

**UNDP/UNEP  
Kigali**

**ENVIRONMENT AND POVERTY REDUCTION IN RWANDA.  
AN ASSESSMENT**

**March2006**

## TABLE OF CONTENTS

TABLE OF CONTENTS .....	2
1. INTRODUCTION .....	2
2. RELEVANCE TO RWANDA .....	3
Physical environment .....	4
Human aspect of environmental scarcity. ....	6
3. COSTS OF ENVIRONMENTAL DEGRADATION IN RWANDA .....	12
4. POTENTIAL CONTRIBUTION OF NRM TO ECONOMIC GROWTH AND HUMAN DEVELOPMENT .....	15
4.1. Poverty and environment .....	15
4.2 Rwandan Context: Preserving ENR for Optimization of Economic Growth .....	16
5. POLICY ENTRY POINTS IN RWANDA .....	18
5.1. PRSP II .....	18
5.2. MDGs .....	20
6. WAY FORWARD .....	21
BIBLIOGRAPHY .....	21

### 1. INTRODUCTION

The importance of environment in development discourses picked its momentum three decades ago. In 1960s the environmental movement was confined to states and focused on conservation and rational use of natural resources. Human ecology and conservation ecology were part of the development paradigm concerned with physical and social environment. Wildlife conservation, wilderness, maritime pollution and possible nuclear disaster were given attention but remained marginal in mainstream inquiries on economic growth and poverty reduction (Clover 2005).

The earliest interest between the environment and growth was the so-called Boserup Hypothesis in 1965 (Clay 1990, Clover 2005). The argument advanced by Ester Boserup was that rural communities would over time adapt their environment and cultivation strategies such that increased yields could be obtained without any significant degradation of the resource base. Significantly, this was a signal that marked a shift from conservation of the environment or environment security to the involvement of people. But even then concerns were on human generated environmental degradation such as overgrazing, desertification, wood fuel crisis and soil erosion as a result of population pressure. Technology was one of the solutions to efficiency and use of resources and increased income growth.

Since 1970s however debates have developed into serious discussions that go beyond conservation ecology to human development, security and political ecology. In 1972 the United Nations Conference on the Human Environment became a landmark in the discourses in that environment and uses of resources started being viewed in relation to economic growth. In 1987 the Brundtland Commission defined more clearly the link between the environment and human development. It was clarified that in order to achieve sustainable development, environmental sustainability shall constitute an integral part of the development process and cannot be considered in isolation of it.

From 1990 till today the elaboration of the linkage between the environment and human development has been promoted by the UN system particularly UNDP and UNEP. Firstly the

expression has come through the development of the concept of human development and that of sustainable development.

UNDP defines human development as a process of enlarging the choices of all people in society. Sustainable development places people at the centre of development process and makes the central purpose of development as creating an enabling environment in which all people can enjoy a long, health and creative life (HDR 1994).

A sustainable human development approach is thus pro-poor, pro-nature and gives priority to poverty reduction, productive employment, social integration and environmental regeneration. Sustainable human development should be able to meet needs of the present generation without compromising the needs of future generations.

Meanwhile the integration and linkage of human development to environment continued to dominate international dialogue. In 1992 in Rio De Janeiro world leaders met to deliberate on development and environment. In 1995 in Copenhagen UNDP organised a summit meeting of countries on how to reduce poverty and promote sustainable development in two decades. In 2000 the UN again through the Millennium Goals placed environment among the central concerns of human development towards year 2015. In 2002 again World Summit on Sustainable Development was held in Johannesburg and underscored the role of environment in human development. It refers to the natural resource base of sustainable development.

That our analysis is grounded in the changing paradigm on development is indubitable. However of a greater significance is the importance of the general relations to the specific context of Rwanda. The critical issue is how the relationships can be corroborated empirically and how the evidence should influence the policymaking process at the national, meso and micro levels. How serious are the environment and human development concerns in Rwanda? Are the concerns of rapid economic growth compromising sustainable development and the reduction of poverty in the long run? Have past policy performances depended at least partly on unsustainable use of the environment to promote economic growth? If so how? Can a change of approach and outlook serve better the desire for economic growth with sustainable development? Can the physical and human development in Rwanda be better used for poverty reduction? How?

## **2. THE RELEVANCE TO RWANDA<sup>1</sup>**

While the debate on environment, human development is truly grounded in the global environment movement, the rationale of renewed interest in Rwanda has a specific and national context. Two streams of argument can be advanced. Firstly major and international discourses on environment and conflict have found empirical evidence in Rwanda after 1990s. Secondly over a period of 40 years there is evidence of a failure of the Boserup hypothesis. Both whether adequate or not, in explaining the conflict in Rwanda have ended up showing that the link between the environment and poverty exists. Looked at from an alternative angle, the costs of past environmental scarcities in Rwanda are too high to disregard in policy making for future development.

For the first line of argument it is worth noting that there is a growing academic and empirical interest in the relationship between environment and conflict (Galtung 1982, Homer Dixon

---

<sup>1</sup> This section draws heavily from data provided by Musahara(2005) Percival and Dixon Homer(1995) and Baechler(1999).

1995, Percival and Dixon 1998, Ellingsen and Wenche 1998, Baechler 1999, Kaplan 2000). Ehrlich et al (2000) has chronicled the relationship between natural resources and violent conflict from antiquity. Examples are Mesopotamia and parts of Middle East, the Maya of Central America and the Khmer of South East Asia. The most recent cases are Haiti, Pakistan, Gaza and South Africa (Dixon and Homer 1995). That Rwanda has been a case study for both the Toronto School and ENCOP reinforces the relevance of the relationship with regard to Rwanda. Of even greater importance is the obvious inference that the current Rwandan 'poverty trap' expressed in low levels of human development draws heavily from a legacy of conflict and genocide.

The Toronto School is about the works of Percival and Homer-Dixon. Their focus was on the causes of conflict. However their definitions of demand side as well as supply side of environmental scarcity provide useful categories of looking at environment and poverty directly. Although they avoid establishing a causal link between the two, the linkage with poverty is at least more than intuitive.

Percival and Homer-Dixon (1995) defined environmental scarcity as scarcity of renewable resources, scarcities of agricultural land, forests, water and fish. Such scarcity may be demand induced resulting from population pressure; supply induced resulting from resource degradation and structural resulting from unequal distribution of such resources. In all cases environmental scarcity has been of immense proportions in Rwanda.

On Rwanda they observed that soil erosion is a case of ecosystem vulnerability. However they observe that the biggest problem to fertility is actually intense cultivation that leads to the erosion of the soil. They document also forest and water scarcity especially in the Southern region and the negative impact of eucalyptus tree planting, which was encouraged by the government in earlier years.

Baechler (1999) also more concerned with environment and conflict and using Rwanda as a case study has brought forth the concept of environmental discrimination. While also in a different context, which is indirect on poverty and economic growth, has provided additional evidence on the relationship between environment and political ecology.

Clay (1998) shows the failure of the Boserup Hypothesis in Rwanda. Whereas the two schools have ample data showing increasing pressure on natural resources, he shows how soil degradation and falling levels of agricultural productivity did not evoke policy responses or adaptation by Rwandan communities. All the three reinforce the role of the physical and human environment in the evolution of Rwanda after independence. More data and information have been accumulated before and after the genocide of 1994 that show how environmental scarcity has played a big role in socio-economic conditions of Rwanda let alone conflict (Andre and Platteau 1995, Waller 1995, Uvin 1998, Ohlsson 1999). In the rest of this section we present some of the data.

