AFRICA typically known as the catchment approach to soil and water conservation in anglophone countries, or gestion des terroirs in francophone countries.

protection, which constitute pledges of durability and a shared valorisation of the resource water.

Farmer Learning Networks

- *Farmer Field School Approach (FFS) for Integrated Soil Management* - is based on the concepts and principles of people-centred learning, and was developed as an alternative to the conventional top-down test and verification (T&V) extension approach. It uses innovative and participatory methods to create a learning environment, including learning networks, in which the land users have the opportunity to learn for themselves about particular crop production problems, and ways to address them, through their own observation, discussion and participation in practical learning-by-doing field exercises. The approach is now being used to enable farmers to investigate, and overcome, a wider range of SLWM problems, including soil productivity improvement, conservation agriculture, and control of surface runoff, water harvesting and improved irrigation.

- In the Sahel, the evolutions in the cultivable surfaces were accompanied by a better knowledge of the hydrological forecasts. The production and the dissemination of data on climate by AGRHYMET centre of CILSS allowed the integration of the climatological factors in the farming calendars of Sahel countries.

3.4 The Core Elements of Successful Approaches for Sustainable Land and Water Management in Sub-Saharan Africa

Effective SLWM requires ***multi-stakeholder*** partnerships to bring together indigenous and scientific knowledge, and to reconcile different stakeholder interests and needs, within both the public and private sectors, including community based and non-government civil society organisations (CBOs, NGOs). Further, ***a multi-sectoral*** and **multi-disciplinary** approach is essential as no one agency has all the disciplinary experts required to solve the ***multi-dimensional*** problems of agricultural water management and land degradation. Successful implementation is therefore fully dependent upon coordination and cooperation in planning and decision making among different government agencies, especially those responsible for agriculture, livestock, forestry, land and water resources, environment, science and technology, finance, planning, and legislation. Further, these multi-stakeholder partnerships and multi sectoral approaches have to be done at **multiple scales.** The concept of multiple scales reflects both natural and administrative or decision-making units that are found at the local, sub-national, national and transboundary levels. This multidimensional management cannot be done without identified responsibility and accountability supported by integrated programmes, policies, and investments both within and among African countries.

It is clear from a review of past efforts to promote SLWM in Africa that there is no universal blue print development approach that will guarantee success. What works in a particular location will be influenced by a variety of area specific factors, such as: (i) the limitations and opportunities imposed by the local climate and other ecosystem resources; (ii) household and community level perceptions as to the nature, severity and consequences of existing degradation on local natural resource-based livelihoods; (iii) the social and cultural norms that influence individual, and communal, behaviour within the local society; (iv) the presence or absence of effective community organisational and institutional structures with strong and respected leaders; (v) the nature of the political system that governs the implementation of national and local level development policies; (vi) the capacity and availability of local advisory support services; and (vii) the type of local market structures and opportunities. That said there are some key core common elements to be found within the diversity of successful SLWM approaches in Africa, these include:

Box 7: Irrigation considerably enhances farm incomes, livelihoods, and employmentopportunities at irrigation schemes in Tanzania and Zimbabwe

At the Participatory Irrigation Development Project in Tanzania, irrigator households achieved an increase of 86 percent in income with the project, which enabled them to enjoy better quality housing, acquire agricultural and household assets, access health services, and finance children's education. In four representative sub-project areas (totaling approximately 400 ha), ownership of ox carts and cattle increased considerably, the number of grinding mills increased from two to 12, and the number of shops increased from two to 74. Irrigator households at the EU-funded Maunganidze Irrigation Scheme in Zimbabwe increased their incomes by over 200 percent and turned a food deficit into a surplus sufficient to feed two additional households. Farmers' own investments in new housing and in water and sanitation were the most obvious signs of improved livelihoods, with a number of modern two or three room houses, ventilated pit latrines and, in a number of cases, their own
protected water well. Traders reported increased sales of agricultural inputs and implements, and increased demand for groceries and house building materials and construction services.
New grinding mills had been established, as well as new workshops for manufacturing farming equipment such as ox carts. There was no doubt that these impacts were the result of investment in irrigation because there were no other sources of income in the area. Excellent road access, for example, by itself had not had any discernible impacts on poverty in the area.
Source: IFAD, 2007

Social-People Centred Management/ Approaches

- *Community-based participatory planning and technology development* – the most successful efforts have built on rural people's inherent skills and capability and empowered them to formulate and implement their own development plans, and to develop and disseminate their own SLWM technologies.

- *People-centred learning* – based on innovative and participatory adult learning methods involving guided practical field based investigations, through which the land users have the opportunity to learn for themselves about particular crop production and land degradation problems, and identify ways to address them, through their own observation, testing and monitoring of different treatments, and reviewing and sharing their findings through sub-group and plenary discussions within common interest groups.

- *Cultural and gender sensitivity* – where the emphasis is on encouraging the participation of marginal groups (women, youths, poor households, ethnic minorities etc) in community decision making, and improving their access to communal ecosystem resources, in ways that build on, and as necessary encourage adaptive changes to, the social and cultural norms of the wider community.[13]

- *Decentralized development* - Essentially, two forms of decentralization have evolved: 'decentralized sectoral' and 'decentralized local government'. Decentralization is not an end in itself; it is rather a means to developing effective, responsive, demand-led services and, in particular, to making government services more locally accountable to rural people.

Sector-wide approaches (SWAps)

Generally, SWAps are intended as a means to coordinate and harmonize efforts at policy dialogue, institutional reform and efficient investment. In recent years, a number of countries in the region have begun to develop sector-wide approaches, moving progressively away from project to program approaches within a coherent strategic framework, a movement strengthened by the Paris agreements on aid effectiveness. Sector-wide approaches are based on a partnership between: (a) the government, which is expected to provide leadership and develop a coherent sectoral strategy; (b) international development partners, who are expected to align their support on the country-led strategy and, to the extent possible, harmonize their support through common arrangements for financing and

[13] This often involves challenging existing assumptions and prejudices that currently limit the participation of such marginal groups, but this is done in a non confrontational manner, in ways that respect local customs and traditions with the emphasis on showing the benefits to the community of addressing current barriers to the active participation of such groups.

technical assistance; and (c) other stakeholders, including civil society and the private sector. In contrast to earlier approaches, sector-wide approaches are intended to focus on not only the financing of a comprehensive investment program, but also on policy dialogue and change, and on the provision of support to, and reform of, national institutions (IFAD, 2007). The potential benefits from sector-wide approaches are, essentially, enhanced development impact and lower transaction costs. At the strategy level, this should be characterized by stronger country ownership and leadership, a coordinated and open policy dialogue, and prioritized and rational resource allocation. At the institutional level, the approach should help strengthen national capacity, systems, and institutions. At the implementation level, scaling up of best practice and benefits to the entire sector should be easier. There should be sector-wide accountability, ultimately with common fiduciary practices and environmental and social safeguards; and there should be a focus on results and reduced duplication in reporting and transactions.

Landscape and Ecosystem Management Approaches

- *Planning within locally recognised landscape units* – the landscape approach draws on principles of landscape ecology (e.g. open exchange systems for energy, nutrients, and minerals, all elements are interacting, etc.) and has evolved from watershed planning within the hydrological boundaries of a small catchment to the development of local SLWM action plans within traditionally recognised blocks of land. These may correspond to the cultural and administrative boundaries of the participating community(ies) or relate to one or more natural landscape units traditionally allocated within the community for specific land uses (e.g. rain-fed crop production, irrigated farming, grazing, forestry, etc).

- *Holistic and integrated planning* – involving a long term strategic and broad scale ecosystem/ landscape approach, that aims at improved management of the land to obtain both production and environmental benefits (e.g. reduced erosion, improved soil fertility, higher yields, increased food security and enhanced rural livelihoods).

- *Landscape Territorial Development*- involves diagnosis and analysis of territorial (rural and urban) issues at a landscape scale and provides a platform for multi-stakeholder negotiation and collaboration to put in place sustainable practice and policy solutions, thus pre-empting problems that arise from competition over use and access to land and natural resources.

Implementation Conditionality

- *Creation of the right enabling conditions* – there are many bottle necks/constraints within the wider society that can hinder the local level adoption of SLWM. A successful project requires that the most critical ones are identified and addressed. Depending on the local situation this may require: (i) supportive legal and regulatory instruments (e.g. national legislation to provide a regulatory framework for the enforcement of community level by-laws); (ii) improved market structures for the supply of inputs and sales of surplus produce; (iii) building the capacity of community-based organisations to prepare and implement SLWM action plans; and (iv) strengthening local advisory support services to ensure they have the capacity to support SLWM interventions at the farm/community level (particularly post project).

3.5 Technological Options for Sustainable Land and Water Management in Sub-Saharan Africa

Sustainable Land and Water Management is meant to address the challenge of improving the profitability and viability of farm and pastoral enterprises while managing and enhancing the supporting natural resources to effect win-win and enduring results. Africa has a growing body of experience with combining technologies and practices for successful SLWM (see box 5 for examples), which are typically site specific, based on local innovation, development and adaptation. While such efforts are believed to have had a positive environmental impact, the primary motivation for their adoption was that the land users expected to obtain tangible on-site production benefits such as higher yields or reduced risks.

Recognizing that there is no one 'miracle' solution to solve the problems of land degradation and low productivity, selection of the appropriate SLWM technologies for a particular area will be determined by: (i) the qualities and characteristics of the local land and water resources; (ii) the SLWM requirements of the land use enterprises to be pursued; and (iii) the socio-economic context and priorities of the land users.

While the emphasis of such a SLWM approach should be at a landscape level and, it will be based on gaining incremental improvements within the land use farming system through combining technologies and practices that will result in *improved plant*[14] *management* (e.g. higher yields, good vegetative cover, reduced raindrop impact), *improved soil and nutrient management* (e.g. higher organic matter levels, integrated plant nutrition, improved soil structure, good rooting conditions) and *improved water management* (e.g. reduced runoff, increased infiltration, improved irrigation efficiency, improved soil moisture conditions). There will be synergistic benefits from combining many of these, which can be expected to lead to even greater production and environmental benefits, than could be achieved with each one on a purely incremental basis.

From a review of the baseline experiences with SLWM (see section 3.2) it is clear that there are a number of common technical elements that underpin the emerging win-win management options, notably: minimum soil disturbance; maintenance of good ground cover; restoration of soil organic matter and related biological activity; integrated plant nutrition management; better crop husbandry; development of integrated crop/livestock/agro-forestry systems; opportunistic flexible improved management of traditional pastoral systems; small scale community managed irrigation, individual market driven investments by smallholders with low-cost technology, Market links combined with reliable water supplies and delineation and management of protected areas.

Specific practices that can be used in combination to achieve SLWM (as shown in Annex 1) include those related to a) crop management (e.g. crop rotation and intercropping, integrated pest management, inter-planting with trees and agroforestry, mulching and residue management, etc.); b) pasture and rangeland improvement (e.g. planned grazing processes, enclosures for recovery or enrichment planting, fire prevention, etc.); c) forest improvement (e.g. planting, natural regeneration, shelterbelt planting, fire protection, etc.); d) improved soil management (e.g. retention of crop residues and soil cover, additions of organic amendments including compost and manure and cover crops, integrated nutrient management, reduced tillage, etc.) and e) improved rainwater management (e.g. contour ridges, natural vegetative strips, soil cover and residue management, reduced tillage, etc. The table in Annex 1 also demonstrates the socio-economic and ecological benefits for the individual practices.

[14] Annual and perennial crops, grasses and other herbaceous pasture species, trees and shrubs.

With such practices in hand, the SLWM approach reinforces the importance of people centred approaches and adaptive management strategies needed to allow local stakeholders to adjust to change, in terms of land use pressures and migrations, changing policies and effects of globalisation, climatic variability/change and effects of the disease pandemics and emergencies.

3.6 Opportunities for the Promotion of Sustainable Land and Water Management

3-6-1 *Emerging opportunities for promotion of SLWM*

Recent years have seen the emergence of a range of new market based opportunities for promoting and funding SLWM, including:

Environmental-Ecological Opportunities:

- *Payments for environmental services (PES)* – is a relatively new source of funding that although small in scale in Africa at present has considerable potential for expansion as part of a comprehensive program for SLWM. In the African context, most promising may be the transfer of funds from outside of the Region in order to pay for globally important services such as biodiversity conservation[15] or carbon sequestration[16]. The World Bank Carbon Finance Unit (CFU) is promoting the use of money contributed by governments and companies in OECD countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition[17]. Other opportunities need to be explored such as encouraging water companies, industry and irrigation schemes to provide financial incentives for land users in upstream catchment areas to adopt environmentally sensitive land management practices for the maintenance of water quality and quantity.

- *Eco-tourism* – is defined by the International Ecotourism Society as “responsible travel to natural areas, which conserves the environment and improves the livelihoods of local people”. There is strong consumer demand for such "ecotourism" products, and globally there are dramatic growth forecasts for this sector of the world's largest industry. While the game parks in countries such as Kenya, Tanzania and South Africa are well known and already attract significant numbers of overseas visitors, there are many other natural areas (both within and outside officially protected areas) that could support eco-tourism with the revenues generated being used to fund local conservation and economic development. The key to sustainable ecotourism is sustainable ecosystem management and benefit with equitable benefit sharing among local populations. Without the biodiversity, there is no business, and this should provide the incentive for those utilising and managing the resource for eco-tourism to reinvest in its conservation.

