

# Impact of Integrated Watershed Management Practices on Sustainable Rural Livelihoods of the People of Rwanda

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**Abstract:** Much of Gicumbi District is rural based and majority of the people depend on land for substance; collect grass for their animals, collect water and obtain wood for cooking, and construction of buildings (homes, institutions and business premises) and different land management practices like tree planting, terracing among others have been adopted by the District to improve rural livelihoods of its people. Even though these practices continue to be encouraged and implemented in the district poverty levels have remained high and yet there are very limited studies conducted to assess the impact of these practices on rural livelihoods. Therefore, this study adopted quantitative and qualitative analysis to assess the impact of the activity of tree planting on sustainable rural livelihoods taking Mwangi watershed in Gicumbi district as the case study. The watershed is 51 Km away to North of Kigali City, with a total population of 78623 inhabitants organized in 17670 households and only 7552 households with 34229 inhabitants is located in Mwangi watershed, and it is only from this population that a study sample was chosen using Slovin's formula. Questionnaires were used to collect data and later analyzed using descriptive statistics with the help of frequency and percentage tables and summary of community thoughts. The key findings indicate that before the introduction integrated watershed management practices, n=98 of respondents acknowledged a problem of livelihood decline and only 2% (n=2) respondents never perceived a decline in their livelihoods. Before the introduction of tree planting practice there area was faced with issues of land degradation which resulted into food shortage, poor nutrition and famine thus affecting economic growth of the area. However, on adaptation of tree planting, conditions of living improved due to increased land productivity and sale of forestry products. From the survey conducted, 85% of all the households located in Mwangi area have noticed an increase in their household incomes which is being used to fulfill other family needs like medical care, house construction, clothes, cater for school expenses as well as rent farm land. The positive and significant impact of the practice of tree planting on the sustainable rural livelihoods of the people of Mwangi watershed is an evident and essential to the sustainable rural development of the watershed. The enhanced income, improved environmental indices, and reduced vulnerabilities of farmers are recognized as new livelihood assets that will influence the future livelihood strategies in the holistic framework. It is concluded that increased land productivity, increased environmental indices and subsidies income as well as diversified livelihood strategies are essential to the sustainable rural development of the rural people. The success of tree planting practice in Mwangi watershed strongly supports the future promotion of similar policies elsewhere in the region, as Rwanda continues to experience large-scale transformation within its vast rural areas.

**Keywords:** sustainable rural livelihoods, watershed, farmers.

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## 1. INTRODUCTION

Poverty, food insecurity, climate change and loss of biodiversity are the main social and environmental challenges being encountered by the world communities (Godfray et al., 2010; West et al., 2014). However, some successes in addressing these issues have occurred for example, from 1990 to 2015, population of undernourished worldwide reduced to a half (FAO IFAD and WFP 2015), more than one billion people have been lifted out of extreme poverty (UN, 2015), and a global network of protected areas has been developed covering over 15% of the terrestrial surface. However, there is still much to be done as approximately 795 million people remain undernourished globally, with 780 million of these being from developing countries (FAO, IFAD & WFP, 2015). Greenhouse gas emissions continue to rise (IPCC, 2014); and

global poverty remains both high, with almost 900 million people surviving on less than \$1.90 per day, and highly concentrated, with 42.6% and 18.8% of the global total occurring in sub-Saharan Africa and South Asia, respectively (World Bank and IMF, 2016).

In the year 2000, the government of Rwanda adopted a primary objective of becoming a middle income country by the year 2020, and in line with the country's Vision 2020 objective, the country adopted its second Economic Development and Poverty Reduction Strategy (EDPRS 2) to guide the country's medium-term development aspirations over the period 2013/14 to 2017/18. The overall objective of EDPRS 2 is to increase the quality of life of all Rwandans through rapid and sustainable economic growth (11.5% per annum) and accelerated poverty reduction (to below 30). The majority of the population in Gicumbi District is rural based and depend on land for substance; collect grass for their animals, collect water and obtain wood for cooking, and construction of buildings (homes, institutions and business premises). In improving the livelihood of these people, the district has emphasized and implemented different Land management practices like tree planting, terracing among others for the last two decades. However poverty levels have remained high in the district. For example According to NISR (2014) poverty levels in the district are higher compared to the national levels, with 49.3% of the population under poverty line and 33.9% of the population in extreme poverty, national levels being 44.9 and 24.1% respectively, and when compared with other districts of Northern Province, Gicumbi district has the highest percentage of extreme poor. And yet this come at a time when there is a growing acknowledgement that conventional sectorial approaches to addressing these often inter-connected challenges like poverty, food insecurity and biodiversity loss are proving insufficient (Godfray et al..2010)

## 2. STATEMENT OF THE PROBLEM

The total population of Gicumbi District counts 395,606, of which 47.7% are male and 52.3% female almost similar to the national ratio and the population density is 477 people per km<sup>2</sup> against 415 at national level high. And 90% of the people lives in rural areas and depend on land on which they grow crops for substance and sale, collect grass for their animals, collect water and obtain wood for cooking, lighting, and construction of buildings (homes, institutions and business premises) NISR (2014), according to the Rwanda State of environment and outlook report (2015), the continued implementation of integrated watershed management practices like terracing, tree planting and water management in rural districts of Rwanda, will help rural people to access a wide range of livelihood strategies thereby improving their living conditions.