### ***Physical environment***

The surface area of Rwanda is 26, 388 square kilometres or 2. 634 mi hectares. The area makes it one of the smallest countries on the continent. Out of these, 32.2 % is arable and 10.1 % holds permanent cropland. The former proportion is land that can be used for agricultural purposes while the latter is a part of the arable land with crops that cannot be

substituted in the short run or seasonally because it is covered by crops all the time. Forest covers 3,000 square kilometres or 14.6 % of total land area. Freshwater resources are estimated at 6 billion cubic metres in total whereby 94 % is for agriculture; 1 % for industry and 5 % for domestic use (GoR 2003).

Rwanda's relief is hilly, with average altitude of 1700 meters. The highest point on Mt Karisimbi is 4507 meters above sea level. Bordered by volcanoes to the North and rolling hills in a large part of the central plateau, it has earned the name of a 'country of a thousand hills'. To the East, it is however relatively flat with altitudes well below 1500 m above sea level. The relief of Rwanda is usually divided into six regions from West to East: Narrow Great Rift Valley slopes sharply to lake Kivu; Volcanic Virunga Mountains which have the highest point in Rwanda towers over the North Western lava plains; The North-South steep rise of the Zaire-Nile Divide has a width of 40 km; A Zaire-Nile Divide has an average elevations of 2,750 meters; The Central Plateau is characterized by rolling hills; Savannah and swamps of the Eastern and Southern border areas cover one tenth of Rwanda.

In most cases the topography and relief is a liability to agriculture and enhances soil erosion. Recent estimates show that 27 % of cultivated land is undertaken on slopes of more than 20 degrees, 23 % on slopes between 10 – 20 degrees, 16 % on slopes between 5 – 10 degrees and between 0 –5 degrees cover 34 %. Total cultivated land in 1986 was 1,025,000 hectares.

Baechler (1999) indicates that Rwanda can be divided into favourable and unfavourable eco-geographical arenas. The Central Highlands are an underdeveloped mountainous region with steep slopes and deeply weathered acid soil of limited fertility. The fertile volcanic soil in the North West and previously the unusable swamps and savannah region in the South and East are being used to the limits of their capacity. On the western boundary up to the Rift Valley, even the most extreme slopes are cultivated. Today, he notes that the once fertile soil is degraded while geographical alternatives are rapidly diminishing.

His work revealed some interesting figures. Loss of humus is to the tune of 10.1 MT per ha and can go up to 36 MT/ha on 5 % of the soils and more than 68 % MT/ha on 1 % of the soil. Clay (1998) states that soil erosion is moderate to severe on 50 % of the land surface of Rwanda. Rwanda according to Rwanda Development Indicators (2001) is losing up to 12, 251 tons of soil per year due to soil erosion.

Another critical issue is water. Baechler (1999) using the Falkenmark indicator he estimates that Rwanda is among water scarce countries of the world. Ehrlich et al (2000) states that countries with less than 1700 cubic metres of water available per capita cannot maintain food self sufficiency reliably. Rwanda with 870 by mid 1990s ranks the 18<sup>th</sup> from the bottom.<sup>2</sup>

Clay (1998) has pointed out that farmers observe a decline in the productivity in nearly half their holdings due to soil degradation. He cites other studies related to Rwanda. Byiringiro and Reardon show that erosion severely reduces farm yields in Rwanda, while Ford on Ruhengeri noted that 4/5th of all sampled population observed decline in soil productivity due to erosion. Clay et al(1999) have shown that yield may be reduced significantly by soil erosion.

---

<sup>2</sup> Other countries with low availability of water per capita below Rwanda are Kuwait 10, Malta 46, UAE 94, Libya 132, Qatar 143, South Africa 170, Jordan 219, Singapore 221, Bahrain 223, Yemen 300, Israel 467, Tunisia 504, Algeria 573, Oman 657, Burundi 658, Djibouti 732, Cape Verde 811. Slightly above Rwanda but also with low levels of availability are Morocco 1197, Kenya 1257, Cyprus 1286, Poland 1463, Korea 1542 and Egypt 1656.

*Land productivity on very eroded farms is 21 per cent lower than on farms with little erosion. The most extreme case is for farms with a low share of high value crops such as coffee and bananas and low share of cultivated area on which fertiliser or organic matter has been applied. The loss was estimated at about 36 per cent pg 83*

Environmental degradation is not limited to soil erosion (fluvial and dry) alone. Of primary forests, which covered 80 % of the country, only 5 – 8 % is left. In 1980s the deforestation rate was 2.3 % or 2000 ha per year. Between 1970 and 1986, 56 % of exploited acreage pushed cultivators into poor soils in marginal land (Baechler 1999). Previous lower limit of cultivated land was 1800 m but today the land limit is 3000 m. The Virunga chains was reduced from 34, 000 ha to 15, 000 ha between 1958 and 1979. Between 1958 and 1996 natural reserves were depleted by 34.8 %, Nyungwe by 17.2 %, Gishwati 86.4 %, Mukura 46.7 %, Virunga 62.5 % and Akagera 17.6 %.

### ***Human aspect of environmental scarcity.***

In the previous section the impact of human activity on degradation is only implicit. In this, we give some data linking sheer physical environment and demographic pressure as well as political ecology. The first is the movement and character of the population of Rwanda over the years and within the geographical limits described.

Over seven decades population in Rwanda has multiplied almost six times. The population of Rwanda in 1934 was 1,595,400 and is currently 8.16 million (GoR 2003). The evolution of population in Rwanda is presented in 1.

In the 1980s Rwanda had a total fertility rate of 8.3 per woman, the highest in the world (World Bank 2004). For many decades the natural rate of reproduction was in excess of 3% the highest in Africa. On a limited area of 26,388 sq km, pressure on land resulted in a high physiological (number of people over arable land) density (Prunier 1995, Waller 1996). Suffice to mention that the physiological density (people per area of arable land), currently in excess of 500 people per square kilometre the highest in Sub Saharan Africa. Too many people in a limited space lead to a crisis in the simple sense of overcrowding.

Population in general and density in particular, become a critical problem only when the capacity to produce food is limited. This is what we called the defiance of the Boserup Hypothesis. Food shortages are recurrent events in the history of Rwanda. It is usually argued that one reason Rwanda had high rates of population growth, was because of limitless supply of food due generally to fertile soils. Rwanda population was not disturbed by slave trade or wars of colonial conquest. However cycles of famines are recorded in the past history of Rwanda; 1890, 1895, 1887-98, 1900-1903, 1904-08, 1909, 1910, 1911, 1912, 1916-18, 1921-22, 1924-26, 1927, 1928-29, 1943 (Baechler 1999). Adverse weather, epidemics, locusts or military expeditions caused most of the famines. Baker (1970:145) writing in years after independence states, "Rwanda is a grossly overpopulated country subject to frequent localised

famines of considerable intensity.” Food shortages followed every political upheaval in 1959, 1963, 1972, and 1982 and in the early 1990s (Uvin, 1998).

