

Nile Basin Initiative
Efficient Water Use for Agriculture Production Project

Rapid Baseline Assessment

Rwanda

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Table of contents

Table of contents	2
Acronyms and abbreviations	4
Existing studies	8
Chapter I Physical characteristics	12
Chapter II Role of agriculture in Rwanda economy	15
Chapter III Assessment of the agriculture sector	16
2.1.Farming	16
2.2.Institutions	17
2.3.Main agriculture production	21
2.4.Livestock production	25
2.5.Forestry	26
2.6.Fisheries	26
2.7.Agro business	27
2.8.Horticulture	27
Chapter IV Constraints of the agriculture sector	29
3.1.Physicals	29
3.2.Socio economics factors	30
3.3.Institutions and policy	32
3.4.Climate uncertainty	32
3.5.Education	33
3.6.Planning	33
Chapter V Opportunities	35
4.1.Soils and climatic conditions	35
4.2.Available water resources	36
4.3.Infrastructures	38
4.4.Policies and legal framework	39
4.5.Education	41
4.6.Population	42
Chapter VI Best practices for efficient water use for agriculture production	43
5.1.Rainwater harvesting	43
5.2.Soil erosion control	44
5.3.Community managed irrigation schemes	46
5.4.Public private irrigation schemes	50
Chapter VII Potential interventions	51
6.1.Capacity building	51
6.2.Policy, strategies and legislations	52
6.3.Best practices on rainwater agriculture	52
6.4.Community managed irrigation	53
6.5.Private irrigation	53
6.6.Benchmark for Monitoring and evaluation	53
Conclusions and recommendations	55
Bibliographie	57

<u>Addendum</u>	<u>58</u>
<u>(b)Terms of references.....</u>	<u>58</u>
<u>People interacted with</u>	<u>67</u>

Figures

Figure 1 Map of agro - ecological areas of Rwanda in relation to altitude. Delepierre, 1982.....	13
Figure 2 Foodstuffs importation (Adapted from data provide by the National Bank, and the Ministry of Economy and Planning)	23
Figure 3 Trends in Agriculture Productivity and estimated water use (Source: Rwanda and Nile: Water plans and their development 1962-2006. (Baligira Robert, 2007. Unpublished work).....	24
Figure 4 Erosion process in Rwanda after Roose, 1992.....	45
Figure 5 Evolution of progressive to horizontal terraces. After Galliker, 1992.....	46
Figure 6 Irrigation water use per District.....	48

Tableau

Tableau 1 Agro climatic zones in Rwanda	13
Tableau 2 Crop production 1994 -2005.....	22
Tableau 3 Marshland development for rice crop production	47
Tableau 4 Planned pilot Project for hillside irrigation	50

Acronyms and abbreviations

AEP	Adduction d'eau potable
APSP	Agricultural Processing Strategy Plan
ARC	American Refugees Committee
ARPEF	Rwanda Flower Producers Exporters Federation
BCEOM	Société française d'Ingénierie
BRL	Bureau d'Etude Français
DRC	Democratic Republic of Congo
Electrogaz	Etablissement Public de Production de Transport, et de Distribution d'Electricité, d'Eau et de Gaz
ESA-EPA	East and South African Export
EXPERCO	Bureau d'Etude Canadien
EWUAP	Efficient Water Use in Agriculture Project
GIRE	Gestion Intégrée des Ressources en Eau
FAO	Food and Agriculture Organisation
FSCN	Forum de la Société Civile sur le Nil
JICA	L'Agence Japonaise de Coopération Internationale
NBI	Nile Basin Initiative

ISAE	Institut Supérieur d'Agriculture et d'Elevage
ISAR	Institut des Sciences Agronomiques du Rwanda
KIST	Kigali Institute of Science and Technology
LWF	The Lutheran World Federation
MFI	Micro-Finance Institutions
MINITERE	Ministère des Terres, de l'Environnement, des Forêts, de l'Eau et des Mines
MSF	Médecin Sans Frontières
MININFRA	Ministère de l'Infrastructures
MINISANTE	Ministère de la Santé
OMS	Organisation Mondiale de la Santé
OER	Observatoire de l'Eau du Rwandais.
ONG	Organisation Non Gouvernementale
PDRCIU	Projet de Développement des Ressources Communautaires et des Infrastructures de l'Umutara
PRSP	Programme Stratégique de Réduction de la Pauvreté
PAD	Project Appraisal Document
PEAMR	projet de Réhabilitation des Adductions d'Eau en Milieu Rural
PIP	Project Investment Plan
PGNRE	Projet de Gestion Nationale des Ressources en Eau
RBS	Rwanda Bureau of Standardisation
REMA	Rwanda Environmental Management Authority
SGI	Société Générale d'Ingénierie
SHER	Société Hydraulique et d'Equipement Rural
SNAQUE	Stratégie Nationale de l'Analyse de Qualité de l'Eau
SOFRINCO	Bureau d'Etude français
UBPR	Commercial Banks and the
UEA	Unité Eau et Assainissement (nouveau nom de l'ancien Direction de l'Eau et Assainissement)

UNICEF	United nations international children's emergency fund
UNR	Université Nationale du Rwanda

Introduction

This study describes the agriculture sector in Rwanda with special reference to three components of efficient water use for agriculture which are water harvesting, community managed irrigation and private and public- managed irrigation. The current study lies within the scope of the project of efficient water use for agriculture production under the Nile Basin Initiative. The objective of the EWUAP is to provide a sound conceptual and practical basis for Nile riparian countries to increase the availability and efficient of water use for agriculture production. This is in keeping with a vision articulated by the Nile basin countries: “to achieve sustainable socio economic development through equitable and benefit from, the common Nile water resources”.

The study contains 7 chapters. The first and second chapters refer to Rwanda physical characteristics and the role of agriculture in the national economy. The third introduces the agriculture sector. It gives brief description of agricultural production system in Rwanda taking into consideration different agro climatological regions in place. The fourth and the fifth chapters analyze constraints and opportunities in agriculture sector, the sixth will look into best practices in the face of water harvesting community managed irrigation and public/private managed irrigation, the seventh chapter discusses potential intervention lastly the report will end with conclusion and relevant recommendations as regards the to efficient water use in agriculture for various users at the national level with emphasis on transboundary water.

Generally, the documents, reports and other information collected ended in these results:

- a) The major source of information on water use in agriculture comes mainly from MINAGRI and its research and public service extensions. Data available include best practices mainly on soils conservation techniques. Water use in agriculture is limited to rainfall and the agriculture production depends on season variation. There is no clear indication on how much water is used for crop production. Data related to water use for agriculture production remains disparate and diversified and the relations of collaboration between various services implied in the follow-up of the water use in agriculture on each level (Government department and other partners such as ONG' S, the private sector,...) are non-existent and the methods of data collection are not standardized.

- b) A number of NGO's are involved in water management for agriculture production. Their participation includes soils conservation activities and bottom valley as well as marshlands reclamation. The methodology used is based on participative approach whereby farmers are gathered in associations to fight against erosion and the safeguard of the environment. By this mechanism, the farmers are sensitized with different techniques on soils conservation (terracing, ...) and the construction of water harvesting facilities.
- c) The sector of water management for agriculture lacks of skilled staffs. This problem exists on all the levels (Ministries, Districts and private sector), thus it proves to be necessary to reinforce the capacities building through all level of natural resources management. The integrated water resources management developed by international Water Management institute (IWMI), FAO and other organizations should be used as a guideline to promote the water use efficiency in agriculture.
- d) The Government of Rwanda is highly concerned by the question of water and the environment management. Important steps took place whereby a water law has been initiated with specific reference to IWRM. Other structures (REMA, RBS) were also institutionalized to enable suitable environment for water resources planning and management. The law in progress envisages equitable utilization of resources as per each sector demand.
- e) The high population density, steep slopes, and abundant rainfall prevail in the highland portions of the country make the task of erosion control a challenging issue for the Government and the peasant farmer.

Existing studies

Material analyzed during this study includes primary and secondary sources on soil and water conservation for agriculture production. The following mains reports are herewith described:

- The National Water Resources Management Project reports, 2005 (PGNRE) prepared by SHER, SGI, SOFRINCO and BRL. Those reports give detailed of information on water use and its management in different sector of the national economy. These reports mention that the field of water is multi sectoral and consequently the water management is a key

- element for economic development and hence poverty reduction. Those reports emphasis on the creation of water agency with an integrated water resources management approach.
- The water sectoral policy adopted in 2004 by MINITERE has an objective to improve the water management, to increase the rate and access of drinking water, to optimize the water use in different economic sectors (Agriculture, Energy, Transport....) and to improve healthiness of the urban and rural areas. According to the document, a framework of coordination of the sector will define the role of the principal speakers which will be installed in order to avoid the scatter of the efforts.
 - Efficient water use for agriculture production. Project document. March 2001. The primary focus of this project document is on agronomic water use efficiency in the sense of increased value of agricultural production or “more crop per drop.” This is reflected by the priority themes of the country reports prepared by national experts in Basin countries. The working hypothesis is that a project focusing on increasing water availability and its efficient use could lead to increased agricultural production. The primary opportunities identified are to better manage watersheds, to enhance productivity of rain-fed agriculture, to identify options for development of community-managed irrigation schemes, and to improve management of public irrigation systems, while at the same time strengthening government institutional capacity.
 - The Rwanda’s Economic Development and Poverty Reduction Strategy (EDPRS): 2007 redefines the country’s priorities and gives a medium-term framework for achieving the country’s long term development aspirations as embodied in Rwanda Vision 2020. The document mainstreams agricultural productivity to ensure that Rwanda meets its growth target. To this end, the area protected against soil erosion will rise from 40% of the agricultural land area in 2006 to 64% in 2012. The proportion of rural households with livestock will rise from 71% to 82%, the application of inorganic mineral fertilizer will increase from 11% to 17%, and the use of improved seed will rise from 24% to 37%. The area under irrigation will increase from 15,000 to 24,000 hectares, and of this, the hillside area irrigated will expand from 130 hectares to 1,051 hectares. The area of reclaimed marshland will increase from 11,105 hectares to 16,442 hectares.

- The water sectoral policy adopted in 1998 prepared by the Ministry of Agriculture, Livestock, Environment and Rural Development. The policy was jointly developed with other government Ministries that have functions which relate to water. The policy recognize that the country possesses water in abundant quantities, however the population increase, growth in agriculture sector and urbanization progress lead to increased use of supply and utilization. The policy aims at providing guidelines for efficient water use in the different sectors (water supply, and sanitation, agriculture, fisheries, industry, etc. It addresses the issues related to quantity, quality and reliability of the country's water resources so as to achieve optimum long term, environmentally sustainable social and economic development. The policy marked an important point in the water resources development in term of legislation.
- PAD Project Appraisal Document (PAD): the document refers that rain-fed agriculture prevails in most of the southern and eastern parts of the Nile basin, where rainfall varies greatly. Food production in the Nile Basin countries meets approximately 75 percent of demand. Except for Egypt, the Nile Basin countries are classified as food insecure, yet their policies focus on food self-sufficiency at the national level instead of on food security, which would be facilitated by improving the regional integration of markets. The **Efficient Water Use for Agricultural Production** project will support cross-border dialogue and exchange on policy issues such as options for reform in publicly managed irrigation, as well as national-level consultations on agriculture and irrigation policy at country request. Improved enabling environment for sustainable watershed management and increased productivity by improved watershed management demonstrated
- The Poverty Reduction Strategy Program (PRSP)- prepared between June 2000 and June 2002, via a national consultative process. The PRSP's objectives fall in the line of 2020 vision and include: (i) to improve the people's living conditions, (ii) to reduce to 25% by 2015 the percentage of the population living below the poverty threshold (compared to 60% in 2002) and (iii) to increase the per capita income from USD 230 in 2004 to USD 1000 by 2020. This performance would largely come from agricultural development and processing, and the creation of additional jobs in the sector. The PRSP identified the following areas, classified by order of priority: rural development and agricultural processing; human development; economic infrastructure; governance; private sector

- development; and institutional capacity building. The PRSP strategy aims to attack the decline in soil fertility and the low use of inputs. An environmentally sustainable labour-intensive public works programme will be developed focusing on soil, water and forestry conservation and management.
- Minagri, *Formulation de la Strategie de Developpement Agricole*, Mars 1998. The Agricultural Development Strategy for 1998-2003 shifted policy thinking towards maximising the economic benefits for agriculture by adopting more intensive farm production systems, with regional cropping specialisation. The objective aims at increasing rural income, enhancing food security, and converting agriculture into a viable sector by moving away from subsistence to a market based activity. Minagri has identified priority subsistence crops, namely maize, beans, potatoes, sorghum and cassava for subsistence and tea and coffee for export whereby rice production should be encouraged in the marshlands.

Chapter I Physical characteristics

Rwanda is one of the 10 riparian Nile Basin countries. It is located in the Southern West of the Victoria Basin and belongs to the Upper Nile River States. The country is located at the following coordinates 1°04' and 2°51' south latitudes, 28°45' and 31°15' east and shares its borders with the Democratic Republic of Congo in the West, Uganda in the North, Tanzania in the East and Burundi in the South. The total area surface is 26,338 sq km. The country is divided into two main basins; the Congo basin representing 17% of the territory and the Nile Basin with 83%. Its relief comprises succession of relatively large hills and valleys. More than 40% of the country is located on an altitude of between 1500 m and 1 800 m. 90% of the national water resources are drained through the Eastern part by the main rivers Nyabarongo and Akagera.

The surface occupied by lakes, rivers and marsh is 212.450 ha, hence approximately 8% of the national territory. Lakes have an area of 128 190 ha whereby Kivu Lakes alone accounts 102 800 ha. The permanent Rivers have 7.260 ha whereas the marshes and bottom valleys add up 170.000 ha.

Rwanda is one of the highest populated countries in Africa with 321 persons per sq. km. And 90% of the populations live from food subsistence agriculture. Annual rainfall ranges from 800 mm to above 1 600 mm, divided between two rainy seasons (March to May and September to December). The amounts of rainfall, falling in two wet seasons, are good, in most parts of the country, but there is a persistent risk of drought in most areas. The temperature is moderate highland equatorial averaging 16° to 23°C.

