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Prioritization of Forest Resources for Sustainable Management of Iyiocha Stream Forest Reserve, Delta State, Nigeria

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Research Article

Abstract – In this study, forest resources were prioritized based on forest stakeholders' ranking. Four forest-adjoining settlements were selected using stratified random sampling: Illah and Ugbolu within three kilometer radius; Akwukwu and Aniwalo within six kilometer radius of Iyiocha Stream Forest Reserve (ISFR) boundary. Based on interest of stakeholders, four respondent groups were purposively selected: Timber harvesters, Taungya farmers, Non-Timber Forest Products (NTFPs) harvesters and Staffs of the Department of Conservation and Department of Forestry, Delta State Ministry of Environment. Four sets of structured questionnaire were administered on 165 respondents using sampling proportionate to size. Field inventory was done in 116 plots of 25m×25m in the plantations using stratified random sampling and 20 plots of 50m×50m in the natural forest using systematic sampling. Twenty-seven tree species and 22 NTFPs were identified. Forest resources were prioritized; and timber and 9 NTFPs were picked with final assigned mean values: timber in plantations and natural forest (X1±1.00), taungya farm land (X2±1.24), fuel-wood (X3±1.52), *Morinda lucida* bark (X4±1.54), *Tetrapleura tetraptera* fruits (X5±2.03), *Treculia africana* fruits (X6±2.53), *Napoleona vogelii* stems (X7±3.02), *Olax subscorpioidea* stems (X8±3.52), *Nauclea latifolia* roots (X9±4.01) and *Morinda morindoides* stems (X10±4.51). Prioritization has helped to identify the forest resources important to the forest-adjoining settlements.

Keywords *– Forest, resources, multiple-use, management, sustainability*

Iyiocha Çayı Orman Rezervinin Sürdürülebilir Yönetimi için Orman Kaynaklarının Önceliklendirilmesi, Delta Eyaleti, Nijerya

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Araştırma Makalesi

Öz – Bu çalışmada orman kaynakları, orman paydaşlarının sıralamasına göre önceliklendirilmiştir. Iyiocha Çayı Orman Koruma Alanı (ISFR) sınırının üç kilometre yarıçapındaki Illah ve Ugbolu ile altı kilometre yarıçapındaki Akwukwu ve Aniwalo olmak üzere ormana bitişik dört yerleşim yeri Tabakalı rastgele örnekleme kullanılarak seçilmiştir. Paydaşların ilgisine dayanarak, dört katılımcı grup bilinçli olarak seçilmiştir: Kereste hasatçıları, Taungya çiftçileri, Kereste Dışı Orman Ürünleri (NTFP'ler) hasatçıları ve Delta Eyalet Çevre Bakanlığı Koruma Dairesi ve Orman Dairesi Personeli. Büyüklükle orantılı örnekleme kullanılarak 165 katılımcıya dört set yapılandırılmış anket uygulanmıştır. Saha envanteri, tabakalı rastgele örnekleme kullanılarak plantasyonlarda 25m×25m'lik 116 parselde ve sistematik örnekleme kullanılarak doğal ormanda 50m×50m'lik 20 parselde yapılmıştır. Yirmi yedi ağaç türü ve 22 NTFP tespit edilmiştir. Daha sonra orman kaynakları önceliklendirilerek kereste ve 9 Kereste Dışı Orman Ürünü nihai olarak atanan ortalama değerlerle seçilmiştir: plantasyonlarda ve doğal ormanlarda kereste (X1±1.00), taungya sistemi (X2±1.24), yakacak odun (X3±1.52), Morinda lucida kabuğu (X4±1.54), Tetrapleura tetraptera meyveleri (X5±2.03), Treculia africana meyveleri (X6±2.53), Napoleona vogelii sapları (X7±3.02), Olax subscorpioidea sapları (X8±3.52), Nauclea latifolia kökleri (X9±4.01) ve Morinda morindoides sapları (X10±4.51). Önceliklendirme, ormana bitişik yerleşimler için önemli olan orman kaynaklarının belirlenmesine yardımcı olmuştur.