For some time Rwanda was able to evade crisis in various ways. Since colonial periods migration to East Africa and the DRC provided relief to land scarcity and population pressure (Baker 1970). It is recorded that after 1950s a third of the population (about 217,000) of Buganda Kingdom (a province of present day Uganda) were Rwandans. Migration figures to East Africa and Congo are as presented in Table 1. While there may be several factors that determined why a Rwandan would decide to migrate, it is most likely that these were largely ‘environmentally induced migration.’

There was also internal migration from land scarce areas to those, which had some surplus (Clay and Ngenzi 1990; Olson, Clay and Kayitsinga 1990). The province-to-province movements can be put into four phases corresponding to the evolution of the land problem nationally.

**Table 1. The flow of migrants from Rwanda to East Africa and Congo**

Year	Number of people to East Africa	Number of People to Congo
1949	11,053	10,992
1950	12,759	6,693
1951	15,087	7,849
1952	19,200	14,018
1953	16,181	3,851
1954	17,548	3,020
1955	15,995	2,715
1956	16,703	2,505
1957	14,844	1,353
1958	16,101	1,013
1959	18,953	747
1960	19,638	140

Source: Baker 1970:145.

The first phase was between 1945 and 1961. Heavy migrations were from Ruhengeri to Byumba Province and from Gikongoro to Butare. Moderate movements were those from Kigali to Gitarama and modest movements were from Gikongoro to Cyangugu and from Kibuye to Gitarama. Another phase in rural migration was from 1962 to 1971. Very heavy movements were from Butare to Kigali. Heavy movements were from Gikongoro to Butare and from Byumba to Kigali. Moderate movements were from Ruhengeri to Byumba. Modest movements were from Gikongoro to Kigali and Gikongoro to Gitarama. Another modest movement was from Byumba to Kibungo. A third phase was that from 1972 to 1976. It was dominated by a massive movement from different provinces to the capital Kigali. The heaviest movements were from Butare to Kigali. Other moderate movements were from Butare to Kibungo, Gisenyi to Kigali Rural Ruhengeri to Kigali and from Ruhengeri to Byumba. There were modest movements from Gikongoro to Kigali and from Byumba to Kigali (Clay and Ngenzi 1990).

The last recorded phase was intensive, though not heavy movements from many provinces to those to the East of Rwanda. This was a period where land scarcity was acute and movement was to the province where there was still ample space. There were modest movements from

Butare, Gikongoro, Kibuye, Gitarama, Gisenyi and Byumba all to Kibungo Province. But there were also modest movements from Gikongoro to Kigali Rural and to Butare. There were movements from Butare to Kigali, from Gitarama to Kigali, Ruhengeri to Kigali, from Byumba to Kigali and from Gitarama to Kigali.

The second exit strategy was expansion of area under cultivation (Clay et al 1996). But by 1980s these two exit strategies were no longer able to ameliorate the situation. Migration had greatly diminished or was discouraged by host countries. For example Uganda expelled Rwandans in 1982 (Waller 1996). There was virtually no more land for extra acreage in most of the provinces.

Growth of population on arable land in 1970 through 1978 was only 1.9 per cent. It was supported by cultivation of wetlands and appropriation of lands left by Tutsi (Ohlsson 1999, Semujanga 2003). But after 1980, the rate of increase on arable land rose to 2.9 %. One result was that between 1980s and 1990 total production increased by 10 % but per capita supply of arable land was diminishing. If it increased at 2.9% per annum the increase over 10 years should have been about 30%

On the other hand decline in agricultural production had started becoming significant. In early 1980s Rwanda was among the top three performers in Sub Saharan Africa. Between 1966 and 1982 food production grew by 4.7% compared to population growth rate of 3.4%. Soon the gap started to narrow and by the 1990s per capita output fell by 20% even if total output had been increasing by 10% in the previous decade. The decade 1990 to 2000 saw a decline in total output of major agricultural crops most spectacularly banana and coffee (Donovan, Mpyisi and Loveridge 2002). Trends in levels of production and productivity of some crops are presented in Table 2. Table 3 suggests that the fall in productivity in major crops is still noticeable in lower tonnage of production. The only exceptions were peas, cassava and potatoes for the year 2000 only. In other years all crops were registering lower levels of productivity than the base level of 1984. Technology in agriculture was too stagnant to absorb the decline in relative productivities (Clay et al 1996). By 1980s onwards food shortages had become a social and economic problem (Pottier 1987, Von Huyweghen 1999). For example if annual food production was 100 units between 1979-81, it was only 70 units in 1993 (HDR 1994).

**Table 2. Trends in production and productivity of major crops 1984-2000**

	1984 tns	1989 tns	1990 tns	2000 tns	1984 kg/ha	1989 kg/ha	1990kg/ha	2000kg/ha
Bananas	1	1.13	1.06	0.82	1	0.89	0.81	0.72
Beans	1	0.82	0.8	0.84	1	0.92	0.82	0.71
Peas	1	0.93	0.65	0.82	1	0.77	0.57	1.35
Peanuts	1	0.67	0.57	1.04	1	0.47	0.47	0.89
Soya	1	2.07	4.62	1.58	1	0.69	1.14	0.4
Sorghum	1	0.74	0.83	0.91	1	0.84	1.07	0.79
Maize	1	0.84	0.86	0.56	1	1.02	0.94	0.8
Cassava	1	0.96	1.23	2.51	1	0.82	0.64	2.35
Potato	1	0.95	1.13	3.8	1	0.89	0.84	1.26
Sweet potatoes	1	1.06	1.12	1.4	1	0.82	0.79	1.06
Coffee	1	0.76	1.15	0.45	1	0.62	0.88	Na

Source: PRSP 2002

Food imports, have for a long time, been a large share of total imports of Rwanda (Bigagaza et al 2003). Kilocalories production per farmer fell from 2,055 per day in 1984 to 1,509 in 1991, well below the recommended minimum of 2,015 per day for active adults). Food shortages were rampant in Rwanda, as mentioned above and there were more shortages and drought in early 1990s (Percival and Dixon-Homer 1995). The Boserup thesis of adaptation had been stretched to limits (Clay 1996. Andre and Plateau 1996).

**Table 3. Production in volume in major crops 2001-2004**

	2001	2002	2003	2004	Trends
Sorghum			166139	163772	-1.42
Maize	92129	91686	78174	88209	12.84
Wheat			16193	16772	3.58
Rice	17697	24539	34056	45190	35.63
Beans	289983	245906	217242	198225	-8.75
Peas			17109	16758	-2.05
Groundnuts			10219	10785	5.54
Soya	17140	19216	16799	18251	8.64
Bananas			2490022	2469741	-0.81
Irish Potatoes	1012269	1038931	1064280	1072771	0.8
Sweet potatoes			995723	908306	-8.78
Yam and colocase			141280	136359	-3.48
Cassava			1104352	912108	-17.41
Horticulture			615635	547775	-11.02

However the relationship between human beings and the environment is not restricted to availability or quantity of resources alone. In Rwanda like in many other parts of the agrarian world a crucial issue, beyond availability, is access to the little natural resources available. That land has become absolutely scarce cannot be overestimated again.

While in the 1960s more than 50 per cent of the people worked on more than 2 ha, today almost 60 per cent have less than 0.5 ha. About 73 per cent work on less than 1 hectare. It is pointed out that, scientifically a plot of less than 0.75 ha may not be capable of fulfilling the nutritional needs of an average family. FAO statistics also state that for a plot to be economically viable for a family, it has to be at least 0.9 ha (GoR 2004).

