CHARACTERIZATION OF THE SAVANNA VEGETATION OUTLIER IN OKHUESAN ESAN SOUTH EAST LOCAL GOVERNMENT AREA OF EDO STATE

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ABSTRACT

Okhuesan Esan South East Local Government Area of Edo State depict the occurrence of mesic savanna vegetation outlier in a forest zone which is rare and isolated case in nature. In this study, the species composition and diversity were record. A check list of plant species was documented and they were catalogued according to their taxonomic names, habit and life form. The result of the survey showed a total of 120 plant species belonging to 51 families and 89 Genera. Fabaceae have the highest number of species 12 followed by poaceae with 11 species, Euphorbiaceae with 9 species, Asteraceae 6 and Apocynaceae 5 species while Amaranthaceae, Commelinaceae and Cyperaceae had 4, 3 and 4 species respectively. Based on the plant habit classification, 40 species (33.3%) were herbs, 11 (9.17%) Grasses, 4 (3.33%) sedge species, 4 (3.33%) vine species, 33 tree species(27.5%) and 27 shrubs (22.5%).The life form of the species were categorized using the classification system formulated by Raunkiaer. The result showed that 5(4.17%) were Mega Phanerophytes, 20 (16.7%) Meso-Phanerophyte, 20 (16.7%) Micro Phanerophyte, 2(1.67%) Nano Phanerophyte, 21 (17.5%) Chamaephyte, 34(28.3%) Hemicryptophyte, 2(1.67%) Geophytes and 7 (5.8%) Therophyte.

Key word*: Mesic savanna, vegetation outlier, Okhuesan Esan.*

INTRODUCTION

An open woody canopy and a continuous layer of herbaceous flora make up savannas. They occupy more than half of the African continent and almost one eighth of the earth's land area (Scholes and Archer, 1997). Environmental variables, seasonality of rainfall, fire, and herbivory regulate the size of the savanna biome (Lehmann *et al*., 2011). Systems with rainfall below 750 $mmyr^{-1}$ typically lack the climatic conditions necessary to generate closed canopies; these systems are known as water-limited savannas because lack of water prevents them from developing closed woody canopies. The theoretical upper limit of woody cover in a landscape is widely defined by rainfall, which also promotes the growth of woody plants (Sankaran *et al*., 2005). Savannas are also widespread in regions with annual rainfall above 750 mm, where woody vegetation can be suppressed by fire and grazing and prevented from turning into a forest (Sankaran *et al*., 2008).

By promoting and repressing woody cover, rainfall and disturbances have a significant impact on the size of the savanna biome. Additionally, measurements of the variance in woody cover show that the distribution is bimodal, with a decline in the presence of savannas with 50–70% tree cover (Hirota *et al*., 2011; Staver *et al*., 2011). The wet climate offers ideal circumstances for the establishment of herbaceous biomass, which can then be converted into high fire intensities that kill woody plants. This is especially true in savannas with higher annual rainfall (1000–2000mm). Because of the intense fires, intense herbaceous growth, and suppression of woody plants, an open savanna environment may be kept in a stable state even during periods of heavy rainfall (Staver *et al*., 2011).

Mesic savannas depend heavily on periodic fires, making them the most frequently burned ecosystems on Earth (Andela *et al*., 2017; Archibald *et al*., 2013). The spread of savannas and the fire regime are both significantly influenced by the seasonality of rainfall. According to Lehmann *et al*. (2011), seasonality of rainfall has the greatest bearing on forecasting where savannas would be located around the world in the mesic climate zone. Long dry seasons fuel and foster the best circumstances for the occurrence of fires. Therefore, systems with a dry season lasting longer than 6 months have a higher risk of burning (Archibald *et al*., 2009).

The seasonality of high rainfall can also have a direct impact on woody ecosystems by limiting sapling survival throughout the protracted dry season. Although an ecosystem's internal feedback loops might help maintain stability, woody communities are rarely stable over a long period of time (Gillson, 2004). Natural growth and decline cycles occur in them, and inter-annual change in rainfall and fauna populations is common. When the vegetation is out of balance with the environment, mesic savannas may undergo longer-term transitions between open savanna and closed forest states over periods of centuries to millennia (Hoffmann *et al*., 2012).

It is an immense subject to research the paradigms that have been created to define and analyze the intricate relationships found in savanna ecology and phytogeographical dynamics along the savanna and forest boundary. The variety of contexts and compositional forms that define this biome have increased the theoretical dilemmas and disputes that have been created by such conflicts in the multidisciplinary literature on savanna vegetation (Campbell, 2013). However, since the majority of people in the tropics, over one-fifth of the world's population, live in savannas and since such studies may help the long-term survival of so many people, who are already threatened by landscape degradation, drought, famine, and disease, it is worthwhile to make further efforts to understand these contexts.

To understand and study environments where grasses and trees co-dominate, as well as the socio-environmental processes that affect such ratios, ecological theories must be modified (Meyer *et al*., 2006). The development of sharp knowledge through research around perceived theoretical gaps and contradictions is an attractive prospect for the critical mind in order to better explain environmental change at different spatial scales (Solbrig, 1990). Ground ecological surveys, aerial images, maps, and satellite photography are helpful resources in such projects (Bucini and Lambin, 2002).

There is debate about the actual environmental impacts of farming, wood harvesting, construction, and firewood cutting. According to McNeely (1994), the specific historical and geographic conditions which obtain in a given situation determine the environmental repercussions of socio-environmental linkages. However, disagreements over the elements influencing the interactions between savannas and forests (and occasionally deserts) have evolved into the fundamental tenets of divisive and generalized theoretical viewpoints. The advent of paradigms that place a focus on non-linear disequilibrium models, a paradigm that has been dubbed the "new ecology," is at the center of a crucial debate in savanna ecology. Christiansen (1993) as rebuttals to the traditional perspective of linear, mechanistic change illustrated by natural vegetation climatic climaxes, succession, and human nature separation (Pickett *et al*., 1992).

