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SOCIO-ECONOMICS AND STATUS OF TWO NON-TIMBER FOREST PRODUCTS (*IRVINGIA* FRUIT AND KERNEL) IN A CHANGING ENVIRONMENT IN CROSS RIVER STATE, NIGERIA

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Abstract

Irvingia fruit and kernels are valuable socio-economic non-timber forest products in South Eastern Nigeria. The dried kernels have long been used in the kitchen as a condiment for the preparation of local dishes and the market continues to expand, because of its contributions to household income and dietary needs. The study focused on the socio-economics and status of *Irvingia* fruits and kernels, in two local government areas (LGAs) within the rainforest of Cross River State, South Eastern Nigeria. A multi-stage sampling technique was employed for the study. Two hundred households in 8 villages were interviewed using semi-structured questionnaire and other participatory methods for data collection. The data collected were analysed using descriptive statistics and Likert type scale. The results of study revealed that 78.5 % of the respondents prioritised the kernels and fruits as a very important source of income and food for their households. Also, 91.5 % of the respondents claimed that the abundance of the fruit and kernel has decreased over time due to extreme changes in the environment. The results of the Likert scale analysis rated perceived effect of changes in the environment on the overall abundance of *Irvingia* fruit and kernel economic and culinary value to be high and positive ($\bar{X}$ = 4.02), which implies that the sustainable availability of *Irvingia* fruits and kernels and their contributions to local household dietary needs and income is not guaranteed. It is imperative to intensify both *in-situ* and *ex-situ* conservation of this valuable tree species.

Key words: Abundances, environmental changes, fruits, *Irvingia* species, kernels, perception.

Introduction

Non-timber forest products (NTFPs) are of enormous socio-economic, cultural and ecological importance in sub-Saharan Africa; the essence of which are extensively documented (Agustino et al. 2011, Ambrose-Oji 2003, Asaah et al. 2003, Ayuk et al. 1999, Bharucha and Pretty 2010, Ermias et al. 2014, Heubach 2012, Heubes et al. 2012, Heubach et al. 2013, Nkwatoh et al. 2010, Shomkegh et al. 2013, Vihotogbe 2012, Vihotogbe et al. 2015, Shomkegh et al. 2016). In fact, across sub-Saharan Africa, wild foods gathered from the forests and other natural or modi-

fied ecosystems, are vital for supplementing agricultural production by contributing to improve food availability, food security and equally plays an essential role in foreign exchange earnings (Ayuk et al. 1999, Bharucha and Pretty 2010, Heubach et al. 2011, Vinceti et al. 2013, Shackleton 2014). NTFPs are especially crucial in years of low agricultural productivity, usually as a result of extreme climate events such as drought, flood, disease and pest outbreak and other natural disasters (Shackleton 2014, Takasaki 2011, Bharucha and Pretty 2010, Fentahun and Hager 2009, Jumbe et al. 2008, Mojeremane and Tshwenyane 2004).

Generally, NTFPs offer a potentially critical role in buffering against food stress caused by changing environmental conditions (Bharucha and Pretty 2010, Shackleton 2014). NTFPs in times of stress can thus be viewed as an effective coping mechanism for dealing with threats to food security (Shackleton 2014, Shackleton et al. 2011, Fentahun and Hager 2009) because of their innate resilience to changing environment by assisting communities to cope in adverse situations (Msalilwa et al. 2013, Shackleton 2014). Furthermore, NTFPs are numerous and versatile (Ambrose-oji 2003, Ahenkan and Boon 2011, Agustino et al. 2011, Shackleton 2014) but this study is considering only one of the most important socio-economic NTFPs found in South-Eastern Nigeria, which have contributed immensely to household income and dietary needs overtime. *Irvingia* species (*Irvingia wombolu* Verm. and *Irvingia gabonensis* Baill.) are highly valuable and extensively utilised tropical African trees and have been identified as very high priority tree species (Ainge and Brown 2001, Nkwatoh et al. 2010). They are among the most important multipurpose indigenous food tree species in West and Central Africa because of its continuous high income share and dietary contribution to rural households (Agbor 1994, Ainge and Brown 2001, Asaah et al. 2003, Ayuk et al. 1999, Babalola and Agbeja 2009, Ewane et al. 2009, Lowe et al. 2000, Nkwatoh et al. 2010, Sunderland 2001, Sunderland et al. 2003, Vihotogbe 2012) and with a market value of about US$ 260,000 per annum across West and Central Africa (Asaah et al. 2003, Nkwatoh et al. 2010, Sunderland et al. 2003). The dried kernels have long been used in the kitchen as condiment for the preparation of local dishes such as “ogbono soup” and other sauce, and the market continues to expand because of its big contributions to households’ income and dietary needs. The soup-thickening quality is enhanced by viscosity and drawability, which varies by tree species and by geographical location (Asaah et al. 2003, Lowe et al. 2000, Vihotogbe et al. 2015).

