

Degree and Determinants of Host Communities' Socio-Economic Dependence on Forest Products of Pendjari National Park, Benin Republic: Automatic Linear Modelling Technique

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Abstract

The study aimed at determining the degree and determinants of host communities' socio-economic dependence on forest products of Pendjari National Park, Benin. Four hundred households in fourteen host communities of the Park were subjected to direct household survey through multistage sampling technique. Forest Dependency Indices were computed to determine the households' dependence on forest products. An automatic linear modelling algorithm through forward stepwise model selection method was employed to model the main determinants to host communities' socio-economic dependence on forest products. Household age category (5-14 and above 60 years), total monthly income, education level of the household members (junior/senior high school, bachelor's degree), place of birth, and religion were the main determinants. Most host communities were observed to be dependent on the park in varied forms and degrees, while Tanguieta and Sangou had the least and highest degree of dependence, respectively. Thus, the findings had provided a template for relevant authorities to rightly allocate resources for alternative livelihood means to the ranked host communities. However, a monitoring indicator had been developed to quantify and safeguard the harms of indigenous people to the biodiversity base. This is believed to create a synergy between sustainable development and indigenous peoples.

Keywords: livelihood, automatic linear modelling, forest products, sustainable development, Benin Republic

1. Introduction

Socio-economic characteristics of host communities to protected areas are usually believed to have a significant influence on determining the types of activities and interactions toward their natural resources (Mehta and Heinen, 2001; Shibia, 2010; Al-Subaiee, 2015). They are directly or indirectly related to rural livelihood, and highly determine their forest consumption and degree of forest dependence. Over the past years, the recognition of the prevalent dependence of host communities on forest products and the poverty-forest use relationships have generated an increasing scientific concern in demonstrating their socio-economic dependence on forest products and understanding its drivers (Mamo et al., 2007; Thondhlana et al., 2012; DOF et al., 2014; Lawry et al., 2015). The dependence of rural households on biodiversity base and their diverse use pattern have become an important topical issue in developing economies (Sapkota and Oden, 2008) such as Benin Republic. This interest was due to the need to resolve the devastating trend of forest depletion and poverty amidst inhabitants of host communities to protected areas.

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According to Meijaard et al. (2013), knowing more about local people usage of forests (such as fuel, medicine, food and food additives, building construction, etc) is an extremely important factor that could enhance planning of land use and minimise the conflict with them.

However, the planning and management framework of Pendjari National Park, Benin Republic had evolved over the years. Specifically, the park was governed by the 1987 law 87-014 and coercion approach was employed until 1993 (CENAGREF, 1997; Tiomoko, 2007). Conservation strategies and management of the park resources did not include host communities in coercion approach, which resulted in situations of conflict between communities' inhabitants and park authority (Tiomoko, 2007; Belem et al., 2007). Currently, the planning and management framework is governed by the law no. 93-009 of 2 July 1993, park zoning (core area, controlled access, habitation and hunting zones) according to UNESCO (2013) and community conservation approach adapted to accommodating local peoples' needs, empowering their aspirations, promoting their active participation in local resource management, and improving their economic welfare (Songorwa, 1999; Mehta and Heinen, 2001; CENAGREF, 2005).

Despite the community conservation approach, the socio-economic characteristics of host communities usually have a significant influence on determining the types of activities and interactions toward their natural resources (Mamo et al., 2007; Vedeld et al., 2007; Babulo et al., 2008; Koenig et al., 2011; Al-Subaiee, 2016). Improper knowledge of the interrelationship between the households' socio-economic characteristics and their dependence on forest products could hinder the management effectiveness of the park authority in rightly allocating resources for alternative means of livelihood to most dependent communities. This had hindered the rational use of these protected areas' resources due to the host communities' over-dependence (Igu, 2017; Ofoegbu et al., 2017; Shrestha et al., 2017; Suleiman et al., 2017) and poor protected area planning (FAO, 2016).

