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Floristic Enumeration of Obite Community Protected Area: A Window for IUCN Exploration and Recognition in Parts of Etche, Rivers State, Nigeria

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ABSTRACT

The floristic enumeration of species conducted in Obite Community Protected Area, Etche, Rivers State, highlights the area's ecological significance by cataloging various plant species, evaluating their conservation status, and identifying strategies to prevent extinction. This study aimed to enumerate plant species of Obite protected area as an avenue for IUCN conservation priority. Ecological methods involving: Braun-Blanquet releve, a hand-held Global Positioning System (GPS - Garmin Dakota 10 model), species authentication, phytosociological analysis and IUCN conservation evaluation status were deployed. Result revealed a tropical rainforest with luxuriant lush floristic condition in diverse transition structure of heterogeneous life-form habit of herbaceous, shrubby and tree species described as low land secondary mosaic vegetation characterized by horizontal distribution in closed and sparse continuum of representative array of plant species in various diversity and abundance. The most dominant family in the order of species richness revealed Euphorbiaceae (n=11species) among the 29 families of 59 general of 72 species. Life-form habit had shrubby habit (n=27species; 35.7%), herbaceous habit (n=11species; 15.28%) and tree habit (n=34species; 47.22%). Phytosociological result is shown in Table 3.1, while the IUCN Red Data List, evaluated four categories of conservation status as presented in Table 3.1. The floristic enumeration of the Obite Community Protected Areas underscores the rich biodiversity present in the region. However, besides other recommendations further ecological studies should be carried out to ascertain the current conservation status of the evaluated categories of IUCN, especially with the species prone to vulnerability and near threatened as a pathway to statutory recognition.

Keywords: *Conservation, protected area, vulnerable, near threatened, least concern.*

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INTRODUCTION

Ecologists, Conservationists, Ecosystem analysts, Taxonomists, Dendrologists, Environmental managers and other floristic researchers frequently employ various techniques, such as botanical surveys, specimen collection, flora enumeration and data analysis, to compile a thorough list of plant species in a specific region, Floristic enumeration is a systematic listing and stock taking of plant species or collection occurring in a vegetation of a given region. Such listing of species helps in understanding the diversity, distribution and composition of plant species in such area thereby aiding conservation efforts and enhancing the understanding of the area's biodiversity.

Plant species are known for their foundational and healthy functioning of any biosphere and are essential for the basic necessities (food, clothing, and shelter) of life for human survival. Such floristic diversities are also known for their synthesizing potential in harnessing oxygen and carbon dioxide from the atmosphere [1]. Beside this inevitable potential attributes of plant species to the environment and its environs, the survival of plant species amidst pervasive ecological demand is in "Red". Report has revealed the disappearance of 571 plant species in which 2 in 5 plants globally are threatened with extinction in the last two and half centuries, and with such figure more than twice the number of birds, mammals and amphibians (total of 217 species) recorded as extinct [2]. More seriously the world is losing the race against time because species are disappearing faster than they can be found and numenclaturally identified. Many of them of utmost importance hold the solution to some of the most pressing challenges of medicine and researches even perhaps of the emerging and current pandemics we are seeing today [3].

Many species are more prone to extinction due to specific traits [4]. By conducting a thorough enumeration, such plant with the traits of extinction risk can be identified. Understanding the unique characteristics of the flora as well assessing their vulnerability to various threats, such as habitat loss, climate change, and invasive species, is critical for developing targeted conservation strategies that prioritize the protection of these at-risk species.

Several studies have also documented the critical relationship between plant diversity and ecosystem resilience [5,6,7], and the importance of understanding local plant diversity for effective conservation strategies [8]. This informed part of a strong rationale for conserving species, upon which researchers carry out floristic enumerations to document and examine plant species present among the essential means for conservation initiatives and ecological research.

This process includes extensive field surveys, gathering plant specimens, and meticulously recording detailed information about each species discovered.

The Obite community is known for its untouched ecological diversity. It shows point where the importance of the environment intersects with human influence. It signifies the critical connection between ecological value and the impact of human activities on the environment. By systematically documenting plant species within a specific area, such as the Obite Community Protected Area, we can assess the diversity present and understand how it contributes to the overall health and stability of the ecosystem. Protected areas are locations with special protection by ensuring the long-term conservation of valuable natural and cultural resources for future generations. They are protected because of their recognized natural, ecological or cultural importance. The areas are usually protected by law, which can be local, national or even international. These areas are important for biodiversity hence they provide a safe habitat for threatened and endangered species [9].

The International Union for the Conservation of Nature (IUCN) is the first international environmental union established in 1948 with its membership Union composed of both government and civil society organisations in Fontainebleau (France). The Union has the tools and knowledge repository to help the world conserve nature and ensure sustainable development, with the objectives of promoting international cooperation, providing scientific knowledge and tools to aid conservation action. With core mandate to tackle three of the most important challenges facing the world's ocean and Polar Regions, viz: climate change, biodiversity loss and pollution. In collaboration with governments, business organisations and scientific experts, IUCN unravels the complexities of global threats and develops innovative solutions for the conservation of nature and the sustainable use of natural resources [10]. IUCN supports countries and communities in achieving effective and equitable protected and conserved areas that yield positive outcomes for society, develop best practices and approaches that enable effective conservation, and help sites achieve high standards, while also informing professional capacity development and influencing national and global policy.

Floristic enumeration provides valuable data on species richness and abundance, enabling researchers to identify which plant species are essential for maintaining ecological functions. This information is vital for conservation efforts, as it helps prioritize species and habitats that require protection. By identifying and cataloging plant species, researchers can prioritize such areas that can be delineated for immediate conservation attention. This prioritization will ensure that limited resources are allocated effectively to protect the most vulnerable and valuable ecosystems. Furthermore, such enumeration will aid in understanding the ecological significance of plant species in maintaining ecosystem services like carbon sequestration, soil conservation, and water cycling essential for preserving the delicate balance of nature. The engaging of communities and raising awareness about the importance of protecting their natural resources can foster a sense of ownership and responsibility, leading to more effective conservation outcomes. The data collected through enumeration can provide a scientific basis for policy and management decisions related to conservation and sustainable development in the Etche region.