The equilibrium viewpoint was in favour of ecosystem theory, mechanistic succession and vegetation climaxes because it was predicated on the idea that science can be generalized and applied to all situations Woodgate and Redclift (1998). According to Gillson (2004), the "non-equilibrium hypothesis" has gradually grown over time due to their emphasis on the dynamics of interrelationships within complex and uncontrollable socio-environmental contexts, these viewpoints may be referred to as disequilibrium analyses, according to Scholes and Walker (1993). Christiansen (1993) emphasizes chaotic fluctuations in socio-environmental situations, contradicting the equilibrium viewpoint of classical ecology as advocated, for instance, by Nicolis, (1994).

The objective of the study is to compile a comprehensive database of plant species present in the savanna outlier and the adjacent forest area in Okuessan by application of the Raunkiaer classification system to categorize plant life forms into distinct groups such as phanerophytes, chamaephytes, hemicryptophytes, and therophytes. This classification will provide critical insights into the adaptive strategies of plants in response to local environmental conditions.

A key component of the research involves documenting the plant habit within the study area. This encompasses the identification and quantification of different plant types, including trees, shrubs, vines, grasses, and sedges. This information will contribute to a comprehensive analysis of the structural composition of the ecosystems which may offer valuable insights for land-use planning, resource management, and biodiversity conservation in the Okhuessan region and similar ecological settings.

MATERIALS AND METHOD

Equipment/apparatus used: Gps device, camera and descriptors.

Study Location Area

Okhuesan belong to Esan South East Local Government Area, with Ubiaja as the head quarter. It Lies between latitude 6°12′10.49″S and 5°58′15.29″S and between longitude 5°49′46.42″E and 5°52′11.63″E. Uromi is one of the earliest settlements among the present thirty–one kingdom in Ishan (Okoduwa, 2002), and its neighbors are the Kukuruku (Owan/Etsako) in the north, Irrua in the north-west, Ugboha and Ubiaja in the south, Okhuesan on the south-east (Butcher. 1982). Okhuesan is a sma ll village comprising of five quarters they are Eguare, Ichala, Idewan, Ikpeko and Odikeken (Osagie, 2007; Amodu *et al.* 2020), as shown on the map below.

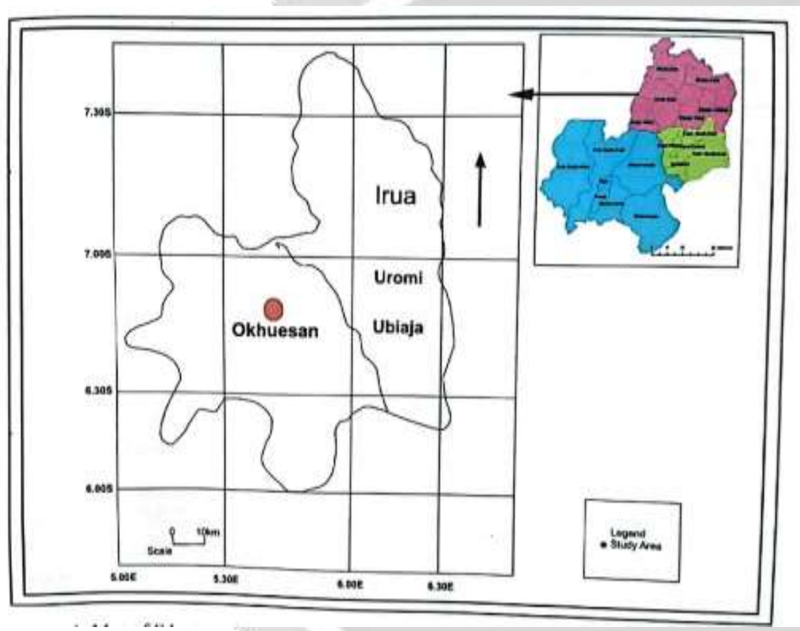

Fig. 1: Map showing the study site among other neighboring local government areas.

Determination of species composition

The species were categorized according to their taxonomic (species and family) names, habits, and life forms, and documented following the method in Amodu *et al.* (2000). Plant identification was done using a descriptor-Aigbokhan (2014). Species that were difficult to identify, were gathered, pressed (using a plant press), and taken to the herbarium for identification.

Statistical analysis

Descriptive statistics such as tables, percentages and charts were used to analyze the results, and the results were arranged systematically following the alphabetical system of classification.

RESULTS AND DISCUSSIONS

Below is the checklist documented from the study site, comprising the species name, family name, the habit of the species and their life form.

Table 1: A table showing the various plant species, their families, Habit and their life form

