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AN ECONOMIC ANALYSIS OF FARMERS' PREFERENCES FOR PARTICIPATORY MANAGEMENT OF VOLCANOES NATIONAL PARK IN RWANDA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS DEGREE IN AGRICULTURAL AND APPLIED ECONOMICS

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DECLARATION AND APPROVAL

Declaration:

The contents of this thesis are my original work and have not been presented for examination in any other university.

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DEDICATION

This thesis is dedicated to my family.

ACKNOWLEDGEMENTS

This achievement involved the intervention of many personalities. I would like to express my gratitude to all those who contributed directly and indirectly and made this work reality.

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ABSTRACT

Urbanization and population growth have been the major forces driving natural forests depletion. Globally, 600 million people depend on forest resources. Specifically, 65 percent of workforce in Sub Saharan Africa (SSA) and 80 percent in Rwanda greatly depend on forests for subsistence agriculture. However, the economic value attached to forest management attributes, and socioeconomic and institutional factors for a participatory decision making process are not well known. Despite different interventions made with regard to conservation, there exists inadequate empirical evidence detailing forest participatory management preferences in developing countries including Rwanda. The Volcanoes National Park (VNP) is a site of global importance for its biodiversity, for instance, it is home to mountain gorillas which are seen as the major source of tourism revenues in Rwanda. This is because they contribute up to 90 percent of the said revenues. This study aimed at characterizing management practices and approaches and estimate the monetary value farmers attached to the park attributes. Primary data were collected using semi-structured questionnaires and a choice experiment method from 192 systematically and randomly selected farmers living at the park-adjacent corridor in the North-Western Rwanda. Descriptive statistics were applied to characterize management approaches and practices. In addition, a Conditional Logit (CL) method was used to assess the value devoted to management attributes. The results of this study revealed that erosion control, animal and crop husbandry were the major farming management practices that increased forest and farm covers. However, the use of agroforestry was low in the area. The study identified the use of untreated water sources and firewood as the main source of energy. Similarly, results indicated that farmers were willing to pay to preserve key park management attributes such as cultural heritage; park production resources; both plants and animals biodiversity and to participate in integrated decision making process. Gender, income, education level and group membership were found to significantly influence preferences. The findings on management approaches and practices provide useful insights on design of forest and land restoration programmes in Rwanda. Further, insights on farmers' preferences are important in formulating cultural-based interventions and appropriate benefit sharing schemes. Finally, the results would guide formulation of environmental empowerment programmes that facilitate ownership in decision making as well as health and nutritional policies.

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LIST OF ACRONYMS

ANP	Akagera National Park
CA	Collective Action
CBO	Community Based Organization
CE	Choice Experiment
CO_2	Carbon Dioxide
CS	Compensating Surplus
CVM	Contingent Valuation Method
ES	Equivalent Surplus
FAO	Food and Agriculture Organization of the United Nations
G and WS	Galleries and Wooded Savannas
GDP	Gross Domestic Product
GF	Gishwati Forest
GoR	Government of Rwanda
HPM	Hedonic Price Method
ICCROM	International Centre for Preservation of the Cultural Property.
IFAD	International Fund for Agriculture Development
IGCP	International Gorilla Conservation Programme
IMF	International Monetary Fund
IUCN	International Union for the Conservation of Nature
KM^2	Square Kilometres
KShs	Kenyan Shillings
MCDA	Multi-Criteria Decision Analysis

MDG	Millenium Development Goals
METR	Marginal Effective Tax Rate
MF	Mukura Forest
MINAGRI	Ministry of Agriculture and Animal Resources (Rwanda)
MINECOFIN	Ministry of Finance and Economic Planning
MINP	Mgahinga Impenetrable National Park
MNL	Multinomial Logit
MWTP	Mean Willingness To Pay
NFR	Nyungwe Forest Reserve
NGO	Non-Government Organization
NISR	National Institute of Statistics of Rwanda
NMGs	Non-Market Goods
NVM	Non-Market Valuation Methods
PFM	Participatory Forest Management
PFMA	Participatory Forest Management Approaches
PNVi	Parc National des Virunga (Virunga National Park)
RDB-TC	Rwanda Development Board-Tourism and Conservation
REMA	Rwanda Environment and Management Authority
RNRA	Rwanda Natural Resources Authority
RP	Revealed Preference
RPL	Random Parameter Logit
RUT	Random Utility Theory
Rwf	Rwandese Francs (US$1=Rwf690)

SMEs	Small and Medium Enterprises
SP	Stated Preference
SSA	Sub Saharan Africa
TCM	Travel Cost Method
TShs	Tanzanian Shillings
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention for Climate Change
US$	United States Dollar
UShs	Ugandan Shillings
VNP	Volcanoes National Park
WHO	World Health Organization
WHS	Worldwide Heritage Site
WTA	Willingness To Accept
WTP	Willingness To Pay

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Natural forests provide ecosystem services such as mitigation of greenhouse gas emissions, protection of the watersheds, conservation of biodiversity, sustenance of critical life forms, and contribute to the livelihood of the rural communities. It is widely known that rural communities worldwide depend on forest resources as their main source of livelihood. The World Bank (2004) estimated that 600 million indigenous people depend on forests, 350 million among them highly depend on forests for subsistence. This group often lose access to resources when local forests become designated as strict nature reserve. The forest dependence is greater in Sub Saharan Africa (SSA) than other developing countries since the demand on forest products and services continue to rise due to urbanization, population growth and increased demand on industrial activities.

On the other hand, a recent demand for environmental solution is growing as concern on the impact of climate change and loss of biodiversity also grows. Population pressure coupled with an estimate of 60 percent prevalence of poverty for those working in agriculture are the major drivers of high dependence on forest resources in Rwanda. This prevalence is also observed on 23 percent for those working in off-farm activities (GoR, 2013a). Additionally, there are issues of small farm sizes and high rate of soil erosion especially in areas surrounding Volcanoes National Park (GoR, 2014). Despite the importance of forest resources, their economic values are poorly reflected in market considerations and largely ignored in the decision making process.(Ghani *et al.*, 2006).

Local communities in South and Eastern Africa have had a long tradition of managing forests by user groups long before the prehistoric period (Sackey, 2007). Up to the colonial period, forest administration concentrated on implementing policies around delineation, gazettement and

management with emphasis on regulation of forest extraction, hunting and water catchment protection. Upon political independence, most countries reviewed their forest policies in line with significant change of development realities such as accelerated deforestation and illegal forest activities. In Kenya for example, uncontrolled forest destruction has forced the government to replace the traditional forest guards with paramilitary forces (Larson, 2005). In Rwanda, it has been noticed that key stakeholders have not been systematically involved in all aspects of decision making on forest management and do not reap the full benefits (GoR, 2013b).

The inclusion of communities in forest management became increasingly common in 1980s in almost all developing countries through some form of Participatory Forest Management (PFM) (Schreckenberg *et al.,* 2006). In Rwanda, forests resources have been state-owned since the creation of first national park in 1925 through a process known as fortress conservation (Gray, 2011).

Participatory Forest Management is a complementary mechanism which safeguards forests while respecting traditional users and including them in the process (Winberg, 2010). This involves a set of processes and mechanisms that enable those people who have a direct stake in forest resources to be part of decision-making in all aspects of forest management, from managing resources to formulating and implementing institutional frameworks (Turyahabwe *et al.*, 2012).

The term forests is used to encompass diverse types of vegetation from dry woodlands to moist tropical forests, coastal mangroves and plantations (Wily, 2001). Farmers or communities refer to the people living within or next to forests. United Nations Framework Convention for Climate Change (UNFCCC) defines forest management as a system of practices for stewardship and use

of forest land aimed at fulfilling relevant ecological, economic and social functions of forest in a sustainable manner.

Forest management practices imply land use management systems and practices related to agroforestry, community forestry, farm forestry, social forestry management; and conservation of water, soil and energy (Alkali and Shetima, 2011). Agroforestry contributes greatly to increasing products and services on farm. Trees planted on terraces are also important for soil and water conservation and the products of fruit trees serves as the major source of income and food supplement for animals (Njama'a *et al.*, 2003). Furthermore, management practices such as conservation tillage, residue management, grassed waterways, terraces, and pastures among others are highly effective in improving surface soil properties and processes, thus reducing water runoff and soil erosion (USDA, 2009).

Integration of biodiversity conservation into agricultural practices is vital for its maintenance, and can contribute multiple ecological and socio-economic benefits. However, the management is made difficult by weaknesses in political and institutional frameworks, lack of human resources and funding, and widespread poverty. Sackey (2007) as well as Boon *et al.*, (2009) noted that complex land tenure system, the conversion of forests to farmlands, a skewed benefit-sharing mechanism are principal challenges bedeviling forest resources management when not properly addressed. Correspondingly, weak institutional and governance structures along with inadequate involvement of relevant stakeholders are the major limitations for effective management in Africa.

Participatory Forest Management Approaches (PFMA) are used to describe systems in which communities and government services work together to define rights of forest resource use, identify and develop forest management responsibilities, and agree on how forest benefits will be

shared (Gobeze *et al.*, 2009). They mainly include: Joint Forest Management (JFM), Community Based Forest Management (CBFM), and Collaborative Forest Management (CFM) (Turyahabwe *et al.*, 2012). However, Khan (2011) classified PFMA to include partnerships, community-based, and co-management. Similarly, Schreckenberg *et al.*, (2006) classified it into community forestry, adaptive co-management and Community-Based Natural Resource Management (CBNRM). These approaches are conditions that would facilitate the process whereby community conservation provides greater economic and social benefits, contrary to strict approaches that are economically costly and fraught with social conflict (Ostrom, 2007; Nagendra, 2005).

PFMAs can therefore be viewed in the form of collective action in the management of forest resources. This is required since the high exclusion cost characteristic of a state-owned approach enables free riders to benefit from the conservation efforts undertaken by other users without cutting down their own levels of consumption (Wade, 1987; Gopalakrishnan, 2005). A decentralized administrative management would be a solution but high enforcement costs reduce the effectiveness of its structure. For that reason, devolution of rights and responsibilities to local user groups should be the best strategy to overcome this market failure problem. In most developing countries including Rwanda, it has been noticed that key stakeholders have not been systematically involved in all aspects of decision making for forest management and do not reap the full benefits (GoR, 2013c). Participatory management can only be possible if service seekers such as water users, national state and Non-Governmental Organizations (NGOs) formed the integral part of decision making bodies (Wenner, 2000).

Rwanda has a total land area of 26,366 Km^2, out of which 8.4 percent is under government protected areas (Martin *et al.*, 2011). Despite its territorial small size, Rwanda is covered by diversified ecosystems consisting of mountain rainforests; gallery forests, savannas, wetlands and

aquatic lands (GoR, 2003). These ecosystems have great impact on rural livelihood, global environmental protection and cultural heritage. In Particular, VNP is the major contributor to national economy where mountain gorilla-based tourism is the third source of income in the country. The degradation of the above ecosystems due to natural and anthropogenic activities have been a source of worry for different interested parties. Table 1 outlines the rate of degradation of different ecosystems[1] comprising natural forests and wooded savannas in Rwanda.

Table 1: Evolution of natural forests areas and wooded savannas (in Ha): 1960-1999

Forests	**Years**						**Rate of degradation in percent**
Year	**1960**	**1970**	**1980**	**1990**	**1996**	**1999**	
NFR	114,025	108,800	97,000	97,000	94,500	189,150	22
GF	28,000	28,000	23,000	8,800	3,800	-	-
MF	3,000	3,000	2,000	2,000	1,600	16,00	47
VNP	34,000	16000	15,000	14,000	12,760	12,760	63
ANP	267,000	267,000	267,000	241,000	220,000	90,000	66
G and WS	150,000	150,000	90,000	50,000	20,000	-	87
Total	**660,025**	**617,800**	**539,000**	**446,800**	**374,660**	**-**	**42**

Source: Adapted from GoR (2003).

This evolution shows that Galleries and Wooded Savannas, Akagera National Park and Volcanoes National Park were the major protected areas with high degradation rates estimated at 87, 66 and 63 percent respectively. In 1960, VNP was estimated to cover 34000Ha. In 1970, the area was reduced to only 16000Ha. This reflects a loss of approximately 47 percent within ten years. This was a result of rapid increase in population that increased pressure on the park in terms of encroachment and deforestation. In addition, several Ha were converted for pyrethrum cultivation between 1969 and 1973 due to its fertile volcanic soils (GoR, 2003). Both Galleries and Wooded

[1] Ecosystems such as NFR: Nyungwe Forest Reserve; VNP: Volcanoes National Park; ANP: Akagera National Park; MF: Mukura Forest; GF: Gishwati Forest and G and WS: Galleries and Wooded Savannas.

Savannas and ANP recognized a great loss from during the war and the post war period. Thus, the government decided to reduce them to settle the returnees in the aftermath of the war. Other protected areas have experienced a decrease mostly attributed to encroachment for agricultural activities.

1.2 Problem statement

The Volcanoes National Park (VNP) has a considerable contribution to Rwandan rural livelihood, global environmental protection and cultural heritage. However, since its gazettement, the effect of its degradation as a result of natural and anthropogenic activities remain a source of worry for relevant stakeholders. The park has been characterized by a fortress conservation approach. This approach excludes participants from park management decision making process, making this state-centered method less effective due to high exclusion cost related to information, monitoring and enforcement. Further, there are problems hindering the implementation such as prevalence of poverty, average small farm sizes, high rate of soil erosion and human wildlife conflicts (Gray, 2011).

All these have remained serious threats to the park resource conservation and sustainable utilization while affecting soil fertility and productivity of the surrounding farms. Thus, there is need to characterise farm management practices and approaches that would increase both forest and farm cover, improve farm productivity, watershed protection and biodiversity conservation.

The park is protected under the *article 96 of the organic law number 04/2005 of determining the modalities of protection, conservation and promotion of environment.* This law has generated incentives for free riders due to high exclusion cost nature of the resource system. As a solution to this market failure, the Government of Rwanda (GoR) has established a five percent of total park

revenues as sharing scheme to support community projects (RDB, 2013) who should compensate the opportunity cost of foregone park users and practices. Nevertheless, Mukanjari *et al.* (2013) argued that tourism revenues do not trickle down to compensate the farmers'cost of conservation.

Incorporating management attributes, and socio-economic and institutional factors in decision making process would assist park managers with estimating the value associated with conseravtion of park resources. Limited information on these values is observed. It is crucial to assess the economic values of park management attributes if the desired goal of conservation and environmental protection is to be achieved.

There is inadequate empirical evidence detailing forest management preferences in developing countries including Rwanda as opposed to the wide-ranging literature in European countries. In Finland, Portugal, UK, Spain and Greece, studies focused on conservation of nature, wetlands, biodiversity and management of water resources attributes (Chuang-Zhong et *al.*, 2001; Birol and Das, 2010 and Lambrecht *et al.*, 2013). Attributes such as cultural heritage and park production activities were not included in their analysis. Mazzanti (2003) and Gomes *et al.*, (2013) studied cultural institutions attributes; still, they did not include other cultural tourism aspects such as religious heritage and handcrafts. Other studies focused on tourism and leisure, rural development, landscape and water supply programs (Colombo *et al.*, 2005; Do and Bennett, 2007; Semeniuk *et al.*, 2008; Scarpa *et al.*, 2009; Millán and Torreiro, 2011 and Cerda, 2012). The decision making on park management was not comprised in their policy as an attribute.

A few of empirical literature in East African countries is found on marketing research in Ethiopia, Kenya and Uganda (Kassie *et al.*, 2009; Kikulwe *et al.*, 2011 and Otieno *et al.*, 2011). Some studies focused on drivers of forest management, conservation and governance

(Press *et al.*, 2013 and Ogada, 2012). The said studies however failed to consider forest management practices and approaches. There is inadequate empirical evidence on forests management practices, approaches and preferences on park management attributes in developing countries and specifically Volcanoes National Park in Rwanda. This research is set to fill in this knowledge gap and propose policy implications to different stakeholders.

1.3 Purpose and objectives of the study

The main purpose of the study is to assess farmers's preferences for participatory management of Volcanoes National Park of Rwanda.

1.3.1 Objectives of the study

1. To characterize management practices and approaches used by Park -adjacent community
2. To estimate the monetary value that farmers attach to participatory management attributes in VNP.

1.3.2 Hypothesis of the study

2. Farmers attach equal monetary value to all the participatory management attributes in VNP.

1.4 Justification of the study

There is inadequate evidence on farmers' preferences for participatory management of Volcanoes National Park in Rwanda. Characterizing management approaches and practices would inform policy makers and practitioners alike on the required strategies aimed at increasing forest crop covers. Similarly, it would offer insights to park managers on the economic value that farmers would attach to park management attributes.

The study intends to create user community participation, awareness and ownership of park protection, conservation, management and resource utilization that would meet current and future needs and demands. The study provides information on alternative sources of income, employment opportunities through vocational training, handcraft making and development of cultural tourism which would increase their incomes and improve livelihood in the area.

Information on farmers' preferences is useful to policy makers on accommodating these features in management decisions and on the design of cultural heritage-based and other environmental empowerment programmes. Likewise, since Rwanda has attracted many business and conference travelers due to success of gorilla tourism (Maekawa *et al*., 2013), the study informs on different diversified tourism products and other off-farm enterprises for investment opportunities and business development.

At national level, this study is contributing to the forestry strategic plan through increased practices for forest and land restoration. It also contributes to preservation of traditional knowledge of religious heritage and handcrafts making to enhance cultural heritage policy. In addition, it promotes low-input, high potential small scale enterprises to enhance food, nutritional and health policies. The study is also relevant for access to safe and improved water services that enhance national policy for water supply. Lastly, it promotes gender-based and environmental friendly cooperatives and policies related to tourism revenue sharing scheme for protection of biodiversity and wildlife.

The study touches on Vision 2020's overarching goal of *accelerating progress to middle income status and better quality of life through sustained growth of 11.5 percent and accelerated reduction of poverty to less than 30 percent of the population*. This is in accordance with its long-term goal

of creating a productive middle class and fostering entrepreneurship. Further, it adds to the Millennium Development Goal (MDG) on promotion of food security and environmental protection. This specifically is in line with *eradication of poverty and hunger*, also *ensures environmental sustainability.* The study therefore emphasizes on intensification of sustainable production systems and the rehabilitation of degraded lands and forests.

