Rwanda

Impact of macro policies on soil erosion

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Table of Contents

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Foreword

The Nile Basin Initiative (NBI) is a partnership between riparian countries of the Nile; namely Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The NBI's shared vision is to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from the common Nile Basin water resources". To translate this shared vision into action, there are two complimentary programmes: the Shared Vision Program (SVP) which creates a basin wide enabling environment for sustainable development; and the Subsidiary Action Programmes (SAPs) engaged in concrete activities for long term sustainable development, economic growth and regional integration of the Nile Basin countries.

The Nile Transboundary Environmental Action Project (NTEAP), one of the seven projects under the Nile Basin Initiative's (NBI) Shared Vision Programme, is mandated to provide a strategic environmental framework for the management of the trans-boundary waters and environmental challenges in the Nile River Basin.

As part of a broader plan of raising environmental awareness, NTEAP seeks to enhance the understanding of common and high priority policy issues that affect the environment of the Nile Basin. This will be done through policy studies of the patterns of economic development and priority transboundary environmental issues. The Nile Transboundary Environmental Analysis which was developed by the riparian countries in collaboration with the World Bank, UNDP and GEF identified priority environmental issues and threats in the Nile Basin. Better understanding of how these environmental threats are influenced by macro and sectoral policies and identifying the root causes is essential to explore possibilities of jointly addressing the threats.

In August 2006 the NTEAP held a planning workshop in Tanzania on impact of macro-sectoral policies on the Nile Basin environment. The workshop discussed the concept note on macro policies prepared by NTEAP, reviewed country papers and decided on the kind of studies that could be carried out in line with macro and sectoral policies. Topics were selected on the basis of their relevance to the Nile Basin, significance of trans-boundary aspect and where policy intervention/policy reforms will be required. Four research themes/topics emerged. These focused on the macro/sectoral policies: on soil erosion; Non point pollution/pesticide pollution; exploration and development of oil projects; and deforestation in the Nile Basin.

This report aims to open a debate that will enhance understanding of the relationship between soil erosion and the environment in the Rwanda part of the basin. Thus it provides a forum to discuss paths for the Nile Basin with a wide range of stakeholders. This in turn will provide a strategic environmental framework for the management of the Nile Basin and the impending environmental challenges and threats existing in the Basin. Further it will contribute to the achievement of sustainable and equitable socio-economic and development of communities in the basin. Specifically, this report provides a synthesis of the impact of macro-sectoral policies on soil erosion in Rwanda. It also suggests the necessary interventions and reforms required to influence policy change.

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Executive Summary

Land constitutes a resource of high value in Rwanda. It occupies a first priority in the national economy since farming employs more than 90% of the working population and contributes about 93% of exports. However, for a long time until 2005, the country did not have a land policy to guide the sustainable management and utilisation of land. A number of disjointed laws were enacted to play the role of sustainable management and utilisation of land. The customary law dominated land tenure system.

The Government concern on problem of erosion started in 1930 and became compulsory in 1947. These efforts were more forceful after independence in 1962. Community participation in soil erosion control was poor as community members saw this government programme as hard labour.
In 1970 revived the soil erosion programme and enacted the soil conservation law of 1982. Although a lot of research was done in the 1980s, farmers were not convinced on the need to invest in soil erosion control as the activity was in most cases expensive to make but did not improve crop yield immediately.

The erosion problem in Rwanda is caused by high population pressure, steep landscape, high rainfall and poor development of alternative source of income forcing large proportion of the population to depend on natural resources services (food, fuel, income etc) for their livelihood.

The absence of macro and sectoral policies might have contributed more on soil erosion problem. The existing macro and sectoral policies lack guidance and implementation strategy. However, currently, the Government of Rwanda is putting much effort in formulation of policies and strategies are guided by Vision 2020 in long term and Economic Development and Poverty Reduction Strategy (EDPRS) in medium term. A number of macro and sectoral policies have been enacted. They include land, environment, forestry, agriculture, water, industries, and investment, among others. These policies aim to increase national economic growth, which depends on increased agricultural productivity. Agricultural productivity in turn depends on good soil utilization, conservation and erosion control.

Recommendations
The current industrial policy needs updating to include various elements such as capacity building on private sector, industrial research and prioritization. There is much focus on agricultural processing and value addition, with less emphasis on supporting industries of tools manufacturing. The industrial strategic plan and master plan to guide capacity to absorb ever increasing population is essential. The relation of industries, service provision and population growth is important. With a well developed industries and service policies, more people can depend less on as envisioned in Vision 2020 that only 50% will depend on agriculture.

Another policy which needs to be put in place is the soil conservation and fertility management plan. Currently the soil conservation is the responsibility of MINAGRI though it is not regarded as part of agricultural intensification. However, it is a tool and component of all technical messages taken to all farmers. The erosion control is not a function of one ministry or sector alone.

The research on erosion needs further development because, to-date, there is no comprehensive study covering all agro-ecological zones and looking at watershed level.

In Rwanda, land constitutes a resource of inestimable value in Rwanda. It occupies a first-rate place in the national economy since farming employs more than 90% of the working population and contributes about 93% of exports. Due to high population pressure, the farmers are using the land on steep slopes which are not recommended for farming.