Forest dependency indices can be computed to determine the households' dependence on forest products and it is referred to the average index value of food and food additives, fuel, housing, medicinal and income dependencies (Anitha and Muraleedharan, 2006). Moreover, several methods could be employed to determine the socio-economic determinants of forest dependence. Amidst these methods, several studies had recognised the significance of a logistic model over an Ordinary Least Square (OLS) linear regression model to deal with socio-economic determinants of forest dependence (Lepetu et al., 2009; Tieguhong and Nkamgnia, 2012). Ratner (2012) opined that the challenge of making a decision on which subset(s) of the large pool of potential predictors to include in a linear regression model is very common and arguably the hardest part of regression modelling (Miller, 2002; Kutner et al., 2004; Weisberg, 2005; Yan and Su, 2009).

Therefore, the automatic linear modelling algorithm through forward stepwise model selection method (Yang, 2013) was employed in this study. In contrast to previous studies, the novelty of the modelling technique is the potential to rank the host communities according to their degree of dependence. This will provide a template for relevant authorities to rightly allocate resources for alternative livelihood means to the ranked host communities. However, it will develop a monitoring indicator to quantify and safeguard the harms of indigenous people to the biodiversity base. Thus, the research aimed to rank the host communities based on their dependence on forest products, and determine the determinants of host communities' socio-economic dependence on forest products of Pendjari National Park, Benin Republic.

2. Methodology

2.1 The study area

Pendjari National Park is located between latitude 10°30'N and 11°31' N, and longitude 00°50'E and 2°00' E (Figure 1) and covers a land mass of 2,755 km². It is situated in the north-west of Benin Republic and declared a Game Reserve in 1954, then upgraded to a National Park in 1961. It is bordered to the North by Burkina Faso (Cheke, 2001; Nago et al., 2006; Assédé et al., 2012). The mean temperature of Pendjari National Park ranges from 18.6°C to 36.8°C and is characterised by rainfall which varies from 800 mm in the North to 1,000 mm in the South. The park's dry season occurs from November to April and the wet season lasts from May to October (Sogbohossou et al., 2014).

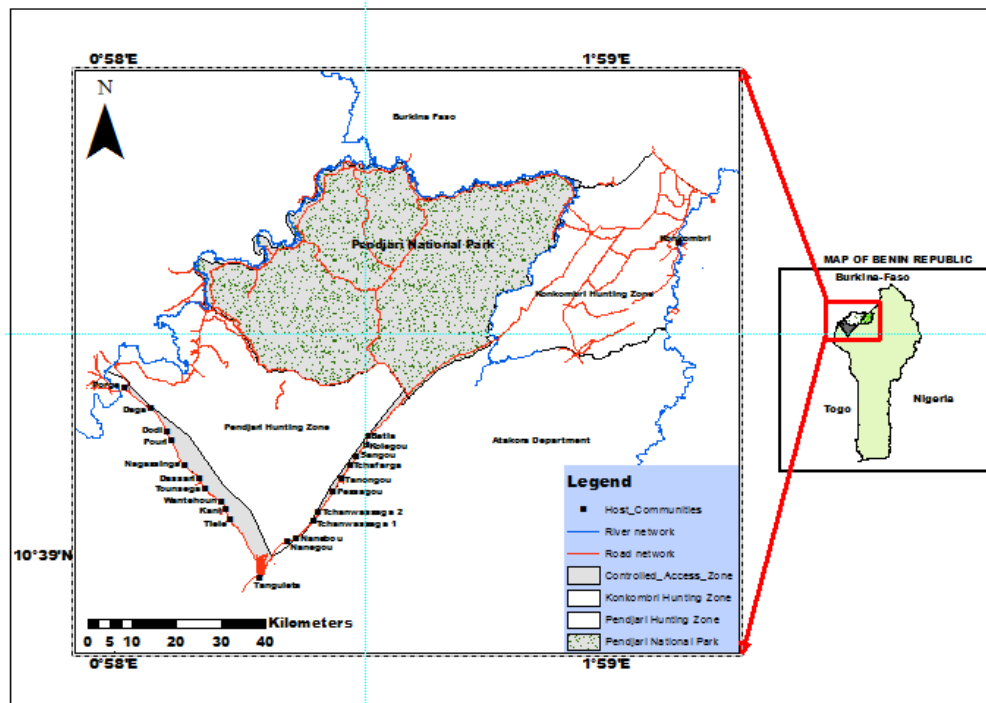


Figure 1: Location of Pendjari National Park in Benin Republic.