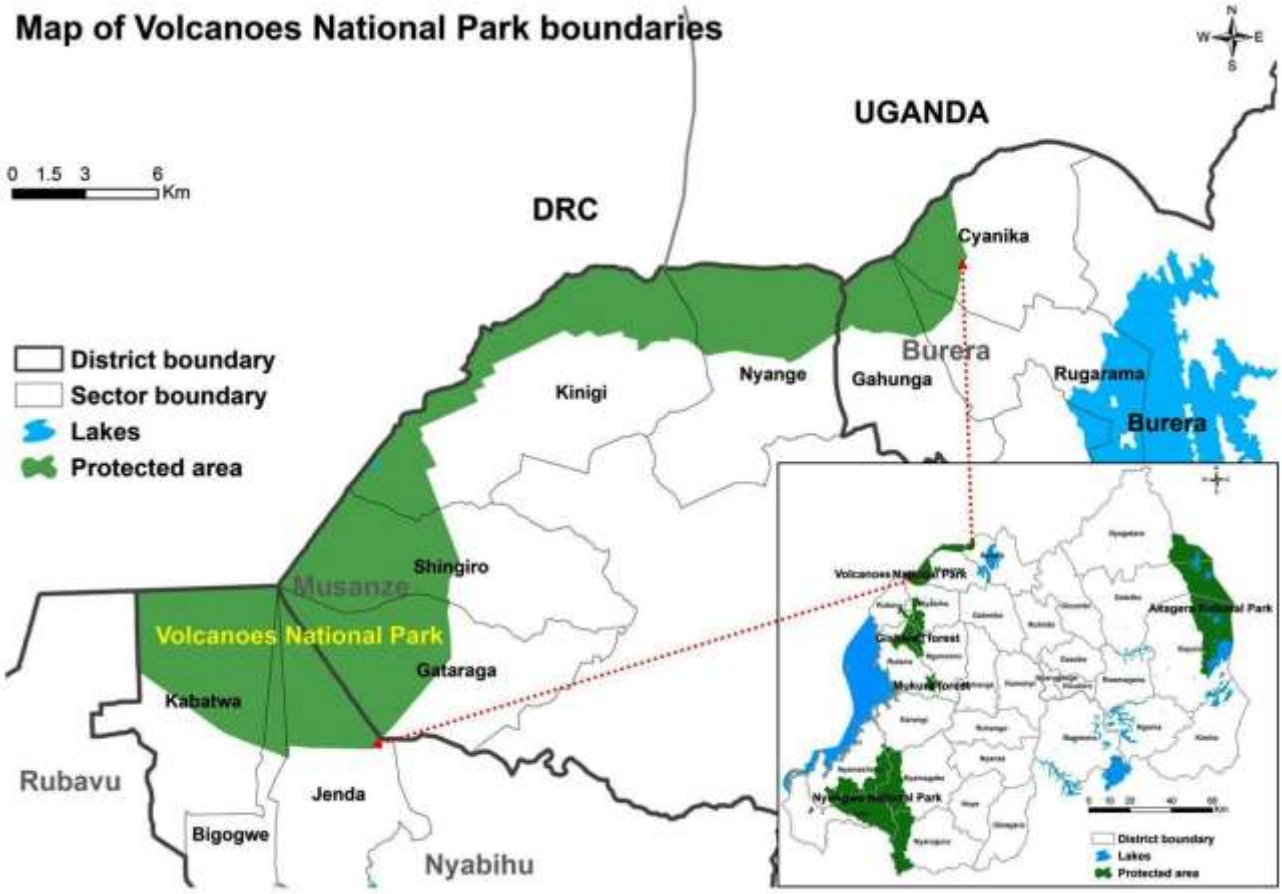
1.5 Description of the study area

The study was undertaken in the Volcanoes National Park area which lies along 1°21'-1°35' South and 29°22'- 29°44' East in North-Western Rwanda. The park is home to some of the most endangered animal species, it is also well known for its warm climate (Bush *et al.*, 2010). It is a site of global importance for its biodiversity values where mountain gorilla is seen as a primary source of tourism revenue and ecological services (UNDP, 2006). The Park is adjacent to the Virunga National Park in DRC and Mgahinga Gorilla National Park in Uganda.

The zone adjacent to the Park is made of four districts (Burera, Musanze, Nyabihu and Rubavu). This zone has the highest population densities in the country (500 to 1,041 inhabintants per square kilometre) compared to 300 inhabitant per km^2 of adjacent areas in Demcratic Republic of Congo (DRC) and Uganda (Plumptre *et al.*, 2004; Hitimana *et al.*, 2006). The community adjacent to the park has remained with little opportunity for diversification into off-farm sources and limited investment in tourim business and culture industry (GoR, 2013b). Engaging farmers in using and managing park production resources as well as developing cultural tourism would open up new opportunities in the area.

Since its gazettement in 1925, the post-independence management is seen not to contribute positively to the development of the local inhabitants as well as the park itself, there is also no

mechanism to resolve human/wildlife conflicts (Gray, 2011). The 1980s brought a global shift towards management approaches and in 1991, the International Gorilla Conservation Programme (IGCP) was founded as a partnership between the African Wildlife Foundation (AWF), Fauna and Flora International (FFI) and World Wide Fund for Nature. Figure 1 represents the location of Volcanoes National Park (VNP) and its Boundaries in North-Western Rwanda.



Source: Government of Rwanda (2014)

Figure 1: Map of Volcanoes National Park boundaries

The park contributes up to 90 percent to Rwandan Tourism , with mountain gorilla-based tourism being the third source of income in the country, earning around US$200 million per year since 2007 (Bush *et al*., 2008). The volcanic soils are very rich and fertile for production of commercial crops such as irish potatoes, maize, and pyrethrum among others. To this end, there is need to characterize management practices and approaches and evaluate the importance farmers attach to management attributes irrespective of their production activities thereby proposing appropriate development programmes.

1.6 Organization of the study

This thesis is organized into five chapters. Chapter one discusses the introduction comprising background of the study, problem statement, research objectives, hypotheses, justification of the study and presentation of the study area. Chapter two reviews the features of park participatory management, past environmental studies and approaches for economic valuation of the VNP. Chapter three discusses the conceptual framework, the types and relevance of data needed and the methodology used. Chapter four presents and discusses the findings. Finally, conclusions and policy implications are presented in chapter five. Emerging issues for future research are also highlighted.

CHAPTER TWO

LITERATURE REVIEW

This chapter specifically details features of park participatory management in section 2.1. Section 2.2 provides a critical review on past studies in environmental valuation. Section 2.3 focuses on approaches for economic valuation of the park.

2.1. Features of park participatory management

2.1.1 General overview of park management

Volcanoes National Park was created in 1925 with 34,000 km^2, it lost more than half of its surface area between 1960 and 2005. Since it was protected under the government organic law number 04/2005 it has gained the current area of 16,000 km^2. The park is rich in fauna and flora protected under Rwanda biodiversity and wildlife policies (GoR, 2011b). Fauna include a total list of 86 species of mammals, 258 species of birds and 878 plants species. These species are classified as endemic, threatened or IUCN listed (Plumptre *et al.*, 2004).

Since 2007, Rwandan tourism attracted more than 16,000 tourists with estimated earnings of US $42 million which has proved to be a boost to the local economy and a source of hard currency (Bush *et al.*, 2010). About 90 percent of tourism revenues are driven by mountain gorillas (GoR, 2009b). Conversely, a total of 380 endangered mountain gorillas only exist in the Virunga area encompassing Volcanoes National Park (VNP), Virunga National Park (PNVi) and Mgahinga Impenetrable National park (MINP), and the major threats to these species include degradation, specifically habitat loss through human modification (Maekawa *et al.*, 2013). Farmers'

participation in the protection, conservation and recovery of biodiversity species of national and global importance is a key strategy to investment and tourism development. For instance, over the last five years tourism investment has received US$252 million (GoR, 2013d). The number of employees in the tourism sector was estimated to increase to 23,000 and other sectors such as restaurants, transportation and retail trade would indirectly benefit from it (NISR, 2011).

Since the establishment of the law in 2005, a total of 180 people were employed as guides, gorilla groups and anti-poaching teams deployed in five protection sectors. Additionally, an estimated 800 community members were involved in day to day park management activities and benefited from temporary employment and revenue sharing support (GoR, 2009). Approximately 10 associations and cooperatives, two umbrella associations for both park protection (Amizero or Hope) and community development oriented activities (Iby'Iwacu) were also formed and supported by IGCP, CARE International and SNV Netherland Development Organization. In spite of all these investments, progress in conservation has been slow and erratic, a situation attributed to exclusion of local people both from the park and from decision making (fortress conservation methods).

The proposed approach would bring a strong collaboration in decision making for park management that benefit a dynamic and vibrant economy for the communities and the country. This approach would shift from a management by a stated-centered regime through a partnership to an integrated multi-stakeholder system. While a partnership management involves both government and farmers, an integrated approach would consist of Government, farmers and private sectors.

2.1.2 Production resources and permitted enterprises

Local access to water for domestic and livestock use is a key issue worth highlighting. As the people access the park, their activities may not be restricted to collection of water. Water availability in the park area allows improved cropping in the dry season. It also improves wet season agriculture and provides other different purpose for farmers like, livestock watering, drinking water, washing and bathing (Pavageau *et al.*, 2013). Similarly, the park can be utilized for bush meat, honey, firewood, mushroom and bamboos. Between 2005 and 2010, inside the park a total of 8,577 water harvesters were detected and 1,232 traditional beehives were removed and destroyed by the management (Bush *et al.* 2010).

Although illegal, collection of certain forest products such as wild honey, mushrooms and water gathering is tolerated (Pavageau *et al.*, 2013). Participation in park water resources conservation would provide insight on methods of supplying water to local communities. The supply should be drawn from the permanent water found in the park or through water harvesting scheme.

Rwanda National Policy and Strategy for water supply and sanitation services (2010) has been implementing its vision to attain 100 percent service coverage by 2020. The access to improved sources of drinking water has reached about 74 percent (rural: 71 percent, urban: 88 percent) in 2008. It is targeted to continue to rise for four percent per year which requires 425,000 people every year to meet the national targets, (GoR, 2010b). In addition, safe and clean water is a pre-condition for improving environmental and personal health. For instance, over 80 percent of diseases that afflict Rwandans are water-borne caused by unsafe water. Between 2000 and 2005, there was no change in the proportion of households having access to safe water (64 percent) nor was any reduction in the average distance a household member had to fetch clean water (0.5km) (GoR, 2013c).

Mushroom production, another VNP enterprise, has been described as the most versatile and prolific agriculture and forestry venture all over the world, and developing countries still have advantages in its growth. The mushroom cultivation is well suited to Rwanda smallholders in the rural household economy plus the park provides a natural climatic condition. Its production has been linked to improved nutrition and phytonutrient intake with nutritional values such as vitamins, iron, calcium, and proteins (UNDP, 2014). However, the mushroom sub sector in Rwanda is still in its infant stage where current production is estimated at 17 tons per annum (Tibrichu and Byukusenge, 2009). It was reported that the rural areas (47 percent) are more affected by protein-energy malnutrition than the urban areas (33 percent) with North 52 percent and West (47 percent) ranked highest (GoR, 2005). Famer's participation in the production of mushroom would improve nutritional status and increase farmers' income through agribusiness development which, in 2007, accounted for 36 percent of Rwanda's GDP and 40 percent exports (Tibrichu and Byukusenge, 2009).

Honey is one of the priority sectors of the Rwandan Integrated Development Program (Omari, 2010). In Rwanda, gazetted forests, national parks and private farms were identified as appropriate beekeeping areas (GoR, 2007). The relevance of beekeeping production is primarily to reduce the National Poverty Index estimated at 41 percent of the rural communities living in extreme poverty, protect and increase forest cover estimated at 20 percent and reduce deforestation (GoR, 2009). Secondly, in accordance with its role of generating medicinal value and supports of agricultural activities, beekeeping contributes immensely to forests conservation efforts and facilitates healthy linkages between biodiversity towards sustainable livelihoods. Thirdly, it is an essential driver to establishment of Small and Medium Enterprises (SME) and employment creation. Lastly, beekeeping is a crucial low-investment and low-input business enterprise that directly generates

economic gains for its participants. SNV (2008) estimates show that more than 45,000 are active beekeepers managing more than 90,000 hives, mainly traditional, across Rwanda. Farmers' willingness to participate in honey production is a key to reduce poverty index, increase farmers' incomes, support other agricultural activities hence increase farm productivity and sustain environmental protection.

Rwanda National Strategy for Climate Change and Low Carbon Development (2011) in its baseline survey identified aggregate emissions or total CO_2 equivalent, amounting to 5,010Gg. Biofuel production in Rwanda using Jatropha is very important to overcome the threats such as rising costs of fossil fuels, land degradation, climate change and rural poverty. Jatropha is a non-edible, oil yielding tree, well adapted to marginal areas with poor soil and low rainfall (Atabani *et al.*, 2013). It grows without competing with annual food crops and does not contribute to a reduction in food production as well as to the destruction of primary forest.

In Rwanda, Jatropha has been grown near ANP in the Eastern part. However, the limited land, growing population and high water requirements for biofuels makes growing biofuel crops a poor option for this area. The park can overcome many of those potentials due to high precipitation and the potential to cut global warming pollution, enhance energy security, and strengthen local economies. Thus, farmers' involvement in Jatropha plantation for biofuel production would mitigate climate change effects, increase incomes and improve forest conservation.

2.1.3 Cultural heritage values of the park

A substantial part of the United Nation's World Heritage Sites (WHSs) can be found in developing countries. The sites attract an increasing number of tourists and income to these countries (Huu and Navrud, 2009). African continent receives about 4 percent of all international and tourism

receipts. In SSA, cultural tourism is said to contribute between 2 to 5 percent of GDP and exports (Fayissa *et al.*, 2008). For instance, in 2005, Kenya recorded an increase of 26 percent in tourism numbers.

Rwandan policy on cultural heritage recognizes sacred hills, forests and trees with legendary history as part of tangible cultural heritage (GoR, 2008). Cultural tourism is important as it improves cultural exchanges and raise the living standards for the local people. Again, through cultural tourism, cultural heritage included creation of job and new infrastructure and sale of handicraft products. The revenue from Rwandan tourism sector increased from US$ 175 in 2009 to US$ 281.8 in 2012. Revenue from cultural tourism activities increased by 18 percent (RDB, 2013).

Adekunle (2007) noted that during the precolonial era, Rwanda was a polytheistic society with religion serving as a unifying force. The park was profoundly honored and was a sacred place of worship as part of religious cultural practice in honor of ancestors in Rwanda. However, the introduction of new religions in the colonial times changed people's beliefs, cults, behavior and rites. Currently about 57 percent of Rwandans are Roman Catholic, 26 percent Protestants, 11 percent Adventist and 5 percent Muslim. The indigenous beliefs have dropped to 0.1 percent (GoR, 2011b). Subsequently, indigenous believers are nowadays despised, treated as being wild and contrary to civilization and qualified as pagans.

Destroying heritage amounts to violating conscience and mind of a nation rendering its history and identity barely distinguishable (GoR, 2008). The park stands a greater risk of degradation if religious heritage is not accommodated in its conservation practices. There is the political will and international support from ICCROM and UNESCO to safeguard and promote Rwanda's cultural

heritage through promotion of cultural practices and traditional techniques recognized as meeting the expectations of the community as an expression of their cultural identity.

Medicinal plants are plants used in traditional medicine of which at least one part has therapeutic properties (GoR, 2010). A majority of Africans depend on traditional medicine despite revolutionary progress made in the field of healthcare. It is estimated that 80 percent of rural population living in developing countries relies on traditional medicine for their health care, socio-economic and socio-cultural heritage (Cam *et al.* 2005). Rwanda cannot ignore the important role traditional medicine plays in maintaining the health of its population (GoR, 2010). Due to this, willingness of farmers to preserve and conserve indigenous forest plant species depicts the economic value attached to them that would help to design programmes in relation to plants, their preparation and administration (Hitimana *et al.*, 2006). This relationship implies how important plants found in the park are used in Rwandan traditional medicine.

Handcraft products have been identified by the Government of Rwanda's vision 2020 as one of the key priority export sectors. This is poised to positively impact economic development and reduce the share of agriculture contribution to GDP from 95 percent to 50 percent (RDB, 2013). In addition, the national tourism policy recognizes the potential of the handcraft sector in wealth creation to a greater percentage of rural population especially women, youth and people with disabilities (GoR, 2001). This is supported by its handcraft and Small and Medium Enterprises policies as well as a five year handcraft strategic plan (2009-2013). However, Rwanda's tourism and hospitality sector requires further development.

Rwanda has surpassed the 50,000 targeted tourists (GoR, 2009b). Very few of these tourists leave the country without a handcraft souvenir purchased from the wayside vendors, and market yards

such as the National Museum. Craft villages/centers attract many tourists which make it a complementary and indispensable activity for peasants in rural areas but most of them are operating in the informal sector (GoR, 2009b).

Handcraft products recognized include among others jewelry products, wood products and basketry (RDB, 2013). These are very popular products in Rwanda whose raw materials are mostly found in the park and managed to be adapted to modern requirements. The basket weaving was traditionally a female reserved activity and has now attracted a significant number of men who are at present involved in basket weaving at professional level (GoR, 2010c). Hence, participation in handcraft conservation is key to developing these employment opportunities in the area.

2.1.4 National park visitation

Visitors to Rwanda's three national parks pay a fee per activity they undertake which ranges between Rwf 3, 000 and Rwf 30, 000. These activities include gorilla and chimpanzee watching, nature walks and mountain trekking (RDB, 2011). In general, there are no standardized entry fees for this park but Rwf 3500 (6 US$) per person payable by Rwandan adult citizens visiting Akagera National Park can be used as a fair estimate. The park pricing is slightly in the same range as in East African region, In Kenya it varies from KShs 250 (US$3) to KShs 1200 (US$14) for EAC nationals (KWS, 2011). In Uganda, the visitation fee was UShs10, 000 (US$5.5) from 2009 to 2010 (UWA, 2011). Therefore, the entrance amount of Rwf 3, 500 (US$6) can be used as the current park visitation fee that farmers would pay. In addition to improve the management, famers would prefer to undertake any activities in the park and would be required to add ‘cost of park utilization’ as conservation premium.

An increase of 7 percent Marginal Effective Tax Rate (METR) for farming related activities (mushroom, beekeeping, Jatropha) would be added to the current park fee. Another 14 percent METR would be complemented for other activities related to tourism (worship, medicinal plants and handcrafts). This is according to *law no 16/2005 of 18/08/2005 on direct incomes and taxes.* The law defines *livestock and inventory generated from agriculture and forestry such as immovable assets and accessories as source of income to be taxed* (GoR, 2005 P.14*).* Therefore, the current study uses the aforementioned features of park participatory management to describe attributes and their levels. These are the main focus of CE design to assess the economic value attached to them by smallholder farmers.

2.2 Review of past studies in environmental valuation

The formulation of forest management policies involves asking communities about their preferences for hypothetical transformation for management approaches and practices. Chuang-Zhong et *al.* (2001) used Choice Experiment (CE) to value nature conservation program in Finland. Respondents' WTP for planning conservation method and attitudes towards nature preservation attributes were positive. However, they did not incorporate other attributes such as cultural heritage and park production activities. The inclusion of these attributes in this study would provide a much more accurate estimate of the existing nature of the park. Besides, it would improve knowledge about the benefits generated by the same attributes on park resources.

Mazzanti (2003), employed CE to assess visitors' WTP for incremental changes in services associated with the stock of the cultural institutions of Galleria Borghese Museum, a worldwide known heritage site (WHS) in Rome. WTP estimates and figures of economic surplus were positively associated with changes concerning attributes such as conservation activities, access policy and cultural services. Likewise, cultural institution attributes like terraced vineyards;

landscape mosaic with agricultural diversity; traditional settlements of a WHS in Portugal were analysed by Gomes *et al.* (2013). They argued that participating in a preservation program was positively determined by the income level and by the status of world heritage attributes. In this study, particular care must be devoted to cultural religious, medicinal and crafts making values of the park that would be linked with a participatory management regime. Accommodating these values would advise future management decisions regarding sustainable park resources conservation for cultural heritage.

Colombo *et al.* (2005) identified peoples' preferences on the design of a policy for reducing the off-farm impacts of soil erosion in Spain. Respondents valued programmes which result in less desertification than those of better water quality, more biodiversity, and more local employment. More research is needed on the determinants of park management decisions that have long term repercussions. The values assigned to these attributes would be imperative in designing programmes that improve park resources, enhance tourism development and increase rural livelihood through employment creation.

Birol *et al.* (2006) used CE to value wetland attributes in Greece. Attributes such as open water surface area, research and education, and retraining of farmers were defined. WTP results confirmed that respondents with higher levels of environmental consciousness, income and education are likely to prefer wetland management scenarios that provide higher levels of the ecological, social and economic wetland attributes. Limited evidence exists on the relationship between park management attributes and community characteristics in developing countries including Rwanda. This study is fundamental in determining heterogeneity in community preferences for an integrated decision making approach. The study is likely required for information on the interaction of park management attributes with socio-economic and

institutional aspects of the communities necessary for environmental-based interventions that would meet their needs.

Moreover, Scarpa *et al.* (2009) and Ayala *et al.* (2012) reviewed CE application on landscape. They identified vegetation, rural aspects, wildlife, water, cultural heritage attributes. In general, respondents had positive preferences to improve these landscape features. Failure to account for management decisions of the park can lead to inappropriate estimation of these attributes since values attributed to a joint decision making process are not known. Integrating the decision making as an attribute would be useful in order to improve park management and balance natural resources protection.