In Nigeria, it is generally perceived that *Irvingia* kernels has more drawability or viscosity properties than any other viscous food condiment and these has increased the priority place on the *Irvingia* species in terms of its preference to culinary value, conservation and contribution to household income. Albeit, the abundances of these NTFPs can be seriously affected by changes in the environment through the evidences of past and future climate simulations in Nigeria and other West-African counties (Abiodun et al. 2013; IPCC 2013, 2014, Heubes et al. 2013; NEST 2011; Shackleton 2014). However, it could be expected that under predicted environmental change, particularly the increase in frequency and intensity of extreme events, the likelihoods of people resorting to consumption of wild foods and sales of NTFPs as a coping strategy may expand (Bharucha and Pretty 2010, Heubes et

al. 2012, Shackleton 2014, Shackleton et al. 2010, Woittiez et al. 2013, Vihotogbe 2012).

Evidently, little is known about how environmental changes, interacting with other drivers of change will impact the forest, more particularly, the range of products and resources the people rely on (Bharucha and Pretty 2010, Nkem et al. 2010, Shackleton 2014). More so, limited research has been undertaken to consider how changes in climate may affect the distribution, productivity or availability of the wild species especially NTFPs that people use for food and other purposes (Shackleton 2014). In order to ensure a viable and sustainable production system of *Irvingia* species in Nigeria, there is need for further understanding of the socio-economics of *Irvingia* in Nigeria (Ladipo 1999), since research initiatives in this direction are still scarce and hindered by poor sampling in quantitative and comparative studies over the entire distribution range of *Irvingia* species and other NTFPs in West Africa (Heubach et al. 2013, Vihotogbe 2012). There is, therefore, a need to examine the perceived socio-economic factors that affect the trends of abundance and status of *Irvingia* fruits and kernels in a changing anthropogenic environment. It is anticipated that the findings of this study may serve as an incentive to safeguard its protracted use and consequent conservation.

Material and Methods

Study area

This study was carried out in Akamkpa and Etung local government areas (LGAs) of Cross River State, Nigeria (Fig. 1). The study area occupies a land area of 7,908.47 km^2 or 42.80 % of the total land area spanning the tropical high forest areas of Cross River State (CRS) at 5°20' and 6°20' N and longitudes 8°05' to 8°45' E (Oyebo et al. 2011). The rainy season commences in the area around March and extends to November, while dry season occurs between December and February, reaching its peak in January, when the harmattan wind sweeps across the entire area. However, the time of commencement, cessation of rainy season and changes in other weather events are recently becoming very irregular and unpredictable. The annual average rainfall is between 2233.33 mm in Etung and 2977.21 mm in Akamkpa with an average temperature for Etung 32.03 °C and 30.90 °C for Akamkpa and an average wind speed of 93.89 knots for Akamkpa and 28.97 knots for Etung in the past 32 years (Udeagha 2015). The arable land in the area is predominantly used for the cultivation of perennial crops, such as plantain and banana, cash crops (cocoa) and other arable crops. Bush fallow cultivation is clearly dominant as it engages about 84 % of the population (Bisong 2004).

Multi-stage sampling technique was employed for this study. The first stage involved purposive selection of two local government areas (LGAs), identified as having forest resources and proximity to forest reserves, national parks and market access from the list of 18 LGAs in Cross River State. In the second stage, four rural villages were selected randomly from each of the two LGAs with emphasis on villages identified as having forest resources, located adjacent to the forest, accessible to market, access roads or water transport and extent of NTFPs in the area, representativeness and accessibility. In all, 8 villages were randomly selected for the study, namely: Nsofang, Abijang, Mkpot and Itaka in Etung LGA: Mfaminyen, Ojok,