- *Environmental Interest Groups* – sometimes known as green lobby groups are typically private sector environmental public interest groups that are promoting environmental protection, conservation and regeneration as a basis for future development actions and demanding such from governments. These groups are often well endowed financially

[15] In this regard the Wildlife Foundation in Kenya, is securing animal migration corridors on private land through conservation leases at US$4 per acre per year.
[16] Principally by paying for reforestation programs, which qualify for carbon credits under the Kyoto protocol.
[17] There are Emission Reduction Purchase Agreements ongoing in Uganda and South Africa and other initiatives under development in DR Congo, Ethiopia, Kenya, Madagascar, Mali, Niger, Uganda and South Africa. Most of these are being developed to address land degradation issues, for instance in DRC, Ethiopia, Kenya, Mali, Niger, and Uganda payments are being made for afforestation, while in Madagascar a Community-managed forest protection programme is under appraisal.

and are calling for and willing to pay for sustainable land management to diminish the effects of climate change and enhance biodiversity, water quality and quantity, among others.

Market and Economic Opportunities

- *Bioenergy* - may provide new markets for farmers producing for agro-fuels. While the pros and cons of bio-fuel production relative to environment and food security benefits are still strongly debate, the production of secondary sources could hold opportunities for African farmers. If producing for such markets uses an SLWM approach, it could benefit the environment and increase food security for example if smallholders farmed bio-crops and biomass as a source of energy for themselves and their local communities or contributed to commercial production for national or international markets. Additionally, some bio-crops can provide additional benefits such as windbreaks, restoration of degraded areas, habitats for native biodiversity and a range of ecosystem services[18].

- *Fairtrade* – has become one of the fastest growing consumer movements in Europe and North America. As a result today more than five million people – farmers, workers and their families – across 58 developing countries benefit from the international Fairtrade system. A recent survey has estimated that British shoppers will spend £2 billion on Fairtrade, organic and locally sourced products in 2007, an increase of 62% since 2002. Fairtrade roast and ground coffee now accounts for about 20% of the UK market and the number of Fairtrade accredited products rises year on year.[19] While still small there are a growing number of farmers in Africa who are benefiting from a fair trade premium for their products[20]. Fairtrade is concerned with more than just paying farmers a premium price for their produce, typically it involves building human and social capital within the participating communities, as well as promoting good farm management practices, with the emphasis on long term sustainable production.

- *Green/Organic Labels and Certifications* - predominately aimed at regulating and facilitating the sale of organic products to consumers, these certification processes have been put in place for farmers and others involved in food production including seed suppliers, food processors, retailers and restaurants. Requirements vary by country and involve a set of production standards that include avoidance of synthetic chemical inputs (e.g. fertilizer, pesticides, antibiotics, food additives, etc.) and genetically modified organisms. Currently there are numerous examples of both certified organic and non-certified organic agriculture in Africa and with a tradition of low input agriculture in Africa, organic agriculture does hold great promise[21]. For example, in Kenya, ecotourism has recently prompted a much greater market for the "green labels" among Kenyan lodges and hotels indicating their responsibility in not degrading the environment but actually working to improve it[22].

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[18] From FAO 2007, http://www.fao.org/newsroom/en/news/2007/1000540/index.html

[19] Figures taken from a special supplement, *Fair Trade – A force for social change,* published in the UK Guardian Newspaper, March 2007.

[20] Examples include: (i) the Cooperatives des Producteur de Coton de Dijidian, Keita Mali who are supplying fair trade cotton to Sainsbury's a UK based supermarket; (ii) the Abahuzamugambi Bakawa coffee cooperative in Rwanda are due to be paid, in 2007, a premium price of $1.65 a pound for their green Maraba coffee beans by the UK based Union Coffee Roasters; and (iii) the Kagera Co-operative Union (KCU) which is made up of 90,000 small-scale coffee growers in north-west Tanzania supply part of the fair trade coffee marketed by Clipper and M&S in the UK, and the KCU has been able to invest some of the fair trade premium into an instant coffee factory (allowing farmers to sell their low grade, non-exportable coffee, within Tanzania) and to fund three schools and attract quality teachers.

[21] http://orgprints.org/5161/03/parrot-et-al-2006-africa.pdf

[22] http://allafrica.com/stories/200708071127.html

- *Food Safety and Good Agricultural Practices (GAP)* protocols evolved in recent years in the context of a rapidly changing and globalizing food economy and concerns of various stakeholders about food production and security, food safety and quality and the environmental sustainability of agriculture across the food chain. The food chain approach has implications for agricultural production and post-production practices and offers the opportunity to address sustainable use of resources. The use of GAP is also being promoted increasingly by the private sector through informal codes of practice and indicators developed by food processors and retailers in response to emerging consumer demand for sustainably produced and wholesome food. This trend may create incentives for the adoption of GAP by farmers by opening new market opportunities, provided they have the capacity to respond[23].

Each of these opportunities can provide incentives for meeting the twin objectives of SLWM as they promote the sustainable agricultural and natural resource management practices that underpin production needed to meet a growing demand from societal priorities and markets.

3-6-2 Possible investment opportunities in irrigation sub-sector

There is a very wide range of opportunities for investment in agricultural water development, from rehabilitation and expansion of existing irrigation schemes, to the development of new irrigation from surface and groundwater resources, improved water control in cultivated wetlands and flood recession planting areas, to improved in-field rainwater management for dryland crops:

- ***Development of new irrigation areas.*** New irrigation development could consist of a wide range of technologies, ranging from individually operated micro-scale irrigation (e.g. using treadle pumps at very low cost) through to large scale. In many cases, the development of small areas by individual smallholder irrigators using micro-irrigation technologies will be appropriate. Small- to medium-scale communally managed schemes also have potential, although where these conveyance structures are needed, they may require some public investment support. Large-scale irrigation would probably only be developed in cases where economies of scale and specific market links can be exploited (e.g., for industrial crops such as sugarcane). Some development is likely to require new storage, which again might range from micro-scale water harvesting systems to large dams, providing opportunities to exploit synergies between irrigation and other uses (e.g., domestic and livestock water supplies, fisheries, or hydropower). Other development is also likely to involve complementary investment in associated watersheds. New irrigation is likely to be used for a range of crops from rice to horticulture or other high-value crops. The range of costs is very great, depending on the water management technology employed. At an assumed average holding size of 0.75 hectares per household, investment in 32 million hectares of new irrigation development could directly benefit some 43 million irrigator households (or approximately 237 million people) plus a further 10-20 million households that would engage in increased opportunities for agricultural wage labor.

- ***Revival of equipped but currently unused areas.*** A mix of interventions is likely to be required to bring back into production the 2 million hectares of land that is equipped for irrigation but currently not used. This land is located in large-, medium- and small-scale schemes and will require interventions such as rehabilitation and upgrading of physical works, changes in the institutional set-up, and improved water management and crop husbandry. At an average cost of $3,500/ha for recent well-designed rehabilitation projects, these investments could prove economically viable. However, these schemes

[23] As a neutral body, FAO is promoting Good Agriculture Practice http://www.fao.org/prods/GAP/index_en.htm

would involve similar O&M costs to those for new irrigation schemes, and the cropping pattern would have to be sufficiently high value to cover those costs and provide an incentive income to farmers. Again, at an assumed average holding size of 0.75 hectares per household, investment in these schemes could directly benefit some 2.7 million households (or 15 million people) plus a further 0.7-1.3 million households engaging in increased agricultural wage employment.

- ***Water control in wetlands and flood recession areas.*** Improving water control on the 2 million hectares of land under 'other forms of water management' in wetlands and flood recession planting areas might involve the development of flood protection and drainage systems, or even irrigation systems. However, in many cases the development of small areas by individual smallholder irrigators, using micro-irrigation technologies (such as treadle pumps) will be appropriate. Such investments are likely to involve lower capital and O&M costs than new or rehabilitated irrigation schemes and may be justified by the production of lower value crops. Cropping patterns could include rice and other cereals, cotton, dry beans, fodder and, in a number of cases, horticulture. Average land holding could be similar to that for new irrigation and the total numbers of direct beneficiaries could be of a similar order to those from investment in the rehabilitation or upgrading of existing, but unused, irrigation schemes — perhaps 4 million households region-wide.

- ***Improving in-field rainwater management for dryland crops.*** Improving in-field rainwater management is an attractive possibility because of the vast areas that might be involved, so that even a small yield increase could have a large production impact. For example, the area currently planted to dryland maize is 24 million hectares (FAO, 2005a). An incremental yield of just 250 kg/ha on this area would be 6 million tonnes — i.e., more than the total projected imports of maize in 2030. In addition, the poverty reduction impact would be immediate because dryland farming is the production system of the poor. Improvements could involve a range of interventions, although all would have the common objective of increasing the effectiveness of rainfall for dryland crops. As discussed, various technologies have been successfully demonstrated in the region but, apart from one or two cases (e.g. the *tassa* in Niger and conservation tillage in Zambia) adoption has been poor. The constraints to wider adoption by smallholders are likely to be similar to those that are thought to currently limit productivity on irrigated land — i.e., a lack of farmer empowerment to access input and output markets, poor agricultural support services (including extension and credit), and a lack of supply chains for implements and equipment. The theoretical potential is 174 million hectares. For the present purpose, it has been assumed that 25 percent of the currently cultivated area, or 46 million hectares, might eventually be developed. Success is likely to be greater in the higher potential agro-ecological zones, particularly in the dry sub-humid zone, but the experience from Niger suggests that good results can also be achieved in the semi-arid zone. Although the possible impact of this development on overall runoff, stream-flow, and ecosystems has not been quantified, it is unlikely that this would be significant.

Another major investment opportunity is:

- ***Solving the problem of low productivity on existing irrigated land.*** As discussed above, irrigated production in sub- Saharan Africa is characterized by low productivity, constrained by unreliable water supplies, poor water management, low input use, and poor crop husbandry, as well as poor access to input and output markets. Apart from unreliable water supplies, the constraints highlighted are mainly institutional and require investment in software rather than hardware. This

opportunity would therefore involve only a fraction of the cost of physical works suggested above and represents a first class investment opportunity.

On the demand side, very important opportunities exist:

- *Demand for basic staples and other foods will increase strongly.* While sub-Saharan Africa is currently self-sufficient in most of its major staples and imports less than 5 percent of its needs for food other than rice and wheat domestic food markets are expected to double in volume by 2015, with some increase in demand for superior foods as incomes rise. At current levels of productivity and rates of growth, net imports of wheat and rice are expected to reach 40 million tons by 2030, while imports of maize and vegetable oils are also expected to increase substantially. Overall, on a region-wide basis, cereals self-sufficiency is expected to decline marginally from 82 percent in 1997/99 to 81 percent in 2030 (FAO, 2003a:68). There will be some growth in world demand for sugar and cotton, but while cotton prices may rise, sugar prices are likely to remain volatile. Irrigated industrial crops, especially sugar and cotton, will continue to supply domestic and export markets. Growth in domestic demand will continue to expand and cotton export prices could rise strongly if USA and EU protection and subsidies are reduced under the Doha Round (FAO, 2006; Diao et al., 2003). However, the combined impact of the EU sugar policy reform and an increase in global demand (partly driven by demand for ethanol) could increase prices for sugar, but with increased volatility.

- *Horticulture demand.* There are substantial growth prospects for irrigated horticulture because the range of potential products is vast (over 80 different commodities in the 'vegetables and fruits' UN trade classification) and sub- Saharan Africa's current share of world trade in these products is small (Diao et al., 2003:61). There are many high-value niches to explore for exports, although the market is highly competitive and risky. However, low wage rates are likely to preserve the region's comparative advantage and exports could grow fast. The large domestic market, which absorbs most horticultural production, will also expand steadily.

- *Demand for fodder.* Fodder production is expected to account for only 4.7 percent of total crop output by 2030 (FAO, 2006), of which only a small proportion is likely to be irrigated. Although fattening and intensive stall-fed systems for milk and meat can be highly profitable where demand for meat and dairy products is firm, and although the projected increase in demand for these commodities is higher than other developing regions and the world as a whole, the increase will be from a relatively small base. Nevertheless, some increase in irrigated production of feed barley, maize, alfalfa, and other green fodder crops is likely.

Need for a New 'Green Revolution' in AFRICA

Learning from limitations of the original green revolution approach: The original 'green revolution' approach, with its reliance on the use of hybrid seed, mineral fertilizers, and mechanisation, largely failed to tackle the problems of low crop productivity in Africa due to high and costly inputs, top down approaches, requirements for good governance and lack of interest of the agricultural sector. Although more successful in other parts of the world, notably South and South-East Asia[24], in recent years such technologies have been found to no longer produce the expected returns, and in particular increased fertilizer use has not been matched by increased yields. It was wrongly assumed that agricultural intensification could be sustained solely by using high levels of external inputs. There were a number of

[24] Where it led to significant crop yield increases in the 1960s and 1970s.

land related elements that the old 'green revolution' approach failed to adequately address, notably:

- *Depletion of soil organic matter* – associated with widespread removal of crop residues for fuel and/or fodder and insufficient organic matter being returned to the soil. The result being a decline in soil biological activity and a lower response to fertiliser.