S/N	PLANT SPECIES	FAMILY	HABIT	LIFE FORM
1	*Acalypha ciliata* Wall.	Euphorbiaceae	Herb	Hemicryptophyte
2	*Acanthospermum hispidum* DC	Asteraceae	Herb	Hemicryptophyte
3	*Achormanis diformis*	Araceae	Herb	Nano Phanarophyte
4	*Achyranthes aspera* L	Amaranthaceae	Herb	Hemicryptophyte
5	*Adansonia digitata* L.	Malvaceae	Tree	Meso Phanaerophyte
6	*Aechynomene Americana* L	Fabaceae	Herb	Hemicryptophyte
7	*Aframomum angustifolia* (Son.) K. Schum	Zingiberaceae	Herb	Chamaephytes
8	*Aframomum melagueta K. Schum.*	Zingiberaceae	Herb	Chamaephytes
9	*Ageratum conyzoides* L.	Asteraceae	Herb	Hemicryptophyte
10	*Albizia lebbeck* (Linn.) Benth	Fabaceae	Shrub	Meso Phanarophyte
11	*Alstonia boonie* De Wild	Apocynaceae	Shrub	Mega Phanarophyte
12	*Alternanthera brassiliana* (L.) Kuntze	Amaranthaceae	Herb	Hemicryptophyte
13	*Anacardium occidentale* L.	Anacardiaceae	Shrub	Micro Phanarophyte
14	*Andropogogon gayanus* Kunth	Poaceae	Grass	Chamaephytes
15	*Adansonia digitata L*	Malvaceae	Tree	Meso phanaerophyte
16	*Anthocleista vogelii* Planch	Gentanaceae	Tree	Meso Phanarophyte
17	*Anthoscliesta nobilis* G.Don	Gentianaceae	Tree	Meso Phanaerophyte
18	*Anthocleista djalonensis* A. Chev.	Gentianaceae	Tree	Meso Phanarophyte
19	*Aspilia Africana* (Pers.) C.D. Adams	Asteraceae	Herb	Chamaephytes
20	*Azadirachta indica* A. Juss.	Meliaceae	Tree	Meso Phanarophyte
21	*Bambusa vulgaris* Schrad ex. J.C. Wendl	Poaceae	Grass	Meso Phanarophyte
22	*Boerhavia diffusa* L.	Nyctaginaceae	Herb	Hemicryptophyte
23	*Bridelia micrantha* (Hochst) Bail	Phylanthaceae	Shrub	Meso Phanaerophyte
24	*Cajanus cajan* (L.) Millsp	Fabaceae	Shrub	Micro Phanarophyte
25	*Calopogonium mucunoides* Desp.	Fabaceae	Herb	Hemicryptophyte
26	*Calotropis procera*	Apocynaceae	Shrub	Micro Phanaerophyte
27	*Cassia occidentalis* L	Fabaceae	Shrub	Nano Phanaerophyte
28	*Celosia leptostachya* Benth	Amaranthaceae	Herb	Hemicryptophyte
29	*Commelina erecta* L.	Commelinaceae	Herb	Hemicryptophyte
30	*Chrysopogon aciculatus* (Retz) Trin	Poaceae	Grass	Chamaeophytes
31	*Cleome rotundifolia L*	Cloemaceae	Tree	Therophytes
32	*Citrus arauntifolia* (Christin)	Rataceae	Tree	Micro Phanaerophyte
33	*Cola milleni* K. Schum.	Sterculiaceae	Tree	Meso Phanaerophyte
34	*Commelina erecta* L.	Commelinaceae	Herb	Hemicryptophyte
35	*Crescentia cujete* Linn.	Bignonaceae	Tree	Phanaerophyte
36	*Crinum jagus* (Thomson) Dandy	Amaryllidaceae	Herb	Geophyte
37	*Crotolaria retusa* Nampy & Sibichem	Fabaceae	Herb	Hemicryptophyte
38	*Cynodon dactylon* (L.) pers	Poaceae	Grass	Chamaeophytes
39	*Cyperus alternifolious* Steud.	Cyperaceae	Sedge	Hemicryptophyte
40	*Cyperus sesleroides* Kunth.	Cyperaceae	Sedge	Hemicryptophyte
41	*Dacryodes edulis* (G. Don.) H.J. Lam.	Burseraceae	Tree	Mega Phanarophyte
42	*Dactylectenium aegyptium* L	Poaceae	Grass	Hemicryptophyte
43	*Dioscorea dumentorum pax*	Dioscoraceae	Herb	Geophytes
44	*Daniella oliveri* (Rolfe) Hutch. & Dalziel	Fabaceae	Tree	Phanaerophyte
45	*Datura stramomium* L.	Solanaceae	Herb	Chamaephytes
46	*Desmodium trifolia* (L) DC	Fabaceae	Herb	Hemicryptophyte