Anahtar Kelimeler *– Orman, kaynaklar, çoklu kullanım, yönetim, sürdürülebilirlik*

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1. Introduction

Forests are vital resources which are able to naturally renew themselves; and do not only produce wood raw materials (Gungor and Ayaz, 2020). They also produce non-wood materials and protective services which are useful to public health and are of greater significance in terms of intensive forestry approach which aims to supply the needs of the contemporary society. Forests across the world offer diverse products such as healthy foods, high in micronutrients and fibre, refined sugar and fat (Arnold *et al.*, 2011). These forest products are often culturally valued, integral to local food systems and food sovereignty, and help households fill seasonal and other cyclical food gaps; and act as a 'safety net' or 'buffer' in times of shortages due to drought or crop failure. These forest products are also used as medicine in treating different diseases. They also serve as a means of livelihood and generate income (Ekhuemelo *et al.*, 2016).

The effective methods to sustain forests, while also providing a broad range of ecosystem goods and services, have been the subject of debate for decades **(**Keeton, 2007). One of these methods is prioritization which helps to place importance on forest goods based on forest stakeholders' opinion for good management of forests. The rural forest dwellers play significant role in forest resource use and forest change in structure and dynamics (Sherbinin *et al.*, 2008). Usually, the public have varied opinions on how and why forests ought, or ought not to be administered and used (Meldrum *et al.*, 2013). With prioritization, such varied opinions would be synchronized to make suitable and worldwide decisions. Generally, approaches to prioritization show people's value and judgement of the existing options; and thereby ease-up choice and decision making.

Prioritization involves the ranking of things by their value (Tee *et al.*, 2014). Prioritization is imperative to forest economists and managers in making decision and in picking amid the scarced available forest goods which are often open to so several other uses. With prioritization, it is easy to decide the option of opportunities to pursue, problems to resolve and results to execute; and in making objective decisions in managing forest sustainably (Gosenheimer *et al.*, 2012). With prioritization, it is easy to decide the forest trees and other forest resources (FRs) which are important to the public so as to reduce the clearing of forest land for other uses such as raising of plantations of agricultural crops and urbanization. If the needs of the people are met through good management of the forest, they will be interested in conserving the forests. Mikkonen *et al.* (2023), used spatial conservation prioritization (SCP) process to discover forest areas not protected that host valuable forest biodiversity in Finland. Gungor and Ayaz (2020), used prioritization method precisely analytical hierarchy process (AHP) to select the best trees species to plant in agroforestry plantations in Bartin region. Popoola and Galaudu (2000), also applied prioritization to find and pick native species to be included in agroforestry systems in the semi-arid region of Nigeria. The final tree species were picked in relation to local peoples' perception to manage the forest sustainably. Though Popoola and Galaudu (2000) study, was carried out about twenty four years ago, prioritization of FRs in respect to peoples' perception is still very useful if sustainable management of forests and FRs in Nigeria is to be achieved.

Some rural communities in which forests and forest reserves are situated easily give in to the idea of converting forest land to other uses because most times they feel the forests and its resources do not yield much benefits and development to them. Through prioritization the needs of the people can be unveiled thereby incorporating them into forest management plan. It is imperative to make sure that natural resources are produced sustainably, which are the fundamental parts of sustainable life (Sen *et al.*, 2019). The welfare of populace in a nation is neglected if foresters failed in managing forest sustainably. Needs changes with time, it is proper to review the needs of the people that were included in the gazette of ISFR in 1969. Prioritization will guide in this decision making and in sustainably managing ISFR. With these, four forest-adjoining settlements around ISFR were surveyed and a field inventory of timber and NTFPs was conducted. Tree species and NTFPs of ISFR were identified. Timber and nine NTFPs which of importance to the forest-adjoining

settlements were identified with prioritization for the sustainable management and efficient use of the FRs of Iyiocha Stream Forest Reserve, Delta State, Nigeria.