The findings can also inform the management and expansion of protected areas, ensuring that the unique floristic diversity of the Obite community is safeguarded for future generations. Also via the trend of floristic condition, composition and structure such study will aid in understanding how plant communities in Obite can help mitigate climate change effects and develop strategies to enhance their resilience in the face of global environmental challenges. Such conservation will enhance the ethno-ecological documentation of plant species thereby promoting cultural preservation and sustainable utilization, as well as the significance of interdisciplinary approaches in conservation research. Therefore, the floristic enumeration not only contributes to biodiversity assessments but also supports effective conservation planning by emphasizing the importance of plant diversity in sustaining resilient ecosystems.

2.0. MATERIALS AND METHODS

2.1. *Study Area, Location and Site*

The study area - Etche is geographically located in north eastern parts of Rivers State situated between latitude 04° 55' 0" N and 05° 12' 0"N and longitude 06° 55' 0"E and 07° 15' 0"E of the State (Fig.1). The study area is bounded in the North by Imo State, in the East by Omuma and Abia State, in the South by Oyigbo and Obio /Akpor Local Government Areas and in the West by Ikwerre Local Government Area of Rivers State (Fig.1) [11]. The area is a complex of agrarian communities in the tropical rainforest belt within the equatorial climate region, characterized by high rainfall, relative humidity and maximum temperature. The ecosystem is characterized with a luxuriant vegetation structure and physiognomy under diverse families. The study area with it climax vegetation are typical of tropical rainforest condition and housing over 14 autonomous communities which include Igbo, Ulakwo, Egwi, Odugwa, Ozuzu, Umuaturu, Okehi, Igbodo, Umuechem, Ndashi, Chokocho, Abara, Okomoko, Afara, Umuola and the Obite study location (Fig.2).

The study location is an agrarian locality with diverse exploitation for domestic firewood logging, charcoal production (carbon credit) and diverse plantations of agricultural produce for both local consumption and marketing [11]. Socio-economically, besides the agrarian activities, the Obite study location is known for hunting and home side domestic trading and daily night market. Based on Key Informant Interview (KII) the study location site i.e. Obite protected area, is as old as the origin of the communities respectively. Obite Community protected area in Etche with its georeferenced coordinates ranging between Lat. 05°12.831'N & Lat. 05°12.849'N and Long. 007°05.041'E & Long. 007°05.073'E has over 15 hectares of land and with another catchments reserve of over 2hectares situated between Lat. 05°12.828' N & Lat. 05°12.851' N and Long. 007°05.033' E & Long. 007° 05.074'E. Though the study site is associated with homogenous vegetation the area is heterogeneous in structure, with the effect of various forms of anthropogenic activities and poaching resulting to some level of ecological succession in a similar assertion by Hopkin [12] for a low secondary vegetation system. Despite such ecological succession by anthropogenic influences, the vegetation can still be described as a tropical rainforest vegetation in relation to similar view of vegetation analysis by SAF [13] and Edwin-Wosu, [14,15,16,17]. Geo-morphologically, the ecosystem is characterized by a sandy loam soil.

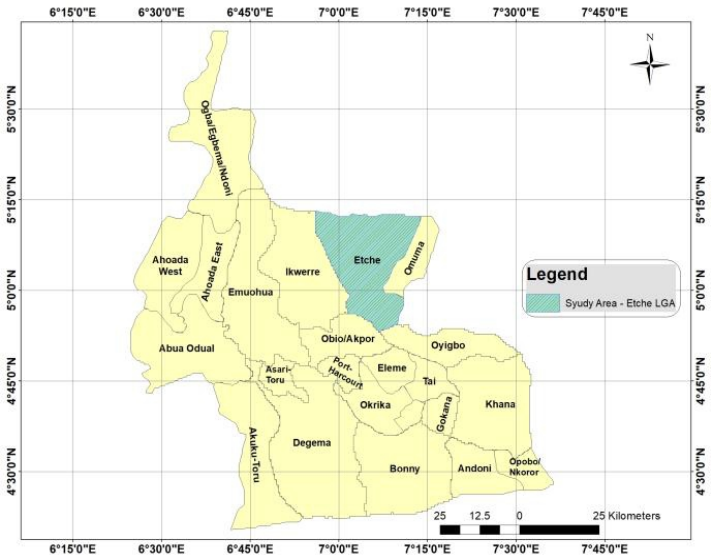

Fig. 2.1: River State indicating study area - Etche

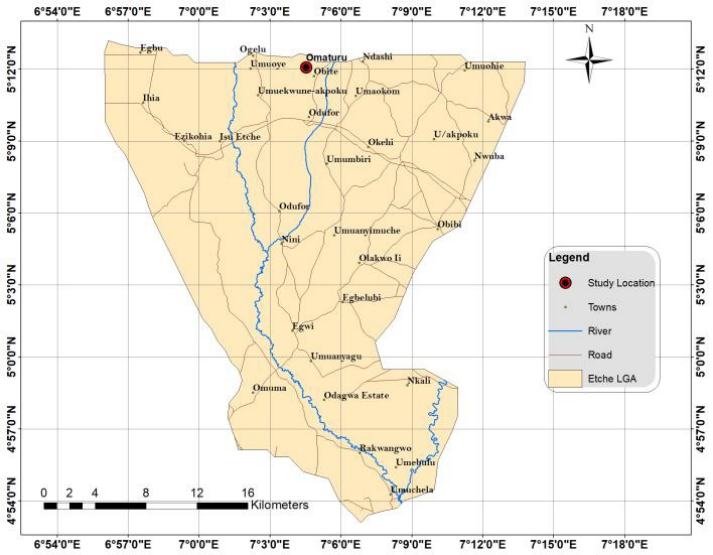

Fig 2.2: Etche study area indicating study location-obite.

