Assessing the value farmers attach to Volcanoes National Park management atrtributes in Rwanda: a choice experiment approach

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Abstract

Despite the roles and functions of natural forests on the livelihood of the rural communities, their economic values are poorly reflected in market considerations and largely ignored in the decision making process. There is inadequate empirical evidence detailing forest management preferences in developing countries including Volcanoes National Park (VNP) in Rwanda. VNP has a considerable contribution to Rwandan rural livelihood, global environmental protection and cultural heritage. This study aimed at assessing the monetary values farmers attached to VNP. A Choice Experiment approach and Conditional Logit model were used to a sample of 192 farmers living along the park corridor using a semi-structured questionnaire. Data obtained were analyzed using Nlogit 3.0. The results showed that farmers preferred to improve the current VNP management and were willing to pay for its participatory management attributes. Farmers' characteristics significantly influenced preferences. The findings have implication on programmes that improve the current park management and on the design of vocational, farmer groups and gender-based environmental awareness and promotional programs.

Key Words: Choice Experiment, Farmers, Participatory Management Attributes, Volcanoes National Park.

1. Introduction

Natural forests provide ecosystem services and contribute to the livelihood of the rural communities. Globally, 600 million people depend on forest resources while 65%in the rural area of Sub Saharan Africa (SSA) rely on forests for subsistence reasons (World Bank, 2004 & Center for International Forestry Research (CIFOR, 2009). In Rwanda, this dependence is high for about 80% of the workforce due to urbanization, population growth and small farm sizes (National Institute of Statistics of Rwanda [NISR, 2012]). In addition to the above, concerns about the impact of climate change and loss of bio-diversity raise as the demand for environmental solution is growing.

Rwanda has a total land area of 26,366 Km^2, out of which 8.4% is under protected areas (Martin et al., 2011). The country is covered by diversified ecosystems consisting of mountain rainforests including Volcanoes National Park (VNP); gallery forests, savannas, wetlands and aquatic lands (Government of Rwanda [GoR, 2009a]). These ecosystems have great impact on rural livelihood, global environmental protection and cultural heritage and, particularly, VNP is the major contributor to the national economy and the third source of income through mountain gorilla-based tourism. However, the effects of its degradation as a result of natural and anthropogenic activities remain a concern for important stakeholders. VNP has been characterized by a fortress conservation approach that excludes participants from park management decision making process. This state-centered method has made park management less effective due to high exclusion costs linked 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).

The VNP is protected under the article 96 of the organic law number 04/2005 determining the modalities of protection, conservation and promotion of environment. Due to high exclusion cost nature of the resource system, this law has created incentives for free riders translating into a market failure. As a solution, the GoR has established a 5% of VNP revenues to support community projects that should compensate the opportunity cost of foregone park users and practices (Rwanda Development Board [RDB, 2013]). Mukanjari et al. (2013) observed 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 values associated with preserving its resources. Nevertheless, limited information on these values is observed. It is crucial to assess the economic values attached to VNP 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. Chuang-Zhong et al. (2001) evaluated nature conservation program in Finland. Respondents had

positive Willingness to pay (WTP) for planning methods and nature preservation attributes. Protection of production resources of the nature and its cultural heritage was not incorporated, the inclusion of which would provide a much more accurate estimates of the existing nature of the resource. It would also improve knowledge about the benefits generated by the same attributes on management of natural resources.

Mazzanti (2003), assessed visitors' WTP for incremental changes in services associated with preserving the cultural institutions of the worldwide known heritage site (WHS) in Rome. Figures of economic surplus indicated positive preferences to conservation activities, access policy and cultural services attributes. Likewise, cultural institution attributes like terraced vineyards; landscape mosaic with agricultural diversity and traditional settlements were used by Gomes et al. (2013) to assess the value of participating in a preservation program of world heritage and was positively determined by the income levels of respondents. However, particular care must be devoted to its cultural religious, medicinal and crafts making values that would be linked with a participatory management regime. Accommodating these values would advise future management decisions regarding sustainable conservation of the WHS resources. Colombo et al. (2005) valued the design of a policy for reducing off-farm impacts of soil erosion in Spain. Respondents stated their preferences for programmes which result in less desertification, better water quality, more biodiversity, and more local employment. More research is needed on programmes and policies that have long term repercussions on management decisions of natural resources. The values assigned to them would be imperative in designing programmes that improve production resources, enhance tourism development and increase rural livelihood.