- *Degradation of soil physical properties* – through a combination of reduced organic matter and degradation of the natural soil structure through conventional tillage practices that lead to increased surface crusting, erodibility and subsoil compaction. The end result being a loss of structural stability, increased risk of soil loss from water and wind erosion, decreased rainwater infiltration, increased runoff, reduced pore spaces and water holding capacity, and restricted crop root development.

- *Adverse changes in the balance of the soil's nutrient resources* – resulting from: (i) a failure to replace the nutrients removed from the soil in the harvested crops; and/or (ii) unbalanced fertiliser application. Whereas there may be a high response in the first few years to the application of nitrogenous fertilisers, the resulting improved crop growth may deplete the soil of other nutrients, resulting in a lower or zero response to such fertilisers in subsequent years should one or more of these other nutrients have become critically deficient.

While there were unprecedented yield increases when it was introduced, advocates of the original 'green revolution' did not recognize that maintaining soil health, essential for the growth of healthy crops, a broader ecologically based SLWM approach that will prevent or correct, adverse changes in soil biological, chemical, physical and hydrological properties. In other words, while the old green revolution may have rapidly improved production, it mined the resource base that was required to support it long into the future. It is time to include our best learning from these experiences and transcend to a more sustainable and transformative approach.

Building the potential for a new green revolution approach Improving the performance of the agricultural sector within AFRICA therefore requires a new 'green revolution', one that will incorporate the best elements of the old 'green revolution' technologies (notably improved crop varieties and livestock breeds) into the more holistic SLWM approach and placing the social and environmental aspects squarely in the management approaches. This renewed version of the green revolution must involve a very clear and coherent integration of the environmental and agricultural agenda and sectors. The focus for the new approach should be on intensifying the productive capacity, while maintaining the protective functions, of healthy ecosystems. The aim being to maximise the range of goods and services that can be realised from the sustainable utilisation of the locally available ecosystem resources (climate, soils, water, vegetation, wildlife etc).

Achieving this will require knowledge of the characteristics and qualities of the different ecosystems, and an assessment of the extent to which they match the production, management and conservation requirements of different productive land uses. Such knowledge is essential for helping land users to determine which are suitable, or not suitable, for their area. This also requires that policy makers and planners recognise that not all of Africa's arable areas and rangelands have the same potential for the intensification of crop and/or livestock production, hence agricultural development policies and programs for different areas will need to be tailored according to their area specific constraints and opportunities. They also need to be able to assess the likely impact (positive or negative) of proposed land use changes on the maintenance of essential (regulating) ecosystem functions and services notably: (i) hydrological cycles; (ii) micro-climate; (iii) nutrient cycling; (iv) biological community dynamics and (v) energy flow and carbon sequestration.

Sustainable utilisation of particular ecosystem resources may require the adoption of mitigation measures to overcome any biophysical constraints (low fertility, low rainfall, susceptibility to erosion) that would otherwise limit their productive potential. Hence intensification, so as to increase the productivity per unit area, will frequently include increased use of external inputs e.g. fertiliser, improved seed, irrigation water. However the emphasis of the new 'green revolution' involves the use of external inputs as a supplement to, but not a replacement for, improvements in soil biological (organic matter), physical (structure) and hydrological (soil moisture) properties.

The Alliance for a Green Revolution for Africa (AGRA) is a recently established organization, which is focusing efforts on a prosperous agricultural system taking into account the economic, social, and environmental aspects required to double or triple farmers' yields. In Africa use of mineral fertiliser averages only 8 kg/ha, some 10% of the world average. The Abuja Declaration on *Fertiliser for the African Green Revolution*[25] called on AU member states to increase the level of usage to an average of at least 50 kg/ha by 2015. To assist in addressing poverty, food security, and other related Millennium Development Goals, it is critical that any input such as increased fertiliser use is promoted as part of a holistic SLWM approach, rather than a stand-alone exercise.

3.7 Overcoming Barriers and Up-scaling and Mainstreaming Sustainable Land and Water Management

To address the simultaneous pressures on land resources –increasing demand for goods and services and unprecedented rates of land degradation, sustainable land management must include *up scaling* of sustainable land and management technologies and approaches and the *mainstreamin*g of an SLWM priority into government and organizations' policies, programmes and ways of working and strategies in particular at the national level.

Although 1.79 million farmers were reported in the year 2000 as successfully cultivating 1.91 million ha using various locally appropriate SLWM practices (Noble et al 2005), this represents a very small percentage of the total cropped area in Africa (180-200 million ha). Therefore, there must urgently be put in place a strategy to scale up these and other local level successes in order to have a significant impact on the inter-related problems of land degradation, declining agricultural productivity and rural poverty. However, as witnessed, up scaling rarely happens on its own. It justifies a commitment at all levels and among all stakeholders to make change happen on the ground at a scale that can dramatically and positively influence both land and livelihoods. In parallel, reforms of policies and targeted investments must be made to overcome the barriers and bottlenecks that hinder progress to scaling up and mainstreaming of SLWM in Africa.

3-7-1. Key barriers and bottlenecks

Bottlenecks and barriers can occur at multiple levels and tend to be related to knowledge and technology; political, institutional and governance barriers; and economic and financial barriers as follows:

- *Knowledge and technological barriers* – although a wealth of information exists on successful SLWM technologies and approaches, there is insufficient sharing of

[25] Issued at the Africa Fertiliser Summit, African Union Special Summit of the Heads of State and Government – Abuja Nigeria 13 June 2006.

experiences at the local, national and regional levels in Africa. There are also still many knowledge gaps particularly on the economic and financial aspects of SLWM. Such gaps are due in part to inadequate monitoring and evaluation of water management and land degradation and its impact. Many existing knowledge bases are not readily accessible to all stakeholders, have institutional conceptual biases, typically contain macro-scale data insufficiently detailed for planning local level interventions, and are largely passive systems with few mechanisms for interactivity and updating from the local level.

- *Policy, institutional and governance barriers* – While there are many achievements, land degradation and SLWM issues are not yet fully understood, internalized and prioritized in country poverty reduction strategies, public expenditure frameworks and sectoral development policies. Most current legislation relevant to land degradation and SLWM lacks many of the essential legal and institutional elements needed to: (i) influence, establish and implement market and trade policies that are economically beneficial and promote the sustainability of the land are tied to investments in SLWM ; (ii) provide secure individual and/or communal land user rights to provide incentives for SLWM investments; (iii) develop effective long term land management programs and targets that address root causes of ecological problems; and (iv) establish socially acceptable mechanisms for encouragement and/or enforcement.

- *Economic and financial barriers* – have resulted in the financial resources available for SLWM in general and to the agriculture and rural sectors in particular not being commensurate to the needs. Current trends are not encouraging and champions, in both government and donor circles, are needed to turn this around. In general, the overall external assistance to agriculture during the last decade has gone down from US$ 3.3 to1.9/ha (1989-2000). In the last five years, only US$ 0.06 to 0.11/ha (of total AFRICA land area) has been invested in combating land degradation which is surprisingly low when compared to the cost of the land degradation and to the budget of the agricultural sector. In addition, inappropriate economic and pricing policies have resulted in unsustainable pressures on land resources while effective incentives for SLWM have not been developed and/or are very insufficiently applied. Poverty and lack of financial incentives or credit forces many land users to pursue short term coping strategies rather than investing in long term sustainability. As a conclusion, achieving SLWM requires a drastic shift in emphasis.

Up scaling can only be advanced in any meaningful way if the main bottlenecks that prevent SLWM adoption are unlocked. To clearly understand specific bottlenecks in a given context, a participatory diagnostic must be carried out which will clarify priorities areas and ensure that investments remove the major constraints to achieving the desired result.

3-7-2. Up scaling and mainstreaming through a dramatic shift in emphasis

Up scaling is dependent on putting in place measures, practices and associated investments that can work synergistically to expand the adaptation and uptake of SLWM in a rapid and cost effective manner at higher scales, as appropriate. This is no small feat. Mainstreaming serves to support up scaling by building the SLWM agenda within national and regional priorities, most often this will occur through reforms of policy, institutions, and finance mechanisms. Such reforms are part of a establishing an enabling environment for the long term.

Successful up scaling and mainstreaming of sustainable land management requires that we learn from our past and transcend to our next best thinking – including what has worked and

releasing what will no longer serve us. The following (Table 4) demonstrates the major shifts in emphasis that are now required in the technological, development, institutional and political aspects to achieve the positive change required.

Table 1: Shifts in Emphasis to Achieve SLWM

Technological Shifts	
From looking at land degradation (soil erosion, overgrazing, deforestation etc) in terms of **what is happening** (treating the symptoms).	**To** looking at land degradation in terms of **why it is happening** and tackling, the root causes.
From a primary focus on rehabilitating degraded ecosystems that have already lost some, or all, of their ecological functions and services.	**To** a primary focus on prevention and protecting and enhancing the ecological functions and services of individual ecosystems.
From a narrow sectoral interpretation of land degradation types, processes and causes leading to single sector biased interventions (such as tree planting, construction of runoff control measures, or hybrid seed/fertiliser extension packages).	**To** a holistic integrated SLWM approach that uses the full range of human and natural resources and synergistic combinations of technical options to restore, sustain and enhance the productivity of individual ecosystems.
From a few 'bright spots' with successful SLWM technologies and approaches.	**To** landscape level change through scaling up successful technologies and approaches.
From individual practices and technologies being promoted.	**To** integrative combinations of practices that promote plant diversity and productivity, soil health and effective water management.
From cropping systems based on ploughing and high reliance on external inputs.	**To** conservation agriculture based cropping systems involving: (i) reduced or zero tillage; (ii) permanent soil cover (crop residues and/or cover crops); (iii) crop rotation; and (iv) balanced plant nutrition using a combination of organic and inorganic inputs.
From encouraging pastoralists to engage in livestock production by settling them on fixed ranches.	**To** improved traditional pastoral systems involving opportunistic, flexible utilisation and planned grazing of heterogeneous rangeland resources.
Development Approach Shifts	
From a top down transfer of technology mode in which the land user is a passive recipient of externally formulated extension messages and research recommendations.	**To** a people-centred learning approach through which land users are enabled to learn about, and investigate for themselves, the costs and benefits of alternative SLWM practices.
From professionals gathering data, analysing it, preparing plans, and then asking the local community if they agree, before requesting mobilization of local resources (notably labour) to implement these plans.	**To** community-based participatory issue identification and planning building on rural people's inherent skills and capability to formulate and implement their own development plans, and to develop and disseminate their own SLWM technologies.
From the concerns of women, youths and other marginal groups being inadequately addressed in community level natural resource management programs.	**To** the adoption of cultural and gender sensitive approaches that actively involve women, youths and other marginal groups in the planning and implementation of community level natural resource management plans.
Institutional and Governance Shifts	
From divergent views and approaches pursued by different stakeholders leading to fragmented, ad hoc, piecemeal, and at times conflicting, efforts to address land degradation problems.	**To** alignment along a common vision of SLWM implementation strategies through multi-stakeholder (donors, policy makers, private sector, and civil society) consensus negotiation, coherent decision making and multi-level national strategic investment frameworks.
From an individual sectoral and sub-sectoral approaches in which each institutional technical unit works separately on its own projects and programs and often not in coherence with one another.	**To** cross-sectoral and multi-stakeholder strategic partnerships and pivotal champions co-creating strategies, programmes, investment frameworks to remove the barriers and overcome the bottlenecks to promoting SLWM.

From few, limited and ineffective knowledge sharing mechanisms within AFRICA.	**To** expanding the knowledge base of documented best practices and lessons learned through the development of effective local, national and regional level knowledge sharing mechanisms operating within, and between, AFRICAN countries.
From land users getting little assistance from weak and poorly resourced local level advisory support service providers.	**To** land users needs for technical advice, credit, seasonal inputs, equipment and produce markets met by a partnership of local decentralised government, private sector, and civil society agents with enhanced participatory process and technical skills and operational capacity to provide effective advisory support services.

Policy Shifts	
From multiple policies that are both contradictory and addressing only symptoms of land degradation.	**To** effective cross-sectoral policy analysis and design that result in transformative policies that both address root causes of land degradation and result in win-win solutions.
From a national strategy policy, legislative and development planning environment in which SLWM is inadequately addressed and funded.	**To** SLWM mainstreamed within and across national strategies and sectoral policies, laws/regulations on agriculture, trade, market, research, and land tenure, public expenditure frame-works, and across development agencies for successful development strategies and programs.
From inadequate and contradictory economic and pricing policies that discourage investment in SLWM by financial investments.	**To** the rapid development of enabling innovative financial incentives, including mini-grants and other market mechanisms that facilitate and encourage private investment in on-the-ground SLWM.
From an inadequate and poorly enforced legal and regulatory environment for SLWM and land degradation control.	**To** a revised body of incentive oriented legislation containing the essential legal and institutional elements needed to recognise ecological problems and opportunities, develop effective land and ecosystem management programs and targets, and establish socially acceptable mechanisms for their enforcement.
From rural households with weak and insecure long term user rights for their individual farm plots and communal forests and rangelands unwilling to invest in SLWM.	**To** locally negotiated regulations, tenure systems, land use plans, and household user rights, governing the use of local soil, vegetation, water and biodiversity resources and which provide users with the security and other resources needed to make long term invests in restoring, sustaining and enhancing ecosystem productivity.