2.2. *Field Sampling and Vegetation Assessment*

The georeferenced protected site covering over 15 hectares were systematically delineated into sampled transects. Based on heterogeneity and irregular physiognomy of the site, anthropogenic influences and other poaching activities, the study location sample site is being fragmented into sub-transect units represented in distance covered with their coordinates. The georeferenced coordinates of the sampled site was taken using a hand-held Global Positioning System (GPS - *Garmin Dakota 10 model*) by adapting the stratified random design of the Braun-Blanquet releve method [18]. A total of five sub-sampling units per sampled transect were systematically sampled. All the important representative plant species sampled were identified in the field as far as possible and were properly authenticated using reference books and Floras such as Burkill, [19,20,21,22,23]; Hutchinson and Dalziel, [24,25,26,27,28]. Vegetation was described in semi-quantitative terms [29], and in accordance, species with a wide frequency of distribution with many stands are described as very abundant (++++>). Some species with similarly wide frequency of distribution but with few stands are said to be less frequent, abundant, or restricted species (+++). The species of limited geographical distribution and with a few stands are termed scarce or occasional (++) and very scarce (+) species. The species designated (++) and (+) are often envisaged as being vulnerable for elimination because of their limited extent alone beside any other factors.

2.3. *Data Analysis*

The quantitative analysis of phytodistribution was based on standard phytosociological indices of frequency, abundance, and density of the representative species [30,31,32]; species diversity [33]; degree of evenness or equitability [34]; Relative density, relative abundance and relative frequency [35]; importance value index (IVI) [36] and ratio of abundance to frequency *cum* distribution patterns with the "Rule of Thumb" as: Regular (<0.03), Random (0.03-0.05) and Contagious (>0.05) [37].

The coordinates were organized in Microsoft Excel and subsequently imported into ESRI's ARC MAP software version 10.8, which allowed for the creation of a geo-referenced map and satellite imagery (Fig. 2.3) that illustrates the spatial distribution of the plant species.

Fig 2.3: Imagery of sample site

2.4. *The IUCN Floristic Assessment for Evaluation of Species Conservation Status*

The evaluation process involves the following steps for its accomplishment:

1. The Google search was navigated to find "IUCN Red List" by clicking the official link to ensure the correct site was accessed.

2. For desktop users, the search bar was prominently displayed on the homepage. For mobile users, the menu was tapped to locate and select the search option, which allowed the query to be entered.

3. The correct species name was typed into the search bar. To confirm the accuracy of the species name, a new tab was opened and a separate search was conducted for that name. The annotated spellings were ensured to match what was found on Google; if they did, readiness to proceed was confirmed.

4. If the species did not appear in the search results, it means "Not Evaluated," indicating that the IUCN has no record of it. This means that the species has not undergone an assessment for its conservation status.

5. If the species had been evaluated, the name along with its IUCN conservation status will be displayed and the species name was clicked to access a wealth of detailed information about it.

6. The detailed information entails such key sections as:
- Abstract: A summary of the species and its significance.
- Population: Information about the current population size and trends.
- Threats: Details about the factors threatening the species' survival.
- Taxonomy: Classification information including family, genus, and species.
- Assessment status: The current conservation status as determined by IUCN.
- Conservation actions: Measures being taken to protect the species.
- Additional relevant details: Any other pertinent information that may be important.

7. The text overview on the page will provide concise information covering:
- Justification for the conservation status: Reasons behind the assigned status.
- Geographic range of the species: Where the species was found geographically.
- Population dynamics: Insights into population changes over time.
- Habitat and ecological context: Description of the species' habitat and its ecological role.
- Threat information: Specific threats faced by the species, such as habitat loss or climate change.
- Use and trade details: Information on species utilization by humans and any associated trade.
- Conservation actions being taken: Current efforts to protect and conserve the species.

Following the above comprehensive process, information regarding a species as evaluated by the IUCN, can greatly aid extrapolation of conservation status.

3.0. RESULTS

3.1. Trend of Floristic Condition, Structure and Composition

The Obite community protected area is a product of conservation effort by the community. It is not actually a sacred grove but a preserved forest by the community laws without any ritual performed. The protected study site by this study was thoroughly examined and can be recognized as a tropical rainforest under luxuriant condition, distinguished by its lush vegetation structure in diverse transition structure of heterogeneous life-form habit of herbaceous, shrubby and tree species. The protected area under the influence of secondary succession due to prevalent human and natural tendencies can also be described as low land secondary mosaic vegetation characterized by a horizontal distribution in closed and sparse continuum of vegetation array of representative plant species in various diversity and abundance (Table 3.1) within the representative sampling unit transect. By its floristic composition a total of 72 species belonging 59 general under 29 families as recorded in Table 1 have revealed the most dominant families as exemplified in Fig. 3.1 in the order of species richness as follows: *Euphorbiaceae* (n=11species)> *Apocynaceae* (n=8species) > *Fabaceae* (n=6species)> *Annonaceae* (n=5species).

The life-form habit of the species as exemplified in Fig.3.2 had 27 species exhibiting shrubby habit representing 37.5% (n=27species; 35.7%), 11 herbaceous habit (n=11species; 15.28%) and 34 tree habit (n=34species; 47.22%) of the total species documented respectively.