Birol et al. (2006) identified open water surface area, research and education, and retraining of farmers attributes to valued wetland management in Greece. Attributed were positively associated with factors like high levels of environmental consciousness, income and education that were likely important to improve wetland management scenarios. Limited evidence exists on the relationship between management attributes of park resources and community characteristics in developing countries and mainly VNP in Rwanda. Determining preference heterogeneity is likely required to inform benefits resulting from an integrated decision making approach with socio-economic and institutional aspects of the communities. Cerda et al. (2012) assessed public economic preferences for biodiversity conservation and water supply of the Biosphere Reserve in Chile. WTP was positively associated with included attributes related to biodiversity and water conservation. Less is known on the value of these attributes in conjunction with other types of biodiversity management related to production resources and cultural heritage. It would be informative to include these landscape features and the payback they may generate while ensuring preservation plan of resources. Participatory management requires the activate involvement of all the stakeholders in managing production resources, preserving cultural heritage and conserving biodiversity. Assessing benefits generated by farmers' preference to

preserve the VNP in an integrated decision making manner would be imperative to understand economic values attributed to its management attributes.

Economic valuation implies that farmers assign a monetary value to the park in terms of use and/or passive use values (Louviere and Hensher, 2000).Use values have a traceable economic behavior associated with direct utilization and ecological functions of VNP resources. These functions support non-consumptive uses essentially carbon sequestration, nutrient cycling among others (Kniivilä, 2004). Passive use values instead have no clear behavioral trail. Use values include both option and bequest use and are defined as an individual's WTP for an environmental good, though he may be barred from making any active use of it. Hicksian welfare measures for a change in environmental quality like Compensating Surplus (CS) and Equivalent Surplus (ES) are appropriate for their measurement.WTP or WTA are often used as substitute's names for CS or ES respectively (Hanley et al., 2009).

A growing number on environmental valuation studies applied hedonic price and travel cost methods to assess use values (Wattage, 2008; Azevedo &Corrigan, 2008; and Vásquez, 2011). Other studies by (Madureira et al., 2011; Lindhjem &Mitani, 2012; Horne, Boxall & Adamowicz, 1998) employed Contingent Valuation (CVM) for hypothetical statements for improvement in environmental quality and wetland management. A multi-attribute CE has then increasingly become an extension of CVM to value passive use values such that farmers can state their preferences over VNP management attributes. Its use is central in better characterizing the management implications of some aspects of the park.

The study employed a Choice Experiment (CE) approach to assess the monetary values attached to VNP participatory management attributes. CE has gain wide applications in conservation of nature, wetlands, biodiversity and management of water resources in developed countries like Finland, Portugal, UK, Spain and Greece, (Chuang-Zhong et al., 2001; Birol & Das, 2010; Lim & Maynard, 2012; Lambrecht et al., 2013). It was also applied to value rural development, water supply programs and landscape management attributes (Hanley et al., 2009; Scarpa et al., 2009; Millán & Torreiro, 2011; Cerda et al., 2012). The approach was expanded to tourism and leisure studies over the past thirty years and then to cultural institutions attributes (Semeniuk et al., 2008; Mazzanti, 2003). A few empirical literatures in developing countries is found using CE in marketing research in Ethiopia (Kassie, Abdulai & Wollny, 2009); Kenya (Otieno, Ruto & Hubbard, 2011) and Uganda (Kikulwe, Wesseler & Falck-Zepeda, 2011). Little has been searched on park participatory management in developing countries including VNP in Rwanda. This paper extends to estimate the value of the park by highlighting farmers' preferences and their willingness to preserve its management attributes which include cultural heritage; production resources; plant and animal biodiversity in an integrated decision making manner.