4. OPERATIONALISING THE FRAMEWORK

4.1 Background

The negative trends of land degradation and unsustainable land management in Africa described in the previous sections are long-standing concerns, and several global and regional and national efforts have been put in place to address these issues, including:

- *The United Nations Convention to Combat Desertification (UNCCD)* motivated by global concern, especially amongst African countries, to address the problem of land degradation, was signed in 1994.
- *The Soil Fertility Initiative (SFI)* launched during the 1996 World Food Summit, was the first regional level concerted attempt toward reversing the detrimental effects of soil degradation and nutrient depletion.
- *The Global Environment Facility (GEF)* designated land degradation as one of its key GEF focal areas at the Second GEF Assembly held in Beijing (October 2002). This was in response to growing global concern over the issues of desertification and deforestation. In 2003, the GEF was designated a financial mechanism of the UNCCD.
- *The Comprehensive Africa Agriculture Development Program (CAADP)* launched in 2002 by the New Partnership for Africa's Development (NEPAD) as an African-led commitment to address issues of growth in the agricultural sector, rural development and food security.
- *The Action Plan of the Environment* also launched by NEPAD, in 2003, as an integrated action plan designed to address environment challenges whilst also combating poverty and promoting socio-economic development.
- *Regional Economic Communities of the Africa Union (RECs)* –which by 2005, along with their member countries took ownership of the implementation process within CAADP, identified priority investment programs and immediate actions, and agreed upon basic principles and procedures for implementation and governance involving also farming and agribusiness stakeholders.
- *The Alliance for a Green Revolution in Africa* - launched in 2006 as an alliance through the Bill and Melinda Gates and Rockefeller foundations to build a prosperous agricultural system focused on economic, social, and environmental aspects required to double or triple farmers' yields. Upon taking up the chairmanship in 2007, former Secretary General of the UN, Kofi Annan, noted that "ours is a Revolution of the 21st century, one that we Africans will own, whose destiny we will shape, and which responds to the specific environmental challenges facing our continent".
- The Great Green wall initiative (GGWI): The Program Green Great wall is an initiative of His Excellence Olusegun Obasanjo, former President of the Federal Republic of Nigeria, whose principle of implementation was adopted by the 7th ordinary session of the Conference of the Leaders and Heads of State of the CEN-SAD held in Ouagadougou on June 1, 2005. The goal of the program is to promote a socio-economic development of the target zones vulnerable to desertification by the implementation of projects of conservation and restoration of the natural resources and promotion of economic activities (agricultural, livestock, fishing, handcraft industry). To give contents to this program, the General secretary of the CEN-SAD and the Commission of the African Union undertook, in collaboration with the Member States and the partners, a series of activities: (I) a preliminary study of definition of the concept carried out by the General secretary of the CEN-SAD and the development of a project of action plan 2008-2010 in collaboration with the Sahara and Sahel Observatory (SSO); (II) a reflection of definition of the concept of the program realized by the Commission of the UA; (III) a reflection of

definition of the program carried out by an ad hoc committee of experts controlled by Senegal (note conceptual, indicative layout, terms of reference…).

- Implementation of UNCCD convention:
  - At national level: With the technical support of the CILSS, most of the countries of west Africa (15 countries on 17) have today a national action plan;
  - At regional level: A sub regional action plan for West Africa and Chad was adopted since 1999. Its implementation is led by the CILSS (secretariat) and the CEDEAO (presidency) which are the two centers of liaisons of this initiative.

- Policies, laws, strategies and regulations adopted in land and water management in West Africa: Different plans and policies made available in West Africa such as:
  - Regional Action plan of Fight against desertification in West Africa and Chad (PASR-AO) adopted in 1999;
  - Common policy of Management of Water resources (PAR/GIRE) of ECOWAS countries adoptee in 2000;
  - Framework for Improvement of Environment (PCAE) of the UMEOA adopted in 2006;
  - Economic Community of West Africa Agricultural Programme (ECOWAP) adopted in 2005,
  - Regional Action program of reduction of vulnerability vis-à-vis the climate changes in West Africa (being prepared since 2007).

Lastly, the World Bank World Development Report published in 2008 focused on the role of agriculture for development for the first time in 25 years noted, “It is time to place agriculture afresh at the centre of the development agenda, taking account of the vastly different context of opportunities and challenges that has emerged”.

However, notwithstanding the above commitments, land degradation in Africa has failed to attract policymakers and donors’ attention in a way commensurate with the dimension of the problem. For this reason, a program of extensive debate and consultation was initiated in the first half of 2004, within and between the World Bank, FAO, NEPAD, African countries and other national, regional and international stakeholder agencies. Some of the key conclusions from these deliberations were that:

- *There were too many overlapping and scattered programs and missions with conflicting objectives* – better alignment and harmonization between stakeholders is required to reduce the drain on country resources.

- *Land degradation is too large a problem for a single institution to address alone* – by pooling resources, a regional partnership can reduce transaction costs and achieve economies of scale across Africa.

- *Narrow approaches have had a limited and un-sustained impact* – a comprehensive approach to SLWM is required, one, which directly and jointly targets identified barriers.

- *Poor knowledge management has constrained the implementation of SLWM scale-up* – better tools are needed to assess the economic and social benefits of SLWM; a vehicle is needed to share success stories and promote replication and benchmarking.

These consultations led to agreement that a new and collective business model was needed to scale up and make more effective SLWM investments and practices in Africa. This was the basis for the development of the TerrAfrica partnership to support and strengthen the implementation of the UNCCD, CAADP and NEPAD Action Plan of the

Environment, with a particular mission to create an enabling environment for mainstreaming and financing effective nationally driven SLWM strategies. TerrAfrica was officially launched in October 2005 at the 7th Conference of the Parties of the UNCCD, in Nairobi Kenya, and at the NEPAD CAADP donor retreat in Pretoria South Africa.

In Parallel of TerrAfrica initiative, in 2001, AfDB, FAO, IFAD, IWMI, and the World Bank identified the low level of investment in agricultural water in sub-Saharan Africa as a major development issue. The agencies, therefore, decided on a joint Collaborative Program to review the current state of agricultural water development and experience gained to date in Sub-Saharan Africa in order to: (a) better understand its performance and potential (b) identify changes in the development context, and (c) develop recommendations to improve investment performance. The objective was to improve the quality of assistance to governments and induce greater investment flows, as well as influence the assistance provided by bilateral donors. The collaborative programme comes out with lessons and recommendations for increasing the contribution of agricultural water management to poverty reduction and growth in the region.

4.2 Role, Objective and Aims of framework

The CAADP Pillar 1 Framework brings together three key elements of the CAADP process as it has developed over the last 4 years (Sustainable Land Management, Water and the Roundtable Process), and as such:

i. **Sustainable land management:** Undertakes to embrace and build on the strategic vision, country support tools and the sustainable land management framework developed through NEPAD-TerrAfrica, as part of the programme of support mobilised by NEPAD under CAADP and EAP to assist countries in scaling up sustainable land and water management practices.

ii. **Agricultural Water Development :** Aims to ensure that issues arising from a number of Initiatives led by several key CAADP and TerrAfrica partners, but mainly through a collaborative initiative involving AfDB, FAO, IFAD, IWMI and World Bank on support to enhance investment and sustainable productivity in agriculture water are well reflected; and

iii. **CAADP Roundtable:** Ensure that the principles and modalities for engagement and integration of sustainable land and water management into the country and regional level CAADP implementation processes (roundtables) is a key element of the Pillar 1 framework itself.

Thus, the role of the framework is to promote partnerships between international, regional, national, district and local/community level stakeholders, with the long term goal of restoring, sustaining, and enhancing, the productive and protective functions of Africa's land and water resources by combating the interrelated problems of land degradation, food insecurity and rural poverty. It will seek to do this through the implementation of a long term, well funded and multi-level program with the short to medium term objectives of:

- building capacity and strengthening the enabling institutional, policy, legislative, budgetary and strategic planning environment for SLWM; and

- mainstreaming SLWM within country-driven programs, to remove the barriers and bottlenecks to financing, and scaling-up on the ground, successful SLWM technologies and approaches.

The aims of framework are to provide support for: (i) coalition building amongst the key stakeholders, regional integration, coordination and partnerships; (ii) empowerment of national and regional stakeholders; (iii) improving the collection, management and dissemination of SLWM knowledge; and (iv) identifying, mobilising and harmonising the investment funds required for the promotion of SLWM at the local, and country levels (and as required sub-regional and regional levels), within nationally determined SLWM strategic investment programs and (v) scale up investments and ensure a more reliable, broad based and sustained flow of funds for agricultural water.

The framework exists to help countries: (i) review, revise, harmonize and coordinate their efforts at the policy, strategy, technical and program levels; (ii) expand and consolidate actions that support SLWM; (iii) benefit from qualitatively and quantitatively increased flows of knowledge, information and expertise to and from members; (iv) better mobilize and channel financial resources; and (v) provide and obtain mutual encouragement and support in their commitment and efforts towards SLWM.

4.3 Operationalisation

In operationalising the CAADP pillar 1 framework the principle focus will be on:

- *Addressing knowledge management barriers* – through filling knowledge gaps and improved management of knowledge collection, storage, analysis and dissemination.

- *Addressing institutional and governance barriers* – through: (i) multi-sectoral and inter-agency stakeholder partnerships at regional, country and local levels; (ii) awareness raising and consensus building on a common vision for SLWM; (iii) building capacity amongst planning, research and advisory service providers at central and local levels; and (iv) decentralisation to address area specific problems and take advantage of local development opportunities.

- *Addressing financial resource bottlenecks* – through increased and harmonised government, donor and private sector investments within a comprehensive strategic planning framework and portfolio of related priority projects and programs.

- *Addressing legislative and regulatory barriers and bottlenecks* – through review, harmonisation and revision of the legislative and regulatory environment for SLWM.

- *Addressing M&E barriers and bottlenecks* – through: (i) better understanding of the processes and impact of land degradation and Agricultural water management; (ii) identification of appropriate scale-sensitive, cost effective and simple indicators; (iii) participatory M&E with the land users incorporating their criteria for success or failure; and (iv) developing effective feedback mechanisms that allow the M&E findings to guide the future design and implementation of SLWM investment activities.

4.4 The Regional Level Operationalisation Road Map

At the regional level, successful Operationalisation of framework will involve a number of supporting activities, in particular:

- *Building a regional consensus and understanding about SLWM* – through consultations (workshops, e-mail conferences, etc) with senior policy makers and technical experts in the key national, sub-regional, regional and international level stakeholder institutions as

one of the barriers to mainstreaming SLWM at the country level is a lack of a common set of SLWM principles[26] among partners.

- *Undertaking a region wide awareness raising/consensus building campaign* – on what CAADP pillar 1 is (and is not) in order to get senior officials and politicians at the national level, and decision makers within multi-lateral and bi-lateral donor and international and regional development agencies to 'buy in', and drive, the regional partnership.

- *Building African-owned coalitions and strategic partnerships for SLWM* – at regional and global levels in order to develop inclusive regional dialogue and advocacy on strategic SLWM priorities, enabling conditions, and delivery mechanisms.

- *Developing a regional coalition of country* – through careful initial country selection and engagement based, on current levels of interest within potential partners and their capacity to undertake the national level road map activities.

- *Developing a mechanism for coordinating and harmonizing grants* – for SLWM related activities and investments under the GEF operational programs within Africa, allowing the GEF instrument to be applied more strategically, cost effectively and with greater impact on reversing land degradation and enhancing productive and sustainable land management within Africa.

- *Developing a Strategic Investment Program (SIP) for SLWM in Africa* – to provide a programmatic financing mechanism for GEF resources aimed at rapidly scaling-up SLWM on the ground in Africa.

- *Developing a regional knowledge base* – as an information resource for those involved in promoting SLWM at the local, national and regional (trans-boundary) levels, this also to be used to help: (i) support high quality regional knowledge based mechanisms; (ii) identify and generate stronger analytical underpinnings; and (iii) harmonize the monitoring and evaluation systems of governments, donors, and civil society organizations.

- *Developing generic Country Specific SLWM Investment Framework (CSIF) guidelines* – (for adaptation at the national level) for scaling up successful SLWM technologies and approaches with a particular focus on how to overcome local, national and regional (trans-boundary) institutional, policy, legal and financial barriers and bottlenecks.

- *Developing generic M&E guidelines* – (for adaptation at the national level) for monitoring and evaluating the results and performance of country level supported activities.

- *Providing a platform* for delivering comprehensive support to agricultural water in sub-Saharan Africa.

- *Leveraging the political dialogue and addressing international rivers riparian issues*.

4.5 The National Level CAADP pillar 1 and TerrAfrica Operationalisation Road Map

At the national level, successful Operationalisation of CAADP pillar 1 framework will involve a series of steps, each with its own set of activities to be undertaken at the national, district and/or local levels:

[26] Including as yet no universal definition of what sustainable land management is, despite it being the focus of the GEF OP 15 and TerrAfrica.

Step 1: Building National TerrAfrica Commitments and Partnerships

Step 1 will involve:

- *Building a broad based national coalition* – by (i) identifying the concerned SLWM stakeholder institutions (within central and local government, the private sector, civil society and international partner agencies); (ii) selecting key stakeholders to act as the principal champions for driving the SLWM agenda and planning process at country level; (iii) building on existing delivery mechanisms such as sector programmes in agriculture, environment, or land and strengthening their land management components; iv) using a pre-existing land/agriculture/environment fora or establishing a core country SLWM team, made up of designated senior representatives from the main stakeholders, to assume lead responsibility for the national program; and (v) setting up a broad consultative SLWM Forum with a wider membership representative of all the concerned stakeholders. The aim is to bring together national, district and local/community level stakeholders in a multi-level partnership able to advocate a common vision of SLWM, share analyses, set the foundations for strengthening and harmonizing policy dialogues and strategies, and improve coordination at all levels.