A study by Hanley *et al.* (2009) employed CVM to assess willingness to pay for a landscape change in two UK national parks. Visitors and residents did not differ in their preferences in choosing the logging as current situation. Apart from using CVM as a two attribute-based method, CE method is used as an extended multi-attribute. In this study, CE was used for attributes such as cultural heritage, park production activities, tourism development and decision making on park management. Its use is central in better characterizing the management implications of some of well understood aspects of the park.

Millán and Torreiro (2011) evaluated social demand towards rural development program in Cantabria, Spain, using five attributes: endangered wildlife, rural landscape, risk of forest fires, and quality of life in rural areas, monuments and traditions. Decision making process was highly responsive to a shift in quality of life in rural areas and to a sustained effort of integrated biodiversity conservation. The study omitted cultural heritage and park production resources attributes necessary for an integrated decision making process since scarcity of resources by the

community and their specific cultural values are the major drivers of decision making for park managers. According to Stovel *et al.* (2005), the evolution and adaptation of religious practices, rituals and festivals should be understood as the normal part of the continuity of living religious heritage to contemporary circumstances and be respected in conservation decision making.

Cerda *et al.* (2012) assessed public economic preferences for biodiversity conservation and water supply of La Campana Peñuelas Biosphere Reserve in Chile. A positive WTP was associated with included attributes such as existence of endemic orchid species, chances of observing animals with scenic attraction, additional protection for an endemic amphibian, and availability of drinkable water in the future. Less is known about WTP for the biodiversity conservation in conjunction with other types of park management related to production resources and cultural heritage. This study would be informative on the payback generated by these park landscapes through a proposed preservation plan of the park.

In addition to the aforementioned studies, participatory management requires the activate involvement of all the stakeholders in managing park production resources, preserving cultural heritage and conserving biodiversity. Assessing the economic benefits generated by farmers' preference and their willingness to preserve these attributes in an integrated decision making manner would be imperative to understand these issues. Therefore this study is an essential prerequisite for any economic valuation effort in developing countries. Although, previous studies applied CE methods on either cultural heritage or biodiversity conservation alone, this study combines both and links them to participatory management decisions and park production resources.

2.3 Review of approaches for economic valuation of the park

In environmental economics, valuation is a policy oriented discipline that puts monetary values on environmental goods and services many of which have no observed market prices. This requires the use of non-market valuation methods as distinct from neoclassical price theory of market goods whereby buyers and sellers reveal their preferences directly through their actions, which create the price of the commodity (Kniivila, 2004). The theoretical framework in environmental valuation is presented in Figure 2. Non-market valuation methods can change due to society's choice, but individuals may not unilaterally choose their most preferred level of consumption.

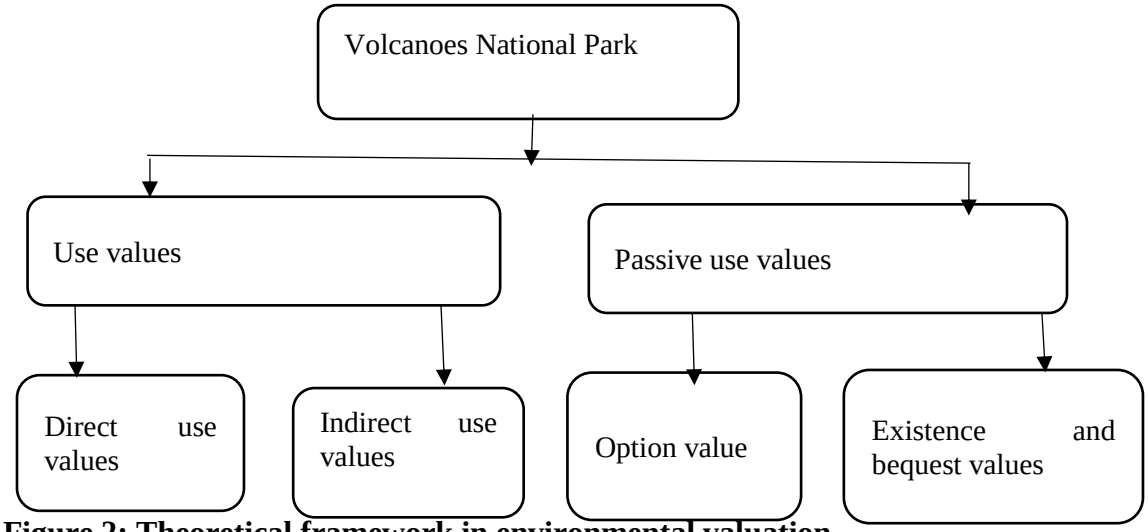


Figure 2: Theoretical framework in environmental valuation

Source: Adapted from Babier *et al.* (1997).

Adamowicz *et al. (*1998) classified non-market values into use and passive use values. Use values are values related to some use, activity or traceable economic behavioral trail while passive use values have no clear behavioral trail. According to Kniivila (2004), use values can be divided into direct use values which Chardonnet *et al*,.(2002) associate with direct utilization of the resource (such as wildlife and firewood). Indirect use values are ecological functions that support non-

consumptive uses such as carbon sequestration, microclimate stabilization, air pollution reduction, nutrient cycling, and watershed catchment protection.

Passive values include option use (uncertainty over future demand as per direct and indirect), and existence and bequest (such as the intrinsic value) values and other values not typically expressed through any market. For that reason, passive use values are defined as an individual's willingness to pay (WTP) for an environmental good, even though he may be barred from making any active use of it. It is then the economic value arising from a change in environmental quality (or any other situational change) that is not reflected in any observable behavior (Hanley *et al.*,1998). What is more, the traditional economic wisdom is that environmental quality (non-use or passive use values) is a luxury good that is too expensive for poor people, especially in subsistence societies (Casey *et al*., 2008).

In attempts to assess passive use values among the poor, the application of welfare economic concept is indispensable. The concept aims to assign values to policies or projects in order to assess whether the benefits justify the costs. As a result, Hicksian welfare measures for a change in environmental quality such as Compensating Surplus (CS) and Equivalent Surplus (ES) are appropriate for measurement. CS means the amount of income an individual farmer would give up after a policy has been implemented that would exactly return her utility to the status quo. The amount of additional income that a farmer would need with the initial condition to obtain utility as after the change is measured by ES.

The CS and ES differ by the implied assignment of property rights where the initial utility level is recognized while for equivalent measure, the subsequent is the basis for comparison. WTP or WTA are often used as substitute’s names for either CS or ES (Hanemann, 1991 and Weber, 2003).

WTP is associated with a desirable change whereas WTA is associated with a negative change. In this study, WTP for a desirable increase in park management attributes was used as a policy instrument.

Empirical approaches to non-market valuation methods, involve comparing the economic benefits provided by a more desirable participatory approach (WTP) to a less desirable current one (WTA). This is exclusively true in a policy context, and indeed economic valuations may well involve comparisons of the effects of different types of governmental intervention (Wattage, 2008). Two types of methods used are revealed and stated preference models.

2.3.1 Revealed preference (RP) methods

In general, RP methods are understood in a way that we do not explicitly purchase non-market goods such as environmental quality. However, we purchase other goods such as choice of a house to buy for which demands are related to non-market goods. These methods can be a real choice of a place for recreation and are based on analysis of actual or real behavior of individuals to build economic models of choice to determine the value of the change in environmental quality (Adamowicz *et al*., 1994).

The particular non-market valuation methods used to infer these values are the Travel Cost and Hedonic Pricing Methods. Travel Cost Method (TCM) is the widely known indirect technique which provides information about empirical modelling. Wattage (2008) argued that TCM infers the values placed by visitors on environmental amenity services from the costs that they incurred in order to experience the services.

Hedonic Pricing Method (HPM) was proposed and used in 1970s based on the weak complementarity assumption (Vásquez, 2011). The basic approach of the HPM can be indicated

in the context of atmospheric pollution, where it has been widely used (Mazur and Bennett, 2008) and valuing environmental externalities caused by noise, traffic, air pollution and landfills as well as urban planning (Morancho, 2003). For example, Smith and Huang (1995) summarized 37 studies carried out between 1967 and 1988 to value an air quality improvement in certain USA cities.

Both Hedonic pricing and travel cost methods rely on the analysis of observable behavior (Azevedo and Corrigan, 2008) and are mostly used for use values such as direct and indirect uses. They are as well limited with analysis of existing alternatives and cannot be applicable in valuation of new states such as improved park management attributes where there is no historical data (Azevedo and Corrigan, 2008).

2.3.2 Stated preference (SP) methods

SP methods are capable of overcoming the limitation of RP methods. This is because these approaches are not based on revealed behavior but on hypothetical statements contingent upon a scenario presented to the respondent by the researcher. Likewise, due to their behavioral characteristics, SP approaches such as Contingent Valuation Method and Choice Experiment are used for elicitation of passive use values. Hence, there are imperative for analysis of potential changes before including them into forest management plans (Adamowicz *et al*., 1994).

Contingent valuation method elicits information through the use of surveys whereby a hypothetical market is constructed. It involves an improvement or decline in environmental quality resulting from changed management (Kragt, 2012). CVM is applied to value farmers' WTP and/or WTA to participate in different park management scenarios. The method was mostly applied to studies with regard to forests management by Madureira *et al.*, (2011) and Lindhjem *et al*., (2012). Conversely,

according to Horne *et al.,* (1998), CVM is a two alternative method traditionally used while CE has increasingly become an extension or variant of the previous. CE employs a series of questions to elicit responses for estimation of preference over attributes of an environmental state with more than two alternatives.

Contingent valuation method is also subject to different reasons impeding the choice of its use such as the occurrence of hypothetical, strategic and cognitive biases. Hence, differences in the way people make WTP/WTA decisions alter the way they state preferences is a potential problem in CVM (Kragt 2012). Still, respondents may also protest against the payment vehicle used in the questionnaire as well as problems with design of the bidding question.

The CE method was initially developed by Louviere and Woodworth (1998) and Louviere and Hensher (2000). It shares a common theoretical framework with dichotomous-choice contingent valuation in the Random Utility Theory (McFadden, 1974) and empirical analysis in limited dependent variable econometrics (Greene, 2003). CE requires respondents to choose their preferred alternative from an array of alternative choices in a SP survey including a baseline scenario (Kragt, 2012).

According to Hanley *et al.* **(**1998), CE method seems to possess several advantages over CVM. Primarily, CE makes it easier to estimate the value of the individual attributes that make up an environmental good since many management decisions are concerned with changing attribute levels, rather than losing or gaining the environmental good as a whole. Secondly, it provides the opportunity to identify marginal values of attributes that may be difficult to identify using revealed preference data because of lack of variation. Similarly, it allows for internal consistency tests in the sense that models can be fitted on sub-sets of the data. Because of this, CE may offer

advantages over other methods in terms of benefits transfer, and attributes with money values can be estimated. Nevertheless, CEs design aspects may create some difficulties such that issues of information provision, survey design, and survey administration are more important than they are in CVMs (Adamowicz *et al.*, 1998).

CE surveys have been widely used in marketing research (Lim and Maynard, 2012; Lambrecht et al., 2013). Birol and Das (2010) reviewed several noteworthy applications undertaken in the European Union countries on a wide array of environmental issues ranging from conservation of wetlands and biodiversity to efficient management of water resources. It was expanded to tourism and leisure studies over the past thirty years and wildlife management (Semeniuk *et al*., 2008) and then to forest management (Do and Bennett, 2007). A few of empirical literature in developing countries is found using CE in marketing research in Ethiopia by Kassie *et al.*(2009); Otieno *et al.*(2011) in Kenya and Kikulwe *et al.* (2011) in Uganda. Little is known on environmental studies and forest management using CE in developing countries including Rwanda (Press *et al.,* 2013 and Ogada, 2012).

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes the conceptual framework used for the study in section 3.1. Section 3.2 outlines the type of data. Section 3.3 explains the source of data and sampling procedure. Both section 3.4 and 3.5 present respectively data collection instruments and the CE design.

3.1 Conceptual framework

In developing countries, where access to and use of natural resources vital to rural livelihood are highly contested, improving cooperation in their management is increasingly seen as an important factor for sustainable conservation. Participatory management builds on the Institutional Analysis and Development (IAD) model by Ostrom (2005) and Poteete *et al.* (2010). It is based on the theory of Collective Action (CA). The CA requires the involvement of a group of people, sharing the same action in pursuing shared interest. Its contextual background integrates three broad sets of attributes related to the resources per se, user resources and governance arrangement (Ruth *et al.*, 2013). The attributes of the park describe the biophysical conditions and trends. These embrace, for instance, cultural heritage, park production resources, plants and animals biodiversity; park management decision making and park visitation fee. The degradation and scarcity of these attributes requests all stakeholders to reflect on what can be done and how to shift these resources available so that local users can influence decision-making more effectively.

The attributes of the resource users encompass both local communities and extra-local users. These are individual and institutional characteristics which include but not limited to age, gender, income, education level and membership to farmer groups. The above-mentioned characteristics affecting park resources management are bounded in the form of group, their social capital and assets. In groups, users are described by shared identity of cooperation more likely to engage in

participation, the social capital such as social cohesion and networking (group membership) that reduces conflicts between communities. Additionally, user assets such as physical, human, social and financial are necessary to the implementation of livelihood strategies for effective participatory management and decision making process (Gopalakrishnan, 2005).

Governance arrangement is another attribute that covers rules and regulations of the park. It relates to the pattern of decision making on issues of public importance such as park resources allocation, management and use (Ostrom, 2005 and Blake *et al.*, 2013). Issues with regard to policies and other compulsory features are also imperative in this case. All the aforesaid factors, as presented in Figure 3, have led to the focus of communities' participation given their willingness and ability to work together towards improved participation for the park management.

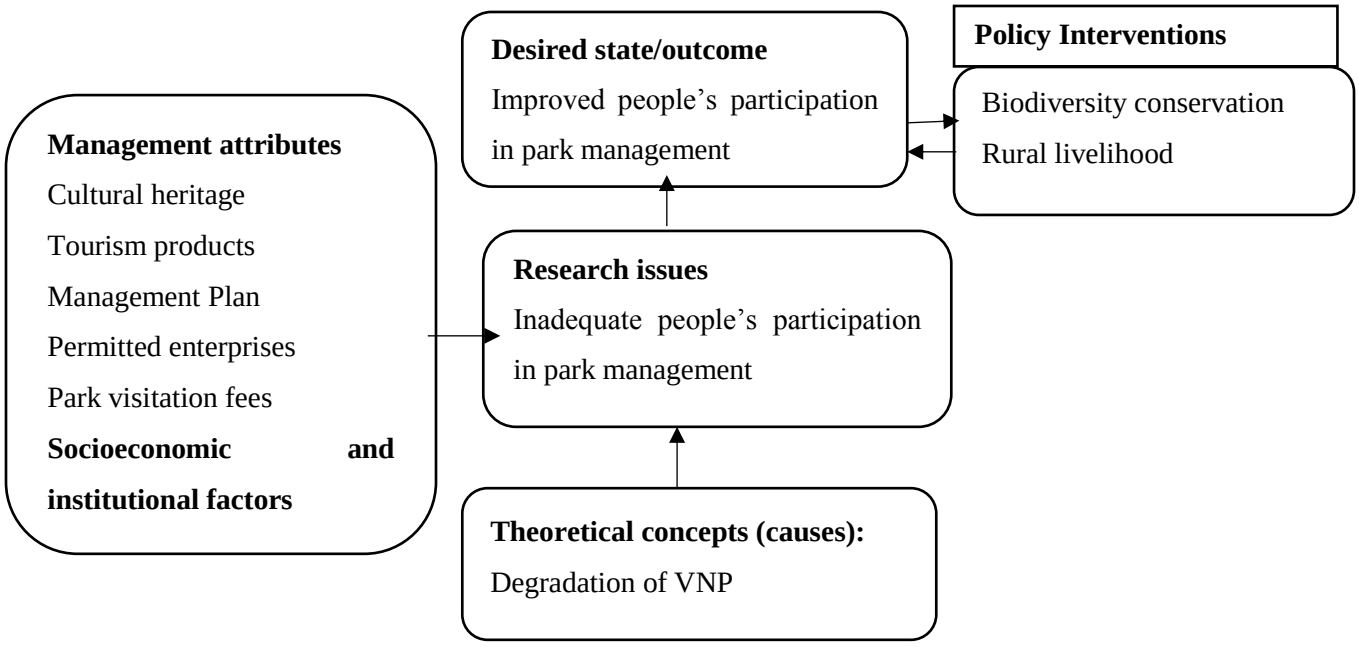


Figure 3: Conceptual framework of collective action for park management

Source: Adapted from Ostrom (2007) and Gregorio *et al.* (2012)

By examining the interaction between these three attributes, progress can be made in improving park resources protection. For this reason, management attributes, and socio-economic and institutional characteristics were recognized in this study. This necessitates the community to make tradeoffs between attributes and their interactions that would advise on strategies aimed to protect the biodiversity and improve the community livelihood.

3.2 Data

Based on the conceptual framework, primary data were collected from districts adjacent the park corridor. They primarily consisted of park management attributes and levels using CE survey in addition to socio-economic, farm and institutional behavior and characteristics of respondents. The management attributes such as cultural heritage; park production resources; tourism development; decision making on park management and park visitation fee were physical characteristics of the park resources.

Table 2 describes the summary of the variables used in this study and their expected contribution. With regard to CE survey, respondents were presented with a number of attributes and asked to choose their most preferred one. Positive preferences were expected from farmers who showed dissatisfaction of the current management policy and demonstrated high desire to improve most of the park features. The relevance of the attributes used in the analysis of CE and the direction of their influence are elucidated in section 2.1 of chapter two.

Data on socio-economic characteristics and institutional arrangements were collected from farmers to help characterizing park management approaches and practices. The information from these variables was anticipated to influence preferences on improving the physical characteristics (or

management attributes) of the park since they are significant sources of heterogeneity in preferences (Ruto and Garrod, 2009).

Table 2: Description of variables and their expected signs

Variables	Socioeconomic, farm and institutional factors	Expected sign
Age	Age of respondents in years	±
Education level	(Form 1= No schooling to 5= University degree)	+
Gender	0. Male 1. Female	±
Household Size	Number of people in a household	±
Income	Household income categories	+
Farm sizes	Total farming acreage by the household	+
Infrastructure development	Average distance to infrastructure facilities in Kilometers (Km)	-
Group membership	(1= member of CBO ; 0 otherwise)	+
	Attributes of participatory management for CE analysis	
Cultural Heritage	**Preservation of the park for cultural heritage** (0= Religious Heritage; 1= Medicinal Plants ; 2= Handcraft Products)	+
Park production Resources	**Protection of the park for production resources** (0=Water utilisation; 1=Beekeeping Production; 2=Mushroom Production ; 3= Jatropha Plantation for Biofuel Production)	+
Tourism Development	**Conservation of biodiversity for tourism development** (0=Wild Animals; 1=Plant Biodiversity; 2=Both Animal and Plant Biodiversity)	+
Decision making on Park Management	**Decision making for park management** (0= Government only; 1= Government and Famers; 2= Government, Famers and Private sector)	+
Park Visitation Fee	**Entrance fee for visitation purpose** (Rwf 3500, Rwf 3750, Rwf 400)	-

Income as a variable was hypothesized to increase farmers' preferences to participate in park resources conservation due to the increased desire for recreational demand or luxury characteristic

nature of the environmental quality as their income increases. For instance, Hussain *et al.* (2010) argued that hunters' greater income is associated with increased likelihood of buying a lease.

Age of respondents was chosen in this study as a variable that influences farmers' preferences. This is because conservation and participation decisions depend much on respondents' expectation about their future. It is postulated that old farmers are likely to exhaust park resources unlike young farmers whose objective is caring about future generation. However, when it comes to preserving the cultural heritage old farmers may choose to conserve the park better than young ones since old people are likely to be more resistant to changes. Torgler *et al*. (2008) argued that age has a negative correlation with willingness to contribute to additional environmental protection. As a result, older people would not live longer to enjoy the long-term benefits of preserving resources. In contrast, positive effect of age is observed in older people when focusing on social norms and position.

