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Tree Species Diversity Status and Contributors to Forest Degradation in Shasha Forest Reserve, Nigeria

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Keywords: cropland; deforestation; forest degradation; forest management; ecological community; tree species diversity indices; shasha forest reserve.

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Tree Species Diversity Status and Contributors to Forest Degradation in Shasha Forest Reserve, Nigeria

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Keywords: cropland; deforestation; forest degradation; forest management; ecological community; tree species diversity indices; shasha forest reserve.

I. Introduction

Deforestation and forest degradation are associated with human activities working against the protection of forests and their management in Nigeria. Knowing the factors leading to deforestation and forest degradation, twin problems influencing sustainable forest management, and on-site biological diversity conservation will assist in implementing policies to control them. These twin human activities are closely related to socio-political, economic, and demographic problems. About 10 million hectares of rainforests are destroyed yearly (FAO, 2015), and based onthe report by Ogunrinola et al. (2020) the species-rich tropical rainforests in Nigeria have been under severe stress to meet needs for forests and non-forest products, leading to painful destruction concerning bizarre and bulk of the wooded area habitat.

A document by FAO (2015) revealed that Nigeria has one of the universe's most significant amounts of primary forest deforestation. It lost 55.7 percent of its primary forests between 2000 and 2005 (Butler, 2005). A scenario that Wilcox (1995) examined to encourage habitat fragmentation generally results in species extinction, adecline in species diversity, and a reduction in primary productivity. Knowing the contributory factors and fundamental impact of deforestation and forest degradation is needed to design trade-off policies for their causes. Forestry Management Evaluation and Coordinating Unit (FORMECU, 1999) noted that about 58 (10.4%) of 560 tree species in Nigeria's forest are endangered. The investigations carried out in Queen's Forest, Oluwa Forest, and Elephant Forest by Onyekwelu et al. (2008) revealed that 16 of 51species, 15 of 45 species, and 8 of 31 species, respectively were endangered. Onyekwelu and Fuwape (2008) believed that not more than 5% of Nigeria's tropical wood is left without severe degradation.

Alarmingly in Nigeria, the primary contributor to deforestation and habitat fragmentation are crop production, fuel, and building supplies. In the northern part of the nation, excessive grazing, and clearance of trees for fuelwood for cooking arealso major issues. In the southwest of the country, logging (commonly in size) continues to cause the growing fragmentation of remnant forestry ecozones. General essential infrastructural development (roads, power lines, mining, built-up areas, and the likes) are primary factors. These factors are aggravated by outdated forest laws and weak law enforcement, a lack of training and capacity in

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the forestry industry, and a general shortage of resources for forest management at all tiers (federal, state, and local government). It is significant to point out that Nigeria is the Federal Republic with a high level of self-reliance at the state tier. While the Federal Ministry of Environment sets national policies, it has little enforcement power.

Enforcement of forest management relies on each nation's 36 states, each of which has its forestry laws guided by those at the federal level. In several states, the management power of the state forestry departments and indigenous organizations is poor, with low funding, low staff morale, inadequate technical training, illiteracy from citizens and decision-makers, shortage of logical forest policies (lacking in most of the nation's development plans), distortion due to oil economy and usually high rates of government corruption.

In Osun State, agricultural expansion and commercial tree felling remarkably rank on the list of deforestation contributors, while urbanization and domestic energy use come next. As with other states, poor conservation and poor implementation of forest laws, policies, and regulations intensify these deforestation contributors. Previous research done by Ogunrinola et al. (2020) highlighted that the major contributors to deforestation and habitat fragmentation in Nigeria were owing to land clearing for arable land, plantation establishment, unrestrained exploitation, population settlements, excessive grazing, charcoal business, poaching, construction, and poor funding of the forestry subsector. To Morales-Barqueroet al. (2015), the intensity of forest degradation is linked to landowners' decisions managing their shifting farming practices.

There is a growing concern in determining ecosystem qualities like forest structure, floristic composition, and species richness in primary forests (Ogunrinola et al., 2020). This arises from the government's concernin reinstating the nation's severely degraded primary forest ecological community. A situation that has guaranteed theadoption and execution of sustainable forest management practices like REDD+ (Reducing Emissions from Deforestation and Forest Degradation) in some parts of the country. Knowing the multitudes of factors fostering deforestation and forest loss in the forestland reserves will assist in applying REDD+ policies that will control this social milieu and encourage forest ecosystem sustainability (Oladipo et al., 2001).

Increasing food production is the number one major contributor to deforestation emissions universally and especially in Nigeria, where the level of deforestation is put at 3.5% per annum as revealed by the Environmental Management Programme Survey (Federal Ministry of Environment, 1999). The evaluation of vegetation and land management variation between 1978/78 and 1993/95 authorized by the Federal Department of Forestry reported that there was substantial expansion in the expanses of agriculture as all kinds of agriculture recognized developed by a total of 84,073km2 within the 18 years (FORMECU,1999).

Likewise, grazing land seems to be increasing irrepressibly. Its area enlarged from 18.3 percent in 1976/78 to 20.06 percent in 1993/95 (FORMECU,1999). A speedily rising population employing a finite resource lacking changes in land use designs or technological developmentsincreases the pressure on land with related destruction hence this study.