Based on elevation, available rainfall and soils conditions, the country has been divided by Delepierre, 1982 into 8 different agriculture regions. Those regions include the Volcanoes Highlands, Buberuka North ridges, Buberuka foot ridges, Gikongoro, Lakes Kivu shores, Central plateau, Eastern lowlands and Kibungo. Further studies with fine resolution confirmed the similar farming patterns. And the country has been divided into 8 clearly distinct regions depending on crop production in term of calories, farming systems, staple crops and animals grown. .

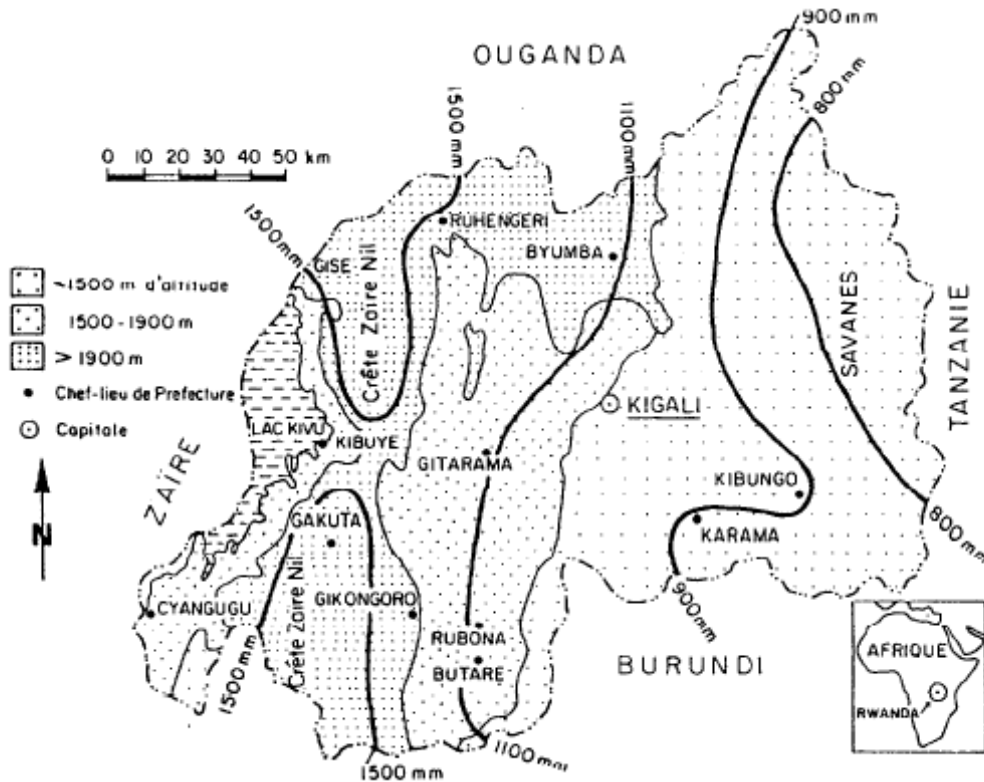


Figure 1 Map of agro - ecological areas of Rwanda in relation to altitude. Delepieyre, 1982.

From the study made by Aquastat in 2005, Rwanda is divided the country into 3 main regions.

Tableau 1 Agro climatic zones in Rwanda

Paramètre	Agro climatic zones of Rwanda		
	High land region	Central Plateau	Eastern Plateau and Western low land
Rainfall (mm/year)	1 300 – 2 000	1 200 – 1 400	700 – 1 400
Temperature (°C)	16 – 17	18 – 21	20 – 24
Evapotranspiration (mm/year)	1 000 – 1 300	1 300 – 1 400	00 – 1 750
Relative Humidity (%)	80 – 95	70 – 80	50 – 70
Runoff coefficient (%)	18	22	10

Source: Rwanda: AQUASTAT 2005

Agriculture in Rwanda is executed on all land types, including on land of marginal quality and on moderate to steep sloping hillsides. In large parts, soils are originally fertile, and the bimodal rainfall makes two crops a year possible, with a third crop grown in the bottom valley and drained marshlands. The analysis of agriculture potential of the country has shown that general agricultural pattern has been influenced by cultural, political and economic factors on the choice of crop cultivation and livestock rising.

Because of the slopes, most land requires soil conservation measures, and manure to prevent the decline of natural fertility. The climatic condition due to sporadic drought in some part of the Nile basin catchment of the Country leads time to time to food shortages. The overexploitation of the lands without its improvement, the inefficient of rainwater management and the lack of watershed management accentuate the erosion process and hence the reduction of crop production.

Chapter II Role of agriculture in Rwanda economy

Farming is the principal economic activity of the Rwandan people, carried out on more than 1.4 million farm households. According to the general population census in 2002, a ratio of 8 people per 10 is used in agriculture whereby 81% are men and 93% are women. The agricultural sector averaged 45% of the GDP in the past decade (1995-2004) and generates nearly 75% of the foreign exchange earnings..

45% of the land area of the country is classified as arable land, 18% is rangeland pasture, and 22% is under forest and woodland. In some areas, particularly in the Nile Basin catchment, the population pressure has reduced the area of arable land available per household to about 0.75 ha per household. Each farm comprises 5 to 6 members, half of them below 15 years of age. About 13% of arable land is under perennial export crops, mainly coffee and tea. A significant production and export of Irish potatoes has arisen in the North and West Provinces in the last few years. Other crops are marketed locally, mainly bananas, which is an important staple food and source of cash income for rural households where export crops are not grown. Beer made from bananas is a major source of income for rural women. Other crops are sorghum, beans, peas, maize, fruit and vegetables. The latter are grown on the bottom valley. Before the mid 1990s, in many areas which had fertile soils, under good farming practices the land was adequate for household food security and for some cash income.

According to the Agricultural Development Strategy for 1998-2003 and the Vision 2020, the agriculture in Rwanda should be shifted from policy thinking towards maximizing the economic benefits for agriculture by adopting more intensive farm production systems, with regional cropping specialization. The plan projected an annual growth rate of 5.6% in the agricultural economy with clear indicated goals on this scenario. . The 2020 vision has set up a number of indicators for agriculture development and those are: (i) hillside irrigation of 10000 ha, (ii) reclamation of 40000 ha of bottom valley lands and marshlands drainage and (iii) construction of 140 valleys dams for rainwater harvesting

Chapter III Assessment of the agriculture sector

2.1. Farming

Rwanda is facing a serious problem of low availability of the cultivable lands. The arable land is 1.385.000 ha, corresponding to 52% of the total surface of the country. 39,1% have a high erosion risk. . A consequence of farming more intensively and farming on steep slopes is the high incidence of soil loss due to erosion, and, along with it, declining soil fertility. Rwanda's National Agricultural Commission estimated that half the country's farmland suffers from moderate to severe erosion.. Demographic pressure is driving soil degradation in Rwanda.

The cultivated area is 852.000 ha i.e. 61.5% of the arable land and 31% of the total surface of the country. The size of cultivable land by family is 0.6 ha. The crop for food consumption occupies 92%. The Banana is the dominant culture with more of the quarter of surfaces cultivated (28%), followed by Bean (21%), Sorghum (10%), Sweet potatoes (12%) and Cassava (8%). The cultures of export are dominated by the Coffee and the Tea which respectively occupy 6.3% and 1.6% respectively.

Rwanda does not satisfy the food needs for its population with its own agricultural production. By taking account of the needs necessary for 2100 K cal, 59 protein gr. and 40 gr. of lipids by anybody per day, one notes that the cover rate reaches respectively only 83%, 73% and 17.5% in 2001. (see: Document de Politique Agricole nationale)

In term potential agriculture lands, Rwandan has 164947 hectares of swamps of which 111.871 ha belong to the lower hydrographic systems and 53076 ha to the primary system. The total surface area under use is estimated at 93754 ha, equivalent to 57% of the total area of marshlands in the country. . Those marshlands are regularly flooded during the rain season and prevent any agriculture activity. However they reduce the maximal flow rates during the rainy seasons and maintain a relatively high flow rate during dry seasons. Only 13000 ha of swamp are currently managed with moderate irrigation structures (regulators, diversions, headworks,...). We should note that hillside irrigation not is net yet known in the country, however different techniques aiming at water control and soils conservation in the steep terrains are used and those include (i) land

conservation infrastructure (grass strips, antierosion ditches, hedgerows, and radical terraces), (ii) organic inputs (composting, manure, green manure, mulch), and (iii) chemical inputs (fertilizer, pesticide, and lime). The agricultural survey carried out in 1984 showed that 1.34 million ha available for agricultural sector, only 1.1 million hectares were effectively used for food production, the reforestation and for pastures.

In regard of the Marshland Master Plan framework, Rwanda defined the priority of products to be cultivated in order to reduce the costs intended for food importation. Among crops such as maize, the potatoes, the beans voluble, prioritized for cultivation, rice takes a first place. The rice plantation using basin irrigation method has been extended in many place of the country and today approximately 62000 tons of rice production is counted whereas its production was estimated at a few 2300 tons in 1995.

Statistics from RADA indicate that Rwanda plants about 12,000 hectares of rice on marshland, which is 20 per cent of the marshland reclaimed for rice growing. The government plans to allocate more 60,000 hectares of wetlands to farmers to grow rice. The move is aimed at increasing acreage of rice fields and boost production of the crop locally as part of making the country self-sustaining in food production and increase household incomes.

2.2. Institutions

At national level, various units manage the agricultural and rural sector: (i) central government institutions; (ii) local decentralized institutions; and (iii) parastatals, private and community institutions.

At the central level

The central level consist of the Ministry of Agriculture (MINAGRI), the Ministry of Land, Environment, Forestry, Water Resources and Mining (MINTERE), the Ministry of Local Government and Social Affairs (MINALOC), the Ministry of Infrastructure (MININFRA), the Ministry of Gender and Women's Enhancement (MIGEPROF), the Ministry of Trade and Cooperatives (MINCOM) and the Ministry of Health (MINISANTE). MINAGRI's new structure comprises three (3)

central administrative units, three (3) development authorities and an Institute of Agronomic Sciences (ISAR).

The central administrative units include: (i) the Financial and Internal Resources Management Unit; (ii) the Information and Communications Technology Unit; and (iii) the Planning, Sector Policy and Capacity Building Unit.

The development authorities include (i) the Rwanda Agricultural Development Authority (RADA), and (ii) the Rwanda Livestock Resources Development Authority (RARDA) and (iii) The Rwanda Horticulture Development Authority (RHODA). The authorities represent MINAGRI in the field by providing extension support for various missions and supervising the decentralized structures in charge of the agricultural and rural sector.

ISAR operates as an agricultural research center. The role played by ISAR consists of research and technical innovations dissemination in various areas: genetic improvement and varietal selection, farming methods, sociology and agricultural economy. It is also responsible for centralizing information, awareness and technology dissemination.

At the decentralized level

The decentralized level has all technical departments of Districts and Sectors. Agricultural activities at the District level are coordinated by an Engineer and at the sector level by the technicians. Their tasks include: (i) conducting research-based extension services; (ii) conducting demonstration tests and training farmers; (iii) disseminating information; (iv) projects monitoring, coordination and development; and (v) support to the elected officers and decentralized authorities. The decentralization has shown tangible results especially in terms of population's implication in projects planning, implementing and management. The farmers have been involved in projects development (by financing, implementing and subsequently projects management). The effectiveness of the decentralized agencies is limited due to lack of qualified skilled staffs and inadequate material and budgetary allocations compared to the responsibilities that they face.

Parastatals, private and community institutions

The parastatals provide a range of services, especially technical supervision, input supplies and marketing of export products. The parastatals include OCIR-Thé and OCIR-Café operating respectively in the tea and coffee sub-sectors. Several other professional structures and cooperatives play a key role in the rural area, not only as beneficiaries of development projects and programs but also as suppliers of support services up- and downstream. These include professional farmers' organizations such as the Rwanda Private Sector Federation (PRSF) which regroups seventeen (17) vocational and sector cooperatives and six (6) provincial cooperatives, the Tea Farmers' Union (FERWATHE), the Coffee Farmer's Cooperative and the Rice Farmer's Association.

Some organizations (e.g. the IMBARAGA Association – an agro-pastoral intergrouping) present in six regions of the country, are becoming gradually national in their community operations. Most of these structures are affiliated to such international organizations as EAFPE (East African Farmer's Federation), REFON (Regional Farmer's Network), IFAP (International Federation of Agricultural Producers), CCFD (France), AGRITERRA (the Netherlands). These agencies collaborate with agricultural research structures (ISAR, UNR), capacity building oriented structures (INADES) and decentralization and grassroots organization support projects.

Finances mechanism and Development Partners

Under the new decentralized budgets provided for the provincial Department of Agriculture, Livestock and Forests in 2002, the livestock program has the largest share of operational costs and the soil and water conservation management program increases its share from 1.8% to 3.5%. The forest resources program increased from 3.8% to nearly 7%. The share of the extension program increases from 1% of actual expenditure in 2001 to 7% of revised budget in 2002, with incremental budget mainly for extension operating costs. This is an indication that the government has set important program to improve the water management and hence to improve the agriculture sector.

Agricultural financing is supported by the National Bank of Rwanda (BNR) which is charged with supervising agricultural banking and loan financing services. The agricultural credit institutions are mainly the BRD and the UBPR. The rural financing aspect, micro-finance institutions are poorly developed and insufficient. Outstanding credit in the agricultural sector accounted for only 4.41% of

total credit to the economy in 2004. The UBPB, with its network of 153 peoples' banks located in all of the country's provinces, seems to be the best placed to offer community financial services occupies a central position and boasts an outstanding loan envelop of 19.6 billion RFW shared among 68 368 debtors (72% men, 20% women and 8% corporate entities). Agriculture and livestock account for 27% and 3% of the total outstanding loans.