2.1 Data collection

Preliminary surveys were conducted at the study area to ascertain the type of sampling techniques to be used and host communities/households to be sampled according to Anitha and Muraleedharan (2006). The sampling populations were households' heads from the host communities of Park. A purposive sampling technique based on the host communities' proximity to the park's boundary and direct influence on the park was used to select 14 communities from 28 communities that were close to the park. Sample size for the study was 400 households Daga (40), Porga (40), Dassari (40), Tounsega (32), Pouri (32), Tiele (16), Wantehoun (16), Kani (16), Nagassega (24), Tanguieta (40), Tanougou (40), Sangou (32), Kolegou (16), and Batia (16). The computation was based on the population size of 38,250 households and average household size of 7.4 in the host communities of the study area (INSAE, 2002; INSAE, 2013; Kassa, 2008; CENAGREF, 2016).

The method employed by Yamane (1967) was adopted to determine the sample size of the sampled households in each study sites at 95% confidence limit i.e.

$$\text{Sample size, } n = \frac{N}{1+N(e)^2} \quad (1)$$

Where;

n = Sample size

N = Population size (Number of households)

E = Error estimate (0.05)

A semi-structured questionnaire was designed to retrieve information from the target population. The instrument consisted of two sections (Section A–Socio-economic characteristics of household; Section B–Dependency of host communities on the park) with a total of thirty-four items. Prior to the study, the questionnaires were validated and Cronbach Alpha was used to determine the reliability coefficient of the instrument, which was found to be 0.87.

2.3 Data analysis

For analysis of the questionnaires, descriptive statistics were used and responses of the respondents were converted using Likert’s scale. Statistical Package for Social Science (SPSS Version 21) software and Microsoft Excel 2010 spreadsheet were employed to compute the following indices and socio-economic determinants:

Forest Dependency Index (FDI)

This index was adopted to determine the socio-economic dependence of host communities on the study area. The following Forest dependency indices as compounded by Anitha and Muraleedharan (2006) were computed namely;

$$\text{Food and food additives Dependency Index, FoDI} = \sum_{i=1}^n \left\{ \frac{X}{1+X_i} \right\} \times 100 \quad (1)$$

Where;

X = 1, If the park is a food and food additives source

X = 0, If park is not a food and food additives source

X_i = Number of other food and food additives sources apart from the park

$$\text{Fuel Dependency Index, FuDI} = \sum_{j=1}^n \left\{ \frac{F}{1+F_j} \right\} \times 100 \quad (2)$$

Where;

F = 1, If park is a fuel source

F = 0, If park is not a fuel source

F_j = Number of other fuel sources except for fuel from the park

$$\text{Housing Dependency Index, HDI} = \sum_{i=1}^n \left\{ \frac{h_i}{H} \right\} \times 100 \quad (3)$$

Where;

h_i = number of parts of the ith house constructed by using the park’s products

H = Total number of parts that can be constructed by using park’s products

$$\text{Medicinal dependency Index, MDI} = \sum_{i=1}^n \left\{ \frac{M}{1+M_i} \right\} \times 100 \quad (4)$$

Where;

M = 1, If the household is using medicine from the park, M = 0 otherwise

M_i = Number of other alternative medicinal options used by the household

$$\text{Income Dependency Index, IDI} = \sum_{i=1}^n \left\{ \frac{y_i}{Y_i} \right\} \times 100 \quad (5)$$

Where;

y_i = income from the park acquired by the i th family

Y_i = Total income of i th family

Thus, the Forest Dependence Index (FDI) of individual household

$$\text{Forest Dependence Index, FDI} = \sum \left[\frac{\text{FoDI} + \text{FuDI} + \text{HDI} + \text{MDI} + \text{IDI}}{5} \right] \quad (6)$$