The values devoted to VNP management attributes inform on programs that would increase employment opportunities. The focus will be on vocational trainings for SMEs, handcraft

products making, and development of cultural tourism which would improve livelihood in the area. Further, the study contributes to the national forestry strategic plan and other policies aimed to improve cultural heritage in addition to food, nutritional and health programs. It promotes gender-based and environment-friendly cooperatives and informs on access to improved water services to enhance quality water supply. It also contributes to the targets set for Economic Development and Poverty Reduction Strategy (EDPRS) and Vision 2020 in Rwanda. Lastly, the paper is in line with pillar one and seven of the Millennium Development Goals (MDGs). The two pillars aim at respectively, eradicating poverty and hunger and ensuring environmental sustainability.

The paper is structured as follows. While Section 1 provides background information, Section 2 describes the management features of the park. Section 3 outlines the design and implementation of the choice experiment approach. Section 4 reports the findings whereas section 5 draws conclusion for program designs and policy improvements.

2. Description of VNP Management Features

Volcanoes National Park lies along 1° 21'-1° 35' South and 29° 22'- 29° 44' East in North-Western Rwanda. It is adjacent to the Virunga National Park in DRC and Mgahinga Gorilla National Park in Uganda. The area 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 inhabitant per km^2). The communities adjacent have remained with little opportunity for diversification into off-farm sources and limited investment in tourism business and culture industry (Owiunji et al., 2004).

VNP harbors most of endangered species, fauna and flora with a total of 86 mammals, 258 birds, and 878 plants species protected at national and international levels (Bush et al., 2010). The park is well known for its warm climate (Pavageau, Butterfield & Tiani, 2013). The climate is favorable for mushroom production well suited to Rwanda smallholders in the rural household due to its improved phytonutrient intake and beekeeping production, important to reduce the National Poverty Index estimated at 40.9% in the area (GoR, 2009b). Additionally, water availability in the VNP area is vital for improved ecological functions in terms of cropping, livestock watering among others. Lastly, Jatropha is essential for biofuel production due to its necessity to overcome the threats such as rising costs of fossil fuels, land degradation, climate change and rural poverty (Pavageau, Butterfield & Tiani, 2013).

VNP has been important as well for the preservation of cultural heritage through use of medicinal plants for traditional medicine and cultural tourism. This has been central for job creation, development of new infrastructure and sale of handicraft products. Its necessity relies on visiting traditional religious heritage as source of intellectual and cultural property rights in their former ancestral territories which helps improve cultural exchanges and raise the living

standards for the local people. In the face of this, the local communities have been excluded from both conservation and decision making.

3. Choice Experiment (CE) Approach

3.1.Definition of variables

The study used primary data sources to assess farmers' preferences to improve the current VNP management regime. Primary data consisted of management attributes and levels using CE survey in addition to socio-economic, farm and institutional behavior and characteristics of respondents. Information from these variables would influence preferences since they are significant sources of heterogeneity in preferences.

VNP management attributes along with socioeconomic and institutional characteristics were postulated to influence farmers' preferences. Age was important since conservation and participation decisions depend much on expectation about the future. Old farmers are likely to exhaust VNP resources unlike young farmers that may care about future generation but when focusing on social norms and position, older people may have positive effect. Income was positively hypothesized to increase farmers' preferences due to the luxury characteristic nature of the environmental quality that increases desire for recreational demand as income increases. Gender was incorporated and it was expected that being male improves and positively influences preferences than their counterpart. This is because men and women have different roles and responsibilities in the house that may enable some and prevent others from participating in decision making process. Farmer's level of education was postulated to increase farm practices and preferences since more educated farmers are environmentally conscious than the less educated ones. Farmers involved in off-farming as the main occupation were assumed to increase farm and forest covers as they might depend less on park resources therefore exhibit positive attitudes and preferences. Farm sizes have been positively correlated with forest resource conservation. 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 preferences. Families with more labor can mobilize part of it for forest dependent activities while maintaining the labor supply for management purposes and therefore can practice multiple soil management practices. Contrarily, large families may have few resources to meet their subsistence needs and high propensity to extract resources from the reserve. Infrastructure facilities were expected to increase the livelihood of the community. Farmers may involve in other business activities and employment opportunities so that they may depend less on VNP resources. Group membership was hypothesized to increase collective action and therefore participating in farmer groups may positively influence preferences and improve forest cover.