Some 40 years ago density on agricultural land was 121 persons per square kilometre; the figure rose to 166 per square kilometre 30 years ago; is thought to have been approximately 262 people per square kilometre in 1990; and is today well above 350 (Baechler, 1999). If Prunier's (1995: 2) calculations are correct the density may be higher than we estimate today. He estimates that in 1934 the gross density was 61 and practical (or physiological) 85. It rose to 73 and 102 respectively in 1950, was 143 and 200 in 1970, 200 and 281 in 1980 and was 270 and 380 as far back as 1989. These features mean a more acute situation of land scarcity and severely constrained access to land by large numbers of the Rwandan population. Meanwhile it has been established that growing miniaturisation of farming plots (Clay 1998 and Blarel 2001), resulting from land scarcity is associated with poverty (GoR 2002a). Current levels of landlessness are in excess of 11% (GoR 2002b). Landlessness is also closely associated with poverty (GoR 2002a).

An aspect of access, consistent with the failure of the Boserup hypothesis is limited access to inputs, modern techniques and technology in agriculture. Rwandan agriculture is still overwhelmingly traditional. The hilly relief does not permit use of modern technology although poverty is perhaps the primary reason for low application. Only 1 tractor is available for 100 hectares of arable land compared to 175 in Botswana or 20 in Tanzania. Irrigation can be applied to less than 0.4% of the cultivated area (GoR 2001) although in terms of households it is used by 9.8% of all households (GoR 2002). In many parts of the country there is lack of access to chemical fertilisers. Firstly the fertilisers are expensive. Chemical fertilisers are used by 5.2% of Rwandan households. Between 1996 and 1998, on average only 400 grams of fertilisers were used per hectare of arable land compared to say 35,700 in Kenya or 53,700 in Zimbabwe (GoR 2002). In this intensification of agriculture as a way of relieving the stress on the supply side environment is limited.

Fertiliser application has been observed to have crop and regional biases such that its demand is expected to be in specific enclaves for specific types (Kelly and Murekezi 2000). Soils that have been degraded of humus are susceptible to being washed away by rain because of lack of binding organic material (Waller 1996). Even in areas like Ruhengeri, where plots are often located on steep hills, soil erosion is one of the causes of low productivity but is further compounded by lack of access to fertilisers, which also accounts for the low level of yield per unit area.

Knowledge on application of fertilisers and modern techniques of production and conservation of the soils by the farmers themselves is considered to be limited (GoR 2002). Extension services are limited and inappropriate (Waller 1996). Access is limited by availability and application of inputs and technology.

**Table 4. Land Distribution by % households 1984**

Classification	Percent of households	Percent of cultivated land not 100%
Less than 0.5 ha	26.4	6.9
0.5 – 1.0 ha	30.3	18.4
1.0 – 1.5 ha	15.6	15.7
1.5 – 2.0 ha	11.1	16.1
> 20 ha	16.4	42.9
Total	99.8	100

Source: ENBC 1983-85; cited in Baechler 1999

**Table 5. Distribution of land holdings in Rwanda in 2000**

Classification holdings	Percentage of agricultural holdings
< 0.5 ha	58.6
0.5 – 1ha	19.0
1.0 – 1.5ha	10.6
1.5 – 2.0ha	5.8
2.0 – 3.0ha	3.5
3.0 – 4.0ha	1.2
4.0 – 5.0ha	0.5
> 5ha	0.8
Total	100

Source: GoR 2002a:162

Percival and Dixon-Homer relate environmental scarcity to unequal access to resources. In Rwanda there is ample evidence that, besides diminishing sizes of plots for cultivation and grazing, land distribution has become more and more skewed over the years (Bigagaza et al 2003). The distribution of land holdings over the years is presented in Tables 4 and 5. In 1984 Rwandan households with less than a hectare were 56.7 % (Baechler, 1999). By 2000 households having landholdings of less than 1 hectare were estimated to be 77.6% (GoR 2002a).

It is noted that by mid 1980s that large swathes of land were in the hands of a minority urban elite. In 1984 it is estimated that 50% of agriculturally productive land was on 182,000 farms out of 1,112,000 (Baechler 1999).

Unequal land distribution in Rwanda may not be as acute as in other parts of Africa. It could be because after all the conditions of scarcity are such that the base from which holdings are appropriated is rather small. Hardly any individuals own more than 40 ha. However it would be naïve to regard it as being unrelated to crisis. The current land policy, drawn by the government, admits the existence of the problem today (Land Policy 2004). It notes as one of several land problems, an elite mainly urban based who have large pieces of land.

There is yet another link between environment scarcity and human activity. Even if land is available and accessible, insecure tenure can be a concern for livelihoods. For many years Rwanda has had no land law or policy (GoR 2004). Written law governed urban plots and land owned by religious organisations especially the Roman Catholic Church. Customary law governed the rest of the land used by farmers for agriculture. Land has been state property. The rights peasant had on land were *usufruct*. Insecurity of land coupled with land scarcity had led to individualisation of land and illegal land markets (Andre 1999). The land transactions were increasing as distress sales by households that had fallen into poverty. Increasing land conflicts based on the insecurity of land tenure, inheritance and the land markets were found to have been increasing since early 1990s (Andre and Platteau 1995).

Literature shows that land tenure has for many years been governed by a centralised state system. During the colonial period (and prior to this, in many areas) the monarchy had a centralised and absolute control of land. During the first and second republics, land was an article gracing the economic base of the ruling superstructure. During the Habyarimana regime (1973-1994), tight and absolute control of land and other resources was exercised by the government. Land and natural resources were a monopoly of the ruling political and military elite from his home area in the north. Natural forests were exploited for economic gain or for illicit drug cultivation by the ruling elite (Gorus 2000).

Many peasants and possibly elites may have acquired entitlements to land and property as a result of political turmoil in Rwanda. Land and property belonging to Rwandans who left the country in the 1950s, 1960s and 1970s were redistributed as 'dividends of democracy' (Semujanga 2003, Mugesera 2004).

A landmark problem was the refusal of the Habyarimana regime to allow Rwandans in exile to return to their country, ostensibly due to land scarcity. Rwanda could no longer hold any more people. This was however an expression reflecting the threat posed to entitlements to the elite of the Second Republic, by Rwandans who had been physically and politically excluded from

access to the entitlements (ACTS 2004). The threat can be detected from the contents of the Arusha Agreement in 1993 on Rwanda's problems.

An important element of the agreement was that of resettling Rwandans. Land and property must have been an important aspect because it was agreed that Rwandans who were out of the country for 10 years would not be allowed to lay claim on land they had left behind in 1959, 1960s or 1970s. Essentially this can be assigned two meanings. The entitlements of those who were in charge of Rwandans were threatened and the returnees had a claim on land. Before the agreements could be implemented the civil war that had propelled the negotiations turned into a horrible genocide. It could be argued that the extremists who may have planned the genocide could have feared losing the control and monopoly of natural and other resources, among other proximate causes (Longman 1998, Gorus 2000, Pottier 2002). It is also possible that the elite felt that by allowing the Rwandans back, a period of attempted repossession of land and property they formerly owned would follow (Semujanga 2003).

Counterfactual to the situation is evidence that secure land tenure stimulates growth and reduces poverty (Blarel 1998). Empirical evidence show that farmers use land to access credit and inputs which augment production levels. Secure land tenure has been observed to enhance investment climate (World Development Report 2005).