Determinants of host communities' socio-economic dependence on forest products

The automatic linear modelling algorithm (Equation 7) through forward stepwise model selection method (Yang, 2013) was employed to know the households' socio-economic characteristics that determine host communities dependence on forest products. Thus, the statistically irrelevant households' socio-economic characteristics to the model were determined and removed using the automatic linear modelling algorithm. Also, if all the categories of a variable significantly influenced the host communities' dependence on forest products, the algorithm generated a single significant value for the associated variable. Thereafter, the statistically relevant households' socio-economic characteristics were ranked using the computed importance ratio to determine the degree of host communities' socio-economic dependence on forest products. The description of the explanatory variables as used in the modelling are stated as follows: Age in years (0–4=1, 5–14=2, 15–60=3, Above 60=4), sex (Male=1, Female=2), place of birth (Yes=1, No=0), ancestral home (Yes=1, No=0), education level (Non-formal=1, Primary=2, Secondary=3, OND/NCE=4, HND/BSc=5, MSc/PhD=6, Others=7), religion (Islam=1, Christianity=2, Traditional worshipping=3, Others=4), total monthly income (Less than N7, 500=1, N7, 500–N24, 000=2, N24, 000 and above=3)

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{14} x_{14} + \beta_{15} x_{15} + \beta_{16} x_{16} + e_i \quad (7)$$

Where;

y_i = Forest Dependency Index

β_0 = Constant term

β_1 to β_{16} = Coefficients relating to the households' socio-demographic characteristics

e_i = Error term with mean value of 0

x_1 = Age_{0–4}

x_2 = Age_{5–14}

x_3 = Age_{15–60}

x_4 = Age_{Above 60}

x_5 = House composition of male

x_6 = Household composition of female,

x_7 = Place of birth,

x_8 = Ancestral home,

x_9 = Education level of Non- formal,

x_{10} = Education level of Primary school,

x_{11} = Education level of Junior/Senior high school

x_{12} = Education level of Bachelor,

x_{13} = Education level of Masters,

x_{14} = Education level of Others,

x_{15} = Religion,

x_{16} = Total monthly income

3. Results

Demographic characteristics of sampled households in the host communities of Pendjari National Park, Benin Republic are presented in Table 1.

Table 1: Demographic characteristics of sampled households in the host communities of Pendjari National Park, Benin Republic.

Characteristics		Frequency	Percentage
Sex	Male	2,101	49.11
	Female	2,177	50.89
Average household size	-	11 ± 5	-
Age	0 - 4	833	19.47
	5 - 14	1,312	30.67
	15 - 60	2,032	47.50
	> 60	101	2.36
Place of Birth	Inside the village	316	79.00
	Outside the village	84	21.00
Ancestral home	Current village	350	87.50
	Not current village	50	12.50
Level of education	Non- formal	2,017	47.15
	Primary school	1,397	32.66
	Junior/Senior High School	846	19.78
	Tertiary	18	0.42
Religion	Islam	69	17.25
	Christianity	226	56.50
	Traditional worshipping	101	25.25
	Others	4	1.00
Total monthly income	Less than 22, 615 cfca	68	22.67
	22, 615 cfca – 72, 360 cfca	124	41.33
	72, 360 cfca and above	108	36.00
Occupation	Farming	310	77.50
	Tour guiding	6	1.50
	Teaching	17	4.25
	Civil service	6	1.50
	Trading	52	13.00
	Fishing	8	2.00
	Herding	1	0.25

\$1 per cfca 603 as at November 2016

It was noticed that 2,101 (49.11%) of the sampled household composition were males, while females were 2,177 (50.89%). However, the mean household size was 11 ± 5 . Household age category (above 60 years) had the least occurrence of 101 (2.36%), while household age category (15–60 years) had the highest occurrence of 2,032 (47.50%). Furthermore, it was noticed that 316 (79.00%) of the household heads were born inside the sampled community, while 84 (21.00%) of the household heads were born outside the sampled community. Although, 350 (87.50%) of the household heads had their ancestral home situated in the current community, while 50 (12.50%) of the household heads had their ancestral home situated outside the current community.

Also, 2,017 (47.15%) of the household members had non-formal level of education, 18 (0.42%) of the household members had tertiary education, while none had University postgraduate education. Thus, 308 (77.00%) of the households were predominantly involved in the farming occupation. Households that are involved in Christianity had the highest frequency of 226 (56.50%), followed by Traditional worshipping [101 (25.25%)], then Islam [69 (17.25%)], while households that are involved in no religion had the least frequency of 4 (1.00%). Most of the households had total monthly income of less than 22, 615 cfca [295 (73.75%)], 102 (25.50%) had total monthly income between 22, 615 cfca and 72, 360 cfca while 3 (0.75%) had total monthly income of above 72, 360 cfca.

