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Natural Resources and Household Incomes among Rural Women: Analysis of Communities Domiciled near National Parks in Rwanda

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Abstract

Historically, national parks were developed along protectionist principles to stave off illegal extraction of plants and wildlife. However, there have been calls to involve local communities in sustainable management of natural resources in recent years. The main objective of this study was to examine the economic activities carried out by rural women located near the Virunga National Park (VNP) in Northern Rwanda. The research also determined the role of such activities in enhancing their financial condition. A total of 118 respondents were selected from Musanze District using a multi-stage sampling technique. Data was mainly collected through a structured questionnaire transcribed in Kinyarwanda. Iteratively Reweighted Least Squares (IRLS) robust regression and descriptive statistics were used to analyze the data. The results showed that basket weaving and agriculture (crop and livestock) were important activities in the lives of rural women. However, most women earned less than 44,190.71Rwf ($73USD) per year and lived in extreme poverty. IRLS robust regression results suggested that location, self-confidence and the type of economic activity were statistically associated with annual household income (p<0.05). These results revealed the importance of building self-confidence and exploring location-specific business opportunities for enhanced incomes among rural women.

Keywords: Economic Activities, Rural Women, Virunga National Park, Survey, Musanze, Rwanda

Background

In rural Africa, women play an important role in a wide range of economic activities that include agriculture, health, family care, firewood collection and food preparation (Deda and Rubian 2004). The involvement of women in these activities is crucial for the achievement of food security and sustainable economic development. Studies have shown that more than 40% of women contribute to labor in smallholder agriculture (FAO 2013). However, they often do not receive any form of economic remuneration resulting in low incomes (Berkes and Adhikari 2006). A nexus of determinants that include poor access to education, land, and financial resources has also resulted in their marginalization in rural societies (Barrett et al. 2001).

In recent years, rural communities located near national parks have been the subjects of a growing body of literature (Chowdury et al. 2009, Kideghesho et al. 2007, Heinen and Mehta 2000). The socioeconomic context of such societies is typically shaped by poverty, high population growth, and limited access to productive resources (Coad et al. 2010, Nyakaana and

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Edroma 2008, Ancrenaz et al. 2007, Hackel 1999). Many of the previous studies conducted in these areas have rarely defined "community" (Nyakaana and Edroma 2008, Mehta and Heinen 2001, Gillingham and Lee 1999). An assumption of a homogenous community negatively affects interventions because it does not consider differences in composition, culture and attitudes towards conservation (Agrawal and Gibson 1999). Consequently, interventions have often precluded rural women in the process of developing sustainable conservation initiatives (Wainwright and Wehrmeyer 1998). Strategies focusing on women are imperative because they have been shown to have positive impacts at the household level (Coad et al. 2010).

Rwanda is a country located in East Africa whose economic development relies on biodiversity found in three main national parks including Virunga, Nyungwe Forest, and Aakagera national parks (ORTPN 2007). The forests are anchored on protectionist values but they are also viewed as sanctuaries from which firewood, water, bush meat, honey, poles, timber, aesthetics, and recreation are obtained by rural communities domiciled near the parks (Nielsen and Spenceley 2011). Subsequently, challenges include but are not limited to illegal firewood extraction and hunting of wildlife (Hogan et al. 2014). The problems may be understood in a broader context where the country faces a burgeoning rural population depending on a limited land resource (Rurangwa 2002). The government, therefore, mandated several public bodies including Rwanda Agricultural Board, Rwanda Office for Tourism and National Parks (ORTPN), Ministry of Finance and Economic Planning, and Ministry of Natural Resources to foster sustainable utilization of natural resources through collaborative activities with rural communities living adjacent to national parks. Various strategies that include revenue sharing, construction of schools, water tanks, boreholes, roads, hospitals and lodges for ecotourism were enunciated (ORTPN 2004, Masozera and Alavapatti 2004, Plumptre and Williamson 2001).

There have been concerns that women have been previously excluded in natural resources oriented projects (Masozera and Alavapati 2004, Badola and Hussain 2003, Tomicevic et al. 2010, Mehta and Heinen 2001). The department of conservation in the VNP developed a number of initiatives including basket weaving and handicrafts making to help integrate women into a mainstream development process. Although previous studies have evaluated the contribution of economic activities to household income, they did not examine the socioeconomic factors that affect the generated revenues. The analysis is important because it provides insights on how various stakeholders can improve income streams from different activities conducted by women. The main objective of this study was to assess the monetary contribution of different activities to household income among rural women living near the VNP in the Northern Province of Rwanda. The study also examined the socioeconomic factors affecting household income as well as the challenges affecting rural women in their quest to improve their financial condition.

