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Identification of the non-tree vegetation of opada forest reserve for conservation

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Abstract

Objectives of study: to identify the non-tree vegetation of Opada Forest Reserve (OFR) and provide comprehensive vegetation data for monitoring, conservation and management of present biodiversity. OFR is about 215.76km^2 in size. Its map was gridded at an interval of one degree and each grid was 3.61 km^2. Using a table of random numbers, ten of the grids were randomly selected. Within each grid, straight line transects of 2km long were randomly laid using Global Positioning System, to locate transects in the right grids and prismatic compass to maintain straight transects, 25m × 25m quadrates were taken at regular intervals of 500m. Each transect accommodated four quadrats which were 40 altogether. 1m^2 sub-plots were located at the four corners of the quadrates for identification and counting of species. There were 160 sub-plots for this assessment. About 48- grass species, 12- climbers, 37- herbs, 4- shrubs and 5- sedges were identified.

Key Words: ***Kogi State, Opada Forest Reserve, non-tree vegetation, shrub, grass, herb,***

Introduction

Biodiversity refers to the total variety of living organisms (plants, animals, macro and micro organisms) that exist on planet earth. The biodiversity of a place is the totality of the genes, species and ecosystems that exist in that place (Ayodele and Lameed 1999). The manifestation of biodiversity is the biological resources (genes, species, organisms, ecosystems) and ecological processes of which they are part. Biodiversity is therefore considered at 3 major levels: Genetic diversity: This is the variety of genetic information contained in all of the individual plants, animals and micro-organisms occurring within populations of species. Simply it is the variation of genes within species and populations. •Species diversity: This is the variety of species or the living organisms. Species Richness: This refers to the total count/number of species in a defined area. Various indices are used including the Mangalet index and Menhink index. Species Abundance- This refers to the relative numbers among species. If all the species have the same equal abundance, this means that the variation is high hence high diversity, however if the one species is represented by 96 individuals, whilst the rest are represented by 1 species each, this is low diversity. Taxonomic or phylogenetic diversity- This considers the genetic relationships between the different groups of species. The measures are based on analysis, resulting into a hierarchical classification representing the phylogenetic evolution of the taxa concerned. Ecosystem diversity: This relates to the variety of habitats, biotic communities and ecological processes in the biosphere. (Thecla 2009), Non-tree vegetation refers to all vegetation excluding trees. Especially shrubs, grasses, climbers, herbs, and sedge vegetation. Flora or plant diversity refers to the variety of plants that exist in the world. Different types of plants compete with plants and other organisms to survive in an ecosystem. Over time, they develop various characteristics to help them survive, which leads to plant diversity. The diversity of plant life exists for many reasons - a key factor being adaptive changes which allow different species to thrive in the many varied environments of the world. Plants have developed adaptations for different soil types, methods of pollination, daylight hours, temperature, altitude, competition with other plants. The list is endless; even two plants of the same species, separated by geography will have different genetic make-up. Diversity within any population is vital

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for that population's survival. The single most important fact about biological diversity is that it is not evenly distributed over the planet. This comes about quite simply because more species live in some places than others. This means that adverse changes in the environment will have a greater effect on biodiversity in some areas than in others. For example, the South American rainforests are particularly rich in terms of their biodiversity and their destruction is well publicized (Botanic Gardens Conservation International 2018).

The role that science can play in combating "Climate Change and its Impact" is to evolve ways for the conservation and management of the present biodiversity, especially biodiversity in the wild and make provisions or simulate ideas for meeting the needs of man for food, herbs and wood from outside the nature reserves such as forest, game reserves and national parks. As agreed to by Gerber (2010) in his article "conservation biology" and Okonkwo (2015), Discoveries of plants with good life supporting potentials, as well as advancements in health care deliveries depend on the availability of the right biodiversity resources in adequate amounts; conservation ensures sustainability of the wild species of these resources in continuity.

Objectives of the study

1. To identify the non-tree vegetation of Opada Forest Reserve (OFR) and
2. To provide comprehensive vegetation data (information) for effective conservation, monitoring and management of the flora of OFR.

Material and Methods

Description of the study area

Opada Forest Reserve is located in the eastern part of Kogi State, Nigeria. It has a total land area of 215.96km^2 (83.08sq miles). It lies between latitude 07^0 $48^/$ $00.00^{//}$ N to Latitude 07^0 $57^/$ $00.00^{//}$ N and Longitude 007^0 $19^/$ $00.00^{//}$ E to Longitude 07^0 $31^/$ $00.00^{//}$ E. the forest is watered by the following six rivers; Egashi, Iyale, Oju ajoma-egbi, Emae, Inergia and Oje-ajokpa rivers. The forest reserve was set aside in accordance with section 36 of the forestry ordinance of Nigeria, it was surveyed in Feb, 1933, mapped in March, 1933 and approved 29th January, 1934.