47	*Dienbolnia pinnata* schumach &Thonn	Sapindaceae	Shrub	Chamaeophytes
48	*Dioscorea dumentorum* Pax	Dioscoraceae	Herb	Cryptophyte
49	*Eleusine indica* (L.) Gaert.	Poaceae	Grass	Hemicryptophyte
50	*Emilia sonchifolia* (L)	Asteraceae	Herb	Therophyte
51	*Euphorbia gracilis* Elliott	Euphorbaceae	Shrub	Chamaephytes
52	*Euphorbia heterophylla L*	Euphorbaceae	Herb	Therophyte
53	*Euphorbia hirta* Linn.	Euphorbaceae	Herb	Hemicryptophyte
54	*Euphorbia prostrata* Aiton	Euphorbiaceae	Herb	Therophyte
55	*Ficus benjamina* L.	Moraceae	Tree	Meso Phanaerophyte
56	*Ficus capensis* Thunb.	Moraceae	Tree	Meso Phanaerophyte
57	*Ficus exaspirata* Vahl.	Moraceae	Shrub	Meso Phanaerophyte
58	*Flueggea virosa* (Roxb)Bail	Phyllanthaceae	Shrub	Micro Phanaerophyte
59	*Gomphrena celosoides* Mart	Amaranthaceae	Herb	Hemicryptophyte
60	*Gloriosa suberba* L.	Colchicaceae	Climber	Chamaeophytes
61	*Gmelina aborea* Roxb	Verbanaceae	Tree	Meso Phanarophyte
62	*Grewia mollis* Juss	Tiliaceae	Shrub	Phanaerophyte
63	*Hannoa undulata* Planch	Simaroubaceae	Tree	Micro Phanaerophyte
64	*Hymenocardia acida* Tul.	Euphorbiaceae	Shrub	Phanaerophyte
65	*Hyptis suaveolens* (L.) Poit	Lamiaceae	Herb	Hemicryptophyte
66	*Icacina tricantha* Oliv.	Icacinaceae	Shrub	Micro Phanaerophyte
67	*Imperata cylindrica* (L.) Raeusch	Poaceae	Grass	Hemicryptophyte
68	*Ipomoea asarifolia*	Convolvulaceae	Herb	Hemicryptophyte
69	*Irvingia wombolu* Vermoesn	Irvingiaceae	Tree	Mega Phanaerophyte
70	*Jatropha gossipifolia* L.	Euphorbiaceae	Shrub	Micro Phanaerophyte
71	*Khaya senegalensis* (Desr)	Meliaceae	Tree	Meso Phanaerophyte
72	*Kyllinga erecta* Schumach	Cyperaceae	Sedge	Hemicryptophyte
73	*Laeusena lycosephala* (Lam.) De Wit.	Fabaceae	Tree	Meso Phanaerophyte
74	*Landolphia owariensis* P. Beauve.	Apocynaceae	Vine	Chamaephyte
75	*Laportea aestuans* (L)	Urticaceae	Herb	Chamaeophytes
76	*Lophira lanceolata* Teigh. Ex Keay	Ochnaceae	Tree	Phanaerophyte
77	*Luffa cylindrica* M. Roem	Curcurbitaceae	Vine	Hemicryptophyte
78	*Magaraterian discoidea* (Bail.) G.L.	Euphorbiaceae	Tree	Phanaerophyte
79	*Manihot esculenta* Cranz	Euphorbaceae	Shrub	Chamaephyte
80	*Mariscus umbrelatus* (Rottb.) Vahl.	Cyperaceae	Sedge	Hemicryptophyte
81	*Naranthes polyandra* (Benth)	Chrysobalanaceae	Shrub	Micro Phanaerophyte
82	*Mimosa invisa* Mart. ex. Colla	Mimosaceae	Shrub	Chamaephytes
83	*Mitracarpus scarbar* Zucc	Rubiaceae	Herb	Hemicryptophyte
84	*Morinda lucida* Benth.	Rubiaceae	Shrub	Micro Phanaerophyte
85	*Nauclea latifolia* Sm.	Rubiaceae	Shrub	Micro Phanaerophyte
88	*Newboldia laevis* (P.Beauv)	Bignonaceae	Shrub	Micro Phanarophyte
87	*Ocimum gratissimum* Linn.	Lamiaceae	Herb	Micro Phanaerophyte
88	*Palisota hirsuta* (Thumb)	Commelinaceae	Herb	Chamaeophytes
89	*Pannicum maximum* Jacq.	Poaceae	Grass	Chamaephytes
90	*Parinari curetelifolia* Planch. ex. Benth.	Chrysabalanaceae	Tree	Meso Phanaerophyte
91	*Parkia biglobosa* (Jaca.) R.Br ex Don	Fabaceae	Tree	Meso Phanaerophyte
92	*Paspalum scrobiculatum* L.	Poaceae	Grass	Hemicryptophyte
93	*Paullinia pinnata* Linn.	Sapindaceae	Vine	Chamaephyte
94	*Pennisetum polystachion* L.	Poaceae	Grass	Hemicryptophyte
95	*Pennisetum purpurium* Schum.	Poaceae	Grass	Chamaephytes
96	*Perquetina negrescence* (Afzel.) Bullock	Periplocaceae	Vine	Hemicryptophyte
97	*Phyllanthus amarus* Schum. & Thonn.	Phyllanthaceae	Herb	Therophyte
98	*Piptadeniastrum africanum* (Hook. f.) Brenan	Mimosaceae	Tree	Micro Phanaerophyte
99	*Prosopis africana* (Guill. & Perr.) Taub.	Fabaceae	Tree	Micro Phanaerophyte
100	*Rauvolfia vomitoria* Alzel	Apocynaceae	Shrub	Micro Phanaerophyte
101	*Scuparia dulcis* L.	Asteraceae	Herb	Therophyte
102	*Securidaca longipedunculata* Fresen.	Polygalaceae	Tree	Micro Phanaerophyte

103	Securinega virosa (Roxb. Ex Wild) Bail	Phyllanthaceae	Shrub	Phanaerophyte
104	*Sessamum radiatum* Schum. & Thonn.	Pedaliaceae	Herb	Chamaephyte
105	*Sida acuta* Burm. fil.	Malvaceae	Herb	Hemicryptophyte
106	*Sinclasia scabrida*	Menispermaceae	Shrub	Hemicryptophyte
107	*Spigelia althelma* L.	Loganaceae	Herb	Hemicryptophyte
108	*Spondias mobin* L.	Anacardaceae	Tree	Phanaerophyte
109	*Synclisia scabrida* Miers	Menispermaceae	Shrub	Chamaeophytes
110	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	Myrtaceae	Tree	Micro Phanaerophyte
111	*Talinum triangulare* (Jacq.) Wild	Portulacaceae	Herb	Hemicryptophyte
112	*Tectonia grandis* L.f.	Verbanaceae	Tree	Mega phanarophyte
113	*Terminalia catappa* L.	Combretaceae	Tree	Mega phanaerophyte
114	*Triclisia subcordata* Oliv.	Menispermaceae	Shrub	Chamaeophytes
115	*Tridax procubens* L.	Asteraceae	Herb	Hemicryptophyte
116	*Uvaria chamae* P. Beauv.	Annonaceae	Tree	Micro Phanaerophyte
117	*Vitellaria paradoxa* Geartn.f.	Sapotaceae	Tree	Meso Phanaerophyte
118	*Vitex doniana* Sweet	Lamiaceae	Tree	Micro Phanaerophyte
119	*Voacanga africana* Stapf	Apocynaceae	Shrub	Meso Phanaerophyte
120	*Vernonia cinerea* L.	Poaceae	Herb	Therophyte

A total of 120 different plant species and 89 Genera was identified in the study area. These species represent a diverse range of plant life within the study area. The presence of 120 distinct species indicates a rich and varied plant community, which is valuable for ecological diversity and potential research and conservation efforts. The result (see table 1) is in agreement with the study of Tchobsala *et al*., (2010), who recorded an average of 140 species, 60 genera and 34 families in the Ngaoundere peri-urban savanna in cameroon.