Gender of respondents was incorporated as a dummy (0= male and 1=female). It was expected that being male improves farm management practices and increases both farm and forest covers and positively influence preferences in participating in forest protection and conservation. This is because men and women have different roles and responsibilities in the house, this enables some and prevents others from participating in decision making process. Although Rwanda is recognized as one of the world leading states in terms of gender equality, inequality persists in some sectors (GoR, 2010c). About 71 percent men have migrated from agriculture compared to 86 percent women and children remaining in the sector (Cutura, 2008). Men's labor is distinctly seasonal involving crops in the fields and women's labor is constant throughout the year, involving unchanging domestic labor on a daily basis. As a result, involving women in other participation activities is a constraint since few of them can afford time away from home.

The level of education of a farmer was hypothesized to increase farm practices and preferences for participating in park resources preservation. Additionally, it was observed that the more educated farmers are environmentally conscious than the less educated ones. Masozera (2002) argued that forest dependence is inversely related to education levels of the members because education opens up diverse and better employment opportunities.

Main occupation of respondents was included as a dummy variable (0= involved in farming or 1= off-farm activities). Farmers involved in off-farming were assumed to increase farm and forest covers. Likewise, since respondents taking part in off-farm activities depend less on park resources for subsistence, they are believed to have positive attitudes and preferences on them.

Generally, farm sizes have been positively correlated with forest resource conservation as well as improving management practices. This is because families with more land are likely to earn more income from their own land, depend less on forest resources and therefore may easily adopt new technologies.

Household size was hypothesized to have either positive or negative preference on park resources management. This because families with more labor can mobilize part of it for forest dependent activities while maintaining the labor supply for village-based activities for management purposes. In addition, large families may have more labor to practice multiple soil management practices where complex topography exists. This would have a positive influence on improving park and farm management practices (Kang and Akinnifesib, 2000). Alternatively, large families may have few resources to meet their subsistence needs, therefore have high propensity to extract resources from the reserve (Masozera, 2002).

Given the importance of infrastructure facilities in increasing the livelihood of the community, distance to infrastructure facilities was predicted to have a positive effect on improving management practices related to farm and forest covers. Farmers may involve in other business activities and employment opportunities so that they may depend less on forest resources.

3. 3 Source of data and sampling procedure

The relevant target population of the study was all farmers living in the sectors, cells and villages located within one Kilometer (Km) at the foot of the volcanoes. In this case, a respondent (farmer) referred to any person who fully or partially operated a small scale farm of at least 0.05 acre, over 18 years old and in a household of at least two members.

A multi-stage cluster sampling approach was used in this study. Three out of four districts (Burera, Musanze and Nyabihu) were purposively selected due to accessibility and number of sectors adjacent to the park. Initially, Rubavu district with one adjacent-sector to the park was not chosen. Subsequently, amongst 11 adjacent sectors in the selected three districts, six were purposively designated for the survey. Thirdly, for each sector, the number of administrative cells adjacent to the park were considered. Attributable to this, a sector with not less than three cells was counted in for random sampling purpose. Consequently, the study covered ten administrative cells. These were: Gisizi, Cyahi, Bisoke, Kaguhu, Nyabigoma, Nyonirima, Mudakama, Ninda, Kabeza and Kareba. Within the cell, a systematic random sampling was applied to select respondents.

Consultations and meetings with local government at sector and cell levels were held to get insights of the general distribution of the population in those cells. The cell leader provided a list of farmers to form a sampling frame. The list used in each administrative cell was obtained using the available list for the last national population and housing survey (NISR, 2012) at the sector level.

Once the target population was identified, the next step was to determine the sample size required to be a representative of the opinions of adjacent community in the park since it is too costly and time consuming to survey the whole population (Krejcie and Morgan, 1970). The sample size determination stated by Rose and Bliemer (2005) in CE is to increase the sample optimality through a two-stage design procedure. Primarily, to get prior coefficients a fractional orthogonal design was used to 72 respondents for a preliminary survey. The coefficients obtained were then used to generate an efficient design for the final survey of 192 respondents. This design had a relatively good level of D-efficiency and a good measure of utility balance. Hence, a total of 192 respondents used in the present study seem to be a suitable sample for both CE and descriptive statistical analysis to ensure robustness of the estimates. Furthermore, the approach involved calculating the sample representativeness at both administrative sector and cell levels using the probability proportional to size in formula one by Glenn (2013).

$$n_i = \frac{N_i * n}{N} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \qquad (1)$$

Where n_i is the sample size proportion to be determined;

N_i is the population proportion in the cluster (cell),

n is the sample size and

N is the total population.

The households to be interviewed were then selected using systematic random sampling from the population in the cell by taking every sixth household since the area was densely populated whereby houses were concentrated along the road or in villages. In total, 211 farmers were interviewed. However, 191 respondents formed part of analysis and 19 questionnaires were

dropped due to some errors during the survey. Table 3 presents the sample representativeness per each administrative cell.

Table 3: Sample determination in the study area

District	Sector	Adjacent Cell	Population per Cell	Percentage sample per cell
Burera	Gahunga	Gisizi	1706	14
	Rugarama	Cyahi	1608	13
Musanze	Kinigi	Bisoke	1055	8
		Kaguhu	1299	10
		Nyabigoma	1208	10
		Nyonirima	1582	13
	Gataraga	Mudakama	1303	10
	Nyange	Ninda	842	7
		Kabeza	603	5
Nyabihu	Jenda	Kareba	1410	11
Total			12,616	100

3.4 Data collection instruments

Specific to CE survey, data were obtained through three main stages. First, a checklist questionnaire governing Focus Group Discussion (FGD) was used as a qualitative research to refine the definition of attributes. Second, the preliminary survey which allowed the collection of additional information and amendment of the survey was used to identify and refine park management attributes. Third, a main survey questionnaire (a semi-structured interview) where respondents provided information related to their socio-economic; farm and institutional characteristics. In addition, there was a CE section with a card showing the possible park management scenarios and their choices.

The survey was implemented in June and July, 2014. Specifically for this study, seven enumerators were trained. The questionnaire was administered in local language (Kinyarwanda). With the assistance of the trained enumerators, the context of the survey was briefly described to

respondents who were informed that there were no wrong or right answers but their opinions were of interest. Where the respondents were not available, the interviewee could be replaced by picking the next person from the list within the same administrative unit. The appendices one and two show the household survey questionnaire and the FGD checklist respectively.

3.5 Choice experiment design and survey

3.5.1 CE management attributes and levels

The study used CE to evaluate the economic value attached to park management features. The first step in CE experiment was to define the good to be valued in terms of park management attributes and their levels. In doing so, a designed experiment as defined by Louviere and Hensher (2000), consisted of combining attributes and their levels was used to permit rigorous testing of certain hypotheses of interest where an alternative was described by a number of attributes. The stated design was used to define policy alternatives that could be described in terms of attributes and the objective was to infer the importance dedicated to the respective attribute levels (Ferrini and Scarpa, 2007). According to Birol and Das (2010), attributes could be relevant policy traits and contain policy cost whereby choice alternatives are policy options and are called profiles.

CE then involved selection of attributes and their levels, experimental design, formation of choice set and measurement of preferences in surveys. The selection of attributes described the good or service in question and was done through literature reviews, focus group discussions or direct questioning. This study classified park management attributes into mandatory (or regulatory) and optional. The mandatory

attributes don't vary and were the laws and policies (environment; forestry, land use, wildlife, and biodiversity) regarding environmental protection. It would be illegal for farmers not to comply while using the park resources. These features require legal procedures for implementation. In this case, they included:

1. A participating farmer is required to respect the organic *law no 04/2005 determining the modalities of protection, conservation and promotion of environment in its article 96 and law number 95/004 sets up conditions for the management of forest resources in Rwanda.* Any illegal activity defined by this law is severely fined.
2. Farmers can engage in production activities in the buffer zone only if they are officially registered with respective cooperatives to ensure use and management of the park. The person would be held accountable for any bad occurrence such as fire, killing animals and cutting trees.
3. Participating farmers would ensure their role in protecting animal and plant biodiversity for the benefits of the country's and people's employment.
4. Any farmer entering the park for the purpose of visitation would pay the park entrance fee as provided by RDB to improve the conservation of the park. An increase of 7 percent METR as tax from production activities would be added. Correspondingly, an upturn of 14 percent METR would be taxed for other activities related to tourism development and cultural heritage in the park to be added to the entrance fees.

Optional attributes are defined by park management levels with regards to farmer's choices to enable all stakeholders in forest participatory management with diverse interests to reach consensus in accordance with collective action in natural resources management, as defined by Ostrom (2005). The levels of utility preferences expressed reflect these attributes role in the CE

design. In coming up with these attributes, cultural heritage value of the park, park production resources as direct values for future consumption in terms of permitted enterprises in the buffer zones were considered. In addition, the study focused on protection of plants and animal species of global importance for tourism development; decision making on park management by different stakeholders as well as park visitation fee that helped to estimate trade-offs made by farmers over these attributes. These optional attributes shown in Table 4, were identified through a review of literature on park management features.

Table 4: Description of attributes and their levels

Variables	Description
Cultural Heritage	Place of worship (ReHe)
	Medicinal plants (MePl)
	Handcraft Products (HaPr)
Permitted Enterprises	Beekeeping production (BePr)
	Mushroom production (MuPr)
	Water collection (WaCo)
	Jatropha planting for biofuel production (JPBP)
Tourism Development	Both Animal and Plant Biodiversity (BAnPl)
	Wild Animals (WiAn)
	Plant Biodiversity (PlBio)
Decision making on Park Management	Decision making by Government only (DMG)
	Decision making by Government and farmers (DMGF)
	Decision making by Government, Farmers and Private sector (DMGFP)
Park Visitation Fee	Rwf 3500
	Rwf 3750
	Rwf 4000

The attribute, cultural heritage, was provided in three levels such as traditional religious heritage, medicinal plants and handcrafts production. This would conserve the park for religious heritage purposes such as traditional beliefs, cults and knowledge. It would also increase employment, promote export and wealth creation through cultural tourism development, traditional, medicine and sales of handcraft products.

Another attribute, park production resources, was given in four levels. They were: water collection, mushroom and beekeeping production and a proposed Jatropha planting for biofuel production in the buffer zone. These attribute levels were expected to raise farmers' incomes through increase in agribusiness activity. Also, they may improve food, nutritional and personal health (water safety) related issues, as well as overcome the threats associated with environmental degradation, climate change and rural poverty. Finally, this would be expected to ensure forests conservation efforts and facilitate healthy linkages between biodiversity.

To conserve the park biodiversity through tourism, the attribute tourism development, was specified in three levels: protection of both wild animal and plant biodiversity, wild animals lone or plant biodiversity. Protection and conservation of both wild animal and plant biodiversity is crucial for their national and global importance. This would increase park tourism revenues, national income and rural employment thereby reducing the dependence of local people on park resources.

For an integrated stakeholder decision making on park management, three levels were provided in this study. This is whether the decisions on park management would be made by the government only (current level), or involve either both the government and farmers or government, farmers and private sectors. An integrated (multi stakeholder) decision making process would enhance collective action and improve a strong collaboration between government institutions, user cooperative and other stakeholders. Likewise, it would enhance a better management of the park to ensure a well-developed, managed and utilized approach for sustainable benefits to all segments of society and the environment.

Lastly, the attribute park visitation fee was defined as additional park visitation amount per farmer to carry out some activities in the park. The attribute was given in three levels Rwf 3500, the current level and the subsequent increases of Rwf 3750 and Rwf 4000. A negative sign was anticipated which is required to estimate welfare changes. The three levels were determined on the basis of basic fees for entrance and activity performed (RDB, 2011). The increments of 7 and 14 percent from status quo of Rwf 3500 resulted in the second and third levels respectively.

3.5.2 Focus group discussion and CE survey design

3.5.2.1 Focus group discussion (FGD)

The focus group discussion helped to obtain preliminary insights and validation on park participatory management attributes and their levels from the literature. FGD also assisted to adapt the questionnaire language to the community. The main purpose of FGD was to get the general view of the current park management; explore possible improvements to the current level and predict possible interventions for a successful participatory conservation. The FGD was conducted in Kinigi sector office after the training of enumerators but the day before the preliminary survey started. The discussion was held with 10 key informants including two local authorities mainly sector agronomists, two members of farmer organizations, four key farmers (youth, male and female), and two park guides. Two people from research institutions (Karisoke Research Center and IGCP) were contacted at their place of work.

The researcher served as the moderator of the discussions while enumerators were assisting in explaining in case there were misunderstandings. An introduction of the aim of FGD was provided to the participants. The introduction emphasized on how their input was to provide necessary information on park participatory management for an improved conservation. Next, it highlighted

that the output from the FGD, were going to update the attributes from the literature as depicted in Table 5.

Table 5: Definition of park management attributes and levels

Attributes	Description	Management levels
Cultural Heritage	Improve and conserve traditional knowledge and cultural exchanges and raise the living standards for the local people through cultural tourism	Religious Heritage Medicinal Plants Handcraft Products
Park Production resources	Improved nutrition, environmental and personal health and increased farmers' income on management, production, protection and product commercialization	Beekeeping Production Mushroom Production Water Collection Jatropha Planting for Biofuel Production
Tourism Development	Protection of plants and animals for national income and rural employment	Both Animal and Plant Wild Animals Plant Biodiversity
Decision making on Park Management	Ensure responsible participation in decision making, access, use and management of the park	DM by Gvt only DM by Gvt + Farmers DM by Gvt + Farmers + Private Sector
Park Visitation Fee	Amount of money farmers can pay to help government generate park income towards improving the conservation of the park since it cannot sustain all conservation costs.	Rwf 3500 Rwf 3750 Rwf 4000

A check list questionnaire was distributed to each participant. The discussions were held in two separate groups of five people using a flipchart then each group leader presented to the participants to have the same consent. The FGD concluded with changing permitted enterprise to park production resources. In addition, the attribute level called place of worship was changed to traditional religious heritage. Participants highlighted as well major problems facing the current

management with regard to the law and policies on park protection, human-wildlife conflicts and revenue sharing schemes.

3.5.2.2. CE survey design

CE used a statistical design theory to combine the levels of the aforementioned attributes into a number of alternative management scenarios or profiles to be presented to respondents. Factorial designs were used to study the effects of these attributes and their levels. (Carson *et al.*, 2013). A complete design that allows factorial enumeration of all possible combinations of attribute levels used in this study had three attributes with three levels each and one attribute with four levels (Hensher and Rose, 2009). This combination would yield 324 profiles. Such designs have statistical effect such as the main effect. The main effect is the difference in means of each level of a particular attribute and the overall mean such that their sum is equal to zero. This implies that, if an attribute has no statistical effect, all regression parameters are exactly zero in theory and non-significant in practice (Louviere *and* Hensher, 2000). However, main effects are not the only effects that may be of interest. The study also employs interaction effects that are particularly of theoretical interest by interacting socio-economic, farm and institutional characteristics of respondents (Rose *et al.*, 2007).

In addition, complete factorial designs are practical only for small problems involving either small numbers of attributes or levels or both. It further generates too many choice sets. Because of this, a fractional factorial design was used to reduce the size of such problems by selecting a particular subset or sample of complete factorials (Rose and Bliemer, 2009).

During the survey, an orthogonal design of 36 scenarios was administered to 72 respondents for a preliminary survey. Each group of six scenarios was shown to 12 respondents: scenario 1-6; 7-12; 13-18; 19-24; 25-30; 31-36 to six different respondents. The use of this design ensured that the attributes presented to respondents were varied independently from one another and the effect of each attribute level upon responses was more easily isolated to avoid multicollinearity between attributes.

Furthermore, the use of orthogonality was found to be easy to construct or obtain and have primarily been concerned with linear regression models. This design also satisfies attribute level balance where all parameters are independently estimable and therefore attributes levels need to be uncorrelated (ChoiceMetrics, 2009). However, due to differences in the variance-covariance matrices between linear and non-linear models, orthogonal designs may not be appropriate for estimating discrete choice models (Rose *et al.*, 2007). Efficient designs aimed at data that generated parameter estimates with smallest standard errors were considered as well (Scarpa and Thiene, 2004). During the survey, the data from the preliminary orthogonal survey were analyzed and the results were used to generate an efficient design for the final survey. A second stage design process was done using prior coefficients from the preliminary survey to generate an efficient design in the final survey.

A generated design with D-efficiency measure of 93.4 percent was good since it had the smallest D-error of 0.076. In addition, a B estimate of 78 percent indicated a good measure of utility balance which shows that this study did not contain choice situations with clearly dominants alternatives. This indicates the complete picture of a good design in that when it is both orthogonal and balanced, it is 100 percent efficient, the same as when all of the parameter estimates have the smallest possible standard errors (Carson *et al.*,2013). Its efficiency therefore provided a single

number that captures all deviations from orthogonality, balance, and minimum standard errors. It turns out that these measure of D-efficient minimizes the D-error, which is an aggregate measure constructed from the variances and covariances of the estimated utility function parameters. D-efficient or D-optimal with sufficiently low D-error yielded data that enable the estimation of parameters with low standard errors (Rose and Bilemer, 2009).

Different coding schemes can be used for representing the attribute levels in the experimental designs. A design coding of (0, 1, 2, 3,) for four levels was used at the expense of orthogonal coding (-1, 1) for two levels, (-1, 0, 1) for three levels and (-3,-1, 1, 3) respectively. The used design had a good measure of D-efficiency of 93.4 percent and a lower D-error = 0.076 which entails the more efficient the design was.

Balancing the utilities of alternatives is of importance since if it is very unbalanced, the choice situation does not deliver information for estimating the parameters (Rose and Bliemer, 2009). The utility balance (B estimate = 77.671) attained fits in the range and shows that this study does not contain choice situations with clearly dominant alternatives. For instance, the optimal value for utility balance of efficient designs is suggested to lie in the range of 70-90 percent. (Choice Metrics, 2009).

3.5.3 Implementation of CE survey

The next step was to present the final design with 36 paired choices scenarios to the respondents. These were grouped into 6 profiles each with six choice tasks and farmers were randomly assigned to one of the six choice sets. Each choice task was describing two possible improved park management alternatives (A and B) and a baseline alternative (C) that defined the current management of the park.

Before the CE actual survey started, farmers were asked about their perceptions, attitudes towards decision making using different statements. It was indicated that respondents were interested in CE study on park management attributes. Using a CE card, the enumerator introduced and explained clearly CE survey to the respondent. The focus was on the significant role of the park, its degradation rate of 63 percent, and consequences of lack of the law protecting the park.

Table 6 shows one of the choice sets of three alternatives, two describe an improved management of the park whereas another alternative (Neither A nor B) explains the current park management status.

Table 6: One of the choice experiment cards within a profile presented to respondents

Attributes	**Alternative A**	**Alternative B**	**Neither A nor B**
Cultural Heritage	Handicraft	Religious	
Park production resources	Jatropha	Beekeeping	
Tourism Development	Animal	Both Animal and Plant	
DM on Park Management	Govt only	Govt only	
Park Visitation fee	Rwf3500	Rwf4000	
Which one would you prefer?			

An improvement of current park management status through a stakeholder (government, famers and the private sctor like NGOs) participatory approach was suggested. Respondents were asked to choose which best management they would prefer by clearly explaining the attributes and levels. Each farmer was then presented with a profile containing a series of six choice sets. Appendix 1 provides all 36 choice sets in six profiles.

3.5.4 Analytical framework of CE

The CE is anchored in two micro-economic theories. Lancaster (1966) multi-attribute utility theory postulates that the utility given by the consumption of a good does not come from the consumption

of this good, but rather from the consumption of its n characteristics called attributes, $A_1, A_2, A_3, \ldots\ldots A_n$. The functional form of the utility U_{iA} of an individual *i* is then:

$$U_{iA} = \beta_{i1}U_{A_1} + \beta_{i2}U_{A_2} + \beta_{i3}U_{A_3} + \cdots + \beta_{in}U_{A_n} \ldots\ldots\ldots\ldots \ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where $U_{A_1}, U_{A_2}, \ldots\ldots U_{A_n}$ are respectively the levels of utility generated by the consumption of the *n* attributes.