The management attribute such as cultural heritage was provided in three levels: traditional religious heritage, medicinal plants and handcrafts production. The attribute intends to protect traditional knowledge heritage through cultural tourism and sales of handcraft products and therefore improve rural livelihood. Park production resources attribute was provided in four levels: production of mushroom, beekeeping, jatropha and protection of water resources. Mushroom is the most versatile and prolific agriculture and forestry venture that was expected to improve nutritional values in the area. Beekeeping production was considered due to its relevance to reduce the National Poverty Index in the area and to the role it plays for income generation and biodiversity conservation. Protection of water resources was seen to be important for improved cropping agriculture practices while providing other ecological purposes (Pavageau, Butterfield & Tiani, 2013). Jatropha plantation was necessary to overcome the threats related to climate change and rural poverty.

Table1: Definition of variables used in the study

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	+
Farming Practices	(1= a measure of farm and forest cover of whether the respondent use at least two farm management practices, 0 otherwise).	-
Infrastructure development	Average distance to infrastructure facilities in Kilometers (Km)	+
Group membership	(1= member of CBO ; 0 otherwise)	+
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** (Frw3500, Frw3750, Frw400)	-

Source: VNP survey design (2014)

The third attribute, tourism development, was provided in three levels: protecting both wild animal and plant biodiversity of national and global importance, protection and conservation of either wild animals alone or plant biodiversity alone. The fourth attribute was provided in three different levels with regard to decision making for VNP management. Decision making by government only defined the current management situation. Both decision making by the government and farmers; and the government, farmers and private sectors describe an improved management scenario. The improved regime was expected to enhance collective action and enhance a strong collaboration between government institutions, user cooperative and other stakeholders. This would result in better management of the park and ensure a well-developed, managed and utilized approach for sustainable benefits to all segments of society and the environment. The price attribute, park visitation fee, was provided in three levels. Amount of Frw 3500 was considered as entry fees at the status quo. The subsequent amount of Frw 3750 and Frw 4000 were referred to the improved management scenario of the park. This attribute was necessary for trade-offs between management attributes to get willingness to pay values.

3.2. Theoretical Foundation

The CE method is anchored in two micro-economic theories (Louviere &Hensher, 2000). The Lancaster (1966) multi-attribute utility theory postulates that the utility given by the consumption of a good does not come from its consumption as such but rather from the consumption of its *n* attributes, $A_1, A_2, A_3, \ldots\ldots A_n$. The Random Utility Theory (RUT) by underpins the econometric basis of CE and stipulates that individual *i*'s indirect utility U_{ij} is the sum of a deterministic term V_{ij} and a random term (ε_{in}) (Manski & Lerman, 1977; McFadden, 1974):

$$U_{ij} = V(Z_j, S_i) + \varepsilon(Z_j, S_i) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

For any respondent *i*, a given level of utility was associated with VNP management alternative *j* and depends on its management attributes (Z_j), 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* is higher than that of *i*.

$$Pr(ij) = Pr\big(V(Z_{ij}, S_i) + e(Z_{ij}, S_i)\big) > Pr\big(V(Z_{ik}, S_i) + e(Z_{ij}, S_i)\big) \ldots (2)$$

The random term,$e(Z_{ij}, S_i)$, could not be observed by the analyst rather we assumed its distribution was identically and independently type I extreme. A Conditional Logit (CL), an improvement of Multinomial Logit (MNL), was therefore applied. Although both CL and MNL suffer from the assumption of independence from irrelevant alternatives (IIA), CL relaxes this assumption and focuses on the set of alternatives for each individual and the explanatory variables as characteristics of those alternatives (Hoffman and Ducan, 1988):

$$P_{ij} = \frac{exp\left(V(Z_{ij,}S_i)\right)}{\sum_{k\in C} exp(V(Z_{ik},S_i))} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