The paramount significance of the paper was to add initial information on the subject of study. Therefore, it was bound that this study would add to the available literature on the subject. Results from this study will be useful in the following aspects: (i) identify and analyze tree species diversity and richness under different physiognomy, (ii) identify and analyze tree biodiversity abundance under different physiognomy, and (iii) study seasonal differences in tree biodiversity abundance under each physiognomy.

Similar literature on the above topic have been studied(Adedeji and Adeofun, 2014; Awotoye et al., 2013). The subsequent gaps (which this current work attempts to fulfill) were discovered. There are documented studies on deforestation and forest depletion, most of which occur in Nigeria, but there are just a couple that emphasize on evaluation of deforestation and forest loss in Shasha Forest Reserve (Adedeji and Adeofun, 2014; Awotoye et al., 2013). This manuscript attempts to highlights the status of tree species diversity degradation in Shasha Forest Reserve with a focus on the state of deforestation and habitat fragmentation. Furthermore, the gaps in the attribute of the site of the study need to be checked. A diversity of the literature studied was conducted in the Southwestern region, and none, focused on the deforestation and forest loss quality condition of Shasha Forest Reserve. This study was a comprehensive study on the tree species diversity and richness under the different physiognomy ofthe forest reserve ecosystem.

This work aims at expanding insight into the interaction between deforestation and degradation, in a bid to identify the factors responsible for tree species diversity degradation in the study region.The aim of this research is also to apply geospatial techniques together with field evaluation of tree diversity state to identify the factors and status of tree species diversity degradation in Shasha Forest Reserve, Southwestern Nigeria.

II. Materials and Methods

a) Site Depiction and Experimental Design

This study was conducted in Shasha Forest Reserve in Osun State, Southwestern Nigeria. The study

site situates on latitude and longitude (7º 05′ and 4º 55′ E) at an altitude of 178 m above water level. The forest reserve is located within the rainforest ecozone with a land cover of 337.298 km2 (Field Trip Earth, 2008). It has experienced a quick degradation from poaching and indiscriminate timber harvesting, wildfires, fuelwood gatherers, and transformation to plantations and cropland (Field Trip Earth, 2008). It has a mean annual rainfall of 1421 mm (Adekunle, 2006), most of which falls during the rainy season from April to October. Shasha Forest Reserve was chosen for the studies because its long-term land-use history is known. The extensive forestland is named after the "Shasha River", a large river in the study area. The Shasha River lies within the 337.298 hectares of land, which comprise the forest reserve. It has mixed moist vegetation. This reserve is one of the few forests that comprise some ecologically distinctive flora and fauna in South western, Nigeria and also includes different forest physiognomies of concern such as indigenous natural forest, non native tree plantation, and arable lands, respectively. The sampling was carried out for a period of twenty-four months (January 2020 to December 2021), spanning two wet seasons and two dry seasons. The variation in the explanatory parameters was utilized in evaluating the physiognomies that were most appropriate for species diversity conservation.

b) Sampling Technique for Tree Species Evaluation

A simple random sampling technique was adopted for the reasonably protected and unprotected plot. A sample plot of 100 m × 100 m area was marked.

The 100 m × 100 m area was demarked within the field. The sampling units 25 m × 25 m were located where the vegetation was relatively protected, and the edge effect satisfactorily surmounts. Sixteen fields were chosen in the tracts for the study, eight each at the two end corners of each lot. Tree species within diameter at breast height (dbh) > 10 cm were classified, and assigned to families, and relative diversity (the number of species in a family) was determined. Most plants were classified on the field, but plants that could not be classified were tagged "unidentified", and portions of that woody species (leaves, bark, and fruits) were taken to the Forestry Herbarium, Ibadan (FHI) of Forestry Research Institute of Nigeria for classification and identification. Each tree species was recorded separately in the field forms, and a possible attempt was identified not to neglect any qualified stem in a sample plot. After the floristic survey of the sampled sites, the tree will be classified into species and families, species richness and abundance of each species in the biotic community, and will be established applying the Shannon-Weiner index specified by Ogunrinola et al. (2020). The number of trees found in the sampling plots on a species basis was estimated by multiplying it by the number of parcels ha–1 to see the abundance of the species in one hectare.