2. Materials and Methods

2.1. Study Area

Iyiocha Stream Forest Reserve is located in Delta State, Nigeria. Its geographic coordinates are between Latitudes 6°15′ and 6°38′North and Longitudes 6°29′ and 6°44′East. Iyiocha Stream Forest Reserve was gazetted in 1969 by the then Military Governor of the Mid-Western State of Nigeria under Sub-section (1) of Section 12 of the Forestry Law (Cap. 38). The total size of ISFR is 875.416ha (8.754km^2); 131.399ha is natural forest, 36.017ha is for taungya farming and 708ha plantations of teak (*Tectona grandis*) and Gmelina (*Gmelina arborea*). ISFR is a rain forest zone with some areas of swamp vegetation; with a yearly rainfall between 1,500mm-1,847.3mm. The rainfall occurs twice in a year between June/July and September/October, with an average temperature of 33°C.

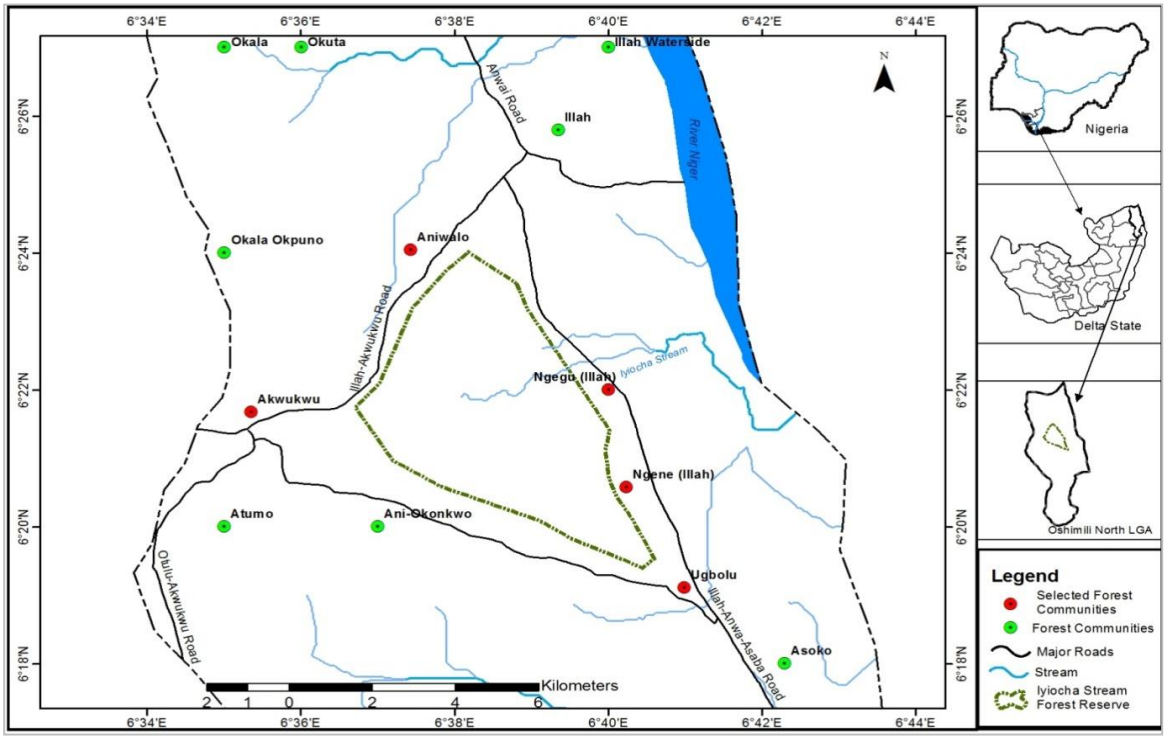

Figure 1. Map of Oshimili North Local Government Area showing ISFR and the forest-adjoining settlements

2.2. Data Collection and Analysis

Data were obtained through questionnaire survey, interview schedule and focus group discussions in the selected forest-adjoining settlements and field inventory was also done. The forest-adjoining settlements were stratified into two: those living within three- kilometer radius of ISFR boundary; and those living within three to six kilometer radius of ISFR boundary. Two settlements were selected at random from the two strata. Illah and Ugbolu settlements picked within the three kilometer radius while Akwukwu and Aniwalo settlements picked within the three to six kilometer radius. Four respondent groups: Timber Harvesters, Taungya farmers, NTFPs harvesters and Staffs of the Department of Conservation and Department of Forestry in Delta State Ministry of Environment were purposively selected based on their stakes in the management of ISFR and utilization of ISFR resources.