- *Sensitization and advocacy* – in order to raise awareness and build a national consensus amongst all stakeholders on: (i) the concepts and principles of SLWM as they relate to the local, district and national level environmental and socio-economic circumstances of the country; and (ii) the need to mainstream and scale up SLWM within a comprehensive national program aimed at addressing land degradation, food insecurity and rural poverty. A key task for the country SLWM team at this stage will be to build the necessary political commitment and secure the increased public funding required to address the barriers and bottlenecks to SLWM.

- *Agreement to a common code of conduct* – to be followed by the concerned stakeholders in the operationalisation of CAADP pillar 1 framework at the national level. This to include agreement to: (i) build a common diagnosis and shared vision for SLWM within the country; (ii) share information about past, on-going and planned SLWM interventions; (iii) better coordinate and harmonise existing SLWM interventions and investments; and (iv) align future SLWM projects and programs under the umbrella of a Country Strategic Investment Framework (CSIF).

Step 2: Stocktaking, analysis and diagnosis of the in-country situation

Step 2 will involve a stocktaking exercise to analyse and diagnose the constraints, barriers, and bottlenecks for mainstreaming SLWM within central and local government development policies and programs, and to identify the opportunities and scope for scaling up successful SLWM technologies and approaches. This step will involve five interrelated sets of component activities:

- *Documentation and assessment of SLWM technical interventions* – Identify and agree upon what can be considered past/on-going SLWM intervention in the country in order to carry out a review of past interventions, to identify factors of success/failure, best practices and lessons learnt. Determine the technical effectiveness and cost-efficiency of the various SLWM interventions used to date with the aim of identifying the 'best practices' for scaling up under the CSIF. Additional studies concerning the cost-effectiveness of SLWM interventions /techniques will need to be carried out in order to convince farmers/land users and policy makers alike of their relevance and importance.

A diagnostic of land degradation, by interpretation of satellite imagery combined with sample soil surveys, should be a preliminary step to up-scaling SLWM.

- *Ecosystem assessment* – so as to identify, characterise and map the country's ecosystem resources that are currently, and/or potentially could be, used to support sustainable crop, livestock, forestry and eco-tourism enterprises. This will involve determining the constraints and opportunities related to the biophysical properties and the socio-economic characteristics of the major land use systems pursued. Such information will be presented as a land use plan for the country, showing for each area the best combination of crops and land husbandry practices (including soil conservation practices) and will serve as the basis for identifying: (i) areas where SLWM interventions are required to address problems of land degradation and low agricultural productivity and to sustain ecosystem health and services; (ii) areas suitable for scaling up specific 'best bet' SLWM technologies and approaches; and (iii) areas where particular land use enterprises could be pursued on a profitable and sustainable basis.

- *Policy diagnosis* – will involve reviewing the legal, regulatory and policy environment in which SLWM interventions will be undertaken to identify where there are barriers and bottlenecks that can be changed in order to create the right enabling environment for the mainstreaming and scaling up of SLWM. Each country will require a clear policy direction in SLWM including priorities, goals and targets informed by research and a clear role distribution among agencies

- *Institutional diagnosis* – will involve an assessment of the legal mandates, technical duties and areas of responsibility of the various national and local level institutions directly, or indirectly, involved in SLWM related activities[27]. This review will also assess the capacity of the institutions to provide the necessary support services to the land users (e.g. skilled manpower, equipment, buildings) as well as documenting the range of SLWM related activities each institution undertakes, and highlight the possible overlaps/gaps between agencies.

- *Financial diagnosis* – will involve a review of the financing modalities and delivery mechanisms in place, including their strength and weaknesses, which could be used to channel increased funding for SLWM. This will involve documenting the: (i) source of such investments (central and/or local government, donor agencies, private sector companies, NGOs, communities and rural households); (ii) type of investment (annual budget allocation, grants, loans, in-kind); (iii) amount invested; and (iv) actual, as opposed to proposed, expenditure on SLWM.

By the end of this step, the various assessments and diagnosis should be synthesised in a short strategic note laying out some priority investment areas that will likely have the greatest impact on reversing land degradation. A long list of recommendations of where there is a need, and scope, for change in order to promote SLWM will be compiled. This list will serve as the basis for the next step involving the formulation of the CSIF and County Agricultural Water Development Strategy.

Step 3 a: Formulation of the Country Strategic Investment Framework

This step involves three sets of component activities:

[27] Specifically those stakeholder institutions identified during step 1.

- *Identification and priority setting* – which will involve a consultative process of screening the options for change identified in step 2 and prioritising them according to whether they: (i) are technically sound and financially viable; (ii) fit national and local priorities; (iii) have the necessary support services in place (or could be relatively easily developed); (iv) have a local champion; (v) are synergistic with other investments; (vi) represent new development opportunities; (vii) offer win-win scenarios (addressing both production and conservation objectives); and (viii) provide opportunities for rapid mainstreaming and up-scaling.

- *Preparation of a preliminary CSIF outline* – providing details of possible investment/actions, including capacity building requirements, to be included in the full CSIF. The outline to consider four broad components: (i) supporting on-the-ground activities (catalytic investments for scaling-up SLWM interventions); (ii) creating a conducive environment for mainstreaming SLWM in development policies and programs; (iii) strengthening government and private sector advisory support services for SLWM; and (iv) developing effective SLWM monitoring and knowledge management systems (see table 5 for elements within components).

- *Formulation and costing of the full CSIF* – will involve the detailed design and costing of the proposed component activities. This to be done in participation with the beneficiaries. This part of step 3 will also involve assessing and mobilizing the required financing, as well as identifying stakeholder partnerships and capacity building needs.

Table 2: Mainstreaming and Up-Scaling components and main types of activities

1. Supporting on-the-ground activities for scaling up SLWM	**2. Creating a conducive enabling environment for SLWM**
1.1 Provide capacity building for SLWM implementers (farmers, forest users, rural community members, etc.) to support integrated approaches to natural resources management. 1.2 Provide technical and financial support for the implementation of participative planning and management of both collective and private SLWM investments, at landscape level. 1.3 Organize and fund SLWM investment pilots/demonstration sites with embedded scale-up strategy such as Farmers Field Schools, etc. 1.4 Strengthening farmer/producer organizations for adoption and up scaling of SLWM practices with technical, financial and political support so that they are part of the decision making process (Country Team, SLWM Fora). 1.5 Providing incentives for SLWM adoption (including support to design of environmental services payments, targeted matching grants or credit programmes).	2.1 Integrating SLWM into national and sectoral development frameworks at national and decentralised levels. 2.2 Encouraging land markets regulated by a land policy, where land users are involved in its monitoring and where land rights and customary tenure are recognised and protected at private and collective levels. 2.3 Encouraging land tenure that records and protects SLWM investments as land capital improvements (accordingly reflected in value of land). 2.4 Reviewing country investment programmes and public expenditure frameworks to identify constraints and entry points for SLWM and to increase predictability of financial flows to SLWM. 2.5 Identify SLWM indicators and programmatic SLWM budget codes that will allow SLWM budgeted and executed figures to be tracked through Public Finance Management tools and linked to associated results. 2.6 Identifying and protecting new food chain opportunities (organic, fair trade, eco tourism, and bio-energy) so that land users get a better return on their SLWM investments. 2.7 Strengthening traditional and innovative conflict resolution mechanisms to prevent mitigate and resolve conflicts over NR. 2.8 Provide tax exemptions to purchase inputs that will be used for SLWM adoption/up-scaling.
3. Strengthening commercial and advisory services for SLWM	**4. Developing effective SLWM knowledge management, M&E and information dissemination systems**
3.1. Strengthening capacities of field operators to provide SLWM input and output services. 3.2. Create and enforce a SLWM derived product label, which will allow premium payments to land users. 3.3. Marketing support for outputs from SLWM, including certification systems to strengthen fair trade and eco-labelling schemes. 3.4. Advising providers of financial services to offer financial products to support SLWM adoption.	4.1 Land users are exposed to SLWM knowledge and experience including best practices through targeted awareness/training campaigns including videos and radio programmes. 4.2 Supporting specific targeted and applied SLWM research (technical, economic, social). 4.2 Support knowledge sharing and innovation networks based upon participatory/community-driven and iterative approaches such as field visits and demonstration sites. 4.3. Strengthen capacity of SLWM stakeholders for innovation 4.4 Developing SLWM M&E for CSIF implementation and evaluation.(selected indicators to be aggregated from local to national and regional levels) 4.5 Developing effective national dissemination strategies for lessons and best practices. 4.6 Develop education curricula that includes SLWM

Step 3b: Formulation of National Agricultural Water Development Strategy

Based on the results of step 2, the country should develop a national strategy for the agricultural water sub-sector that recognize both its importance for agricultural growth and poverty reduction and the economic realities, as well as the need for water to be developed within a broader framework that promotes agricultural growth through profitable investment and market-oriented production. The strategies should be supported by a comparative analysis of the various investment options, including: (i) Investment in increasing productivity and profitability of existing schemes; (ii) Expansion or new construction of large, medium, small, and micro-scale irrigation schemes (including water harvesting) linked to

profitable markets, following best practices for new storage and based on viable institutional models; (iii) Testing and scaling-up of technologies for in-field rainwater management, provided these are proven to be technically and financially feasible and replicable by smallholder farmers on a sustainable basis; (iv) Development of sustainable supply chains for micro-scale irrigation and in-field rainwater management equipment; (v) Investment in research on agricultural water management, both adaptive research at the national and regional levels and basic research at the regional level. Particular emphasis will be needed on three components: (a) the technology, profitability, affordability, and replicability of in-field rainwater management for dryland crops; (b) crops and crop husbandry improvements for staples; and (c) monitoring and evaluation of the performance of agricultural water investments on a region-wide basis in order to provide the basis for rapid scaling-up of emerging successes; (vi) Investment in institutional reforms, including those for decentralized development and all necessary capacity building.

Box 8 : Recent irrigation strategies are in line with a market-driven approach

Working with the FAO, six West African governments — Mali, Mauritania, Senegal, Ivory Coast, Niger, and Burkina Faso — have developed irrigation strategies with approaches in common.a These include:

- A redefinition of the roles of the state, farmers, and the private sector, with a new emphasis on liberalization, farmer empowerment and minimal government involvement;
- Participatory approaches from identification of projects through to management of the works;
- Prioritization of individual or small group schemes;
- Review of more alternative interventions to find solutions that are least cost and most profitable for farmers;
- Accounting for environmental impacts and social equity;
- Requirements that farmers cover O&M costs and a share of the capital costs;
- Removal of administrative and fiscal obstacles; and
- Promotion of demand driven research.

Source: Gadelle in Sally et al., 2002

The strategy process involves same sets of component activities than the CSIF formulation.

Step 4: Implementation of the Country Strategic Investment Framework and the AWD strategy

The CSIF needs to be more than just an approved document it needs to be made operational, hence this step is concerned with ensuring the implementation arrangements, with regard to financing modalities and delivery mechanisms are in place. This is to ensure the effective mobilisation and harmonisation of the CSIF SLWM proposals, with the focus on investments that are: (i) people-centred; (ii) integrated; (iii) built on existing knowledge; (iv) multi-scale and multi-level; (v) based on partnership and responsibility; (vi) aimed at removing bottlenecks; and (vii) coordinated and aligned for implementation within existing national mechanisms (e.g. national action programs to combat desertification and reduce poverty) and African regional level initiative, notably the NEPAD.

Toward this end, this step will focus on improving national level knowledge generation and management with the aim of cost effectively identifying, generating, organising, and disseminating high quality, customised knowledge that can be used to: (i) support decision-making; (ii) inform policymaking; (iii) advance mainstreaming (in particular in the national poverty reduction strategy, donor country strategies and sector plans); and (iv) help secure future domestic financing. It will involve a review of existing baseline data sets and institutional information systems with the aim of identifying key gaps, and improving the sharing and dissemination of SLWM related information. A key component of this will be the documentation and dissemination of local level experience with successful SLWM technologies and approaches as part of a strategy for scaling up the geographic area

impact of existing SLWM successes on the country's inter-related problems of land degradation, declining agricultural productivity and rural poverty.

Further, this step should focus strongly on building the multi-level capacity required to implement the CSIF proposals, in particular:

- *national policy level* – with the emphasis on building the capacity of senior officials and policy makers to review and formulate policies that address both productivity and ecosystem resource sustainability issues, and to enable them to mainstream SLWM and integrated ecosystem management (including biodiversity, Carbon sequestration etc) into national programmes (poverty reduction MDGs etc) and to create the required enabling environment.
- *technical agency level* – with the aim of strengthening institutional mechanisms and capacities for intersectoral approaches, and promoting community-based participatory planning for the identification and adoption of locally appropriate SLWM practices.
- *district/provincial level* – with the emphasis on building decentralised planning and advisory support service teams that can promote the field level scaling up of successful SLWM practices through providing rural communities with the required technical advice, credit, investment, tools etc.
- *local community level* – with the aim of building capacity of community based organisations to test, develop and adopt improved locally adapted SLWM practices for individual farm plots and communal pastures and forest areas (e.g. using FFS approaches) etc.