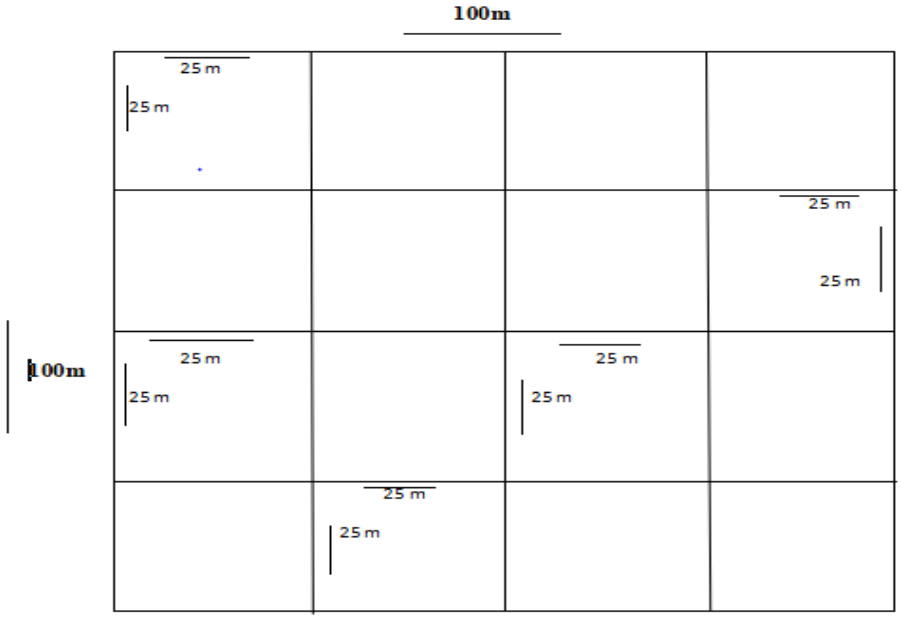

Figure 1: Plot Layout with Simple Random Sampling Technique

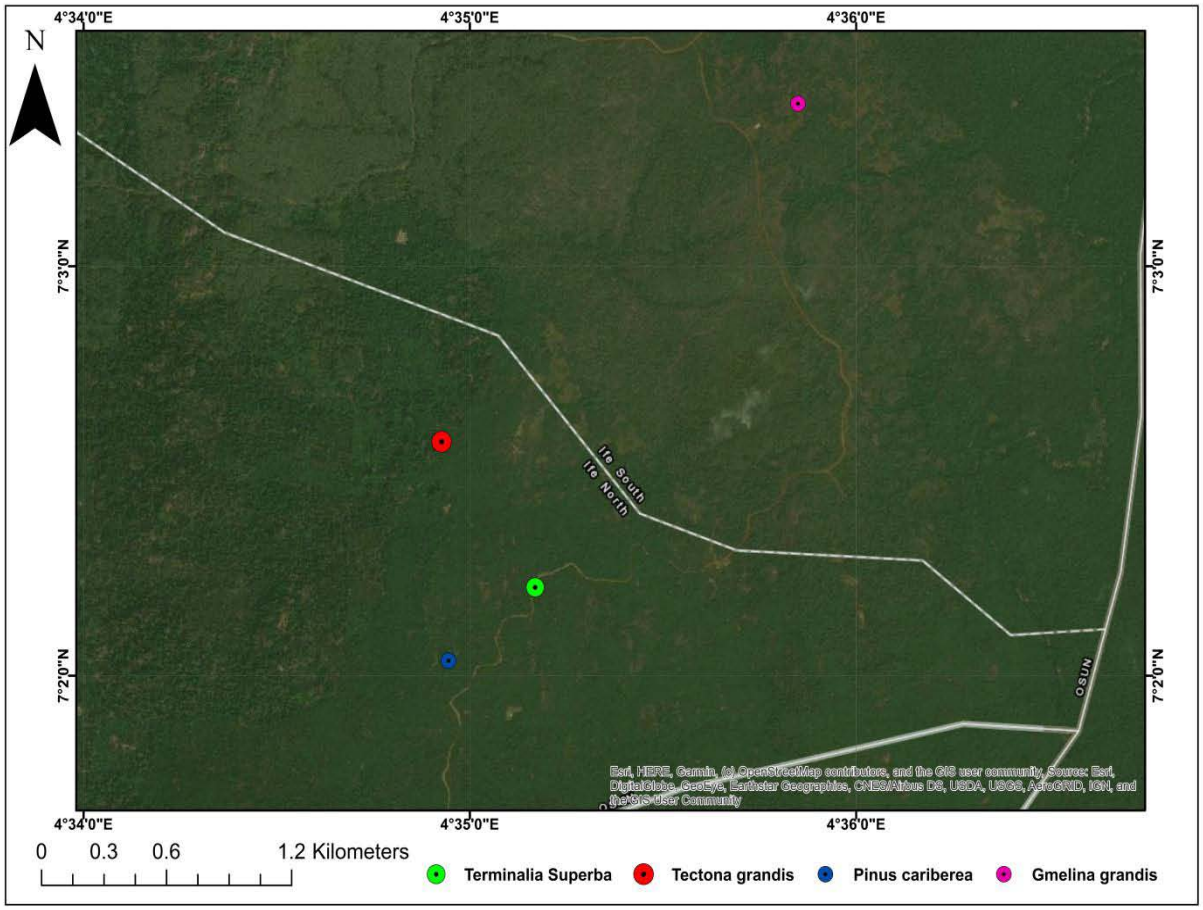

Figure 2: Map of the Study Area

c) *Plant Species Identification, Grouping, and Biodiversity Indices*

Plant species composition, abundance, and the number of families were established for each plot in line with their countenance. A marker was employed to label each enumerated woody plant to prevent double enumeration. The biodiversity indices were found for each sampled point and were used for the comparison of species diversity among the physiognomies.

The subsequent biodiversity indices were found for the location

- Species Relative Density (RD) number of individuals per hectare was found by applyingthe formula in line with Ogunrinola et al. (2020):

$$RD = \left[\frac{n_1}{N}\right] \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots eqn \quad (1)$$

Where RD = relative density, ni = the number of individuals of species i, and N = the total number of individuals in the whole population.

