ASSESSMENT OF SPECIES-BASED ECOSYSTEM SERVICES AND ITS USEFULNESS IN FOREST-SAVANNA ECOLOGICAL ZONE

ABSTRACT

Forest ecosystems are the main species rich ecosystem on earth, having a significant role in the provision of massive benefits to the populace who depended on them for sustenance. This study aimed at assessing the forest provisioning ecosystem service and use in Ihiala Local Government Area of Anambra State, Nigeria. The objectives of this study include the identification of forest provisioning ecosystem services and their uses, people's dependence for livelihood and quantity of ecosystem services supplied by community forests. Stratified sampling technique was used to select 8 sampled communities while Nikolopoulou convenience sampling technique was adopted for selecting sampling size of 200 persons. Also, 31 key informants were interviewed across the study area. The responses from the entire sampled questionnaire and interview were analyzed using Microsoft excel and statistical package for social sciences.The study revealed that a good number of the forest resources such as Elaeisguineensis, Garcinia kola, Bambusa vulgaris, Azadirachtaindica and Brophyllumpinnatum have multiple uses. The result also revealed that the nature of forest determines the quantity of ecosystem service benefits supplied. Hence, those community forests with weak policies supply less than 40% of resources because their traditional laws of entering and harvesting forest resources are no longer effective, while those with strong policies like restriction into their sacred groves, forest reserves and swampy forests supply above 40%. The chi-square value of 352.873 with 28 degrees of freedom (DF) proved that there is strong relationship between the nature of forest and the quantity of ecosystem services provided. This research concludes that forest ecosystem in Ihiala L.G.A, supplies a wide variety of plant and animal species to the populace, which they basically use for timber, firewood, food and medicine. Nonetheless, without alternative and diversified livelihood, the supply is becoming unsustainable. It recommends that since palm tree and its resources are averagely abundant in the study area, there is need to support the establishment of basket making training centre in various communities and as such, make it an attractive skill acquisition programme.

Keywords: Provisioning ecosystem services, Forest-savanna, Ecosystem services benefits, livelihood, Forest ecosystem, medicine.

1. INTRODUCTION

To live at all, to survive and as well flourish in good health, humans need a wide variety of life-sustaining benefits derived from nature known as ecosystems services, (Millennium Ecosystem Assessment (MEA 2005; Díaz et al., 2018). Ecosystem services are the direct, indirect, tangible

and intangible benefits, provided by ecosystems to human society. Forest ecosystems are the most diverse terrestrial ecosystems, supporting a quite large majority of the world's terrestrial species, (Anderson & Grove 1987; Oyediji and Adenika, 2022). In tropical regions, forest ecosystems are highly productive and rich biodiverse ecosystems that house a large variety of flora and fauna (Jermy and Chapman, 2002; Malhi et al. 2004). We have a various means of livelihood, diverse food products and advancements in medical research as a result of Forest ecosystems. As such, medicinal plants have been used all through the millennia by the populace as basis for the medicinal treatment of diseases in both developing and developed countries. Today, there is an ever increasing interest in plant-derived medicines and sweet-smelling plants regarding their use, cultivation and conservation, (FAO, 2022). Ecosystem service is therefore a topical issue of concern; with much interest and focus on tropical ecosystems due to its rich biodiversity, (FAO, 2001; Igu and Machant, 2016, Igu, 2017).

In Nigeria, a good percentage of forest ecosystems have been studied across a variety of ecological regions, (Ezenwaka and Graves, 2014; Igu, 2016 and 2017; Olajide, Popoola and Otokiti, 2020;Ancha, Verinumbe, Jande and Abakpa, 2021; Ajayi , Olusola and Olajide, 2019). As there has been an increase in quantitative assessments of ecosystem services in most of the tropical forest types in Nigeria, however, there is still scarcity of data on ecosystem service assessment in forest savanna ecological zone. Even as Ezenwaka, Ekeke, Oyebade and Anyadiegwu, (2004), identified and evaluated some threatened indigenous medicinal plants in Eastern Nigeria, but studies that assessed the supply and use of all the tangible benefits including medicinal resources from forest-savanna ecological region is still lacking. Since research data on forest provisioning ecosystem services is scarce in the study region, this research will be very significant to the scientific community particularly environmental engineers, forest policy promulgators', forest resource allocators, decision makers biogeographers, foresters, geographers, botanists, pharmacists, ecologists, natural scientists, environmental managers and regional planners.

2. MATERIALS AND METHODS

2.1 Study Site

The study area is Ihiala Local Government Area in Anambra State, Nigeria (Figure 1) with its coordinates lying between Latitude 5° 45′ 00″ N to 5° 55' 35" N and Longitude 6°30′ 30″ E to 6° 50′ 35″ E. Ihiala L.G.A is located 48km North of Owerri and 40km South of Onitsha. It has a land mass of about 1,385sq.km It is located in the Southern part of Derived-Savanna (Forest-Savanna) Ecological Zone, Southeastern Nigeria, (Figure 2). The study area is bounded at the west by Ogbaru (in Ogbaru L.G.A, Anambra State), at the North by Ozubulu in Ekwusigo L.G.A, Anambra State, at the east by Ukpor and Orsumenyi in Nnewi South L.G.A, Anambra state and at the South by Egbuoma, Ohakpu, Ozara and Oguta in Egbema / Oguta L.G.A of Imo State, (Figure 3 and Figure 4).