Until 2005, the country did not have land policy to guide in sustainable utilization. Agricultural activities and land tenure system were guided by bits and pieces of law. These were of less importance as customary land tenure system dominated the management and utilization of land. The Government concern on problem of erosion started in 1930 and became compulsory in 1947. However, these efforts were more forceful after independence in 1962. The community regarded the trench making as drudgery and was not willing to invest any more energy in maintaining the erosion control structures, till 1970's when the Government realised the danger of not controlling erosion, and revived the activity. The erosion problem in Rwanda is a function of high population pressure, steep landscape, high rainfall and poor development of alternative source of income forcing large proportion of the community to depend on natural resources services (food, fuel, income, etc) for their livelihood.

The absence of macro and sectoral policies might have contributed more to the soil erosion problem. The existing macro and sectoral policies and laws in many sectors have no clear guiding principles. Most laws that have been enacted such as the soil conservation law of 30 March 1982 have not been re-enforced to-date.

However, currently, the Government of Rwanda is putting much effort in formulation of policies and strategies, and is guided by Vision 2020 in long term and EDPRS in medium term. Decentralized policy is now in place and monitoring and evaluation of execution through imihigo is functional. Other sectoral policies such as land, environment, forestry, agriculture, water, industries, investment are also in place and functional. These policies have a common goal of increasing national economic growth, which will also depend on increased agricultural productivity which in turn, depends on good soil utilization, conservation and erosion control.

Soil erosion in Rwanda

Development of the policies for alternative source of livelihoods which will take off the pressure from the land will be the best option. These policies may include comprehensive industrial policy, its strategy, and master plan. Currently industrial policy need updating to various elements including capacity building on private sector, industrial research and prioritization. There is much focus on agricultural processing and value addition, with less emphasis on supporting manufacturing industries. With a well developed industries and service policies, Rwanda can expect that more people can be off land as indicated in Vision 2020 that only 50% will be depending on agriculture.

Another policy which needs to be put in place is the soil conservation and fertility management plan. Currently the soil conservation is the responsibility of MINAGRI, however, it does not regard it as a part of agricultural intensification programme. The soil conservation plan is a tool and component of all technical messages taken to all farmers. This good method, however, is supposed to stand alone, and its strategy developed. Erosion control is not a function of one Ministry alone; the later should only coordinate.

The research on erosion needs further development because, to-date, there is no comprehensive study covering all agro-ecological zones and looking at watershed level. The available information should be expanded and research into soil erosion be extend, from the top of the hill where the erosion starts down to the river to assess the related sediments. The research into erosion should develop system thinking in addition to single plot in single locality. This will explain the basis of having sediments in Nyabarongo River throughout the year. How much does soil erosion problem contribute to sediment load in Nyabarongo River and how much comes from coltan washing and stone queries. Rwanda's relief presents varieties, composed mainly in the east by lowlands; in the centre by hills and in the west by high mountains; the altitude increases westward and varies between 1000 and 4500masl.

Extent and severity of soil erosion

Rwanda is a mountainous country with high rainfall pattern (annual rainfall ranges between 783 mm and 2058 mm) that makes the country's numerous hillsides extremely vulnerable to erosion. Large part of the country is prone to soil erosion risks as indicated in Table 5.1 below. Only 23.4 % of the country has small risks, 37.5% need protection measures and 39.1% are high to very high erosion risk.

The land shortage has necessitated the occupation and development of land which is unsuitable for agriculture. Crops are planted on slopes and occupy up to more than 80% of land known as marginal (land above 60% slope which should be left for forestry only), resulting in soil erosion due to cultivation on excessively steep slopes (>60%). Lack of water management and conservation coupled with excessive exploitation of these resources, make soils in Rwanda prone to continuous degradation and erosion.

Table 1: Distribution of soils according to slope and erosion risk classes

Soil erosion risk class.	Very High	High	Average		Weak	Very weak
Surface (Ha)	357,529	436,563	763,005		340,376	136,625
% of Soils	17.6	21.5	37.5	16.7	6.7	

Source: PSTA 2004

Where it becomes necessary to use these sites, it is recommended to use terraces. However, terraces are expensive to make, takes time per house to construct, reduce land size and produce low yield during the first two years, but doubles yield in the following years when sufficient quantities of manure are applied on them. Due to misuse of land and cultivation on steep slopes without protection, land losses are considerable and are estimated between 0 and 557 tonnes/ha/year. The soil load varies according to the gradient of the slope and type of crop planted and management. It is generally accepted that for slopes between 2 to 5% farming practices are enough to address the effect of soil erosion. For slopes up to 25%, anti erosion measures (hedges, trenches) become necessary. Slopes which are above 25% need heavy works such as terracing. Terracing recommended and the conservation of cultivated lands becomes more difficult on slopes above 35%. Beyond 65% any cultivation should be avoided. The area should be protected.

The transboundary concern is the soil load carried by running water and rivers. For example, Nyabarongo River carries solid load of between 51 kg/s at Nyabarongo near Kigali, to 44 kg/s at Nyabarongo near Kanzenze, and 26 kg/s at Akagera near Rusumo falls. The variation gap of these losses varies between 33 and 288 kg of dry matter per second. (Environ. Policy, 2004)

The government concern on soil erosion started in 1930's when the population was still very small (69 people/km2) and by 1947, it became a colonial order to control erosion using trenches. This was a top down order which was accompanied by punishment. To date the community has not adopted it as their sole responsibility to-date. At independence, especially during the first republic government, the erosion control measures were abandoned as drudgery till in 1970's. However, the population growth continued and exerted enormous pressure on natural resources, in particular on arable land and forests, and it became necessary to resume soil conservation measures. By 1982, a law on soil conservation and erosion control was enacted. This pressure is reflected in the increased demand for natural resources (land, water, energy (fuel wood), foodstuffs, etc), land clearing for agricultural and animal production purposes, building of houses, modification and destruction of biodiversity habitats, and deforestation in general. Consequently, soil erosion is accelerated in most cultivated areas without protection measures as indicated above.

