| **RESEARCH ARTICLE**

An Application of Choice Experiment to Assess Farmers' Willingness to Pay for Volcanoes National Park Management Attributes in Rwanda

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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 for 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 an 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.

| **KEYWORDS**

Choice Experiment, Farmers, Participatory management attributes, Volcanoes National Park

1. Introduction

Natural forests provide ecosystem services and contribute to the livelihood of 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). Alternatively, as demand for an environmental solution is growing, concerns about the impact of climate change and loss of bio-diversity rise.

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 greatly impact rural livelihood, global environmental protection, and cultural heritage. In particular, 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 the park management decision-making process. This state-centred 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 the prevalence of poverty, average small farm sizes, high rate of soil erosion and human-wildlife conflicts (Gray 2011).

VNP is protected under article 96 of the organic law number 04/2005, determining the modalities of protection, conservation and promotion of the environment. The law has created incentives for free riders due to the high exclusion cost nature of the resource system, 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 socioeconomic and institutional factors in the 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 the nature conservation program in Finland. Respondents had a 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 estimate of the existing nature of the resource. It would also improve knowledge about the benefits generated by the same attributes on the management of natural resources.

Mazzanti (2003) assessed visitors' WTP for incremental changes in services associated with preserving the cultural institutions of Rome's worldwide known heritage site (WHS). 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 that 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 attributed to valued wetland management in Greece. Attributes 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 natural 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 socioeconomic 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 features on the payback generated by these landscape features while ensuring its proposed preservation plan. Participatory management requires the active involvement of all the stakeholders in managing production resources, preserving cultural heritage and conserving biodiversity. Assessing benefits generated by farmers' preference to preserve park attributes in an integrated decision-making manner would be imperative to understand economic values attributed to VNP management attributes.

Economic valuation implies that farmers attach a monetary value to the VNP in terms of use and/or passive use values (Louviere and Hensher 2000). Use values have a traceable economic behaviour associated with the direct utilization of the VNP resources and ecological functions. These functions support non-consumptive uses, essentially carbon sequestration nutrient cycling, among others (Kniivilä 2004). Passive use values instead have no clear behavioural trail. Use values include both option and bequest use values and are defined as an individual's WTP for 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 either CS or ES (Hanley et al. 2009).

A growing number of 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 gained wide applications in the conservation of nature, wetlands, biodiversity and management of water resources in developed countries like Finland, Portugal, the 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 park's value by highlighting farmers' preferences and their willingness to preserve its management attributes, including cultural heritage, production resources, plant and animal biodiversity, in an integrated decision-making manner.

The values attached to VNP management attributes inform on programs that would increase employment opportunities. The focus will be on vocational training for SMEs, handcraft products making, and the 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 Poverty Reduction Strategy (EDPRS) and Vision 2020 in Rwanda. Lastly, the paper is in line with pillars one and seven of the Millennium Development Goals (MDGs). The two pillars aim to eradicate poverty and hunger and ensure environmental sustainability.

The paper is structured as follows. While Section 1 provides background information, Section 2 describes the design and implementation of the choice experiments. Section 3 reports the findings on VNP management attributes, whereas section 4 draws the 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 inhabitants 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 the most 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 favourable 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 the 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 a 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. Despite that local communities have been excluded from conservation and decision-making, VNP has potential and diversified features. Associating the monetary values to the aforementioned features is key to improving farmers' wellbeing.

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 socioeconomic, farm and institutional behaviour 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 expectations about the future. Old farmers are likely to exhaust VNP resources, unlike young farmers that may care about future generations, but when focusing on social norms and position, older people may have a positive effect. Income was positively hypothesized to increase farmers' preferences due to the luxury characteristic nature of the environmental quality that increases the 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 the 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 a high propensity to extract resources from the reserve. Infrastructure facilities were expected to increase the livelihood of the community. Farmers may be involved in other business activities and employment opportunities to 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 attributes such as cultural heritage were provided in three levels: traditional religious heritage, medicinal plants, and handcraft 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 reducing the National Poverty Index in the area and its role in 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 utilization; 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, Frw 3750, 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 and protecting and conserving wild animals alone or plant biodiversity alone. The fourth attribute was provided in three different levels regarding decision-making for park management. Decision making by the government only defined the current management situation. Both decision making by the government and farmers; and the government, farmers and private sectors describes an improved scenario. Improving the current management was expected to enhance collective action and improve a strong collaboration between government institutions, user cooperative and other stakeholders. This would enhance 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 tradeoffs between management attributes to get the willingness to pay values.

3.2. Theoretical Foundation

The CE method is anchored in two microeconomic 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, $A_1, \quad A2, A_3, \dots\dots A_n$. The Random Utility Theory (RUT) 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):

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

For any respondent i, a given level of utility was associated with VNP management alternative j and depended 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.

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

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. Therefore, a Conditional Logit (CL), an improvement of Multinomial Logit (MNL), was 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):

$$P_{ij} = \frac{exp\big(V(z_{ij}, S_i)\big)}{\sum_{k \in C} exp(V(Z_{ik}, S_i))} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{ (3)}$$

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

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

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 the 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 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:

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

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 the willingness to pay (WTP) formula (Hanemann 1991). The utility parameters for park management attributes were entered as random parameters assuming a normal distribution.