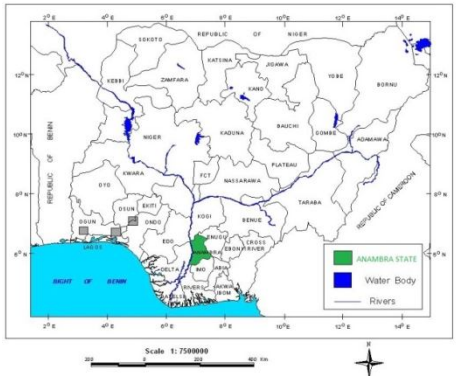

Figure 1: Map of Nigeria showing Anambra State

Source: Ezeomedo and Igbokwe, (2018).

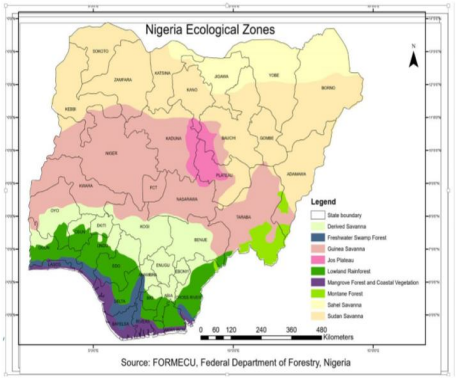

Figure 2: Map showing Ecological Zones of Nigeria.
Source: FORMECU, Federal Department of Forestry, Nigeria

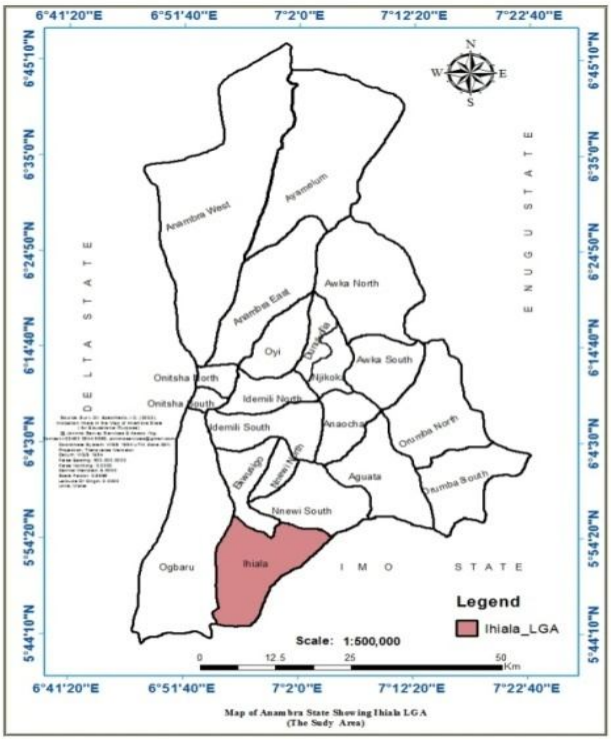

Figure 3: Map of Anambra State showing IhialaL.G.A (the Study Area)

Source: Jorinno Survey Services, (2023).

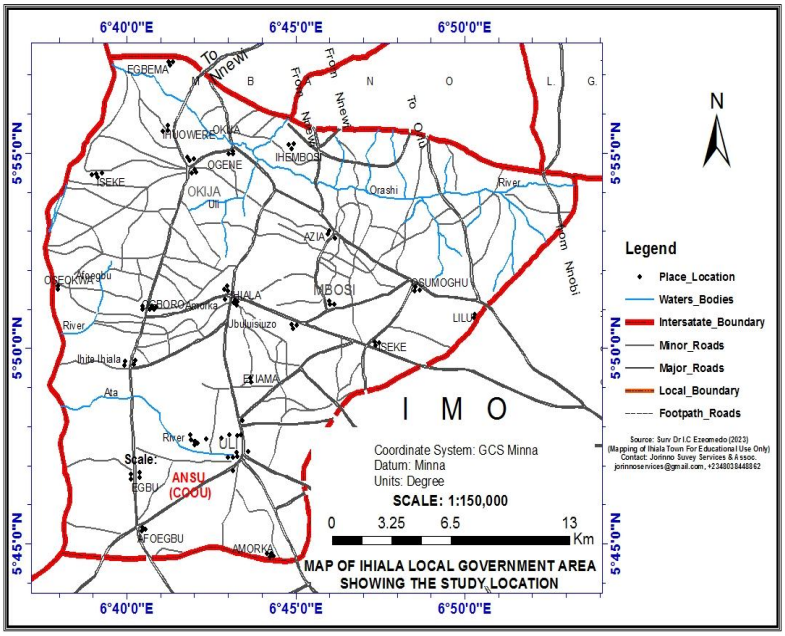

Figure 4: Map of IhialaL.G.A showing the ten communities

Source: Jorinno Survey Services, (2023).