Land relief, population and resources imbalance

The imbalance between the population and natural resources which have been degrading over decades, have led to the cultivation of marginal areas, the erosion and unplanned farming. Rwanda's soils are fragile and therefore vulnerable and very sensitive to erosion. The country is characterised by an uneven relief and steep slopes. The rainfall is very high and bimodal and ranges from 900mm/year in the eastern part to 2500mm/year in the highlands. These high rainfalls expose steep-sloped soils to water erosion because of fragile nature of soils from poor sandstone parent rock in many parts of the country. Usable land (for settlement, livestock pastures, infrastructure development etc) is estimated at 52% of total surface area of the country.

Population density of about 309 inhab./km2 for physical density and more than 410 inhab./km2 for physiological density in absence of alternative source of income lead to excessive overcrowding of the population on land, leading to use of marginal areas and increased soil erosion without policy and strategy on compulsory soil conservation measures. As a result of the high population pressure, the available land per house hold is about 0.6 ha. According to 2002 Census, the distribution of households per available land is shown in Table 3

Table 3: The plot size categories and proportion of households for each category in Rwanda according to population 2002 census

Plot size (ha)	Households % of population
0.00 - 0.50	54%
0.50 - 0.75	14%
0.75 - 1.00	11%
1.00 - 2.00	16%
2.00 - 3.00	3%
>3.00	2%

Source: *2002 Census*

The reduction of cultivated areas per family is widespread in the whole country, with 54% of population having an average size of less than 0.50 per household in some parts. However, according to FAO, the critical threshold below which a farmer cannot meet his basic food needs through agriculture alone is about 0.75 or 0.90 ha. Basing on FAO and the 2002, Census, 68% of Rwandan population is unable to meet basic food needs. This situation contributes to the exhaustion of land resources and accelerated soil erosion and deterioration.

This land shortage has necessitated the occupation and development of land which is unsuitable for agriculture. Crops are planted on slopes and occupy up to more than 80% of the marginal land. Cultivation on excessively steep slopes without any techniques for erosion control or soil and water management and conservation, together with their excessive exploitation, make soils in Rwanda prone to erosion and continuous degradation. Land losses are considerable and are estimated between 0 and 557 tonnes/ha/year. The methods and techniques used for soil conservation and erosion control have given priority to soil protection at the expense of the

improvement and restoration of soil fertility, making them less attractive to farmers in the absence of fertility amendment measures and source of manures. This inadequacy of modern farming techniques for land development and rational management of land resources leads to frightening erosion.

While forests and natural reserves in Rwanda are subjected to high human pressure and the rate of deforestation is very high, the decentralised decision making will ultimately develop community level strategy of forestation and management. The massive deforestation due to population pressure, combined with the abandonment and destruction of erosion control systems, greatly contribute to the degradation of the bare land on steep slopes and hills making it prone to severe soil erosion. Additionally, the exploitation of mines and quarries carried out in the different parts of the country affects soils on hills and contributes to increased erosion and sediments in Nyabarongo River and its tributaries.

Effect of structural adjustment programme and job loses

Rwandese government signed the structural adjustment programme (SAP) in 1990. Under SAP package included:

(i) devaluation of the Rwandan Franc by 40% in November 1990 and a further 15% in June 1992;
(ii) control on recruitment and salaries in the state sector;
(iii) increase in user fees for health, education and other services;
(iv) reduced subsidies to coffee producers;
(v) the phased removal of protectionist trade restrictions;
(vi) privatisation of some state enterprises;
(vii) increased taxes in some sectors to help reduce the budget deficit; and
(Viii) a social 'safety net' programme to cushion the impact of adjustment on the poorest. The SAP led to social unrest and did not achieve its goals. In addition due to war and genocide 1994, its influence on soil erosion cannot be emphasized.

Nevertheless, the effect of SAP on soil erosion may not be under rated because the retrenched Government employees and controls on salaries increased pressure on dependence on natural resources, which in turn might have influenced soil erosion, though there is no clear direct linkage.

Macro/sectoral policies

Influence of Macro policies on soil erosion

The macro policies have a significant role to play in national economic growth and development, which in turn influence the use of natural resources. Rwanda is guided by vision 2020 in long term and EDPRS in medium term for national development. Both vision 2020 and EDPRS identifies agriculture as a major contributor to economic growth and national development. This places more emphasis on proper land management and soil erosion control as an essential activity. The two policies direct all activities in soil conservation and erosion control. In addition, there is decentralized policy which enables grassroots participation in decision making and enhances adoption and ownership. It is anticipated that the three policies will play key roles in the erosion control.

Influence of sectoral policies on soil erosion

In general, the current policy situation in Rwanda is good and progressive. The sectoral policies which did not exist in the past are now in place. During the last five years, the country has developed various sectoral policies which include environment policy, land policy, forestry policy, water and sanitation policy, agricultural policy, industrial policy, and investment policy, among others. All these policies clearly identify focus areas in keeping with national priorities for economic growth, and poverty reduction. Soil conservation is also indicated as a key factor in all of the policies.