Step 5: Monitoring and Evaluation

This step involves the formulation of a country specific TerrAfrica M&E system for monitoring and evaluating the results and performance of national and local level, SLWM related interventions implemented under the CSIF. This will involve the identification of indicators that can be used to assess the outcome and impact of specific SLWM interventions at both project and programme levels. This will be undertaken in collaboration with government M&E teams. It will also take into consideration the TerrAfrica indicators developed at the regional level, so as to ensure a degree of commonality between the indicator sets used by different countries to allow for regional aggregation.

Whenever possible, at national level, in the context of PRSP monitoring or sector programme monitoring, existing M&E system with input-output-outcome-impact indicator matrices should be revised in order to incorporate SLWM indicators and targets.

Conclusion

We know that there are many good practices going on in Sub-Saharan Africa, both by governments and civil society – it is imperative that these be scaled up so that we don't need to 'reinvent the wheel'. TerrAfrica provides us with that platform. The challenge is to not only mobilize the communities on this issue, but to include them so that they become part of the elements of change. Wangari Maathi.[28]

[28] Assistant Minister of Environment and Natural Resources Kenya, and 2004 Nobel Peace Prize Winner, quoted in the TerrAfrica Press Release of 24th October 2005.

5. ANNEXES

Annex 1: Land Resources Underpin Social and Economic Development

The sources of wealth in Africa. Africa contains a great diversity of natural ecosystem resources[29] (soils, vegetation, water and wildlife), which constitute the region's natural capital assets. It is from these assets that the provision of goods (food, water, wood, fibre and industrial products) and essential ecosystem services and functions are drawn in order to support African populations long into the future. (See box 1). Although not specifically established for Africa, globally, fundamental ecosystem services have been valued at US$33 trillion a year, which is just less than twice the global gross national product (GNP) of US $18 trillion (Costanza, 1997).

Essential Ecosystem Goods, Functions and Services (after FAO, 2006)

- *provisioning* - which provide the products extracted from ecosystems for human consumption (food security) and trade – food, water, timber, fuel, fibre, medicine, ornamental plants, etc.[30]
- *supporting* - which include the basic natural processes that sustain life on earth – biomass and oxygen production, soil formation, carbon cycling, maintenance of biodiversity, etc.
- *regulating* - which benefit humanity through the regulation of natural ecosystem processes – maintaining climate and hydrological cycles, water purification, break down of waste products, erosion control, prevention/mitigation of natural disasters (notably floods, landslides) etc.
- *maintaining cultural* - which relate to the non-material benefits that ecosystems provide for society – recreation, aesthetic value, healthy environment, spiritual benefits, sense of belonging, social relations, prevention of land resource conflicts, etc.

While Africa's non-renewable mineral resources (gold, oil, copper etc) are highly valued and have attracted considerable investment for their exploitation, Africa's renewable land resources, those most critical to economic and social well being, have been largely undervalued, with inadequate investment from both the public and private sectors in their sustainable utilisation. However, agriculture remains crucial for economic growth in Africa. In most African countries, agriculture provides 60 percent of all employment and constitutes the backbone of the economy as the largest contributor to the GDP; is the greatest source of foreign exchange accounting for 40 percent of the continent's hard currency earnings; and serves as the main generator of savings and tax revenues. The agricultural sector is also still the dominant provider of industrial raw materials with about two-thirds of manufacturing value-added being based on agricultural raw materials (CAADP, 2002). Additionally, 70 percent of rural populations of AFRICA depend on forests or woodlands for their livelihoods and the continent contains 25 percent of the world's remaining rainforest and 20 percent of the worlds' biodiversity hotspots (Costanza, 1997). Some 25 million pastoralists and 240 million agro pastoralists depend on livestock (and thus fodder and rangeland) for their primary source of household income (ILRI, 2006).

Another primary source of great wealth in AFRICA is of course derived from its people - the human and social capital that exists. It is the creativity, indigenous skills, knowledge and labour resources of its population, the crucial human assets of concerned communities that must be valued, supported, and strengthened for managing AFRICA's land resources.

When the goods and services can be sustainably derived from a healthy and stable land resource, the stage is set for high productivity, increased GDP and employment, thriving businesses, increased export potential, food safety and security, human health and well

[29] Derived from variations in local climatic conditions, landscape features, soil properties, surface and groundwater resources, vegetation types, as well as wildlife resources.
[30] This includes realising the potential economic and social benefits of particular areas from tourism through the preservation and development of wildlife habitats, scenic landscapes, and recreation opportunities.

being, and harmonious and cohesive communities at all levels of society. When well managed land resources have the potential to provide the wide range of sustainable livelihoods for different land users[31], accelerate sustainable rural development, enhance the quality of life for all society. However, inappropriate land uses and poor land management practices have led to a decline in their productivity and the capacity to produce goods and services, and therefore a reduction in their social and economic value for Africa.

Increasing Demand. However, while in many parts of the world population growth rates are declining, that of AFRICA is expected to still be growing at 2.1 percent per year to 2030, when globally every third person born will be a sub-Saharan African. By 2050, this will rise to every second person. Already population growth has exceeded the growth of Africa's GDP (particularly agricultural GDP) so that the population as a whole has become poorer over the last two decades. Such a rise in population and the subsequent changes in consumptive patterns will place further and severe demands on the continent's ecosystem resources, which will need to be better, managed if the human requirements, goods and services of AFRICA's rural populations, 83 percent of whom are living in extreme poverty, are to be met. Poverty, food insecurity, ill health, malnutrition and conflicts over scarce farmland, grazing, forest and water resources, as well as increased vulnerability to natural disasters, are the direct results of inappropriate development policies and programs that have failed to invest in the sustainable management of Africa's ecosystem resources.

Meeting the demand. Rebuilding Africa's natural capital assets is a prerequisite for sustainable social and economic development. Meeting demand requires increased quality and quantity of goods and services. This means successfully tackling land degradation through promoting and up scaling SLWM on the ground. Likewise, social resources will need to be enhanced through building the social capital assets of community-based groups, indigenous social networks, and local government and private sector support services. As well, it will require mainstreaming through integrating knowledge, expertise, participatory processes and reformed institutions and policies (particularly related to land tenure and markets) for long term change. Implementing such a holistic SLWM programme holds promise for prosperous landscapes and livelihoods in Africa.

Investing to make a difference. Increased investment in agriculture[32] is increasingly recognised as the key to reducing poverty and hunger, as this has been shown to have greater impact than equivalent investment in urban and industrial development (FAO, 2006). However, sustainable agricultural growth in AFRICA depends on restoring, sustaining and enhancing the productive capacity of AFRICA's land resources. This has been largely over looked, and under-funded, in past agricultural development strategies, which have taken the land resources for granted rather than recognising them as valued productive assets that require improved care and management to fully realise their potential.

Within the overall vision of the African Union's (AU) New Partnership for Africa's Development (NEPAD) [33] the vision for African agriculture[34] is to maximise the contribution of what is still the continent's largest economic sector. By 2015, the vision is to improve productivity of the agriculture sector to attain an average annual growth rate of 6% thereby enabling the agricultural sector to provide the strategic basis for eradicating poverty, achieving food security, and building the foundations of sustainable economic development (CAADP, 2002). However turning such a vision into reality requires that those rural households, private companies, and state enterprises, engaged in crop, livestock and

[31] From small-scale subsistence farmers to large scale commercial farmers/estate managers, pastoralists, ranchers, foresters, hunter/gatherers, game farmers, as well as nature reserve managers and eco-tourism companies.
[32] As advocated during the 2006 FAO World Food Day.
[33] Formally adopted at the 37th Summit of the Organisation of African Unity in July 2001.
[34] As set out in the Comprehensive Africa Agriculture Development Program (CAADP 2002).

forestry based enterprises for subsistence and commercial market purposes, pursue environmentally sound production measures. This in turn requires the development of a supportive enabling environment through mainstreaming the concepts and principles of sustainable land management into central and local government rural development policies and programs.

The Consequences of Land Degradation in Africa

> *"It's much harder to farm now than when I was young. We grow maize here to eat, and tobacco to sell, and vegetables, but the rains are affecting everything. We never had to apply fertiliser then, but now we do, and still we do not get as much from our crops as we used to. We are learning to grow different crops and to compost, but it's not enough."*[35]

This Malawian farmer's experience reflects the reality faced by a growing number of rural households in Africa. Some 59% of Africa's population still live in rural areas and primarily depend on the local land resources to meet their basic needs for food, fuel, water, shelter and cash. Increasingly such households are finding their livelihoods adversely affected by land degradation and climate change. A variety of scientific studies back up farmers' anecdotal reports, confirming that the quality – hence productivity – of Africa's land resources is declining while the number of poor people and the land derived goods and services are increasing dramatically.

About 874 million hectares of Africa's land is considered suitable for agricultural production. Of this, about 83 percent have serious soil fertility or other limitations and will need costly improvements and amendments to achieve high and sustained productivity.

Land degradation is continuing and increasing in severity and impact. If present trends continue two-thirds of Africa's croplands could effectively be non-productive by 2025 (UN, 2004). At the same time the total area and productivity of Africa's traditional rangelands is decreasing. The ecological, economic and social consequences of this will be severe, for not only the welfare of individual rural households, but also for future development and social stability, both urban and rural, at the country and regional levels. If nothing is done to address the problem, the future for Africa will surely be bleak.

Economic consequences Globally only 4.4% of GDP on average comes from the agriculture sector, however in AFRICA it is significantly higher, nearly 30% thus continuing land degradation is a major factor to Africa's underdevelopment. As land productivity has declined, the useful, or economic, yield from individual croplands, rangelands and forests/woodlands has also declined. Soil nutrient depletion in the fields of Africa's small-scale farmers is severe with inadequate replenishment of the nutrients lost due to soil erosion, leaching and removal in harvested products. Given the higher potential of irrigated areas, the economic losses due to land degradation per unit area will be significantly higher than in the continent's rainfed farming areas. Rangeland degradation involves both reduced forage productivity and quality, water cycling effectiveness, and resilience for drought. In years with unfavourable rainfall, this has often lead to massive livestock losses.

[35] The words of Denis James, a smallholder farmer with a family of 10, living in the village of Kholongo in central Malawi. From an article headed '*By November, people will start eating wild roots*' from the UK Guardian Newspaper of 25th October 2006.

Some of the Economic Consequences of Land Degradation within Sub-Saharan Africa

Economic Consequences	
Consequence	**Nature and Severity of the Economic Losses**
Loss of GDP	• Over 3% of Africa's agricultural GDP lost annually as a direct result of soil and nutrient loss – equivalent in cash terms to US$ 9 billion per year (Dregne, 1991, Dreschel et al., 2001).
Crop Yield Losses	• In originally fertile lands, under continuous cropping without nutrient inputs, cereal grain yields declined from 2-4 tons/ha to under 1 ton/ha (Sanchez et. al., 1997). • In 1989 estimated that crop yield losses due to past erosion ranged from 2 to 40%, with a mean of 6.2% for Africa. In the absence of erosion, 3.6 million tons more of cereals, 6.5 million tons more of roots and tubers, and 0.4 million tons more of pulses could have been produced (Lal, 1995). • A study of the effects of soil erosion in Malawi (World Bank, 1992) found annual yield losses for specific crops varied from 4 to 11 percent, while a large field survey in Tanzania found yields were 30% higher in the areas with least erosion compared to those with the most (Kilasara et al., 1995).
Loss of Land Productivity	• The productivity loss in Africa from soil degradation since World War II has been estimated at 25% for cropland and 8-14% for cropland and pasture together (Odelmann, 1998). • Irreversible soil productivity losses of at least 20% due to erosion are reported to have occurred over the last century in large parts of Ethiopia, Ghana, Kenya, Lesotho, Nigeria, Southern Africa, Swaziland and Uganda (Dregne, 1990). •
Soil Nutrient Loss	• Soil fertility degradation is considered the single most important food security constraint in AFRICA (in Verchot, et al., 2007) • For the last 30 years, estimated average annual losses per hectare in 37 AFRICA countries are 22 kg of N, 2.5 kg of P and 15 kg of K (Sanchez, 2002). Replacing these lost nutrients by purchasing mineral fertilisers would cost about US $4 billion. • Reported average annual soil nutrient losses of 23 kg/ha from 1983-1990 increased to 48 kg/ha in 2000 (FAO, 2006). • There is a negative nutrient balance in AFRICA's croplands with at least 4 million tons of nutrients removed in harvested products compared to the 1 million tons returned in the form of manure and fertiliser (FAO, 2006).
Loss of high value irrigated land through poor irrigation practices	• Many countries have lost a high percentage of their irrigated lands due to salinization Kenya (30%), Namibia (17%), Nigeria (34%), Sudan (27%) and Tanzania (27%). • In other countries the losses of irrigated lands are due to water-logging DR Congo (20%), Mauritania (50%) and Gambia (10%)
Increased food imports and high dependence on food aid	• Africa spent US$18.7 billion on food imports in 2000 alone. • The World Food Programme has spent US$12.5 billion (45 percent of its total investment since its establishment) in Africa and 50 percent in 2001. • In 2000, Africa received 2.8 million tons of food aid, over a quarter of the world total. (CAADP, 2002).
Reduced agricultural exports	• Of the total merchandise exports from Africa, the contribution from the agriculture sector has declined to 20% from over 50% in the 1960s. (CAADP, 2002)

Ecological consequences. The extreme ecological consequence has been the physical loss of formerly productive land thereby reducing the area available for crop, livestock and forest production. The degradation of other ecosystem resources notably forests, water and biodiversity has also had severe ecological consequences.