Ihiala Local Government Area is naturally endowed with large forest land. Most of their forests are known for the supply of different forest products, such as timber, firewood, medicinal materials, and foods like; African star apple (*Chrysophyllumalbidum*), *Treculiaafricana, Irvingagabonensis*(bush mango), *Termitomycestitanicus* (Mushroom), *Ambiayaalbidium, Cola nitida* (Oji), *Brachystegiaeurycoma* (Achi), and palm products. Most families built their houses only with timber from Iroko tree (*Miliciaexcelsa*) and other hard wood from these forests. Some economic trees such as *Irvingiagabonensis* and *Garcinia kola*, were gathered once in a while by the village women, taken to the house of the village head and shared by all. More so, most herbalists in the area were known to be successful both in treatment and in making livelihood. This is because those forests provided all the resources they needed for the treatments of diseases, (Ejezube, 2023). Presently, most of these forests provide less than what they used to supply. Therefore, this study investigated the supply of forest ecosystem services and use in Ihiala L.G.A.The objectives of this study include the identification of forest provisioning ecosystem services, their use and peoples dependence for livelihood.

2.2 Data collection

Using stratified sampling technique, the study area was divided into four quarters namely;Okija Zone, Ihiala Zone, Uli / Amorka Zone and Ebenesi Zone. Two villages were selected from each of the zones as sample locations, giving 8 sampled locations. However, this research adopted the convenience sampling technique in selecting questionnaire respondents from the total population. According to Nikolopoulou, (2023), convenience sampling is a type of non-random sampling used to explain a sample which has been chosen from the target population, on the basis of their accessibility to the researcher. This can be due to geographical immediacy, availability at a given time, or willingness to participate in the research.

Consequently, due to high rate of insecurity in the study area, the researcher took on the convenient sampling method to determine the sample size through the community village meetings and gatherings. 25 persons from each of the sampled communities were sampled, on the basis that at least 25 persons attend each village meeting in almost all the communities, according to some village heads. These 25 persons multiplied by 8 sampled communities gives 200 persons as the questionnaire population sample size for this study. For the key informant

interview, the study interviewed 31 persons; 8 village heads of the sampled communities, 6 herbalists, 5 hunters, 6 non-timber forest products sellers' and 6 timber/firewood sellers, Apart from village heads, interview to other categories was based on availability of data source.

2.3 Method of data analysis

The responses from the entire sampled questionnaire and interview were collected and analyzed using Microsoft Excel and Statistical package for Social Sciences (SPSS). In trying to identify the vital provisioning ecosystem services supply in the study area, the respondents were asked to indicate the numerous benefits they gather from the forest, their names and uses. These benefits include wild fruits, vegetables, bush meats, construction material, medicinal resources, and fodder. These were then presented in tables as timber and non-timber forest provisioning services; with their local, common and botanical names and individual uses. To assess the level of dependency on ESs, answers from questionnaire that referred to the use of nature-based sources were analysed using descriptive statistical technique. The results were presented in charts and tables.

3. RESULTS

3.1 Socio-Economic/Demographic Characteristics of Respondents

To test the accuracy of the information gotten from this research, respondents' biodata were obtained, analyzed and presented in Table 1.

Table 1:Characteristics of Questionnaire Respondents

Biodata	Frequency	Percentage
Gender		
Male	108	54.0
Female	92	46.0
Marital Status		
Single	48	24.0
Married	119	59.5
Divorced	1	.5
Widowed	29	14.5
Separated	3	1.5

Age		
30 – 40 years	56	28.0
41 – 50 years	39	19.5
51 – 60 years	57	28.5
61 – 70 years	34	17.0
Above 70 years	14	7.0
Educational Level		
Primary	12	6.0
Secondary	103	51.5
Tertiary	65	32.5
Non-Formal	20	10.0
Occupation		
Trader	60	30.0
Farmer	63	31.5
Civil Servant	45	22.5
Palm Oil Business	15	7.5
Hunter	17	8.5
If a native of this community		
Yes	181	90.5
No	19	9.5
How long lived in the community		
Less than 10 years	35	17.5
10 – 20 years	61	30.5
20 – 30 years	21	10.5
30 – 40 years	36	18.0
Above 40 years	47	23.5

3.2.Forest provisioning ecosystem servicesbenefits inIhiala L.G.A

Forest resources are discussed under timber and non-timber provisioning services

3.2.1. Timber provisioning ecosystem services

Some common tree species in the study area which are used for timber, log and firewood are shown in Table 2.

Table 2:Some common tree species for timber and firewood in Ihiala L.G.A

S/No	Botanical Name	Common Name	Local Name
1	*Newbouldialaevis*	Tree of life; Fertility tree	Ogilisi (Igbo)
2	*Treculiaafricana*	Bread fruit	Ukwa
3	*Elaeisguineensis*	Palm tree	Nkwu
4	*Anthocleistavogelii*	Murderer's mat	
5	*Baphianitida*	Camwood or African Sandalwood	Uhie
6	*Canariumschweinfurthii*	Bush Candle tree	Ube Okpoko
7	*Dialiumguineense*	Velvet Tamarind	Cheleku
8	*Irvingiagabonensis*	Bush mango	Ugiri
9	*Brachystegiaeurycoma*		Achi
10	*Miliciaexcelsa*	Iroko	Orji
11	*Ambiayaalbidium*	African star apple	Udara
12	*Chrysophyllumalbidium*	African star apple	Udara
13	*Afzelia Africana*	Mahogany	Akparata
14	*Cola acuminata*	Kolanut	Oji
16	*Ceibapentandra*	silk cotton tree	
17	*Garcinia Kola Heckel*	bitterkola	Akilu
18	*Gmelinaarborea*	Gmelina	
19	*Bambusa vulgaris*	Bamboo	Achalla

Source: Verified after Anoliefoet. al., (2015)

3.2.2. Non-Timber provisioning ecosystem services

Non-timber forest resources include fruits, vegetables, spices, animals and medicine. These are discussed as plant species utilized as foods and spices (Table 3), animals utilized as bush meat (Table 4) and some plant species utilized as medicine (Table 5).