All these policies focus on rural development and importance of increased agriculture productivity in economic growth, proper land use and adoption of erosion control measures for soil and fertility conservation as integral part of all strategies. However, as pointed out by one political analyst, adequate policy is only one of the several important components that need attention:

The principal cause of policy failure, both in agriculture, land and environment and the rest of the economy has been the assumption that change of policy and its supporting legislation will be adequate to ensure a successful outcome of the reforms. Without adequate attention given to the acceptance of the reforms by the stakeholders, the organisational requirements for the reform execution, and the time needed to implement reforms

It is for this reason that the GOR is giving power to local authorities and grass root structures to make decisions through decentralization, and make it known to the public through performance based contract imihigo. Therefore, besides policy development, there is a great need to give attention to policy acceptance, execution mechanism and implementation time framework, and reliable monitoring and evaluation of execution.

Land tenure system, legal and institution frameworks

According to Rwanda national land policy, land tenure may be considered as methods and procedures of land acquisition and appropriation. It is, in other words, a combination of regulations that determine modes of access, exploitation, and control of land and its renewable natural resources. It is therefore a relationship between humans or social groups, and land or its underlying resources. Land tenure has a multi-disciplinary dimension that includes social, technical, economic, institutional, legal and political aspects. The debates on the land issue stand to include space and nature, methods of land appropriation, the role of the government, among others.

Currently, the land tenure system in Rwanda is supported by a dual legal system namely acquisition according to customary law or conceptions, and acquisition according to the written law. Like during the colonial period, the customary law still dominates. Land tenure system during pre-colonial was 100% customary. During the colonial period very little change occurred. A large proportion of arable land continued to be under traditional system which is still being used in rural area to date. As compared to the colonial period, the situation after independence (in 1962) till 1994 did not change much as 90% of the country's arable land was still governed by customary law. The written law still applied to a very small number of persons, especially in urban entities, trading centres, as well as institutions like religious communities, GOR institutions.

Under customary law (which governs almost all the rural land), the land belongs to the family. It is passed on from one generation to the other from son-to-grandson inheritance. The written law governs land under urban administrative entities and some rural lands belonging to institutions like churches, non governmental organisations and government agencies. This statutory law establishes rights of land tenure to individuals such as short term lease, long term lease and title deeds (particularly in towns). The written land law applies to a very small number of people trading centres, as well as religious communities

During the pre-colonial period, the customary law was characterised by collective ownership of land, and was based on the complementary links between agriculture and livestock. This system facilitated economic production, stability and harmony in production. As the socio-political and administrative structure became stronger and better organised, so did the land resources become more vitally important. The land rights were respected and transmitted from generation to generation according to tradition and custom. The colonial rulers found this system in place, and added a new method of land administration governed by written law, as a dualism model on the duplicity of the king's powers, and those of the colonial power. The colonial rulers applied indirect rule and channelled their commands through the King. The colonial government introduced the written law into the "Codes and Laws of Rwanda". They imposed this legal structure to protect the interests of colonialists and any other foreigners who desired a plot of land in Rwanda.

During 1st and 2nd Republic after independence, the situation did not change much, 90% of the country's arable land remained governed by customary law. The government of the time recognised the very important role played by the commune in the administration of land. Through the 'Loi Communale' of 23/1/63, the conservation of rights concerning registered land under customary law is the responsibility of the commune. The period after independence may be looked into during three decades following independence, the 1960's, 70's and 80's. The 1960's saw suppression of the "Ibikingi" system, declaring land to be state property, and repossess land which had belonged to the 1959 Tutsi refugees, in order to acquire additional land. The 1970-1980 decade, was an intensive internal migration from the densely populated areas in the North, South and West in search for vacant land. The Government attempted to transform the existing housing system into grouped homesteads, known as the "paysannat". The purpose was to enforce an even distribution of plots.

The decree No. 09/76 of 04/03/76 concerning the purchase and sale of customary rights on land, or the Right of Soil Occupation gives the right to purchase and to sale the customary property land on condition of having the permission of the Minister in charge of lands and the obligation to remain with an area of 2 ha minimum. The buyer may also justify that he does not have a land of at least 2 ha.

At the beginning of the 1980s, the "new" land no longer existed, and serious problems began to emerge; the reduction of soil fertility as well as land for cultivation, family conflicts stemming from land expropriation and scarcity. The average surface area of a family's cultivation plot was reduced to 1.2 ha in 1984 from 2 ha in 1960.

After the Tutsi genocide in 1994, the return of 1959 Tutsi refugees gave rise to some serious land problems. The land shortage problems added to already existing problems such as excessive parcelling of plots, deforestation, and the increased degeneration of the soil. Under this tenure system, and population pressure, soil conservation and erosion control was not effective.

This situation resulted in the development of a national land policy of 2005 that takes into account the evolution of the land situation and, and brings radical changes to ensure proper land management and land administration. According to national land policy and land law of 2005, every Rwandan has a right to land.

Policy on population growth in relationship to economical growth

The absence of population policy and dependence on natural resources for income generation are the major source of land crisis and poor soil conservation and soil erosion in Rwanda. The Rwandan population estimated at 1,595,400 during 1934, rose to 8.2 million during the year 2002.

The high population pressure led to reduction in plot size per family with some having an average area of about 0.5 ha per household. This resulted into poor land management and without flexible erosion control measures. In addition, most soils are fragile, and therefore very vulnerable and sensitive to erosion. Moreover, the country is characterized by hilly terrain, with a physiographic pattern of steep hills. Thus Rwanda gets its name - "Land of thousands Hills" from the hilly

terrain, high altitudes and rainfall. The eastern part of the country is lowlands and receives an annual rainfall that is less than 1,000 mm per year, while the higher altitudes of the northwest receive an average of 1,800 mm per year, with a maximum of 2,500 mm. This high rainfall makes the slopes vulnerable to soil erosion.