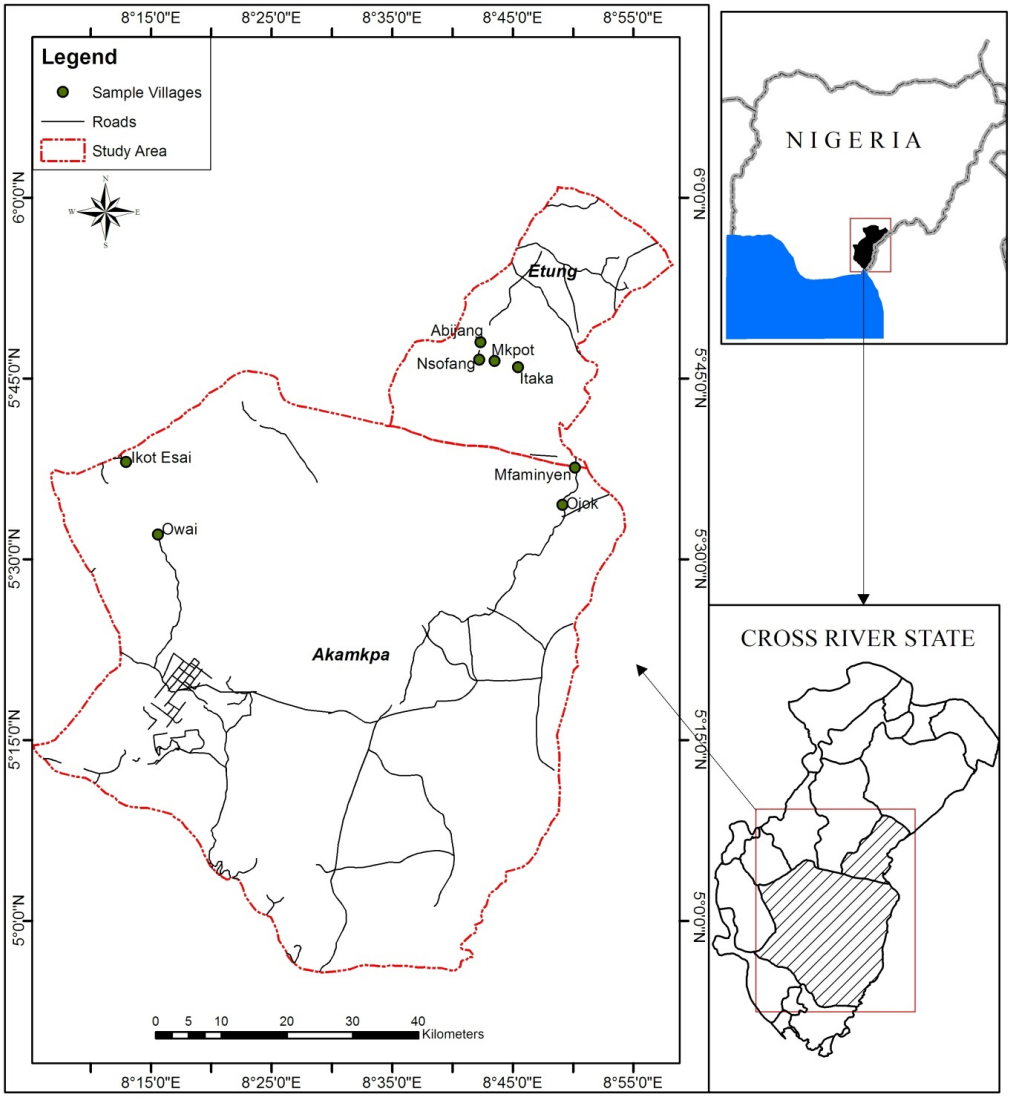

Fig. 1. Map of the study areas showing selected local government areas and sampled villages.

Owai and Iko Esai in Akamkpa LGA (Table 1). In the third stage, sample households were selected using lottery method. The list of sampled households in each village was obtained with the assistance of community leaders and their councils. The household's involvement in NTFP-related livelihood activities and access to the forest was used as yardstick while selecting the sample households. Each household identified to be involved in NTFP-related activity in each of the selected villages was assigned a number on paper, which was then put in a box.

The numbers were drawn from the lottery box without replacement until a sam-

Table 1. Local government areas, villages, number of households and sample size used.

LGAs	No of villages*	Sampled villages	No of households	No of sampled households
Akamkpa	63	Mfaminyen	365	25
		Ojok	371	25
		Owai	267	25
		Iko Esai	425	25
Etung	14	Nsofang	496	25
		Abijang	432	25
		Mkpot	412	25
		Itaka	374	25
	78	8	3142	200

Note: * – Source Cross River State traditional ruler's council audit of villages (1976).

ple size of 25 households was reached in each village (Angelsen et al. 2011), corresponding to 5–10 % of households in the villages. In order to ensure comparison, variation and representativeness in the selection of geographical sub-units (villages) in a study, Angelsen et al. (2011) stipulated, as the rule of thumb, a minimum sample size of 25–30 households from each village as appropriate for a village ranging in size from 100–500 households (Table 1).