Furthermore, this survey revealed that these 114 plant species belong to 51 different plant families. Plant families are groupings of related species based on their botanical characteristics. The discovery of 51 plant families within the study area suggests that the area supports a wide variety of plant lineages and taxonomic groups which agree with the study of Menaut *et al*., (1995) which state that nwoodlands and savanna in Africa were characterized by the increase of the species diversity.

The diversity of plant species and families within the study area has important ecological, environmental, and conservation implications. It can serve as a vital resource for researchers, who aim to better understand the region's biodiversity and ecosystem dynamics. Additionally, this information can guide land management and conservation efforts, as it highlights the significance of the study area in terms of plant diversity and species richness.

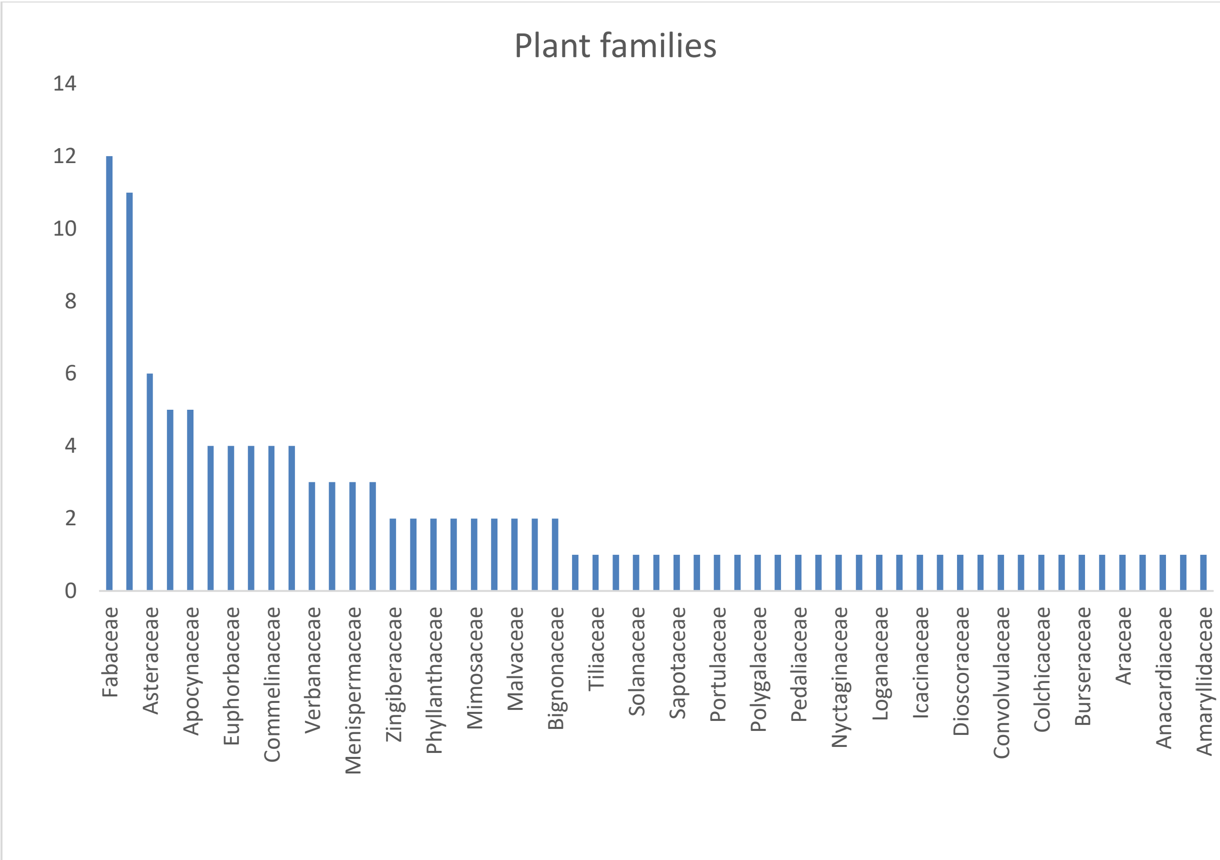

Fig. 2: Plant families in the study area

Diverse range of plant families was observed in the study area, each contributing to the overall botanical richness of the region. Among the identified plant families, Fabaceae stands out with the highest number of species, having a total of 12 different species. This observation is in close agreement with the findings of Asase and Oteng-Yeboah (2007) and Asase *et al*., (2009) which state that Leguminosae and Combretaceae were dominant tree families in Guinea savanna vegetation. Lawson (1986) also these families among those identified as common in the forest vegetation of West Africa. Also, Poaceae is the second most prominent, with 11 species. Other notable families contributing significantly to the plant diversity of the area include Euphorbiaceae with 9 species, Apocynaceae and Asteraceae, both presenting 5 and 6 species respectively.

The diversity in the number of species among these plant families highlights the varied ecological roles and adaptations within the study area. Different families often represent unique ecological niches and adaptations to specific environmental conditions. These findings can be invaluable for researchers, conservationists, and land managers as they provide insights into the distribution and prevalence of different plant families, guiding decisions related to land use, conservation, and ecological studies within the study area.

Table 2: Plant growth form and number of species with relative abundance

Growth form/Habit	No of species	Relative (%)
Herb	40	33.3%
Trees	33	27.5%
Shrub	27	22.5%
Grass	11	9.17%
Sedge	4	3.33%
Vine	4	3.33%
Climber	1	0.83%
Total	120	100%

Plant species in the study area categorized based on their growth forms, revealing the following distribution:

Herbs were the most dominant growth form, with 40 species. This category includes a wide range of non-woody plants, often with a relatively short lifespan, suggesting their adaptation to the environmental conditions of the study area.