Financial, material and human resources

Bad management and poor utilization of land resources and erosion control are also products of the lack of human, material, and financial resources. A good land administration requires skilled and motivated staff, as well as an enormous amount of material and financial resources. Currently, there are inadequate personnel and resources. Studies on soil erosion are carried out by postgraduate students for academic purposes and lack continuation. Case studies carried out in one locality are never scaled up to look at the whole system and watershed in general. A lot of data is missing to enable land manager make informed decision. For example there is no data on the amount of soil eroded from the slope deposited in the valley bottom or carried by river as sediments. Similarly the variation of amount of sediments in rivers during the year, taking into consideration the rain and dry season variability. Though the study along Nyabarongo indicated variation at different points, it did not show the seasonal variation at these points.

Forestry policy and natural reserves

Rwandan forests are subject to human pressure. Due to the clearing of forests for cultivation purposes, between 1958 and 1978 the Nyungwe Mountain Forest's surface area was reduced from 114,125 ha to 97,138 ha, i.e. a loss of approximately 17,000 ha in a space of 22 years. This was, in other words, a deterioration of 15% of the forest's surface area. This huge forest had already been undergoing a slow destruction due to a steady stripping off of fuel substances for commercial purposes, as well as the poaching of buffaloes and elephants. Currently, the surface area of the Nyungwe Mountain Forest is estimated at 90,000 ha. In 2000, the government declared the forest a National Park.

One should also note that the surface area of the Akagera National Park was reduced from 331,000 ha during 1956 to 255,000 ha in 1992. Today, the reserve has a surface area of 90,000 ha, i.e. a third of its original surface area, since two thirds of the park was ceded by the Government in 1997, for the resettlement of old refugees returning from countries of Asylum. The move was in respect of the Arusha Peace Accord of 1993.

Given that this region is semi-arid because of the prolonged drought in the east, north-east, and south-east of the country which are occupied by large-scale pastoralists, overgrazing is serious. Consequently soil erosion and general land degradation that leads to progressive desertification is being felt in the semi-arid valleys of the park, as well as the outlying areas. In 1997, over 30,000 cows died due to lack of water during the prolonged dry season. In 2000, 22 hippos died from the drought.

Remedial Government policies and actions

Development of Natural resource management (NRM) policies

Farmers' interest in land management, soil conservation and erosion control depends greatly on the land tenure system. Farmers invest their time and resource on the land they actually own. They invest in soil improving technologies such as progressive or radical terracing, trenching making, organic manure application, liming, or planting agro-forestry species, etc. Rwanda's ecosystem is fragile and requires good management practices. The fragility was exacerbated by the effects of the Tutsi genocide and subsequent actions taken to provide settlement and land for returnees at the end of the genocide. It is in this context that environmental issues and erosion control in particular are put at the top of the agenda for national development and decision-making.

One of Rwanda's areas of focus to alleviate poverty is economic growth, in which the agricultural sector is expected to be a major contributor (EDPRS 2007). This objective cannot be achieved without strong soil conservation measures and re-enforcement of soil erosion control.

The major problem facing Rwanda with regard to the management and protection of natural resources is the imbalance between population and natural resources. In general human activities on natural resources have had negative consequences the environment in general and soil erosion in particular. It is in this way that population pressure on land results in deforestation on hillside for growing food and reduction in recharge of water table, silting up of lakes and rivers, and the destruction of biodiversity. Due to these interactive growing environmental problems, the Government of Rwanda felt it necessary to develop policies and laws in the field of management and protection of environment, water resources, land, forestry, mining with a view to ensuring sustainable use of natural resources and protection of vital ecosystems for present and future generations.

National Environmental Policy (NEP) and Law

The National Environmental Policy and Law were born out of the concern that the environmental degradation had continued to worsen as a result of population pressure, serious erosion, pressure

Table 5: The trend of population and density during the 1934 to 2002 period

Year	1934	1949	1955	1960	1970	1979	1982	1986	2002
Population (000.)	1,595.4	1,887	2,374	2,694	3,680	4,957	5,526	6,500	8,200
Density (pers./km^2)	66	78	98	111	177	196	218	250	309

Source: *Moeyerson 1989 and sensa 2002*

on natural resources, massive deforestation, pollution in its various forms, lack of a strong and coherent political, institutional and legal framework and, in a particular way, as a result of the 1994 war and Tutsi genocide. Therefore, the Government of Rwanda realised that it was necessary and urgent to provide the country with an environment policy capable of improving man's well-being, with a view to guaranteeing sustainable utilisation of natural resources and the protection of vital ecosystems for present and future generations. It sets out overall and specific objectives as well as fundamental principles for improved management of the environment, both at the central and local levels, in accordance with the current policy of decentralisation and good governance in the country.

The NEP sets out institutional and legal reforms with a view to providing the country with a coherent and harmonious framework for coordination of sectoral and cross-cutting policies; and also lays a solid foundation for the establishment of a legal framework for improved management of the environment, as well as the right principles for the participation of the population in general, and women and the youth in particular. It contains policy and strategic options with regard to population, land-use management, management and utilisation of natural resources and other socio-economic sectors, as well as the necessary arrangements for the implementation of the policy. It offers a framework for the reconciliation of the three pillars of sustainable development, namely environment, social and economic issues. It is thus in line with the policy for poverty reduction while ensuring the quality of life and environment.

The overall objective of the Environmental Policy is the improvement of man's well-being, the judicious utilisation of natural resources and the protection and rational management of ecosystems for a sustainable and fair development.