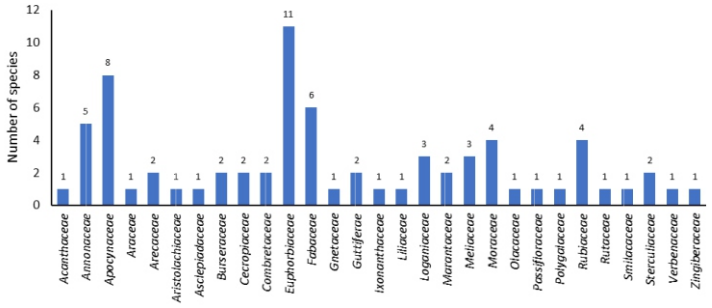

Fig. 3.1: Family distribution of species across studied location

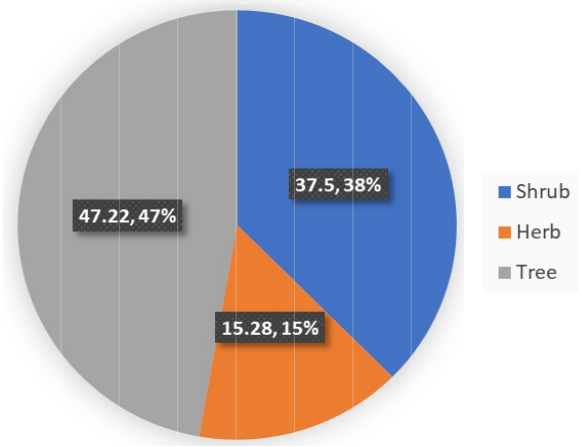

Fig. 3.2: Percentage distribution of Plant Habit Life-forms

3.2. Phytosociological Evaluation

A total of 72 plant species were recorded at the study site (Table 3.1) with an overall frequency of occurrence recording 4900. Among these, 34 species were identified as very abundant with a wide frequency of distribution (80-100%) and 1.63-2.04% relative occurrence, while 15 species were less frequent and restricted in distribution with a frequency of 60% and 1.22% relativity. More so 18 species were scarce with few stands occasionally frequent with 40% occurrence and 0.82% relativity while five species with the lowest frequency of 20% and relative frequency of 0.41% were very scarce or rare.

The total abundance of 311.7 was recorded at the study site, with *Bridella ndellensis* showing the highest abundance of 25 and a relative abundance of 8.02%. *Anthocleista vogelii* had an abundance of 20 and a relative abundance of 6.42%. *Laccosperma opacum* and *Aframomum daniellii* were each exhibiting an abundance of 11 and relative abundance of 3.53% respectively while the least abundance among 66 species ranging from 1 to 9, with relative abundance of 0.32 to 2.89%, as shown in Table 3.1 was recorded.

The total density of species recorded at the study site was 201.2ha^{-1}, with *Laccosperma opacum* and *Aframomum daniellii* demonstrating the highest density of 11ha^{-1} and a relative density of 5.47% respectively, while *Acanthus montanus* recorded a density of 9ha^{-1} and a relative density of 4.47% with the remaining 69 species exhibiting density values ranging from 0.6 to 7.6ha^{-1}, with relative densities of 0.30 to 3.78%.

The total sum of the Importance Value Index (IVI) for the 72 species was 300, with *Laccosperma opacum* and *Aframomum daniellii* exhibiting the highest IVI of 11.04 and relative IVI of 3.68%. *Bridella ndellensis* had an IVI of 10.91 and a relative IVI of 3.64% while the IVI values ranging from 1.6 to 9.4 with the relativity of 0.53 to 3.13% were recorded among 69 species.

The Shannon-Weinner species diversity richness and evenness noted *Laccosperma opacum* for highest richness (2.08); evenness (1.12) followed by *Bridella ndellensis* with 2.04

richness and 1.10 evenness while least richness and evenness is 0.001 respectively by *Ficus exasperata*

The total number of 72 species has exhibited diverse degree of distribution pattern in which 13 (18%) species had regular pattern, 20 (28%) species had random distribution pattern while 39 (54%) species recorded contiguous pattern of which *Bridella ndellensis* had the highest contiguous distribution pattern at 1.25, and *Anthocleista vogelii,* at 1.00.

3.3. Conservation Status Evaluation

In this study the species evaluated the classification into four conservation categories based on IUCN evaluation (Table 3.1): VU (6 spp.); LC (50 spp.); NT (5 spp.) and NE (11 spp.). Documentation of *K. grandifolia, K. ivorensis, G. kola, E. cylindericum*, *T. ivorensis* and *A. obanensis* (Vulnerable species) as well as *G. africanum, M. excelsa, I. gabonensis, H. leadermannii*, and *N. diderrichii* (Near threatened) are novelty in this study (IUCN version 2024-1). However, it is recommended that further ecological studies be carried out to ascertain the current conservation status of the aforementioned categories of IUCN evaluation especially with the species prone to vulnerability and near threatened status. The occurrence of conservation concern species among the vulnerable and near threatened and the increasing anthropogenic drivers justified the current rating (potentially threatened) proposed in this study.

4.1. DISCUSSION

Protected areas have become one of the most important instruments to preserve nature and, when effective, can significantly reduce human pressure and derived threats to biodiversity [38]. The floristic enumeration of species conducted in Obite, Etche, Rivers State, highlights the area's ecological significance by cataloging various plant species, evaluating their conservation status, and identifying strategies to prevent extinction. The study area is situated in the tropical rainforest belt within the equatorial climate region, which is marked by high rainfall, elevated humidity, and maximum temperatures. This ecosystem is a rich vegetation hotspot with variety of plant families, reflecting the typical characteristics of climax vegetation found in tropical rainforests amidst its cultural significance.

It has been indicated from the study that the floristics of the Obite Protected Area is representatively composed of 72 species of 59 genera reflecting its abundance, richness, and evenness across 29 families involving: *Acanthaceae, Anonnaceae, Apocynaceae, Araceae, Arecaceae, Aristolochiaceae, Asclepiadaceae, Burseraceae, Cecropiaceae, Combretaceae, Euphorbiaceae, Fabaceae, Gnetaceae, Guttiferae, Ixonanthaceae, Liliaceae, Loganiaceae, Marantaceae, Meliaceae, Moraceae, Olacaceae, Passifloraceae, Polygalaceae, Rubiaceae, Rutaceae, Smilacaceae, Sterculiaceae,Verbenaceae* and *Zingiberaceae*. The family Euphorbiaceae recorded 11 species and by Ogie-odia *et al.* [39] is noted as one of the largest dicot families and conspicuous in the tropics. Though, earlier studies on rainforests ecosystems have revealed that conservation can support livelihoods and biodiversity, while reinforcing local and Indigenous values, cultures, and institutions. Its delivery can help address cross-cutting global challenges, such as climate change, conservation, poverty, and food security. Therefore, understanding trends in community-based conservation is pertinent to setting and implementing global goals [40]. Of the total species recorded in the study sampled site, 23 species exhibited a 100% frequency, indicating that these species are very common and were consistently and abundantly observed with a wide frequency of distribution during the survey. This high frequency may be attributed to the area offering suitable conditions for their growth.