As expressed by McFadden (1974), the indirect utility function obtained by individual *i* from alternative *j* in choice situation C was:

$$V_{ij} = \beta + \beta_1 Z_1 + \beta_2 Z_2 + \cdots + \beta_n Z_n + \delta_1 S_1 + \delta_2 S_2 + \cdots + \delta_l S_m \ldots\ldots\ldots \quad (4)$$

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

Equation four describes the dependent variable as the choice between alternative A or B and the "Neither A nor B" referred to as current management scenario. The probability of picking a given park management alternative was a function of VNP attributes presented in the choice alternative and the Alternative Specific Constant (ASC). The ASC was equal to 1 when either alternative A or B was chosen and 0 when the neither management alternative was picked. Explanatory variables were VNP management attributes and/or respondents characteristics. The model was specified assuming that the observable utility function would follow a strictly additive form:

$$\frac{\boldsymbol{Pr}[\boldsymbol{y=0}]}{\boldsymbol{Pr}[\boldsymbol{y=1}]} = \beta_0 + \beta_1 REHE + \beta_2 MEPL + \beta_3 HAPR + \beta_4 MUPR + \beta_5 BEPR + \beta_6 WACO + \beta_7 JPB + \beta_8 BANP + \beta_9 WAN + \beta_{10} PLBIO + \beta_{11} DMGO + \beta_{12} DMGF + \beta_{13} DMGFP + \beta_{14} AGE * Z_j + \beta_{15} EDUC * Z_n + \beta_{16} GE * Z_n + \beta_{17} INCOME * Z_n + \beta_{18} FAMP * Z_n + \beta_0 CBOME * Z_n + \beta_0 INFRA * Z_n + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

where β_0 is the ASC,$\beta_1 up\ to\ \beta_{20}$, are coefficients of utility parameters; and Z_n, is a set of park management attributes from attribute *j* to*n*.

Alternatively, attributes and respondents characteristics were described as follows: 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. AGE: age of the respondents, 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.

The coefficients from the variables allowed estimation of welfare values using willingness to pay (WTP) formula (Hanemann, 1991). The utility parameters for park management attributes were entered as random parameters assuming a normal distribution.

$$WTP = -1\frac{\beta_{VNP\ attribute}}{\beta_{park\ visitation\ fee}} \quad (6)$$

3.3 Choice Experiment Design and Survey

A designed experiment, as described by Louviere & Hensher (2000), was used to formulate attributes and their levels and permit rigorous testing of hypotheses of interest. Alternatives were defined by a number of attributes in a CE process. This process involved the selection of attributes and their levels, experimental design, formation of choice set and measurement of preferences in the survey. The selection of attributes was done through the literature and validated during both the focus group discussion and key informant interviews. Key informants were sector agronomists, farmer organizations, farmer representatives, park guides and two research institutions representatives.

The study classified VNP 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 VNP resources. These features require legal procedures for implementation. In this case, a participating farmer was required to respect the organic laws number 04/2005 and 95/004 for both environmental protection and management of VNP resources. Secondary, he should be legally registered in the respective cooperatives to engage in production resources. Next, a farmer was to ensure his role in protecting biodiversity for tourism purposes. Lastly, he would pay an entrance fee for the purpose of visitation to improve the conservation of the park. Optional attributes are defined by respondents' levels of preferences. These attributes were considered to enable stakeholders, through the review of policies and programs, with diverse interests to reach consensus. They are as well the ones that entered the CE design (refer to Table 1).

The CE design uses a full factorial design that combines all the levels of the attributes into a number of profiles. Such designs are practical only for small problems. The application of a full factorial for this study would have generated 324 profiles. An orthogonal design that aimed to reduce the number of profiles was used to ensure that the attributes presented to respondents were varied independently from one another and therefore avoids multicollinearity between them. The study applied a two-stage design process comprising orthogonal design for preliminary survey and then efficient design for the final survey. Prior coefficients from the

preliminary survey were used in the final survey to generate an efficient design. The generated D-efficiency measure of 93.4% implied that the design had a good measure with smallest D-error of 0.076. In addition, an estimate of B of 78% obtained indicated a good measure of utility balance. It shows that this study did not contain choice situations with clearly dominants alternatives.