Both primary and secondary data were collected. Primary data was collected from the study area through the combination of both qualitative and quantitative tools using a semi-structured questionnaire, supplemented by other participatory approaches such as focus group discussions (FGDs), among others for the data collection. The questionnaire was developed based on the reconnaissance survey, consultation with different experts on socio-economic issues and reference to literature. Individuals, who had lived in the area for a long time and had good experience of the uses and trade in *Irvingia* fruits and kernels, were selected for the FGDs. FGDs were conducted by forming small groups (4–6 members) with extractors and brokers sharing similar background and who have experience and ample knowledge of utilization of the species. In all, a total sample size of 200 households in 8 villages was selected and used for administering the semi-structured questionnaire.

Data Analysis

The data collected was analysed using IBM Statistical Package for Social Science version 20 and Excel 2007. Descriptive statistics such as percentages, tables, frequencies, standard deviation and graphs, as well as inferential statistics such as Likert type scale, were employed in analysing the socio-economic characteristics of the households and the trends in perception of the abundance of *Irvingia* fruits and kernels in the past 10 years, respectively. The Likert type scale for the determining the household perceived impact of changing environment on the availability of *Irvingia* fruits and kernel as follows:

The mean scores of respondents' re-

sponses to the questions were used to assess the impacts of climate change. The mean scores (weighted mean) were derived from a five point Likert scale question (Impact statement): "Strongly agreed" = 5, "Agreed" = 4, "Undecided" = 3, "Disagreed" = 2, and "Strongly disagreed" = 1. To determine the possible impacts of changing environmental conditions on the abundance of *Irvingia* fruits and kernels as perceived by the households, the values on the Likert-type scale were summed to get 15, and then divided by 5, to get a mean score of 3. The overall mean was calculated by dividing the sum of mean score by the number of impact statements. The equation is expressed as specified by (Likert 1932, Denis and Dormody 1994, Sullivan and Artino 2013, Belachew and Zuberi 2015) in Eqn. 1.

$$\frac{\sum \bar{X}}{N} \quad (1),$$

where:

$\sum \bar{X}$ – Summation of the mean score from each impact statement;

N – Number of impact statement.

Decision rule: Any impact statement mean score of ≥ 3.00 was taken as significant, positive and 'agreed' decision that changing environmental conditions had been impacting on the availability of *Irvingia* species (fruits and kernel) over time, while mean score of < 3.00 was regarded as a negative and disagreed decision, implying that changing environmental conditions had no impact on the availability of *Irvingia* species (fruits and kernels) in the study area. A grand mean (overall mean) of > 3.00 was regarded as 'agreed', indicating that the respondents perceived impact of changing environment on availability of *Irvingia* fruits and kernels as significant, positive and high, while any grand mean score of < 3.00 was regarded as 'disagreed', indicating that the households perceived changing environmental impact on the abundance of *Irvingia* fruits and kernels was negative and low.

Results and Discussion

Socio-economics characteristics of households involved in the gathering/ extraction of *Irvingia* fruits and kernels

The socio-economic characteristics of the households presented in Table 2 revealed that the ages of the sampled household heads ranged between 28 and 75 years, with an average of 48.51 years. This implies that the respondents have a lot of experience with regard to changes in their environment and gathering of *Irvingia* fruits and kernels and could be in a better position to make inference on the trends of abundance of *Irvingia* fruits and kernel. This agreed with the findings of Akponikpe et al. (2010), Awe et al. 2011 and Msalilwa et al. (2013) that age had an influence on the accumulation of knowledge on environmental changes and variability and gathering of NTFPs of a particular locality. Overall, 82 % of the household heads were between 25 and 59 years (Table 2). This demonstrated that majority of the household heads were still there in productive and active working age, which is below 60 years, and are still actively involved in the gathering and collection of *Irvingia* fruits and kernels for their household needs.

Among the respondents, 73 % and 27 % were male and female household heads, respectively. About 30 % of the respondents did not have formal education, while the rest had primary (34.5 %),