### **3. THE COST OF ENVIRONMENTAL DEGRADATION IN RWANDA**

Like in other developing countries, Rwanda depends heavily on its natural resources; land, forests, waters and wildlife. They constitute the country's main sources of households and national income, providing the basis for farming, fishing, household energy production as well as tourism.

However, over the last two decades, these resources have been seriously depleted and degraded as already indicated above. For example forest cover decreased by 70 % during 1958-1996 due to clearance. Gishwati and Mukura forest, the montane forests are close to extinction with 86 % and 90 % respectively cleared while the Mutara hunting domain has completely disappeared. It has not yet been possible to calculate directly the costs of this degradation. However indirect evidence of high costs, that should inform policy makers are available. The most obvious concern is the resulting loss of ecosystem services offered by the environment.

Forests provide many valuable environmental services. At the watershed level reduced sedimentation, stream flow regulation, help maintain soil quality, limit erosion, stabilize hillside, modulate seasonal flooding and protect water. Many people living in and around forests depend directly on them for food, medicines and other basic needs.

There are many problems associated with deforestation: flooding, siltation, loss of plants and animals, genetic material that have great potential value for medicine, agriculture and other industries.

In a study carried out around Bwindi forest and Volcanoes National Park, there is a net difference in hydrology regime in forested versus deforested watershed. In the forested watershed, stream flows with less or no sedimentation while in the adjacent deforested area, channels are dry and wetlands show a high rate of sedimentation and erosion is common and wildlife is non-existent. The socio-economic impact of this and the number affected households need to be estimated.

As tropical forests act as an effective filter between the atmosphere and the soil, any attempt to remove the forest cover will decrease the soil protection leading to over land flow and protection with direct consequence of ground water reserve depletion, the increase of the rates of erosion along stream banks, gullies and roads. This logic is supported by the commonest indicator of erosion in agriculture-C-Value(Clay 1996). Plants with a high crop cover such have low erosivity index. Banana has for example an erosivity index or crop cover of 0.04 while manioc has 0.45. The same should apply to forest cover.

There is lot evidence that deforestation and forest services degradation constrain the economy and development options. There is a dearth of statistics on the number of households that have been affected by degradation and deforestation in Rwanda. However their gross effects of such phenomena to the economy has been demonstrated by Rugezi Wetlands. The later are largely responsible for the lowering of water levels of Lake Bulera and Ruhondo which are the major sources of hydro electricity supply to Rwanda. The problem is a result of many years of degradation of forests in their catchment area of the lakes and specifically water loss in the Rugezi wetlands the main sources of water inflows to the lakes. The cost of this has been shortage of electricity which is costing the economy heavily. A direct cost has been resorting to electricity generated by diesel engine costing the government in excess of 100 million francs a month. In the long run the energy shortage will have impact on the growth rate of the economy and rising cost of living(World Bank 2004). More detail on other costs are in the case study presented in the main report of this study.

Erosion on agricultural land is estimated to be 75 times greater than what occurs in natural forested areas(Myers, 1993 in Gurrieri et. al, 2003). In agro ecosystems of Africa, Asia, and South America average erosion rates are around 30-40 tons per ha per year. An example from Nigeria approximates soil loss from a cassava fields on a slope of about 12 % to be 221 tons ha per year. In other areas, sloping agricultural land under tropical rainfall loses as much as 400 tons per ha per year. In Rwanda, where mountainous areas that are intensely cultivated this rate is expected to be higher as some slopes are as steep as 30 per cent.

Several studies have shown that effect of erosion on land productivity is immediate. Losing even an inch of topsoil reduced considerable crops yields for the farmers. If soil erosion proceeds too far, it can convert land to desert, becoming wasted land.

Rwanda is among three countries in Africa, experiencing unusual heavy soil losses. About half of Rwanda s farm land shows evidence of modest to severe erosion. A part being acidic, two third of the land is exhausted and continued to be cultivated because farmers have no other plans. In 1986, the service of agricultural survey and statistic estimated 10 tons/ ha of arable land carried away by erosion every year. The deterioration of soil reduces food availability for people who depend solely on agriculture. A report by MINAGRI (2003) gives an estimate of 40,000 people failed to be fed each year due to soil erosion.

DSA.MINAGRI data for 1984-1991 show that except for maize yields of all major crops have declined. Table 4 shows that the trend was maintained throughout the 1990s. There has been a strong decline in the yield of tubers, the main sources of calories for the poor (GTZ-IFAD, 2002). In Rwanda, farm size is the main yield determinants, but erosion also greatly reduced yields. For example It was found that very eroded farms produced 21 % less than farm with little erosion. This loss rises to 36 % of farms with little use of fertilizers or organic matter ( Clay et al., 1995).

The impact of soil erosion can even go beyond decline in agricultural productivity. For example when Gishwati natural forest has been converted to settlement area, the deforestation that resulted has caused the area to be no longer considered viable for agriculture due to erosion (Lanjouw et. al. 2004 in Heckel, undated)

Though there is no empirical data on how soil erosion affect the GDP but in developing countries with similar socio-economic background (Mali, Malawi, Mexico), the gradual loss of agricultural productivity from soil erosion translate into annual losses is equivalent to 0.5-1.5 percent of these countries gross domestic products ( World Bank, 2003).

In addition, the overall forgone environmental benefits since most of these ecosystems services are not traded in the formal market. The evidence show that there has been tremendous costs correlated with the environmental deterioration.

The availability of water is critical for plant growth. As erosion occurs, the water holding capacity of soils decreases and run off increases. Even moderately eroded soils absorb 10 to 300mm less water per ha per year from rainfall than un eroded soils.

Depending on rainfall, soil type, slope and other factors, a 20 -40 % reduction in available water to plants in agroecosystems reduces productivity from 10 to 25 %.(Pimentel and Kounang 1998 in Gurrieri et al, 2005). This is in turn will decrease the amount of organic material input to the soil diminishing the overall productivity for the area.

Deforestation also has negatively impacted the availability of energy especially in rural areas. It is estimated that 81 % of the country energy consumption is from wood, most of which used at household level. The high demand of wood for energy purposes has also contributed to more deforestation. Sustainable biomass supply is estimated to be lower than the national consumption which is estimated at 5,394, 696 c u m. MINECOFIN (2002) shown that wood consumption from 1990s outstripped its wood production by 2.3 millions cubic meter annually

The scarcity of wood has been a burden for children and women as they are the main energy collectors and users. They have to walk long distance to gather firewood. The collection of firewood which has become more time consuming has automatically limit the abilities of women to engage in other productive activities such as income generating activities. In addition, the gathering of firewood is usually done at the expense of the children's opportunity to go to school. is done with direct consequence on food insecurity and the education for children. In a survey done in Gishwati (GIS, 2002), families complain about the drop out of children due to time allocated by children to collect firewood.

Wetlands outside the main reserves are poorly protected and managed. The planned and unplanned conversion of those wetlands into agricultural land could easily lost through clearance and over-use. Water resources mainly in wetland and valleys were constrained as water shades and wetland areas were lost due to the conversion of this natural habitat to agricultural land. The demand to convert more land to agriculture has led to the destruction of Rwanda 'wetland, which has resulted in flooding, sedimentation and loss of biodiversity as well as natural habitat.