An example of a choice set presented to the respondents is depicted in Table 2. In both designs 36, paired choices scenarios presented to the respondents were grouped into 6 profiles. Each profile had six choice tasks and farmers were randomly assigned to one of the six choice sets. Every single choice task was describing two possible improved park management alternatives (A and B) and a baseline alternative (C) that defines the current management of the park. The enumerator introduced and explained clearly CE survey to the respondents. The emphasis was put on the significant role of the park. In addition, they highlighted its degradation rate of 63% and consequences that may arise due to lack of the law protecting the park. An improvement of the current park management status through stakeholder (Government, famers and NGOs) participatory approach was proposed to farmers. They were requested to choose which best management they would prefer by clearly explaining the attributes and levels. The design was made using NGENE.

Table 2: One of the choice experiment cards presented to the farmers

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	3500 Frw	4000 Frw	
Which one would you prefer?			

Source: VNP survey design (2014)

The study applied a probabilistic sampling through a purposively cluster and multi-stage random sampling. Three out of four districts adjacent to the park (Burera, Musanze and Nyabihu) were purposively selected. The selection was based to road accessibility and number of sectors surrounding the park. Rubavu district with one adjacent-sector to the park was not selected. Among 11 adjacent sectors, in three selected districts, six were purposively selected for the

survey. The administrative cells from the six sectors were randomly selected. These were: Gisizi, Cyahi, Bisoke, Kaguhu, Nyabigoma, Nyonirima, Mudakama, Ninda, Kabeza and Kareba. Consultations and meetings with local government at sector and cell levels were held to get insights on 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. The households to be interviewed were then systematically randomly selected from the population in the cell by taking every 6^{th} household. In total, 211 farmers were interviewed. However, 191 respondents formed part of analysis and 19 questionnaires were casted due to errors during the survey. Data were analyzed using LIMDEP 8 or Nlogit 3.0.

4. Results, Discussion and Policy Implications

4.1. Socio-economic and institutional characteristics of respondents

Table 4 presents socio-economic, farm and institutional characteristics of farmers. The average age of 39 years indicates that the respondents were young to middle age (18 to 55 years old) which may be a sign of incentives to preserve VNP resources. Young people are also potential forces for sustainable environment-friendly development. Almost all the respondents attended only primary school. The low literacy may posit serious threats on VNP due to its positive association with poverty and substantial reliance on resources. The average monthly household income was approximately Frw61, 747 (US$89.62). Most of the households earned less than Frw100,000 (US$150) per month. This indicates farmers would exhibit negative preferences for preserving since they are poor and heavily rely on them for income and subsistence farming compared with passive use values that are luxurious and do not exist in the informal sector of the economy (Casey et al., 2008).

Table 3: 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 (Frw)	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 Frw 100, 000 (%)	90.9
Proportion of male farmers (%)	57

Proportion of married respondents (%)	85
Proportion of respondents who attended primary school (%)	91
Proportion of respondents who attended secondary school (%)	9
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

Source: VNP survey data (2014)
*the average exchange rate between June and July, 2014, one US$ was equivalent to Frw 690.

High average household sizes compared to the national levels in conjunction with the observed low average farm sizes would result in degradation of the park and farm covers while giving rise to resources exhaustion. These increasingly small farm sizes can cause serious socioeconomic and environmental problems. Slightly more than a half was male. Majority of them were married, three-quarters were engaged in subsistence agriculture and less than a quarter were combining both farming and off-farming activities. The great dependence on the park is a key challenge to conservation and management of its resources. About 80% of respondents had their farms within one kilometer (Km) from VNP boundary and the closest proximity is exceedingly correlated with dependence on VNP resources. 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 development of infrastructure facilities has created new employment opportunities and easy access to business transactions and reduced threats to VNP resources. Approximately, 48% of farmers belonged to Community-Based Organizations (CBOs) but only about 30% of them reported that their CBOs participated in activities related to park conservation and management. The low proportion might be attributable to poor collaboration amongst interested parties and hence inadequate collective action in managing these resources.