CE aims at identifying the trade-offs that individual *i* makes between the attributes in order to estimate β_{in}. In addition, the Random Utility Theory (RUT) by Manski and Lerman (1977 and McFadden (1974) underpins econometric basis of CE. It stipulates that individual *i*'s indirect utility U_{ij} is the sum of a deterministic term V_{ij} and a random term (ε_{in}):

$$U_{ij} = V(Z_j, S_i) + \varepsilon(Z_j, S_i) \quad \ldots\ldots\ldots \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where for any respondent *i* a given level utility was associated with any park management alternative *j* and depends on management attributes (Z_{ij}) and socioeconomic and institutional characteristics of respondents (S_i).

The choices made between alternatives were a function of the probability that the utility associated with a particular option *j* was higher than those for other alternatives.

$$Pr(ij) = Pr\left(V(Z_{ij}, S_i) + e(Z_{ij}, S_i)\right) > Pr\left(V(Z_{ik}, S_i) + e(Z_{ij}, S_i)\right) \ldots\ldots\ldots\ldots\ldots \quad (4)$$

The error term (Z_{ij}, S_i) is not observed by the analyst. Assuming its distribution is identically and independently type I extreme, the Multinomial Logit Model (MNL) would be adequate for analysis. However, MNL assumes homogeneity in preferences by focusing on the individual as the unit of analysis and uses the individual's characteristics as explanatory variables. A

Conditional Logit (CL) model that relaxes this assumption and focuses on the set of alternatives for each individual and the explanatory variables as characteristics of those alternatives was used.

CL takes the following general form: $P_{ij} = \frac{exp\left(V(Z_{ij,}S_i)\right)}{\sum_{k\in C} exp(V(Z_{ik},S_i))}$ …… (5)

The indirect utility function obtained by individual *i* from alternative *j* in choice situation C was expressed as: $V_{ij} = \beta + \beta_1 Z_1 + \beta_2 Z_2 + \cdots + \beta_n Z_n + \delta_1 S_1 + \delta_2 S_2 + \cdots + \delta_l S_m$ …….. (6)

Where β was the Alternative Specific Constant (ASC) which captured the effects on utility of any attributes not included in choice specific attributes.

The empirical model is expressed in equation seven. The dependent variable was the choice between alternative A or B and the current management scenario referred to as "Neither A nor B". Explanatory variables were management attributes and/or respondents characteristics. This model was specified with the assumption that the observable utility function would follow a strictly additive form. The probability of picking a given park management alternative was a function of attributes presented in the choice alternative and the ASC. The ASC was equal to 1 when either alternative A or B was chosen and 0 when the neither management alternative was picked. By operationalizing the CL model, we obtained:

$$\frac{\Pr[y=0]}{\Pr[y=1]} = \beta_0 + \beta_1 REHE + \beta_2 MEPL + \beta_3 HAPR + \beta_4 MUPR + \beta_5 BEPR + \beta_6 WACO + \beta_7 JPB + \beta_8 BANP + \beta_9 WAN + \beta_{10} PLBIO + \beta_{11} DMGO + \beta_{12} DMGF + \beta_{13} DMGFP + \beta_{14} AGE * Z_j + \beta_{15} EDUC * Z_n + \beta_{16} GE * Z_n + \beta_{17} INCOME * Z_n + \beta_{18} FAMP * Z_n + \beta_0 CBOME * Z_n + \beta_0 INFRA * Z_n + \mu_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

Whereβ_0, the ASC is equal to 1 when either alternative A or B is chosen and 0 when the neither management alternative was picked;

β_1 $up\ to$ β_{20} , are coefficients of utility parameters; and

Z_n , is a set of park management attributes from attribute *j* to *n*.

Alternatively, according to equation seven, attributes were described as REHE: Religious Heritage; MEPL: Medicinal Plants; HAPR: Handcraft Products; MUPR: Mushroom Production; $BANP$: Both Animal and Plants Biodiversity; WAN : Wildlife Animal only; $PLBIO$: Plant Biodiversity only; $DMGO$: Decision Making by Government only; $DMGF$: Decision Making by Government and Farmers and $DMGFP$: Decision Making by Government, Farmers and the Private Sector. Similarly, Factors were AGE: age, EDUC: Education level of the respondent; GE: Gender of the respondent; INCOME: Monthly income levels; FAMP: Farm Management Practices: CBOME: Membership in Community- Based organizations; and INFRA: Infrastructure Development.

Despite their difference, MNL and CL share a common likelihood function (Hoffman and Ducan, 1988). Their main concern is the assumption of independence from irrelevant alternatives (IIA). This states that the probability ratio of choosing between alternatives does not depend on the attributes of the other alternatives (Birol *et al.* 2006). If the IIA assumption is violated then estimates are biased and lead a model to incorrectly predict of destination being chosen. But again, preferences are heterogeneous and in light of this problem, it is requisite to account for this heterogeneity of individual preferences. Several models such as the Random Parameter Logit Model (RPL) and Latent Class Model have been developed to relax the IIA problem (Train, 1998). However, the major limitation was that this study could not use the above models. The data acquired could not allow their estimation and they are more computationally complex than CL (Christiadi and Cushing, 2007). The single available method that could give improved estimates than the basic mutlinomial logit (MNL) by relaxing the IIA assumption and allow variation across

respondents' characteristics is the conditional logit (CL). CL provides a more favorable choice for computational reasons in the case heterogeneity does not lead to a significant bias in the derived estimates (Haan, 2006).

Welfare estimation from CE coefficients is consisted with utility maximization and demand theory. The tradeoffs between utility parameters of park management attributes with those from the price coefficients allowed to estimate the change between the Marginal Rates of Technical Substitution (MRTS) and Marginal Utility of Income (MUI). In this study, the MRTS represented by park management attributes whereas MUI represented park visitation fee. In view of that, Willingness to pay (WTP) values were estimated using formula eight as suggested by Hanemann (1991).

$$WTP = -1\frac{\beta_{VNP\ attribute}}{\beta_{park\ visitation\ fee}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

The analysis included socioeconomic, farm management practices, and institutional factors. Socio-economic characteristics encompassed age, gender, marital status, main occupation, education and income levels of the respondents. Farm management practices related to erosion control (Anti erosion ditches, progressive and radical terraces); animal husbandry (zero grazing and animal feeding, grazing in the park; crop husbandry (mixed cropping, intercropping, crop rotation, mono-cropping, integrated animal-cropping system and crop residue management) and agroforestry system (agrisilvicultural, silvicultural, agrosilvipastoral and apiculture with trees). Institutional factors entailed distance to infrastructure services and membership to CBOs.

The analysis of the aforesaid factors concentrated on estimation of means, standard deviations, percentages and factor analysis. This helped to characterize farm practices and assess farmers' perceptions and attitudes on management approaches using SPSS software. Moreover, CE analysis

used a CL model. The model consisited of interacting socio-economic, institutional characteristics with management attributes. Using Nlogit econometric software version 3.0 (Greene, 2003), 25 possible interactions were generated. Although age was considered in interaction, its inclusion in analysis yielded insignificant estimates. However, dropping all its interactions from the analysis was making the model insignificant as well. Moreover, handcraft attributes in interaction with socio-economic characteristics was making the attribute per se not significant and therefore its interaction was not included in the analysis.

Most of interactions that were insignificant and exhibiting unexpected sign were step by step dropped and the model could be run again until we had 14 significant variables out of 19. This enabled the estimation of the distribution of WTP by avoiding high WTP values. According to Proust (2009), in cases where two-factor interactions are indistinguishable from main effects, a stepwise regression approach can allow for removing some insignificant main effects while adding highly significant.

CHAPTER FOUR

RESULTS AND DISCUSSION

The present study aimed specifically to both characterize management practices and approaches, and evaluate the monetary values that farmers attached to park participatory management attributes. In this chapter, results are presented and the discussion is organised as follows. Characterization on management practices and approaches, socioeconomic, farm and institutional factors form part one. In this part, section 4.1.1 presents socio-economic and insititutional characteristics of farmers. Section 4.1.2 characterizes farm management practices. Section 4.1.3 describes results on farmers' perception and attitudes towards decision making on park management. In part two, CL results are presented in section 4.2.1 while Willingness to Pay (WTP) estimates for park management attributes are in section 4.2.2.

4.1 Characterization of management approaches and practices

4.1.1 Socio-economic and institutional characteristics of respondents in the VNP area

The socio-economic, farm and institutional characteristics of the indigenous farmers are presented in Table 7. The average age was 39 years, almost all farmers were young to middle age (18 to 55 years old). The results confirm the youthfulness of the farming population in Rwanda (16-60 years) compared to most countries (15-64 years) (GoR 2014). Studies by Jumbe *et al.*, (2008) and Mulenga *et al.* (2011), independently indicated that young age was positively associated with the household's likelihood of utilizing forest products. On the other hand, the youthfulness may be a sign of incentives for preservation of park resources since young people participate in park maintenance through community work.

Table 7: Socio-economic, farm and institutional characteristics of respondents

Variables	Sample respondents (N=192)
Average age of respondents (in Years)	39(15)
Average number of people in a household	5(2)
Average monthly household income (Rwf)	61,747(77,380)
Average farm size (in acres)	0.89 (0.6)
Average distance to	
The nearest school (in Km)	1.4(1.3)
The nearest health centre (in Km)	3.6(3.2)
The nearest market (in Km)	5.2(4.9)
The nearest paved road (in Km)	3.9(2.6)
Proportion of respondents below 55 years old (%)	85
Proportion of respondents with monthly income below Rwf 100, 000 (%)	90.9
Proportion of male farmers (%)	57
Proportion of married respondents (%)	85
Proportion of widowed respondents (%)	9
Education level	
Proportion of respondents who attended at most primary school (%)	91
Proportion of respondents who attended at least secondary school (%)	9
Main Occupation	
Proportion of farmers engaged in farming only (%)	80
Proportion of farmers having land within 1 Km from the park (%)	78.6
Proportion of farmers with other farms far from the park (%)	63
Proportion of respondents who use farm management practices (%)	95.8
Proportion of farmers with membership to CBOs (%)	48.4
Proportion of members whose CBO have management activities (%)	30.2

* Standard deviations are in parentheses
*the average exchange rate between June and July, 2014: one US$ was equivalent to Rwf 690.

Because young people are potential force for sustainable environment-friendly development, measures should be taken to raise their living standards. This would enable them play their full role in the management of forest resources (GoR, 2010). This is in line with results whereby it was argued that a good understanding of socio-cultural factors such as age would help shape the formulation and subsequent implementation of conservation programmes (Koku, 2001).

Almost all the respondents attended only primary school, with only very few having at least secondary education. This low literacy compared to the average national literacy rate of 70 percent may posit serious threats on park resources. This is because the farmers have never received training in different trade and off-farm employment. The findings agree that a positive relationship exists between low literacy, poverty and reliance on park resources (Jumbe *et al.,* 2008). It is therefore crucial to implement programmes that may build capacity of the households through vocational trainings or offer incentives that could be effective at reducing pressure on park resources.

The study also showed that the average monthly household income was approximately Rwf 61,747 (US$89.62). Most of the households earned less than Rwf 100,000 (US$150) per month. This indicates that majority of the farmers were poor and relied mainly on park resources for income and subsistence farming. The results are not unexpected, considering that 80 percent of the residents live below the national per capita income of 272 which was in 2007 and far below the current one of US$ 639 (IMF, 2014). Also, results drawn from a study by Jayne *et al.* (2003) indicated that the average annual per capita household incomes varied from US$ 43 to US$ 337 in Eastern and Southern African countries. Further, it was found that about 75 percent of the rural population were below each poverty line. Poverty may result in negative preferences for preserving resources since passive use values are luxurious that do not exist in the informal sector of the

economy (Casey *et al.*, 2008). However, in Rwanda agricultural contributes the largest share (46 percent) of household income followed by wage and business income (NISR, 2012). Moreover, it was indicated that the existence of the park has brought about spillover effects to the community (Ekise *et al.*, 2013). Appropriate interventions to ensure sustainability of park resources should focus on provision of non-farm income activities that can help reduce household reliance on park resources.

The findings indicate higher average household size compared to the national levels. This, in conjunction with the observed low average farm sizes, would result in degradation of the park and farm covers. In turn, it may have a negative impact on park preservation which would give rise to resource exhaustion. This agrees with Mpyisi *et al.* (2003) who found that 72 percent of Rwandan rural households own less than 0.75 Ha and these increasingly small farm sizes can cause serious socioeconomic and environmental problems. The results further corroborate with Oeba *et al.* (2012) who found that land and household sizes are the most important factors influencing community's decision of tree planting and retention for improvement of forest cover in Kenya. In addition, large families have propensity to extract resources from the reserve. This information is crucial in assisting GoR to effectively promote forest and agricultural interventions geared towards improving land restoration and forest cover.

Slightly more than a half were male. Majority of them were married. In addition, three-quarters were engaged in subsistence agriculture. Further, less than a quarter were combining both farming and off-farming activities. This is an indication of great dependence on the park and farms which is a key challenge to park resources conservation and management. Similarly, IFAD (2006) found that about 85 percent depend on agriculture, particularly smallholder farming for their livelihood. The results also indicated that about 80 percent of respondents had their farms within one Km from

the park boundary. This close proximity is exceedingly correlated with dependence on park resources. Therefore, interventions aimed at improving rural income through non-farm income activities and vocational training are requisite.

Access to infrastructural facilities is amongst the main indicators of the standard of living of a community. The average distance to the nearest school was 1.4 Km; 3.6 Km to the nearest health center; 5.2 Km to the nearest market whereas the average distance to the nearest paved road was 3.9 Km. The findings are in the same range to countrywide averages in rural areas. At national level, the proportion of population visiting a health centre increased from 49 percent in EICV2 to 66 percent in EICV 3 due to increased proximity to health centers. This is due to the fact that, in the same period, the mean time needed to reach a health centre reduced from about 95 to 60 minutes (NISR, 2012). Given this, one can explain that infrastructure development in the area can positively contribute to the park conservation since it helps in creating new employment and easy access to business transactions.

The results showed that 48 percent of farmers belonged to community based organizations (CBOs) but only about 30 percent of farmers reported that their CBOs participated in activities related to park conservation and management. This might be attributable to poor collaboration amongst interested parties and hence inadequate collective action in managing these resources. Participation in CBOs would promote farmers' awareness and increase their level of environmental consciousness. Ogada (2012) notes that institutionalization of farmer groups in forest-based associations reinforces social relations and cohesion as well as mutual trust. Thus, there is a need to increase farmers' capacity and awareness through environmental education programmes especially through the CBOs.

4.1.2 Farm management practices in park area

Adequate farm management practices have been identified as one of the key pillars of vision 2020 to transform agriculture from subsistence to a productive, high-value, market-oriented farming that is environmentally friendly. The study identified different management practices in the area. They included erosion control, animal and crop husbandry, and agroforestry. Farmers were asked to rank different management practices from the least applied to the most applied practices, results are presented in Table 8.

Table 8: Frequency of management practices by farmers in the park area

Farm Practices	Management	Frequency of management activities				
		Not Applicable	Never	Rarely	Mostly	Always
Erosion Control	AE Ditches	0	9.6	8.6	13.9	67.9
	Radical Terraces	34.8	54.0	7.5	2.1	1.6
	Progressive Terraces	0	44.4	9.1	24.6	21.9
Animal Husbandry	Zero grazing	0	31.0	11.8	14.4	42.8
	Fodder Bank	0	35.3	20.3	25.1	19.3
	Grazing in VNP	0	69.0	16.6	14.4	0.0
Crop husbandry system	Mixed cropping	0	79.7	12.8	3.2	4.3
	Intercropping	0	43.3	18.2	21.9	16.6
	Monocropping	0	5.9	5.9	35.8	52.4
	Crop-Animal system	1.1	40.6	16.0	26.2	16.0
	Crop rotation	0	4.8	5.9	18.3	71.1
	Residue management	0	5.3	15.0	26.2	53.5
Agroforestry system	Agrisilvicultural	4.8	46.0	16.6	21.4	11.2
	Silvopastoral	25.1	63.6	4.3	5.3	1.6
	Agrosilvopastoral	28.9	59.4	6.4	3.2	2.1
	Apiculture_tree	22.5	66.8	5.9	.5	4.3

Findings revealed that more than a half of respondents never applied radical terraces; slightly two-thirds always applied anti-erosion ditches; and less than half never applied progressive terraces as

soil conservation measures. Relatively less than a third indicated that radical terraces were not applicable in their farms and their use together with progressive terraces was therefore very low. These findings are lower than 78 percent of the population that have adopted farm management practices as documented by NISR (2012). The disparity could be attributed to the fact that most respondents had small pieces of land with low income levels.

Three types of grazing system are found in Rwanda: open, semi, and zero grazing (GoR, 2011c). Zero grazing, coupled with small farm sizes, offers the best level of earnings to a farmer. Farmers were asked about their grazing system as well as feed and fodder practices. Less than half of farmers reported that they had always used zero grazing. A relatively small number indicated that they had mostly applied these animal husbandry techniques. Only a small number rarely grazed in the park. One-third indicated that they never applied zero grazing and fodder bank production while quite high number indicated that they never entered the park for grazing.

Different agricultural practices which include cropping systems have been promoted by the GoR through the Crop Intensification Program (CIP). CIP aims to increase national agricultural productivity and improve food security through the use of soil management practices on six priority crops (Cantore, 2008). In this study, a high proportion of farmers indicated that they never applied mixed cropping compared to less than half who never applied both intercropping and integrated crop-animal system as crop husbandry practices. A very low number of respondents indicated that monocropping, crop rotation, and residue management were never applied. Similarly, a low number of farmers reported that they rarely used crop husbandry practices.

Agroforestry trees not only serve as timber, food, fodder and shade, they also increase nitrogen content in the soil (Nair, 1991). Four types were identified in this study such as agri-silvi-cultural

(crop-tree system), silvopastoral (animal-tree system), agrosilvopastoral (crop-animal-tree system) and apiculture with trees. Relatively less than a third of respondents indicated that agrisilvicultural, silvopastoral, agrosilvopastoral techniques and apiculture with trees respectively were not applicable in their farms. About a half specified that they never used agrisilvicultural technique whereas between a half and two-thirds showed that they never applied respectively silvopastoral, agrosilvopastoral and apiculture. Approximately, a few number responded that they mostly and always used these practices in their farms. The comparatively low levels of agroforestry practices in the area suggests that restoring the park and the neighboring land is still a major challenge and can negatively affect soil fertility, farm productivity and forest conservation.

In Figure 4, the study observed that farmers used public water sources such as protected spring and public standpipe during the normal period of rainy season and during dry seasons. In a study on WTP for water quality improvement in rural Kenya via spring protection, Kremer *et al*. (2007) concluded that households were willing to pay annually for protected spring water.