The NEP objectives, in particular objectives i, iii and iv above cannot be met without soil conservation and erosion control techniques. Soil erosion is one of major environmental problems in the country and should be priority in all developmental activities. Therefore NEP will re-enforce land policy in conservation of soil and related programmes.

National land policy (NLP) and Law

The National Land Policy adopted by Government of Rwanda (GOR) in February 2004 and a land law enacted on 14th July 2005 as law number 08/2005 consist of a package of changes that have to address the issues of land management and conservation in the country. Rwanda has never had a land policy before. However, it enacted land law in 1976 which was not put into use. Thus the country had never even had an effective land law, apart from a few scattered land regulations, most of which date back to the colonial period, and which strengthen the duality between the written law (very restrictive and confining) and the customary law (widely practised, but with a tendency to cause insecurity, instability and precariousness of land tenure, in general). The Rwandan Government, therefore, found it imperative and absolutely necessary to arm itself with a national land policy that would enable the population to enjoy a safer and more stable form of land tenure, and bring about a proper and well- planned utilisation of land while ensuring a healthy and efficient land management and administration.

Therefore, the overall objective of the national land policy is to establish a land system that is secure for all Rwandans, land reforms that are necessary for good management, and proper use of national land resources for a harmonious and sustainable development that ensures protection of the environment. In the absence of land policy, farmers were not able to invest their capital in soil erosion control measures irrespective of the forceful means applied since 1930's and soil conservation law of 1982 which has not been applied, although recognised by land law of 2005.

The land policy document attempts to analyze land-related problems; in order to find solutions that are adaptable to the scope of existing problems. Without claiming to solve all the land-related problems with miracle solutions, the document could be regarded as the most complete, and realistic to date. The presence of land law and national land policy will ensure secure ownership of land and stimulate good land management, erosion control, increased agricultural productivity important in national economic growth, development and poverty reduction. Therefore the land reform as interpreted from the land law and land policy may stimulate rapid economic growth and enable investing in soil conservation and erosion technologies. The need to stimulate economic growth is a prerequisite to poverty reduction according to EDPRS and Vision 2020. Therefore the land policy and land law are critically important for the country as basis for soil conservation and erosion control.

National Forestry Policy (NFP)

Among essential natural resources, forests play an important role in soil conservation, erosion control and community livelihood in general and preservation of ecological balance. This role of forests is particularly important in Rwanda inasmuch as they contribute greatly to watershed protection against erosion, thus making agriculture viable, and covers the daily basic needs of wood for more than 96% of the population. Furthermore, forests generate direct monetary income (revenues) for households; public entities and the country in general thus contribute to poverty alleviation. In this sense, forests are considered as a capital.
However, since 1960's (last 40 years), the natural forests areas have declined by 65% and a tree species diversity highly reduce and at the verge of disappearing. As a result forest cover remaining till 2004 was only 19% of the total land area of the country as compared to 26% in

1993, and will continue to decline because of the population pressure. The decline of forestry without mitigation measures is a result of lack of forest policy which would have guided the proper utilization of forestry service in a sustainable way. The development of forest policy is important in order to achieve vision 2020 objective of increasing protection against erosion from current 20% to 80% in 2010 and 90% by 2020. The overall objective of the national forest policy is to make forestry one of the bedrocks of the economy and of national ecological balance. This will ensure proper use of techniques of natural protection and erosion control in particular.

Irrespective of the aforementioned importance, Rwanda has not had any forest policy. The earliest and latest attempt to have a forestry policy was made in 1993, which was neither completed nor implemented. Forestry activities were therefore based on working plans and methodological texts, which overlooked major objectives and guiding principles that normally characterize a good forestry policy.

The objectives and strategies of the current forestry policy would enable the government to face the challenging situation of a continuous wood shortage, deterioration of soil, and soil loss due to erosion. The present forest policy addresses all issues, targets ecological and economic welfare of the existing woodlands, research, institutional capacity building and personnel in particular, including number and quality of forestry personnel. It is important to link forestry with rural development. Reforestation will be encouraged to ensure that there is a balance between firewood, timber, environmental and soil protection and erosion control.

National Agricultural Policy (NAP) and strategy

The National Agricultural Policy and Strategic Plan for Agriculture Transformation (SPAT) emphasize clearly on the fact that soil conservation and erosion control are top priorities in order to ensure sustainable production systems. The Government both at central and local level has launched a sensitization programme towards enhanced community mobilization for erosion control and this was particularly reflected in the "Performance Contracts" signed between the President of the Republic of Rwanda and District Mayors every year.

Furthermore, the Government has completed the process of establishment of the legal and institutional framework for better and sustainable natural resources management. It is within this context that the Land Law and Environment Law was enacted in 2005 and the Rwanda Environment Management Authority (REMA) established to ensure the increasing agricultural productivity be done using environmentally friendly technologies.

Since agriculture accounts for over one-third of GDP, it is essential to increase agricultural productivity and ensure that Rwanda meets its growth target under EDPRS period and beyond. The agricultural policy and strategic plan for agricultural transformation are important in achieving EDPRS objectives. However, the increase in productivity will depend on success in protection of land against soil and fertility losses. The area protected against soil erosion during EDPRS (2008-2012) is estimated to rise from 40% (of the agricultural land area) in 2006 to 64% in 2012. The Government will aim at the integration of different methods for reducing erosion, restoring and improving soil fertility, as well as use of technologies acceptable to environmental protection. The erosion control and soils conservation technologies will be included in all packages offered to the producers for sensitization, mobilization, and development of technique such as terraces, mulching, etc. However, under agricultural policy, the fight against erosion is not yet perceived as an intensification parameter.