Trees were also well represented, with 33 species. Trees are characterized by their woody stems and long life spans, indicating their importance in shaping the local ecosystem. Shrubs, comprising 27 different species, added to the structural and ecological diversity of the area. Shrubs are woody plants with relatively low height. We identified 11 grass species, indicating their significance in the ecosystem. Grasses often play a critical role in open landscapes and various ecological functions.

Sedges were represented by 4 species, which can be associated with wetland and riparian habitats, highlighting the importance of such environments in the study area. Vines, with 4 species, provide climbing or trailing plants, impacting the local vegetation structure and providing habitat and food sources for wildlife.

This distribution of plant species across different growth forms showcases the ecological complexity and diversity of the study area, guiding informed decisions related to conservation, land management, and the study of local ecosystems.

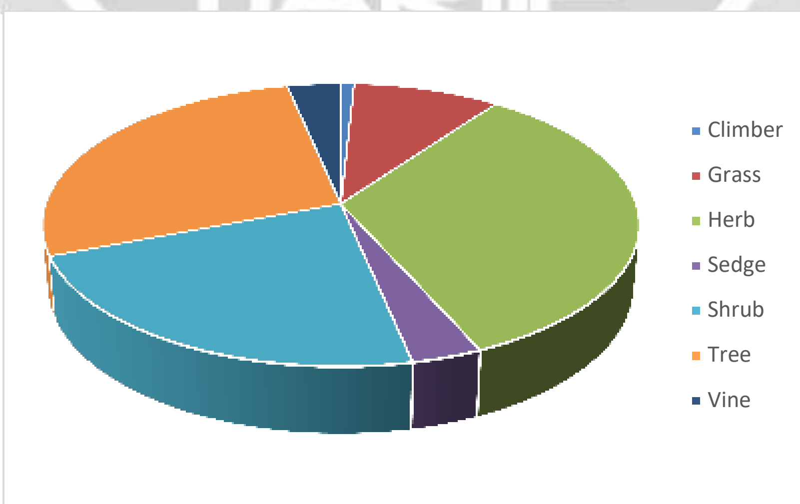

Fig. 3: A pie chat representation showing the various plant Habit

Habit of the observed plant in the study area showed that Herbs was the predominant category with 43 species followed by Trees with 35 species, Shrubs 28, Grasses 12, Sedges 4 and vine 3.

Life form classification

Below is a table (Table 3) that shows the classification of species according to their life form spectra.

Table 3: Total number of species per life form class and life form spectra in percentage for Savanna according to Raunkiear (1934) system of classification.

Plant life form	No of species	Abundance (%)
Mega phanerophytes	5	4.17%
Meso Phanerophytes	20	16.7%
Micro phanerophytes	20	16.7%
Nano Phanerophytes	2	1.67%
Chamaephytes	21	17.5%
Hemicryptophytes	34	28.3%
Geophytes	2	1.67%
Therophytes	7	5.83%
Total	120	100%

The proportions of the flora in the various groups, or what Raunkiaer called the biological spectrum, differ from one climate to another, claims Singh (1976). According to Singh and Joshi (1979), each species within the community exhibits a significant degree of structural and functional individualism as well as a range of ecological amplitudes and modes. Typically, it has been demonstrated that a plant's growth form clearly correlates with important environmental conditions (Bharucha and Ferreira 1941).

In this survey of the study area, we categorized the identified plant species based on their life forms, providing insights into the composition of the local plant community. Mega-phanerophytes were represented by 5 species. These include large woody plants, contributing to the structural diversity of the ecosystem. Meso-phanerophytes comprised 20 species, indicating the prevalence of moderately sized woody plants in the area. Micro-phanerophytes, with 20 species, represented smaller woody plants within the plant community. Nano-phanerophytes were observed with 2 species, suggesting the presence of very small woody plants in the study area. Chamaephytes were represented by 21 species. This life form typically includes low, woody plants that may have their buds close to the ground. Hemicryptophytes included 34 species, signifying plants with overwintering buds close to the ground, contributing significantly to the local flora. Geophytes were observed with 2 species. These plants have below-ground storage organs, contributing to the diversity of the plant community. Therophytes were represented by 7 species. These are typically annual plants that complete their life cycle in a single growing season. This distribution of plant species based on their life forms provides valuable information about the ecological roles and adaptations of different plants within the study area. In this study hemicryptophytes were the dominant species. Similar report shows that hemicryptophytes and therophytes were dominant in Tungnath and Panwalikantha area of Himalayan region (Sundriyal, 1994).

According to Moradi *et al*. (2010), chamaephytes and therophytes are signs of an unsuitable environment. According to (Qadir and Shetvy, 1986), therophytes grow particularly well in areas where the local flora has been disturbed. The competitive ability of Chamacphytes has an impact on other allied species. The majority of hemicryptophytes and microphanerophytes are the next dominating plant types at anthropogenically stressed areas, showing the highest performance of the species that belong to these life forms.

According to Nautiyal *et al*. (2001), chamaephytes can thrive in environments with high levels of disturbance, particularly those where animals are allowed to graze. However, (Ram and Arya, 1991) stated that the dominating life forms in the Rudranath alpine zone were chamaephytes and phanerophytes. According to Sudhakar *et al*. (2011), chamaephytes and hemicryptophytes are the primary life forms for the snowline vegetation in the central Himalaya. Hemicryptophytes are said to be typical in temperate locations while therophytes are typical of desert climates, according to Tripti and Mukharjee (2011) and Sharma and Dhakre (1993).

CONCLUSION

The ecological survey conducted on a savanna outlier in Okuessan, Esan Southeast Local Government in Edo State, Nigeria, has yielded valuable insights into the rich biodiversity and ecological characteristics of this unique ecosystem. This study was a comprehensive examination of the plant species in the region, providing a deeper understanding of the natural environment and its ecological dynamics. One of the primary objectives of this survey was to document the plant species found in the area and categorize them according to their taxonomic names, habit, and life form. The results of the study revealed an astonishing diversity of plant life, with a total of 114 plant species belonging to 51 families and 89 Genera. This finding underscores the ecological significance of the savanna outlier, highlighting its role as a habitat for a wide range of plant species.