The density of the species showed significant variation across the sampled sites which had a higher number of woody species, including trees and shrubs. Species distributions and population sizes are dependent on interactions among physical, chemical, and biological factors [41,42].The differences between the diversity of woody plants in the study area possibly could be attributed to management, rainfall regimes, disturbance, and distance history [43,44,45]. Similar study has revealed abiotic and biotic factors that regulate species distribution to include such climatic features as temperature, moisture and availability of macro- and micronutrients as well as intra- and interspecific interactions, life history traits, and demography [46, 47]. Identifying the important ecological factors that drive community structure is fundamental for understanding the effects of biodiversity on ecosystem functioning [48, 49]. Further, with biodiversity being threatened by climate change and other human impacts, understanding the influence of abiotic and biotic factors on species distribution is critical for predicting responses to environmental change [50].

Bridella ndellensis showed the highest abundance at 25. When a species has the highest abundance in a protected area, it signifies that this species is thriving and more numerous. At the global level, protected areas have been used to conserve biodiversity and maintain ecosystem services [51]. However, enhancing the complementarity of protected climatic conditions can help to conserve the biodiversity already present in protected area networks [52]. This suggests that the protected area offers a suitable habitat with essential resources (food, shelter, and fewer threats) for the species survival. Measuring species abundance can also inform conservation efforts with respect to rare and endangered species. To compile its Red List of Threatened Species, the International Union for Conservation of Nature uses species abundance as one of its primary tools to assess the extinction risk of threatened plants.

The Importance Value Index (IVI) indicates the overall picture of ecological importance of the species in a community, [53,54]. This value is a combination of the percentage values of relative frequency, relative abundance and relative density,or relative dominance [53,55,56,57]. *Laccosperma opacum* and *Aframomum daniellii* had the highest IVI of 11.04 respectively, which means that this species plays a significant role in the ecosystem. This value measures how dominant a species is in an ecosystem [56] as well the level of adaptation of species to both natural and anthropogenic effects [58]. A high IVI indicates that the species is not only abundant but also well-distributed and has a strong presence in terms of biomass or coverage. This suggests that the species contributes greatly to the ecological functions and overall health of the community, making it a key component of that ecosystem.

Report of the IUCN evaluation has revealed four categories of conservation status of species in the study location with some species prone to vulnerability and near threatened while others are least concerned and not evaluated. The six species identified as vulnerable include *Anthonotha obanensis, Terminalia ivorensis, Entandrophragma cylindricum, Khaya ivorensis, Khaya grandifolia* and *Garcinia kola.* Exploitation is the main threat facing these species. It has been reported that exploitation is a significant concern that contributes to the decline in population numbers and the loss of biodiversity [10]. Such scenarios arises from natural and anthropogenic intrusions involving over harvesting and population pressure, thus subjecting the species

to high risk of extinction particularly in tropical regions [59,60,61,62,63,64]. Similarly, various anthropogenic activities such as agricultural expansion, livestock grazing, and tourism, and have negatively affected the vegetation composition across the world with subsequent habitat fragmentation, and introduction or expansion of invasive species [65, 66]. While natural habitats are more resistant to invasions by alien species, excessive anthropogenic pressures are noted to increase the habitat efficacy for immigration of non-native or weedy species [67].

A total of 50 species were categorized as “Least Concern” suggesting that these species have stable or increasing populations and are widely distributed in their habitats. Although they may encounter some threats, these are not significant enough to elevate their conservation status. Therefore, "Least Concern" species are regarded as being at lower risk compared to those labeled as Vulnerable, Endangered, or Critically Endangered. While a "Least Concern" (LC) status for plant species might seem like a positive sign, it doesn't guarantee its long-term survival. This designation often reflects a lack of sufficient data rather than a true assessment of the species' health. Even abundant species can face threats like habitat loss, climate change, or invasive species, leading to rapid declines. Therefore, continuous monitoring is crucial to detect early warning signs of decline and prevent a species from slipping into a more threatened category. These corroborates George *et al.* [68] who reported a significant majority (62.8%) of the species as least concern, while 21.3% not been evaluated for their conservation status.

The five species classified as "Near Threatened" include *Gnetum africanum*, *Milicia excelsa, Hallea ledermannii, Irvingia gabonensis*, and *Nauclea diderrichii*. Their classification may be attributed to factors such as population reduction and over-harvesting. The exponential increase in human population has placed a massive and growing burden on the natural world and many species are prone to this ecological vicissitude. Currently, 28% of all assessed species are threatened with extinction, and the number continues to grow [69], which could be likened to biological annihilation [70] to refer to the current situation as an ongoing “biological annihilation.” Such extensive losses do not only impact the species in question but could result to genetic erosion of biological resources that could have been utilized by humans for a variety of purposes of health and economic implication [71,72]. Absence of conservation measures will thus undermine sustainable development goals and rob future generations of potentially life saving scientific discoveries and other human health benefits [71, 72, 73]. Besides species may not be driven extinct across their entire range, but the number of species undergoing range contractions eliminates large numbers of species from ecosystems of habitation, thereby decreasing the biodiversity of these ecosystems. This can have deleterious impacts on ecosystems, including lower productivity and overall stability [74, 75, 76]. As these drivers of both natural and anthropogenic influences impact on species [77]. The IUCN classifies them as near threatened hence these factors significantly impact their population dynamics and recovery ability. Such combination of threats can lead to a decline in their numbers, placing them at risk of becoming vulnerable or endangered in the future.