Among other challenges to be tackled include the implementation of the national agricultural policy; absence of a link between decentralized services and central services of MINAGRI, not understood in the same way by its actors; discrepancy between the research and the transfer of technologies; weakness of the popularization system network; insufficiency of training and information for one part of the population (ubujiji); soil deterioration process and the fertility decrease.

Sustainable development of agriculture cannot reasonably be achieved in the absence of priority and concentration of effort and resources on soil conservation. Therefore, among other things, the agricultural policy emphasises the need to: carry out environment protection and soil conservation through appropriate technologies and methods; build technical capacities for land technicians, decentralized instances and producers in the field of soil preservation; adapt the methods of fighting against soil deterioration to the environment's physical and chemical conditions; integration of different methods for erosion control, restoring and improving the soil fertility; collection of rain water and use it on farm to meet crop water requirements.

National Decentralization policy (NDP)

Rwanda has adopted territorial reform from 2006, and there are now four provincial administrations; the Kigali City, 30 districts, 416 sectors; and 2,148 cells. Each District and each sector should have extension officers; there are at least 446 agricultural extension officers at the level of district and sectors responsible for technology dissemination in agriculture, livestock and natural resources. This number is large enough to disseminate agricultural and sustainable land management (SLM) technology. Moreover, there is political will and farmers are interested to produce more and satisfy their family needs. In addition, NGOs, and many cooperatives have hired their own

extension officers.

The SLM is now a component of performance contract Imihigo between the district authorities and the Republican President. This is a new approach to ensure that the district commitments are made public through signing the above contract publicly which can be monitored. In this way the leaders become accountable to both the public and the Republican President. The local authority becomes more focused on achievement and community development. Since the development pathway of Rwanda as indicated in the Economic Development and Poverty Reduction Strategy (EDPRS) is through increased economic growth. Agricultural transformation, the SLM and soil is the main focus together with agricultural intensification and transformation.

Result-based management tool (Imihigo) is a genuine Rwandese response to address the challenge of reforming local government and managing change. One of the challenges is sustainable land management and erosion control. The Imihigo is used in Rwanda to design a series of performance management contracts signed between the republican President and the district mayors on behalf of their constituents. The public engagement is recorded publicly in a written contract that presents a set of development targets backed by specific performance indicators over a period of one year. Therefore, the technologies dissemination of SLM and soil erosion are no longer the role of extension officers alone, instead the political will is very high and the output must be reported at the end of year.

The Imihigo approach shares many characteristics with **Results-based Management Tools**. First, each Imihigo identifies a set of clear priorities. Second, each Imihigo presents a set of specific targets backed by measurable performance indicators. Third, each Imihigo undergoes a well-defined process of performance monitoring and evaluation. Fourth, each Imihigo constitutes an efficient accountability mechanism and an incentive for local government leaders and their population to implement the decentralization policies and to meet local and national development targets. The SLM technologies and their applications, monitoring indicators for outputs are part of the contract signed in each district. This is why each sector has got an extension officer which includes SLM. The country is losing large quantities of soil and nutrients through erosion. In addition the country is focusing on increased productivity and contribution for economic growth for poverty reduction. It is for this reason that there is great political will to support technology dissemination, including SLM and soil erosion control, which is much needed in Rwanda.

National policy on soil and water conservation and farming system

Since 1930's, the colonial government placed erosion control among the priorities, and by 1960, trenches for erosion control were put on 40% of arable land; likewise in 1988, the 2nd Republic established soil conservation measures on 85% of arable land. However, all these efforts were government initiated and led. Community participation and ownership was absent. Any effort for soil conservation and erosion control should target the community sensitization and adoption without using law enforcement.

Until the 1980s, the soil conservation methods and techniques used have mostly targeted the aspect of soil protection by stopping the sediment and ignored the aspect of improvement or restoration of soil fertility. The soil conservation techniques focused on applying 'compartmentalised' isohypse ditches reinforced by hedges without taking into account the agro-bioclimatic regions; till beginning of the 90s that radical terracing, originally conceived in 1973, was applied. In general the public has not yet understood the anti-soil erosion campaign as one of the measures to increase land productivity and crop yield.

Rwanda has limited soil resources which should be well managed for sustainable development. The soil conservation policy should therefore reinforce the various anti-erosion techniques adapted to each region, with other production-intensification techniques, by proposing a range of different types of cultivation. The farmers would choose from among different types, depending on their capacity, and the existing technical and socio-economic constraints. The importance of Rwandan Agriculture depends on how the natural resources "specially land" which is the main capital of production, is managed. The national policy for soil conservation and erosion control will have to play an essential role in conservation, maintenance and rational use of essential natural resource. It will be strengthened by strict enforcement of the law no 11/82 of 30 March 1982 governing the soil conservation. It shall also be supported by the land tenure law of 2005. The policy itself is of little importance if it is not substantiated by planning of land use for improvement of social and economic welfare of the population.

Comprehensive industrial policy, strategy and master plan

In general, Rwanda's population of 8 millions is not very high to be a good market for large industry development. The main problem of population is that they depend on land services and for a long period the country has been depending on agriculture and natural resource products without developing alternative source of income, such as industries and their associated services. As a result the population density according to land size has become very high beyond bearable capacity. Hence, the major problem is the lack of policies which create alternative employment.

Policy on Payment for Environmental Services (PES)

Rwanda does not have the payment for environmental services (PES) apart from tourism and payment for

entrance fees in the protected areas and visit of mountain Gorillas in the Volcano National Park, and other animals in the protected areas. To-date, the government is still responsible for NRM services.