Forest dependency indices of host communities to Pendjari National Park, Benin Republic are presented in Table 2. The data revealed that Porga and Kolegou communities were the most dependent on food and food additives with dependency index of 100 ± 0.0 each, while Tanguieta community was the least dependent on food and food additives with dependency index of 36 ± 45.3 . Also, it was observed that Kani and Kolegou communities were the most dependent on fuel with dependency index of 100 ± 0.0 each, while Tanguieta community was the least dependent on fuel with dependency index of 60 ± 44.1 . Moreso, it was observed that Kani community was the most dependent on housing with dependency index of 86 ± 5.2 , while Tanguieta community was the least dependent on housing with dependency index of 22 ± 32.4 .

The data revealed that Porga, Tanougou and Kolegou communities were the most dependent on trado-medicinal with dependency index of 100 ± 0.0 each, while Tounsega community was the least dependent on trado-medicinal with dependency index of 43 ± 24.6 . It was observed that Sangou community was the most dependent on income with dependency index of 73 ± 42.5 , while Tanguieta community was the least dependent on income with dependency index of 5 ± 22.1 . The data revealed that Sangou community were the most dependent on the forest products of Pendjari National Park with dependency index of 84 ± 9.6 , while Tanguieta community was the least dependent on the forest products of Pendjari National Park with dependency index of 39 ± 26.8 .

Determinants of the host communities' socio-economic dependence on forest products of Pendjari National Park are presented in Table 3. The result indicated that the automatic linear modelling method presented five predictors to be determinants to host communities' socio-economic dependence on forest products. Age classes of 0–4years ($p=0.05$), 5–14years ($p=0.00$), above 60years ($p=0.00$), religion ($p=0.00$), total monthly income ($p=0.00$), education level of junior/senior high school ($p=0.00$), bachelor's degree ($p=0.00$), place of birth ($p=0.00$) had significant influence on the forest dependency index of the Park. Moreover, household members with age group of 5–14years had the highest degree of importance (0.288) to determining host communities' socio-economic dependence on forest products followed by place of birth (0.174), while household members with non-formal education had the least degree of importance (0.024).

Host communities	Food and food additives	Fuel	Housing	Medicinal	Income	Forest Dependency Index	Ranking	Table 2: Forest dependency indices of host communities to Pendjari National Park, Benin Republic.
Daga	55±27.3	65±26.6	84±1.8	61±21.2	24±40.81	58±21.8	10 th	
Porga	100±0.0	89±21.2	81±19.3	100±0.0	46±47.21	83±22.2	2 nd	
Dassari	45±43.6	61±44.6	65±35.7	65±41.1	36±45.27	54±13.2	12 th	
Tounsega	38±25.4	61±33.0	68±24.3	43±24.6	8±18.45	43±23.5	13 th	
Pouri	58±31.4	67±27.3	70±24.8	68±30.5	11±20.49	55±24.6	11 th	
Tiele	81±25.0	78±25.6	81±4.8	97±12.5	11±27.70	70±33.4	8 th	
Wantehoun	56±17.1	63±22.4	85±3.7	72±25.6	63±50.00	68±11.4	9 th	
Kani	84±35.2	100±0.0	86±5.2	76±28.5	22±36.37	74±30.2	6 th	
Nagassega	90±25.5	92±19.0	82±15.3	89±22.3	27±41.65	76±27.5	5 th	
Tanguieta	36±45.3	60±44.1	22±32.4	70±39.1	5±22.07	39±26.8	14 th	
Tanougou	88±33.5	78±33.9	70±28.7	100±0.0	34±51.13	74±25.0	7 th	
Sangou	88±33.6	91±23.6	74±25.8	94±16.8	73±42.47	84±9.6	1 st	
Kolegou	100±0.0	100±0.0	83±0.0	100±0.0	19±40.30	80±35.2	3 rd	
Batia	75±40.8	91±20.2	83±0.0	88±34.2	56±72.70	79±13.8	4 th	

Automatic Linear Modeling					
Socio-economic characteristics		Coefficients	Significance	Importance ratio	Degree of Importance
Age (years)	0-4	1.89	0.05*	0.031	8 th
	5-14	3.20	0.00*	0.288	1 st

Table 3: Determinants of host communities’ socio-economic dependence on forest resources of Pendjari National Park, Benin Republic.