Sampling proportionate to size was used to administer questionnaire on 165 respondents: timber harvesters (5), taungya farmers (60), NTFPs harvesters (95) and staffs of the Department of Conservation and Department of Forestry in Delta State Ministry of Environment (5); 158 copies of questionnaire were valid.

Stratified random sampling technique was applied to lay 116 temporary sample plots (TSPs) in the forest plantations comprising of 19 age series (Table 1). In each of the age series, line transects of 300m with a distance of 100m between transects were laid. Sample plots of 25m×25m (625m^2) were demarcated along each transect at 100m interval. Sampling by proportion was applied to allocate the plots across the 19 age series for the four species of trees (*Tectona grandis*, *Gmelina arborea*, *Khaya ivorensis* and *Terminalia ivorensis*). A stand with larger area had more plots. One plot each was sampled in the plantations of *Khaya ivorensis* and *Terminalia ivorensis* due to the small sizes of the stands (0.4ha each).

Table 1
Distribution of Sample Plots (0.0625ha) in the Plantations

Tree Species	Age	Stand Area (ha)	Total No. of Plots	No. of Sample Plots
Tectona grandis	32	20	320	3
	31	10	160	2
	30	10	160	2
	29	20	320	3
	28	20	320	3
	27	20	320	3
	26	20	320	3
	25	20	320	3
	24	20	320	3
	23	20	320	3
	22	20	320	3
	21	20	320	3
	20	28	448	4
	19	40	640	6
Sub-Total			4,608	44
Gmelina arborea	32	10	160	2
	31	10	160	2
	50	400	6,400	66
Sub-Total			6,720	70
Khaya ivorensis	35	0.4	1	1
Sub-Total			1	1
Terminalia ivorensis	35	0.4	1	1
Sub-Total			1	1
Total			11,330	116

A systematic line plot inventory was adopted in laying temporary sample plots (TSPs) for the natural forest. Five transects of 600m long were placed at a distance of 300m apart. Four sample plots of 50m×50m were demarcated in altemating position at space of 150m along each transect with the aid of a measuring tape. Twenty plots were sampled, with a total area of 50,000m^2 (5 hectares).

A sampling intensity of 2.5, 5 and 10 percent was employed for harvesters of FRs depending on their population following Diaw *et al.* (2002), which recommends that a sample of 2.5 percent be employed to survey a respondent group whose population is more than 1000, while 5 percent may be employed to survey a population of 500 to 1000, and a sample of 10 percent be employed to survey those whose population is less than 500 people. With the above recommendation, 10% sampling intensity was employed for timber harvesters and Staffs of the Department of Conservation and Department of Forestry while 2.5% sampling intensity was employed for NTFPs harvesters. For taungya farmers; 100% sampling intensity was used. For the field inventory, one percent sampling intensity was employed for the plantations while four percent sampling intensity was used for the natural forest following Klauberg *et al.* (2016).

Data were collected on ISFR resources and the FRs that are important to the forest-adjoining settlements following preference.

The timber and NTFPs were prioritized following Adeola *et al.* (1994), method of prioritization. Though, this method was first used 30 years ago, being the only localized method of prioritization that have been used over the years in Nigeria; it is still very useful in prioritization of Nigeria FRs based on peoples' perception. It is also still relevant in revealing the FRs that are important to the people which should be incorporated into forest management plan thereby managing forests sustainably.