However, some species have not been evaluated and therefore lack information under the IUCN classification. These include *Anchomanes difformis, Marantochloa lucantha, Musseunda landophioides, Hedranthera barteri, Manniophyton fulvum, Saba Florida, Aristolochia albida, Thanmatococcus daniellii, Smilax anceps, Landolphia dulcis,* and *Bridella ndellensis.* Not Evaluated species exhibit unique traits compared to evaluated species [78], primarily due to the absence of comprehensive data regarding their population status, distribution, and threats. Consequently, Not Evaluated species may possess characteristics such as limited knowledge about their ecology, behavior, and habitat requirements, which complicates our understanding of their role within ecosystems. They may also be potentially vulnerable, as unnoticed population declines or habitat loss can occur without formal evaluation. Furthermore, their geographical range and habitat preferences may not be well documented, leading to challenges in conservation planning. The specific threats they face, mau remain unidentified, which can impede the development of effective conservation strategies and may lead to extinction of species. It highlights the need for more research and data collection to assess the species' population, habitat, and threats [79]. The problem, however, is that many species remain unassessed against the Red List, or are too poorly understood to assess [40,80]. Such species are considered 'Data Deficient' and it is a Red List category given to species for which a lack of biological data precludes confident assignation to a threat category [80]. Data-deficient species typically are either taxonomically uncertain species, or are recently described, and have few or very old occurrence records, or lack information on population status, geo-graphical distribution and threats [81]. Until these species are assigned a conservation status, they may be excluded from global and local conservation priorities. This would be especially problematic given that many data-deficient (DD) species are likely already threatened by extinction [82,83,84,85,86].

As species are exploited beyond their capacity to recover, not only does their population diminish, but the overall diversity within ecosystems is also threatened. The level of poverty has tremendously attributed towards the negative actions across the threatened plants species, for the search of food, shelter and other agricultural practices and very poor planting and management of trees across regions [87].This loss of diversity can disrupt ecological balance, leading to further consequences for the environment and the services it provides. Addressing exploitation is crucial for conservation efforts aimed at protecting vulnerable species and maintaining healthy ecosystems. It is crucial for communities, individuals, and Society in general to be aware of the IUCN status of plant species within their environment. This Categorized species in their levels of Threatened status serves as a warning to encourage conservation efforts to protect these species before they reach a more critical status.

4.2. CONCLUSION

The floristic study conducted in the Obite Protected Areas in parts of Etche, Rivers State, revealed a remarkable diversity of plant life. The findings underscore the urgent need for conservation initiatives aimed at protecting the unique plant species in the region. Additionally, this research establishes a solid framework for future investigations, offering a valuable baseline for tracking changes in local flora over time. The extensive data collected not only serves as a critical foundation for effective environmental management but also supports sustainable development efforts in Rivers State. This is particularly important given the area's classification as a tropical rainforest, which is home to rich biodiversity and complex ecosystems that provide essential services to both wildlife and local communities.

This study highlights the vital role of conservation efforts in maintaining the ecological integrity of the Obite area, ensuring that its unique plant species and habitats are preserved for future generations. By prioritizing these initiatives, we can contribute to the overall health of the ecosystem and support sustainable practices that benefit both the environment and local livelihoods. This can be achieved via the following recommendations: i. strengthening bioright principles of protected areas to safeguard identified endemic plant species, ii. Implement targeted conservation programs focused on unique plant species in the area, iii. Conduct further research in Obite to monitor plant population, medicinal and economic benefit, health and habitat conditions, iv. Assess the effectiveness of conservation efforts by raising awareness on biodiversity and specific plant species in the region, v. Local community engagement in conservation initiatives by educating them on the importance of preserving plant species and ecosystems, vi. Advocate for stronger environmental laws and policies to protect natural habitats and endangered species, vii. Encourage sustainable use of plant resources while safeguarding the local ecosystem, viii.call for IUCN assessment for international statutory recognition as conservation area.

Table 3.1: Phytosociological Distribution and Conservation Status of Species in Parts of Etche Obite Community Protected Area

Family Notation	Species	Common Name	Habit	%f	D	A	%RF	%RD	%RA	IVI	RIVI	SdH'	SdE	A/F	IUCN STATUS
1	*Acanthus montanus* (Nees) T. Anders	False thistle	Herb	100	9	9	2.04	4.47	2.89	9.4	3.13	1.55	0.83	0.09	LC
2	*Cleistopholis patens* (Benth) Engl & Diels	Salt & oil tree	Tree	100	2	2	2.04	0.99	0.64	3.67	1.22	0.11	0.06	0.02	LC
	Uvaria chamae P. Beauv	Finger root	Tree	60	1.4	2.33	1.22	0.70	0.75	2.67	0.89	0.05	0.03	0.04	LC
	Dennettia tripetala Bak. F	Pepper fruit	Shrub	60	0.6	1	1.22	0.30	0.32	1.84	0.61	0.13	0.07	0.02	LC
	Xylopia aethiopica (Dunal) A. Rich	Guinea pepper	Tree	60	1	1.67	1.22	0.50	0.54	2.26	0.75	0.09	0.05	0.03	LC
	Monodora tenuifolia Benth	African nut meg	Tree	40	0.8	2	0.82	0.40	0.64	1.86	0.62	0.13	0.07	0.05	LC
3	*Landolphia dulcis* (R. Br) Pichon	Vine rubber	Herb	80	3	3.75	1.63	1.49	1.20	4.32	1.44	0.23	0.12	0.05	NE
	Rauvolfia vomitoria Afzel	Swizzle stick	Shrub	60	3	5	1.22	1.49	1.60	4.31	1.44	0.23	0.12	0.08	LC
	Voacanga africana Stapf		Shrub	100	3	3	2.04	1.49	0.96	4.49	1.50	0.26	0.14	0.03	LC
	Funtumia africana (Benth) Stapf	False rubber	Shrub	40	2	5	0.82	0.99	1.60	3.41	1.14	0.06	0.23	0.13	LC
	Saba florida (Benth) Bullok	Paste rubber	Shrub	20	1	5	0.41	0.50	1.60	2.51	0.84	0.06	0.23	0.25	NE
	Hunteria umbellate (K. Schum) Hailler F.		Tree	20	0.6	3	0.41	0.30	0.96	1.67	0.56	0.14	0.08	0.15	LC
	Hedranthera barteri (Hook.f.) Pichan		Shrub	40	1	2.5	0.82	0.50	0.80	2.12	0.71	0.11	0.06	0.06	NE
	Holarrhena floribunda (G. Don) Dur. & Schinz	False rubber tree	Tree	60	2	3.33	1.22	0.99	1.07	3.28	1.09	0.04	0.02	0.06	LC
4	*Anchomanes difformis* (Bl.) Engl.	Forest anchormanes	Herb	40	1.4	3.5	0.82	0.70	1.12	2.64	0.88	0.05	0.03	0.08	NE
5	*Laccosperma opacum* (Mann & Wendl) Drude	Rattan palm	Shrub	100	11	11	2.04	5.47	3.53	11.04	3.68	2.08	1.12	0.11	LC
	Laccosperma acutiflora (P. Beauv) O K'tze	Rattan palm	Shrub	100	7.6	7.6	2.04	3.78	2.44	8.26	2.75	1.21	0.65	0.08	LC
6	*Aristolochia albida* Duchartre	Dutchman's pipe	Herb	80	3	3.75	1.63	1.49	1.20	4.32	1.44	0.23	0.12	0.05	NE
7	*Pergularia daemia* (Forssk) Chiov		Herb	80	7	8.75	1.63	3.48	2.80	7.91	2.64	1.11	0.60	0.11	LC
8	*Canarium schweinfurthii* Engl	Incense tree	Tree	60	2.4	4	1.22	1.19	1.28	3.69	1.23	0.11	0.06	0.07	LC
	Dacryodes edulis (G. Don) H. J. Lam	African pear	Tree	100	1.4	1.4	2.04	0.70	0.45	3.19	1.06	0.03	0.02	0.01	LC
9	*Musanga cecropioides* R.Br	Umbrella tree	Tree	100	2	2	2.04	0.99	0.64	3.67	1.22	0.11	0.06	0.02	LC
	Myrianthus arboreus P. Beauv	Myranthus	Shrub	40	1.2	3	0.82	0.60	0.96	2.38	0.79	0.08	0.04	0.08	LC
10	*Terminalia ivorensis* A Chev.	Black afara	Tree	40	1.2	3	0.82	0.60	0.96	2.38	0.79	0.08	0.04	0.08	VU
	Terminalia superba Engl & Diels	White afara	Tree	40	0.8	2	0.82	0.40	0.64	1.86	0.62	0.13	0.07	0.05	LC
11	*Bridelia ferruginea* Benth	NA	Shrub	60	2	3.33	1.22	0.99	1.07	3.28	1.09	0.04	0.02	0.06	LC
	Bridelia atroviridis Mull-Arg	NA	Shrub	60	4	6.67	1.22	1.99	2.14	5.35	1.78	0.45	0.24	0.11	LC