These problems were compounded, especially in the southern regions of the country, by several droughts in the 1980s and early 1990s. The impact of water scarcity on agriculture was harshest in arid regions in south East and North East of the country.

In addition, inappropriate use of water resources has lead to the pollution and biodiversity degradation and levels in many lakes and rivers (Muhazi, Mulera, Kivu, Kagera, etc.) are decreasing progressively.

Many disease are associated with environmental problems such as polluted drinking water and air pollution. If water is well protected, it can avoid healthcare costs from water quality related illness. These indirect costs, especially the value of a human life or the ecosystem services provided by natural resources are very difficult to estimate.

Thus, the poor are more affected by environmental degradation. Environmental resources make a significant contribution to average rural incomes. There is evidence that natural resources play an important role in the economy of rural households, the deterioration of the environment will direct affect their livelihood.

It is recognised that the level of current exhaustion of natural resources can hamper the development of the country and the socio economic base of future generation. It is clear that Rwandans rely so much on natural resources and have few alternatives. It is then important to protect their natural resources in order to maximise the growth opportunities.

#### **4. POTENTIAL CONTRIBUTION OF NRM TO ECONOMIC GROWTH AND HUMAN DVELOPMENT**

##### ***4.1. Poverty and environment***

Natural resources have a significant role in the lives of the poor in developing countries. When resources are degraded, contested, or inaccessible, the poor tend to be negatively affected, often driven even deeper into poverty. Increased attention is being paid to the poverty environment (P-E) dynamic in debates about and strategies for poverty alleviation.

Countries' environmental and natural resources (ENR) provide economic benefits in different ways; this may be directly through productive sectors or as inputs to other sectors via the informal sector or through the services they provide. However, many of the benefits are overlooked and as Cavendish (2001) pointed out, the utilizations of ENR are excluded from conventional economic surveys of households. As a consequence, very little is known about their value in terms of overall rural households welfare and about how their use and value might vary across household types. The main problem in this area is that there are no accurate physical and economic data on rural households and environmental resources. This leads to several questions: how accurate is economic analysis of rural poor households if a significant source of economic value has been ignored? What is really known about the dynamics of environmental change if physical data are missing? And finally what can be said empirically about the poverty-environment linkage in such a context?

In the 1990 World Bank Report it was confirmed that most of the poverty in the world corresponds to peasants in rural areas of developing countries and the analysis of poverty should focus particularly on the determinants of income flows of poor agricultural households. Most of their income comes from their agricultural output; therefore the main agricultural inputs, labour and land, as well as climatic fluctuations (Nugent and Walther, 1981) play a dominant role in understanding the nature and the cause of poverty. Aggregate data of Less Developed Countries (LDCs) supports the pervasive importance of climatic variations, showing that the agricultural output patterns are closely related to climatic fluctuations.

Environmental resources contribution to households income was quantitatively proved by Cavendish (2000) who noted that there was ample evidence that rural households used environmental resources quite extensively. His study, based on household data from rural Zimbabwe, showed that about 35 % of average total income came from freely-provided environmental goods. The sampled data proved that the poor are more resource-dependent than the rich, which means that environmental degradation harms more poor people. However, another finding was that aggregate total resource demand rose with income and this suggests that better off households are, in quantitative terms, the most users of environmental resources. Cavendish also showed that environmental resources were important for key economic activities. In both cash generation and the fertilizer provision, environmental resources proved quantitatively significant in total and were of a particular importance once again to poorer households.

#### ***4.2 Rwandan Context: Preserving ENR for Optimization of Economic Growth***

The relationship between poverty and environment is complex. In Rwandan context, farmers who own cows are generally better-off because they use manure for preserving soil fertility and they can afford to invest in anti-erosive activities. When their cattle numbers decline, soil conservation practices decline as well leading to poor harvests. For example, MINECOFIN (2002) reports that food security studies conducted by *Save the Children Fund* found that most households in all surveyed areas had lost much of their livestock during the war and the genocide. Consequently, between 1990 and 2000, the use of organic inputs in farming declined from 95% to 69% of farmers, and from 70% to 57% of area. In addition to the reduction in the use of modern and traditional inputs, environmental protection practices also declined during the 1990s. The proportion of farms in the crop survey where investments in soil conservation measures were applied decreased from 93% in 1990 to 65% in 2000, and the area covered by such investments fell from 76% to 65%. This obviously resulted in the increase in the proportion of poor farmers in rural areas.

The limited amount of available land has forced farmers to reduce periods of fallow and also to move to marginal agricultural lands on steep slopes and the increased agricultural exploitation of wetlands. This has led to the deterioration of soil fertility and to problems of soil erosion. MINAGRI has estimated that Rwanda loses the capacity to feed 40,000 people each year due to soil erosion that takes each year an estimated 945,200 tons of organic matter, 41,210 tons of Nitrogen, 280 tons of phosphorous, and 3 tones of potash (MINITERE 2003).

In the 2005 Rwandan PRSP annual progress report, two important factors were reported concerning the importance of environmental protection and economic growth. The rapidly growing tourism in the country was cited as one of the sources of GDP growth in 2004 while electricity shortages due to hydropower decrease because of environmental mismanagement in

Rugezi marshland was reported to be one of the factors that drove the inflation increase during that year. Bad rains due to unfavorable climatic conditions also were reported to have heavily contributed to the bad performance of the national economy. Tourism and hydroelectricity are important economic development sources that are also linked to environment. This suggests that if Rwanda wants to increase its economic growth, sustainable environmental management is a must. As for unfavourable climate conditions, well planned and managed irrigation system could help to reduce the agricultural production dependence on weather caprices. This again will require a sustained and environmentally friendly ways of national water resource management. It will also require production of crops in a more sustainable manner such as adopting crops that are need less water or which are less susceptible to drought.

From the Profile of Poverty in Rwanda it is clear that poverty is disproportionately concentrated among households whose primary livelihoods are agricultural activities, either on their own account or through agricultural wage labour. Overall, for those households whose primary activity is agriculture on their own account, about 97% of active members work on the household farms. Of the remaining economic activities diversification takes around 2% of other active members (Bush et al. 2005). The implication here is that other economic activities contributing to households incomes are very limited. Throughout Rwanda, the prevalence of agricultural activity is apparent, especially among the poor, and the majority of households appear to have little other alternatives that is why when the rain patterns change, the economic growth is automatically affected. The population living near wetlands and forests do harvest some natural resources and get income from them and this increases the dependence of the household and national level on environmental resources for subsistence and income generation. Yet overexploitation of environmental resources has a direct impact on the quality of environmental resources and this leads to increased poverty and further degradation of these fragile resources.

A study carried out by Masozera et al. (2004) around Nyungwe National Park showed how poor people from five sampled villages depended heavily on the forest for energy, medicinal, nutritional and other subsistence needs. The findings showed that forest dependency varies between 60 % and almost zero. High forest dependency was reported in villages with lower average incomes and younger people were more dependent on forest resources. Bweyeye district was found to be more dependent on Nyungwe forest more than other districts namely Rangiuro, Nshili, Kitabi and Gisakura. The income share from forest resources was estimated to be 60 % of the total annual income earned by households in Bweyeye district. A more detailed study should be able to establish how much is the dependency in monetary terms. The study also identified other dependent variables that had a significant impact on forest resource dependency such as age, gender, education, access to market and household's size. The results about these variables are interesting because they have important policy implications. For example, more educated households depend less on forest resources as well as those who have easy accessibility to the markets. By investing more in education, the government will be helping in natural resource protection. The most likely explanation is that education expands the choices of people especially the poor on earning livelihoods from jobs not dependent on natural resources. Indeed higher levels of poverty in Rwanda are inversely related to levels of poverty and non dependency on agriculture (GoR 2002).