According to the District Development Plan, 2013/2018, land management principles such as terracing, Tree planting, infiltration trenches among others have been seen as means for improving rural productivity in the district for they are believed to improve rural livelihoods by improving land productivity on which the majority of the population depend on. Even though these practices continue to be emphasized in the district, poverty levels have remained high. According to NISR (2014) poverty in the district are higher compared to the national levels, with 49.3% of the population under poverty line and 33.9% of the population in extreme poverty, national levels being 44.9 and 24.1% respectively, and when compared with other districts of Northern Province, Gicumbi district has the highest percentage of extreme poor.

Furthermore, the NISR (2014) survey revealed that poor people are directly dependent on their immediate environment and poor households in particular rely heavily on expenditure-saving, labour intensive activities for their subsistence and survival, such as growing food, collecting water, fuel wood or grazing animals and any degradation of their land deepens their poverty. Despite all these, the information concerning the impact of tree planting on livelihoods of the local people is still minimal, for example in Gicumbi district (area under study) there is no any study conducted to assess the impact of integrated watershed management of which tree planting is one of the practices being extensively encouraged in rural livelihoods and filling this knowledge gap will provide a proper assessment for these activities and hence being the reason for their continued implementation.

## 3. OBJECTIVES OF THE STUDY

To examine the contribution of tree planting on sustainable rural livelihoods of the people of Mwanze watershed in Gicumbi district.

## 4. METHODOLOGY

The research **methodology** describes the research methods and techniques employed in the study. It includes area of study, research design and population or sample size as well as sampling procedure, data collection methods, secondary data sources, validity and reliability of instruments, data analysis and ethical considerations.

## 5. RESEARCH DESIGN

Research design is a mapping strategy. It is the conceptual structure within which research is conducted. According to Kothari (2008), research design is a statement of the elements under study and strategies for collecting the evidences, analysis of data as well as reporting the findings. The study used non-experimental design (explanatory) to collect data. The reason for this choice is to describe the situation as it existed at the time of the survey. Descriptive statistics were used in collecting, analyzing and linking qualitative data to provide a better understanding of the impact of integrated watershed management practices on sustainable rural livelihood of the local people of Gicumbi district. A survey approach using Participatory Rural Appraisal tools allowed relatively more data to be collected in a short time, and was used to encourage community participation. Both primary and secondary data were collected from the farmers, sector and cell staff, self-help groups, and administration personnel. The study employed exploratory research design, where qualitative and quantitative approaches were used.

## 6. TARGET POPULATION

The study targeted people living in Mwange watershed area mainly in the sectors of Byumba, Kageyo and Mutai, precisely those from the cells of Muhondo, Horezo, Gihembe, Nyamiyaga, Mutandi, Gacurabwege and Nyarutarama. These were areas that shared a common boundary with River Mwange and have one way or another benefited from integrated watershed management practices applied in the management of Mwange Watershed in Gicumbi district. The total population of the area was 78623 inhabitants organized in 17670 households. However only 7552 households with 34229 inhabitants were located in Mwange watershed and it is only this population that a study sample was chosen from using different sampling techniques.

## 7. SAMPLE SIZE AND SAMPLING TECHNIQUE

A sample design helps the researcher to obtain representative data which are not biased. A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample (Kothari, 2004). A sample size of this study was determined largely from the following factors, total number of people living in the area, the acceptable margin of error and the desired level of continuance. The sample size was calculated basing on the following Slovine's formula:

$$n = \frac{N}{1 + NE^2}$$

Where:

n: required sample size

N: Total number of population living in the area

E: Margin error at 10% (standard value of 0.1)

34299

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$$1 + 34299(0.1)^2$$

$$= 99.70929387$$

$$\cdot 100$$

The study used a sample size of one hundred (100) respondents. They included key informants from the District, Sector and cell levels. The key informants were; District Agriculture Officer, District Social affairs office, at Sector level the key informants will be, Sector Social affairs officer and Sector agriculture officer one from each of the seven Sectors, and at cell level, the key informants will be Cell Executive officer and Cell Social and Economic development affairs officer, and one from each of the seven Cells as well. These were believed to be the principal actors of local government and are assumed to have the greatest knowledge and concern on Social-economic status of the people in the area under study as well as in the District in general since power, responsibilities, and resources have been concentrated at the district, Sectors and Cell. Focused group discussions with communities were also held in the villages, Cells and Sectors of the District. The respondents were selected using purposive sampling and random sampling methods.