Table 3:Some common plant species for food and other uses

S/N	Botanical Name	Common Name	Local name	Use
1	*Canariumschweinfurthii*	African olive or Bush candle tree	Ube Mgba or Ube Okpoko	Fruit, firewood and timber
2	*Piper guineense*	Ashanti pepper	Uziza	Leaf for vegetable, seed for spice and medicine
3	*Gongronemalatifoitum*	Bushbuck Leaf	Utazi	Vegetable and Medicine
4	*Gnetumafricanum*	Wild spinach	Ukazi or Okazi	Vegetable
5	*Pleurotus tuber-regium*	King tuber oyster	Osu	Spice and Soup thickener
6	*Dialiumguineense*	Velvet Tamarind	Cheleku	Fruit, trunk for firewood
7	*Brachystegiaeurycoma*		Achi	Seed as soup thickener, trunk for timber
8	*Landolphiaowariensis*	White rubber vine	Utu	Fruit
9	*Dennettiatripetala*	Pepper fruit	Mmimi	Fruit and spice
10	*Pachystelabrevipes*	Loquat	Udaranwaenwe	Fruit

11	*TermitomycesTitanicus*	Mushroom	Ero	Food
12	*Elaeisguineensis*	Palm tree	Nkwu	Economic tree; palm oil, leaves as thatch, fodder and broom, logs for building, palm wine, etc
13	*Treculiaafricana*	Breadfruit	Ukwa	Economic tree, seed fried for snacks and cooked for food, trunk is for timber and firewood, leaves for fodder.
14	*Irvingiagabonensis*	African Bush mango (sweet)	Ugiri	Fruit for food, seed for making soup, leaf for fodder
15	*Irvingiawombolu*	African Bush mango (bitter)	Ogbolo	Seed for making soup, leaf for fodder, trunk for timber
16	*ChrysophyllumAlbidum*	African star apple	Udara	Fruit
17	*Cola nitida*	Kola	Oji	For traditional rites
18	*Miliciaexclesa (Moraceae)*	Iroko	Orji	Trunk for timber, leaves for fodder, fruit for birds
19	*Pterocarpussoyauxii*	Mututi	Oha	Vegetable, medicinal
20	*Pterocarpussantalinoides*	African coral wood	Uturukpa	Vegetable, medicinal
21	*Acanthus montanus*	Mountain thistle	Agamebu	Medicinal
22	*Bambusa vulgaris*	Bamboo	Achalla	For constructions, fodder and Medicine
23	*Ocimumgratissimum*	Scent leaf	Nchuanwu	Vegetable, medicinal
24	*Detariummicrocapum*	Sweet detar	Ofo	Soup thickener
25	*XylopiaaethiopicaDunal*	Guinea pepper	Uda	Spice and medicine
26	*Aframomummelegueta*	Alligator pepper	Oseoji	Medicine and spice
27	*Pentacletramachrophyla*	Oil bean tree	Ukpaka	Food, medicinal, firewood
28	*Mucunapruriens*	Velvet bean or devil's bean	Agbara	Vegetable, medicinal
29	*Tetrapleuratetraptera*	Soup perfume	Uraura	Spice, medicinal
30	*Moringaoleifera*	Moringa		Vegetable, medicinal
31	*Anacardiumoccidentalis*	Cashew tree		Fruits, Nuts and firewood
32	*Garcinia Kola Heckel*	Bitter Kola	Akilu or Ugoro	Medicinal, trunk for timber
33	*Afzeliabellavarbella*	Mahogany	Akparata	Seed as soup thickener, trunk for timber
34	*Baphianitida*	African Sandlewood	Uhie	Medicinal and cosmetic material
35	*Ficuselastica*	Rubber Tree		Economic tree with numerous benefits
36	*Gambeyaalbida*	White star apple	Udalanwannu	Fruit and medicinal

Source: **Researcher's fieldwork (2023)**

Table 4:Common wild animal species in the study area

S/No	Common Name	Local Name	Use
1	Antelope	Mgbada	Bush meat, Skin used for making drum
2	Deer	Ele	Bush meat
3	Ram	Okebule	Bush meat
4	Grass Cutter	Nchi	Bush meat
5	Wolf	Edi	Bush meat
6	Chipmunk	Osa	Bush meat
7	Squirrel	Uze	Bush meat
8	unverified	Ururu	Bush meat
9	Parrot	Ichoku	Bush meat
10	Guinea Fowl	Ogazi	Bush meat
11	Cane rat	Ewi	Bush meat
12	Kite	Nkwo	Bush meat and economic
13	Shrew	Nkapi	Economic