It was also found that households with higher average income are less dependent on the forest. Further more, results of logit analysis revealed that agricultural income and access to outside markets are shown to reduce forest dependency. Raising income from agriculture and creating

additional employment opportunities through increased access to markets and towns will increase the opportunity cost of household's forest products and mineral collection from Nyungwe forest. These findings suggest that economic development plans should go hand in hand with environmental protection.

Rwanda has a high potential of increasing economic growth through a better management of its natural resources. As shown above, poor people depend on natural resources either through agricultural activities or direct extraction of natural products. At the same time, natural products are used as inputs into production processes or direct consumable commodity goods that poor households sell at the market or use for daily subsistence. The opportunity of increasing economic growth from natural resources lies in a sustainable management of many lakes and wetlands that are all over the country; development of an irrigation system that will allow Rwanda to produce more agricultural products; exploitation of hydropower potential in a sustainable and environmentally friendly manner; optimization of tourism potentials by focusing on fauna and flora protection and a systematic marketing system. An important remark here, is that each of these steps need to be carefully planned for and costed. There is evidence for instance that irrigation schemes can be uneconomic with exorbitant maintenance and operational problems. Within the current decentralization process in Rwanda, the authorities will need to work with local people using proactive and bottom up approach in natural resources management to increase participation of local stakeholders. In order to achieve this, thorough, focused and interdisciplinary studies are needed in the above mentioned natural resources potentials in order to help Rwandan decision makers design well informed and focused natural resources policies that will contribute to national economic development.

## **5. POLICY ENTRY POINTS IN RWANDA**

### **5.1. PRSP II**

Environment in PRSP I was regarded as a cross cutting issue. It was an item presented in two paragraphs towards the end of the paper. The text was as follows;

The three major environmental problems in Rwanda relate to water, soil and biomass. These problems are intimately linked with actions in the water, energy and agricultural sectors. Hence environment is a cross-cutting issue and an environmental perspective needs to be taken in each case. The primary objective of environmental policy in Rwanda will be to ensure that economic development is sustainable and does not destroy the natural resources on which it depends through full marshland drainage or inappropriate use of agro-chemicals. The organisational structure of environmental regulation and policymaking is under review.

It is important to appreciate that apart from regulation, most of the positive interventions to support environmental protection are taken within other sectors. In particular, infrastructure such as terracing, reforestation and water management within marshes will be undertaken as part of the agricultural strategy. The clarification of property rights to be achieved by land policy will also be essential to ensure that people have an incentive to invest in their land. For both these reasons, it is envisaged that the Ministry of Land, Resettlement and Environment (MINITERE) should play an important role in the formulation of agricultural policy. The process of reforestation will also be supported by actions in the energy sector, encouraging more efficient use of fuel wood and substitution into other fuels. The management of water supply will be supported by MINERENA as well as actions to encourage water harvesting in the settlement and housing sector. pg 70

Another mention of investment was under agriculture. It was a single paragraph entitled environmental investment. It read as follows;

*In addition to the reduction in the use of modern and traditional inputs, environmental practices also declined during the 1990s. The proportion of farms in the crop survey using conservation investments fell from 93% in 1990 to 65% in 2000, and the area covered by such investments fell from 76% to 65%. Pg 20*

It would be naïve to argue that a measure of importance of the environment in PRSP would be the length of paragraphs dealing in environment. However besides the general expression of the need to mainstream environment in poverty reduction policy in concrete terms the environmental management has not yet been seen as important to growth and as costly to society( if neglected) that more attention and resources needed to be allocated to it. A few remarks in this regard are in order.

Firstly as recognised by PRSP, environment as a function is very wide. Whereas in some countries the concern may be pollution by industries and motor vehicles in Rwanda, concerns are more on land degradation, water, deforestation or generally the degradation of the ecosystem. There is a need for an identification of the balance and mix of priority item in environmental management in Rwanda. Planting trees is important as a remedial action in conserving the environment. However in relation to growth and poverty reduction, there are equally urgent issues of managing the marshlands and relieving over cultivation by applying more inputs especially fertilisers. The latter statement should not imply that fertiliser application is panacea to major land problems in Rwanda. Fertiliser profitability varies with agro economic areas and crops(Kelly and Murekezi 2000).It is neither a substitute to anti erosion conservation.

Secondly, when the priority areas have been identified, there has to be firm commitment by government to protect resource allocations directed to them. This should however be informed by the gains and quick wins that investing in the priority areas can be demonstrate.

A third issue is that of awareness. The government and policy makers should be able to understand the cost of environmental degradation. These cannot support resources commitment to the sector, the link between environmental scarcity, conflict and poverty is clearly identified. Ordinary people, households and producers in Rwanda have to appreciate the long term gains of environmental conservation or management. One practical way of doing this, besides education and sensitisation, is to formalise their property rights to environmental resources. The ultimate aim of the project to which this assessment belongs is to demonstrate that link.

Finally an institutional framework for environmental conservation and protection should be the first expression of a change of attitude. It is true that environmental concerns will be addressed more fully by the existence of a separate Ministry of Environment. However the need to coordinate all the activities that are related to environment must be recognised across different sectors of the economy. Water, agriculture, wildlife, planning and several other sectors must integrate environment sustainability into their programmes and projects.

## 5.2. MDGs

In the millennium goals environment is stated as Goal Number seven with there targets. The goal and targets are stated respectively as follows.

### **Goal 7.Ensure environmental sustainability**

Target 9. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

Target10.Halve the proportion of people without sustainable access to safe drinking water

Target 11. By 2020 achieve significant improvement in the lives of slum dwellers.

In relation to MDGs, then environment is vitally important to poverty reduction and human development. Indeed our own argument is supported by Target Number 9. Target Number 10 is a clear reminder that environment is important to health. Finally environmental protection and conservation is not restricted to rural areas. It also addresses poverty in towns and especially in slum dwellers.

But an important argument to make here is that environmental concerns are related to most of the other Millennium Development Goals. In MDGsing poverty reduction, it is important that environmental issues are mainstreamed in each of the goals with perhaps the exception of HIV/AIDS only(See Table )

**Table 1: The key links between the environment and the MDGs**

<b>Millennium Development Goals</b>	<b>Examples of Links to the Environment</b>
1. Eradicate extreme poverty and hunger	Livelihood strategies and food security of the poor often depend directly on healthy ecosystems and the diversity of goods and ecological services they provide.
2. Achieve universal primary education	Time spent collecting water and fuel-wood by children, especially girls, can reduce time at school.
3. Promote gender equality and empower women	Poor women are especially exposed to indoor air pollution and the burden of collecting water and fuel-wood, and have unequal access to land and other natural resources.
4. Reduce child mortality	Water-related diseases such as diarrhoea and cholera kill an estimated 3 million people a year in developing countries, the majority of which are children under the age of five.
5. Improve maternal health	Indoor air pollution and carrying heavy loads of water and fuel-wood adversely affect women's health and can make women less fit for childbirth and at greater risk of complications during pregnancy.
6. Combat major diseases	Up to one-fifth of the total burden of diseases in developing may be associated with environmental risk factors – and preventive environmental health measures are as important and at times more cost-effective than health treatments
7. Ensure environmental sustainability	Current trends in environmental degradation must be reversed in order to sustain the health and productivity

The table shows clearly that in the bid to achieve the Millennium Goals environment is important in each of them.