secondary (25 %) and tertiary (10.5 %) education, respectively. This high rate of literacy among the respondents could positively influence their perception of environmental changes and variability. This agreed with the findings of Msalilwa et al. (2013) and Fonta and Ayuk (2013) that educational level influenced the people's perception of changes in environment and variability. Majority of the respondents (94 %) were native to the area, thus this implies that they are very much aware of changes in the environment and would be in the position to tell their own story about the trend in changing climate and their level of involvement in collection and gathering of *Irvingia* fruits and kernels, while the rest (6 %) were migrants/settlers from other places, who came for trade in *Irvingia* fruits and kernels or as migrant labourers who also help local households in the gathering, collection and processing of kernels of these NTFPs. Ermias et al. (2014) and Msalilwa et al. (2013) affirmed that how long a person lived in an area helps the individual to accumulate experience and knowledge on the changes in the environmental condition and their participation in forest related (mainly NTFPs) activities of that particular locality. A large proportion (97 %) of the households engaged in crop and livestock production, as well as trading in *Irvingia* fruits and kernels to supplement their source of livelihood because these could serve as a supplementary and alternative sources of food and income especially crucial in years of crop failure, usually as a result of extreme weather event (See Shackleton 2014, Woittiez et al. 2013). This also agreed with the findings of Belachew and Zuberi (2015), Blench (2003) and Kurukulasuriya and Mendelsohn (2008), who asserted that mixed cropping and crop switching helped farmers to cope and adjust to prevailing environmental condition like climate change.

Forest land is an important fixed asset to the households upon which cultivation of agricultural crops, rearing of livestock and collection of NTFPs depend. The result shows that (87.5 %) of the households had their land, while (12.5 %) did not have their own land (Table 2). Among those who had their own land, majority (72 %) got theirs' through open access to land acquisition. Open access is a means of land acquisition whereby an individual or household claim portion of forested land through own clearance (Fonta and Ayuk 2013). This practice was found to be prevalent in the study area where land was cleared in order to give way for the expansion of agricultural activities, especially for the cultivation of cocoa tree (*Theobroma cacao* L.) alongside with *Irvingia* species. However, the *Irvingia* trees function as shade to the cocoa trees and equally provides additional income and food for the farmers. This practice was observed to be a very high surrogate income generation for the households in the study area. The remaining (23.5 %) of the respondents got their land through inheritance, while 4.5 % got theirs through lease or rent.

The family size ranged from 1 to 15 persons, with the majority (46 %) of the households having 7 to 9 persons with an average of 8 persons per household (Table 2). The high household size implies that the household's involvement in the collection and gathering of *Irvingia* fruits and kernels could be high in order to supplement both their food and other household's needs. Accordingly, Anyanwu (2013) indicated that following microeconomic arguments in Nigeria, children are considered as an essential part of the household's work force to generate household income, and as insurance against

Table 2. Distribution of households based on their demographic and socio-economic characteristics.

Variables		Frequency, N	Share, %
Age:			
	28–35	19	9.5
	36–43	52	26.0
	44–51	56	28.0
	52–59	37	18.5
	60–67	27	13.5
	68–75	9	4.5
Household headship by gender:			
	Male-headed	146	73.0
	Female-headed	54	27.0
Educational Status of households:			
	Non-formal	60	30.0
	Primary	69	34.5
	Secondary	50	25.0
	Tertiary	21	10.5
Residence:			
	Born where respondent resides	188	94.0
	Migrated	12	6.0
Household's primary occupation:			
	Trading in NTFPS/crop/livestock	194	97.0
	Trading/ civil servant	6	3.0
Land ownership:			
	Yes	175	87.5
	No	25	12.5
Methods of Land Acquisition:			
	Open access	144	72.0
	Inherited	47	23.5
	Lease/rent	9	4.5
Household size:			
	≤3	12	6.0
	4–6	50	25.5
	7–9	92	46.0
	10–12	45	22.5
	13–15	1	0.5
Household heads' years of occupational experience:			
	≤12	22	11.0
	13–20	71	35.5
	21–28	42	21.0
	29–36	41	20.5
	37–44	18	9.0
	45–52	6	3.0

old age. About one third (35.5 %) of the household heads had between 13–20 years of occupational experience, while 21 % and 20.5 % had 21–28 and 29–36 years of occupational experience, respectively (Table 2). The average number of years of occupational experience was 24 years for the sampled households. This result indicated that the respondents were highly experienced in their various occupations and, therefore, were in a good position to make reasonable livelihoods from it, while also being aware, to a large extent, of the changes in the environment. Maddison (2007) and Gbetibouo (2009) reported that farmers with high level of farming experience were more likely to notice environmental changes than those with less farming experience. This result also indicated that the households were aware of the salient implications of changing environment on their livelihoods. This concurred with the findings of Maddison (2007) in eleven African countries that farming or working experience increased households' perception of environmental changes in a particular locality.