With the method, the amount of times a particular forest resource is mentioned (a) was computed to obtain its mentioned value (b). Average ranking (c) of one forest resource was solved as the summation of its assigned ranking by each respondent over respondents' number. The rank value (d) was solved by tabulating and ordering of the individual resource position. Assigned value was obtained by addition of mentioned value and the rank value and the result was divided by 2. Thereafter, the FRs which are important to the forest stakeholders were selected in ascending order from the first to the tenth.

$$\text{Final Assigned Mean Value (e)} = \frac{b+d}{2} \quad (1)$$

Where,
b = Mentioned value
d = Rank Value

3. Results and Discussions

3.1 Tree Species Identified

Tree species (both indigenous and exotic species) were identified in plantations and natural forest in ISFR (Table 2). The ISFR tree species are utilized by the forest-adjoining settlements in different ways. Eighty-one percent of the trees are used in timber production, building and construction, boat- building, medicine, pulp and paper production while 19% are used as staple food and medicine.

Identification of the tree species in ISFR agrees with Ihenyen *et al.* (2009), that identified and evaluated the composition of trees of Ehor Forest Reserve in Edo State, southern Nigeria. Trees are important forest resource of any forest as revealed in this study and this necessitates their identification. Trees play a vital role in climate change mitigation, water cycle maintenance and purifying of water (Ekhuemelo *et al.*, 2016).

From the field inventory, *Tectona grandis* (teak) has the highest frequency (625 per hectare) while *Treculia africana* (African breadfruit) has the least frequency (1 stand was identified in ISFR). Though, the exotic tree species (*Tectona grandis* L.F and *Gmelina arborea* Roxb) are more in ISFR, they are not sustainably managed and utilized. The high frequency of *Tectona grandis* might be because of the high viability of their seeds as noticed during the field inventory. The exotic tree species especially *Tectona grandis* (teak) has a fast growth rate with more of them in plantations than the indigenous tree species. The plantations of the indigenous tree species (*Terminalia ivorensis* A. Chev and *Khaya ivorensis* A. Chev) are degraded. These indigenous tree species plantations were degraded due to poor management resulting from lack of timber harvesting control. According to Lafrankie e*t al.* (2006), tropical rainforests are vulnerable to deforestation and degradation. There is a vast increase in anthropogenic activities, excessive logging and over exploitation of FRs due to population growth in Nigeria. Adekunle *et al.* (2010), observed that a total of 111,377 timber stems, belonging to 62 diverse indigenous hardwood species of tropical rainforest ecosystem, distributed among 16 families, were harvested from Ondo State forest ecosystem between 2003 and 2005.