14	Forest Cobra	Ekenweohia	Medicinal and economic
15	Bush fowl	Okwa	Economic and bush meat
16	Hog	Eziohia	Bush meat
17	Rabbit	Okeoyibo	Bush meat
18	Sparrow	Nza	Bush meat
19	Viper	Abuala	Bush meat, skin used to make shoes
20	*unverified*	Oguna	Bush meat
21	African Pygmy Goose	Obogwummiri	Bush meat
22	Peregrine Falcon	Ufu	Bush meat
23	Monkey	Enwe	Bush meat
24	*unverified*	Obuadike	Bush meat
25	Chameleon	Ogwomagala	Medicine
26	Galago (aka bush baby)	Ekiri	Medicine
27	Hawk	Agunkwo	Bush meat
28	Kite	Egbe	Bush meat
29	Snail	Ejule	Bush meat
30	Porcupine	Ebiogwu	Bush meat and economic
31	Bat	Usu	Bush meat
32	*unverified*	Nbe	Bush meat and economic
32	Wild lizard	Ngwere-oru	Bush meat
33	*unverified*	Oghu	Bush meat

Source: Researcher's fieldwork (2023)

Table 5:Some Common Plant Species for Traditional Treatment of Diseases

S/N	Botanical Name	Common Name	Local Name	Plant Part(s) Used and Ailment(s) Treated
1	*Azadirachta indica*	Neem; Indian liliac	Ogwu-iba (Igbo); Dogoyaro (Hausa)	The whole plant is used for treatment of malaria and fever; as expectorant, liver tonic, intestinal worms anti-microbial and inflammation. Also soaked and used as pesticide.
2	*Brophyllum pinnatum*	Resurrection plant; African never die;	Odaaopue (Igbo)	The leaves are used for treatment of stroke and strengthening of bones; used to treat convulsion, boils, cough, catarrh, anti-diarrhea and anti-ulcer.. Intestinal pains and used to resuscitate somebody in coma.
3	*Chromoalena odoratum*	Siam weed	Obiara-ohuru or Ahihia Eliza or abalidiegwu (Igbo)	The leaves are used in treatment of fever and diabetes. The leaves are also squeezed fresh on cut to stop bleeding and sterilize the wound. The leaves are also used to treat skin rashes. The leaves and stem are used to ferment cassava for easy softening.
4	*Newbouldialaevis*	Tree of life; Fertility tree	Ogilisi (Igbo)	The leaves are used as eye ash for conjunctivitis. The stem bark is used for treatment of skin infection. The root is used for treating ear problem. For boundary demarcation.
5	*Sidaacuta*	Stubborn grass; common wire weed	Udo-asi (Igbo)	The whole plant is used to cure low sperm count, stop diarrhea and dysentery. It is also used to aid child's birth.
6	*Jatrophagossiplifolia*	Wild cassava	Ake mgbogho	The latex is applied to cure ringworm. The leaves are used as a purgative and to treat hemorrhage.
7	*Amaranthusspinosus*	Thorny pig weed, African spinach, Picric amaranth	Inineogwu	The leaves are used to stop hot and discomforting stomach. The whole plant is used for waist pain and as vegetable. The roots are used for the treatment of STDS.

8	*Syndrellanodiflora*	Node weed, Cindrella weed, Start work	Ogwuafo (Igbo)	The leaf is used to treat stomach upset. It is also used as laxative. The leaves juice is used to stop bleeding in wound.
9			Ijigara	For treating Arthritis and toothache
10	*Ocimumgratissimum*	Scent leaves, fever plant, Basil	Nchuanwu (Igbo)	The whole plant is used to prevent mosquito bite. The leaves are used as laxative, treatment of stomach pain, catarrh, treatment of nose bleeding, and treatment of sore throat etc.
11	*Cymbopogoncitratus*	Lemon grass	Irirooyibo (Igbo)	The leaf is used for the treatment of malaria, typhoid fever, headache, cough and mosquito repellant.
12	*Jatrophacarcas*	Physic nut	Ugbelu (Igbo)	The leaf poultice is used to stop bleeding and for hastening healing. The latex is used for the treatment of ringworm.
13	*Euphorbia heterophylla*	Spurge weed; Fire plant	Ogwuafo (Igbo)	The plant when soaked is used as a laxative. When boiled, it is used as purgative.
14			AnaraOfia and Akaito leaves(Igbo)	To stop miscarriage
15	*Ageratum conyzoides*	Goat weed	Agadi-nwaanyi-isi-awo-ocha (Igbo)	The leaves are used as a lotion for scabies, for treatment of fever. The juice of the leaf is dropped in the eye to cure inflammation.
16	*unverified*	*unverified*	Akanta (Igbo)	A root peeled, pounded and the liquid used for treating madness
17	*Costusafer*	Spiral ginger or bush cane	Okpeteohia (Igbo)	For treatment of stroke, stomach ache and disorder, infection, and arthritis. The leaves are used in treatment of cough, measles, malaria and eye defect.
18			Ijeara (Igbo)	For treating toothache and decay
19	*Aspiliaafricana*	wild sunflower; Hemorrhage plant	Orama –ejula (Igbo)	Leaves and flowers stop bleeding; Seeds used in treating cold and coughs
20	*Garcinia kola*	Bitter kola	Akilu or Ugoro (Igbo)	Used as anti-poison, antibacterial, immune booster and for treatment of cough and catarrh
21	*unverified*	*unverified*	Uteagu (Igbo)	Roots for treating infection
22	*unverified*	*unverified*	Njoabahu leaf (Igbo)	For detoxication of any kind of poison in the body
23	*Tetrapleuratetraptera*	*unverified*	Osakirisa or Uraura (in Igbo)	The leaves and fruits are used to manage convulsion, serves as immune booster, used for post-partum care, boosts blood, used as antibacterial, used to treat stomach disorder etc.
24	*Mucunapruriens*	Velvet bean or devil's bean	Agbara (Igbo)	Used in treating muscle pain, toothaches, infertility, scorpion and snake bites, lowers blood sugar, serves as blood purifier, etc.