Materials and Methods
Description of Study Area
Virunga National Park (VNP) is situated in the Northwestern part of Rwanda and it was promulgated in 1925 mainly to preserve wildlife that was exploited for commercial reasons (ORTPN 2004). It shares borders with Uganda and the Democratic Republic of Congo (RDC) forming what is commonly referred to as the "Virunga massive" (Plumptre et al. 2004). Initially, the national park covered about 34,000 ha of forestland that drastically declined due to encroachment from the populace (Plumptre and Williamson 2001). Current estimates indicate that total land covered by the national park is 16,000 ha implying that half of its original size and

associated biodiversity have been lost over time (ORTPN 2004). Figure 1 shows the districts that are adjacent to the park.

Burera and Musanze are located in the Northern Province while Nyabihu and Rubavu districts are positioned in the Western Province of the country (Figure 1). The main economic activities are crop agriculture, livestock husbandry as well as other off-farm activities that involve a commercial trade of handicrafts, bricks, traditional beer, household retail goods, and woodcarving. Woodcarving and handicraft markets have been lucrative because of the influx of foreign tourists (ORTPN 2004).

Figure 1: Districts Located near the VNP in Northern Rwanda
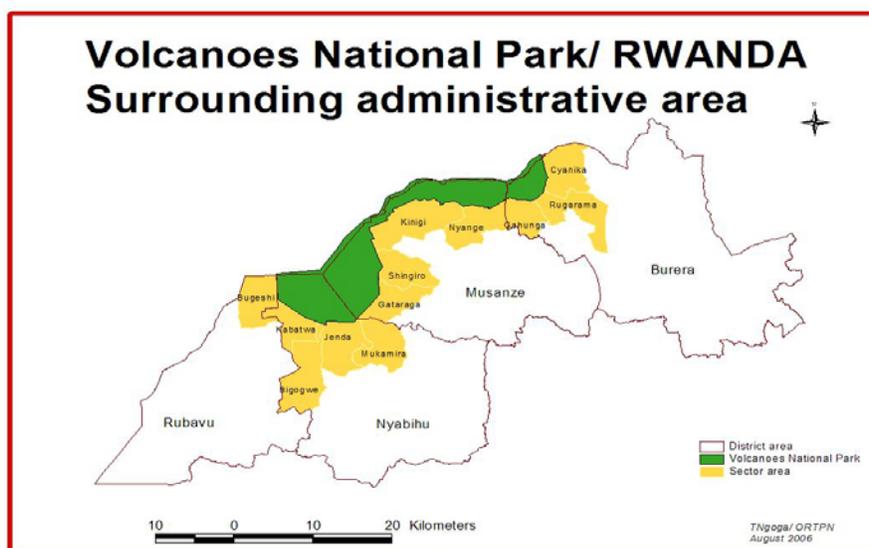
Musanze district was purposively selected given the financial resource limitations and that most of the women involved in handicraft making were located in the district. The four sectors from the district (Nyange, Kinigi, Gataraga and Shingiro) that are adjacent to the VNP were included in the research.

Population and Sampling

Broadly, a multi-stage sampling framework was used to determine the number of households to sample at the district and sector levels. Firstly, the sample at the district level was determined and secondly at the sector level. Proportionate allocation sampling was used to ascertain the number of households to include at these two levels. There were 46,514 adult women (older than 21 years) in the four selected sectors at the time of doing research (Musanze District Development Plan 2011). Following Kothari (1985), a sample size of 118 respondents was established. Nyange, Kinigi, Gataraga and Shingiro sectors accounted for the following percentages of adult women population: 29%, 26%, 23% and 22% respectively. These percentages were subsequently used in proportionate allocation sampling to determine the number of respondents to include in the survey according to their weights. The sample was disaggregated as follows: Nyange (34); Kinigi (31); Gataraga (28) and Shingiro (25). Lists of adult women obtained from Musanze District offices were used to facilitate a random selection of respondents for the survey through a lottery technique. The selected respondents were assured of the privacy and

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confidentiality of their responses. No voice recordings of participants were used in the research. Furthermore, they were asked to indicate whether they would voluntarily participate in the survey. In the event that a given respondent voluntarily opted out, the lottery method was employed to randomly select other respondents as replacements.