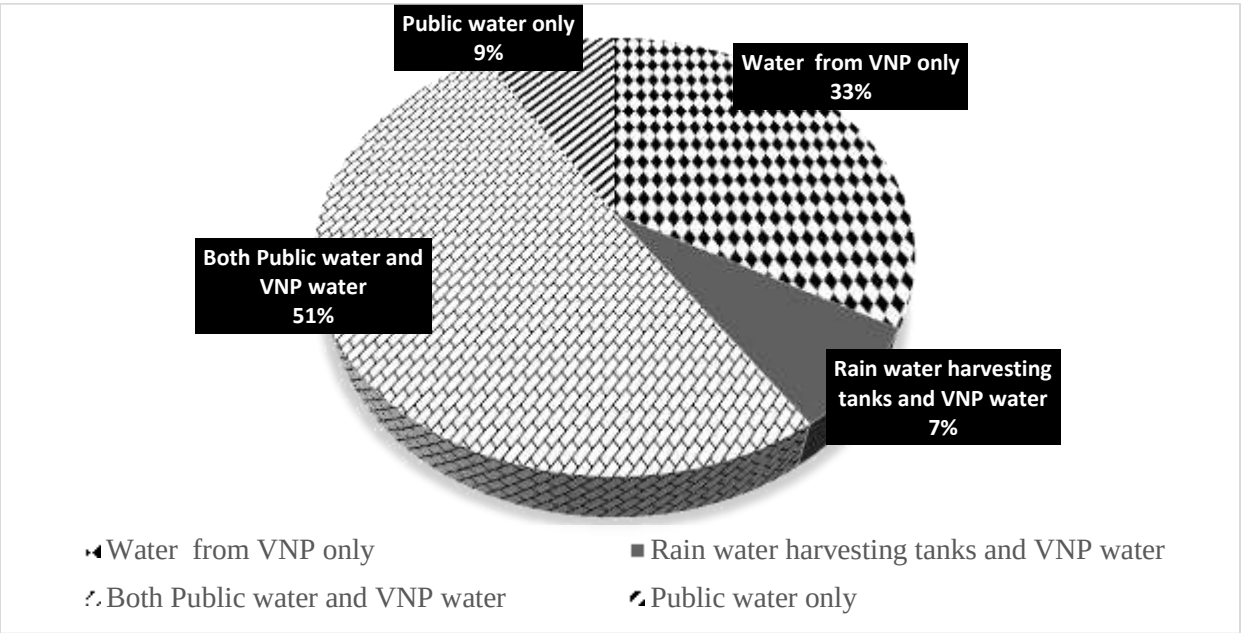


Figure 4: Sources of water in the study area

About half of respondents stated they could access water from the park in the dry season. Approximately a third of respondents had access to park water only. A small number indicated that they normally got access to clean water from protected public springs and rainwater harvesting tanks.

The use of untreated water from the park was highly witnessed. As depicted in Figure 5, the distribution of water sources is according to respondents' districts. About a quarter of the respondents in Nyabihu and half in Musanze districts reported that they had been using water only from the park throughout the year. On the other hand, the rest of Musanze residents and half of Burera district had access to safe and clean water from a protected public spring, public standpipe or water piped into dwelling only during rainy seasons. In addition, public pipes and rain water harvesting tanks accounted for a small number of respondents in Burera and Musanze.

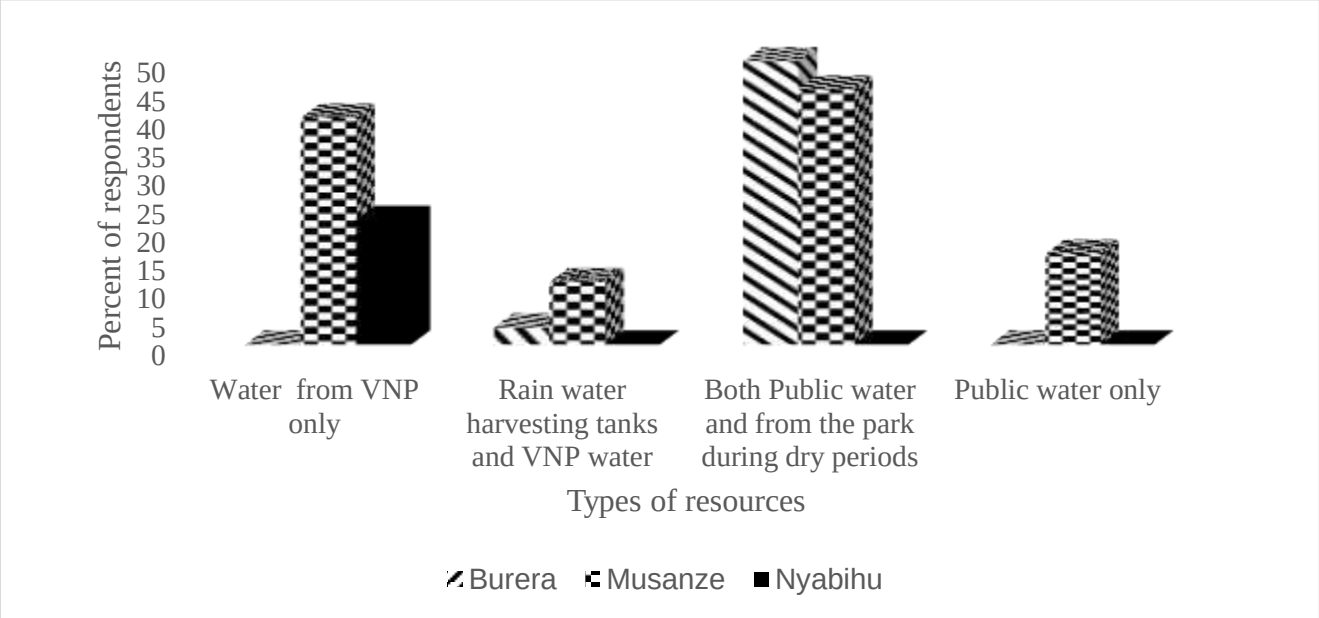


Figure 5: Distribution of water sources according to respondents' districts

Sources of energy for cooking and lighting is very important to management of forests. Figure 6 shows the use of energy for cooking and lighting in the study area.

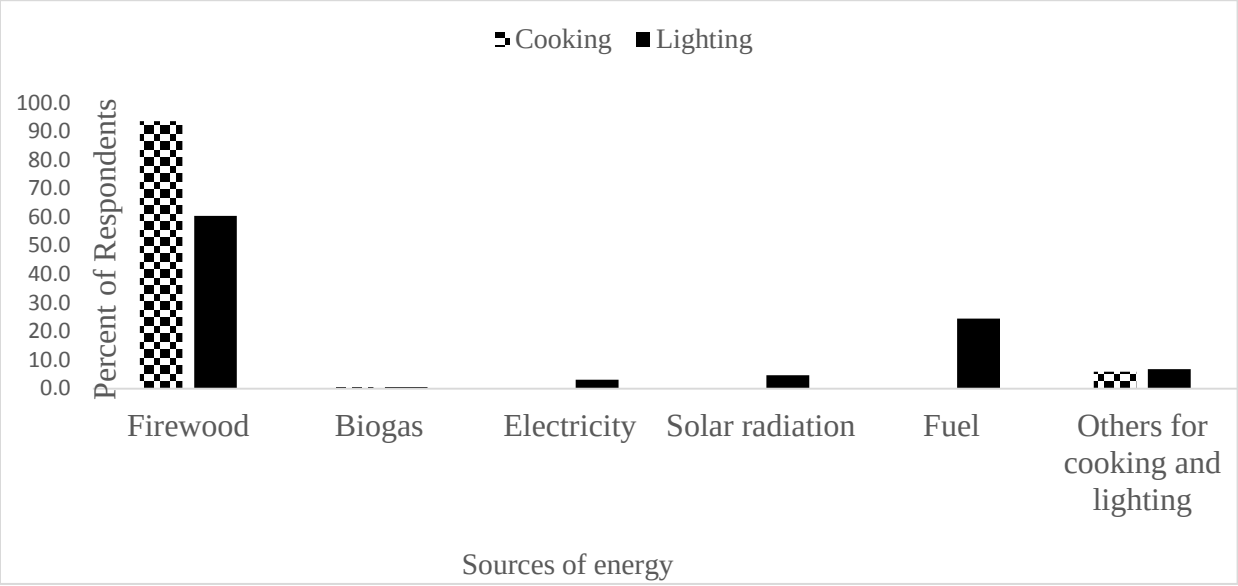


Figure 6: Use of energy for cooking and lighting in the study area.

The study revealed that firewood was the major source of energy used for cooking by farmers with very low use of charcoal and biogas. Farmers' use of biomass resources was higher than at national level. Wood and charcoal are used by 57 percent and 23 percent respectively (Ndegwa, 2010). This extraordinary use of firewood may lead to the extraction even exhaustion of park plant resources since it was the sole place for firewood collection.

The practice of sourcing firewood from natural forests was banned due to its contribution to their degradation. Fuel wood also occupies the big part as the primary sources of energy for lighting. Use of electricity was as low as 3 percent in Burera district compared to Nyabihu (10 percent) and Musanze (14 percent), the national average is 10.8 percent (NISR, 2012). Since the wood resources were limited, there was high demand for biomass energy and this great demand gives rise to serious

and widespread concern about the sustainability of forest plantation, natural vegetation and farmlands (RNRA, 2013). Therefore, developing programmes aiming at increasing farm practices for forest and farm cover such as agroforestry, use of improved energy saving stoves and others may reduce high use of biomass and would assist in park conservation.

4.1.3 Farmers' perception and attitude towards decision making on park management

To determine the most important factors that influence management choices, farmers were asked to rate a proposed management regime with comparison to the current one. Figure 7 represents a four level scale of importance of decision making on park management by the government only; or both government and farmers, as well as government, farmers and private sector.

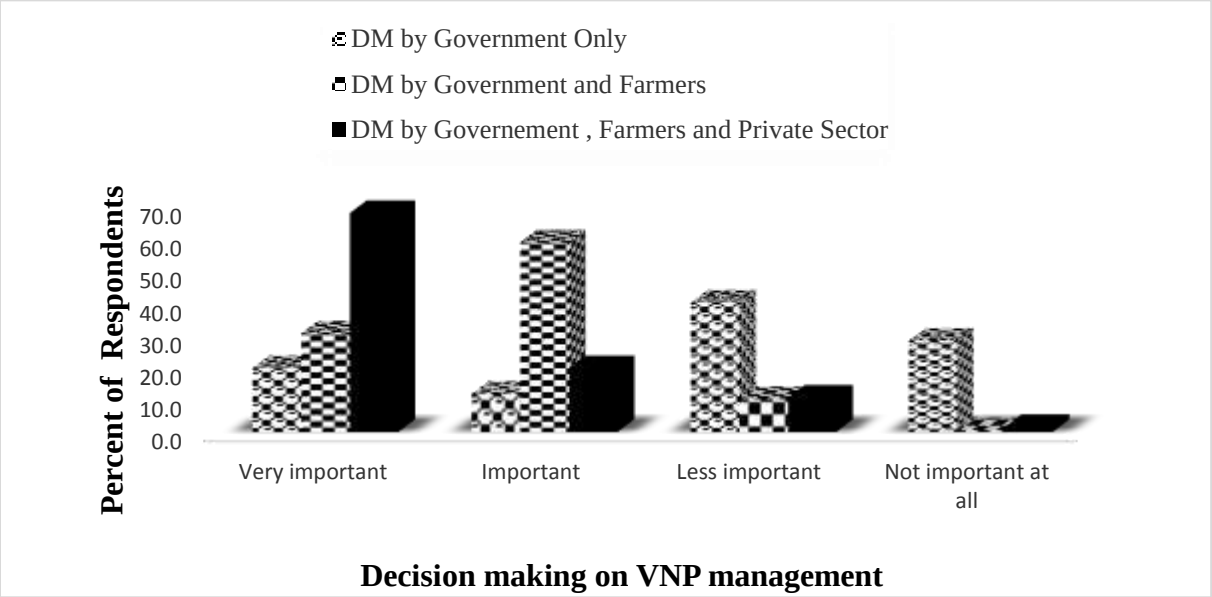


Figure 7: Relative importance of decision making on park management

Respondents were asked how often they had been carrying out different activities since the organic law *no 04/2005 determining the modalities of protection, conservation and promotion of environment* was established. Similarly, they were asked about their perceptions, attitudes towards

decision making on park conservation related to different statements with regard to park management.

Table 9 presents the results on frequency of activities carried out in the park and farmers' perception and attitudes on park management. Beekeeping (2.92) and water collection (3.0) were the activities mostly carried out in the park. It suggests that despite the law established, farmers were mostly concerned with water resources and honey collection in the park.

Table 9: Activities undertaken in the park, farmers' perception and attitudes on park management

Types of Activities undertaken in the park	**Sample mean (N=192)**
Mushroom farming	1.1(0.3)
Water collection	3.0(1.0)
Honey collection	2.9(1.1)
Handcraft material collection	1.3(0.6)
Medicinal plants harvesting	1.1(0.5)
Worship in the forest	1.0(0.2)
Participation in community work regarding park conservation	3.7 (37.3)
Farmers' perception and attitudes on park management	
I consider the current degradation status of the park as critical	3.1(1.4)
I am well satisfied with the current management policy	2.9(1.6)
Tourism development is a key to conservation of wild animals and plant species	4.7(0.6)
Government can involve farmers and private sector in decision making to improve the current park management	4.5(0.8)
User cooperatives should be allowed to carry out some activities in the buffer zones	3.9(1.4)
The park should be used to preserve our traditional cultural heritage including handcraft making and traditional medicine	3.0(1.5)
The park should have a place that is meant for traditional beliefs and cults of worship for ancestors to preserve our traditional religion heritage for the future generation	3.6 (1.5)

Notes: Numbers in the table indicate 0: Not Applicable; 1: Never; 2: rarely; 3: Quite often; 4: Very often. Similarly, 1: strongly disagree, 2: disagree, 3: undecided, 4: agree, 5: strongly agree. Standard deviations are in parentheses.

Again, the explanation could be that in spite of the efforts employed by the government in rehabilitating some sources of water, inadequate water supply remained a pertinent problem in the area. However, farmers indicated that they were rarely or never involved in activities like mushroom farming, handcrafts collection and medicinal plants harvesting in the park.

Respondents reported that the park was never used for worship activities as had been in the past. Moreover, respondents indicated that they very often participated in park conservation and management through community services and reported lost animals from the park.

Further, the results on perception revealed that farmers were indifferent to whether the current degradation status of the park was critical and were generally dissatisfied with the current management policy. This is because farmers were not aware of the current degradation of the park or laws governing compensation of human wildlife conflicts. This could be explained by inability of park management to either curb the problem or offer compensation for the damage and employment opportunities related to park conservation. Mukanjari *et al.* (2013) recommended the use of performance-linked benefit sharing scheme where the local community is effectively locked into a binding contract with the park management agency and therefore assumes full responsibility for the park resources dynamics. Likewise, there should be consolidation of the current tourism gains through the harmonization of rules and regulations to reduce costly competition and strengthen collaboration.

On the other hand, farmers strongly agreed that the government should involve all the stakeholders in decision making process and that tourism development was a key to conservation of biodiversity. They also agreed that user cooperatives should be allowed to carry out some activities

in the buffer zones and there should be a place that could be used for traditional worship practices as part of their cultural religion heritage.

The findings show that farmers had high interests in tourism development**.** Secondly, they valued strong collaboration through user cooperatives and participation in an integrated approach in decision making process with all stakeholders in management of park resources exploitation. Thirdly, they were interested in promotion and preservation of traditional religious heritage and handcraft material to the future generation.

These results are a sign that this study would provide a realistic CE survey and should possibly reflect respondents' interests in participatory management of the park. This would help us to get information on how indigenous people make tradeoffs between management attributes with regard to the preservation of luxury environmental quality independent of direct impacts from the informal sector of the economy (Casey *et al.*, 2008).

4.2 Farmers' preferences and WTP for park management attributes

This section presents results from analysis of CE for stakeholder participation in the management and decision making of the park.

4.2.1. Farmers' Preferences for park management attributes

Stakeholder participation in the management and decision making of the park provides intervention measures with adequate policy implications. Table 10 indicates estimated utility parameters using Conditional logit model. The log likelihood value of -829 obtained suggests a strong significance of the model. This shows that utility parameters for attribute levels were statistically different from one another. The Pseudo R-Square of 0.34 means the overall model fitness is good as well. In discrete choice models, the Pseudo_R square (ρ^2) value is similar to R^2

in linear regression analysis, except that significance occurs at lower levels whereby values between 0.2 and 0.4 are considered to be extremely good fits (Birol *et al.*, 2006).

Table 10: Conditional Logit for farmers' preferences for park management attributes

Management variables	Coefficients	t-ratios
Religious Heritage	0.19 (0.54)	0.35
Handcraft Materials	0.32 (0.21)*	1.50
Jatropha Plantation for Biofuel Production	1.53 (0.47)***	3.25
Beekeeping Production	1.50 (0.47)***	3.20
Mushroom Production	1.37 (0.42)***	3.22
Both Plant and Animal Biodiversity	1.45 (0.19)***	7.61
Plant Biodiversity	-0.08 (0.19)	-0.40
Decisions by Government and Farmers	1.52 (0.16)***	9.79
Decisions by Government, Farmers and Private Sector	1.68 (0.47)***	3.58
Park Visitation Fee	-0.0002 (0.00)*	-1.78
Income*Religious Heritage	0.36 (0.13)***	2.79
Income*Water Resources	0.74 (0.15)***	4.82
Age*Religious Heritage	-0.45 (0.17)***	-2.57
Gender*Religious Heritage	0.07 (0.08)	0.96
Education*Religious Heritage	0.12 (0.12)	1.06
Education*Water Resources	0.11 (0.13)	0.79
Education*Decisions by Government, Farmers and Private Sector	0.22 (0.13)*	1.75
CBOME*Water Resources	0.37 (0.18)**	2.03
CBO*Decisions by Government, Farmers and Private Sector	0.31 (0.19)*	1.60
Log likelihood	-834.025	
Pseudo R_Square	0.34	
Number of respondents	192	

Notes: ***, **, * imply statistical significance at 0.01; 0.05 and 0.1 respectively. Standard errors are in parentheses.

The results show that farmers had positive and significant preferences for handcraft material over religious heritage and medicinal plants. The importance of handcraft in Rwandan society has been highlighted regarding promotion of cultural tourism, provision of rural incomes and strengthening collaboration amongst rural communities and other stakeholders. This is consistent with the findings by Eriksen *et al*. (2005) and Musyoki *et al.* (2012), the two studies argued that handicraft

making can be used as a coping strategy to mitigate vulnerability and climate stress, strengthen the capacity of the local community and encourage collaboration and networking amongst the stakeholders in Kenya and Tanzania respectively. There is need for the government to implement user friendly policies that promote activities like handcraft. Such will ensure the conservation of the park as well improved livelihoods of those around it.

Farmers also showed positive preferences for Jatropha plantation for biofuel production followed by beekeeping production and mushroom production in the buffer zone. They also indicated that, relative to protecting park production resources, farmers preferred Jatropha plantation, mushroom and beekeeping production. The results may provide useful insights on perceived benefits and potentials of these production resources to increase rural incomes, mitigate climate change effect, contribute to household diet while providing incentives for sustainable forest management.

Farmers' preferences over Jatropha production is consistent with studies by Wahl *et al.* (2009) which argued that Jatropha helps combat greenhouse effect, stop soil erosion, create additional income for the rural poor, and provide a major source of energy. The results on beekeeping also supports recommendations by Gemeda (2014) that governments are required to provide landless and marginalized people with necessary bee keeping technologies and inputs to ensure maximum honey production while promoting watershed rehabilitation and conservation. Further, the findings are consistent with what Bognetteau *et al*. (2007) call a strong link between forests and traditional beekeeping. This creates opportunities for promoting beekeeping as an incentive for sustainable forest management.

Preferences for mushroom is in line with recommendations by Celik and Peker (2009) for strengthening mushroom production sector to enable the rural economy to keep its vibrancy and

development. Similarly, the study contended that mushroom increases and diversifies business, employment opportunities, and provides income opportunities for disadvantageous groups including small family farms in rural areas. Its cultivation offers benefits to market gardens when it is integrated into the existing production systems. The market for mushrooms continues to grow due to the culinary, nutritional and health benefits it possesses (Sánchez, 2010). Preserving the park for its production resources is fundamental to implement programmes that promote environment- friendly low input, high potential and prolific small-scale farm enterprises. This would result in increasing farmers' income and enhance national food, nutritional and health status.

The respondents showed significant positive preferences to protect both wildlife and plant biodiversity in the park for tourism development rather than protecting either plants or animal species separately. This clearly explains how much farmers understand the role of tourism for their livelihood and for the country's economy through protection of plants and animals of national and global importance. Similarly, many studies reported positive and significant preferences to protect biodiversity such as plants and animal species. For instance, Bie and Hearne (2006) reported that the public have greater preferences for conservation of biodiversity than for scenic beauty which reflect an acceptance of the existence value of nature. Williams and Cary (2002) study showed a positive association between landscape preferences, ecological quality, biodiversity conservation and protection of natural environments. Government in collaboration with other stakeholders should therefore collaborate to design environmental protection programmes such Payment of Ecosystem Services (PESs), carbon finance and park tourism revenue sharing schemes for the community.