Among the plant families identified, Fabaceae emerged as the most prominent, with 15 species, representing 12% of the total species recorded (see Table 1 & fig. 2). Poaceae, followed closely behind with 12 species (9.6%), and Euphorbiaceae with 10 species (8%). Asteraceae and Apocynaceae both contributed 6 species (4.8%) to the plant diversity, while Amaranthaceae, Commelinaceae, Cyperaceae, and Rubiaceae each accounted for 4 species (3.2%).

Based on the plant habit classification, the study revealed that herbs constituted the most significant proportion, accounting for 42 species (34.4%). Trees and shrubs were also well-represented, with 33 tree species and 26 shrubs identified. Grasses and sedges contributed to the diversity with 11 (9.6%) and 4 (3.2%) species, respectively, while 4 (2.4%) vine species added to the ecosystem's complexity. The life forms of the plant species were categorized using the Raunkiaer classification system, which further highlighted the ecological diversity in the area. Meso-Phanerophytes (18.4%), Micro-Phanerophytes (20.8%), and Chamaephytes (17.6%) were among the dominant life forms, showcasing the adaptability of the plant species to the environmental conditions.

In the ecological survey conducted on the savanna outlier in Okuessan, Esan Southeast Local Government in Edo State, Nigeria. It is essential to acknowledge that while the study provided valuable insights into the plant species and life forms of the vegetation, it did not encompass all ecological parameters that influence the dynamics of this ecosystem.

One crucial aspect not considered during the study is the assessment of climatic conditions. Climatic factors, including temperature, rainfall patterns, and seasonal variations, play a significant role in shaping the structure and function of savanna ecosystems. Understanding the influence of climate on plant phenology, water availability, and fire susceptibility is paramount in comprehending the ecological dynamics of the region. Moreover, knowledge of climatic conditions is fundamental for making predictions about the ecosystem's response to climate change and variability.

Another noteworthy ecological parameter not addressed in the survey is the fire regime. Fire is a natural and essential ecological process in many savanna ecosystems. It plays a vital role in maintaining vegetation structure, nutrient cycling, and species composition. The frequency, intensity, and timing of fires can profoundly affect the ecological dynamics of the savanna. An assessment of the historical fire regime and its impact on the plant community would have provided a more holistic understanding of the ecological processes at work in the area. Furthermore, other ecological factors, such as soil nutrient levels, wildlife diversity, and hydrological characteristics, can significantly influence the ecological dynamics of the savanna.

While this study has provided valuable baseline information, it also highlights the need for further investigations that encompass a broader range of ecological parameters. The understanding of savanna ecosystems, like the one in Okuessan, can be enriched by considering a multitude of ecological factors, which in turn can lead to more effective conservation and management strategies for this unique environment. This ecological survey has not only expanded our knowledge of the biodiversity in this savanna outlier but also emphasized the ecological importance of protecting and conserving this unique habitat. The findings are invaluable for future ecological studies, land management, and conservation efforts in the region. It is clear that the savanna in Okuessan is a treasure trove of plant diversity and a crucial component of the larger ecological landscape in Edo State. As we move forward in our understanding of this ecosystem, it is imperative that we continue to explore, preserve, and appreciate the ecological wonders it holds.

REFERENCES

Aigbokhan E.I. (2014) Annotated Checklist of Vascular Plants of Southern Nigeria – a quick reference guide to the Vascular Plants of Southern Nigeria: a systematic approach. University of Benin Press, Benin City. 345p.

Amodu E., T.B. Momoh, S.O. Otoigiakhi, A.l Iyeh, T.A. Owolabi, K.C. Ezenwa, E.O. Olayioye, O.C. Iyoriobhe, O.F. Aferuan (2020). Ethnobotany and Ethnopharmacology of the Igala kingdom in Kogi East, Nigeria. *Taiwania* 65(2): 199 - 208.

Andela, N., Morton, D. C., Giglio, L., Chen, Y., van der Werf, G. R., Kasibhatla, P. S., & Randerson, J. T. (2017). A human-driven decline in global burned area. *Science*, 356(6345), 1356-1362.

Archibald, S., Lehmann, C. E., Gómez-Dans, J. L., & Bradstock, R. A. (2013). Defining pyromes and global syndromes of fire regimes. *Proceedings of the National Academy of Sciences*, 110(16), 6442-6447.

Archibald, S., Roy, D. P., van Wilgen, B. W., & Scholes, R. J. (2009). What limits fire? An examination of drivers of burnt area in Southern Africa. *Global Change Biology*, 15(3), 613-630.

Asase, A., Ekpe, P. K., & Amponsah, J. Y. (2009). Floristic Composition, Abundance, and Distribution Pattern of Woody Plants in a Tropical Savanna in Northern Ghana. *Journal of the botanical research institute of Texas*, 309-316.

Asase, A., & Oteng-Yeboah, A. A. (2007). Assessment of plant biodiversity in Wechiau community Hippopotamus Sanctuary in Ghana. *Journal of the Botanical Research Institute of Texas*, 549-556.

Bharucha, F. R., & Ferreira, D. B. (1941). The biological spectra of the Matheran and Mahabaleshwar flora.

Bucini, G., & Lambin, E. F. (2002). Fire impacts on vegetation in Central Africa: a remote-sensing-based statistical analysis. Applied Geography, **22**(1), 27-48.

Butcher, H. L. (1982). Intelligence reports in Ishan division of Benin province. Nigeria National Archives Ibadan, 240.

Campbell, M. O. N. (2013). Biogeography, environmental history, and sustainability in coastal Ghana. Nova Science Publishers.