The Government within the Vision 2020 and the Economic Development and Poverty Reduction Strategy framework crafted a national policy whose objectives include putting in place an enabling legal, institutional and economic environment for the development of IMFs, and facilitating access to financial services to the less privileged. Thus, the government set up an Agricultural Guarantee Facility (FGA) managed by the BNR. As at 31 March 2006, the FGA had a budget of 3.86 billion RFW , including 1.1 billion RFW allocated by the Government and 1.76 billion RFW provided by Dutch Cooperation.

Public financing for agricultural development programmes continues to be largely external. For the Public Investment Programme (PIP) 2003 – 2005, agricultural projects and programmes are externally funded at 93.1% through contributions of 36.7% by the World Bank, 33.1% by the ADB, 21.4% by the EU, 1.1% by China and 0.7% by IFAD. Major ongoing donor operations are in agricultural and rural development, livestock, fishing, forestry development, marshlands development and capacity building. The most important bilateral cooperation partners in the agricultural sector in the past years have been the Netherlands, Belgium, USA and China.

Rural Organization

Rwanda's rural comprises various forms of relatively institutionalized organizations: traditional and customary mutual assistance associations, collective work associations, tontines, cooperatives, intergroupings, cooperative unions or federations. There are more than 20000 cooperatives, above 70% of which are active in the agricultural sector. Cooperatives vary in dynamism and effectiveness, depending on the natural potential of zones and the level of external technical and financial assistance generally from NGOs. Women membership of the cooperatives ranges from 40 to 60%. These associations are mostly engaged in farming and stockraising, trade, art and craft, construction materials (making of bricks and roof tiles), tontines and mutual assistance schemes.

In 2004, nearly 52 local NGOs operating in the agricultural sector were registered by MINALOC. Equally in 2004, MINALOC also listed 22 international NGOs operating in the agricultural sector, including World Vision, Agro-Action Germany (AAG), CARE, Catholic Relief Services (CRS), Handicap International and Caritas International – all specialized in the promotion of cooperatives, training, environmental education and micro-financing. These NGOs are generally well integrated into the local environment and have adequate human and financial resources to meet their objectives, especially by promoting farmers' participation.

The local NGOs usually lack the human capacity and the necessary financial resources to fill the gap left by administrative structures and provide cooperatives with effective supervision. In terms of management of cooperative assets, ignorance of the basic principles of rational financial organization and management is a major obstacle to profitable operations. Furthermore, inefficient management and lack of transparency negatively affect the confidence of members, at times leading to the dissolution of the cooperative. In regions with low production potential and little donor/NGO support, most cooperatives are poorly structured specifically due to the low number and poor quality of supervisors at the district level.

2.3. Main agriculture production

Overall, agricultural production and productivity levels are low. Farming systems are risk averse, minimizing the use of capital inputs. Risk averse on low productivity and incomes are thus locked in a vicious circle. Agro-industrial activity is extremely limited, with only some cereal processing and dairy processing.

In Rwanda, household production systems are characterized by subsistence rain-fed grain, root crop and banana production, traditional livestock rearing, and limited horticulture and Soya production. More than 80% of crops production is used for local consumption. For most Rwandans, the food regime is 50% tubers, 30% banana and 20% legumes, cereals, vegetables, etc. Until the early nineties, foodcrop production largely covered domestic consumption.

Tableau 2 Crop production 1994 -2005

Year	Crop production in tons			
	Cereals	Rice	Root&tubers	Banana
1994	132000		1207000	1489400
1995	141000	2300	881000	2001400
1996	182081	6596	1143004	2105397
1997	211433	9805	1245959	2248419
1998	191226	7935	1204203	2625485
1999	175004	8919	1445638	2897433
2000	235706	11654	2902051	2212250
2001	280702	15610	3070409	1784058
2002	304446	20976	3485214	2784870
2003	294106	28191	3111483	2410537
2004	314943	46190	2639761	2469741
2005	409358	62193	3118050	2593083

Source: Indicateurs de développement du Rwanda, 1999, 2000, 2001, 2002, 2003 et 2004

Currently, the country's food situation has been seriously compromised by the deteriorating natural resources due to population pressure on agricultural land (intensive farming, settlement of returnees in forest zones, fragmentation of farmlands, etc.) and frequent droughts. Over the last years, both production and productivity has fallen for bananas, beans, and the main grains, sorghum and maize.

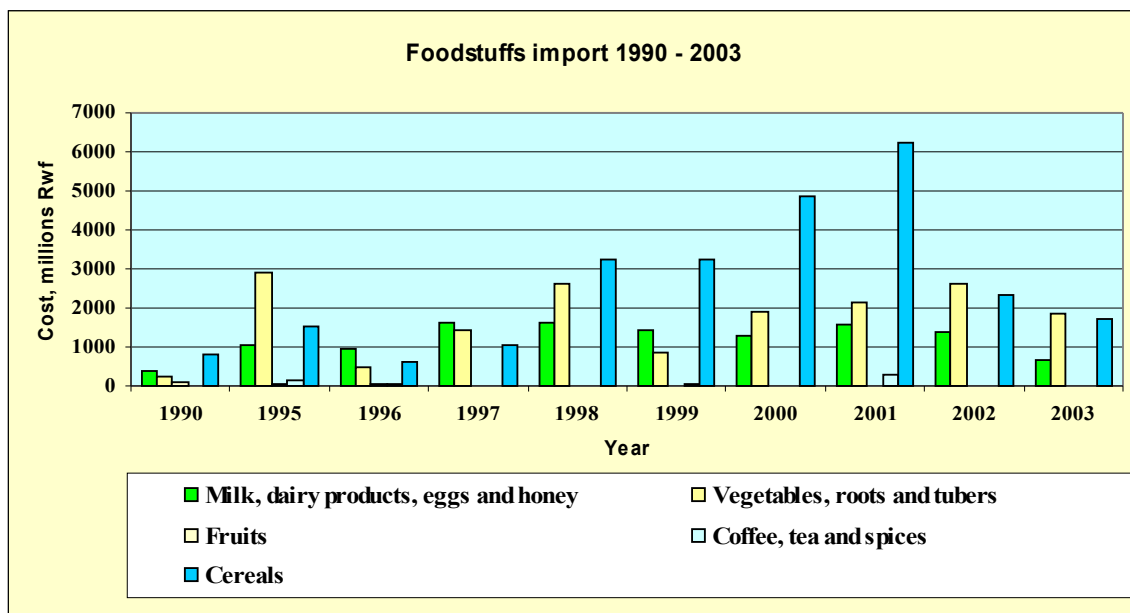


Figure 2 Foodstuffs importation (Adapted from data provide by the National Bank, and the Ministry of Economy and Planning)

With arable land becoming rarer to find, the people have no other choice but to cultivate areas reclaimed from swamps and steep hillsides, often in an uncontrolled manner. It also notes the decrease in the use of inputs. The combination of these factors has speeded up soil degradation and the falling productivity, thus putting the country's food security in jeopardy. In 2004, Rwanda spent more than USD 46 million on food imports¹.

In January 2006, Rwanda imported 3,601 MT of maize through the Gatuna border post with Uganda, consisting of 2,413 MT of grain and 1,189 MT of flour. This level of imports is comparable to the average level of the last two years and shows that domestic maize production is insufficient to satisfy national demand, especially as maize export levels are not significant. . Slight climatic changes leave many rural households vulnerable to food deficits. Hunger is already a chronic problem in some area of the country. Many see the immediate cause of this diminished productivity as soil degradation due to increasing pressure placed upon the land by the rapidly growing of the population. It is estimated that erosion caused by water removes from the countries lands capable to nourish forty thousand people per annum. The major constraints of the agricultural context are related mainly to the lack of cultivable lands and also a strong pressure on the natural resources due to a high demographic pressure. However, the linkage between the population growth and declining yields and land degradation is not simple but involves the interaction between societal, institutional and environmental factor over both time and space.

¹ MINAGRI Statistics, 2005

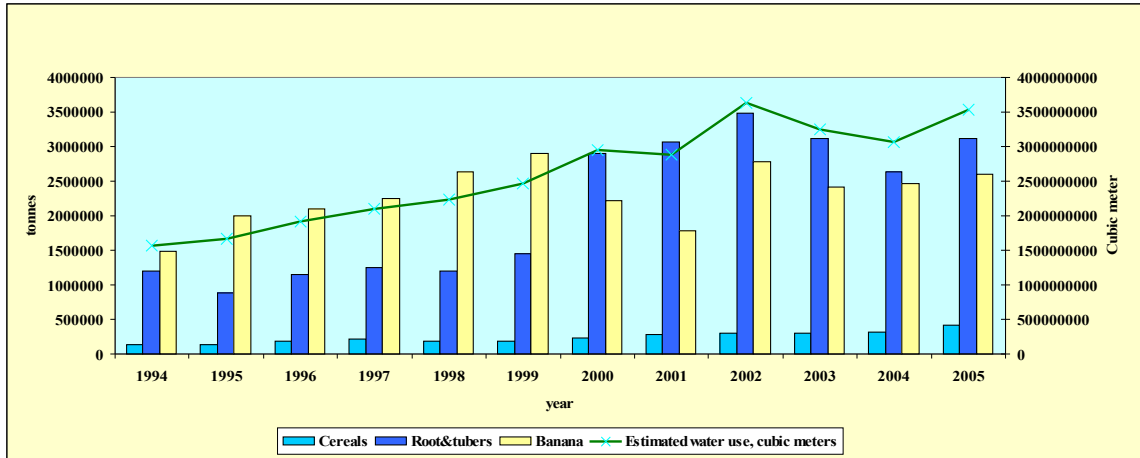
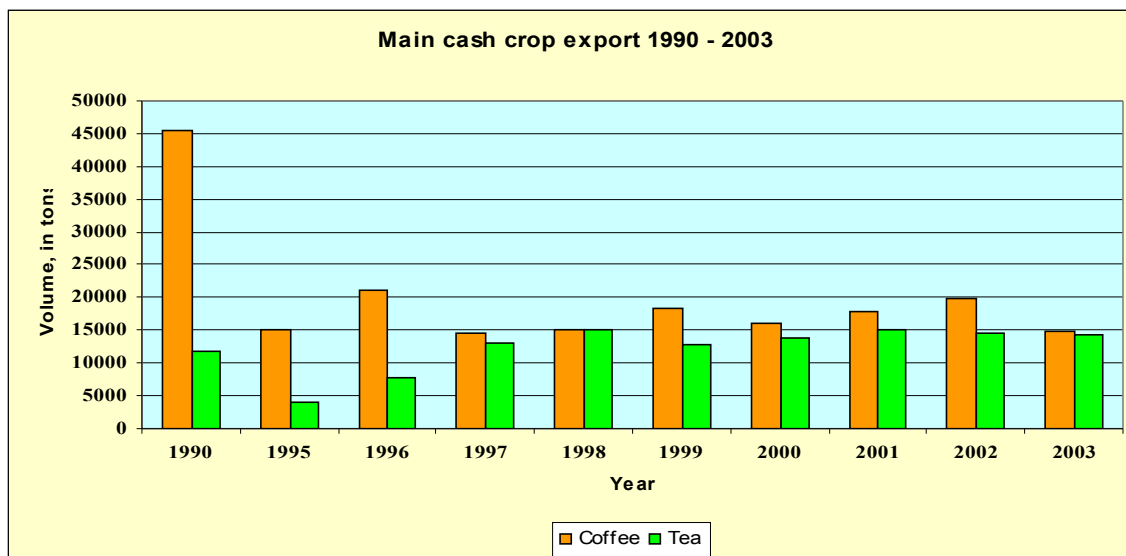


Figure 3 Trends in Agriculture Productivity and estimated water use (Source: Rwanda and Nile: Water plans and their development 1962-2006. (Baligira Robert, 2007. Unpublished work)

The country's main exports remains tea and coffee and, to a lesser extent, pyrethrum extract. Tea, the main cash crop, is cultivated by 28 000 farmers. Tea production has grown by 4% on yearly average, following the recent investment carried out in tea factories. In 2004, an estimated 11 300 tons of tea were exported. The tea network is managed by OCIR-Thé. Traditionally the main export crop, coffee production has declined by nearly 14% in the past decade, mostly on account of international price fluctuations and the drought. Coffee export was estimated at 19 000 tons in 2004. Most of the coffee produced is classified under the “ordinary” category – the least appreciated Arabica coffee on the international market. Few activities, for “full-washed” coffee production (e.g. The Maraba Coffee Cooperative in Butare), are under study. For pyrethrum, the 2004 commercialized production is estimated at 1 250 tons.



2.4. Livestock production

Livestock production systems are predominantly traditional, although a small number of modern livestock enterprises exist. The breeding contribution to the national economy is still weak in spite of efforts undertaken for the reconstitution of the livestock decimated by the war and the genocide of 1994. The main species raised include cattle (1 466 573 heads, of which 7% improved), goats (961 812 heads), sheep (380 557 heads), pigs (214 701 heads), poultry (2 519 568 units) and rabbit (506 927 units).. Livestock has been on the increase for the last few years and cattle have virtually passed 1990 levels (813415 head of cattle) with an increase of 244% from 2001 to 2004. In the other hand, livestock contributes marginally to the GDP (3.7%). Sub-sector exports (unprocessed skins) accounts for 2-4% of the country's total exports. Rwanda's annual consumption stands at 12 liters of milk and 4.8 kg of meat per capita, compared to 220 liters and 10 kg per capita per annum recommended by the FAO.

The major constraints in animal production and development consist of food, medical, genetic, valorization and of exploitation. This sector faces several constraints, notably inadequate feeding both in terms of quantity and quality due to the limited and poor pasturage, lack of watering resources in some farming zones and limited use of agricultural by-products. Moreover, epidemics which regularly strike the herd and poor performance of the local breed limit livestock productivity.

Lacking human and material resources, the veterinary services are unable to meet the demands of livestock farmers.

2.5. Forestry

The Rwandan forest covers 197 000 ha (about 7.5% of the territory) and comprises four natural forests: Nyungwe in the South-West (90 000 ha), Gishwati in the West (2 000 ha), Birunga in the North-West (15 000 ha) and Akagera in the East (90 000 ha). Forestry resources are constantly deteriorating, with the attendant impact on bio-diversity, soil and water conservation. Indeed, since the 1994 crisis, the national parks area has reduced from 417 000 ha to 105 000 ha. The Akagera Reserve has lost two-thirds of its size and the Gishwati Forest has almost completely disappeared (from 37 000 ha to 2 000 ha). Sylviculture comprises the production of fire wood and working wood, estimated at nearly 4 million m³/annum. The forestry sub-sector was estimated to account for 2% of the GDP in 2004.