Data Collection Methods

Structured questionnaires were administered to individual women. The instrument was constructed originally in English but was translated into Kinyarwanda. The purpose of the structured questionnaire was to obtain demographic, economic, and social data. The instrument was organized into four sections namely demographic data, economic activities, challenges and possible solutions. A combination of closed and open-ended questions was used. The severity of problems affecting the implementation of income-generating activities was measured on a five-point Likert scale ranging from 1-very important through 5-least important. One of the main challenges of conducting a study that enumerated household income was that many outputs such as milk, honey, maize meal, beans and vegetables were not marketed and therefore did not have a formal price (Brooks et al. 2011). Shadow prices were used to assess the economic value of such products. It was necessary for enumerators to have more than one visit in consultation with the other members of the household because a number of respondents were not available at their respective households at the time of the interview.

Data Analysis

Descriptive and inferential statistics were used to analyze the data. Descriptive statistics were mainly in the form of frequencies, mean and mode. An initial multiple regression model was specified to examine the socioeconomic factors associated with household income and the variables are described in Table 1.

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \ldots + \beta_n x_{ni} + \varepsilon_i$$

Where: y_i represents annual household income in USD; x_i represents the set of factors influencing household income.

Table 1: Description of Dependent and Independent Variables to Examine Factors Influencing Household Income among Respondents

Variables	Description
Dependent	
Total household income	Annual household income earned in US$
Independent	
Sector dummy 1	1-if respondent is located in Shingiro; 0-Otherwise
Sector dummy 2	1-if respondent is located in Kinigi; 0-Otherwise
Sector dummy 3	1-if respondent is located in Nyange; 0-Otherwise
Age1	1-if aged between 36-50 years; 0-Otherwise (reference category 20-35 years)
Age2	1-if aged more than 50 years; 0-Otherwise

Education1	1-if attained primary level; 0-Otherwise (reference category "never attended formal school")
Education2	1-if attained secondary level; 0-Otherwise
Education3	1-if attained University level; 0-Otherwise
Activity1	1-if basket weaving; 0-Otherwise (reference category "agriculture")
Activity2	1-if regular employment; 0-Otherwise
Family size	Number of members in household
Training1	1-if trained in basket weaving; 0-Otherwise
Training2	1-if trained in mushroom production; 0-Otherwise
Training3	1-if trained in bamboo production; 0-Otherwise
Marital status1	1-if married; 0-Otherwise (reference category "single")
Marital status2	1-if widowed; 0-Otherwise
Self confidence	Originally measured on a five-point Likert scale from 1-Very high through 5-Very low (converted to 1-Very low through 5-very high)
Farm size	Size of farm in hectares

Iteratively Reweighted Least Squares (IRLS) robust regression was then used to correct for non-constancy of error variance in the model. Non-constancy of error variance affects the efficiency and validity of t- and F-tests (Kutner et al. 2005). A total of 1000 iterations were specified and the weights for residuals were based on the bi-square weight function (Kutner et al. 2005). In addition, the scaled residuals were defined using the Median Absolute Deviation (MAD). The procedure of using MAD was conducted to standardize the error terms. DFBETA values of greater than 1 indicated the extent to which residuals affected parameter estimates (Wooldridge 2010). The Friedman test, a non-parametric procedure, was also used to rank the extent of importance of socio-economic challenges faced by women based on a 5-point Likert scale (Beasley and Zumbo 2003).

Presentation of Results and Discussions
Socio-Demographic Characteristics
The results summarizing socioeconomic characteristics are shown in Table 2.

Table 2: Socio-Demographic Characteristics by Sector

Mean/Modal class	Sector			
	Gataraga	**Shingiro**	**Kinigi**	**Nyange**
Age	36-50 years (57%)	36-50 years (60%)	20-35 years (52%)	36-50 years (53%)
Education	No education (90%)	Primary (52%)	Primary (64%)	Primary (68%)
Marital status	Married (71%)	Married (52%)	Married (68%)	Married (59%)
Household size	8	5	6	7

Half of the respondents in Kinigi sector were aged between 20 and 35 years. However, the majority of interviewed women in Nyange (53%) and Gataraga sectors (57%) were aged between 36 and 50 years. A similar pattern was evident in Shingiro where 60% of the women were between 36 and 50 years. About 64% had primary level education in Kinigi while 68% had the same level of educational attainment in Nyange. In Shingiro, 52% had a primary level education. However, 9 in every 10 women interviewed in Gataraga sector had never attended school. Most of the respondents in the four sectors were married. On average, each household had six members with Gataraga sector having the highest number of 8 compared to 5 people in Shingiro sector. At least 50% of the interviewed women from each sector were married.

Characterization of Rural Household Economy

Respondents' economic activities were lumped into agriculture, basket weaving and regular employment. Agriculture was a common economic activity for many of the respondents. Shingiro sector had the highest proportion of women involved in agriculture (92%) followed by Gataraga sector with 82%. Nyange and Kinigi sectors had 45% and 47% of respondents involved in agriculture respectively.