Data collection

Coordinates were taken round the boundaries of the reserve to assess the integrity of the size of the place with the aid of Global Positioning Systems (GPS). Data generated from GPS assessment were sent to a GIS station for the production of a map. The resulting map was gridded to obtain 41 plots, 25% (10 plots) were selected using a table of random numbers **(**Steel *et al.* 1997). Within each study plot, a straight line transect of 2km long was randomly laid. The transect lines were established with the help of a GPS, in order to locate transects in the right sampling plots and a prismatic compass was used to maintain straight line transects. In the process of establishing the transect lines, tree trunks, low hanging branches and shrubs were tagged at 25m interval along the transect lines, in areas where there were no vegetation to tag, stem cuttings were firmly dug into the soil at the point to be tagged, however some spots were too rocky to be dug, big rock pieces were piled and the peak of the pack tagged. Each tag was given a numerical number. This was necessary for easy identification of sampling routes. Tall grasses, shrubs and herbs along transect lines were simply reduced to ease movement in very bushy areas.

25m × 25m quadrates, were established at regular intervals of 500m along the transect lines and alternately located on either side of the transect lines. Each transect accommodated four quadrants, there were 40 quadrates altogether. 1m^2 sub-plots were located at the four corners of each quadrant for the thorough identification and counting of grass species, there were 160 such sub-plots for grass assessment. Within each sub-plot, each non-tree plant was thoroughly counted; samples of each plant species were uprooted and carefully preserved in poly-bags and brought to the office for identification. The figures obtained from this exercise within the sub-plots can be used by management to extrapolate the population of each identified species per hectare.

Results and Discussion

The results from the study are presented on tables 1 and 2. Table 1 revealed that 48- grass species were identified in the course of the studies from the 10 transects used for the study.

Table 1: Grasses of Opada forest reserve study sites

SN	SCIENTIFIC NAME	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	Total
1.	*Andropogon tectorum*	128	8o		50	130	7	360	230	164	772	1921
2.	*Andropogon gayanus*							10				10
3.	*Afranum angustifolium*					79	35	16				130
4.	*Aneilema aequinoctiale*		10									10
5.	*Asystasia gangetica*			10	70			50			100	230
6.	*Borreria verticillata*										15	15
7.	*Byrsocarpus coccineus*				100		20			20		140
8.	*Cana Indica*		76	22								98
9.	*Cassia obtusifolia*		3									3
10.	*Cissampelos mucronata*					40	20					60
11.	*Cymperus dilataus.*		41				12	25	80			158
12.	*Commelina benghalensis*		104	65	70							239
13.	*Colocasia esculentum*		20									20
14.	*Costus afer*				50	263	7	27	85	212		644
15.	*Crinum zeylanicus*					374	206	170				750
16.	*Culcasia scandens*				7							7
17.	*Cyperus esculentus*		20			60						80
18.	*Cynodon dactylon*			180								180
19.	*Desmodium gengeticum*	6			62	54	32					154
20.	*Desmodium solicifolium*		20			10	7					37
21.	*Dissotis irvingiana*			35	12				30			77
22.	*Fimbristylis dichotoma*			177								177
23.	*Gunterbergi nigritana*				15							15
24.	*Imparata cylindrical*	14	10	12	20		12					68
25.	*Impomoea involucrate*			15	40							55
26.	*Jussiaea decurrens*	10										10
27.	*Mariscus alternifolius*					216	32	84	36	10		378
28.	*Melanthera scandens*			5								5
29.	*Mimosa Invisa*		35									35
30.	*Monilia whitei*	30										30
31.	*Oldenlandia alfinis*				80		10					90
32.	*Oplismenus hirtellus*				80							80
33.	*Panicum brevifolium*					140	550					590
34.	*Panicum maximum*			40	29	140	10					219
35.	*Pennisetum bizantha*							20				20
36.	*Pennisetum polystachyon*				80	100	13					193
37.	*Phyllanthum amarus,*										15	15
38.	*Piliostigma thonningii*	40										40
39.	*Rottboellia cochinchinensis*	84	54			5	45	8	150		170	516
40.	*Scleria boivinii*	40									30	70
41.	*Scleria naumanniana*			60		110						170
42.	*Stylosanthes erecta*		30									30
43.	*Spigelia anthelinia*				10	30						40
44.	*Sesanum indicum*					50						50
45.	*Seteria anceps*										95	95
46.	*Schizachyrium sanguineum*					100					105	205
47.	*Tephrosia bracteolate*		40		200							240
48.	Vigna pubigura			40	10	35						85

Table 2: Climber, herb, shrub, and sedge vegetation of Opada forest reserve study sites