## 6. WAY FORWARD

Rwanda is facing a formidable challenge of choosing a course of action. There are two choices . Either to take the environmental issues as 'business as usual' or take concrete steps to use natural resources for growth in a manner that is sustainable and pro-poor. The 'business as usual' attitude may mean two things. Firstly it is an attitude of not recognising the impact of environmental degradation on conflict and poverty reduction in Rwanda. Secondly it may mean that policy makers and households are aware of the linkages but prefer either rapid growth without care of what happens to the environment and poverty or are interested in short term gains leaving the future to itself. The second choice would require recognising and mainstreaming natural resource management, particularly conserving, protecting but also managing the environment. This could be done following a number of steps.

Assembling data and information on the linkage of natural resources and growth and poverty reduction

- i. Elaborating a case of how natural resource management can lead to pro-poor growth
- ii. Evolving a realistic advocacy strategy that can demonstrate the relationship between natural resource management and human development at policy making level and among grass root producers as rightful participants in NRM
- iii. Demonstrate how environmental scarcities and lack of NRM strategies are linked to conflict and how Rwanda is an exceptionally case
- iv. Engage government to put in place institutional framework that can ensure efficiency in coordination between departments that interface environment particularly agriculture, water, minerals, tourism and commerce
- v. Engage government especially Ministry of Finance to safeguard and protect allocations to environment

## BIBLIOGRAPHY

ACTS (2004). Land Tenure Reform as a way of preventing conflict in the Great Lakes. Policy Brief. Nairobi.

André,C. (1998) Land access, policy and reform in Rwanda. (mimeo)

André and Plateau J-P. (1998) Land Relations Under Unbearable Stress: Rwanda Caught in the Malthusian Trap. Journal of Economic Behavior and Organization Vol 34 pp1-47

Baechler, G. (1999) *Violence through environmental discrimination: Causes, Rwanda Arena and Conflict Model*. Kluwer Academic Publishers

Baker, R. (1970) Reorientation in Rwanda. *African Affairs* Vol 69 No 275 pp 141-154

Bigagaza, J. Abong, C. and Mukarubuga, C. (2003) Land scarcity, distribution and Conflict in Rwanda in *Scarcity and Surfeit ACTS/ISS*. Nairobi and Pretoria Chp 2 pp50-83

Blarel, B. (2001) Tenure Security and agricultural production under land scarcity: The case of Rwanda in John Bruce and Shem Mighot-Adhola. *Searching for land tenure security in Africa*. Kendall/Hunt Publishing Company

Bush et al. (2005); *Mainstreaming Poverty – Environment Linkages in the European Community’s Development assistance in Rwanda*. Draft Report, May 2005

Cavendish, W. (2000) ; *Empirical Regularities in the Poverty-Environment Relationship of Rural Households: Evidence from Zimbabwe*. *World. Dev.* 26:1979-2003.

Clay, D. and Ngenzi, I. (1990). *Migration temporaires dans les ménages au Rwanda*. Kigali. MINAGRI.

Clay, D and Lewis, L. (1996). *Land use, soil loss and sustainable agriculture in Rwanda*. Michigan State University

Clay Daniel, Byilingiro Fidele, Jaakoo KANGASNIEMI, Thomas Reardon, SIBOMANA Bosco, UWAMARIYA Laurence, Tardif-Douglin, (1995) *Promoting Food Security in Rwanda Through sustainable Agricultural productivity: Meeting the Challenges of Population Pressure, land degradation and Poverty*, MSU agricultural economics

Clover, J and Cornwell (eds) (2005). *Supporting Sustainable livelihoods*. ISS. Pretoria

DfID (2004). *How to Note. Environment, Growth and Poverty Reduction*. London

Dixon-Homer, T. (1994). *Environmental Scarcities and Violent Conflict. Evidence from cases*. *Journal of International Security* Vol 19.5-40

Donovan, C. Mpyisi, E. Loveridge, S. (2002) *Forces driving change in Rwandan smallholder agriculture 1990-2001*. FSRP/MSU

Ehrlich, A. H., Glerick, P and Conca, K. (2000). *Resources and environmental degradation as sources of conflict*. 50<sup>th</sup> Pugwah Conference on Science and World Affairs. Queen’s College. Oxford Cambridge

Ellingsen and Wenche (1998). *Beyond environmental scarcity*. *Journal of Peace Research*

GoR (2001a). *Rwanda Development Indicators*. Kigali

GoR (2002a). *Ministry of Finance. Poverty Reduction Strategy Paper*. Kigali

- GoR(2002b). Ministry of Finance.A Profile Of Poverty For Rwanda. Directorate of Statistics
- GoR(2003). Rwanda Development Indicators. Kigali
- GoR(2004).National Land Policy. Kigali.
- Gorus, J. (2000). The State an instrument of ethnicity. Ruddy and Gorus,J. The Politics of identity and economics of conflict in the Great Lakes. Brussels: VUB University Press
- Gurrieri. et., al, 2005: Virunga-Bwindi Region: Analyzing the region s watershed supplies to local communities
- GTZ-IFAD, 2002: Tackling land degradation and Desertification, GMS, Grafiche, Rome.
- Kaplan (2000). The coming Anarchy. Atlantic Monthly
- Kelly and Murekezi( 2000).Fertiliser Response and profitability. Kigali.FRSP / FAO
- Masozera et al. (2004); Forest Dependency and its Implications in Protected Areas Management: A Case Study From Nyungwe Forest Reserve, Rwanda. Scand. J. for Res. 19(Suppl.4) (2004).
- Musahara(2005).Poverty and Government expenditure.An assessment of the impact of expenditure and interventions on poor groups with focus on Rwanda.PhD Thesis .University of the Western Cape.
- NUGENT, J.B. and R.J. WALTHER: (1981); 'Short-run Changes in Rural Income Inequality: A Decomposition Analysis', Journal of Development Studies, 1981.
- Ohlson, L. (1999). Environmental Scarcity and Conflict. Peace and Development Studies Center. University of Gothenburg
- Percival, V and Homer-Dixon, T. (1995). Environmental Scarcity and Violent Conflict: The case of Rwanda. Project on Environment, Population and Security. University of Toronto
- Pottier, J. (1997). Social Dynamics of Land and Land Reform in Rwanda. Department of Anthropology and Sociology. University of London
- Prunier,G(1995).Rwanda.A History of Genocide. Kampala
- Semujanga, J.(2003). Origins of genocide. Humanity Books.
- UNDP (1994) Human Development Reports. New York

Uvin, P (1998) *Aiding Violence. The Development Enterprise in Rwanda*. West Hartford, Conn: Kumarian Press

Van Huyweghen, S (1999). *The Urgency of Land and Agrarian Reform in Rwanda*. *African Affairs*. Vol 98,353-72

Waller, D. (1996). *Rwanda. Which way now? OXFAM Country Profile*. Oxford: Oxfam