- Species Diversity Index was extrapolated by applying the Shannon-Weiner diversity index (Ogunrinola et al., 2020):

$$\sum_{i=1}^{s} p_i \ln(p_i) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots eqn \quad (2)$$

Where:

H' = Shannon-Weiner diversity index
S = Total number of species in the community
Pi = Rate of S constituted of the ith species
ln = Common logarithm

- Species Evenness in each community was carried out by applying Shannon's equitability (EH):

$$E_H = \frac{H^i}{lnS^i} = \frac{\sum_{i=1}^{s} P_i \ln(P_i)}{\ln(S)} \ldots\ldots\ldots\ldots\ldots eqn \quad (3)$$

III. Data Analyses

The data collected were subjected to appropriate descriptive analysis for tree species diversity and richness and the abundance under the different physiognomy, and subjected to analysis of variance (ANOVA).

IV. Results

The results of the tree relative density showed that 9 (39.91%) of the local tree species observed were the predominant onespresent during the study (Table 1). Six hundred and forty-four (644) individual tree stands, belonging to 60 species and 24 families of the trees were recorded. Rauvolfia vomitoria of the family Apocynaceae (46) mainly predominated tree species, followed by Celtiszenkeriof the family Ulmaceae (32), and the families with the highest number of species were Sterculiaceae (8), Euphorbiaceae (7), and Ebenaceae (6) (Table 1). The tree species diversity indices obtained showed that Shannon-Weiner diversity and species evenness were (3.855and 0.596), respectively. Rauvolfia vomitoria of Apocynaceae family had the highest Shannon–Weiner (0.189, 0.029) and Diospyrosmon buttensis, Diospyros canaluculata of Ebenaceae family, Memecylon afzeliiof Melastomataceae family, and Oxyanthus specious of Rubiaceae had the lowest Shannon–Weiner respectively (0.010, 0.002).

Table 1: Family Distribution of Genera, and Species in Shasha Forest Reserve in both Seasons

Family Name	Species Names	No of Genera	No of Species	Total No of Species
Annonaceae	*Clestopholis patens* (Benth.) Engl. and Diels	1	1	6
	Enantiachlorantha Oliv.	1	1	3
	Xylopiaaethipica(Dunal) A.Rich	1	1	3
Apocynaceae	*Alstonia boonei* DeWild.	1	1	10
	Funtumiaelastica(Preuss) stapf	1	1	19
	Holarrhena floribunda (G.Don) T. Durang&Schinz	1	1	5
	Pricalima nitida (Stapf) T Durand &H.Durand	1	1	30
	Rauvolfia vomitoria Afzel.	1	1	46
Bignoniaceae	*Mikhamia*sp	1	1	7
	Spathodeacampanulata P. Beauv.	1	1	13
Caesalpiniodeae	*Danieliogea*(Harms) Rolfe ex Holland	1	1	10
Capparaceae	*Buchholziacoriacea* Engl.	1	1	18
Combretaceae	*Terminalia ivorensis* Chev.	1	2	21
	Terminalia superb Engl. & Diels (Limba)			
Ebenaceae	*Diospyrosbarterii* Hiern	1	6	78
	Diospyros canaluculata De Wild			
	Diospyrosdendo Welw.exHiern			
	Diospyrosmonbuttensis Gurke			
	*Diospyrossuaveolens*Gurke			
	Diospyroscanaliculata De Wild			
Euphorbiaceae	*Drypeteschevellerii* Beille	1	4	40
	Drypetes floribunda (Muell.Arg) Hutch.			
	*Drypetespaxii*Hutch.			
	Drypetesprincipum (Muell.Arg) Hutch			
	Macaranga barteri Mūll-Arg	1	1	19
	Ricinodendronafricanum(Ball.) Pierre	1	2	5
	Ricinodendronheudelotii(Ball.) Pierre			
Malvaceae	*Nesogordoniapapaverifera*(A.Chev.) R.Capuron	1	1	6
Melastomatacae	*Memecylon afzelii* G.Don	1	1	1
Meliaceae	*Entandrophragmaangolense*(welw.) C. DC	1	1	5
	Guareacedrata(A.Chev.) pellegrin	1	1	5

	Trichlisiamonadelpha A Juss	1	1	19
Moraceae	*Ficus exasperate* Vahl	1	1	12
	Milica excelsa (Welw.) C.Berg	1	1	8
	Morusmesozygia Stapf	1	1	4
	Musangacercropioides R.Br	1	1	26
	Myrianthusarboreus P. Beauv.	1	1	4
Myristicaceae	*Pycnanthusangolensis* (Welw.) Ward	1	1	11
Olacaceae	*Strombosiapustulata* Oliv.	1	1	26
Pandaceae	*Microdesmispuberula* Hook f. ex planch	1	1	13
Passifloraceae	*Barteriafistulosa* Mast	1	1	3
Rubiaceae	*Canthiumhispidium* Benth	1	1	2
	Oxyanthus specious DC	1	1	1
Sapindaceae	*Chytranthusma crobotry* (Benth)	1	1	3
Sapotaceae	*Aningeriarobusta*(A.Chev.) Aubrev. And Pellegr.	1	1	12
	*Malacthaalnifolia (*Baker*)* Pierre	1	1	4
Sterculiaceae	*Cola gigantean* A.Chev.	1	1	20
	Hildegardia barteri Schott &Endl	1	1	2
	Mansonia altisima A Chev.	1	1	21
	*Octolobuangustatus*Hutch.	1	1	8
	Sterculiaoblonga Mast	1	3	36
	*Sterculiarhinopetala*K. Schum.			
	Sterculiatragacantha K. Schum			
	Triplichiton scleroxylon K.Schum	1	1	6
Tiliaceae	*Desplatsiadewevrei* (De. Wild. andTh.Dur.) Burret	1	2	11
	Desplatsialutea Bocq			
Ulmaceae	*Celtismildbraedii* Engl	1	3	39
	Celtistenufolia Nutt.			
	*Celtiszenkeri*Engl			
Violaceae	*Rinoreadentata*(P. Beauv.) Kuntze	1	1	3