SN	Name of plant	Total	Typess	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
1.	*Aframum Angustifoliu*	127	Herb				16	95	16				
2.	*Asystasia gagetica*	230	Herb			10	70			50			100
3.	*Aneilema Aeqinoctiale*	10	Herb	10									
4.	*Cana indica*	85	Herb	63	22								
5.	*Colocasia Esculentum*	20	Climber	20									
6.	*Commelina Benghalensis*	259	Herb	104	65	90							
7.	*Commelina Diffusa*	451	Herb	158	23		45	106	23	8	30		58
8.	*Crinum Zeylanicus*	754	Herb				378	206	170				
9.	*Cissampelos Mucronata*	60	Climber				40	20					
10.	*Cissus populnea*	669	Climber		15	70	265	7	17	85	212		
11.	*Cymperus Dilatatus*	158	Sedge	41				12	25	80			
12.	*Cymperus Esculentus*	80	Sedge		20		60						
13.	*Culcasia scandens*	7	Herb			7							
14.	*Desmodium Gangeticum*	202	Herb	6		112	54	30					
15.	*Desmodium Salicifolium*	17	Herb				10	7					
16.	*Dioscorea Bulbifera*	982	Herb		50		250		116	107	300		159
17.	*Dissotis Irvingiana*	77	Herb	35	12				30				
18.	*Fimbristylis Dichotoma*	117	Herb		117								
19.	*Guntenbergia Nigritana*	15	Herb			15							
20.	*Impomoea Involucrate*	55	Climber				15	40					
21.	*Jussiaea decurrens*	10	Herb	10									
22.	*Mariscus alternitolius*	384	Sedge				6	216	32	84	36	10	
23.	*Melanthera Scandens*	5	Herb			5							
24.	*Mimosa invisa*	35	Shrub		35								
25.	*Oldenlandia Affinis*	90	Herb				80		10				
26.	*Phyllanthus Amarus*	15	Herb										15
27.	*Scleria boivinii*	180	Sedge	40		110							30
28.	*Scleria Naumanniana*	110	Sedge	60		50							
29.	*Sesamum indicum*	95	Herb										95
30.	*Stylosanthes*	39	Herb		30								

31.	*Spigelia anthelmia*	40	Herb				10	30					
32.	*Tephrosia Bracteolate*	240	Shrub		40		200						
33.	*Vigna gracils*	75	Herb		15	30		30					
34	*Asparagus africanus Ixnn & A. Pauli*	109	Climber				1	35	63		10		
35	*Byrso carpus Coccineus (schum & Thinn)*	160	Herb				100		30			30	
36	*Choclospernum Tictorium*	4	Herb		3		1						
37	*Combretum molle (R.Br.Ex G.Don)*	17	Climber	5	10								2
38	*Desmodium solicifolium (Poir)DC*	27	Herb				10	7			10		
39	*Desmodium velutinum DC*	135	Herb				35		40			60	
40	*Eriosema elomeratum Hook.F.*	5	Herb	5									
41	*Gongronema Latifolium*	8	Climber	5		3							
42	*Gardenia terifolia schum & Thinn*	15	Shrub	1				1	11	1	1		
43	*Icacina terifolia olie*	110	Herb			110							
44	*Lantana spp*	66	Herb		15			21			30		
45	*Mucuna pruriens DC*	10	Climber	10									
46	*Nelsonia campestris R.Br.*	100	Herb										100
47	*Olax viridis*	102	Herb									101	1
48	*Pipper guineensis*	2	Herb	1		1							
49	*Palisota hirsute K.Schum*	65	Herb	20			35			10			
50	*Paulinia pinattu. Linn*	95	Climber									40	55
51	*Sarcoce phallus latifolius (S.M) Bruce*	13	Shrub				2		1			10	
52	*Siphonochilius aethiopicus*	89	Herb	20		5					64		
53	*Sidalinifolia juss ex cav.*	59	Herb	20			12		27				
54	*Tregia spp pax*	44	Herb	17		3		22					
55	*Urena lobata Linn*	180	Herb		40					100		40	
56	*Uvaria chamae*	7	Climber							7			

57	Vigna gracilis	198		15	30		30					24	99
58	*Wissudula spp.Linn*	30	Herb						20	10			
SN	Name of plant	Total	Typess	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
34.	*Aframum Angustifoliu*	127	Herb				16	95	16				

Source: Field survey. Where: T_{1-} T_{10} refers to transects 1- 10.

In the course of this study, 12- climbers, 37- herbs, 4- shrubs and 5- sedges were identified as presented on table 2.