Table 2
Tree Species

S/No	Botanical Names	Family Names	Common Names	Urhobo/Edo Names	Yoruba Names	Igbo Names	Hausa Names
1	*Albizia ferruginea* (Guill & Peir) Benth	Fabaceae	Albizia	Uwowe (E)	Ayinre-langara	Ngwe	Ayinre
2	*Alstonia boonei* De Wild	Apocynaceae	Stool wood	Ukhu (E)	Ahun/awun	Egbu/Akpe	Gududal
3	*Antiaris toxicaria* Lesch	Moraceae	Antioris	Ogiovu (E)	Akiro (Ikale)	Aji/Oji anwu	Akufodewa
4	*Azadirachta indica* A. Juss	Meliaceae	Neem			Akomsirop	Dogonyaro
5	*Bixa orellana* Linn	Bixaceae	Lipstick tree	Omigia-bor/Ikpododo (E)	Aje/Agbon	Uhie	Kwakwar
6	*Bombax buonopozense* P. Beauv	Bombacaceae	Cotton tree	Obokha (E)	Eso	Ndu kumu (Awawa)	Gurjiiyaa
7	*Ceiba pentandra* (Linn) Gaertn	Bombacaceae	Kapok tree	Okhu (E)	Aragasa	Akpu-ogwu	Rimi
8	*Cola Millenii* K. Schum	Malvaceae	Monkey cola	Ewoha-bitan (E)	Obi edun	Achi okokoro	N.A.
9	*Couroupita guianensis* Aubl	Lecythidaceae	Cannonball tree		Asunje	Akpulla	Kade/Kadanya
10	*Elaeis* guineensis Jacq	Palmea	African oil palm	Orien edi (U)	Eyin	Ako	Dayyadii
11	*Ficus capensis* Thunb	Moraceae	Cape fig	Opoto (E)	Abo odan	Opoto	Shiwaka
12	*Gmelina arborea* Roxb	Verbenaceae	Gmelina				
13	*Hallea ledermannii* (K. Krause) Verde	Rubiaceae	Poplar		Abura	Uburu	
14	*Khaya ivorensis* A. Chev	Meliaceae	African mahogany	Ogwan-go/Okpen (E)	Oganwo	Eyi/Utu-eyi	Madachi
15	*Magnifera indica* Linn	Anacardiaceae	Mango	Imágoro (U)	Mangoro	Mongoro	Mangwaro
16	*Mansonia altissima* Chev. A	Sterculiaceae	Masonia		Otutu	Amunututu	
17	*Morinda lucida* Benth	Rubiaceae	Brimstone tree	Ikpamaku (U)/Ebghedore (E)	Oruwo/eruwo	Eze-ogu/Njisi	Alillibar raafii
18	*Nauclea diderichii* (De Wild & Thonn. Dur) Murrill	Rubiaceae	Opepe	Urherekor (U)	Opepe	Ubulu	Tafaashiyaa
19	*Pycnanthus angolensis* (Welw.) Warb	Myristicaceae	Wild nutmeg	Ab-oro (U)	Akujaadi	Akwa-mmiri	Kurmii
20	*Ricinus cummunis* L	Euphobiaceae	Castor bean	Era-ogi (E)	Ewe-laa	Ogiri Ogba	Dan kwasare
21	*Saba comorensis* (Bojer ex DC) Pichon	Apocynaceae	Rubber vine			Oto	Eciwo/Orombo-ososo
22	*Tectona grandis* L.F	Lamiaceae	Teak				
23	*Tetrapleura tetraptera* (Schum & Thonn) Taub	Fabaceae	Aridan fruit	Ufuo-oyibo (U)/Ighimiakia (E)	Aidan/Aridan	Oshogis-sha	Dawo/Taub
24	*Terminalia ivorensis* A. Chev	Combretaceae	Black afara	Unronron (U)/egboen-nebi (E)	Afara-dudu	Awunshin-oji	
25	*Treculia africana* Decne. ex Trecul	Moraceae	African breadfruit	Osokporode (U)/Ize (E)	Afon	Ukwa	Fisa
26	*Triplochiton scleroxylon* K. Schum	Sterculiaceae	Obeche	Ewowo (U), Obeke (E)	Aifo (Owo)	Ehu /Ebenebe	
27	*Zanthoxylum gilletii* (De Wild) Waterm	Rutaceae	African satinwood	Alufio (U)	Orin ata	Uko	

Sources of local names:
Vernacular names of some Nigerian plants: Edo/Urhobo Version (Ugbogu *et al*., 2012)
Vernacular names of some Nigerian plants (Yoruba) (Gbile, 2002)
Vernacular names of some Nigerian plants: Igbo Version (Onyeachuism *et al*., 2012)
Hausa names for plants and trees (Blench and Dendo, 2007)

3.2 Non-timber Forest Products (NTFPs) Identified and their Local Uses

The NTFPs and their different parts are used for various purposes (Table 3). About 32% of the NTFPs are used for food, 4.5% are used as fuel and spice in cooking and medicine; and as broom, water and food wrapper respectively. While 22.7% are utilized for medicine, 13.6% of the NTFPs are used as both food and medicine and 9.1% are utilized as meat.