Through the environment policy, the country did not have the policy before. It is in the process to establish enabling environment such as creating awareness for environment, establishing land tenure system through land reform, improve infrastructures and establish regulations for the environment. The laws linked to the environment are already established. However, the related regulations are underway, not yet established.

Watershed for many dams for irrigated rice farms in the rehabilitated marshlands and hydropower plants need protection. This can be achieved when clear policy on PES is developed and put in place. Because the watershed may go beyond the administrative area where the dam is built, it may require mapping all areas using GIS and mark possible sources of sediments which may have effect on infrastructures in down stream.

The experience of reduced water in Ntaruka hydropower, which resulted in power shortage in the whole country due to agricultural activities on watershed of Rugezi marshland, is a good lesson for the country to develop PES policy

Institutional framework
The erosion control is multi-sectoral in nature and it involves different ministries and institutions. The implementation of the national policy will necessitate establishment of complete framework for coordination. There is a great need to coordinate the soil conservation and erosion control activities at different levels. Some actors have their own objectives which they should attain. Therefore different actors in soil conservation or erosion control with different objectives should be coordinated to ensure contribution to national objective and continuity. It is important to link different actors and provides synergies among them. It is also essential to learn from past experience.

Sectoral coordination
Currently information on soil conservation, erosion, environment, and forestry, is scattered in different institutions and sectors which initiate and implement their programmes and policies with little or no consultation with others. These institution linked to soil conservation include MINAGRI, MINITER, MINALOC (imihigo), ISAR, NUR, REMA, RADA, UNDP, FAO, among others. .This makes it even more complicated to appreciate inter-sectoral issues and monitor effectiveness of conservation techniques. Possible option to keep this information as database would be the use of National Institute of Statistics. It should be able to gather all data and establish linkages between different institutions, organizations and ministries.

Institutional and human resource capacity
The capacity of execution is not sufficient especially in the area of soil conservation at district level. Obtaining accurate baseline information for realistic monitoring of soil erosion may require capacity building and partnership with other institutions. Therefore there is a need to develop a profile for each district and plan for capacity building. Before any soil conservation and erosion control measures are executed, it requires mapping out different options available and their contribution to crop yield. Without reliable information maps, it is difficult to plan and undertake appropriate protection and management measures, yet this is the basis for sustainable soil conservation. The local authorities should have such maps available and information for dissemination to the community.

Ensuring sustainable funding:
The infrastructures for soil erosion control are expensive, while sectoral budget allocations are usually too meagre to support large scale activities in erosion control and soil conservation. It requires national focus and strategies such as communal work "Umuganda", to support budget allocation. In addition, it needs capacity building for the community and sensitization for infrastructure maintenance without further national expanses.
Validation of proposal
(Recommended ways of validating the suggested proposal, say through piloting)

National stakeholder workshop: The validation will involve national stakeholder workshop to discuss different constraints in erosion control, the proposed options above and different solution. The workshop deliberation should give way forward and sustainable solution. This would cover coordination, available and missing information, experiences elsewhere, financing mechanism and alternative source of income for development to reduce pressure on land. The participants should be drawn from national institutions, regional, international and UN organizations, donors, NGOs and private sector interested in agriculture and environment.

Formalization of proposal
The workshop should give recommendations and actions needed and will be submitted to all stakeholders involved and other interested parties. The ministries responsible which were represented in the workshop and are part of recommendations, they will have indicated the feasibility of execution. Since Rwanda has good policies and interest in handling erosion problems, the formalization would follow normal government channels through ministries and finally cabinet approval.

Evaluation process
Suggested ways of evaluating the success of the proposed policy reform
Rwanda has established a good policy of result based performance. The recommendations from the stakeholder workshop will form part of performance contract and will be evaluated as is being done through out the country and publicly.

Summary and Conclusions

Insufficient soil conservation is seen as the main challenge for a sustainable development of Agriculture in Rwanda. Not only does it hamper the long term planning of any development activity but it also threatens the environment. Rwanda has to define new strategies to ensure sustainable development and increase prosperity to its population as indicated in vision 2020 and EDPRS.

Rwanda has good policies which may accelerate the adoption of soil conservation technologies, if farmers involvement and active participation at different phases of execution is observed, in particular at identification and diagnosis of problems, types and causes of soil degradation; experimentations and demonstrations of solutions to be recommended; discussions on options to be chosen for the implementation of tested solution on overall plan. The progressive implementation by farmers with the help from the government will enhance adoption and ensure sustainable soil erosion control. Good policies alone are not enough. Mitigation measures should avoid errors from colonial time of commanding farmers to construct erosion infrastructures using law and orders. The soil conservation and erosion control maps are needed as they will serve in decision making especially when prioritizing fund for interventions, because some provinces are more prone to erosion than others because of nature of landscape and terrain. The National Statistics Institute should develop and keep these maps using collected data from districts.

A strong potential for addressing the soil conservation and erosion control issues lies in decentralized planning and governance process. The decentralization policy (and program), implemented by GoR since 2000, has focused on empowering local communities to participate in political and economic decision making, through bottom-up planning using the community development committees (CDCs). It is the view of the consultant that the CDC structures present a good entry point for mainstreaming soil conservation and erosion control issues, especially if these are well linked with the development local committees at cell, sector and district levels. The CDC should be conversant with execution of new policy and legal framework, like land policy, land law, soil conservation and erosion control law 11/82 of 30 March 1982.

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