Household's prioritisation of uses of *Irvingia* fruits and kernels in the past 10 years

Majority (78.5 %) of the respondents prioritised *Irvingia* fruits and kernels as a very important source of income and subsistence use for their households, while 21.5 % considered it to be important in the last ten years (Fig. 2). Most of the sampled households (97 %) placed very high priority on the kernel rather than on the edible pulp since the kernel was the 'gold', which brought the much needed income. Trade in the kernel of *Irvingia* species played a very important role in contributing to rural household economy, thus helping the rural households to meet both their food and other household's needs (Ayuk et al. 1999, Sunderland et al. 2003, Ewane et al. 2009, Babalola and Agbeja 2009, Nkwatoh et al. 2010).

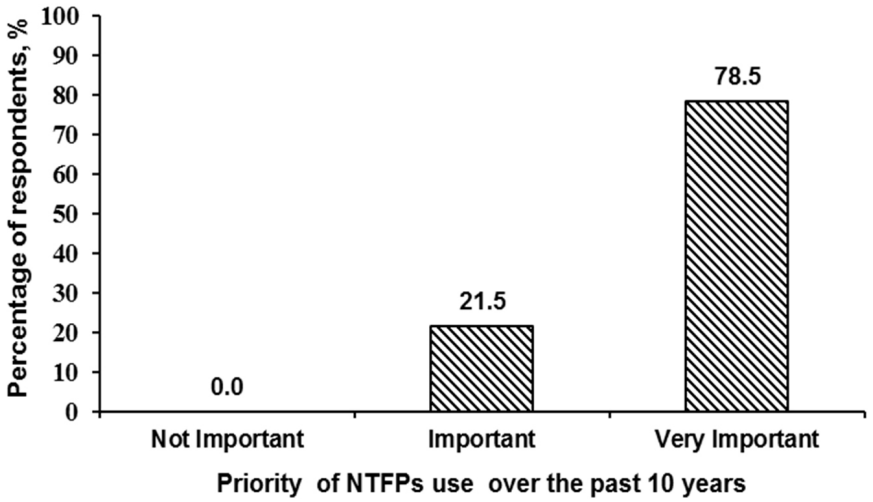

Fig. 2. Ranking of uses of *Irvingia* fruits and kernels.

Local perception on past and present abundance of *Irvingia* fruits and kernels ($1= ₦198)

Majority (91.5 %) of the respondents reported that *Irvingia* fruits and kernels were becoming rarely abundant recently. This implied that its abundance had decreased over the years, while 8.5 % maintained that *Irvingia* fruits and kernels were still abundant (Fig. 3). Sixty percent (60 %) of the respondents believed that *Irvingia* fruits and kernels were becoming less abundant in the past five years; 33.5 % maintained that they were still abundant, while few (5.5 %) believed that the fruits and kernels were becoming more abundant in the last five years (Fig. 3). Fifty-five percent (55 %) of the households affirmed that *Irvingia* fruits and kernels were more abundant ten years ago; 32 % affirmed that *Irvingia* fruits and kernels were much more abundant about ten years ago, while 13 % believed that they were less abundant ten years ago (Fig. 3). The respondents reported that the demand for *Irvingia* fruits and kernels has increased significantly in the last 10 years, because of their decreasing supply due to environmental changes, hence non-abundance as before. This increase in demand became more intense in the 2012–2013 season, judging from the high number of brokers (buyers) who came to their villages in search of these NTFP. This was suggestive of the high economic value placed on the NTFP in terms of contributions to household economy. According to the sampled households, they were in the position to bargain for the selling price of *Irvingia* fruits and kernels from ₦ 3500 last season to ₦ 7000 this season for 6.5 kg measure of the kernels of the wet season species (*Irvingia gabonensis*). In the last season, the selling price for a 6.5 kg of kernels of the dry season species (*Irvingia wombolu*) was higher (₦ 8000) than the price (₦ 5000) in the subsequent season. This indicated that the supply was low, perhaps because *Irvingia* fruits and ker-