	Bridelia grandis Piere	NA	Shrub	40	1	2.5	0.82	0.50	0.80	2.12	0.71	0.11	0.06	0.06	LC
	Bridelia ndellensis Beille	NA	Shrub	20	5	25	0.41	2.49	8.01	10.91	3.64	2.04	1.10	1.25	NE
	Maesobotrya barteri (Baill) Hutch.	Bush cherry	Shrub	40	1	2.5	0.82	0.50	0.80	2.12	0.71	0.11	0.06	0.06	LC
	Maesobotrya dusenii (Pax) Hutch	Bush cherry	Shrub	60	1.6	2.67	1.22	0.80	0.86	2.88	0.96	0.02	0.01	0.04	LC
	Macaranga barteri Mull-Arg		Shrub	60	3	5	1.22	1.49	1.60	4.31	1.44	0.23	0.12	0.08	LC
	Macaranga spinosa Mull-Arg		Shrub	80	5	6.25	1.63	2.49	2.01	6.13	2.04	0.63	0.34	0.08	LC
	Manniophyton fulvum Mill-Arg		Shrub	100	1.8	1.8	2.04	0.89	0.58	3.51	1.17	0.08	0.04	0.02	NE
	Ricinodendron heudelotii (Baill.) Pierre	African wood oil nut	Tree	100	3	3	2.04	1.49	0.96	4.49	1.50	0.26	0.14	0.03	LC
	Alchornea cordifolia (Schum & Thonn) Mull-Arg	Christmas bush	Shrub	80	4	5	1.63	1.99	1.60	5.22	1.74	0.42	0.23	0.06	LC
12	*Pentaclethra macrophylla* Benth	Oil bean	Tree	40	2.4	6	0.82	1.19	1.93	3.94	1.31	0.15	0.08	0.15	LC
	Dialium guineense Wild	Velvet tamarind	Tree	20	0.6	3	0.41	0.30	0.96	1.67	0.56	0.14	0.08	0.15	LC
	Senna siamea (Lam) Hoim & Barneby	Siamesse tree	Tree	40	3	7.5	0.82	1.49	2.41	4.72	1.57	0.31	0.17	0.19	LC
	Berlinia grandiflora (valv) Hutch & Dalz		Tree	40	1	2.5	0.82	0.50	0.80	2.12	0.71	0.11	0.06	0.06	LC
	Anthonotha obanensis (Bak. J) J. Leonard	African rose wood	Shrub	100	5	5	2.04	2.49	1.60	6.13	2.04	0.63	0.34	0.05	VU
	Anthonotha macrophylla P. Beauv.	African rose wood	Shrub	100	2.4	2.4	2.04	1.19	0.77	4	1.33	0.16	0.09	0.02	LC
13	*Gnetum africanum* Welw	NA	Herb	100	5	5	2.04	2.49	1.60	6.13	2.04	0.63	0.34	0.05	NT
14	*Garcinia kola* Heckel	Bitter cola	Tree	40	0.6	1.5	0.82	0.30	0.48	1.6	0.53	0.15	0.08	0.03	VU
	Harungana madagascariensis Lam ex Poir	Dragon's blood	Shrub	100	5	5	2.04	2.49	1.60	6.13	2.04	0.63	0.34	0.05	LC
15	*Irvingia gabonensis* (Aubry-Lecomte) Baill.	Bush mango	Tree	60	1	1.67	1.22	0.50	0.54	2.26	0.75	0.09	0.05	0.03	NT
16	*Dracaena mannii* Bak.	Asparagus tree	Shrub	40	1.4	3.5	0.82	0.70	1.12	2.64	0.88	0.05	0.03	0.09	LC
17	*Anthocleista djalonensis* A. Chev	Cabbage plant	Tree	60	2	3.33	1.22	0.99	1.07	3.28	1.09	0.04	0.02	0.06	LC
	Anthocleista nobilis G. Don	Cabbage plant	Tree	40	2.2	5.5	0.82	1.09	1.76	3.67	1.22	0.11	0.06	0.14	LC
	Anthocleista vogelii Planch	Cabbage plant	Tree	20	4	20	0.41	1.99	6.42	8.82	2.94	1.38	0.74	1.00	LC
18	*Thanmatococcus Daniellii* (Benn) Benth	Protein sugar	Herb	100	7	7	2.04	3.48	2.25	7.77	2.59	1.07	0.58	0.07	NE
	Marantochloa lucantha (K. Schum) Milne Redh	Yoruba soft cane	Herb	100	6	6	2.04	2.98	1.93	6.95	2.32	0.85	0.46	0.06	NE
19	*Khaya grandifolia* C.DC	Mahogany	Tree	100	3	3	2.04	1.49	0.96	4.49	1.50	0.26	0.14	0.03	VU
	Khaya ivorensis A. Chev	Mahogany	Tree	80	1	1.25	1.63	0.50	0.40	2.53	0.84	0.06	0.03	0.02	VU
	Entandrophragma cylindricum (Sprague) Sprague)	West African cedar	Tree	60	2.4	4	1.22	1.19	1.28	3.69	1.23	0.11	0.06	0.07	VU
20	*Milicia excelsa* (Welw) C.C.Berg.	Iroko	Tree	100	1.4	1.4	2.04	0.70	0.45	3.19	1.06	0.03	0.02	0.01	NT
	Ficus sur Forssk	Bush fig plant	Tree	40	1	2.5	0.82	0.50	0.80	2.12	0.71	0.11	0.06	0.06	LC
	Ficus exasperata Vahl	Sandpaper plant	Shrub	100	1.2	1.2	2.04	0.60	0.39	3.03	1.01	0.001	0.001	0.01	LC
	Ficus mucuso Welw ex Ficalho	Fig plant	Tree	40	1.4	3.5	0.82	0.70	1.12	2.64	0.88	0.05	0.03	0.09	LC
21	*Coula edulis* Baill	NA	Tree	80	1.4	1.75	1.63	0.70	0.56	2.89	0.96	0.02	0.01	0.02	LC
22	*Barteria nigritana* Hook.f	NA	Shrub	80	5	6.25	1.63	2.49	2.01	6.13	2.04	0.63	0.34	0.08	LC