The Government of Rwanda has repeatedly cautioned farmers on the need for proper land management and has initiated nationwide campaigns to encourage farmers to counter soil erosion by the use of terraces and hedgerows, and through reforestation.

2.6. Fisheries

The production potential is estimated at 7 400 tons, all resources combined. Lake productivity is estimated at nearly 40 kg/hectare/annum, compared to the African average of 150 kg. The piscicultural infrastructures include a number of small ponds with a surface area changing from 6 to 50 ares. The total national production in fishery can be estimated for the last years between 2.000 and 3.500 tons. Lake Kivu has on its own 2.080 tons while other lakes located in the Nile basin can produce only 1.200 T for the other Rwandan lakes. (see <http://www.fao.org/docrep/006/AD198F/AD198F03.htm> accessed on 4 april 2007). Fishing, practised by nearly 5 500 artisanal fishermen, accounts for 0.3% of the GDP. The fishing sub-sector is estimated to generate 35 500 jobs.

Introduced pisciculture technology in early 1983 showed that according to the local conditions, the production potential may reach a result of 50 kg/are/year. .

The identified constraints of pisciculture development include the lack of qualified technical supervisory staff, the lack of regular contributions out of alevins, an insufficient demand for fish, the expensive construction of ponds, and finally a lack of clearness as for the objectives of the interventions

2.7. Agro business

The Agro-business is a new concept in developing countries. It targets the integration of agricultural sector development within an approach of market where the demand condition the productivity and the competitiveness of the agricultural sector. Instead of concentrating investment efforts on the food supply, the actual debate puts a special emphasis on skills and control of markets. Therefore, Agro-business puts together all the factors of agricultural markets in order to stimulate the production so as to respond to consumers' demand. It particularly deals with the agro-industry sector in the broad sense (collection, transformation, preserving, conditioning and marketing of products from agricultural origin) and the sector of agricultural inputs.

The Government of Rwanda is engaged in promoting the Agro-business through : (i) commodity chains development, (ii) transformation and competitiveness of agricultural products to facilitate access to markets. The Commodity chain approach constitutes one of the Government's essential axes of intervention methodology and is based on the reinforcement of professionalism, specialisation and regionalisation of agriculture. Research constitutes an important support since it has to intervene at all stages of the commodity chain. The promotion of export products as well as the increasing involvement of the private sector has particular importance.

2.8. Horticulture

Commercial floriculture is a new industry in Rwanda. At this moment there is only one company with 6 hectare greenhouses and 200 employees who produces and exports sweetheart roses. Through a partnership Agreement with ESA-EPA, ARPEF was entitled to export Flowers in

European Union by 2008 with out paying tax. Currently, ARPEF has acquired property land in Bugesera (800 ha), Ruhengeri-Nyabirande (80ha).

Chapter IV Constraints of the agriculture sector

3.1. Physicals

The agricultural sector faces several constraints that hinder its development, notably farming on very steep slopes (50% of fields have a slope gradient above 35%), uncontrolled deforestation and irrational development of catchment basins which exposes them to serious erosion. Rapid population growth and shortage of arable land are the causes of overfarming.

Due to both the steepness of the slopes and the heavy volume of surface water runoff, unlined drainage ditches can eventually lead to gully formation. In most parts of northwestern Rwanda, topsoils are relatively thin and are underlain with a very acidic B horizon, i.e., the stratum of soil that lies immediately beneath the topsoil layer. If, in terrace construction, this B horizon is brought closer to the surface, which is often the case toward the back of the terrace, crop yields will decrease unless farmers add lime or find other methods to reduce the acid level of this subsoil. (Chorley *et al.*, 1984)

The current living condition explains the unquestionable predisposition to the impoverishment of the soil whose restoration and conservation prove to be a difficult if appropriate measures are not taken on time. The population density has increased from 143 inh per sq. km in 1970 to the current 323 inh per sq. km in 2002. In Rwanda there is considerable evidence of declining soil fertility, leading to a vicious cycle of declining yields and further impoverishment. They are estimated between 50 and 557 tons per hectare and per annum according to the slope and of vegetable cover. These losses relate to the sediment transport by the Nyabarongo River estimated at 51 kg/second on the level of Nyabarongo-Kigali, at 44 kg/second in Nyabarongo-Kanzenze and 26 kg/second in Akagera-Rusumo. These losses correspond 33 kg to 288 kg of dry matters a second. One estimate that induced hydrous erosion involves total annual losses of the nutrients estimated at 945.200 tons of organic matter, 41.210 tons of nitrogen, 280 tons of phosphorus and 3.055 tons of potash on all the extent of the Country.

The effects of erosion on the hydrographic network of Rwanda result in disturbances of the hydrological regime and affect on change of water level in lakes and rivers. The irrational management of the natural resources, forest in particular, involves the degradation of the soils by the aggressiveness of precipitations on the stripped lands. The effect of two ploughings and two annual weeding to the hoe starting from the bottom of the slope causes a migration of sediments estimated between 30 and 60 tons per hectare and per annum. This allows a rise annual of the slopes from 15 to 30 cm each year and the disappearance of the fertile arable layer in less than 30 years. The soil impoverishment due to erosion has impacted on crop production whereby the harvest crop production of cereals, leguminous plants and tubers has reduced in the recent years.

Water resources and related infrastructures are unequally distributed in time and in space. The problem of erosion and pollution by aquatic plants such as water hyacinth, lack of sensitization policy on the economy and management of water, agricultural technologies that are unsuitable to water resources management Lack of available water available absence of professional and technician in water sector .

3.2. Socio economics factors

3.2.1. Infrastructures and Markets

The major constraints to the development of the agriculture sector include the inadequate transport, storage and preservation infrastructure. Several production zones are isolated. The storage and processing capacities are also undeveloped. In addition, the country lacks marketing infrastructure, especially in the rural area. Moreover, in the absence of an effective information network, traders and other private operators are not well-informed about existing rural marketing opportunities.

3.2.2. Energy

The exploitation of timberings at the pressure on woody resources for energy production constitutes a serious threat and a way of impoverishment of the soil. 98% of the Rwandan households use wood like source of energy. The wood deficit was 3.000.000 m³ per annum; in 1997, it had passed to 4.500.000 m³ per annum. In addition, in the sector of industry, no particular provision was taken, until today, to counter the phenomenon of deforestation which would result

from the wood consumption in the sector of industry. . The forestry overexploitation, the problem of the environment has accentuated due to land overexploitation. The consequences of this deforestation are the soil erosion of the lands and thus problem of silting. At that time already, the undertaken studies showed an annual deficit of about 2.106 cubic meters.

3.2.3. Poverty

The number of poor households accounts 68% in rural area and 23% in urban area. The per capita income averaged USD 230 in 2004. Most malnourished persons live in the rural area and two-thirds of the rural population lives below the poverty threshold. Only 13% of the population has access to health services. The rural literacy rate stands at 56% for men and 51% for women. Rural access to potable water stands at 47%. Agricultural production falls short of covering the food needs. It is estimated that 45% of children suffer chronic malnutrition. Less than 11.5% of rural households do not own land. Poverty increases as land availability decreases. About 28.9% of the poorest quintile has less than 0.2 ha of land whereas 37.8% of the wealthiest quintile households hold more than 1 ha. . The ownership on land is problematic, in light of the fact that some politically connected individuals have acquired, over the last few years, land holdings of 50 ha or more for coffee and cattle production.

3.2.4. Gender

Gender-based division of labor is also remarkable, depending on the agricultural activity. The Poverty reduction Strategy study, in 2002 has revealed that between the 15 to 60 year age group, women devote 30% of their time to domestic chores and 33% to agriculture, compared to men (20% to agriculture and 4% to domestic chores). Men devote 54% of their time to miscellaneous activities and remunerated labor, compared to 18% for women. . There are gender divisions of labour and management responsibility in relation to livestock. Men manage cattle and women small stock.

Tradition continues to put rural women at a disadvantage in terms of their access to land, credit, healthcare and participation in local development decision-making bodies. The cost of healthcare is particularly discouraging to the poor. The disparity is more pronounced at the income and age-group level. The genocide and the war have accentuated the living condition of women. Hundreds

of thousands of children became orphans after 1994, with the problem further aggravated by the AIDS pandemic. Estimates put at 613 000 the number of Rwandan orphans below the age of fourteen. Widows account for 80% of households headed by women.

In 1999, the country's legislative texts have been revised to open the way to equal rights in all areas. Male and female children have equal rights to inherit their parent's property, both prior to, and after, the death of a parent. However, there remain a number of obstacles to effective implementation of the law. Firstly, the law only applies to married women: those in long-term unmarried relationships are not covered. Many couples do not get legally married because of the expense, while polygamous households are not legally recognised. Secondly, the land law stipulates that women can inherit land as guided by the inheritance law; while the inheritance law (Article 90) states that the land law will further spell how women can inherit land. This does not clarify the position.

3.3. Institutions and policy

There is no well established structure for the coordination of activities on soil and water management. A few departments exist within the different ministries in charge of these activities but there is lack of harmonization except for few workshops where there is representation of each ministry. The recent created Soil Fertility and Soil and Water Conservation Initiative (SFI/SWCI) in Rwanda, is not yet well established.

3.4. Climate uncertainty

Drought, floods and the landslides are very frequent in Rwanda. The Provinces of the East and the South are touched by an alternation of floods and prolonged drought while the areas of the Northern part know especially the landslides. The recent phenomena of El Nino (1997-1998) and the NINA (1999-2000), resulting from the effects of general circulation of the atmosphere, disturbed the rainfall patterns of Rwanda with floods causing the erosion and the landslides lasting the period of El Nino and the drought prolonged during the period of the NINA. One could also remember well floods and landslides during the recent period from October to December 2001 which damaged more than 2000 ha in the West of the country.

Rwanda's crop production has been affected by the weather conditions by an increase in prices of most agriculture products since 1995. Localized food insecurity remains in 11 out of 30 Districts of the country. In Bugesera, many households are food insecure as a result of poor 2007A bean production. In the Congo-Nile Ridge and the Southern Plateau food economy zones, high population densities and poor soil fertility make the region chronically food insecure. Heavy rainfall at the end of January caused floods that destroyed homes, crops and infrastructure, particularly in southern and eastern regions. In some place the impacts are particularly severe in Nyaruguru District, where the rains caused land degradation in a flood-prone valley, rendering it unusable for agriculture for at least one or two seasons. The reports reported 200 ha damaged and an estimated affected population of 3535 people affected

3.5. Education

Following the loss of lives during the 1994 war and genocide, all government departments are in dire need of skilled manpower. Worker replacements are slow and vocational training is still inadequate. In addition, agronomic research is for now unable to provide the necessary support to the development of the agricultural sector. Agricultural development is handicapped by weak sectoral organization, inadequate skilled human resources, the inexperience of young researchers and limited financial resources.

3.6. Planning

The inadequate lands planning combined with the demography increase lead to a shortage of the arable lands and accentuate the pressure on lands occupation. The agricultural activities without preliminary measurements of conservation has exerted on the natural reserves like the forest of Gishwati, the forest of the Volcanos and the natural forest of Nyungwe. The same pressure is also noticed on all the wooded zones of the Districts of the Country located on the steeply sloping slopes, which leaves soils without protective cover vegetable, thus opening the way with hydrous erosion and the impoverishment of the soil.

In spite of the abundance of the water resources, water use to supplement rain-fed agriculture is not wide used. And the farming is highly dependent on vagaries of the weather. Water is not

always available in enough quantity and at the right time for farming purposes. The lands on hills are more concerned as per lack water storage and for which reason can harbor very limited farming during the dry season. Some marshland areas are completely flooded during the rainy season, rendering them inappropriate for farming. Currently, only 13000 hectares of land have been developed mostly for rice crop growth. The eastern province where rainfall is the lowest are the most affected. Water control is limited to a few marshlands on which the population has built mostly makeshift structures.

The use of mineral fertilizers, lime and other fertilizing agents is very limited. Current fertilizer consumption stands at 3 500 tons yearly, representing less than 2 kg/farmed hectare, compared to an African average of 11 kg, an Asian average of 51 kg and the recommended average of 150 kg. Very limited use is also made of pesticides, veterinary products and feeds. Agricultural implements remain rudimentary. All tasks are manual, without the use of animal or mechanical energy. Another major constraint to increased agricultural production concerns the shortage of quality seeds. Around 6% of farmers use certified seeds. Although there is a high demand especially for rice, cassava, beans, sorghum, potatoes, maize and vegetables, supply is very limited.

Chapter VOpportunities

4.1. Soils and climatic conditions

Although the majority of the lands are of an average good quality, the country has a high agricultural potential as per its very fertile lands located in the area of the volcanos in the North-West. The less fertile lands and acids one occupy the Congo-Nile ridge and the highlands of Ndiza and Bubekura. The country has a methane layer in the lake Kivu which can be exploited for the manufacture of manure as well as layers important limestones which could be used as to improve these acid lands.

Despite many constraints to its development, the agricultural sector has a number of potentials which, if adequately tapped, should lead to production intensification and improved value added. Such potentials include the favorable climatic conditions that are conducive to agricultural activities in most regions of the country and thanks to which a wide variety of crops (foodcrops, tree crops, cash crops, etc.) can be produced year round, even as stocks can be raised. The Ministry of agriculture estimated that swamps occupy 180751 ha, where bay papyrus constitutes 105744 ha and 75007 ha are swampland. . Nearly 12% is used in agriculture production. The marshlands reclamation and development would contribute to: increasing the areas under crop, enhancing output through water control and natural soil fertility, and introducing new high output crops. Moreover, they offer large possibilities for intensified productivity per surface unit.