Farmers showed a high preference of integrated decision making to a decision making of government and farmers only. By this, the farmers expressed a desire to move from the current

park management where decisions are made by the government only. The high preference to move from the current approach of decision making on park management might be attributed to the government failure to mitigate the problem of human-wildlife conflict in the area and crop damage compensation. There is also lack of policies regarding tourism revenue sharing through employment provision and infrastructural facilities for livelihood diversification in the area. Moreover, there is high exclusion cost incurred by a centralized administration leading to ineffectiveness when collective action is not accounted for.

Decision making by both farmers and government may bring a strong collaboration since farmers may help in reporting illegal activities, participate in community services on park management among others. However, including the private sector such as national and international NGOs, private business firms, civil societies, and farmers' organizations and quantifying their interrelationships are useful in formulating better park management policies. Integrating stakeholders in park management is consistent with Multi-Criteria Decision Analysis (MCDA) theory as opposed to neoclassical assumption of profit maximization. The latter has been criticized for omitting risk and uncertainty and use of income or profit as the sole metric for evaluation of agricultural and forestry decisions (Ananada and Herath, 2008). MCDA is a series of decision rules aimed to investigate, analyze and resolve decision problems constrained by multiple objectives. Its importance is that it can potentially increase the substantive quality of decisions by balancing interests against each other, thereby producing solutions of higher overall stakeholder satisfaction (Nordström, 2010). This suggests that the government should revise the current approach and establish an approach that would improve planning, management, conservation and law enforcement in park resources allocation.

The price coefficient, park visitation fee, was negative and statistically significant as it was expected. This is consistent with consumer theory on the inverse relationship between quantity demanded such as increase in environmental quality and the price. It indicates that the effect of utility of picking a choice set with a higher payment level is negative (Birol et al., 2006).

To assess possible sources of heterogeneity in preferences for park management attributes, the standard discrete choice model (CL) with interactions between estimates of the utility parameters and socio-economic and institutional characteristics of respondents was applied. Although CL carries the IIA assumption, it was chosen over other models for its easy computational property. CL is similarly attractive for its simple structure and therefore provides a suitable model choice of park management attributes. It is as well regarded as a more advantageous choice in case where heterogeneity does not lead to a significant bias.

Interactions between income and religious heritage as well as between income and water resources were positive and significant. These positive preferences between high income and religious heritage implies that high income farmers would like to restore and preserve the traditional cultural heritage for personal and public enjoyment and recreational purposes. It may also be an indication of how much this community deeply values traditional religious heritage as a source of intellectual and cultural property rights in their former ancestral territories. For that reason traditional religious heritage should be recognized and accommodated in conservation decisions. This luxurious characteristic of religious heritage is consistent with economic theory, that as farmers gain higher income, the consumption of recreational luxurious goods increases. People with great income may play important roles regarding promoting and maintaining cultural traditions and values. In addition it is consistent with the axiom of non-homothetic preferences in that when the income elasticity of demand for environmental quality is high, then preferences are no longer homogenous

in the society. It follows that societal preferences would change as well (Bhattarai, 2004). The results advocate for the implementation of programmes that aim at increasing households incomes. This is specific to off-farm and vocational activities to improve the quality of life for recreational purposes.

Positive interaction between income and water resources explains how farmers were concerned with quality of water. Farmers with high income would prefer to have safe and clean water rather than extract water resources from the park. It was also reported by Kreye *et al.* (2012), that, in the USA, an increase in income is significantly associated with an increase in WTP. As a result, farmers exhibited a growing demand for protecting water quality from pollution due to increased number of visitors and expenditures by tourists. This is relevant to the recommendations of Kremer *et al.* (2007) that spring protection appears less cost effective than point-of-use water treatment in improving water quality in rural Kenya. Furthermore, this is consistent with the studies by Kanyoka *et al.* (2008) and Vásquez (2011) in rural areas of South Africa and Guatemala respectively, households showed positive preferences for good water services. This study recommends the implementation of programmes that protect water from going to waste, ensuring its sustainability. Again, the government should develop strategies of long-term investments in improved water quality services.

The interaction term between gender and religious heritage was negative. The negative preference may be attributed to the fact that, although women were involved in maintenance and conservation of park resources to some extent, their awareness on natural resource preservation was limited and often lacked detailed knowledge of their local environment. According to the World Bank (2004), lack of gender awareness constrains the sustainable use and management of forests and forest ecosystems throughout the world. This negative preferences might be explained in that, generally,

throughout the developing world, women are usually the ones engaged in household subsistence activities such as the collection of water, fodder, wood for fuel, among other activities. Equally, the limited access to land, forest and water resources can leave women with little choice but to engage in harmful environmental practices. The same was argued by Adger and Brown (2009) that whereas men have been able to diversify their livelihood strategies, women have less room to maneuver and increasingly rely on activities that diminish forest resources. This situation has impacted on the way women and men perceive change on the current and future management of forest resources. In Rwanda, some of problems that are specifically gender related are women's lack of control over key resources or the gender based division of labour (Bush *et al.,* 2010). It is imperative to design programmes aimed at empowering women on environmental awareness and income generating activities for livelihood diversification.

Interactions between education and decision making by all the stakeholders on park management were positive. It is noted that highly educated farmers have high level of environmental consciousness therefore high level of participation in decision making. This in line with Birol *et al.* (2006); and Ruto and Garrod (2009) that participation is positively influenced by educational level attained by a farmer as well as the improved wetland management attributes.

Similarly, membership to a farmer organization was positively correlated with preserving the park for water resources. This shows how user groups such as farmer groups and other cooperatives have local perceptions of the forest water resources and recognize a great need to conserve and improve the forest. The local people felt that the situation was dire enough that it might be only improved through collective action. In their study Sangkapitux *et al.* (2009), report that downstream farmer groups were willing to provide an average of one percent of their annual income for a substantial improvement for the quantity and quality of water resources. This would

then be used to compensate marginalized groups' change of their agricultural systems towards more environment-friendly practices.

Membership to a community based organization (CBO) was positively related to the integrated decision making by all stakeholders which is relevant with the theory of collective action in the management of common pool resources. This an indication of local perceptions on the importance of forest water resources mainly in improving ecological functions such as cropping and livestock watering. It is consistent with Ogada (2012) and Gopalkrishnan (2005) arguments that participation in social groups increases the possibility for information sharing and build trust in their respective social groups in the form of collective action in the management of common pool resources. However, Nagendra (2005) highlighted the issue of heterogeneity in collective action for forest management. He noted that the impact of heterogeneity are strongly felt when institutions are weak. On the contrary, when strong institutions exist, they are able to craft effective solution to address challenges of heterogeneity at both operational and collective choice levels.

4.2.2. Farmers' MWTP for park management attributes

Welfare estimation in terms of farmers' WTP is useful in order to facilitate an up-to-date policy design in environmental valuation. This section aims to estimate tradeoffs between park management attributes. In doing so, parameter estimates from the price coefficient allows to evaluate the change between the Marginal Rates of Technical Substitution (MRTS) in park management attributes and Marginal Utility of Income (MUI) represented by park visitation fee (Azevedo and Corrigan, 2008). Table 11 reports values of marginal WTP, or implicit prices for the estimated park management attributes.

Table 11: Estimation of farmers' MWTP for park management attributes

Variables	Coefficients	t-ratios
Religious Heritage	884.32 (2552)	0.346
Handcraft Material	1469.23 (1169)	1.257
Jatropha Plantation for Biofuel Production	7105.11(2402)***	2.958
Beekeeping Production	6937.98(2274)***	3.052
Mushroom Production	6335.47(2126)***	2.979
Both Plant and Animal Biodiversity	6721.53 (3678)*	1.828
Plant Biodiversity	-348.59 (901.7)	-0.387
Decisions by Government and Farmers	7042.34(3962)*	1.777
Decisions by Government ,Farmers and Private Sector	7799.76(4581)***	1.702

Notes: ***, **, *imply statistical significance at 0.01; 0.05 and 0.1 respectively. Standard errors are in parentheses

WTP values to preserve the park for cultural heritage attributes were not significant at 10 percent level of significance. Farmers' WTP values to protect park production resources ranged from Rwf 6335 (US$9) and Rwf 7105 (US$10.3); Rwf 6938 (US$10). The values are corresponding to the literature (Oeba *et al.* 2012) on the positive contribution of agricultural cash practices on household diets, incomes and therefore improving livelihood through user registered cooperatives (Mulenga *et al.*, 2011).

WTP for improved stakeholder participation in decision making for park management varied from Rwf 7,042 (US$10.2) to Rwf 7,780(US$11.30). The state-owned and centered management decision making process was the least valued. It was followed by the management by both farmers and the government, improved stakeholder participation in park protection, management and conservation had the highest value. A study carried out in Uganda by Adams *et al*. (2003) however concluded that creating multi-stakeholder partnerships for conservation built on revenue sharing is a daunting institutional challenge. Willingness to pay values are in the same range with what Diga et *al.* (2010) found in Rwanda between 2007 and 2010. They argued that household food and non-food expenditure per capita per month when estimated at current prices was valued between

Rwf 5, 250 and Rwf 10, 662. The figures are also within the ranges of amount paid per activity when visiting the park. The park visitation fee per activity, charged as entry fee, varies between Rwf 1,000 and Rwf 30,000 for national adults or children (RDB, 2011).

From the WTP table, park management attributes were ranked according to the highest preferred attribute to the lowest preferred. The most important attributes was decision making, with the highest ranked being government, farmers and private sector; followed by both government and farmers. The second and third attributes were protection of resources for Jatropha plantation and beekeeping production respectively. Lastly conservation of both plants and animals, and conservation of the park through mushroom production in that order.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Summary

This study attempted to analyze farmers' preferences for participatory management of Volcanoes National Park (VNP) in Rwanda. Despite the extensive literature in European countries, there is inadequate empirical evidence dwelling on forest management preferences in developing countries. In addition, only a small number of studies in East African countries focused on marketing research and forest administration and governance. The VNP has been characterized by a fortress conservation method excluding farmers from playing a part in decision making process. This state- centered approach has been blamed for being less effective due to high exclusion cost related to information, monitoring and enforcement. Moreover, despite the roles and function of VNP, its economic value are poorly revealed in market considerations and generally overlooked in the decision making process. Incorporating management attributes, and socio-economic and institutional factors in decision making process would assist park managers with estimating the value associated with conservation of park resources. However, limited information on these value was existent.

Valuation study is a policy oriented discipline that puts monetary value on the park management attributes. The main purpose of the study was to assess farmers' preferences for participatory management of VNP of Rwanda. Specifically, the study intended to characterize management practices and approaches used by park -adjacent community and estimate the monetary value that farmers attach to participatory management attributes. Further, it was hypothesized that farmers attached equal monetary value to all the participatory management attributes in VNP.

The literature highlighted some important contextual issues in the management of VNP. First, the study discussed the features of park participatory management of the park. It also emphasized on the relevance of these features in the context of Rwanda and VNP. These features were the main focus of CE design that was used to assess the economic value devoted to the park. Similarly, the study provided evidences of past studies in environmental valuation. Several studies using different attributes in nature conservation, wetland management, preservation of world cultural heritage we reviewed. Nevertheless, assessing the economic benefits generated by farmers' preference and their willingness to preserve these attributes in an integrated decision making manner is yet to be understood. The application of CE methods on either cultural heritage or biodiversity conservation separately or combined and linking them to participatory management decisions and park production resources would be a needed prerequisite for any economic valuation effort in developing countries. Furthermore, the reviewed literature on approaches for economic valuation of the park differentiated the theoretical difference between use values and non-use values such as passive use values. It was noted that stated preferences (SP) were the appropriate method for analysis of passive use values, and not revealed preference (RP) methods. CE, as SP method, was a more convenient method for analyzing these multi-attributes for participatory management than CVM and would enable approximation of WTP values.

Conceptually, this study was grounded on both the Institutional Analysis and Development (IAD) model and the theory of Collective Action (CA) in management of natural resources. Based on this, the study collected data embracing information on socioeconomic and institutional status of respondents, farm management practices and farmers' perception and attitudes on approaches in decision making for effective conservation and management of the park. In addition, responses to a CE card for farmers' preferences were provided. The management attributes and their levels

were identified through a combined review of literature, FGDs, and consultations with key informants. Park attributes were envisaged to be either compulsory or optional. The latter entered the design and were then involved in experimental design, formation of choice set and measurement of preferences in surveys. A two-stage design comprising orthogonal and efficient were used through preliminary and then final surveys. The survey questionnaire was administered through a face-to-face interview to 192 respondents situated at the foot of the volcanoes corridor in Burera, Musanze and Nyabihu districts.

The results of this study recognized erosion control, animal and crop husbandry as the major farming management practices that increased forest and farm covers. There was low use of agroforestry in the area. Use of untreated water sources was observed whereas the major source of energy for cooking and lighting was found to be firewood. The study further, noted that farmers were mostly concerned with water resources and honey collection in the park despite the law established against such. Farmers were dissatisfied with the current management policy due to inadequate laws governing compensation of losses resulting from human wildlife conflicts or lack of awareness of the current degradation of the park. Farmers' perceptions and attitudes revealed that enhancing tourism development and involving all the stakeholders in decision making process would generate an accurate CE results and should possibly reflect respondents' interests in participatory management of the park.

The results on farmers' preferences indicated that they were willing pay to improve the decision making process involving all stakeholders in the management of the park. They also had positive preferences and were willing to pay to change the current park management situation. This would

aim at protecting plant and animal biodiversity; conserving park production resources and restoring and preserving traditional cultural heritage. Finally, socioeconomic characteristics such as income, education and gender were the major forces driving farmers' preferences for improving park management. Participation in group membership was also a major institutional characteristic for the community preference.

In brief, the study assessed farmers' preferences for participatory management of the park. It characterized farm management practices and approaches along the park corridor and estimated the monetary value farmers attached on its management attributes. The study was also to provide policy makers with insights on policy issues related to forest and land restoration. In addition, the results support the preservation of traditional knowledge through religious heritage and handcrafts making to enhance cultural heritage policy. Moreover, the study promotes the protection of park resources to enhance improved health and nutritional status of the community. These may result into increased rural income, access to safe and improved water services and policies related to tourism revenue sharing scheme through protection of biodiversity and wildlife as well as integrated stakeholder decision making approach.

5.2 Conclusions

This study used both descriptive analysis and CE modelling to explain management approaches, practices and assess the economic value farmers attached to the park resources independent of their direct use for production purposes. The study found that farm sizes in the area were on average small (0.89 acre). These were coupled with low levels of literacy with about 90 percent who attended at most primary school. About 80 percent of the households are engaged in farming activities with average monthly income of Rwf 61,747 ($89.48). All these combined are the major

causes of the park depletion in the area. There is need to improve the literacy level through vocational trainings and diversify incomes through off-farm activities.

The study identified different management practices such as progressive terraces for erosion control; zero grazing, feed and fodder storage for animal husbandry; mono-cropping, crop rotations, residue management systems, and crop-tree practices for crop husbandry management as important to increase farm and forest covers. However, the use of some of these practices such as agroforestry is still low in the area. There is need to improve these practices and adopt other practices such as radical terracing, intercropping that might increase the green cover in the forest and farms.

The study also recognized three major sources of water in the area; public spring and piped water, water flowing from the park, and rainwater harvesting tanks. More than 20 percent of respondents used untreated water, and firewood as the major source of energy. This implies that farm and forest resources are overexploited. Energy saving cooking stoves should therefore be introduced to curb exploitation arising from used of firewood.

The study revealed that short distances to infrastructural facilities could positively contribute to forest resources conservation. With nearest infrastructural facilities the community can easily access employment and business opportunities. This would reduce the dependence on forest resources.

Farmers' perception on park management revealed that integrating all stakeholders in planning and management decision making is the most preferred approach to conservation. This means that farmers and private sector should be included in all aspects of decision making. Water collection and honey harvesting were the major activities undertaken by farmers inside the park. This reveals

that, although farmers participate in park conservation, illegal activities are still being carried out inside the park which is a challenge to conservation.

Findings from the CE study revealed that farmers preferred preserving the park mostly for handcraft production. This implies the high value they attach to park resources for preservation of cultural tourism and knowledge. The results also indicated high preferences in protecting both plants and animal biodiversity rather than either plants or animals only. This explains that regardless of the rampant animal wildlife conflict, farmers understand well the role and benefits of tourism to them and to the country in general. Moreover, farmers prefer a system whereby all stakeholders participate in decision making for park management and where decisions are made by both farmers and government to improve the current management by government only. This helps farmers to have self-responsibility in the planning, management and use of natural resources. In addition, positive preferences when income is in interaction with water and religious heritage revealed that increase in income increases the quality of life such as recreational activities and improved water quality. A negative preference for gender-interacted with religious heritage may be explained that females are mostly engaged in households' activities and are inclined to park resources degradation.

The findings also indicated that educational levels and group membership positively influenced individual preferences in preserving the park through an integrated decision making process. This shows how increase in knowledge through education and group sharing increases farmers' level of environmental consciousness for cultural tourism development and participation in decision making. Therefore, membership in CBO or social group improves farmer's participation in collective action for resources management. To this end, farmers showed high preferences and were willing to pay more to improve decision making from the centered-state approach to an

intermediate decision making by a partnership between farms and government to the improved integrated multi-stakeholder decision making process. WTP to protect both plant and animal diversity for tourism development was higher than respective WTP to conserve park production resources and WTP to preserve the cultural heritage attributes.

5.2 Policy implications

Findings from this study pointed out policy options to improve future prospects in management of natural resources in Rwanda. Results on inadequate management practices would inform policy makers on measures in areas of forest, water, and soil conservation. The information would in turn assist farmers to improve farming practices in order to increase farm and forest cover. Placing the park within the socio-economic and institutional contexts provides insights on management approach that would increase participation in farmer cooperatives and create new income generating activities. These would encompass off-farming activities such as crafts making for cultural tourism and opening new business and employment opportunities in the study area as a result of tourism activities. Local community will also be effectively involved in participating in every aspect of the identification, planning and management of the park.

Results of farmers' preference for restoring and preserving traditional religious heritage and protecting handcrafts products informs that Ministry of Sports and Culture in collaboration with Rwanda Development Board's tourism and conservation unit should promote strategies that will reinforce the restoration of the park. It would also integrate traditional religious heritage and crafts making development in conservation decisions to enhance cultural heritage (tourism) policy.

Information on preferences to protect park production resources informs the Ministry of Agriculture and Animal Resources together with Ministry of Health on agricultural schemes that

promote environment- friendly low input, high potential and prolific small-scale farm enterprises to increase their income and enhance food, nutritional and health policies.

Currently, the laws and strategies governing human-wildlife conflict compensation and employment provision in the area are not well established. Farmers' preferences to protect both plant and animal biodiversity informs on awareness and ownership on natural resources protection, conservation, management and utilization by user community that would meet current needs and future demands. It also advises different investment opportunities in the park area related to tourism industry, culture and agribusiness development. Moreover, farmers' desire to protect the biodiversity informs the Ministry of Agriculture and Animal Resources together with Ministry of Environment and land (MINERA) in designing environmental protection programs. This may include Payment of Ecosystem Services (PESs), carbon finance and park tourism revenue sharing. Positive preferences for improved stakeholders decision making for park management implies that the government should revise the current approach and establish one that would improve planning, management, conservation and law enforcement in park resources allocation.

Findings on low levels of literacy, small farm sizes, and lack of income diversification, together with positive preferences of interaction of income and management attributes implies that RDB should empower farmers through vocational trainings in different off-farm activities such as craft, tailoring, and modern stove making that will increase their incomes and livelihood.

Information on positive preferences for high income and cooperative members on water resources preservation informs the Ministry of Infrastructure together with RDB that they should develop strategies of long-term investments in improved water quality provision. Access to safe and clean water should be a precondition for improving environmental and human health therefore improving environmental conservation.

Finally, results of socioeconomic characteristics such as education, gender and income affecting farmers' preferences informs RDB with Ministry of Gender on the design of programmes aimed at empowering women on environmental awareness, income generating activities, and livelihood diversification.