Source: Researchers fieldwork: (2023)

3.3. Dependence on ecosystem services

Dependence on ecosystem services benefit wasassessed using the type of fuel used in cooking by households and forest related livelihoods people make from forest resources in the study area.

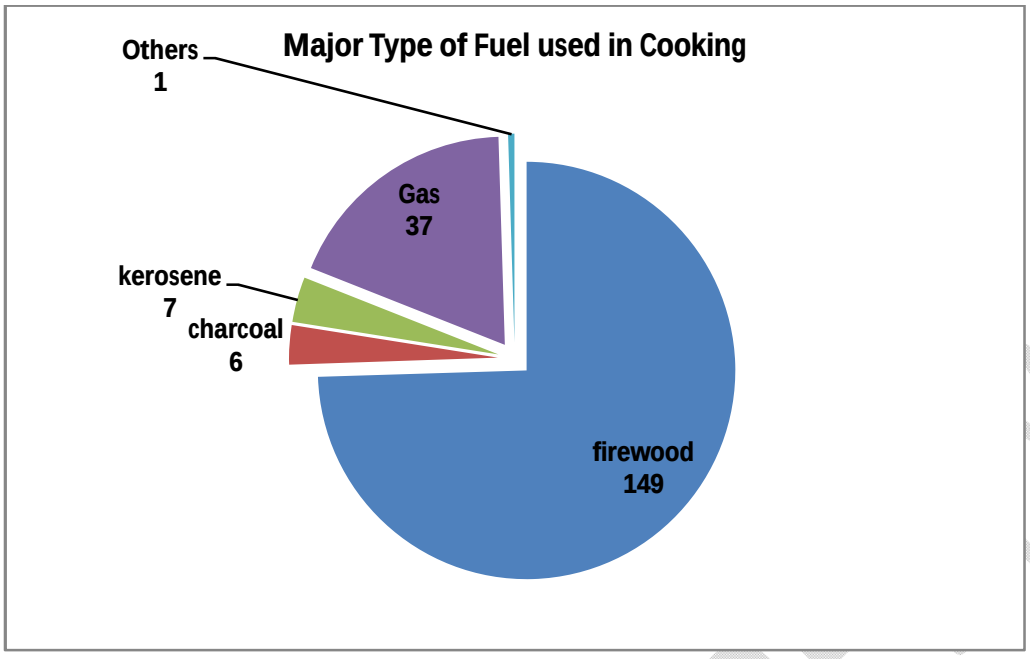

Figure 5: Major type of fuel used in cooking

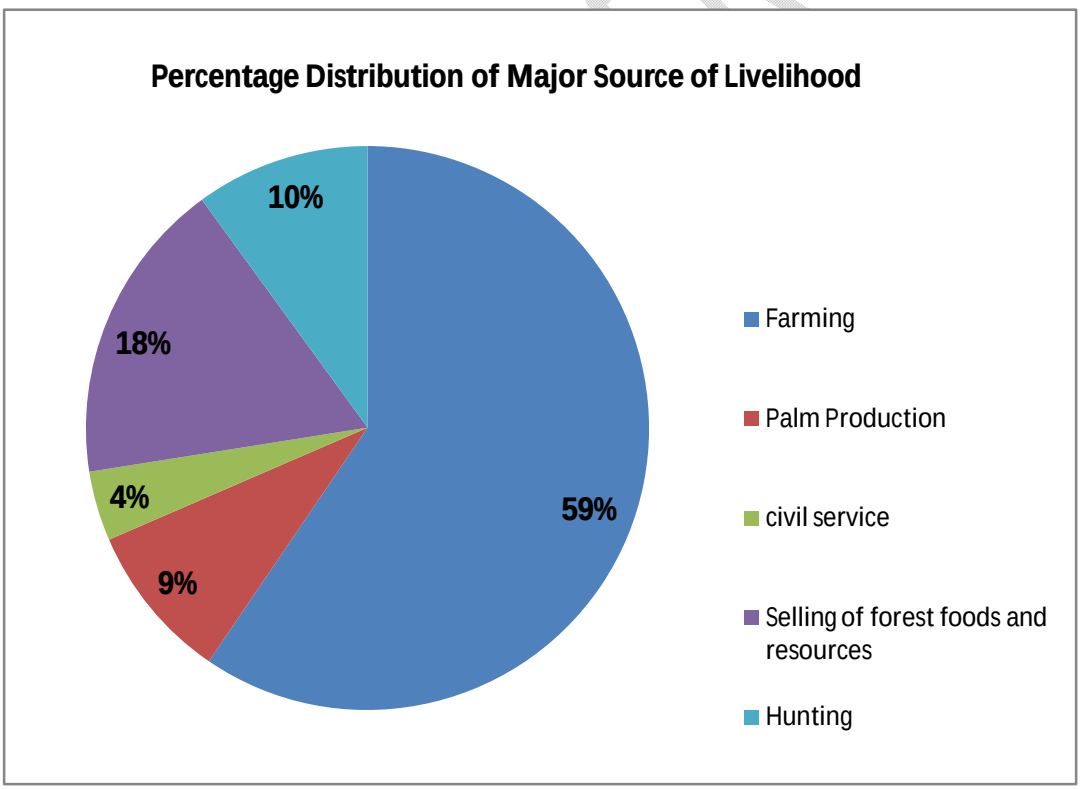

Figure 6: Major Source of Livelihood

3.4 Community forests and ecosystem services benefits supplied

The quantity of ecosystem services benefits supplied by individual forest communities are as presented in Table 6.