Basket weaving emerged as one of the most important economic activities practiced by rural women in the study sites. This was mainly in response to the influx of foreign tourists to the VNP who were interested in purchasing local cultural artifacts. In Kinigi sector, for instance, 55% of the women indicated that they were involved in this activity. Half of the respondents in Nyange sector were also making baskets. However, it was less common in Gataraga and Shingiro, where 11% and 8% of the respondents revealed involvement in the activity. Most respondents indicated that they illegally accessed bamboo from the VNP.

Regular employment opportunities that were available for women in the VNP were explored. No respondents had access to regular employment from Kinigi and Shingiro sectors. However, only 7% and 3% of the respondents were employed as tourist guides from Gataraga and Nyange respectively. About 95% held a positive view towards the VNP as a source of benefit to their livelihoods because of high demand for local products as well as training received.

Incomes Associated with Economic Activities

Total household income from agriculture, basket weaving and regular employment were computed. Gataraga sector had the highest mean gross annual income per year of 44,190.71Rwf (73 USD). This was followed by Kinigi sector with gross annual income of 31,129.03Rwf (50USD) while Shingiro and Nyange had average incomes of 26,065.25Rwf (43USD) and 19,520.59Rwf (32USD) respectively. Few respondents had cows, goats, or sheep. However, half of the respondents owned sheep while 22% had goats. About 10% of the sample indicated owning cows. Results of the Friedman test showed that the three most important challenges were related to lack of marketing skills, training and lack of self-confidence (Chi-square value of 53.3, $p<0.05$).

Socioeconomic Factors Associated with Annual Household Income

Results of the IRLS robust regression are indicated in Table 3.

Table 3: Socioeconomic Factors Related to Annual Household Income based on a Survey Conducted with Respondents in Four Sectors Located near National Parks

Parameter	Estimate	Standard Error	95% Confidence Limits		Chi-Square	Pr > ChiSq
Intercept	11.6469	4.5109	2.8056	20.4882	6.67	0.0098
Activity 1	-7.6842	2.3908	-12.3700	-2.9983	10.33	0.0013
Age2	-0.7737	2.2695	-5.2218	3.6744	0.12	0.7332
Activity2	648.9470	6.4563	636.2929	661.6011	10103.0	<.0001
Self confidence	1.8896	0.7429	0.4336	3.3456	6.47	0.0110
Training3	2.1252	2.3846	-2.5486	6.7990	0.79	0.3728
Training2	-0.0992	1.9451	-3.9115	3.7130	0.00	0.9593
Sector dummy 2	-6.4632	3.2167	-12.7678	-0.1586	4.04	0.0445
Family size	-0.2068	0.2667	-0.7295	0.3159	0.60	0.4381
education1	3.7118	2.4009	-0.9939	8.4175	2.39	0.1221
Age1	-0.0822	2.2846	-4.5600	4.3955	0.00	0.9713
education3	-1.2167	3.3336	-7.7504	5.3169	0.13	0.7151
Training1	3.0079	2.3378	-1.5741	7.5898	1.66	0.1982
Sector dummy 1	-6.3873	3.1064	-12.4757	-0.2989	4.23	0.0398
Sector dummy 3	-5.9061	3.4148	-12.5990	0.7869	2.99	0.0837
Farm size	0.1941	0.9491	-1.6661	2.0544	0.04	0.8379
Scale	7.6631					

Four independent variables were statistically associated with annual household income. These were activity1 (basket weaving), activity2 (regular employment), self-confidence, sector dummy 2 (Nyange) and sector dummy 1 (Kinigi) ($p<0.05$). In addition, sector dummy 3 (Shingiro) was significant at the 10% level ($p<0.1$). Relative to agriculture, respondents who were engaged in basket weaving earned about US\$7.68 less annually, ceteris paribus. Greater self-confidence was associated with an increase of US\$1.88 in annual household income. When compared with Gataraga sector, respondents located in Kinigi, Shingiro or Nyange earned about US\$6 less income annually. Respondents who were regularly employed obtained \$648 higher annual income than those were not formally employed. Independent variables such as age, education and training were not significantly associated with annual household income ($p>0.05$). The Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC) values were 193.12 and 244.65 respectively.