The country has 9 agro-bio-climatic zones and from the diversified ecosystems. Because of its agro-bio-climatic diversity, the country has the advantage of having the systems of production resting primarily on a food mixed-farming staged in bands on the hills and which sometimes a breeding may be associated. The climate favours thus a whole range of cultures going from the tropical cultures to the cultures of the moderate countries.

4.2. Available water resources

4.2.1. Rainfall

Rain water in Rwanda occupies important place in agriculture and hence in the national economy. 70% of this water is used for rain fed agriculture. The PGNRE SHER, 2005 pointed out that data on rainfall are reliable but badly represented the situation of the country as regards rainfall patterns. Prepared mean monthly precipitation for the period 1970 and 2005 indicates that rainfall can produce water changing from 23.704 and 36.87 billion cubic meters/year. The Maximum monthly precipitation that ever occurred from 1930 to 2006 was 281 mm in April, and the minimum of zero was in July. However we should note that rainfalls are subject to very high losses due to evaporation and evapotranspiration equivalent to 82%. (See TBW, 1991 and the calculated ETP by ISAR).

4.2.2. Surface water

Surface water in Rwanda is mainly defined as lakes and rivers. The hydrological rivers regime is affected by the geographical and temporal rainfall distribution. The important flows are recorded in the great rain season in there are with high precipitation. For the Nile Basin Catchment, the highest river discharge happens during May and April whereas the low water levels take place in August-September. Nevertheless, there is an irregularity more marked in the basins of the Congo River where the strongest flows can be observed in November or December. The permanent rivers cover 7.260 ha and the discharge measured at different hydrological stations indicate the following values Nyabarongo at Kigali station : 78 cubic m/s, Nyabarongo at Kanzenze: 100 cubic m/s, Akagera at Rusumo: 232 cubic m/s, Akagera at Kagitumba: 256 cubic m/s.

Lake water has nearly 6% of the total surface of the country that represents approximately 1.500 sq. km of which 65% are occupied by the Rwandan part of the Lake Kivu, in the west of the country. The other lakes, of which the number exceeds about thirty, belong to the hydrographic system located in the Nile basin catchment. Those are respectively categorized as lakes of North, the lake of the central plate, the lake Muhazi, lakes of the depression of Bugesera, lakes of South-east and lakes of the national park of Akagera. The Bulera and Ruhondo lakes in the North of the

country have a relatively high depth up to 100 meters while the other lakes (Mugesera, Sake, Bilira, Cyohoha, Rweru, Ihema, etc...), the depth changes from 5 to 7m and hence exposed to pollution.

Since 1990, the hydrological monitoring network has changed and only two hydrological stations at Rusumo-Akagera and Butare Bridge on Nyabarongo remain in operation under the support of FAO. However the situation for water level measurement seems better to be monitored as per regular water level measurements done on some lakes Bulera, Ruhondo and Cyohoha where water is used for electrical power generation and/or for drinking purposes.

4.2.3. Ground water

Ground water Rwanda are categorized into springs emerging on the sides of the hills, shallow aquifers having a depth up to 60 m and the deep wells up to 200 m. Spring water is very important in Rwanda as more than 86 % of drinking water is taken from simple protected springs and/or water supply systems using spring water. Those waters are normally of good quality, are often drinkable and can be used at low costs. Taking into account the spring mean flow of 0.4 l/sec, it can be estimated water potentiality of the springs equivalent to contribute up to 290,1 billion cubic meter per year. We have to note that the administrative status of the source, its precise geographical site (location determined by GPS), flow measurement realized at the time of the study and sometimes series of water quality analyses, as well as information on households using the water can be found for some projects.

Research established that ground water in Rwanda has two main origins. . The first category includes ground water formed from rainwater infiltration into soils, this water is generally low mineralized. The second type of ground water is highly mineral-bearing with a relative high concentration of chlore; the water is located in greater depths and is formed by condensation. The ground water potentiality and principal hydrogeological characteristics of Rwanda were detailed in the studies done by SOGREAH 1989, JICA, 1991, these investigations include geophysical survey to locate the water table which may be quantitatively and qualitatively satisfy the water demand for people and cattle in the area of eastern part of Rwanda.. Different studies showed that the water table of the volcanic lands of Rwanda must roughly represent a regular flow going from 7,5 to 13

l/s/km², that is to say 35.000 m³ /h at least known 750 km² of surface. All data of drilled are now recorded in a database developed by SHER. .

Since 1985 that the first drillings, having a depth going from 30 to 100 m, could be carried out with the assistance of Jica “Japanese Cooperation Agency” within the framework of the project called “Alimentation en eau potable de la région Orientale du Rwanda”. During this study, apart from drillings survey, the Schlumberger methods and electromagnetic EM 34 were used and longitudinally profiles obtained at the time of these studies could show the bed rock resistivity of the area of the project. Between the periods of 1985 to 1991, the project realized 72 wells and 80 % of them are currently still operational in the Eastern Province. In 1998, LWF launched a campaign for the realization of 75 drillings in the former Province of Umutara which ended with installation of 58 positive drillings located in 5 Districts of the Province. In 2002, the project «Projet Développement des Ressources Communautaires et d’Infrastructures d’Umutara PDRCU » carried out 58 drillings of which 35 were positive. The localization of these drillings was also mentioned in the Master line of Umutara worked out by Experco. Between 2003 and 2004, MSF Belgium constructed 23 wells in the Island of Nkombo in Province of Cyangugu. These wells have a casing equal 80 cm of diameter and are equipped with Afridev pumps. In July 2004, Electrogaz carried out drillings survey; these drillings were intended to know the nature and the thickness of the alluvial aquifer, the quantity and the quality of water as well as the possibilities of ground water exploitation in the bed rock. The results of these studies contain the analyses of the quality of water as well as the parameters on pumping tests.

4.3. Infrastructures

The agriculture in Rwanda is not yet mechanized meanwhile the agriculture modernization as clearly expressed in the Vision 2020 document, the PRSP and the National Agricultural Policy, encourages the private sector to invest in agriculture, through which production will increase. The dynamic self-organization demonstrated by farmers and their desire to take over the development of the agricultural sub-sectors and their commitment in marshland management give guarantees for the sector sustainable development. Furthermore, the establishment of an agricultural sector financing mechanism (e.g. the Agricultural Guarantee Facility) will help put agricultural financing back on track.

4.4.Policies and legal framework

The government has undertaken several lands management policies reform. After projecting the future in the Vision 2020 document, the Government prepared a National Poverty Reduction Strategy whose implementation is based on the preparation of plans for the core economic sectors. Thus, MINAGRI drafted a National Agricultural Policy (NAP) and an Agricultural Processing Strategy Plan (APSP) in 2004 (validated in January 2005) which offers clear guidelines for the development of the agricultural sector in the years ahead. Six specific objectives are defined in the APSP: (i) provide adequate supply of agricultural products and food security to the population; (ii) increase family income and diversify its sources; (iii) maintain, protect and improve water resources and land management; (iv) contribute to macro-economic balance and growth; (v) contribute to finding solutions to social issues related to gender, youths, the landless/other vulnerable groups and AIDS; and (vi) transform the mission and role of various actors (the Government, farmers, the civil society and the private sector) to enable them to adapt to the new vision.

The land use system was reviewed within the framework of the Law passed in May 2005. The purpose of the new law is to end the ambiguity between the customary law and the written law, protect property ownership and encourage private agricultural investment. This organic law equitably protects land rights, irrespective of whether they emanate from customary law or the written law. According to the legislation, catchment area lands (hills) belong to the indigenous population and are managed customarily by lineage while bottom valley, marshlands, lands bordering lakes and forests belong to the State. Their classification and allocation for further development fall within the responsibility of the Ministry under which such lands and environment are assigned. All citizens can own land. With regard to access to land ownership and tenure rights, the new law prohibits all forms of discrimination (gender, origin, etc.). Both men and women have equal rights to land ownership. As encouragement to attract foreign investment, foreigners are entitled to long lease and may even own property.

The decentralization policy empowers Districts and CDC to organize farming on state-owned lands. The Common Development Fund (CDF) was established by Law No. 20/2002 of 21st May 2002 and became operational in October 2002. CDF aims at financing and implementation of

development projects and programs at the District levels. The projects are prepared by Districts, submitted to CDF for financing and approved by the Board of Directors of the CDF according to different criteria, including viability of the project and the principle of equitable distribution. To be valid, all transactions must be registered with the registry.

National Commission of Soils Conservation was created by the government. In the conjunction with Provinces and Districts, the National Commission put in place an action plan for soils and water conservation in different Districts.

At international level, Rwanda is actively involved in the implementation of the Second National Report on of the Climate Change Convention. Rwanda has ratified the CCC convention (CCC) of the 22/10/1998 by committing itself to combine its efforts with those of the other countries signatories of the aforesaid convention in the protection of its natural and environmental inheritance in order to fight against the progressive projection of the turning into a desert. The environmental protection constitutes an important indicator for country sustainable development and exploits several factors like water, the lands, the forests, the marshes, the lakes and the rivers like their biological diversity. Concomitantly, each ministry was seen assigning a province where it will exert a regular follow-up of the activities of soils conservation.

In order to address gender inequities in access to land, concrete measures were taken to eliminate the social and legal constraints that prevent women from participating in the country's political, social and economic life. Currently, the law establishes constitutional equality for both men and women. Moreover, it is mandatory under the Constitution that women occupy 30% of seats in Parliament. Considerable progress has been made in terms of girl's enrolment (85% in 2002) and women's participation in governmental bodies (32.3% of ministries in 2006). Official statistics confirm a 42% women representation at the policy-making level, thus improving women's participation in decision-making.



4.5. Education

The educational policy gives a detailed attention on the teaching of sciences and the technology by which strategies were developed for environmental protection. The Ministry has introduced in primary and secondary schools several courses related to environmental protection and particularly, the fight against the desertification. Moreover the Ministry aims at opening in each province of the country at least a center of excellence of sciences and a professional technical training school to increase the knowledge and the practices in the environmental field. Indeed, in vocational schools agri-veterinary surgeons of the sections of agronomy, forestry, school farms and gardens are directed towards the control of knowledge and the strategies of environmental protection and safeguard.

At primary education level, already a course "Science and Elementary Technology" - S.T.E was introduced from the 1st year up to the 6th year. At the level of the higher learning education, knowledge as regards environment is more and more specialized. Specific Integrated programs in connection with the environmental protection are offered in different institutions: (i) KIST, Department of Civil Engineering and Environmental technology, (ii) NUR, Department of Natural Sciences and Agronomy and Agroforestry Department, (iii) ISAE, Department of Agriculture. Various research programs are directed involved in the environmental protection and management: (i) ISAR has different programs for environmental protection to improve agriculture production; (ii) IRST through its Pharmacopeia Center develops a program on medicinal plants protection by avoiding their disappearance. The CITT (KIST) and the Energy Center (IRST) in their program of renewable energy, set up and already adapted and suitable technology to access other sources of energy (biogas, solar energy) which will reduce the use of biomass as a principal energy in rural area. Some centers in rural area (Centers of health, Prisons, schools, Villages...) have accessed this kind of energy.

4.6. Population

The existence of a young farming community, opened with the innovation, should take part in the modernization of the sector. The 4,1million working population and the attachment of the farmers to agriculture are the subject of another potentiality not less important.

Chapter VI Best practices for efficient water use for agriculture production

5.1. Rainwater harvesting

The rainwater storages of 10 to 50 m³ collect clean water coming from the roofs reduce the water drudgeries considerably, improve the level of hygiene and allow creation of an intensive multistage garden around the dwellings.

The absorption ditches support infiltration of surface waters on the slopes of less than 20% of slope on deep and permeable soils. Unfortunately, they require much work (200-350 days per hectare and per annum for their installation and 20 to 50 days for their maintenance. Those ditches hardly improve the crop production from where the abandonment by the farmers. Their principal interest lies in the progressive transformation of the landscape into not very sloping terraces. The ditches of diversion are to be proscribed on the strong slopes (more than 15%), because they lead inevitably to the gulying of the discharge system.

The permeable microbarrages (grass cords, of stones, quickset hedges and embankment) aim at slowing the surface runoff by dissipating their energy and spreading out them in water slick which causes the deposit of the sediments. The grass and stone cords are effective only on the slopes of less than 20%. The quickset hedges are not completely effective the first two years, except if one brings a mulch to the foot of the trees. As of the third year, the hedges block erosion. It is quickly formed a slope (20 to 30 cm per annum) and a progressive terrace which one can transform into two horizontal terraces: one is improved and is reserved for the intensive culture, the other impoverished for frugal cultures like the manioc and sweet potatoes of which the fertility should be restored. Work needed for permeable microbarrages installation is 50 to 100 days per hectare and per annum and 10 to 20 days for maintenance as well as the requirement out of fertilizers.

5.2. Soil erosion control

Rwanda has a long experience in soil erosion control. Erosion control is widely practiced in the form of contoured hedgerows, normally planted with *Pennisetum* species. (See Nair (1989). The use of biological slope breaks, largely abandoned after independence in the early 1960s, has been actively promoted by the Government of Rwanda since the early 1980s..

We should recognize however that erosion control is regularly called into question by the farmers, undoubtedly because of the mode of action which implies them only like voluntary service providers on their own lands, without taking into consideration their knowledge neither of their indigenous traditional practices, nor the benefit in terms of improvement of the fertility of the lands.

Traditionally, the cultures are distributed around the habitat (dispersed on the hills) in direct relationship to the fertilization from the major part of the nutrients received from family waste, residues of culture, ashes, peelings and latrines. Usually banana trees are planted around the house and between the banana trees push the associated food crops: corn, beans, colocases, potatoes and condiments.