Some of the Ecological Consequences of Land Degradation within Sub-Saharan Africa

Ecological Consequences	
Consequence	**Nature and Severity**
Loss of productive land resources	• Between 4-7% of the land area of AFRICA is already so severely degraded that it is believed to be largely non-reclaimable (data from GLASOD and TERRASTAT). • This is the highest proportion of any region in the world.
Loss of forest resources	• 3.7 million Ha (0.7% of the total land area) lost to deforestation per year. • Between 1980 and 1995, Africa lost some 66 million ha of forest, with 65% going in the 1990s due to rising demand for farm land, timber and other forest products.
Loss of water resources (quantity and quality)	• Some 86% of African soils being under soil moisture stress (Eswaran et al., 1997 found in Swift and Shepherd, 2007) • Degradation of the region's watersheds and river basins, has led to river flows fluctuating more than before, with flooding more frequent and extensive in the rainy season, while water shortages are experienced for longer periods in the dry season. • Increased downstream sedimentation due to higher river sediment loads. • Increased surface runoff has decreased groundwater recharge – water tables have dropped, many former perennial rivers, streams and springs have been reduced to an intermittent flow, and many wells and boreholes have dried up. • Lake Chad has shrunk in size due to degradation of its catchment area, combined with over extraction of water from its tributaries for irrigation, and other purposes.
Loss of biodiversity resources	• 126 African animal species have become extinct[36] and a further 2,018 are threatened. • Some 125 plant species are recorded as extinct and close to 2,000 more are threatened, of which some 250 are critically endangered. (APEI 2003, IUCN 2006) • Loss of such species means a loss of part of the world's global heritage as well as the loss of potential economic opportunities both now and in the future.

Social consequences There is a strong causal link between the incidence of land degradation and the incidence of rural poverty, with the poorest rural communities in AFRICA generally located in the most ecologically fragile and degraded areas. As the land becomes more degraded, it produces less thus reducing the ability of poor households to meet their basic welfare needs. Poverty and land degradation feed off each other leading to an ever increasing downward spiral. This in turn increases the demands on state and local government welfare services for food aid and other forms of poverty relief. While the economic losses, from land degradation at the district and national levels, constrain the development of services in rural areas, and the availability of off-farm employment, further enhancing the reliance of resource poor rural households on the exploitation of their local land resources.

[36] Or extinct in the wild as some species may still survive in zoos.

Some of the Social Consequences of Land Degradation within Sub-Saharan Africa

Social Consequences	
Consequence	**Nature and Severity**
Increased poverty	• In 2001 45% of Africa's population lived below the poverty line of less than $1 per day. • If nothing changes, absolute numbers of poor will continue to increase, so by 2015 close to half the world's poor will live in Africa.
Reduced food security	• In the decade 1990-2000 cereal availability per capita in AFRICA decreased from 136 to 118 kg/year
Hunger and malnutrition	• In 1997-99 some 194 million people (up from 167.7 in 1990-92) or 34% of the population of AFRICA had insufficient food to lead healthy and productive lives. • At the end of the 1990's, in 30 African countries over 20% of their population were undernourished, and in 18 over 35% were chronically hungry. • In 2001 28 million people in Africa faced food emergencies due to droughts, floods and strife, with 25 million needing emergency food and agricultural assistance. • In sub-Saharan Africa, 15 percent of the population or 183 million people will still be undernourished by 2030 – by far the highest total for any region, and only 11 million less than in 1997-99 (CAADP 2002). • Malnutrition is expected to increase by an average of 32% (UNDP 2006).
Increased health problems	• Hunger and malnutrition in Africa has increased susceptibility to malaria, HIV-AIDS and tuberculosis. (CAADP 2002, Sanchez 2002). • Degradation of water resources has increased the risk of water borne diseases.
Forced migration	• Land degradation has led to forced migration of individuals, rural households and whole communities, when declining productivity meant their land resources could no longer provide for their needs, or when their personal security was threatened (e.g. by encroaching sand dunes, floods or land-slides).
Increased land resource conflicts	• Conflicts (between settled farmers, herders and forest dwellers) over access to land resources have increased as households and communities affected by land degradation have encroached on the traditional lands of others in the search for new land for their crops and/or livestock.

Through its impact on crop yields, livestock productivity, availability of forest products, and indirectly on fisheries, land degradation reduces the ability of individual rural households to be food secure. Malnutrition due to poverty and declining food production and quality, combined with increased water borne diseases due to declining water quality, will result in increased health problems with their associated costs at both the individual household and wider society levels.

Given the extreme reliance of rural livelihoods on agriculture, forestry and livestock, it is reasonable to conclude that persistent and deepening poverty in Africa is in part an outcome of stagnation in the productivity of land and labour, itself a consequence of land degradation and unsustainable agricultural practices.

Annex 2: Agricultural water projects and poverty reduction

Direct and indirect impacts on income poverty reduction

Investment in agricultural water management can reduce income poverty directly and indirectly. The first direct effect is on farm incomes: agricultural water management can increase yields, allow an increase in the intensity of cropping and a change to higher value crops, and hence increase farm outputs and incomes. Farm outputs and incomes can also be increased because irrigation itself justifies the use of complementary yield enhancing inputs. For example, the component study on agricultural water development for poverty reduction in Eastern and Southern Africa (IFAD, 2007) reviewed five irrigation development programs in Madagascar, Tanzania, and Zimbabwe. Average increases in *per capita* farm incomes 'with project' on rice projects in Madagascar and Tanzania were found to be in the range of 86-220 percent, while incomes on non-rice projects in Zimbabwe increased between 14 percent and 600 percent. The average increase in *per capita* farm incomes across the sets of case study projects was 226 percent. Investment in irrigation, in these cases, more-than trebled average *per capita* incomes. Moreover, none of the projects studied was achieving anywhere near optimum yields and outputs. For example, the weighted average paddy yields 'with project' at one project studied (Upper Mandrare Basin Project, Madagascar) were only 1.9 t/ha and 1.3 t/ha respectively for the main and off-season crop — clearly well below potential. Similarly, average irrigated grain maize yields at three non-rice projects studied in Zimbabwe were only 2.5-3.4 t/ha — also well below potential. The lesson is clear: even moderately performing investment in irrigation can have significant impacts on farm incomes and hence on poverty reduction. The corollary is that such projects could have a far greater impact on poverty reduction if they performed better.

The second direct effect of agricultural water management on income poverty is via rural employment: additional demand for labor is created first for construction and on-going maintenance of canals, wells, pumps, and the like (or land preparation in the case of investments in in-field rainwater management), and second for crop production and farm-to-market activities. Thus, agricultural water development increases both the numbers of workers required and (because of multiple cropping) their period of employment (Lipton et al., 2003). In the projects analyzed in the component study, investment in irrigation was found to have resulted in an incremental 45 days/ha of wage labor on average, over and above farm family labor, valued at approximately $1/labor-day (IFAD, 2007).

The third direct effect is via food prices: increased food output can reduce local food prices and so improve real net incomes among net food purchasers, including both rural and urban poor. At the same time, positive effects on real net incomes will still be experienced by net food producers and wage laborers provided the effect of reduced prices is offset by increased output and employment. On the other hand, negative effects may be experienced by surplus producers in remote dryland cropping areas when agricultural water development is introduced. However, because the majority of the poor in sub-Saharan Africa are net food purchasers, the overall net effect of reduced food prices on income poverty reduction and hunger can be expected to be positive (Lipton et al., 2003).

The indirect impacts of agricultural water development on income poverty can include those obtained via rural and urban employment as a result of growth in the rural and urban non-farm economy. Agricultural growth can influence non-farm activity in at least three ways: through production, consumption, and labor demand links (Rosegrant et al., 2005). Income and employment multipliers within the surrounding non-farm economy can be particularly large: between 1.5 and 2.0 in Asia (Haggblade et al., 1989 and Hazell et al., 1991; both cited in Rosegrant et al., 2005), although they are only about one-half as large in Africa (Dorosh et al., 2000 and Haggblade et al., 1989; both cited in Rosegrant et al., 2005).

Lower multipliers in Africa were attributed by Dorosh et al. to low per capita incomes, poor infrastructure, and farming technologies that required few purchased inputs — in other words, to a less developed agriculture sector. Water-managed agriculture intrinsically involves higher levels of inputs — including labor — and results in greater employment, outputs, and incomes than dryland agriculture. Thus, the multipliers from successful agricultural water investment are likely to be higher than those for investment in dryland agriculture in general. Although no information was available on the non-farm employment impacts of agricultural water development in sub-Saharan Africa, non-farm employment in India has been found to be higher in irrigated villages than in non-irrigated villages (Dasgupta et al., 1997; Jayaraj, 1992; Saleth, 1996, all cited in Rosegrant et al., 2005). At the large-scale Muda Irrigation Project in Malaysia, for example, for every dollar of income generated directly by the project, another 83 cents was generated in the form of indirect or downstream income benefits (Bell et al., 1982, cited in Rosegrant et al., 2005). *To sum up, even moderately successful investment in agricultural water development can treble per capita farm incomes and provide additional wage employment of approximately 45 labor-days/ha —, which in itself has a significant impact on income poverty reduction.* Every dollar of income so generated probably generates at least US$ 0.40-0.50 in the form of indirect income benefits. This is so even for investment projects that perform no better than modestly.

Agricultural water development could also be one of the better alternatives for poverty reduction. Clearly, investment in agricultural water development can have substantial impacts on income poverty reduction, but is it the best of the available alternatives? As discussed, when up to 90 percent of rural people are poor and rely on agriculture for their primary livelihoods, significant growth in agriculture is a necessary step toward poverty reduction. Although improved primary education, better health services, clean water and better roads are all important and appropriate investments, they are not sufficient in and of themselves to generate increased rural incomes (Brooks, 2005). Since agricultural growth is so important for poverty reduction when compared with the available alternatives, agricultural water development could be even more so, since the potential income growth per hectare from successful investment in agricultural water is greater than that from dryland agriculture. Although data are not available to prove the validity of this assumption for sub-Saharan Africa, differences in the rate of growth of average agricultural output per unit of crop area were important in explaining cross-state differences in rural poverty reduction in India, for example, where the impact of irrigation in reducing poverty was found to be even higher than that of rural literacy and significantly higher than roads, fertilizers and modern varieties (Datt et al., 1997, cited in Rosegrant et al., 2005). If this is the case elsewhere, there would appear to be no reason why the same should not apply in sub-Saharan Africa.

Furthermore, the income poverty reduction impacts of agricultural water investment can induce positive impacts on other MDGs. The income poverty reduction impacts of agricultural water investment induce important positive impacts on other MDGs, including reduced hunger, improved access to primary education, safe drinking water, and basic sanitation, as well as a contribution to improved maternal health, reduced child mortality, and generally better nutrition and health (IFAD, 2007).

Targeting the poor and women

Some irrigation project designs of the past two to three decades have attempted —usually unsuccessfully — to target the poorest. Defining extreme poverty in terms of the MDG income poverty level has now simplified targeting. Where targeting the poorest socioeconomic stratum has been specified in the past, it has rarely been implemented as planned (IFAD, 2007). Either the technology was inappropriate for the poorest and the targeting methodology was weak or implementation staff had not fully understood the

intentions or found it socially infeasible to carry out because of the socio-geographical and political implications of excluding the less poor. Defining extreme poverty in terms of per capita income of less than $1/day has simplified targeting, as most rural people in the region have to subsist on less than this amount. For example, in the Madagascar, Tanzania, and Zimbabwe cases cited above, no attempt was made at targeting, yet it is clear that it was mainly the extreme poor who benefited because average without-project farm incomes ranged from only $0.03 to $0.13 per capita-day.

Agricultural water investments, even without targeting, will therefore mainly benefit the extreme poor, although in a range of different ways. It is likely that the vast majority of the rural populations of sub-Saharan Africa fall into the category of 'extreme poor' and almost any agricultural water development based on principles of profitability and equity will benefit a majority of poor people. However, different poor people may benefit in different ways: some will benefit from direct participation as producers, others will benefit directly from agricultural wage employment, others from access to crop by products for livestock and others from employment in upstream and downstream economic activities generated by the investment. Moreover, it is usually the poorest stratum that benefits most from the additional wage employment opportunities generated by investment in agricultural water (IFAD, 2007).

There are, however, a number of ways in which the poverty reduction impacts of investments can be enhanced. The first step is to understand the socioeconomic profile of the communities, how they derive their livelihoods, what their constraints are, how they interact socioeconomically, and how agricultural water management can improve their livelihoods. Based on this knowledge, measures can be included to make projects more pro-poor. These measures include: (a) capacity building and empowering the poor to participate effectively, (b) ensuring that the voice of the poorer segments of communities is adequately heard in participatory planning and land and water allocation decisions; (c) minimizing involuntary resettlement and ensuring that the poor are not excluded or further marginalized by the development; (d) strengthening the bargaining powers of the poor though institutional reform and facilitating their access to land and water; (e) targeting the poor with extra technical support; (f) ensuring that the entry price is affordable to the poorest stratum, for example, by the use of affordable technologies; (g) ensuring that cost-recovery arrangements/water charges are not unfairly weighted against the poorest stratum; and (h) optimizing the potential for direct and indirect employment gains.