Table 6: Quantity of ecosystem services benefits supplied by sampled forests

Percentage Supplied / Forest	0-20%	20-40%	40-60%	60-80%	Above 80%	Remark
IkpaOgwugwu forest	**52.0**	32.0	16.0	0.0	0.0	Poor
Umuogu forest	8.0	12.0	**60.0**	12.0	8.0	Average
Mgbu and Okotoba Forests	16.0	**60.0**	16.0	4.0	4.0	Poor
OgwugwuUbahuekwem	24.0	8.0	24.0	12.0	**32.0**	Plentiful
Atammiri forest	20.0	20.0	**44.0**	16.0	0.0	Average
Ogada forest	24.0	8.0	24.0	12.0	**32.0**	Plentiful
Ihueke Forest	16.0	**44.0**	20.0	4.0	16.0	Poor
Akaba Forest	**44.0**	4.0	32.0	8.0	12.0	Poor

The result was further subjected to Chi-Square Test, to test for the relationship in the supply of ecosystem services among these community forests. The null hypothesis was postulated as: let H0 be:

There is no significant relationship between the categories of forest and the percentage of supply of ecosystem service benefits, Table 7.

Table 7: Chi-square test result of quantity of ecosystem services benefits supplied

Ecosystem services Supply (%) / Forest	0-20%	20-40%	40-60%	60-80%	Above 80%	Total
IkpaOgwugwu forest	52 (25.5) (27.539)	32 23.5 3.074	16 29.5 6.178	0 8.5 8.5	0 13.00 13.00	100
Umuogu forest	8 (25.5) (12.01)	12 (23.5) (5.628)	60 (29.50) (31.534)	12 (8.5) (1.441)	8 (13.00) (1.923)	100
Mgbu and Okotoba Forests	16 (25.5) (3.539)	60 (23.5) (56.691)	16 (29.5) (6.178)	4 (8.50) (2.382)	4 (13.00) (6.231)	100
OgwugwuUbahuekwem	24 (25.5) (0.088)	8 (23.5) (10.223)	24 (29.5) (1.025)	12 (8.50) (1.441)	32 (13.00) (27.769)	100
Atammiri forest	20 (25.5) (1.186)	20 (29.50) (7.127)	44 (29.5) (7.127)	16 (8.50) (6.618)	0 (13.00) (13.00)	100
Ogada forest	24 (25.5) (0.088)	8 (23.5) (10.223)	24 (29.5) (1.025)	12 (8.50) (1.441)	32 (13.00) (27.769)	100
Ihueke Forest	16 (25.5) (3.539)	44 (23.5) (17.883)	20 (29.50) (3.059)	4 (8.50) (2.382)	16 (13.00) (0.692)	100
Akaba Forest	44 (25.5) (13.422)	4 (23.5) (16.181)	32 (29.5) (0.212)	8 (8.50) (0.029)	12 (13.00) (0.077)	100
Total	204	188	236	68	104	800

Expected frequencies are below the observed frequencies, while chi-square contributions are below expected frequencies.

The result of the Chi-sq test between individual community forest and percentage of ecosystem services supply: Chi-Sq = 352.873, DF = 28, P-Value = 0.000.

3. DISCUSSION

From the socio-economic/demographic characteristics of respondents it observed that the highest occurring value of respondents' socio-economic features, is that 54% are male, 59% are married, 28.5% are between the age of 51-60, 51.5% attained secondary school level, 31.5% are farmers, 90.5% are native of the community and 30.5% have lived for 10-20years (Table 1). This shows that information supplied to the researcher were sourced mainly from married men, who are responsible for the wellbeing of their household, who are old enough to know their community history and who attained at least higher basic education to understand simple communication in English language. 90.5% of them are native of their communities and have lived for at least 10-20 years in the community. Being a native of the community supported the idea of Igu and Marchant, (2016) that indigenous people have a greater access and opportunity to their community forest

Some common tree species in the study area are used for timber, log and firewood. More of these plants species are sturdy, but are seriously going extinct in the study area just like other tropical forests ecosystems that are threatened with extinctions and probable collapse, as proved by Igu and Marchant, 2016. Nevertheless, some of these vulnerable plants are preserved till today because of traditional laws which were believed to have come from the ancestors and any desecration of these laws attracts strict penalty from the gods. Example; *Ambiayaalbidium, Irvingiagabonensis, Cola nitida, Brachystegiaeurycoma, Miliciaexcelsa and Ceibapentandra*. Very few of them are preserved in sacred grovesand used as shrines such as *Miliciaexcelsa* and *Ceibapentandra*, (Anoliefo, Nwokeji and Ikhajiagbe, 2015).