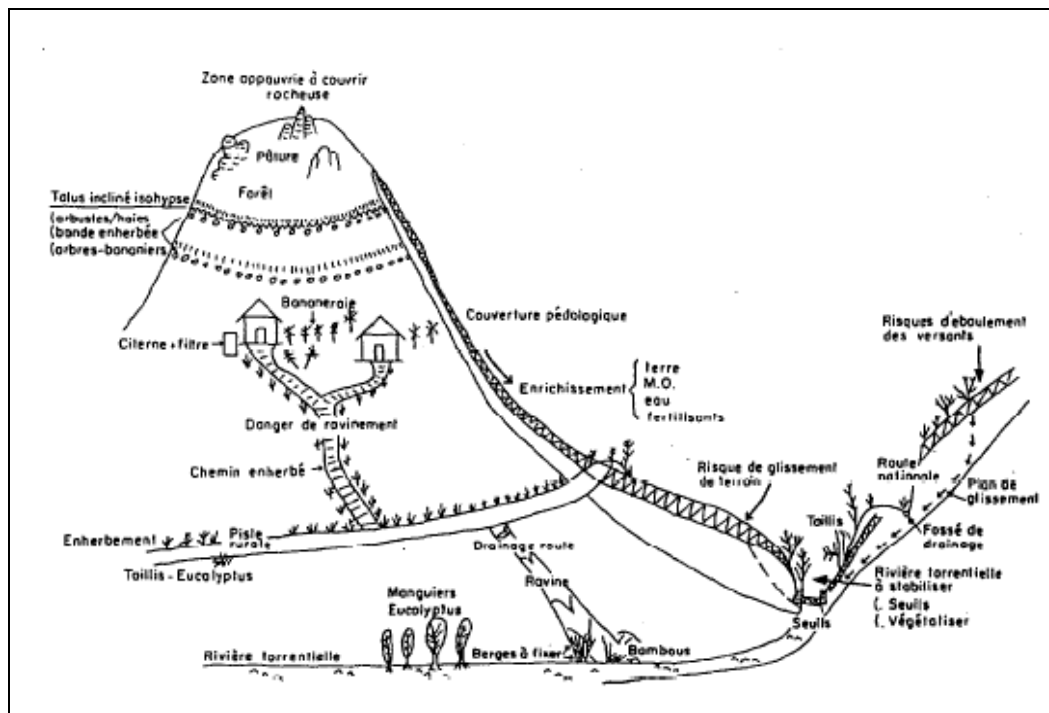


Figure 4 Erosion process in Rwanda after Roose, 1992

The efforts of individual farmers, working with extension agents and government officials, have emphasized physical methods (ditches and quickset hedges) as the dominant approach to controlling soil loss and degradation. Terraces and drainage ditches have been constructed in many parts of the country.

Biological approaches such as planting grass strips and hedgerows have been also introduced as complementary methods of reducing soil loss. Yet, because grass strips and hedgerows often remove sizable segments of land from crop production, they can push farmers to cultivate additional, often marginal lands and thereby increase the potential area undergoing accelerated agricultural erosion. Another biological approach, one that has received relatively little attention from agricultural extension leaders in Rwanda, is the integration of erosional controls into farmers' cropping and land use systems. Crops and other forms of vegetation vary considerably in their ability to protect the soil from the erosive effects of rainfall and runoff. Differences in the rates of maturity, extent of leaf cover, root systems, and crop-specific farming practices, are some of the more important factors that determine the relative effectiveness of various forms of agricultural land use in controlling soil loss. These factors can also affect the overall performance of land engineering strategies.

The horizontal steps (locally called "radical terraces B) make it possible to absorb all water (rainwater and surface runoff between terraces) and to capitalize the manure that one accumulates there. But it must be clear that the radical terrace requires large investments in work 500 to 1.200 days per hectare and in inputs of 20 t/ha of manure, 1 to 5 lime t/ha and other manure specific to each culture. For this type of antierosive structure, risks of landslide are excluded. It appears reasonable to introduce fruit-bearing as it is practiced in some area of Tanzania.

The microterrasses in staircase (cultivated width of approximately a meter) on fixed embankment with grasses (maximum 100 cm) require much less work and stabilize well the stiff slopes in the event of associated manual culture because the roots of the cultures remain in the humus-bearing horizon. Contrary to the traditional technique, it is better to maintain in place the herbaceous network which protects the slope.

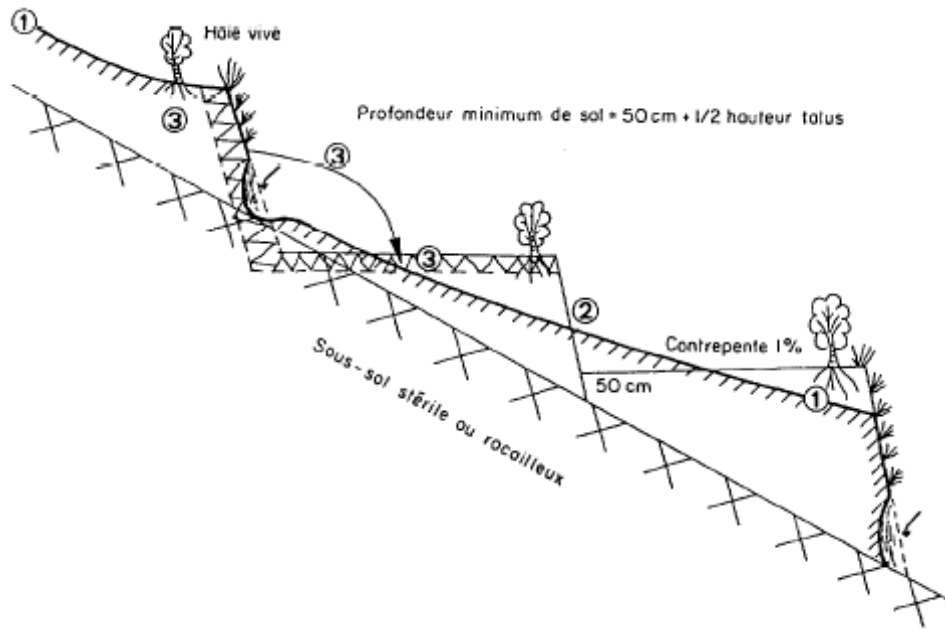


Figure 5 Evolution of progressive to horizontal terraces. After Galliker, 1992.

5.3. Community managed irrigation schemes

At the end of Sixties, reclaimed marshlands for agriculture production were few in Rwanda. The only irrigation case developed during the colonial period was located in the former Kibuye Prefecture. It was in years 1945 that the Belgians put in place a main canal Ntaruko – Rubengera with 8 km of length to irrigate a small farm using different secondary canals.

After the independence, the country population started to increase and the government come up with a bilateral co-operation with China to reclaim marshlands for rice grow. From 1964 to 1988, different bilateral agreements were signed by the government to enable rice plantation on a small scale in Mukunguli marshland (1964), Kabuye marshland (1967), Bugarama (1980), Kagitumba - Muvumba valley (1977) and later Butare (PRB) in 1988. From 1962 to 1994, the total cultivated and irrigated lands were estimated to be 4000 ha.

Currently the surface irrigated in Rwanda reaches 13000 ha on an irrigable potential of 170.000 ha of the marshes, that is to say 7.6%. The major part of irrigated lands is in the marshes and is cultivated out of rice. Irrigated rice production contributes enormously to the livelihoods and incomes of farmers in the country whereby 70% of rice is produced in the country.

There are also some cases of hillside irrigation which are carried out by pumping systems. Here sprinkler irrigation system is done for 55 ha while drip irrigation is made only for 6 ha in the all country. Few hectares are irrigated in Ngororero District using spring water and in the Gasabo District with rainwater retained by hillside ditches.

Tableau 3 Marshland development for rice crop production

Provinces	Surface area of the Sub catchment ,ha	
	Nile basin	Congo basin
East province	17677	
South Province	36080	
North Province	5616	
Kigalio City	2879	
West Province		3841
Total area, ha	62252	3841

Adapted from : MINAGRI/National rice production programme 2006-2016

In 2000, the water use in Rwanda was estimated at 150 million m³/an. Agriculture as principal use consumed 68% whereby rice crop practiced on 8.500 ha would have used approximately 25.500.000 m³. According to FAO (2005), on a total of 165.000 ha to be irrigated, only 8,3% are equipped with irrigation systems. Among them 62% are equipped with water control facilities. In general it is estimated that marshland reclamation and hillside irrigation will make possible the food subsistence in the near future. The following map shows location of cultivated marshlands and water use in crop production Most of those marshlands are located in the Nile basin Catchment.

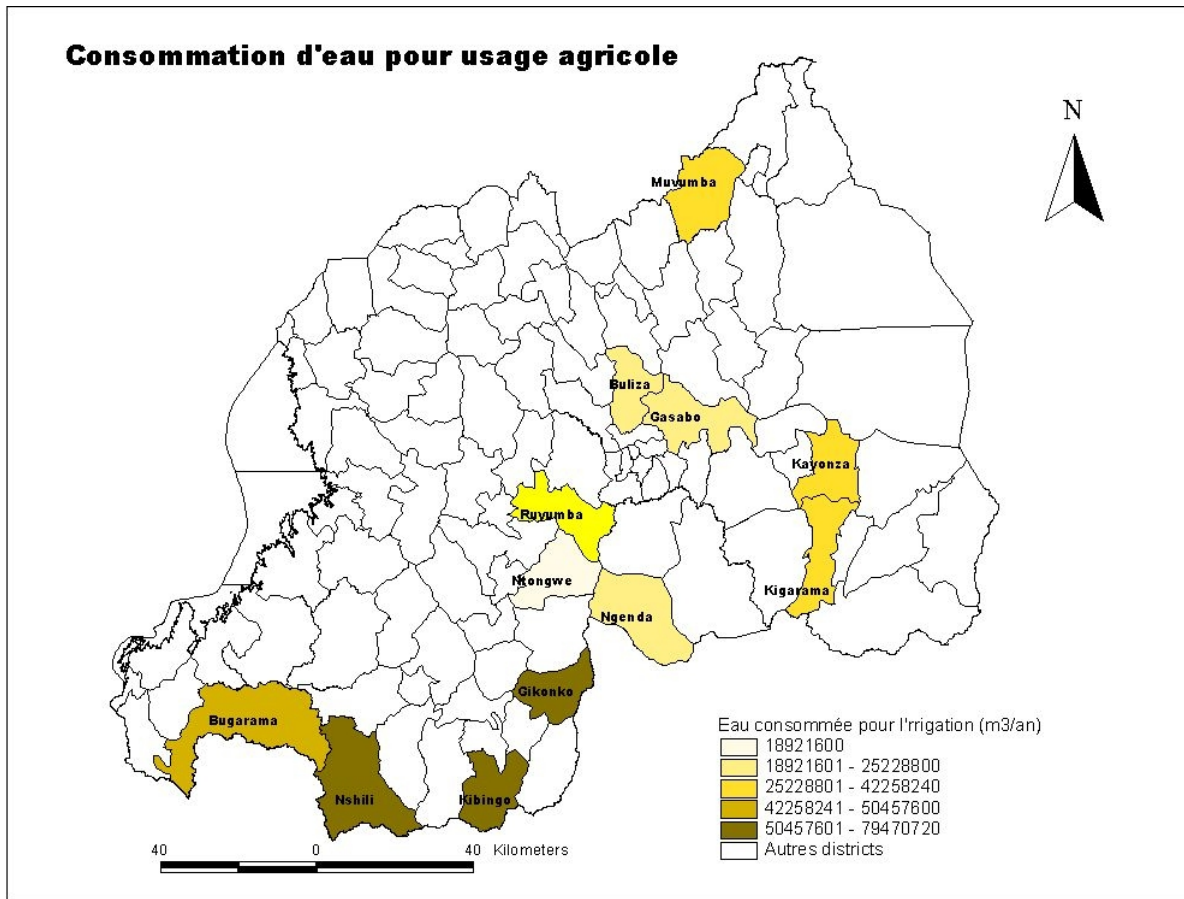


Figure 6 Irrigation water use per District

Source : MINITERE, Troisième rapport national sur la mise en œuvre de la Convention des Nations Unies sur la lutte contre la désertification au Rwanda (Avril, 2005)

5.3.1. Small scale Irrigation systems

Among other irrigation projects, we can mention the irrigation of the Mwesa Valley which covers a net area of 650 ha. The purpose of this project is to limit the impact of drought in Bugesera and the management of the valley should permit the cultivation of rice and market-garden crops twice yearly, as well as water and soil conservation (WSC) through erosion control works on nearly 5 000 ha within the basin. The irrigation of the Mwesa Valley will require the pumping of water from the Nyabarongo River and its channeling through canals and supply ducts up to the head of the valley. The amount of water to be pumped from the river varies from 235 l/s in November to 716 l/s in

September, depending on the needs of crops cultivated. The September figures represent respectively 1.2% and 0.25 % of the average minimum and maximum flow of the Nyabarongo. The total length of the irrigation is estimated to be 100,6 km and the project also includes provisions to supply the pumping station with electricity tapped from Nyamata (7 km away).

The Rome-Kigali Peri-Urban Agriculture Project is a multi-faceted city-to-city cooperation project. The project has involved communities in the management of 500 wetland areas and 1,150 small watersheds; set up 230 local associations on rehabilitated wetlands and 36 in hill areas; established at least 40 micro-gardens, some located in schools for training purposes; and created 96 animal breeding associations and 26 forestry associations. Following the success of the Peri-Urban Agriculture project between Rome and Kigali, the Glocal Forum, together with FAO, is promoting two new peri-urban projects in the cities of Asmara and Nablus. .

Pursuing the same objective, ADRA has developed 100 hectares of swampland in Ntende/Gatsibo District, Eastern Province, with the involvement of riparian communities. By developing this land, associations have benefited their members. Increased production has eased their precarious living conditions. In several cases, they have been able to produce a surplus that they can sell on the market.

The irrigation project of 240 ha of land along the shores of Lake Cyohoha and in Gashora sector have been prepared starting in July this year under implementation by Lux development. .

Swamp reclamation and radical terracing have made it possible to farm formerly unusable land. In rural Kigali Province, in cooperation with various associations, Oxfam Quebec has developed hills into productive terraces, and swamps into cropland, farmed for the benefit of these same associations. Such activities promote access to land. At the same time, they provide farmers with techniques to combat erosion and soil depletion.

For its part, Experco International has assisted in the mechanical tillage of land that was formerly part of Akagera Natural Park. This land had hardened and was deemed more or less arid. The tillage made it possible to increase the cultivated area of household plots by 10 to 60 percent.