Targeting agro-ecological zones and farming systems with high agricultural potential and concentrations of poverty can also be pro-poor. It was found that when arid and semi-arid zones had been targeted for poverty reduction, the results were mixed, mainly because of the generally high costs of water development in such zones, their general remoteness from markets and their sparse populations (IFAD, 2007). In contrast, the more humid agro-ecological zones, which also coincide with high incidences of poverty, provide better potential for investing in agricultural water for poverty reduction (Dixon et al., 2003). This perhaps surprising suggestion may be explained by considering that, as population densities increase, farmers gradually shift from extensive to increasingly intensive production systems. The trend is encouraged once significant market opportunities emerge. Where population densities are high, where a process of intensification has already started, and where market opportunities are emerging, investment in agricultural water development is therefore likely to be more successful than in the drier zones. This does not exclude the possibility that there will be opportunities for investment in agricultural water management in the arid and semi-arid zones and that these could make a significant contribution to poverty reduction and growth — provided they are demonstrably economically viable and physically sustainable.

In addition to considerations of gender equity, targeting women can also enhance poverty reduction impacts. Women contribute 60-80 percent of labor for food production in sub-

Saharan Africa, typically with a major role in planting, weeding, application of fertilizers and pesticides, harvesting, threshing, food processing, transporting, and marketing, while men are generally responsible for land clearing and preparation, including plowing (FAO, 2003a). This division of labor also applies in irrigated agriculture. In many Southern African countries, the proportion of female-headed rural households and women-led farms may exceed 50 percent (IWMI, 2005g). At selected schemes in Zimbabwe, for example, 20-64 percent of the plot holders were female-headed households (IFAD, 2007). In rice-growing areas in West Africa and parts of Southern and Eastern Africa, paddy cultivation is increasingly becoming a 'female farming system' in which women are often the decision makers on formerly male managed farms as a consequence of male migration to towns for work (IWMI, 2005g).

Women often take the lead in fruit and vegetable production (Box 3.4), as well as in production support activities such as savings groups (IFAD, 2002). Studies have shown that gender-equitable agricultural production boosts productivity (IWMI, 2005g). Clearly, targeting women for training and support services and ensuring their equitable participation in the benefits of agricultural water investments can improve productivity and enhance poverty reduction. Yet, despite the rhetoric, most staff in support services are male and policies and communications strategies are biased toward males. Projects can compensate for these biases by building gender considerations into design and implementation from the outset (IWMI, 2005g).

Annex 3: Investment Performance and Development Impact in Agricultural Water Development

Rates of return Although there were many failures in the 1970s and 1980s, recent irrigation projects have generally had acceptable rates of return. A component study for the collaborative programme study report (IWMI, 2005b) reviewed 45 donor-financed projects implemented in the region from 1970 onwards. The study found that externally financed projects in the 1970s and up to 1984 had often dismal outcomes: investment was largely in development of new large-scale irrigation, with very high costs per hectare and low or negative rates of return. Subsequent to 1985, outcomes improved: of the 22 sub-Saharan Africa projects reviewed that began in 1985 and later, only one had an ERR below 10 percent and others had ERRs ranging up to 60 percent and above. The key factors associated with higher rates of return include lower per hectare costs, market access, productivity, and institutional design. A number of factors influence rates of return. The study found that sub-Saharan Africa projects with higher per hectare costs tended to have lower ERRs, and 'failure' projects (those with ERRs below 10 percent) had, on average, unit costs per hectare four times those of 'successful' projects (ERRs above 10 percent). The component study found that lower-cost 'improvement' projects have higher ERRs than new construction projects (IWMI, 2005b), a finding which is confirmed by the Zimbabwe experience where upgrading cost 20 percent of new gravity development and 40 percent of new pumped supply and where upgrading projects had very much higher rates of return (IFAD, 1999, cited in World Bank, 2005c).24 Second, market access matters: projects where higher-value crops can be sold profitably do better — in Zimbabwe, projects with good market access have rates of return generally at least three times higher than where market access is poor (IFAD, 1999, cited in World Bank, 2005c). Third, productivity makes a difference: in an example from Malawi, where 28 small-scale schemes were ranked according to the use of production factors, the low input-low output schemes all had significantly lower ERRs — and five had negative ERRs (Malawi Small- Scale Irrigation Development Project). Finally, attention to institutional and software aspects of projects matters, particularly empowerment of farmers and streamlining of the role of public agencies is important. Systems managed by farmers or jointly by farmers with government have performed significantly better than systems managed solely by a government agency (IWMI, 2005b).

Sustainability Returns to investments in irrigation can be high, but the risks are also high, and irrigation projects have a mixed track record on sustainability. Despite the findings of the component study that rates of return for completed projects have largely improved, the record on sustainability has been mixed. The frequent need for rehabilitation projects in large-scale irrigation in sub-Saharan Africa (Sudan, Madagascar, Mali) is testament to the poor sustainability of some supposedly 50-year investments in the sector. Rates of return calculated for externally financed projects at completion of the construction phase have sometimes had to be revised downward subsequently, and current reports of the performance of projects previously rated as 'successful' are sometimes not encouraging.

Are irrigation investment costs higher than elsewhere? *Past studies found the cost of irrigation development in the region to be excessively high.*

A 1995 study found that World Bank-financed irrigation projects in sub-Saharan Africa cost an average $18,000/ha, compared to an average worldwide of $4,800/ha (World Bank, 1995). These findings reflected the very high cost of the generation of large-scale schemes constructed in the region in the 1970s and 1980s — the nine major donor financed projects in the period 1975-79 had an average cost per hectare of $24,500. Not surprisingly, governments and financiers tended to view irrigation investments as high cost and uneconomic, particularly large-scale investments that carry greater environmental and

social risk. Investment behavior has been risk averse in recent years and investment in irrigation has dropped. The component study on irrigation investment costs (IWMI, 2005b) found that the new generation of irrigation projects in sub-Saharan Africa is not much more costly than those in other regions. Irrigation projects that could be called 'successful' because their rate of return at completion was more than 10 percent did not have costs that were very much higher than those of developing countries were as a whole. For new construction, sub-Saharan Africa 'successful' projects cost somewhat more than successful projects in Asia, but less than those of the highest cost region, the Middle East and North Africa. The cost of 'failure' projects in sub-Saharan Africa was significantly higher than for developing countries as a whole. The costs of 'failed' projects in the region (EIRR <10 percent) averaged $16,000-23,000/ha. However, as noted above, project performance appears to have improved in recent years — only one post-1990 project appears among the 'failures' in the sample.

Main factors affecting costs *The biggest determinant of project costs is the type of irrigation investment financed.* The range of costs in the sample for the component study is huge — from $225/ha for simple rehabilitation to $55,000/ha for a large-scale multi-purpose project. The principal reason for the lower unit costs of projects in recent years is the move away from the construction of large-scale schemes in the 1970s and 1980s to rehabilitation projects and, more recently, to small-scale and micro-irrigation projects. Evidently, the lessons of the past have, to some extent at least, been learned. This change is also linked to the continuing decline in cereals prices and hence to the deteriorating economics of large-scale irrigation for staples, and to the improving economics of horticulture, for which smaller scale and micro-irrigation is well adapted (IWMI, 2005b). *The evidence on economies of scale is mixed.* The component study found that unit costs vary inversely with project size, i.e., there are economies of scale, but that within larger projects smaller scale schemes had higher economic returns (IWMI, 2005b). By contrast, an FAO study (FAO, 2005b) found only weak correlation between project size and unit costs. Although the sample sizes in the studies are too small and the population too heterogeneous to establish very clear conclusions, it is likely that the region's high software costs do reduce when apportioned over larger projects. *Community empowerment may keep costs down — and improve performance*. The component study found that community involvement in decision making keeps costs down and improves performance. Projects where farmers themselves made larger capital contributions and managed irrigation systems, or shared management with a government irrigation agency, record significantly better results in terms of project performance and unit costs (IWMI, 2005b). *To some extent, these lessons on keeping costs down are already being reflected within recent projects.* More recent projects are selective in choice of technology and are often decentralized and farmer-driven, with higher farmer contributions, leading to lower unit costs. For example, for new development at Mali's Office du Niger, farmers were asked to contribute 20 percent of the total cost. As a result, development costs, which have typically exceeded $10,000/ha for large scale development, were only $2,518/ha (Aw and Diemer, 2005).

Experience of design and implementation: The component study on the design and implementation processes (IWMI, 2005d) found that project design in the past was largely top down, although newer projects are adopting more participatory approaches. Although there was a wide divergence of experience, the study found that past project design was generally characterized by a lack of fit of projects to goals, lack of consideration of alternatives, and lack of demand drive. Schemes developed by governments were often based on imperfect understanding of markets, farming systems, and livelihood strategies. The component study found that newer projects have adopted a less top-down approach. In some countries, a start has been made on integrating user participation (intellectual and financial) into project planning and implementation. Some of these projects are carried out through decentralized units as part of larger community driven rural development programs. In fact, many of the donor-financed projects that have been evaluated as successful on completion in recent years have been characterized by both decentralized and participatory

approaches. It is, however, too early to tell whether these approaches consistently improve project performance and if decentralization has encountered problems. *The quality of projects has been reduced by common weaknesses in preparation.* Weaknesses include: (i) poor treatment of the key land and water security issues, (ii) lack of adequate environmental assessment; (iii) lack of evaluation of markets and profitability; (iv) lack of a related realistic agricultural support package; (v) over-estimation of institutional capacity, evidenced by too complex designs and too many components; and (vi) poor technical design and over-optimistic hydrological analysis (IFAD, 2007). This weakness has resulted in technology choices and costs that were not appropriate for the market prospects of the crops grown (IWMI, 2005d).
Farmer empowerment appears to improve project quality. Underlying these weaknesses, the study found a pervasive top-down approach and neglect of farmer ownership. By contrast, approaches that empower farmers by taking them in as partners and decision makers from the beginning and supporting their development as commercial agents equipped to deal in the market place from the beginning appear to have the potential to improve the economics and prospects for sustainability of projects. Approaches to empowerment found to significantly improve project quality at entry include moving responsibility and capacity for project implementation and services to the local level, increasing the participation of disadvantaged groups in decision making, improving the accountability of service providers, and helping smallholders form strong organizations (IWMI, 2005d; World Bank, 2005m). *Weaknesses in institutional capacity have impaired project implementation.*

The study found that implementing agencies have often proved inadequate to the tasks they were given. In many cases, weaknesses reflect the complexity of the organizational structures set up and the performance of the staff involved. Public agencies have often lacked the skills, resources, and incentives to do the job assigned to them and the comparative advantage of the private sector or NGOs for certain tasks has been generally ignored. Project agencies also had difficulty in coping with design changes as implementation proceeded. A particularly difficult challenge has been dealing with the social and cultural problems encountered where institutional changes such as irrigation management transfer or private sector participation were part of project implementation (IWMI, 2005d; FAO, 2006).

Inadequate support to the implementing agencies has also been a cause of poor quality. In general, the component study found that governments and donors have provided a supervision process that did not match the challenge of implementation under conditions in the region, and this support has stopped too early in the cycle. There has been overemphasis on reaching physical and disbursement targets at the expense of development effectiveness (IWMI, 2005d; IFAD, 2007). Even where promising new approaches such as decentralization and participation were incorporated into projects, success has not been automatic: problems of technical, financial, and social feasibility have constantly arisen during implementation. The managers of even well implemented projects have sometimes lost sight of the poverty reduction and cost effectiveness imperatives. In general, governments and donors have not reacted with a supportive and flexible approach to help managers trying to implement projects. Weaknesses in the learning process have made it hard to assess project impacts and to rectify shortcomings as they have occurred. Monitoring and evaluation have generally been poorly handled, with design only loosely tied to the Log Frame, which should form the basis for the monitoring and evaluation system. Implementation of M&E systems has typically started far too late in the cycle and there has been an almost complete failure to recognize that: (a) information systems are not only a fundamental requirement for project-level M&E but also for farmers' enterprise management purposes, and (b) that farm-level information systems are required to feed into project level M&E systems. Thus, although many projects have poverty reduction objectives, almost none has monitored indicators of income such as input levels, yields, production, and prices

(IWMI, 2005d). In a study of six projects in the region, in not one single case were inputs, yields, prices, and farmer incomes systematically measured. As a result, it was not possible for farmers to accurately judge the effectiveness of improved technologies, nor was it possible for the projects to provide adequate ex post justification for the investments made. No realistic assessment of the poverty reduction impacts of these projects could be made. Moreover, the lack of monitoring applies equally to environmental and health aspects, despite their obvious relevance to sustainability (IFAD, 2007). Poor sustainability in subsequent operations reflects weaknesses in design and implementation. The component study found that weakness in scheme operations after completion of the physical works largely stemmed from weaknesses earlier in the project cycle: over-estimate of water resource availability, poor design and construction, inadequate attention to institutional arrangements and agricultural support services, and above all, the general neglect of farmer empowerment and underlying conditions of profitability. The most telling indictment is that in many cases farmers have refused to take over responsibility for operation and maintenance of schemes supposedly developed for their interests (IWMI, 2005d; FAO, 2006).

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