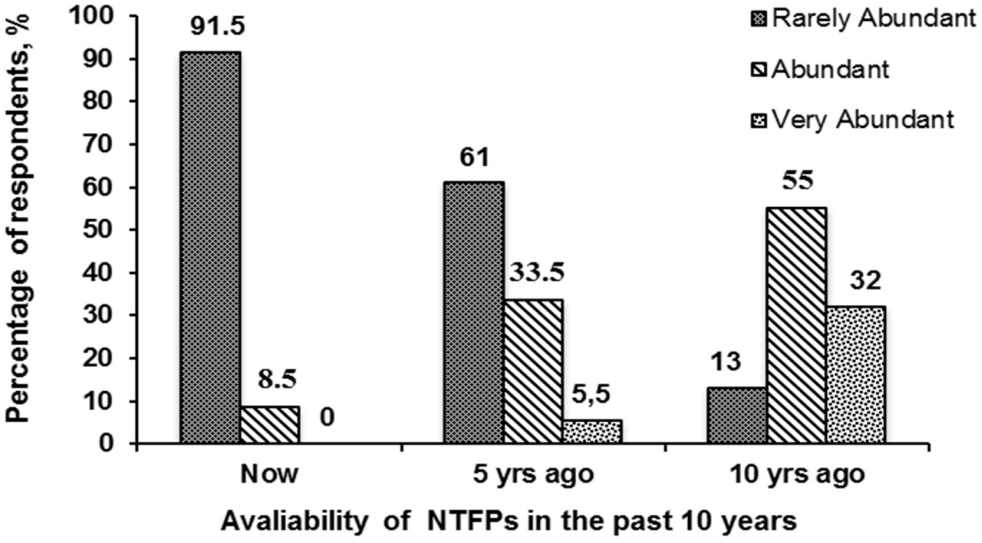

Fig. 3. Trend of abundance of I*rvingia* species in the past ten years.

nel were becoming less abundant than used to be the case in the past 10 years, thereby creating a supply gap by making the overall demand to exceed supply. Sunderland (2001) and Sunderland et al. (2003) had earlier reported that during the period of low supply both the wholesale and retail prices of *Irvingia* fruits and kernels could increase by up to 300 %.

Reasons for decrease in abundance of *Irvingia* species in the past 10 years

The reasons for the low abundance and diversity of *Irvingia* species across the study area could be attributed to lack of proper seed dispersal mechanism as reported by 89 % of the respondents, and its inability to withstand short-term changes in the environment due to extreme weather events (Vihotogbe, 2012). Humans and wild animals do not normally feed on *Irvingia wombolu* fruits because of the bitter pulp and juice (endocarp). Because of this, it is difficult for it to be properly dispersed and this invariably has reduced its diversity and abundance (Vihotogbe et al. 2014b). *Irvingia wombolu* fruits mature during the dry season when rainfall is inadequate to trigger germination or to create enabling environment to support germination (Vihotogbe 2012; Vihotogbe et al. 2014c; Vihotogbe et al. 2015). Ninety five percent (95 %) of the respondents strongly believed that the current climatic conditions had not favoured the increase in abundance of *Irvingia* spp. because they had continued to experience increase in extreme weather events in the past 10 years, which included damping of the flowers due to recent excessive rainfalls, shrinking of the flowers due to increase in heat intensity, and blowing way flowers by increase in wind speed according to them these would reduce the abundance of the fruits at maturity. Invariably this had contributed to overall decrease in the abundance of *Irvingia* spp over time.

Impact of decreased abundance of *Irvingia* fruits and kernels on rural household economic and food needs

Majority (71.5 %) of the respondents strongly believed that if the availability of *Irvingia* fruits and kernels kept decreasing, it would have significant impacts on its contribution to the overall household income and food needs (Fig. 4). For example, the NTFPs would lose their safety-net function in time of financial shortfall or environmental crisis such as crop failure, among others (Heubes et al. 2012, Shackleton 2014). On the other hand, only 20 % of the sampled households indicated that the decrease in the abundance of *Irvingia* fruits and kernels would have some impacts on its overall contribution to their wellbeing. However, 8.5 % of the households indicated that the decreasing availability of *Irvingia* fruits and kernels would have very little impact on its contribution to their overall wellbeing.

Perceived impact of changing climate on the abundance of *Irvingia* fruits and kernels economic and culinary value

The perception of changing climate survey using five point Likert scale (Table 3), has shown that the current changes in the environment was impacting on the abundance of *Irvingia* species economic and culinary values. All the respondents (100 %) strongly agreed that environmental changes were causing positive and significant reduction in the availability of *Irvingia* fruits and kernels, confirming the findings of Deryng et al. (2014), Shackleton (2014). Regarding reduction