	Above 60	7.55	0.00*	0.077	5 th
Religion		-7.92	0.00*	0.119	4 th
Total Monthly Income		7.15	0.00*	0.073	6 th
Education	Non-formal	0.73	0.09 ^{ns}	0.024	9 th
	Junior/Senior High School	1.31	0.01*	0.067	7 th
	Bachelor	22.51	0.00*	0.147	3 rd
	Place of Birth	11.13	0.00*	0.174	2 nd
	Constant	10.32	0.10 ^{ns}	-	-

4. Discussion

The study revealed that the host communities depended on the forest products at varying degree and different forms. It supported the view of Babulo et al. (2008), Bwalya (2013) who stated that the importance of forests as a source of livelihood varies geographically, over time and across households. The composition of the sampled host communities' households in Pendjari National Park were mostly females. The finding was in consonance with the report of INSAE (2015) that the proportion of women within the Beninese population and Atacora department remained practically 51.2% and 50.7% respectively in 2013. But the insignificance of gender in the host communities' socio-economic dependence on the Park negated the assertion of Mehta and Heinen (2001), that gender remained one of the factors that influenced the perception of host communities on their immediate protected areas.

However, the vast majority of the household composition was observed to fall within the age bracket between 15 years and 60 years. It is believed that the host communities of Pendjari National Park were most active and productive with greater tendency to exert their energy into natural resources exploitation or conservation in the protected area. Contrary, the result revealed that the age class had no statistical significance on the host communities' socio-economic dependence on forest product despite its dominance. The exerted pressure on natural resources of the park emanated from the age classes 5-14 years and above 60 years. This can be attributed to the rural-urban migration-drift by the age category of 15–60 years for education and business purposes, which reflected the inadequacy of basic educational and social amenities towards improving the social and economic well-being of the communities. Although, the drift is usually temporary and short-stay in nature because most age group members unite with their households daily or weekend.

The International Organisation for Migration (2011) and Blum (2014) corroborated the existence of the rural-urban migration attitude in Benin Republic among the age group of 15–60 years from rural areas in order to meet their daily needs. Their reports revealed an increased number of Beninese nationals migrating to other West African countries due to demographic growth, poverty, unemployment, increased living costs, difficult climatic conditions and dwindling natural resources though, no mention of age class of Beninese nationals involved. Hence, the result was in consonance to the findings of Ofoegbu et al. (2017) and Igu (2017) who believed that youths depended more on the forests of South Africa and Niger Delta region of Nigeria. It implied that the involvement of the older population in the forest products utilisation ensures the park's sustainability due to the linkage between their adequate knowledge in the forest resources management/utilization and optimal usage of forest products (Mamo et al., 2007).

Household heads' place of birth played a significant role that determined the socio-economic dependence of host communities on the forest products of the park. Most household heads were born inside the host communities, which implied that the provided information could be reliable due to their adequate knowledge and experience of the happenings in their respective communities. Much more, the study revealed that majority of the households were illiterate with little or no formal education which fell in line with IUCN (2002) report that the literacy rate in Pendjari National Park is very low. Although, no formal education level had no statistically significant influence on host communities' socio-economic dependence on forest products of the Park. Despite this, higher education levels such as junior/senior and bachelor's degree education had a significant influence on the host communities' forest dependency indices.

It supported the assertions of Malleson et al. (2014), Widianingsih et al. (2016) and Fikir et al. (2016) that higher education level of household members played a significant influence on their forest resources dependence in Cameroun, Ghana, Nigeria, Indonesia, Hammer District of Southeastern Ethiopia. This implied a higher understanding and alignment to re-orientation of value system through

conservation awareness programs as substantiated by McClanahan et al. (2005) and Satyanarayana et al. (2012). This finding contradicted the views of previous authors on the positive link between awareness on the availability of forest products and education (McClanahan et al., 2005; Anthony, 2007). Moreover, the majority of the households fell within the poor income group due to their total monthly income below the poverty line limit of less than \$1.25 daily. This could affect the dependence of host communities on the park's forest products which supported the views of Bwalya (2013), Malleson et al. (2014), Ofoegbu et al. (2017) and Igu (2017) who observed that household income significantly linked with their likelihood of engaging in forest resources utilisation and management.