Source: Field Survey,(2021)

Table 2: Floristic Composition and Significance of Tree Species Recorded

Family Name	Species Names	Common Name	Uses
Apocynaceae	*Alstonia booneiDe* Wild.	Stool wood, pattern wood	Timber; Root and bark are used in the treatment of diseases.
Sapotaceae	*Aningeriarobusta*(A.Chev.) Aubrev. And Pellegr.	*Aningeria*	Veneer, carpentry, furniture, and interior joinery.
Passifloraceae	*Barteriafistulosa* Mast	Ant tree	Stem bark, roots, and leaves are used in disease treatment.
Capparaceae	*Buchholziacoriacea* Engl.	Wonderful kola	House construction; Fruits and seedsare consumed most time.
Rubiaceae	*Canthiumhispidium* Benth	Buje	
Ulmaceae	*Celtismildbraedii* Engl	Red-fruited stinkwood	Light construction, flooring, interior, furniture, and good for fuel.
Ulmaceae	*Celtistenufolia Nutt.*	Dwarf hackberry	Timber and fiber-rich bark are utilized for the manufacture of ropes and paper.
Ulmaceae	*Celtiszenkeri*Engl	Ivory coast	Light construction, flooring, interior, furniture, particleboard.
Sapindaceae	*Cyrtanthusmacrobotrys* (Benth)	savannah	
Annonaceae	*Cleistopholis patens* (Benth.) Engl. and Diels	Salt and oil tree	Timber and medicinal purpose
Sterculiaceae	*Cola gigantean* A.Chev.	Giant cola	Furniture; Nuts used in the manufacture of cola drinks.

Caesalpinioideae	*Danieliaogea*(Harms) Rolfe ex Holland	West African gum	Plywood, joinery, general millwork, furniture, boxes, and decorative veneer.
Tiliaceae	*Desplatsiadewevrei* (De. Wild. And Th.Dur.) Burret		
Tiliaceae	*Desplatsialutea*Bocq		
Ebenaceae	*Diospyrosbarterii*Hiern		The wood is used locally, and stems are used as chew sticks.
Ebenaceae	*Diospyroscanaluculata* De Wild		
Ebenaceae	*Diospyrosdendo* Welw.exHiern		
Ebenaceae	Diospyrosmon buttensis Gurke		
Ebenaceae	*Diospyrossuaveolens* Gurke		
Ebenaceae	*Diospyroscanaliculata* De Wild		
Euphorbiaceae	*Drypeteschevellerii* Beille		
Euphorbiaceae	*Drypetes floribunda* (Muell.Arg) Hutch.		
Euphorbiaceae	*Drypetespaxii* Hutch.		
Euphorbiaceae	*Drypetesprincipum* (Muell.Arg) Hutch		
Annonaceae	*Enantiachlorantha*Oliv.		
Meliaceae	*Entandrophragmaangolense* (welw.) C. DC	Tiama Mahogany English mountain mahogany	Timber, cabinetwork, exterior and interior joinery, veneer and plywood, shipbuilding.
Moraceae	*Ficus exasperate* Vahl	Forest sandpaper	Used for making canoes, house posts, furniture, stools, utensils, containers, and drums.
Apocynaceae	*Funtumiaelastica*(Preuss) stapf	West Africa rubber tree	Used for carving spoons, bowls, and other household utensils; Timber for beams and rafters in buildings[
Meliaceae	*Guareacedrata*(A.Chev.) pellegrin	Scented guarea	The wood is used for house building, flooring, joinery, interior trim, paneling, window frames, doors, shipbuilding, vehicle bodies, furniture, cabinetwork, decorative boxes, crates, veneer and plywood. It is suitable for musical instruments.
Sterculiaceae	*Hildegardia barteri* Schott &Endl		It is used to make ropes, floats, plates, and dishes.
Apocynaceae	*Holarrhena floribunda* (G.Don) T. Durang & Schinz	False rubber tree	It can be used as a glue; used traditionally for carvings, combs, spoons, stirrers for the rice-pot, and handles for axes and small implements.
Euphorbiaceae	*Macaranga barteri* Mūll-Arg		It is used as vermifuge and febrifuge. (antioxidant) It is also used to relieve cough and bronchitis
Sapotaceae	*Malacthaalnifolia (*Baker) Pierre	Country mallow	
Sterculiaceae	*Mansonia altisima*A Chev.	African black walnut	Used as high-class joinery, cabinetwork, furniture, turnery, decorative veneer and handicrafts. It is also used in the construction of doors and windows, shop fittings, and boxes and crates
Melastomataceae	*Memecylon afzelii* G.Don	Edwinani	
Pandanaceae	*Microdesmispuberula* Hook f. ex planch	Diola	The twigs serve as chew stick; It is used to make chairs, spring traps,