23	*Carpolobia lutea* G. Don	Poor man's candle	Shrub	40	1	2.5	0.82	0.50	0.80	2.12	0.71	0.11	0.06	0.06	LC
24	*Hallea leadermannii* (K. Krause) Verde	Poplar tree	Tree	100	5	5	2.04	2.49	1.60	6.13	2.04	0.63	0.34	0.05	NT
	Morinda lucida Benth	Brimstone tree	Tree	80	1.4	1.75	1.63	0.70	0.56	2.89	0.96	0.02	0.01	0.02	LC
	Nauclea diderrichii (De Wild & Th. Dur) Merrill	West African boxwood	Tree	80	2.4	3	1.63	1.19	0.96	3.78	1.26	0.13	0.07	0.04	NT
	Musaaenda landophioides		Herb	100	3	3	2.04	1.49	0.96	4.49	1.50	0.26	0.14	0.03	NE
25	*Zanthoxylum gilletii* (De Wild) Waterman	Fagara	Tree	60	1.6	2.67	1.22	0.80	0.86	2.88	0.96	0.02	0.01	0.04	LC
26	*Smilax anceps* Willd	West African sarsiparilla	Herb	100	1.6	1.6	2.04	0.80	0.51	3.35	1.12	0.06	0.03	0.02	NE
27	*Triplochiton scleroxylon* K. Schum	African white wood	Tree	60	2.2	3.67	1.22	1.09	1.18	3.49	1.16	0.07	0.04	0.06	LC
	Cola acuminata (P. Beauv) Schum/Engl	Native true cocala	Tree	80	2.4	3	1.63	1.19	0.96	3.78	1.26	0.13	0.07	0.04	LC
28	*Vitex doniana* Sweet	Black plum	Shrub	100	2.4	2.4	2.04	1.19	0.77	4	1.33	0.16	0.09	0.02	LC
29	*Aframomum daniellii* (Hook.f) K. Schum	Wild alligator pepper	Herb	100	11	11	2.04	5.47	3.53	11.04	3.68	2.08	1 .12	0.11	LC
	ΣS = 72 species	**TOTAL**		**4900**	**201.2**	**311.7**	**100**	**100**	**100**	**300**	**100**	**24.24**	**13.5**	**6.73**	

Note: %F= Percentage frequency. D = Density. A = Abundance. %RF = Relative frequency. %RD = Relative density. %RA = Relative abundance. IVI = Importance Value Index. SdH'= Species diversity. SdE = Species diversity evenness. A/F = Ratio A: F distribution pattern *with the "thumb of rule" designated as follows: Regular (<0.03), random (0.03 – 0.05), and contiguous (>0.05) distribution.* ***+ (1-25) Very scarce, ++ (26-59) Scarce, +++ (60-79) Abundant, ++++> (80-α) Very abundant, NA- Not available.***

Family Serial Notation: 1. Acanthaceae. 2. Annonaceae. 3. Apocynaceae. 4. Araceae. 5. Arecaceae. 6. Aristolachaiceae. 7. Asclepiadaceae. 8. Burseraceae. 9. Cecropiaceae. 10. Combretaceae. 11. Euphorbiaceae. 12. Fabaceae. 13. Gnetaceae. 14. Guttiferae. 15. Ixonanthaceae. 16. Liliaceae. 17. Loganiaceae. 18. Maranthaceae. 19. Meliaceae. 20. Moraceae. 21. Olacaceae. 22. Passifloraceae. 23. Polygalaceae. 24. Rubiaceae. 25. Rutaceae. 26. Smilacaceae. 27. Sterculiaceae. 28 Verbanaceae. 29 Zingiberaceae.

Conservation Status Ranking: VU: Vulnerable; LC: Least Concern; NT: Near Threatened; NE: Not Evaluated.

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