Discussion

Socio-demographic characteristics considered in this study were age, educational level, marital status and household size as it related to the four sectors. These parameters have an important influence on agricultural incomes earned over time as well as values towards conserving biodiversity (Tomicevic et al. 2010, Mehta and Heinen 2001). Results are therefore likely to be useful to various stakeholders that include the Ministry of Finance and Economic Planning (MINECOFIN), Ministry of Natural Resources (MINIRENA), Rwanda Agricultural Board and Rwanda Office for Tourism and National Parks (ORTPN). Outputs provide a guide to the

identification of the most lucrative income generating activities and designing of possible strategies to enhance financial sustainability.

Findings showed that the majority of women had a primary level education or never attended formal school. Results also indicated an average household size of 6 members. These results are in line the observations from recent NISR Health and Demographic Survey (2014) which pointed out that older sections of the rural population, particularly women, had relatively lower access to education compared to men. While enrollment in primary schools has been increasing over time, the proportion of females who continue to secondary education level in Rwanda is estimated to be 30% (Ministry of Education Statistics Yearbook 2012). These results portend the potential negative impacts of educational constraints on various rural household socioeconomics.

National-level studies that have attempted to characterize the Rwandan economy revealed agriculture as the predominant activity that sustains the rural population (Rurangwa 2002). In line with this observation, findings from this study suggested that agriculture was a key activity in the generation of household income. IRLS robust regression analysis showed that agricultural income was higher than revenue generated from basket weaving. However, it was lower than the income obtained from regular employment. Sector level differences in household income may be explained by the resource endowments found in each region. In Kinigi sector, basket weaving was likely to be more lucrative because of a higher number of tourists. However, such visits were seasonal. On the hand, Gataraga has relatively higher agricultural activity mainly due to flatter terrain when compared with other sectors. The income obtained from agriculture may be higher since the demand for food products is more predictable. Results on the magnitude of annual income are consistent with Vinck et al. (2009) who showed that households that relied predominantly on agriculture earned incomes less than 50,000Rwf per year (83 USD). In addition, the third integrated household living conditions survey (EICV3) also asserts that most individuals engaged mainly in agricultural activities were poor. If the standard of 1USD per day is used as the benchmark for poverty, then most of the households were in extreme poverty. Poverty is one of the main reasons behind illegal extraction of resources from national parks (Chowdury et al. 2009, Masozera and Alavapatti 2004, Yamagiwa 2003, Plumptre and Williamson 2001).

Four main factors may help to explain the low incomes observed in the four sectors. First, agricultural activities were eminently subsistence and based on traditional methods of production. Secondly, production was carried out on small and hilly slopes which exacerbated soil erosion. Third, many of the respondents did not have any livestock such as cows, sheep, or goats to provide manure for improving soil fertility. Fourth, lack of formal employment opportunities may be attributed to low education levels among women (Deda and Rubian 2004). Social benefits from amenities such as water tanks, lodges, roads and schools have not trickled down to the household level. These factors may have resulted in intermittent food supply shocks especially in the October-November and April-May periods (Plumptre and Williamson 2001).

Findings also showed that self-confidence had a positive relationship with household income. This suggests that confidence building may be considered an ingredient of small business success among rural women (Kabeer 2005, Leach and Sitaram 2002). Given that the majority of the women were not formally educated, adult training methods may be used to improve facets related to personal outlook, marketing and general business skills (Mehta and Heinen 2001). Such training opportunities may be helpful in developing "ambassadors of conservation" whose role is to inculcate the ecological value of forests to other members of the community. Rural women may also be encouraged to broaden income sources once they have developed self-belief (Chowdury et

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al. 2009, Badola and Hussain 2003). Some respondents had already been trained by ORTPN and NGOs in bamboo production through women cooperatives. However, they still illegally obtained natural resources from the park indicating that the training may have been inadequate.

Conclusions and Recommendations

The results of this analysis showed that agriculture and basket weaving were important sources of income. However, these households remained poor or very poor. This may explain why there was a tendency towards illegal extraction of resources from the VNP. Given that annual income varied by sector, community-driven income diversification strategies that consider the unique natural resource endowments could be further explored to increase incomes. It is important to focus on the entire value chain (input acquisition, production, and marketing) for each of the identified small business areas because some activities (e.g. agriculture) are seasonal and may require alternative markets. Building self-confidence may also be helpful in developing business ventures that may be successful in the long-run. Since these communities are closely knit, it may be prudent to take advantage of the already existing social capital inherent in such populations. Rural cooperatives are already existent but emphasis may be placed on shared values and commitment. Self-confidence may also be consolidated through the use adult-based educational strategies because a large proportion of the women did not attend formal school. The use of peers that were successful in business and identified from the community may also assist to increase self-belief among respondents. Innovative marketing activities anchored on socio-cultural aspects may be further considered in this regard. An example of such a strategy is the use of bamboo-based traditional forms of packing agricultural products.

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