Tableau 4 **Planned pilot Project for hillside irrigation**

Provinces	Surface area of the Sub catchment ,ha	
	Nile basin	Congo basin
East province	6300	
South Province		
North Province		
Kigali City		
West Province		
Total area, ha	6300	200

Adapted from : FAO, Besoins d'investissement en maîtrise de l'eau et infrastructures rurales dans le cadre du NEPAD: Cas du Rwanda (Mai 2005).

The use of labor-intensive work (LIW) to develop marshlands has strengthened the effective participation by the beneficiaries and their ownership of the facilities put in place. This approach should be encouraged in future Bank operations. The Emergency Agricultural Production Recovery Project financed by the ADF obtained remarkable results in terms of impact, sustainability, ownership and participation by the beneficiaries in managing the marshlands developed. That success is the result of enhanced capacity of cooperatives born out of beneficiary associations, and their involvement in all phases of project implementation. Although the project was completed in 2004, the cooperatives put in place continue to satisfactorily manage and maintain the marshlands developed.

5.4. Public private irrigation schemes

The public private irrigation schemes are limited to cash crop production in the Eastern province and to some extent new introduced horticulture plantations which have been introduced later 2004.

Chapter VII Potential interventions

6.1. Capacity building

There is a need to empower farmers the skills to solve their own water problems locally. Such 'empowerment' includes encouraging stronger institutions based on local cultural principles leavened as necessary by concerns for equity and fair play, integrating scientific knowledge with local wisdom to identify the feasible options available to the community, and helping them to identify any external assistance they may need, for example sources of credit or technical assistance. Capacity building in all levels will include development of technical and human capacities such as training, information exchange, technology transfer, active participation in international for a, equipment acquisition.

The second point is that durable and effective river basin level institutions can only be built on a strong foundation of local institutions. We suggest establishing interim forums in which the diverse stakeholders' interests would be represented, and to use these forums for educating people on IWRM principles as applied to their circumstances.

Main area of training

- Rural Engineering and Soil Conservation (Water reservoirs, barrages, Diversion systems, water preservation techniques that limit soil losses through erosion, improved irrigation structure
- Marshland reclamation and development for agriculture production
- Prevention of soil erosion
- Rainwater harvesting technologies
- Watershed management (Management of natural forests, Increase and diversify forestry products, Reforestation programmes
- INRM and IWRM approach
- Development and propagation of low cost irrigation technologies
- Hydropower and Irrigation development. The promotion of Low water using technologies

- Operation and Maintenance recovery
- Improved management of boards in charge of irrigation and drainage (Rational soil and water utilization for improved soil fertility and optimal water utilization)

The study tour should be one of the priority to set up for farmers. It should be planned in the Nile Riparian Countries focusing mainly on the actual needs of agricultural transformation in Rwanda. The main areas of activity will be a) hill side soil & water conservation b) Use of technologies of water harvesting c) modern irrigation technologies (drip & sprinkler) to be adapted for hill side, marsh land & low land irrigated agricultural development.

6.2. Policy, strategies and legislations

Agriculture will bring benefit only with an increase of water use for crop production. In this sense irrigation remains the only effective response for the intensification of agriculture in Rwanda . However the major constraint major related to irrigated agriculture are the lack of financial supports, the high price of the inputs like the fuel and electricity, as well as the bad management and the absence of maintenance of the hydro agricultural infrastructures.

A national policy should be adopted in a way of improving investments in irrigation and hence water use in crop production. These measures will be promoted through the encouragement of professional organizations, the development of rural credit, and through NGOs actions and farmer associations which are complementary to public services.

Development and water resources conservation for sustainable utilization to improve the socio economic development of the country is the objective of the policy. The water resource management policy will have to cover the entire water resource cycle in a holistic manner. This entail policies for the protection of the sources which produce the water resources, that is ground water, lakes, rivers wetlands and other hydrological ecosystems.

6.3. Best practices on rainwater agriculture

Anti-erosive bands considerably reduce the runoff on a slopes side and partially reduce it on a plot because the land goes from the top to bottom of a slope. Therefore, terraces are necessary.

However, it is worth noting that terraces increase land slip risks by water infiltration and nutritious elements leaching. Well managed terraces with agroforestry association lead to interesting results.

Those technology such as wastewater treatment: waste stabilization ponds (WSP), wastewater storage and treatment reservoirs (WSTR), constructed wetlands (CW) chemically enhanced primary treatment (CEPT), and upflow anaerobic sludge blanket reactors (UASBs) should be also encouraged.

6.4. Community managed irrigation

Low-cost water lifting and application technologies (e.g., treadle pumps, small power pumps, bucket and drip systems) should be promoted. And the overall agricultural yields per unit area will not depend on irrigation only but also on the use of crop husbandary as well as soil erosion control and adequate plant nutrients.

6.5. Private irrigation

Joint venture agreements should be encouraged with experienced companies located in the Nile Riparian Countries should be also encouraged. This kind of collaboration will bring new technologies in water management in the country.

6.6. Benchmark for Monitoring and evaluation

- The main lessons drawn from various operations mostly relate to the project implementation approach in Rwanda or elsewhere. Centralized decision-making strongly affected the sustainability of achievements. Project implementation units should work with grassroots communities and the decentralized technical departments during the project implementation phase. In that regard, beneficiaries should be sensitized and organized into associations and intergroupings with a view to establishing cooperatives at project entry. That would train members of those structures and ensure their involvement in implementing projects.

- Any coordination activity related to efficient water use for agriculture production should be separately assigned solely to persons dedicated to such tasks and not to persons occupying positions of responsibility within MINAGRI. A system for conducting a yearly performance evaluation of activity and/or project coordinators and staff should be put in place at project start-up to further motivate such workers.

- Furthermore, activity or project implementation units should work in concert with District technical departments which will, in the end, take over the supervision of the above structures. Project financing should necessarily include provisions to build the capacity of the technical departments.

- Difficulties were also noted at the procurement level, leading to considerable delays in project implementation. To overcome this problem, the Government has simplified the domestic procurement procedures under the new public procurement code. To that end, it set up a National Public Procurements Committee to speed up procedures and ensure compliance with Rwandan rules and donor regulations. In addition, it drew up a program to train officials involved in project implementation. Furthermore, the Government has reduced the number of signatories to public procurement approvals and set up a “desk office” to monitor Bank Group projects.

Conclusions and recommendations

1. In Rwanda the population increase has affected the water demands in all sector of the national economy. The food production has failed to keep pace with population growth over the past decade. The productivity and income security of the approximately 90 % of the Rwandan population who depend largely on agriculture (cropping, livestock, fisheries) can be increased significantly through improved water and land management.
2. The agriculture particularly the crop production system of Rwanda is mainly based on rain fed while the rainfall pattern in the country is not evenly distributed through out and from period to period this water is not sufficient neither in quantity nor in terms of regularity. The seasonal agriculture and dependence on rainfall has created chronic famines and food insecurity in some area of the country while experiences show that those lands have sufficient water resources which are not properly utilized and managed. The water management in agriculture lands using modern irrigation systems will enable the country to change from the subsistence agriculture to market agriculture and hence to overcome the problem of chronic famines. This will ensure increase in yield of crop production which is necessary for food security and in come generation.
3. Many technologies and practices that are already crafted but not truly field-tested, provided that market development, information supply to farmers and adequate legislation go hand in hand with it.
4. In Rwanda, 11 out 30 Districts are permanently affected by erosion due to steep slopes, common throughout the nation, coupled with heavy seasonal rains make the task of erosion control essential to the future of Rwandan agriculture.
5. The specific use to which land is put, e.g., cultivation, fallow, pasture, woodlots, and, if it is cultivated, the particular combination of crops grown, can be seen as contributing to both the cause and the solution of the land degradation problem. On average, however, its

effectiveness in controlling soil loss has been mixed. The cultivation should avoid the cropping of secondary crops such as maize and manioc on steep slopes as per their poor soil conservation qualities and promote the cultivation of woodlots and pastures only the gentler slopes and maintain, which provide excellent erosion protection.

6. Water resource development for agriculture and other purposes is urgently needed to promote economic development and poverty reduction. The oversimplified perspectives on agricultural water use in the context of watershed management can lead to serious harm to the productivity and well being of people.
7. It is essential that the organized users assume the responsibility for the reclaimed and drained marshlands, in the form of self-financing and of self-management. It should be privileged the autonomous of different user groups through their total implication at all the stages of the intervention. The concept of autonomy requires the grouping of users under the responsibility of the project. This option considers technical and financial autonomy and allows the transfer of competences in order to maximize the chances of success and land management and development sustainability.
8. It is important also to envisage the implication of private sector (qualified operators, public services, ONG, engineering and design departments,...) within the framework of contracts of provision of services. This subcontracting will make possible to limit the role of MINAGRI which is required at policy level.
9. Alternatives to existing land use practices that may promote decrease damages during high rainfall periods are also needed. Unfortunately, promising solutions such as vegetative buffer zones, afforestation of slopes greater than 70%, and systematic erosion control interventions are difficult to implement in the face of scarce resources and growing population pressures. As pragmatic contributions to these problems, the continuation of applied research projects which concurrently address the technical and social aspects of land use in the North Province, and in densely populated regions throughout the mountain world, is fully warranted.

Bibliographie

Addendum

(b) Terms of references

**NILE BASIN INITIATIVE
EFFICIENT WATER USE FOR AGRICULTURAL PRODUCTION (EWUAP) PROJECT**

**TERMS OF REFERENCE (TOR) FOR NATIONAL CONSULTANT
RAPID BASELINE ASSESSMENT TO COMPLEMENT COUNTRY REPORTS BY
COLLECTING ADDITIONAL INFORMATION AND IDENTIFYING OPPORTUNITIES AND
NEEDS RELATED TO THE EXCHANGE OF BEST PRACTICES IN WATER HARVESTING,
COMMUNITY MANAGED IRRIGATION, AND PUBLIC/PRIVATE MANAGED IRRIGATION**

1.0 BACKGROUND

The Nile riparian countries realizing their common concerns and interests over water have made agreements towards cooperation by establishing the Nile Basin Initiative (NBI). The NBI is guided by a Shared Vision “to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.” In order to translate this shared vision into action, the NBI has launched a Strategic Action Program, which includes two complementary components: 1) Shared Vision Program (SVP); and 2) Subsidiary Action Programs (SAPs). The SVP includes a series of technical, socio-economic, confidence building, and training projects to be implemented basin-wide to help establish a foundation for trans-boundary regional cooperation and create an enabling environment for investments and action on the ground. The Efficient Water Use for Agricultural Production (EWUAP) is one of eight projects of the Nile Basin Initiative's (NBI) Shared Vision Program (SVP).

Agriculture, in general, plays a significant role in the livelihoods of households in the Nile Basin contributing greatly to economic growth and Gross Domestic Product (GDP). On the other hand, compared to the other sectors, agriculture is the main consumer of water. The riparian countries rely on the waters of the Nile River for their basic needs and economic growth, or have desires and expectations of harnessing the Nile for development activities. The agricultural sector is the dominant user of water in the basin but the luxurious and unchallenged use cannot be continued because of growing and competing demands from other sectors. There is a growing pressure to reduce the amount of water allocated for agricultural production mainly because of increasing demands from expanding urban centers, industry, mining, recreation and tourism. Agriculture is, therefore, expected to produce more crop per given volume of water if the system is to be sustained as a viable activity. Such a growing threat can best be addressed in a comprehensive way by collectively dealing on the subject at a basin level.

The EWUAP project is desired, therefore, to be a first step in bringing together the regional and national stakeholders in the riparian countries to develop a shared vision on common issues related to the increase of the availability of water and its efficient use for agricultural production. The main thrust of the EWUAP Project is to establish a forum to assist stakeholders at regional, national, and community levels to address issues related to efficient use of water for agricultural production in the Nile Basin. The forum is expected to foster exchange of experiences furthering Nile cooperation by enhancing mutual confidence and providing a critical building block to the sustainable utilization of Nile waters. The EWUAP project will provide an opportunity to develop a sound conceptual and practical basis for Nile riparian countries to increase the availability and efficient use of water for agricultural production. The EWUAP is expected to meet its project objectives by bringing together regional and national stakeholders to have a common view and understanding on ways and means of improving water use in the sector and develop a shared

TERMS OF REFERENCE FOR NATIONAL CONSULTANTS – RAPID ASSESSMENT OF AGRICULTURAL SECTOR

Page 1 of 5

1 Nile riparian countries include Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda while Eritrea has an observatory status.

vision on common issues. The project will create a framework to promote basin-wide cooperation and awareness, and build limited capacity by focusing on some of the common and basic issues related to water harvesting and irrigation. The project will help establish forums to discuss broad development paths for the Nile Basin with a broad range of stakeholders; improve the understanding of the relationship between water resources development and agricultural activities; enhance basin wide cooperation and raise agricultural management capacities of basin wide institutions.

Key outputs for the project as stated/defined in some of the previous studies, assessment works, and design documents are as follows:

- Establishment of regional dialogue on Water Harvesting (WH);
- Strengthening of regional consultation on Community-Managed Irrigation (CMI) and enhancement of overall awareness on efficient water-use;
- Strengthening of regional consultation on Public and Private-Managed Irrigation (PMI) and the enhancement of awareness on efficient water-use;
- Exploring and disseminating best practices in water harvesting, community and private-public managed irrigation;
- Building national capacity for a sustainable management of water harvesting and irrigation practices; and
- Providing national level support for agriculture, water harvesting and irrigation policy development.

2.0 OBJECTIVES OF THE STUDY

The main objective of the study is to undertake a quick assessment of the agricultural sector identifying opportunities, constraints, needs, and potential interventions or areas of investment with respect to the theme "Efficient Use of Water for Agricultural Production". The Rapid Baseline Assessment (RBA) will complement information already assembled in the country reports by gathering additional information including identification of prospects related to the exchange of best practices for water harvesting, community-managed irrigation, and private and public-managed irrigation. The RBA, essentially a desk work, entails review of relevant documents and study reports in the sector (policies, strategies, technologies/best practices, and developments) including the country papers prepared during the design and development of the Shared Vision Program (SVP) of the Nile Basin Initiative (NBI). The RBA work could, if needed, be supplemented/complemented by a quick, verification like, field visits and/or interviews of stakeholders using pre-established questionnaire, to collect primary data/information.