			handles, and implements and made into a type of guitar.
Bignoniaceae	*Mikhamia spp*		
Moraceae	*Milicia excelsa* (Welw.) C.Berg	African teak	It is used for construction work, shipbuilding and marine carpentry, sleepers, framework, trucks, draining boards, outdoor and indoor joinery, stairs, doors, frames, garden furniture, cabinetwork, paneling, flooring and profile boards for decorative and structural uses. It is also used for carving, domestic utensils, musical instruments, and toys.
Moraceae	*Morusmesozygia* Stapf		The wood is suitable for sliced veneer, high-class furniture, flooring, staircases, joinery, and turnery, agricultural implements, toys, novelties, carvings, boxes, crates, vats, posts, poles, piles, mine props and shingles.
Moraceae	*Musangacercropioides* R.Br	Corkwood	Production of stools, musical instruments,walkingsticks, trays, baskets, toy popguns.
Moraceae	*Myrianthusar boreus* P. Beauv.	Giant yellow mulberry, Monkeyfruit	It is used to make domestic utensils and also used for fencing.
Malvaceae	*Nesogordonia papaverifera*(A.Chev.) R.Capuron	Red wood	It is used for general construction, floors, joinery, turnery, boatbuilding, tool handles, gunstocks, plywood, utility crossarms, and furniture.
Sterculiaceae	*Octolobusangustatus* Hutch.		The stems are made into spear shafts
Rubiaceae	*Oxyanthus speciosus* DC	Whipstick loquat	The wood is used for building poles, whipsticks, and tool handle. The wood is used for fuel.
Apocynaceae	*Picralima nitida* (Stapf) T Durand &H.Durand		Small dippers and spoons are made from the shell of the fruit. It is used traditionally to make items such as combs incense holders, spoons, walkingsticks, arrows, weaver's shuttle.
Myristicaceae	*Pycnanthusangolensis*(Welw.) Ward	African nutmeg/ilomba	It is used for veneer peeling, panels, furniture frames, box-making, pencils, and minor joinery.
Apocynaceae	*Rauvolfia vomitoria*Afzel.	Poison devils pepper	Hunting poison
Euphorbiaceae	*Ricinodendronafricanum* (Ball.) Pierre		It is used in making small kitchen utensils, carved material, dye, and tanning.
Euphorbiaceae	*Ricinodendronheudelotii* (Ball.) Pierre	African oil-nut tree	Paper pulp, bowls, used for fishnet floats and rafts for heavy timbers, used for rough planks and coffins.
Violaceae	*Rinoreadentata*(P. Beauv.) Kuntze	Oloborobo	Chewing stick
Bignoniaceae	*Spathodeacampanulata* P. Beauv.	African tulip tree	It is used for making blacksmiths' bellows. The wood is used for the carving and production of plywood.
Sterculiaceae	*Sterculiaoblonga* Mast	Yellow sterculia	It is used for flooring, beams, planks, and furniture.
Sterculiaceae	*Sterculiarhinopetala* K. Schum.	Aye	Timber, construction, flooring, joinery, interior trim, paneling, stairs, high-quality furniture, ship and boat building, turnery, tool handles, toys, poles, veneer and plywood.

Sterculiaceae	*Sterculiatragacantha* K Schum	English African Tragacantha	It is used for posts, boards, and construction work.
Olacaceae	*Strombosiapustulata* Oliv.	Itako	Veneer, building poles and transmission poles, and heavy-duty flooring.
Combretaceae	*Terminalia ivorensis* Chev.	Idigbo/Ivory coast almond	Light construction, door and window frames, joinery, furniture, cabinetwork, veneer and plywood. It is suitable for flooring, interior trim, vehicle bodies, sporting goods, boxes, crates, matches, turnery, hardboard, particleboard, and pulpwood. It is used locally as planks, roof shingles, fencing posts, dug-out canoes, drums, and mortar.
Combretaceae	*Terminalia superba*Engl. & Diels (Limba)	Afara/ black limba	It is used as interior joinery, doorposts and panels, mouldings, furniture, officefittings, crates, matches, and especially for veneer and plywood.
Meliaceae	*Trichliliamonadelpha*A Juss		The wood is used in house building, suitable for light flooring, joinery, interior trim, shipbuilding, vehicle bodies, furniture, cabinetwork, boxes, crates, toys, novelties, veneer, particleboard,plywood, hardboard and as well as pulpwood for paper production.
Sterculiaceae	*Triplichiton scleroxylon* K.Schum	Obeche	Timber and woodwork
Annonaceae	*Xylopiaaethipica*(Dunal) A.Rich	Ethiopian Pepper	It is used for making bows and crossbows for hunters and warriors. It is used also for requiring resilience such as boatconstruction, masts, oars, paddles and spars

Source: Field Survey,(2021)

V. Discussion

A designed evaluation for an exploratory, checklist of biodiversity species, genus, and their families in biological Shasha Forest Reserve, Osun State,was revealed in Table 1. A total of six hundred and forty-four (644) species distributed into forty-five (45) genera were identified in Shasha Forest Reserve. Rauvolfia vomitoria of the family Apocynaceae (46) mainlypredominated tree species, followed by Celtiszenkeriof the family Ulmaceae (32), and the families with the highest number of species were Sterculiaceae (8), Euphorbiaceae (7) and Ebenaceae (6) (Table 1). From the study that was conducted in the sampling site, it was observed that Rauvolfia vomitoria (Apocynaceae) had a moreprevalent dominant species in the whole four sampled plots because the species is more suitable for the geographical area in terms of survival rate and reproduced more frequency by natural means (through the dispersal of seedlings by wind, water, birds and rodents, and biological agents) which causes it to be in more abundances than the other tree species.