Table 3
NTFPs and their Local Uses

S/No.	NTFPs	Uses	Parts Used
1	*Bambusa vulgaris* Linn (Bamboo)	Food	Young shoots
2	Bee products (honey, wax, propolis)	Food, medicine	Jelly, wax, propolis
3	*Cola millenii* (Monkey cola)	Food	Fruits
4	*Elaeis guineensis* fruits (Palm fruits)	Food	Fruit/kernel
5	Fish	Food	Tissue
6	Fuel wood	Fuel for cooking	Stem and branches
7	*Gmelina arborea*	Medicine	Leaves
8	*Magnifera indica* (Mango fruits)	Food	Fruit
9	*Morinda lucida*	Medicine	Bark
10	*Morinda morindoides*	Medicine	Stem and leaves
11	*Napoleona vogelii*	Medicine, food	Stem and leaves, fruits
12	*Nauclea latifolia*	Medicine	Root
13	*Olax subscorpioidea*	Broom	Stem
14	Snails	Meat	Tissue
15	Taungya farm produce (cassava, yam, coco-yam, sweet potatoes, rice, maize, soya beans)	Food	Tubers, grains, seeds
16	*Tectona grandis*	Food wrapper	Leaves
17	*Tetrapleura tetraptera*	Spice for cooking, medicine	Fruit
18	*Treculia africana*	Food	Fruit
19	Water	Water	Water
20	Waterleaf (*Talinum triangulare* (Jacq) Wild)	Food, medicine	Leaves
21	Wild games (antelopes, grass cutter, squirrels etc)	Meat	Carcass
22	*Zanthoxylum gilletii*	Medicine	Root

The use of timber alongside NTFPs has grown and according to Chikamai *et al*. (2009), forests provide timber and NTFPs which consist of very valuable materials, substance and/or commodities that are of great importance to forest-adjoining settlements. The identification of NTFPs in this study supports the finding of Amusa and Jimoh (2012), which identified a total of 75 NTFPs distributed in 43 families in Omo Forest Reserve (OFR) South-West, Nigeria with an area of about 130,500 hectares. Also, the end uses of the NTFPs discovered in their study has similar uses with the ones identified in this study. Ogeh *et al*. (2016), also revealed in their work that the forest is used for both timber and other resources such as gathering of fuel wood, harvesting of medicinal plants and fish farming.

Treculia africana (African breadfruit) ranked sixth in this study; and it is used as staple food. The seeds are removed from the pods, peeled and ground to make a local staple food called *Ukwa* in the Eastern part of Nigeria and in *Asaba* Areas of Delta State. Using the seeds of *Treculia africana* as staple food could pose a threat to its sustainable management since the seeds serve as organ of regeneration. It is therefore necessary to control the harvesting of the pods so as to preserve the seeds for planting and explore vegetative propagation.

Olax subscorpioidea stems are harvested and fastened together to form broom which is used locally, in sweeping. Artificial regeneration of *Olax subscorpioidea* should be encouraged to ensure its sustainability.

The identified nine medicinal plants in this study are used for treating different illnesses. *Morinda lucida* bark when boiled is utilized for the treatment of malaria fever and typhoid fever. *Napoleona vogelii* stem and leaves are utilized for the treatment of peptic ulcer, diarrhoea, fever and as an antibiotic. The *Nauclea latifo-*

lia root when soaked in water or alcohol is used for the treatment of high fever, gonorrhoea, stomach ache and infertility in both male and female. Harvesting the root of *Nauclea latifolia* as medicine will reduce its availability. The leaf *Nauclea latifolia* could be used as alternative to the root to increase the availability of *Nauclea latifolia*. *Morinda morindoides* stem and leaves is boiled and used for the treatment of fever and cholera.

The *Tetrapleura tetraptera* fruits are utilized as spice in cooking; and in treating convulsion, hypertension, diabetes, arthritic pains, rheumatoid pains, gastrointestinal disorders, asthma, fibroid, prevention and treatment of heart diseases, used to inhibit the growth of bacteria, as a contraceptive and post-partum care in new mothers immediately they put to bed to encourage post-partum contraction. *Tetrapleura tetraptera* fruit is of importance to the forest-adjoining settlements and its usage in treating different ailments could reduce its availability. Planting of Ten hectares of *Tetrapleura tetraptera* is necessary to boost its availability. *Talinum triangulare* leaf is used as vegetable; and in treating hepatic ailments; in regulating blood sugar level in *diabetes mellitus*, regulates cholesterol level, prevent cancer and stroke. *Gmelina arborea* leave is used for the treatment of headache, cough and gonorrhoea. *Zanthoxylum gilletii* is found in the natural forest and the root is used in the treatment of cough, cold and pneumonia. Using *Zanthoxylum gilletii* root as medicine could also pose risk to the tree.