5.3 Contribution to knowledge

This study contributes to agriculture and resources economics literature in different ways. The characterization adds to the existing literature on management practices aimed at increasing forest and farm covers in the area. Recent studies have been focusing on forest administration and governance, socioeconomic impact of the park on rural livelihood in developing countries. This study builds on this literature and identified approaches for effective park management in Rwanda. In addition, the study aimed to estimate the monetary values devoted to protected natural resources like VNP. This has never been measured with regard to environmental valuation studies in Rwanda and elsewhere in the region. Scarce literature is found in valuation of market goods. The valuation would inform park managers on the benefits that would be accrued if the desired management approach is put in place.

The study offers insights into approaches for an effective integrated multi-stakeholder decision making on park management. A limited number of studies is found on benefits sharing schemes in protecting mountain gorilla in park areas. Small holder farmers in Rwanda critically depend on local ecosystems for survival. They are also affected by the changes in availability of goods and services such as water, medicinal plants and firewood among others. High values attached to them would inform on how different stakeholders would share the benefits generated by protecting these services. It would also enhance mechanisms that prevent the loss of the ecosystem services that are important for food, fiber, fuel and water for the rural poor in Rwanda. Further, the management

approaches, practices, preferences for the park management attributes and their welfare estimation has not so far been documented in environmental studies in countries like Rwanda. Therefore, this study provided literature on this area of knowledge in areas of environmental economics in Rwanda.

5.4 Limitations and further areas of research

This study focused on characterizing management practices and approaches in the area within one Kilometre from the park. The study focused also on the economic value farmers attached to park management attributes. This study contributes to the limited literature on assessing park management that will increase farmer's awareness and self-responsibility to conserve the park and increase both park and farm covers. It also provides policy makers with management approaches that would empower farmers in collective participation in the management of environmental goods such as National Parks in Rwanda.

Furthermore, the estimation of economic values for park management attributes is one of the pioneer studies in environmental valuation studies conducted in Rwanda. The findings will inform on the design of programmes that will improve the livelihood of the community adjacent the park. Since the data could not allow the estimation of RPL, further research should focus on preference heterogeneity in management conservation of National Parks. Studies should be carried out on cost benefit analysis of human wildlife conflict compensation since farmers showed their desire to collaborate with other stakeholders to protect both plants and the animals. Finally, studies on cultural heritage aspects of the park should be carried out since, although farmers have showed preferences over them, currently their practices are despised.

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APPENDICES.

Appendix 1: Household survey questionnaire: VNP in Rwanda

I. INTRODUCTION TO THE RESPONDENT

Hello, my name is ……..…… Thank you for agreeing to participate in this interview. This research is being carried out by a researcher MSc student in Agricultural and Applied Economics, University of Nairobi. The purpose of this study is to assess farmers' preferences for participatory management of Volcanoes National Park and we have been granted permission to talk to people by RDB-TC and the Sector authority. Most of the questions are related to your preferences for management of VNP and when answering, please remember that there are no correct or wrong answers.

II. Information of Household Members

Form Number: ……..

Name of enumerator: ……..... Date: …….

Name of respondent: …… Village: ……...

Cell: …… Sector: …… District: ……..

Phone number: …… ID No: …….

A. Socioeconomic Characteristics of Respondents

1.Age	……
2. Gender	1.Male 2.Female
3. Marital status	1. Single 2.Married 3.Widowed 4. Others
4. Main occupation	1. Farming 2. Off-farming 3. Both farming and off-farming
5. Education level	1. No schooling 2.Primary 3. Artisan 4. Secondary 5. University degree

6. How many people normally live in your household? ……

How many are over 18 years in your household…….?

7. What is your daily and monthly income in your household……..?

Income category	**Person 1**	**Person 2**	**Person 3**
1. Daily income per person			
2. Total daily income			
3. Total monthly income			

B. Farm characteristics and management practices

Do you own land at 5 Kilometers from the park?

1. Yes 2. No

9. Do you have other farmlands somewhere else far from VNP?

1. Yes 2. No

10. What is your total farm size? ……. (m^2).

11. What are the main crops do you grow on your land near the park? …….

……..

12. 1. Do you normally use some management practices in your farm near the park?

1. Yes 2. No (skip to next question)

2. If yes, using a scale from zero to five where 0= not applicable; 1= never applied; 2= rarely applied; 3= mostly applied; 4= always applied explain how often have you applied the following soil conservation practices in your farms for the last five years.

1.Erosion control	Not applicable	Never	Rarely	Mostly	Always
1.Construction of AE ditches					
2.Radical terracing					
3.Progressive terracing					
4.Conservation buffers					
5.Others (specify					

2.Animal husbandry	Not applicable	Never	Rarely	Mostly	Always
1.Zero grazing					
2.Fodder bank production					
3.Grazing in the national park					
4.Others (specify)					

3.Crop farming systems	Not applicable	Never	rarely	Mostly	Always
1.Traditional mixed cropping					
2.Intercropping					
3.Monocropping					
4.Mulching					
5.Intergrated crop-animal system					
6.Crop rotations					
8.Residue management					

4.Types of agroforestry practices	Not applicable	Never	rarely	mostly	Always
1.Agrisilvicultural (crop-tree system)					
3.Silvopastoral (animal (pasture)- trees system					
3.Agrosilvopastoral (crops, pasture and trees)					
4.Apiculture with trees					

13. What are the sources of water in your household?

a.Sources of water			
1.Water from VNP	2.Rainwater harvesting tank	3.Public water tanks	4.Others

14. Energy Utilization

What are sources of energy in your house and explain whether you use them for cooking and lighting.

a. Source of energy for cooking and lighting	b. Cooking	c. Lighting
1.Firewood		
2.Biogas		
3.Electricity		
4.Solar energy		
5.Fuel		
6.Others (specify)		

c. Institutional factors and Level of environmental consciousness

15. Are you a member of any Community Based Organizations (CBOs)/cooperatives?

1. Yes 2.No

The name of the CBO……

16. Does your CBO have any roles or activities related to management of Volcanoes National Park?

1. Yes 2. No

17. If yes, what are the major activities/roles your CBO is involved in? .....
…….

18. What is the distance to the nearest infrastructure facilities and how long it takes you?

a.Infrastructure facilities	b. Distance in km	c. Time used
1.School		
2.Health Centre		
3.Market		
4.Road		
5.Others		

19. What do you think is your role in the management of Volcanoes National Park as a farmer?
……

20. How important is the decision making on park management is for:

	1.Very important	2. Important	3.Less important	4.Not important at all
1.Government only				
2.Government and famers				
3.Government, Farmers and Private Sector				

21. How often have you been involved in the following activities in and from the park?

Sources of income	**Never**	**Rarely**	**Quite often**	**Very often**
1.Mushroom farming				
2.Water collection				
4. Beekeeping production (Honey)				
5. Handcraft products making				
6. Medicinal plants harvesting				
7.Worship in the forest				
8. Others (specify)				

III. a. CHOICE EXPERIMENT

22. 1. Using a scale of 1 to 4, where 1 = strongly disagree and 5 = strongly agree, could you please indicate your thinking in the following statements (about VNP).

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I consider the current degradation status of VNP as critical					
I am well satisfied with the current management policy					
Tourism development is a key to conservation of wild animals and plant species					
Government can involve farmers and private sector in decision making to improve the current park management					
User cooperatives should be allowed to carry out some activities in the buffer zones (water, mushroom and honey collection)					
VNP should be used to preserve our traditional cultural heritage including handcraft making and traditional medicine					
VNP should have a place that is meant for traditional beliefs and cults of worship for ancestors to preserve our traditional religion to the future generation					

Introduction to VNP management levels

VNP makes a significant contributor to national economy, environmental protection and cultural preservation. However, the Park is highly degraded (rate of 63percent) to extinction due to anthropogenic activities. The organic law no 04/2005 for protection, conservation and promotion of environment was put in place despite illegal activities still being carried out such as collection of water, mushroom and beekeeping production which accelerate some other activities suc as forest fire, poaching, and others.

Assume that there is no such law and there are no other organization in charge of this protection and conservation, thus no measures regarding the protection of VNP. This will have an impact on community welfare in this area such loss of soil fertility and productivity, increase of climate change effects, loss of endemic species, loss of jobs, among others.

Suppose the GoR, want to improve the current VNP management status through a stakeholder (Government, famers and NGOs) participatory approach. In this case, cooperative of farmers will be allowed to carry out some enterprises in the buffer zone (water, mushroom and beekeeping) by ensuring their responsibilities in park management.

Therefore, the following regulations will be required in order to participate in VNP management:

1. Compulsory regulations

- Respect the organic law no 04/2005 determining the modalities of protection, conservation and promotion of environment
- Only farmer cooperatives are required to engage in permitted enterprises in the buffer zone
- Participating farmers will ensure their role in protecting animals and plant biodiversity for tourism development
- Participating farmers or national tourists will be paying an entry fee of 3500 RwF; 3750 RwF and 4000 RwF respectively when visiting the . Therefore, the following attributes and levels were formed for VNP management:

Attributes	**Management levels**
Cultural Heritage	Place of worship
	Medicinal plants
	Handcraft Products
Permitted enterprises	Beekeeping production
	Mushroom production
	Water collection
	Jatropha planting for biofuel production
Tourism Development	Both animal and plant
	Wild Animals
	Plant Biodiversity
Decision making (DM) on Park Management	DM by Gvt only
	DM by Gvt + Farmers
	DM by Gvt + farmers + P sector
Park Visitation Fee	3500 RwF
	3750 RwF
	4000 RwF

22.2. I would like to show different management scenarios and their options that can be made by combining the above attributes and their levels. You are requested to compare them carefully and indicate which one you prefer than others.

PROFILE ONE

Scenario 1

Attributes	**Alternative A**	**Alternative B**	**Neither A nor B**
Cultural Heritage	Handicraft	Religious Heritage	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Animal	Both Animal and Plant	
DM on Park Management	Govt only	Govt only	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 2
Scenario 3

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Religious Heritage	Handcraft	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Both Animal and Plant	Animal	
DM on Park Management	Govt only	Govt and famers	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Religious Heritage	Handcraft	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Animal	Animal	
DM on Park Management	Govt, Farmers and Private sector	Govt, Farmers and Private sector	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 4

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Plants	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt and famers	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 5

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Mushroom	Water	
Tourism Development	Animal	Animal	
DM on Park Management	Govt, Farmers and Private sector	Govt and famers	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 6

Attributes	**Alternative A**	**Alternative B**	**Neither A nor B**
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Animal	Plants	
DM on Park Management	Govt only	Govt only	
Park Visitation fee	4000 RwF	3750 RwF	
Which one would you prefer?			

Using a scale of 1 to 4, where 1 = never considered and 4 = always considered, how much consideration were you giving to each of the participatory management attributes in the choices you have made

VNP Management Attributes	**Never considered**	**Sometimes considered**	**Mostly considered**	**Always considered**
Cultural Heritage				
Permitted Enterprises				
Tourism Development				
DM on Park Management				
Park Visitation fee				

22.4. Were you considering and comparing all attributes before you made a choice?
Yes……. No ……
22.5. Is there any other factor that influenced your responses to the choice experiment questions besides the information given? .....

b. Other Profiles

PROFILE TWO

Scenario 7

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Mushroom	Water	
Tourism Development	Animal	Animal	
DM on Park Management	Govt and famers	Govt only	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 8

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Animal	Animal	
DM on Park Management	Govt only	Govt only	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 9

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Mushroom	Jatropha	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt and famers	Govt and famers	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 10

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Water	Water	
Tourism Development	Both Animal and Plant	Plants	
DM on Park Management	Govt only	Govt, Farmers and Private sector	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 11

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Mushroom	Water	
Tourism Development	Animal	Animal	
DM on Park Management	Govt only	Govt only	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 12

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Medicinal	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Plants	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt and famers	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

PROFILE THREE

Scenario 13

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Beekeeping	Water	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt, Farmers and Private sector	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 14

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt and famers	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 15

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt only	Govt, Farmers and Private sector	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 16

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Beekeeping	Water	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt and Farmers	Govt, Farmers and Private sector	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 17

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Handcraft	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt and Farmers	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 18

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Mushroom	Water	
Tourism Development	Animal	Animal	
DM on Park Management	Govt, Farmers and Private sector	Govt, Farmers and Private sector	
Park Visitation fee	3750 RwF	3500 RwF	
Which one would you prefer?			

PROFILE FOUR

Scenario 19

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Mushroom	Water	
Tourism Development	Both Animal and Plant	Animal	
DM on Park Management	Govt and Famers	Govt, Farmers and Private sector	
Park Visitation fee	4000 RwF	3750 RwF	

Scenario 20

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt and Famers	Govt only	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 21

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt and Famers	Govt and Famers	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 22

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Mushroom	Mushroom	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt only	
Park Visitation fee	3750 RwF	3500 RwF	
Which one would you prefer?			

Scenario 23

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt only	Govt and Famers	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 24

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Medicinal	
Permitted Enterprises	Mushroom	Water	
Tourism Development	Animal	Animal	
DM on Park Management	Govt, Farmers and Private sector	Govt and Famers	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

PROFILE FIVE

Scenario 25

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt and Famers	Govt only	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 26

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Plant	Animal	
DM on Park Management	Govt and Famers	Govt only	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 27

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt and Famers	Govt, Farmers and Private sector	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Scenario 28

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Water	Beekeeping	
Tourism Development	Animal	Animal	
DM on Park Management	Govt only	Govt and Famers	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 29

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt only	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 30

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Jatropha	Mushroom	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt, Farmers and Private sector	Govt, Farmers and Private sector	
Park Visitation fee	4000 RwF	3750 RwF	
Which one would you prefer?			

PROFILE SIX

Scenario 31

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Animal	Animal	
DM on Park Management	Govt and Famers	Govt only	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 32

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Plant	Both Animal and Plant	
DM on Park Management	Govt only	Govt only	
Park Visitation fee	3750 RwF	3500 RwF	
Which one would you prefer?			

Scenario 33

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Handcraft	Worship	
Permitted Enterprises	Jatropha	Beekeeping	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt and Famers	Govt, Farmers and Private sector	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 34

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Worship	Handcraft	
Permitted Enterprises	Beekeeping	Jatropha	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt only	Govt and Famers	
Park Visitation fee	4000 RwF	3500 RwF	
Which one would you prefer?			

Scenario 35

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Medicinal	
Permitted Enterprises	Water	Mushroom	
Tourism Development	Animal	Plant	
DM on Park Management	Govt only	Govt, Farmers and Private sector	
Park Visitation fee	3750 RwF	3750 RwF	
Which one would you prefer?			

Scenario 36

Attributes	Alternative A	Alternative B	Neither A nor B
Cultural Heritage	Medicinal	Handcraft	
Permitted Enterprises	Mushroom	Jatropha	
Tourism Development	Both Animal and Plant	Plant	
DM on Park Management	Govt and Famers	Govt, Farmers and Private sector	
Park Visitation fee	3500 RwF	4000 RwF	
Which one would you prefer?			

Appendix 2: Focus group discussion checklist questionnaire

This FGD will help to obtain preliminary insights and validation on VNP participatory management attributes. To assess preferences ion VNP, farmers will put value on management attributes that they think should help to improve the management of VNP. Attributes of VNP are its main characteristics or features. They include compulsory of regulatory that are necessary for protection and conservation of the park whereas optional are chosen to include park management.

Current VNP management situation:

The organic law no 04/2005 for protection, conservation and promotion of environment was put in place despite illegal activities still being carried out such as collection of water, mushroom and beekeeping production which accelerate some other activities suc as forest fire, poaching, and others. Assume that there is no such law and there are no other organization in charge of this protection and conservation, thus no measures regarding the protection of VNP. This will have an impact on community welfare in this area such loss of soil fertility and productivity, increase of climate change effects, loss of endemic species, loss of jobs, among others. Suppose the GoR, want to improve the current VNP management status through a stakeholder (Government, famers and NGOs) participatory approach.

1. Assume the GoR would like to improve the management and decision making process of VNP, what are the attributes would you advise to include in it?

a. State which ones you think should be compulsory

……..

……

……

b. State which ones you think should be optional

……..

…….

……..

2. What do you think about the following attributes and their levels?

3. VNP should have a place that is meant for traditional beliefs and cults of worship for ancestors to preserve our traditional religion heritage to the future generation. It should also used for traditional medicines and handcrafts making to preserve our cultural heritage as per Rwanda Cultural policy.

- Dou you agree or disagree…….?
- What are the features do you think should be included to preserve our cultural heritage for future generation……...?

4. VNP should have a buffer zone where farmers should carry out enterprises in their respective registered cooperatives as well as where to collect water. This is to ensure their responsibility not to carry out some illegal activities inside the park.

- Dou you agree or disagree…….?
- The following enterprises have been thought of: beekeeping, mushroom and Jatropha and water collection. Do you think they are relevant.....?
- Which ones you think should be included.....?

5. Protection of plants and animals for national income and rural employment is essential for Tourism development attribute. Dou you think the following levels are relevant?

- Protection of both plant species and endangered animal, ……? Yes or No.
- Protection of both plant species only……..Yes or No
- Protection of endangered animal……Yes or No
- What do you think should be included.....?

6. To ensure responsible participation in decision making, access, use and management of the park, decision making on park management should be done through participation by different stakeholders.

- Do you agree or disagree.....?
- What if decision making on park management is done by the government only…….
- What if decision making on park management is done by both Government and Farmers only……
- What if decision making on park management is doney Government, Farmers and the Private Sector…….?

7. Park Visitation Fee for national tourists was estimated to 3500 RwF as the basis for entrance fee. This is regarded as the amount of money farmers can pay to help government generate VNP income towards improving the conservation of the park since it cannot sustain all conservation costs.

- Do you think the following amount makes sense? 3500 RwF; 3750 RwF; 4000 RwF?
- What do you think should be the entrance fee for the nationals.....?

8. Therefore, the following attributes and their levels were chosen to include VNP management scenarios,

VNP attributes	**VNP Management levels**
Cultural Heritage	Place of worship
	Medicinal plants
	Handcraft Products
Permitted enterprises	Beekeeping production
	Mushroom production
	Water collection
	Jatropha planting for biofuel production
Tourism Development	Both animal and plant
	Wild Animals
	Plant Biodiversity
Decision making on Park Management	DM by Govt only
	DM by Govt + Farmers
	DM by Govt + farmers + Private sector
Park Visitation Fee	Rwf 3500
	Rwf 3750
	Rwf 4000

Appendix 3: Conditional logit commands used in the analysis

```
Title; CL model of VNP management attributes with socioeconomic and institutional characteristics$
CLOGIT ;Lhs=CHOICE
   ; CHOICE= a,b,c
   ;Rhs=TREHE,HAPR,JPBP,BEPR,MUPR,BANPL,PLBIO,DMGF,DMGFP,PVF,
       INCOTRE,INCOMWA,GETRE,AGEGTRE,
       EDUCTRE,EDUCWACO,EDUCDMGF,CBOMEWA,CBOMEDMG$

Title; WTP for VNP management attributes (CL model)$
WALD; Labels=b1, b2,b3,b4,b5,b6,b7,b8,b9,b10,
          b11, b12,b13,b14,
          b15, b16,b17,b18,b19
   ;start=b
   ;Var=Varb
   ;Fn1=-1*(b1/b10)
```

```
;Fn2=-1*(b2/b10)
;Fn3=-1*(b3/b10)
;Fn4=-1*(b4/b10)
;Fn5=-1*(b5/b10)
;Fn6=-1*(b6/b10)
;Fn7=-1*(b7/b10)
;Fn8=-1*(b8/b10)
;Fn9=-1*(b9/b10)
;Fn11=-1*(b11/b10)
;Fn12=-1*(b12/b10)
; Fn13=-1*(b13/b10)
;Fn14=-1*(b14/b10)
;Fn15=-1*(b15/b10)
;Fn16=-1*(b16/b10)
;Fn17=-1*(b17/b10)
;Fn18=-1*(b18/b10)
;Fn19=-1*(b19/b10)$
```