The results also revealed that a substantial part of Shasha Forest Reserve had been altered between 1986-2021. Most of the forested areas have been encroached on by farmers for crop production and the like purposes. This result corroborates the study of Nathaniel et al. (2012), which revealed a steady decline in forest and land utilization intensification with expansion in croplands/fallow ground and housing areas in south western Nigeria. The notice able fallin forested ranges and rise in the arable land was not without a heavy toll on the tree species.

The number of tree species (60) found in the study area is lesser relative to the number found by Ihenyen et al. (2010) in Ehor Forest Reserve, Nigeria.

The result was equally lower comparative to the report of several scholars in other tropical forests (Gerald et al., 2004).The decline in forested habitats and tree species compared to earlier studies in the tropical wood could be due to increasing human intrusion into the forest reserve in need for agricultural purposes by farmers who currently settled in villages that have now been opened within the forest and fringes and borders.

The expansion in cropland and reduction in the forest range confirms the claim of Adedeji and Adeofun (2014) that forests were cleared to make way for food and tree crops. The number of tree species per hectare

(60) recorded in this study was observed to be higher than the number of species recorded (55) in the same area by Adekunle (2006) and (Onyekwelu et al., 2005).

Part of the explanation for this may be that moderatelyor slightly unprotected tropical forests are likely to maintain more plant speciesthan a forest that is dense and protected (Mishra et al., 2004). This also shows the degree to which man has encroached on theforest between 2000 and 2021. The more varied a range is, and the, more its unchangeability. The overall Shannon's equitability of 0.596 for this study is smaller than the 0.66 observed by Onyekwelu et al. (2005) for Queen Forest, an unaltered ecological community reserve in Ondo State. This showed lower naturally-occurring of individual tree species within the species reported, indicating that species evenness lesser declined as forest depletion intensified. This agrees with the finding of Nath et al. (2005) for tropical biomes in India that tree species'evenness declined with the rise in intensity of forest stress. The results of the tree relative density showed that 9 (39.91%) of the indigenous tree species observed were the predominant onespresent during the study (Table 1). Shasha Forest Reserve, generally is predominated by tree species in the families Sterculiaceae, Euphorbiaceae, and Ebenaceae.This result is corroborated by Adekunle (2006), who observed Sterculiaceae; Euphorbiaceae, has one of the prevalent families in the primary forest of the research area. Furthermore, Ihenyen et al. (2010) in Ehor Forest Reserve in Edo State also observed that Sterculiaceae, Euphorbiaceae, and Ebenaceae be among the predominant families in those forest reserves.

The types of tree species such as (Pricalina nitida, Celtiszenkeri, Diospyrosspp, Strombosiapustu lata, and Sterculiarhinopetala.) primarily found in this range are immature for commercial timber uses, because most of them are below the merchantable girth of (48 cm) required for harvesting. This signifies that the ecological community has been previously logged, during which matured invaluable economic trees have been selectively exploited. Strombosiapustulata Oliv was one of the predominant tree species found by Adekunle (2006) in the primary forest of the study area 2006.

Nevertheless, some of these tree species Strombosiapustulata Oliv, Diospyros spp, and Funtumiaelastica (Preuss) Stafp, were among the tree species obtained by Onyekwelu et al. (2008) to dominate Oluwa Forest Reserve, the adjacent forest reserve to the study area.

Therefore, considerable numbers of the tree species found are fewer in abundance due toexploitation and degradation of the forest area and rate of conversion to cropland.

This study was designed to assess the woody plant diversity to signify the number and variety of diverse species in the ecosystem within the area under investigation. Good insight on how to give proper accountability of a reserve and to preservediversity is crucial for both current and subsequent generations.

The structural composition of tree species conservation within Shasha Forest Reserve is fast declining owing to the encroachment of arable farmlands into the forested area. The increasing of cultivated farmlands and non-forested, abandoned sites, uncontrolled logging, charcoal business, comercial fire collection, human population settlement, and habitat fragmentation are severe degrading factors within the reserve. In reversing this, urgent measures have to be taken to give a trade-off for land needed for subsistence agriculture and impaired land meant for afforestation in place of primary forest in Shasha Forest Reserve. Management interferences like enrichment planting, regulated selective logging, and protection of biological regeneration can further aid in restoring this ecological community. Finally, planned of regenerating the indigenous tree species in the forest reserve is an imperative means to confront the present rate of depletion in the area. Further study on the factors contributing tothe such menace is recommended to monitor the seasonal variations in contents of biodiversity indices and relate to the past treespecies diversity studies. The work has provided information on the extent of forest degradation in the Shasha Forest Reserve as a way of evaluating the ecological health of the study field as a result of deforestation. The work also added to the benchmark information on plant species diversity indicesstudiesin our environment.