## 8. RESULTS AND DISCUSSION

The study intended to establish the main source of fuel wood for the residents of Mwangi watershed, and the findings indicated that Watershed residents acquire fuel wood from different sources. Only 99 respondents answered the question.

**Table 1: Sources of fuel wood for the residents of Mwangi watershed**

Major Sources	Before the intervention	After the intervention
	Frequency	Frequency
Own (private) land plantation	73	73
Village(community) plantation	16	23
Buying	-	-
Institutional forests (church)	10	3
Total	99	99

Source: Primary data, 2016

The major objective of the EDPRS for the forestry sector is to provide an adequate and sustainable supply of forest products and manage forestry resources for poverty alleviation by income and employment generation. In this research, households were asked about the sources of fuel wood from which they get for domestic consumption in all intervention period 73 % of the respondents in the area the source of wood was from their private land holdings. Other sources of wood are community plantations and from church yards. In line with the Constitution, Vision 2020 and EDPRS23, Rwanda is committed to environmental protection, diversification of energy sources, erosion prevention, and reduced fuel wood consumption and implementation of a reforestation strategy. The major objective of the EDPRS for the forestry sector is to provide an adequate and sustainable supply of forest products and manage forestry resources for poverty alleviation by income and employment generation. The study also attempted to establish how the role of fetching wood is felt among the watershed community.

**Table 2: The responsibility of fetching wood**

Purpose	Frequency	Percentage
Male adult	4	4
Female adult	11	11
Male and female adult	9	9
Female adult and girls	48	48
Female adult and children	12	12
Girls	10	10
Boys	6	6
<b>Total</b>	<b>100</b>	<b>100</b>

Source: Primary data, 2016

In Rwandan culture the kitchen is the domain of women and girls. A significant percentage of their working time and energy involves obtaining and using firewood. The responsibility of collecting fuel was asked. The survey results clearly indicated that the burden of collecting fuel is mainly that of Female adult and Girls' as well as children's responsibility. As shown in table 4.8 above, about 48 percent of Female adult and Girls(women/ wives), 12 percent of Female adult and Girls' and 11 percent of female adult female have the task of collecting fuel in the watershed area whereas only 6 percent of boys and 4 percent of Male adult (husbands) share this responsibility and people in the area need trees for producing fuel wood, income Generation, Soil conservation well as construction and fodder for domestic use and commercial purposes and this was revealed in when respondents were asked for reason why they need trees.

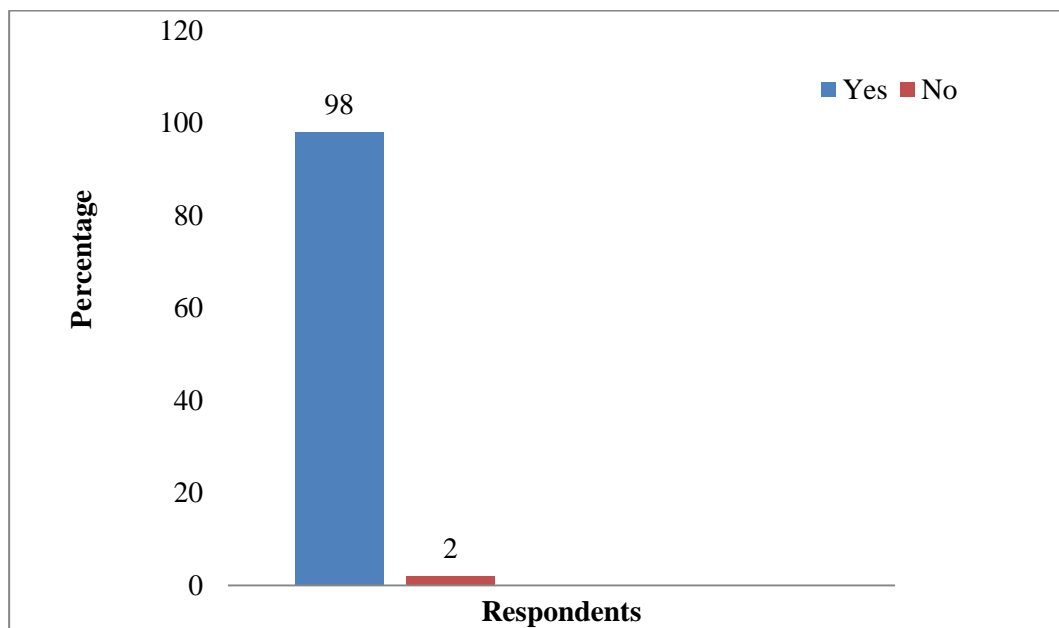
**Table 3: Reasons why the watershed community needs Trees**