3.3 Prioritized Forest Resources

Timber and nine NTFPs were selected after prioritization (Table 4). For each forest resource, the number of times it was mentioned by the respondents was taken. Timber harvesting was assigned the first priority as the major forest resource and management activity of ISFR. The prioritized forest resources were arranged based on their corresponding final assigned mean values. As mentioned earlier, these FRs were prioritized to give insight of the FRs that are important to the people and that should be included in the forest management plan of any particular forest.

Timber (in plantations and natural forest) was ranked first, being the major management activity of ISFR, implies that trees are of great importance such as in managing erosion, purification of water and biodiversity maintenance in ISFR and the forest-adjoining settlements; and in production of wood products such as sawn wood. Taungya farm land for taungya farming which involves trees planting with agricultural crops was next in ranking to timber. It could be advantageous in managing of ISFR sustainably in the sense that the taungya farmers could be engaged to plant more trees and raise plantations of *Terminalia ivorensis* and *Khaya ivorensis* which are native to ISFR, alongside their food crops. Though, taungya farming could also create threat to some FRs which taungya farmers may perceive not to be important.

Fuel wood harvesting was ranked third, which is a main supply of cooking energy used by the people. The demand for fuel wood and its use as a major source of domestic energy around ISFR, if not monitored and controlled, might lead to indiscriminate felling of trees for fuel wood; thereby posing threat to managing the forest reserve sustainably. *Morinda lucida* bark was ranked fourth; followed by other prioritized forest resources. According to Gosenheimer *et al.* (2012), the concept of prioritization facilitates the idea of objectives to follow.and opportunities to follow. Hence, the future mangement plan for the forest reserve may be implemented with regards to the prioritized forest resources.

Ogeh and Jimoh (2023) went further and estimated the quantity demanded of the above prioritized forest resources and the quantity available in ISFR and thereafter, developed a goal programming-input-output model to know if the available forest resources could meet the demand and later provide information on the quantity that those managing ISFR can produce to meet the peoples' needs in a sustainable manner.

Table 4
Forest Resources in Order of Priority

Ranked Values	Forest Resources	Priority Ranking	Average Values	Standard Deviation	Final Assigned Mean Values
1	Timber in Plantations and natural forest	X_1	1.000	1.3985	48.0000
2	Taungya farm land	X_2	0.3636	1.0445	31.0000
3	Fuel-wood	X_3	0.3333	0.8933	29.0000
4	*Morinda lucida* bark	X_4	0.0424	0.1719	5.5000
5	*Tetrapleura tetraptera* fruit	X_5	0.0303	0.1000	5.0000
6	*Treculia africana* (African breadfruit)	X_6	0.0303	0.0560	5.5000
7	*Napoleona vogelii* stem	X_7	0.0182	0.2602	5.0000
8	*Olax subscorpioidea* stem	X_8	0.0182	0.3012	5.5000
9	*Nauclea latifolia* root	X_9	0.0121	0.4619	5.5000
10	*Morinda morindoides* stem	X_{10}	0.0121	0.4943	6.0000

4. Conclusion and Recommendation

Timber and NTFPs of ISFR were identified and prioritized based on forest stakeholders' ranking and ten important FRs of ISFR were selected. The identification of ISFR resources and their prioritization will help in decision making conceming managing ISFR sustainably. The utilization of the diverse forest resources in diverse ways by the forest-adjoining settlements could also enhance the sustainable management of ISFR; through involvement of the forest-adjoining settlements and other forest stakeholders in protecting and conserving ISFR and its forest resources. This study also supports sustainable consumption and production of forest resources in ISFR which is in line with the sustainable development goal 12 with the aim to ensure sustainable consumption and production patterns of forest resources.

For Iyiocha Stream Forest Reserve to be sustainably managed, it is recommended that the prioritized forest resources be given attention and included in the management plan of Iyiocha Stream Forest Reserve.

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Author Contributions

Kesiena Tina OGEH: conceptualization, visualization, writing - original draft, methodology, funding, field survey, software, formal analysis, writing - review and editing.

Saka Oladunni JIMOH: supervision, provision of writing materials, writing - review and editing.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the data reported in this paper.

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