4.2. Farmers' Preferences and WTP for VNP Management Attributes

Table 4 reports the Conditional Logit (CL) model for assessing farmers' preferences for participating in the management and decision making of VNP. The obtained log likelihood value of -829 suggests a strong significance of the model which implies 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. Values between 0.2 and 0.4 are considered to be extremely good fits since their significance occurs at lower levels as opposed to those in linear regression analysis.

CL results show that farmers had positive and significant preferences for handcraft material over religious heritage and medicinal plants. Handcrafts contribute to promotion of cultural tourism, provision of rural incomes and strengthening collaboration amongst rural communities and other stakeholders. It is also a coping strategy to mitigate vulnerability and climate stress. Farmers

preferred to protect Jatropha, beekeeping and mushroom production resources in VNP. Jatropha helps combat greenhouse effect, stop soil erosion, create additional income for the rural poor, and provide a major source of energy (Wahl et al.2009).The strong link between forests and traditional beekeeping would create opportunities for promoting beekeeping as an incentive for sustainable forest management. Preferences for mushroom would results in increasing and diversifying business and employment opportunities, and provide 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.

Table 4: CL for Farmers' Preferences for VNP Management Attributes

Management variables	Coefficients	t-ratios
REHE	0.19 (0.54)	0.35
HAPR	0.32 (0.21)*	1.50
JPBL	1.53 (0.47)***	3.25
BEPR	1.50 (0.47)***	3.20
MUPR	1.37 (0.42)***	3.22
BANP	1.45 (0.19)***	7.61
PLBIO	-0.08 (0.19)	-0.40
DMGF	1.52 (0.16)***	9.79
DMGFP	1.68 (0.47)***	3.58
PVF	-0.0002 (0.00)*	-1.78
INCOME*REHE	0.36 (0.13)***	2.79
INCOME*WACO	0.74 (0.15)***	4.82
AGE*REHE	-0.45 (0.17)***	-2.57
GENDER*REHE	0.07 (0.08)	0.96
EDUC*REHE	0.12 (0.12)	1.06
EDUC*WACO	0.11 (0.13)	0.79
EDUC*DMGFP	0.22 (0.13)*	1.75
CBOME*WACO	0.37 (0.18)**	2.03
CBOME*DMGFP	0.31 (0.19)*	1.60
Log likelihood	-834.025	
Pseudo R_Square	0.34	
Number of respondents	192	

Source: VNP survey data 2014
Notes: ***, **, * imply statistical significance at 0.01; 0.05 and 0.1 respectively. Standard errors are in parentheses.

The respondents showed 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 indicates how much farmers understand the role of tourism for their livelihood and for global importance and national economy. Respondents had high preferences for an integrated decision making with government and farmers and government, farmers and the private sector aiming at improving the current VNP management status. It might be attributed to the government failure to mitigate the problem of human-wildlife conflict in the area and crop

damage compensation. Decision making by both farmers and government may bring a strong collaboration between parties and improve collective action. Involving the private sector in the management such as national and international NGOs, private business firms, civil societies, and farmers' organizations and quantifying their interrelationships are useful in formulating better management policies of VNP.

The price coefficient, park visitation fee, was negative and statistically significant as it was expected. Its sign is consistent with consumer theory on the inverse relationship between quantity demanded such as increase in environmental quality and the price and that the effect of utility of choosing a choice set with a higher payment level was negative (Birol et al., 2006). The sign of the price coefficient was used to estimate tradeoffs between VNP management attributes as the change between the Marginal Rate of Technical Substitution (MRTS) in management attributes and Marginal Utility of Income (MUI) represented by park visitation fee.

Table 5 reports values of marginal WTP, or implicit prices for the estimated park management attributes using Nlogit 3.0. CL model with interactions between estimates of the utility parameters and socio-economic and institutional characteristics of respondents was applied to assess possible sources of heterogeneity in preferences for VNP management attributes.