Campbell, M. O. N. (1998). Interactions between biogeography and rural livelihoods in the coastal savanna of Ghana (Doctoral dissertation, Imperial College London (University of London).

Gillson, L. (2004). Testing non-equilibrium theories in savannas: 1400 years of vegetation change in Tsavo National Park, Kenya. *Ecological Complexity*, 1(4), 281-298.

Hirota, M., Holmgren, M., Van Nes, E. H., & Scheffer, M. (2011). Global resilience of tropical forest and savanna to critical transitions. Science, **334**(6053), 232-235.

Hoffmann, W. A., Geiger, E. L., Gotsch, S. G., Rossatto, D. R., Silva, L. C., Lau, O. L., ... & Franco, A. C. (2012). Ecological thresholds at the savanna-forest boundary: how plant traits, resources and fire govern the distribution of tropical biomes. *Ecology letters*, **15**(7), 759-768.

Lawson, G.W (1986), Plant Life in West Africa. Ghana Univeristy Press, Accra.

Lehmann, C. E., Archibald, S. A., Hoffmann, W. A., & Bond, W. J. (2011). Deciphering the distribution of the savanna biome. *New Phytologist*, **191**(1), 197-209.

McNeely, J. A. (1994). Lessons from the past: forests and biodiversity. *Biodiversity & Conservation*, 3, 3-20.

Meyer, K. M., Wiegand, K., Ward, D., & Moustakas, A. (2007). The rhythm of savanna patch dynamics. *Journal of Ecology*, **95**(6), 1306-1315.

Nautiyal, M. C., Nautiyal, B. P., & Prakash, V. (2001). Phenology and growth form distribution in an alpine pasture at Tungnath, Garhwal, Himalaya. *Mountain research and Development*, **21**(2), 168-174.

Nicolis, G. (1994) Dynamical systems, biological complexity and global change. In; Biodiversity and Global Change. Editors solbrig OT, Van-Emden HM, Oirdi PGWJ. CAB International Wallingford, 21-31.

Odu, C.T.I. & Vine, H. (1968). Transformations of 15N-tagged ammonium and nitrate in some savanna soil samples. In: International Atomic Energy Agency (ed.) Isotopes and Radiation in Soil Organic Matter Studies, pp. 351-361 Vienna.

Okoduwa, A. I. (2002). Emergence of Esan States. EPHA: Ekpoma Journal of Religious Studies, 4(1), 23-25.

Osagie, J. I. (2004). Economic development in Esan in the colonial period. Unpublished Ph. D. Dissertation, University of Benin, Benin City, Nigeria.

Pickett, S. T., Parker, V. T., & Fiedler, P. L. (1992). The new paradigm in ecology: implications for conservation biology above the species level. In Conservation biology: the theory and practice of nature conservation preservation and management (pp. 65-88). Boston, MA: Springer US.

Qadir, S. A., & Shetvy, O. A. (1986). Life form and leaf size spectra and phytosociology of some Libyan plant-communities. *Pakistan Journal of Botany*, **18**(2), 271-286.

Raunkiaer, C. (1934). The life forms of plants and statistical plant geography; being the collected papers of C. Raunkiær. The life forms of plants and statistical plant geography; being the collected papers of C. Raunkiaer.

Redclift, M. (2002). *Sustainable development: Exploring the contradictions. Routledge*.

Sankaran, M., Ratnam, J., & Hanan, N. (2008). Woody cover in African savannas: the role of resources, fire and herbivory. *Global Ecology and Biogeography*, **17**(2), 236-245.

Singh, R. and Joshi M.C. (1979) "Floristic composition and life forms of sand dune herbaceous vegetation near Pilani, Rajasthan. Indian" *J. Ecol*. 6:9-17

Singh, J.S. (1976), Seasonal variation in composition, plant biomass and net primary productivity of tropical grassland at Kurukshetra, India" *Ecol. Monogr*, 44:351-376Kurukshetra, India" Ecol. Monogr, 44:351-376.

Scholes, R., & Archer, S. (1997). Tree-grass interactions in savannas. *Annual review of Ecology and systematic*, 28, 517-544.

Scholes R.J. Walker B.H. (1993) An African savanna: Synthesis of the Nylsvley study (Cambridge Studies in Applied Ecology and Resource Management). Cambridge University Press, Cambridge.

Sharma, S.C. and Dhakre, J.S., (1993). "Life form classification and biological spectrum of the flora of Shahjaahanpur district, Uttar Pradesh (India)", *Indian J. Forestry*. **16**(4): 366-371.

Solbrig, O. T. (1990). Savanna modelling for global change. Biology International Special Issue 24. International Union of Biological Sciences, Paris.

Solbrig O.T. (1993). Ecological constrains to savanna land use. In; The World's Savannas: Economic Driving Forces, Ecological Constraints and Policy Options for sustainable Land Use. Young MD, Solbrig. The Pantheon Publishing Group, Paris 21-47.

Staver, A.C. Archibald, S., & Levin, S.A. (2011), The global extent and determinants of savanna and forest as alternative biome states. *Science*, 334 (6053): 230-232.

Sudhakar, Reddy C. Hari Krishna P, Meena S.L. Ruchira Bhardwaj, Sharma K.C. (2011), Composition of Life forms and Biological spectrum along elimatic gradient in Rajasthan, India, *International Journal of Environmental Sciences.* **1**(7): 1632-1639.

Tchobsala, Amougou A. Mbolo M. (2010) Impact of wood cuts on the structure and floristic diversity of vegetation in the peri-urban zone of Ngaoundere, Cameroon, J. Ecol Nat Environ 2(11): 235-258

Tripti, A. Mukkharjee, (2011), Biological spectrum of Bankati forest Areas in Burdwan District, West Bengal. Indian J. Sci. Res., 2(4): 57-60