The desk review work coupled with supplemental primary information from other sources, should lead to the identification and recommendation of the major needs of the sector, potential areas for possible interventions, and project ideas focusing on introduction of technologies and best practices in water harvesting, community managed, and public and private managed irrigation. Emphasis should be placed on interventions designed to contribute to capacity building at national and local levels when identifying/selecting potential activities.

As part of the RBA, consultant shall identify national stakeholders' (public/private professionals, research institutions, water user representatives, associations, community groups, women groups, and NGOs) who are involved in the provision of various services in the sector. The Consultant should explore with the national stakeholders major concerns and practical options and needs to improve WH, CMI, and PMI. Information on existing institutional, technical and

TERMS OF REFERENCE FOR NATIONAL CONSULTANTS – RAPID ASSESSMENT OF AGRICULTURAL SECTOR Page 2 of 5
1 Nile riparian countries include Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda while Eritrea has an observatory status.

professional capacities in the areas of efficient water use (water productivity) will be assessed and compiled.

A list of local/national institutions (research/higher learning), associations, NGOs and think-tanks with potential to organize and conduct capacity building activities in the fields of water harvesting and irrigation shall also be compiled.

In addition, the RBA should provide data to be utilized as bench-mark in Performance Monitoring Plan in association with the three project components and see if interventions/investments are contributing to the achievement of project goals and objectives and whether implementation of activities is proceeding in accordance with approved plan.

Finally, the Consultant shall make a power-point presentation of findings and recommendations to a team of experts and leaders from the Ministries of Agriculture and Rural Development, and Water Resources, Technical Advisory Committee (TAC), World Bank, and donors in the respective country. The Consultant might be requested to travel to the Project Management Unit (PMU) office in Nairobi, Kenya, to discuss, share experiences and exchange ideas on the findings of assessment work with the other national Consultants from the other Nile Basin countries and, possibly, a regional consultant and reconcile recommendations, if need be.

3.0 STUDY LOCATION AND METHODOLOGY

The RBA will be carried out concurrently in all nine riparian countries (Burundi, D. R. Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda). In countries where the Nile Basin is only a small part, the study will focus on the part of the country that lies within the Nile Basin. However the Consultant is expected to provide an overall picture of the agricultural sector in relation to water harvesting and irrigation (small and large-scale) with greater emphasis on efficient water use and productivity of water. The assessment shall to a great extent be a desk work of reviewing sector-wide study reports, country papers, and other specific documents dealing with agriculture and water resources. It is believed that a quick assessment of the sector could be effected using existing secondary data sources. If need arises, the RBA work could be supplemented with primary data/information generated from limited and targeted verification type studies and/or interviews conducted with government officials and other stakeholders in the sector.

In order to produce a fair and balanced report identifying sector wide opportunities, constraints, needs, and areas for potential intervention reflecting national interests and existing conditions, consultation should be broadened to include government offices, research and higher learning institutions, associations, NGOs, individuals and groups involved in the agriculture and water sectors. The consultant should review/examine appropriate documents and database existing in the Ministries of Agriculture, Water Resources, and Environment, research institutions, associations, NGOs, donors and others. Reference should also be made to other relevant documents available in the national NBI office of the respective country. Some important reference materials available in the national NBI offices include but are not necessarily limited to:

- Project Appraisal Document; Efficient Water Use for Agricultural Production. World Bank, March 2005.
- Project Implementation Plan; Efficient Water Use for Agricultural Production, April 2005.
- Project Implementation Manual; Efficient Water Use for Agricultural Production.
- Country reports prepared in support of the above documents. and

TERMS OF REFERENCE FOR NATIONAL CONSULTANTS – RAPID ASSESSMENT OF AGRICULTURAL SECTOR

Page 3 of 5

¹ Nile riparian countries include Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda while Eritrea has an observatory status.

- Integrated Water Resources Management strategy developed by the International Water Management Institute (IWMI), FAO and others.

Special consideration should be made to references focusing on Integrated Water Resources Management, Watershed Management, Water Harvesting, and Irrigation within the watersheds of the Nile River.

The consultant shall relate findings and/or recommendations of the rapid baseline assessment work to the recommendations described in project design documents such as the Project Implementation Plan Project Appraisal Document.

4.0 SCOPE OF WORK

Based on the background information and some of the objectives for the assessment work, the Consultant will undertake the following:

- I. Review and analyze documents and/or reports describing the agricultural sector in general and emphasizing on WH, CMI, PMI, productivity of water, and efficient use of water for agriculture;
- II. If need arises, verify important findings from desk review with primary data collected from field visits and/or interview of appropriate officials and individuals;
- III. Identify opportunities, constraints and needs of the sector by concentrating on the efficient use of water and water harvesting under rain fed and irrigated agriculture, and pinpoint some potential interventions;
- IV. Prepare a background information on the agricultural sector, identify constraints and opportunities by highlighting the prominence and role of water management practices (harvesting, storing, diversion, conveyance and utilization) in the sector;
- V. Put together information on the current state of water use in the sector showing major opportunities and drawbacks;
- VI. Based on findings of desk review, personal experiences, and knowledge on the sector, propose interventions/activities to be considered for implementation under the three project components (Water Harvesting [WH]; Community-Managed Irrigation [CMI]; and Public/Private-Managed Irrigation [PMI]);
- VII. Review institutional and legal framework arrangements for the sector with special emphasis on management of water resources for agriculture, and policy/strategy development with respect to the efficient use of water for agricultural production. Identify key players in the sector and show their relationships;
- VIII. Illustrate the state of water use in relation to WH, CMI, and PMI by taking into consideration extension services, water storage and conveyance, water allocation, charges/fees, and the enforcement of guidelines and regulations;
- IX. Provide information on associations, water use groups, NGOs and others involved in the provision of services related to water use and irrigation;
- X. Identify site(s) that might qualify as center(s) of excellence for sharing information on best practices nationally and only one site per component (WH, CMI, and PMI);

- XI. Identify and register best practices associated with efficient use of water in the sector but related to the three project components that you feel could be shared with other users in the basin;
- XII. Critically examine service provisions (extension and other inputs) and indicate if investment in staff training is something that should be considered in the area of capacity building;
- XIII. Identify and document bench marks for use as baseline data in monitoring project interventions in WH, CMI, and PMI systems;
- XIV. Observe and record, if possible, level of awareness, at all levels, on the growing and competing demands for water from other sectors and the likely scenario of fee based service in irrigated areas;
- XV. Describe and/or list some actions to be considered by the project in promoting improved water productivity at all levels;
- XVI. Compile and synthesize information generated as a result of the above tasks and others and produce/develop desired assessment report; identify project components (different than those in the design documents); and provide some baseline data that serve as bench marks for monitoring and evaluation purposes.

5.0 DURATION OF ASSESSMENT WORK AND DELIVERABLES

The proposed rapid baseline assessment of the agricultural sector will be carried out in four weeks time (20 up to 23 working days). The Consultant, to be selected from a list supplied by TAC members, Project Steering Committee (PSC), and/or National Project Coordinators (NPC) will conduct the rapid baseline assessment based on time frame shown below or an alternative to be submitted by consultant and agreed upon:

- Preparation and submission of a detailed work plan showing details of the processes and activities to be undertaken including the time frame required for the assessment work (desk review, field verification, consultation, etc): 0.5 day;
- Identification, collection, assembly and sorting out of relevant documents, study reports and other reference materials including development of questionnaire, if need arises, for field activities and/or interviews: 2 days;
- Review appropriate documents while identifying, summarizing and compiling relevant information, data and other necessary inputs required for the preparation of the baseline assessment report: 8 days;
- Sort out, analyze and compile data/information collected, detect limitations, develop methodologies and simple questionnaire, if need is felt, for the collection of additional primary data and/or field verification works, and preparation of the first draft report: 3 days;
- Undertake field activities, if found necessary and approved, to collect primary data for verification and corroboration: 2 days
- Review/revise draft report based on the nature of primary data and findings from field verification visits: 1.5 days;

- Produce and submit Draft Interim Report at the end of 19 working days to the Project Management Unit (PMU) in both hard copy and soft copies (word format in a floppy diskette or CD) for initial review and comments;
- Organize and conduct seminar to present/discuss major findings/recommendations of the assessment work within 2 days of submission of the Draft Interim Report to TAC, SC, NPC, PMU and other stakeholders in order receive some feedback information - 1 day;
- Revise the Draft Interim Report by incorporating relevant comments, suggestions and observations received from PMU, seminar participants and other stakeholders who reviewed the report: 1 day;
- Produce and submit a Final Draft Report of the Rapid Baseline Assessment work to the PMU. The Final Draft Report will be submitted to the PMU in both bound hard (five) and soft copies (word format in a floppy diskette or CD): 0.5 day;
- Request by PMU to effect certain changes and incorporations to the Final Draft Assessment Report, if found necessary, within two working days. The Contractor will incorporate necessary/requested changes and submit a final version in software only: 0.5 day.

6.0 EXPECTED OUTPUTS

A comprehensive assessment report of the agricultural sector of a riparian country comprising of:

- i. Overview of the agricultural sector in relation to efficient use of water resources for agricultural (crop, livestock, and agro-forestry) production in the country, covering legal and institutional frameworks, identifying needs, constraints and opportunities, recommending project components (new or additional) and priority areas of investments/interventions;
- ii. List of institutions or firms involved in the areas of water harvesting, community managed irrigation, and private/public managed irrigation systems and their capacities;
- iii. List of centers of excellence for the three components indicated above and/or others identified by the Consultant;
- iv. List of national stakeholders including public/private professionals, associations, research institutions, societies, higher learning, community organizations, NGOs, women groups, and others associated with the three project components and/or others identified during the assessment;
- v. Suggested/recommended interventions to be considered at grassroots level including actions to increase greater awareness and understanding on the urgent need for efficient water use and/or improved productivity;
- vi. Information/data that can be used as bench marks for monitoring and evaluation of interventions. And
- vii. The main report, including background information on the agricultural sector, should not exceed 35 pages and font sizes of 10 - 11. Consultant can provide as much information as possible in Annexes and/or Attachments for which there is no limitation. Consultant is encouraged to provide lists/rosters of stakeholders,

TERMS OF REFERENCE FOR NATIONAL CONSULTANTS – RAPID ASSESSMENT OF AGRICULTURAL SECTOR

Page 6 of 5

1 Nile riparian countries include Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda while Eritrea has an observatory status.

reference materials, persons contacted, offices/sites visited, TOR, and related as part of the Annexes.

7.0 MONITORING AND SUPERVISION

This will be carried out by the PMU and the NPCs in each of the Nile basin countries. The services of the WH, CMI, and PMI Working Groups might also be used to provide invaluable assistance in monitoring and supervision.

8.0 METHODOLOGY AND STANDARDS

The Consultant will be expected to employ the most effective methodology to achieve results. This study will basically involve collection and compilation of existing information from relevant sources (Ministries of Agriculture, Water, Land and Environment, Research Institutions, NGOs and the private sector). The Consultant will primarily focus on secondary data sources with an option to gather additional primary information if found absolutely necessary in terms of verifying/substantiating secondary data. In addition the Consultant will be expected to:

- o Design and use questionnaires that are realistic and capable of capturing accurate information,
- o Collect most of the data from existing secondary sources,
- o Use credible support staff in data and information collection,
- o Prepare clear and concise reports,
- o Ensure that the reports are delivered on the specified date(s),
- o Communicate any unforeseen deviation from the agreed consultancy plan immediately, with clear justifications and proposed remedial course of action

9.0 REFERENCE DOCUMENTS

The following documents would be availed as reference background material:

- i. Project Appraisal Document(PAD)
- ii. Project Implementation Plan(PIP)
- iii. Country reports/documents prepared in relation to the design and development of the project and available with TAC and/or the national NBI office in each of the Nile basin countries.
- iv. Integrated Water Resources Management strategy developed by the International Water Management Institute (IWMI), FAO and others (available in the web-sites of each organization).

10.0 TIME FRAME

The proposed assessment would commence o/a the beginning of the 4th week of August 2006 and completed by the 1st week of October 2006 (Estimated 23+ working days).

11.0 RENUMERATION

The Consultant will be remunerated in accordance with the standard/official UNDP rates for National Consultants in each of the respective Nile basin countries. Reimbursable expenses will be made according to an agreed and approved plan

12.0 QUALIFICATIONS OF THE CONSULTANT

- Advanced degree in water resources management, agriculture, environment, or related fields of study;
- Extensive experiences in water harvesting, irrigation (small and large scale), watershed management, crop and livestock production;
- At least ten years of experience in agricultural production, soil & water management, environment, and natural resources management;
- Excellent knowledge of the broader agriculture, efficient use of water, and general environmental issues;
- Experience working in the country, particularly in the watersheds of the Nile River is an added advantage.
- Fluency in spoken and written English; knowledge of French an added advantage.
- Excellent presentation and communication skills.
- Excellent analytical skills.
- Good computer skills.
- Experience in having worked with/for an international or donor organization is an advantage.

People interacted with

NN	Name	Institution
1	Cyubahiro Edouard	MINAGRI
2	Gaju Anita	RURA
3	Ndutiye Simon	MINETERE
4	Gashagaza Mukwaya	NUR
5	Habiyambere Thadée	Consultant
6	Harindintwali Réverier	MINAGRI
7	Kayiranga Didace	ISAR
8	Ngarambe Vincent	MIG
9	Niragire Antoine	NDSS/WRPM/NBI
10	Niyamira Faustin	Agronome District Gasabo
11	Mulingirwa Emmanuel	NPC/NTEAP
12	Nzeyimana Innocent	NUR
13	Mushinzimana Juvénal	ISAE
14	Rwakazina Innocent	MINITERE
15	Ruberengeyo Théophile S.	MININFRA
16	Ruhamyia Coletha	KIST
17	Rayar Antoni Joseph	ISAE
18	Sendenge Norbert	MINAGRI