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

3.3 Choice Experiment Design and Survey
As described by Louviere & Hensher (2000), a designed experiment 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 didn't vary and were the environmental protection laws and policies (environment; forestry, land use, wildlife, and biodiversity). It would be illegal for farmers not to comply while using the park 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. Second, 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. For instance, the application of a full factorial for this study would have had 324 profiles. An orthogonal design that reduced the number of profiles was used to ensure that the attributes presented to respondents were varied independently from one another and therefore avoided multicollinearity between them. The study applied a two-stage design process comprising orthogonal design for a 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 the smallest D-error of 0.076. In addition, an estimate of B estimate of 78% obtained indicated a good measure of utility balance. It shows that this study did not contain choice situations with clearly dominant 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 described two possible improved park management alternatives (A and B) and a baseline alternative (C) that defines the park's current management. 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 the lack of the law protecting the park. A participatory approach was proposed to farmers to improve the current park management status through stakeholder (Government, farmers and NGOs). 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 RwF	4000 RwF	
Which one would you prefer?			

Source: VNP survey design (2014)

The study applied probabilistic sampling through a purposive 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 on road accessibility and a number of sectors surrounding the park. Rubavu district with one adjacent-sector to the park was not selected. Among 11 adjacent sectors, six were purposively selected for the survey in three selected districts. 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 6th household. In total, 211 farmers were interviewed. However, 191 respondents formed part of the 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. Socioeconomicc and institutional characteristics of respondents
Table 4 presents the socioeconomic, farm, and institutional characteristics of farmers are presented in. The average age was 39 years, indicating that these farmers were young to middle age (18 to 55 years old), which may be may be a sign of incentives for the preservation of VNP resources. The young people may participate in park maintenance through community work and are potential forces for sustainable environment-friendly development. Almost all the respondents attended only primary school. Low literacy may pose serious threats to park resources since there is a positive relationship between low literacy, poverty, and reliance on park resources. The average monthly household income was approximately Frw 61,747 (US$89.62). Most of the households earned less than Frw 100,000 (US$150) per month. This indicates that the majority of the farmers were poor and relied mainly on park resources for income and subsistence farming and thus exhibited negative preferences for preserving passive use values that are luxurious and do not exist in the informal sector of the economy (Casey et al. 2008).

Table 4: Socio-economic, farm and institutional characteristics of respondents

Variables	Sample respondents (N=192)
The average age of respondents (in Years)	39(15)
The 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)

The proportion of respondents below 55 years old (%)	85
The proportion of respondents with monthly income below Rwf 100 000 (%)	90.9
The proportion of male farmers (%)	57
The proportion of married respondents (%)	85
The proportion of respondents who attended primary school (%)	91
The 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 Rwf 690.

Large 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 and would give rise to resources exhaustion. Therefore, these increasingly small farm sizes can cause serious socioeconomic and environmental problems. Slightly more than a half were male. The 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. This great dependence on the park is a key challenge to park resources conservation and management. About 80 percent of respondents had their farms within one kilometre (km) from the park boundary, and the close 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, easy access to business transactions, and reduce threats to VNP resources. Approximately 48 percent of farmers belonged to Community-Based Organizations (CBOs), but only about 30 percent of farmers reported that their CBOs participated in park conservation and management activities. This 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 CL results in the obtained log-likelihood value of -829 suggest 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. 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, except that.

CL results show that farmers had positive and significant preferences for handcraft material over religious heritage and medicinal plants. Handcrafts contribute to promoting cultural tourism, providing 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 VNP production resources. This is because Jatropha helps combat the 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 mushrooms would result in increasing s and diversifying business and employment opportunities and provide income opportunities for disadvantaged 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 5: 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 wildlife and plant biodiversity in the park for tourism development rather than protecting 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, national and global importance.

Farmers showed a high preference for integrated decision-making to government and farmers only and to move from the current VNP management where decisions were made by the government only. The high preference might be attributed to the government's failure to mitigate human-wildlife conflict in the area and crop damage compensation.

Decision making by both farmers and government may bring a strong collaboration. 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 management policies of VNP.

The price coefficient, park visitation fee, was negative and statistically significant as was expected. It is consistent with consumer theory on the inverse relationship between quantity demanded, such as an increase in environmental quality and the price and that the effect of the utility of choosing a choice set with a higher payment level was negative (Birol et al. 2006). This helped to estimate tradeoffs between park participatory management attributes whereby parameter estimates from the price coefficient allows estimation of the change between the Marginal rates of Technical Substitution (MRTS) in management attributes and Marginal Utility of Income (MUI) represented by park visitation fee.

Table 6 reports values of marginal WTP or implicit prices for the estimated park management attributes using Nlogit 3.0. To assess possible sources of heterogeneity in preferences for VNP management attributes, the standard discrete choice model (CL) with interactions between estimates of the utility parameters and socioeconomic and institutional characteristics of respondents was applied.

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 as a source of intellectual and cultural property rights in their former ancestral territories. The axiom of non-homothetic preferences 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). In addition, farmers with high incomes 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 of natural resource preservation and often lack detailed knowledge of their local environment compared to men. Equally, women limited access to

land, forest and water resources can leave women with little choice but to engage in harmful environmental practices and specifically in Rwanda, some of the 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 a high level of environmental consciousness, therefore, a 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.

Table 6: 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

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 Frw 7105 (US$10.3); Frw 6938 (US$10). The values correspond 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 Frw 7,780(US$11.30). The state-owned and centred 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 Frw 10, 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 park resources for handcraft production to enhance cultural tourism and knowledge. Secondly, 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. Therefore, policy establishment for improving the current management status should 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 services. However, the 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 highly educated people and CBO members preferred to improve the current park management through an integrated decision-making process. This increase in knowledge through education and group sharing would increase farmers' level of environmental consciousness for cultural tourism development and participation in decision making. Therefore, membership in CBO or social group improves farmers' 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. In addition, 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 reinforced to better protect plants and animals. Vocational training, Community-Based Organizations (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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