However, the situation in Pendjari National Park was such that the planning framework and management strategies employed by the park authority encouraged host communities to gain benefits from the park-cheaper sales from hunters' and poachers' kill, free accessibility to non-timber forest products (medicinal plants), cultural integration with tourists for further assistance, access to farmlands, provision of employment (eco-guard, park staff), gifts to schools by foreign tourists, fishing in free zone and Pendjari River, food and food additives (such as fodders for animals, food spices, etc), housing materials, and so on. The participatory management strategy allowed the host communities to harvest medicinal plants and tangible fruits from the controlled access and hunting zones, once they received authorization from Village Associations for the Management of Wildlife Reserves (Vodouhe et al., 2010). According to (IUCN, 2002) and Vodouhe et al. (2010), most of the villages adjacent to the park formed "Village Associations for the Management of Wildlife Reserves" (AVIGREF), which enabled villagers to participate in decision-making process about the park and to share the benefits from park entry fees for tourism, hunting licenses and fines imposed for illegal activities. Much more, some communities had benefitted from other various initiatives of AVIGREF such as the provision of Donkey's cart/trolley, skills training on compost production, repair of boreholes, repair, and supply of chairs/tables, and employment of teachers to schools. This is believed to reduce undue pressure on the forest products of the core area (i.e. Pendjari Biosphere Reserve). Population size, urbanisation and proximity of a host community to a protected area could positively influence their socio-economic dependence on forest products (Jimoh et al., 2013; Zeng et al., 2016; Igu, 2017; Suleiman et al., 2017; UNESCO, 2017).

This was evident in Tanguieta with the lowest dependence on food and food additives, fuel, housing materials, trade-medicinal products, and forest income. Indeed, the availability of other alternatives for survivability and improved livelihood such as animal feeds for fodder; gas, kerosene, and charcoal for fuel; various clinics, hospitals, pharmacy, drug stores, few business opportunities could be a better explanation towards their low forest dependence. Also, coupled to the fact that Tanguieta is strategically located at the park's periphery along the expressway linking Cotonou (the commercial hub of Benin Republic) and Burkina-Faso, most households can be socio-economically sustained without forest products from the park. Geographical location in terms of close proximity to the park's boundary and nature of animal husbandry of Porga and Kolegou communities contributed to their most dependent on food and food additives. However, remoteness of the host communities influenced the overall dependence of each host community on the park's forest product.

5. Conclusion

The forest dependency indices revealed that most host communities in Pendjari National Park were dependent on the park in varied forms and degrees. The determinants of host communities to their socio-economic dependence on forest products of the park were household members' age, religion, total monthly income, education and household head's place of birth. Despite the households' socio-economic determinants to forest dependence, downward trend in the perceived availability of forest products over time, and the adopted management strategy in the current planning and management framework which allowed host communities' involvement and benefit gains from biodiversity conservation in Pendjari National Park, community advocacy programmes should be initiated to involve relevant stakeholders.

Stakeholders such as the authority of Reserve de Biosphere de la Pendjari, community leaders, household heads, youth representatives, market women leader, tour operators and relevant government officials. This initiative becomes necessary in order to identify and prioritise the social and economic needs of each host community. It will provide useful information to improving the livelihoods and well-being of the host communities' inhabitants. And, the livelihood/well-being improvement can be achieved through forest products' value addition (i.e. processing, preservation), and provision of alternative means of survival and social amenities (i.e. health centres, accessible roads, market stalls, kerosene and/or gas stations, modern cooking kiln, animal feed sales point, hay and silage production centre, well equipped primary and secondary schools, good transportation system, electricity, subsidy in fertilizer and other agricultural inputs supply, etc). These will provide a template for sustainable development and better co-existence between protected areas and their host communities.

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