Table 5: Estimation of Values Farmers attached to VNP Management Attributes

Variable	Coefficient	t-ratios
REHE	884.32 (2552)	0.35
HAPR	1469.23 (1169)	1.26
JPBP	7105.11(2402)***	2.96
BEPR	6937.98(2274)***	3.05
MUPR	6335.47(2126)***	2.98
BANP	6721.53 (3678)*	1.83
PLBIO	-348.59 (901.7)	-0.39
DMGF	7042.34(3962)*	1.78
DMGFP	7799.76(4581)*	1.70

Source: VNP survey data, 2014

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

Interactions between income and religious heritage as well as between income and water resources were positive and significant. High income farmers would like to restore and preserve the traditional cultural heritage for personal and public enjoyment and recreational purposes and also as a source of intellectual and cultural property rights in their former ancestral territories. The findings are in line with the axiom of non-homothetic preferences which indicates that when the income elasticity of demand for environmental quality is high, then preferences are no longer homogenous in the society and societal preferences would change as well (Bhattarai, 2004). Again, farmers with high income would prefer to have safe and clean water rather than extract water resources from the park. The interaction term between gender and religious heritage was

negative. Women have limited awareness on natural resource preservation and often lacked detailed knowledge of their local environment compared to men. Equally, women limited access to land, forest and water resources can leave them with little choice but to engage in harmful environmental practices and specifically in Rwanda, some of problems that are gender related are women's lack of control over key resources or the gender based division of labour (Bush et al., 2010).

Interactions between education and decision making by all the stakeholders on park management were positive. Highly educated farmers have high level of environmental consciousness therefore high level of participation in decision making. Similarly, 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. Thus, membership to a farmer organization was positively correlated with preserving VNP for water resources through collective action.

WTP values to preserve the park for cultural heritage attributes were not significant at 10% level of significance. Farmers' WTP values to protect park production resources ranged from Frw 6335 (US$9) and Frw7105 (US$10.3); Frw6938 (US$10). The values are corresponding to 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 Frw 7,042 (US$10.2) to Frw7, 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. Willingness to pay values correspond to household food and non-food expenditure per capita per month estimated between Frw 5, 250 and Frw10, 662 (Diga et al., 2014).

5. Conclusion

This study assessed the value of VNP participatory management attributes and drew policy implications. In comparison to the current park management, the findings revealed that farmers preferred to preserve VNP resources for handcraft production to enhance cultural tourism and knowledge. Secondary, they preferred to protect both plants and animal biodiversity for tourism development. Next, they highly valued participation in integrated stakeholder decision making to enhance self-responsibility in planning, management and use of natural resources. Policy establishment for improving the current management status should therefore consider these attributes for an integrated participatory decision making process.

When looking at household and institutional characteristics that influenced preferences, the findings suggested that higher income farmers preferred to improve the current park management for religious heritage and water resources. This may increase the quality of life such as recreational activities and improved water quality in the area. However, female did not choose to

improve the current management status for religious heritage which is an indication of how women, mostly in SSA, have limited access to these resources that can leave them with little choice but to engage in harmful environmental practices. There is also women's lack of control over key resources or the gender based division of labour in Rwanda. Furthermore, the study findings also indicated that high educated people and CBO members preferred to improve the current management of VNP through an integrated decision making process. This increase in knowledge through education and group sharing would rise 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 park resources management.

In this context, the research suggested that policies that promote cultural tourism should be implemented to preserve cultural knowledge. Low input, high potential small farm enterprises to enhance food, nutritional and health policies should also be promoted. Additionally, access to quality water supply and off-farm employment opportunities for SMEs should be enhanced to improve community livelihood. Benefits sharing schemes should be initiated while tourism, biodiversity and wildlife policies should be enforced to better protect plants and animals. Vocational trainings, Community-Based Organisations (CBOS) and gender empowerment programs should be initiated and enhanced to promote awareness and income generating activities. Finally, programmes that facilitate ownership in decision making should be given priority.

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