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Statement of Competing Interests

The authors declare that they have no competing interests.

References Références Referencias

1. Adedeji, O. H and Adeofun, C. O. (2014). Spatial Pattern of Land Cover Change Using Remotely Sensed Imagery and GIS: A Case Study of Omo-Shasha-Oluwa Forest Reserve, SW Nigeria (1986-2002). Journal of Geographic Information System. 6: 375-385.
2. Adekunle, V. A. J. (2006). Conservation of tree species diversity in tropical rainforest ecosystem of

southwest Nigeria. Journal of Tropical Forest Science. 18: 91–101.
3. Awotoye O. O., Adebola, S. I. and Mathew, O. J. (2013). The Effects of Land-Use Changes on Soil Properties in a humid Tropical Location; Little-Ose Forest Reserve, South-Western Nigeria. Research Journal of Agricultural and Environmental Management, 2: 176-182.
4. Awotoye, O. O., Adebola, S. I. and Mathew, O. J. (2013). The Effects of Land-Use Changes on Soil Properties in a humid Tropical Location; Little-Ose Forest Reserve, South-Western Nigeria. Research Journal of Agricultural and Environmental Management, 2: 176-182.
5. Butler, R. (2005). A World Imperiled: Forces behind forest loss Retrieved from http://rainforests. Monga bay.com/0801.htm.
6. FAO, (2015). Forest and Forest Soils: an Essential Contribution to Agricultural Production and Global Food Security. FAO International years of soils. http://www.fao.org/soils-2015/news/newsdetail /en/c/285569.
7. Federal Ministry of Environment (FME), (1999). Federal Environmental Protection Agency FEPA) decree no 58 of 1988 and reviewed in 1999; Federal Ministry of Environment (FME) in 1999
8. Field Trip Earth, (2008).Surveying Wildlife in Nigerian Forest.12-19 pp.
9. FORMECU, (1999). Forest Resources study of Nigeria. Overview Revised National Report prepared for Forestry Management Evaluation and Coordinating Unit, Volume 1:108 pp.
10. Gerald, E., David, L. N. H. and John, M. K. (2004). Density and species diversity of trees in four tropical forests of the Albertine rift, western Uganda. Diversity and Distributions. 10: 303–312.
11. Ihenyen, J., Mensah, J. K. and Okoegwale, E. E. (2010). Tree/Shrubs Species diversity of Ehor Forest reserve in Uhunmwode Local Government Area of Edo State, Nigeria, Researcher, 2 (2): 37-49.
12. Mishra, B., Tripathi, O. P., Tripathi, R. S. and Pandey, H. N. (2004). Effects of anthropogenic disturbance on plant diversity and community structure of a sacred grove in Meghalaya, northeast India. Biodiversity Conservation. 13: 421-436.
13. Morales-Barqueroa, L., Borregoc, A., Skutschd, M., Kleinn, C.and Healey, J. R. (2015) Identification and quantification of drivers of forest degradation in tropical dry forests: A case study in Western Mexico, Land Use Policy 49: 296–309.
14. Nath, P. C., Arunchalam, A., Khan, M. L., Arunchalam, K., and Bharbhuiya, A. R. (2005). Vegetation analysis and tree population structure of tropical wet evergreen forests in and around Namdapha National Park, Northeast India. Journal of Biodiversity Conservation. 14: 2109–2136.
15. Nathaniel, O. A., Albert, A. A. and Samson, A.(2012). Geospatial Analysis of Deforestation and Land Use Dynamics in a Region of South western Nigeria. Deforestation around the World, 978-953.
16. Ogunrinola, O. F., Ogunwale, T. O., Oke, S. O, and Ogar, P. A. (2020). Effect of Four Different Physiognomies on Selected Macro arthropod Communities in Akure Forest Reserve, Aponmu, Southwestern Nigeria, Proceedings of 7th NSCB Biodiversity Conference October, pp. 219-228.
17. Oladipo et al., (2001).First National Biodiversity Report on Nigeria, pp 5
18. Onyekwelu, J. C. and Fuwape J. A. (2008). Conservation and Restoration of Degraded Forest Landscapes in Rainforest Zones of Nigeria through Reforestation Projects. Forests and Forest Products Journal. 1: 29-39.
19. Onyekwelu, J. C., Adekunle, V. A. J. and Adeduntan, S. A. (2005). Does the tropical rainforest Ecosystem possess the ability to recover from severe degradation? In: Popoola. L., Mfon, P. and Oni, P.I. (eds) Sustainable Forest Management in Nigeria: Lessons and Prospects. Proceeding of the 30th Annual Conference of the Forestry Association of Nigeria, Kaduna, 7th –11th Nov. 2005. 145–163 pp.
20. Onyekwelu, J. C., Mosandl, R. and Stimm, B. (2008). Tree species diversity and soil status of primary and degraded tropical rainforest eco systems in south-western Nigeria. Journal of Tropical Forest Science. 20:193–204.
21. Wilcox, B. A. (1995). Tropical forest resources and biodiversity: the risks of forest loss and degradation. Unasylva 46: 43 – 49.