The above vegetation lists were compiled with the aid of important plant identification aids "Some changes and corrections…" (Lowe and Sholade 1990). The useful plants of West tropical Africa (Daziel 1953), Flora of West African trees volume 1 part one and two and volume 2 (Hutchinson and Daziel 1954). A hand book of West African weeds (Okeziel *et al.* 1998). The flora of Nigeria: grasses (Lowe 1989), Traditional medicine and Pharmacopoeia (Mashana *et al.* 2000). There is more to non-tree forest vegetation than meets the eyes, important products derived from non-tree forest vegetation abound and include: Food products, edible fruits, Vegetables, Spices, condiments and herbs. Industrial plant oils and waxes, plant gums, natural plant pigments, seeds, fibers and rattern, vegetable tanning materials, essential oils, insecticides/herbicides and medicinal plants**.** In a study by Lorena (2009) to access the role of plant interactions in the restoration of degraded ecosystem a meta analysis across life-forma and ecosystems. The life-form of the interacting species, particularly of neighbours, largely influenced the interaction outcome. Herbs had strong negative effects, especially on other herb species, whereas shrubs had large facilitative effects, especially on trees. Semiarid and tropical systems showed in general more positive neighbour effects than wetlands and particularly mesic temperate systems, where negative interactions predominated. However, these results were largely influenced by the over-representation of herb species in wetlands and temperate habitats, survival facilitation being found in all systems when only woody species were considered. Pre-existing vegetation can have large impacts on species establishment in degraded habitats. He also observed that inhibition predominates in herbaceous communities typical of early-successional stages, whereas facilitation prevails in communities dominated by shrubs and trees, whereas restoring herbaceous communities seems largely reliable on removal techniques, augmenting populations of nurse shrubs and trees should be considered a promising strategy for restoring woody late-succession communities.

The grass species are working hard to keep us cool, soak up carbon, capture particulates in the air, produce oxygen, capture rain water and reduce run-off (Lorena, 2009) which results in land degradation like erosion. However, keeping lawns green in Southern California is said to increase greenhouse gas emissions, rather than absorbing them, the problem is all the emissions needed to keep the lawns healthy: mowing, leaf-blowing, production of fertilizer all these add up to four times the amount of greenhouse gas that the grass can store in its soil as carbon. Spreading fertilizer causes soil beneath the grass to release nitrous oxide, and while its warming effects are dwarfed by those of carbon dioxide, it is, 300 times more potent as a greenhouse gas **(**Brennan, 2010; Ensarbete, 2015). "An athletic field gets tilled every year, over a 35-year timescale; there's no net storage of carbon." (Townsend 2010). While these findings hold true for Southern California, they might not for parts of the world with enough rainfall to keep lawns green without watering — "in a place where lawns grow naturally, where you don't have to irrigate or fertilize them, and you don't have to mow them all the time." Furthermore, cattle emit huge amounts of methane, especially if corn-fed. Grass that may help tackle global warming by cutting the level of methane given off by cows is being developed reports the latest issue of the Society of Chemical Industry (2008) Timothy, (2009). Methane is denser than and 23 times more effective as a global warming agent than carbon dioxide" (Townsend 2010). Grasses can sequester huge amounts of carbon annually, especially when grazing practices include high density, short-term exposure efforts with the cattle eating the grasses down and moving on to let the grasses grow back. This sustainable grazing technique causes some root shedding below the soil line, leaving lots of organic matter, and thus, carbon. On just one acre of biologically healthy grassland soil, there can be between 0.5 - 1.5 tons of carbon deposited in the soil annually. This is equivalent to taking up to 5.5 tons of CO_2 out of the atmosphere and sinking it into an acre of soil. While this impressive level of carbon sequestration is impossible in the high desert with little rainfall, it is absolutely viable where there is rain or available water to grow pasture. With proper management, ruminants can once again contribute to the life and water cycle supporting ecology of our biological system. This amazing ecological interaction on 11 billion global acres of grazed land would equate to sequestering 60% of human-caused CO_2

Conclusion

The non-tree forest products are of extreme importance in today's world economy considering the long list of products and benefits derivable from them. Except their use is properly studied and known abuse, indiscriminate utilization of the wild species and possible extinction is inevitable.

Recommendation

Information on the possible contribution in combating "Climate Change and its Impact on Africa" by this group of plant species that are so abundant in the environment is scanty and so needs scientific attention and results made public. Even if the use of some of them is not currently known their conservation should of a necessity be promoted pending when knowledge gets to that junction. Opada Forest Reserve till date is a natural forest, even with serious illegal exploitations there has never been any form of enrichment planting or restocking with plants or animals but for external boundary maintenance. Pressure from conservationist and international public opinion is strongly requested to prevail on the government of Nigeria to upgrade Opada forest reserve to a game reserve or better still to a national park so as to ensure sustainability of the reserve for posterity in perpetuity.

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