Common species valued for food have multiple uses (Table 3). Therefore the rural populace derives food, medicine, fodder, and construction materials from their community forests just like other forest ecosystem in Nigeria. Some of the common wild animals are used as bush meat, where very few of them are used for medicine, research and economic purposes, (Table 4). Still, a good number of these animals are near threatened, where a lot of them have gone extinct; example Antelope, Porcupine and Wolf. Majority are seriously endangered such as Wild lizard, Guinea Fowl and Grass Cutter. Nevertheless, most hunters were not discouraged by this change; rather, they go to faraway swampy forests of Imo state such as Ogbum in Egbu community,

Ossemoto, Ufufu-achi and Ede-Akpu (all in Imo State) and hunt as much various species of animals as possible. Thusswamp forest ecosystems are important in meeting the needs of people who depend on them to sustenance, (Igu and Machant, 2016).

Traditional treatment of diseases is practiced by many people in the study area. The leaves, barks, roots and even whole plants of some species of plants are infused or soaked or boiled to obtain a liquid drink that is used to treat various ailments, (Table 5). Some of these common species of plants have multiple uses and are very beneficial to the people of the area, example *Sidaacuta, Mucunapruriens,Garcinia kola, Azadirachtaindica, Syndrellanodiflora, Chromoalenaodoratum, Cymbopogoncitratus, Ocimumgratissimum and Brophyllumpinnatum*(plate 1).Therefore a substantial percentage of the population depended on traditional medicines for treatment and prevention of diseases and as well a means of livelihood for traditional doctors, (Ezenwaka et al 2004, Obute 2005; and Ogbe et. al., 2009).

Plate 1: Domesticated sample of*Brophyllumpinnatum*

Out of the 200 sampled questionnaires used for this study, 149 respondents indicated that firewood is the major type of fuel used by the populace in the area. This proves that, although the village people seldom visit the forests, their major source of fuel for cooking is firewood. A village head interviewee said that as a rural area, people mostly use firewood in cooking. They

either buy from the firewood sellers in their various village markets or once in a while they go to the far away forests and cut large quantity that can sustain them for a long time. Consequently, this proves that 1.2 billion people across tropical countries are highly dependent on nature for their basic needs including firewood, Fedele, Camila, Donatti, Ivan Bornacelly and Hole, (2021). Although every village setting is mostly known for farming (figure 7), but some villages have other means of livelihood that is peculiar to them which is forest-related. Example, Okija is known for palmwine tapping and hunting such that presently, the community has hunters association of about 20 persons (interviewee Echefu, 2023). On the other hand, Isseke community is known for basket making, such that everybody in every household knows how to weave basket including their wives, (interviweeEjenobi, 2023). These are sold to the major dealers at the collection point and transported to different parts of the country especially the northern region and other agricultural regions for the packaging of tomatoes, onions, carrots, pepper and others, (Interviewee Ndubueze, 2023).

The quantity of ecosystem services benefits supplied by individual forest communities are presented in table 6. It was observed that poor supply of forest resource falls within 0-40%. While, those between 40-80% shows result of averagely supply benefits and above 80% indicates plentiful supply of ecosystem services benefits to the populace. The result revealed that the supply of forest resources from IkpaOgwugwu and Akaba is about 20%; Ihueke, Mgbu and Okotoba forests supply 20-40%; Umuogu and Atammiri forests supply 40-60% while OgwugwuUbahuekwem and Ogada forests supply above 80%. Those forests that still provide up to 80 % are those that mostly border with Osseakwa, River Niger and other large water bodies. Hence, those community forests with weak policies supply less than 40% of resources because their traditional laws of entering and harvesting forest resources are no longer effective, while those with strong policies like restriction into their sacred groves, forest reserves and swampy forests supply above 40%. The result of the chi-square test indicates a significant association between the categories of forest and the percentage of supply of ecosystem services. The Chi-square value of 352.873 with 28 degrees of freedom (DF) suggests a strong relationship between the two variables. Additionally, the p-value of 0.000 indicates that the observed association is highly unlikely to have occurred by chance alone. Therefore, we reject the null hypothesis,

concluding that there is a statistically significant relationship between the type of forest and percentage of ecosystem services supplied.

4. CONCLUSION

The supply of forest ecosystem benefit and their use are commonly the same in all the communities of the study area. Very few of the forest resources are averagely available. Some of them have multiple uses and the people intensively use them in various ways, where majority of the common wild animals used as beef are endangered. The variation in supply of ecosystem services is as a result of the type of forest in the study area. The type that supplies much resource is few in number, such that without more sustainable means of survival, those forests will seriously deplete. Therefore, this research recommends thatsince palm tree and its resources are averagely abundant in the study area, there should be establishment of palm production industry which will include soap and cream factory, palm kernel factory and a mechanized oil mill industry. These ventures will create more sustainable livelihood for the rural populace.Similarly, there is need for the establishment of basket making training centrein various communities of the study area; and make it an attractive skill acquisition especially in Isseke and Uli. This will enhance the wellbeing of everyone including the less privileged that can just sit at a place and make their livelihood out of basket making.It is significant to strengthen the traditional regulations as a means of conserving the species of the forest-savanna ecosystem from extinction in the study area.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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