Purpose	Frequency	Percentage
Fuel Wood	26	26
Construction Wood	23	23
Income Generation	26	26
Soil Conservation and Other	25	25
Total	100	100

Source: Primary data, 2016

Half of the total respondents in the area need trees mainly for income generating and fuel wood production purpose. This might be due to the absence of natural forests in the vicinity where one can easily get construction wood. 25 and 23 percent of the responding respondents in the watershed area need trees for construction, soil conservation and other purposes respectively.

In this study, an attempt was made to find out whether the people of Mwange watershed area in Gicumbi district benefited and still benefit from the intervention of tree planting in their area. 98 percent of the respondents benefited and still benefit from the practice of tree planting while 2 percent have not benefited from this practice.



**Figure 1: Benefits of tree planting activity**

Source: Primary data, 2016

For the respondents who did not gain from tree planting activity argued that the dividing of land among members of the family like their sons after deciding to make their own family greatly reduces their land holdings and the small pieces of and they have been left with are put under excessive food production and most of them are too old to get involved in labour intensive activities. The research also attempted to find out how the activity of tree planting benefited the people of Mwange Watershed, Table below.

**Table 4: Benefits of tree planting**

Response	strongly disagree	Disagree	Not sure	agree	strongly agree	Total
	Frequency					
Raised farm income	-	2	-	-	98	100
Enhanced agricultural productivity	-	2	-	-	98	100
Generation of rural employment	-	2	-	-	98	100
Reduced risk by diversifying crops	-	2	-	-	98	100
Reduced soil loss	-	2	-	-	98	100
Increased land property value	-	2	-	-	98	100
Improved water quality by reducing sedimentations	-	2	-	-	98	100

Source: Primary data, 2016

The findings indicated that 98 percent of the total respondents strongly agreed that tree planting activity raised farm income, enhanced agricultural productivity, generated of rural employment, reduced risk by diversifying crops, reduced soil loss, increased land property value and improved water quality by reducing sedimentations. However, 2 percent of the total respondents disagreed with the above benefits.

#### Relationship between variables:

The tables below show the relationship between factors; independent variable and dependent variable.

**Table 5: Relationship between terraces and sustainable rural livelihoods**

sustainable rural livelihoods	Terraces		
sustainable rural livelihoods	Pearson Correlation	1	.754**
	Sig. (2-tailed)		.000
	N	100	100
Terraces	Pearson Correlation	.754**	1
	Sig. (2-tailed)	.000	
	N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).			

Pearson correlation coefficient, ( $r=0.754$ ) shows that there is a positive and high correlation relationship between terraces and sustainable rural livelihoods in Gicumbi district where the P-value ( $0.000 < 0.05$ ). This means that the terraces have a big contribution on promoting sustainable rural livelihoods in Gicumbi district.

**Table 6: Relationship between tree planting and sustainable rural livelihoods**

sustainable rural livelihoods	Tree planting		
sustainable rural livelihoods	Pearson Correlation	1	.732**
	Sig. (2-tailed)		.000
	N	100	100
Tree planting	Pearson Correlation	.732**	1
	Sig. (2-tailed)	.000	
	N	100	100
**. Correlation is significant at the 0.01 level (2-tailed).			

Pearson correlation coefficient, ( $r=0.732$ ) shows that there is a positive and high correlation relationship between tree planting and sustainable rural livelihoods in Gicumbi district where the P-value ( $0.000 < 0.05$ ). This means that the tree planting do contribute a lot in promoting sustainable rural livelihoods in Rwanda, precisely in Gicumbi district.

## 9. CONCLUSION

The vulnerabilities of farmers to shocks have been dramatically reduced through improved environmental indices and enhanced per capita net income derived from agricultural productivity. According to a sample survey conducted 98% of all the households located in Mwange area noticed an increase in their household incomes which is being used to fulfill other family needs like medical care, house construction, clothes, cater for school expenses as well as rent farm land. The enhanced income, improved environmental indices, and reduced vulnerabilities of farmers are recognized as new livelihood assets that will influence the future livelihood strategies in the holistic framework.

It is concluded that increased land productivity, increased environmental indices and subsidies income as well as diversified livelihood strategies are essential to the sustainable rural development of the rural people. The impact of integrated watershed management practices' success in Mwange watershed strongly supports the future promotion of similar policies elsewhere in the region, as Rwanda continues to experience large-scale transformation within its vast rural areas.

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