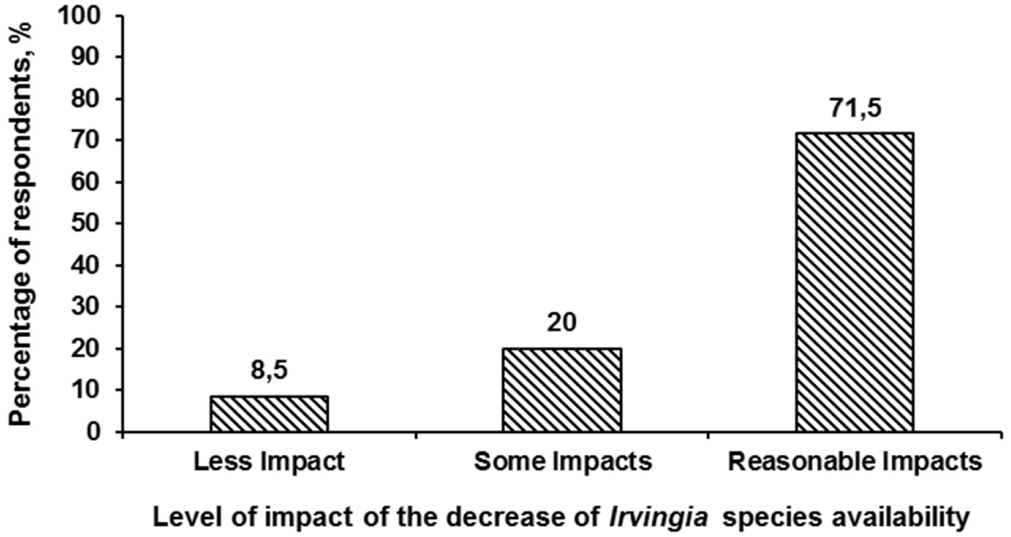

Fig. 4. Level of impacts of the decrease in *Irvingia* fruits and kernels abundances on household economy.

in quantity of collected *Irvingia* fruits and kernels, 87 % strongly agreed to the statement, while 13 % were undecided. Nearly 79.5 % agreed with statement reduction in income generated from the kernels. Also 45.5 % strongly agreed with the statement reduction in food availability and abundance, while 22 % strongly disagreed. About 48 % strongly agreed with statement that changing climate had not started inducing conflict over forest resource management with 25 % strongly disagreeing. However, 57.5 % of the households strongly agreed with the impact statement that changing climate had started triggering out-migration, thereby reducing availability of labour, while 16 % strongly disagreed. For all the response the most common rating was the "Strongly Agreed", the weighted mean was above ($\bar{x}$ = 3.7) for all except one ($\bar{x}$ = 2.37), showing the high level of awareness / perception of environmental changes and its impacts on the abundance of *Irvingia* fruits and kernels. Overall increasing impact of environmental changes on the abundance of *Irvingia* fruits and kernels was high and positive, thus implying that most rural households would not be in the position to continuously rely on *Irvingia* fruits and kernels for their dietary and income needs.

Conclusions

The study revealed that the abundance of *Irvingia* fruits and kernels was decreasing over time due to the perceived changing climate conditions. This could affect the sustainable availability of the *Irvingia* fruit and kernels and their contributions to local household dietary needs and income. It is, therefore, very pertinent for policy makers especially at the local level to formulate policies and design strategies aimed at sustaining the future availability of *Irvingia* fruits and kernels through a consolidated community based forest management and other conservation measures using modern approaches and techniques that would

Table 3. Mean distribution of rural households rating of impact of environmental changes on the abundances of *Irvingia* fruits and kernels economic and culinary values.

Impact statement	Strongly agreed	Agreed	Undecided	Disagreed	Strongly disagreed	Sum of responses	Mean score	SD
Reduction of the abundances Irvingia fruits and kernels	154(77.0)	46(23.0)	-	-	-	954	4.770*	1.67
Reduction in quantity collected of Irvingia fruits and kernels	131(65.5)	43(21.5)	26(13.0)	-	-	905	4.525*	1.37
Reduction income generation from Irvingia fruit and kernels	159(79.5)	31(15.5)	7(3.50)	-	3(1.5)	943	4.715*	1.71
Reduction in the availability of foods	91(45.5)	52(26.00)	12(6.0)	1(0.5)	44(22.00)	745	3.725*	0.94
Increase in conflicts over the of forest resources	50(25.0)	8(4.0)	3(1.5)	43(21.5)	96(48.0)	473	2.365	0.47
Out-migration thereby reducing the availability of labour	115(57.5)	46(23.0)	2(1.0)	4(2.0)	33(16.5)	806	4.030*	1.21
Overall mean							4.022*	
Number of respondents							200	

Note: * – Positive and agreed rating, SD – Standard Deviation. Figures in parenthesis are percentage distributions of the household rating.

ensure more domestication of *Irvingia* species in public, government and private lands. This would create more access to *Irvingia* fruits and kernels gathering and extraction for cultural and economic uses while increasing the resilience of the rural households to adjust to changing environmental conditions. Additionally, this would enhance the genetic diversity of this invaluable forest resource and conserve its innate resilience to the changing anthropogenic environment.

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