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Full Length Research Article

WOODY PLANTS DIVERSITY IN THE SECONDARY VEGETATION OF THE NIGERIAN DEFENCE ACADEMY, AFAKA KADUNA

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ABSTRACT
An inventory of the secondary vegetation in the Nigerian Defence Academy(NDA) Afaka was conducted. The aim was to enumerate woody plants species, identify the poisonous plants and medicinal plants with trypanosomal activity therein and the plant species diversity. Fifteen Study Plots each measuring ,25m by 25m were demarcated in the study area and all plants not below 1.0 meter in height were enumerated and identified to species level. Plants were identified using the Flora of West Africa and Nigerian Trees. The plant vital statistics were collected from the enumerated plants. A total of 2867 plants spread in 17 families and 33 species in the 15 plots were identified. some of the identified families include: Fabaceae, Euphorbiaceae amongst others. Some identified species include: Annona *senegalensis, Lophira lanceolate Van Tiegh ex Keay, Syzygium guineense*. The species diversity index ranges from 2.372 to 1. 633. The inventory confirmed the presence of poisonous plants, medicinal plants and rare plants species in the study area and it is recommended that urgent conservation method for the rare plant should be considered, medicinal plant with antitrypanosomal activity be explored while the poisonous plants should be tagged for easy identification by users of the ecosystem.

Keywords: Vegetation inventory, secondary vegetation, poisonous plants, medicinal plants, antitrypanosomal potential.

1. INTRODUCTION

Vegetation is the aggregate of all the plants growing in an area (soils or waters) (Box and Kazue;2013). Tree inventory is obtained either by means of measurements of individual trees or stand taken from the ground or on remote sensing imagery (aerial photographs, satellite imagery and others) (Asrat and Tesfaye,2013). The fundamental prerequisite of any Vegetation inventory is a good identification of tree species (Morales and Marco,2023). The applications of vegetation inventory include but not limited to protecting the population of trees, development of good management plan and decision, providing guidelines for protecting of trees during construction, assessing and analyzing damage to trees by drought and calculating emission of volatile organic compound(VOC) gases from different species amongst others(Ostberg,2013).

Poisonous plant is a whole plant or part of it which a small quantity of it when consumed or in contact, absorbed or inhaled by an animal or man over a short or a prolonged period exerts a serious or harmful effects on the system or cause death by reason of cumulative action of the toxic property (Steyn,1934 and Long,1917)) on the other hand, Medicinal plant is any plant in which one or more of its organs are the richest bio-resource of drugs for traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs(Swami *et al.*, 2008).However, a very small difference exists between the terms 'medicinal' and 'poisonous' (Kerala,2012) and the difference is the dose (Carol and Deborah,2010).

Kaduna state and in particular the Nigerian Defence Academy (NDA) Afaka falls within the Guinea Savannah ecological zone. Anthropogenic activities like fuel wood collection and burning, agriculture, grazing, road construction and infrastructural development had resulted in deforestation and Vegetation degradation (Akther *et al*,2022) of the NDA secondary vegetation. Vegetation inventory has been done worldwide but none has been done specifically on poisonous plants in the Nigerian Defence Academy Afaka secondary vegetation.
The aim of this research work was to carry out inventory of woody based plants in the NDA secondary vegetation, identify poisonous and medicinal plants with antitrypanosomal potential therein and the plant species diversity.

2.0 METHODOLOGY

2.1 The Study Area

The Nigerian Defence Academy(NDA) Afaka lies between latitude 10° 36'0" N and longitude 7° 23'0" E. The coordinates of each study plot was taken and recorded accordingly (Table 1).

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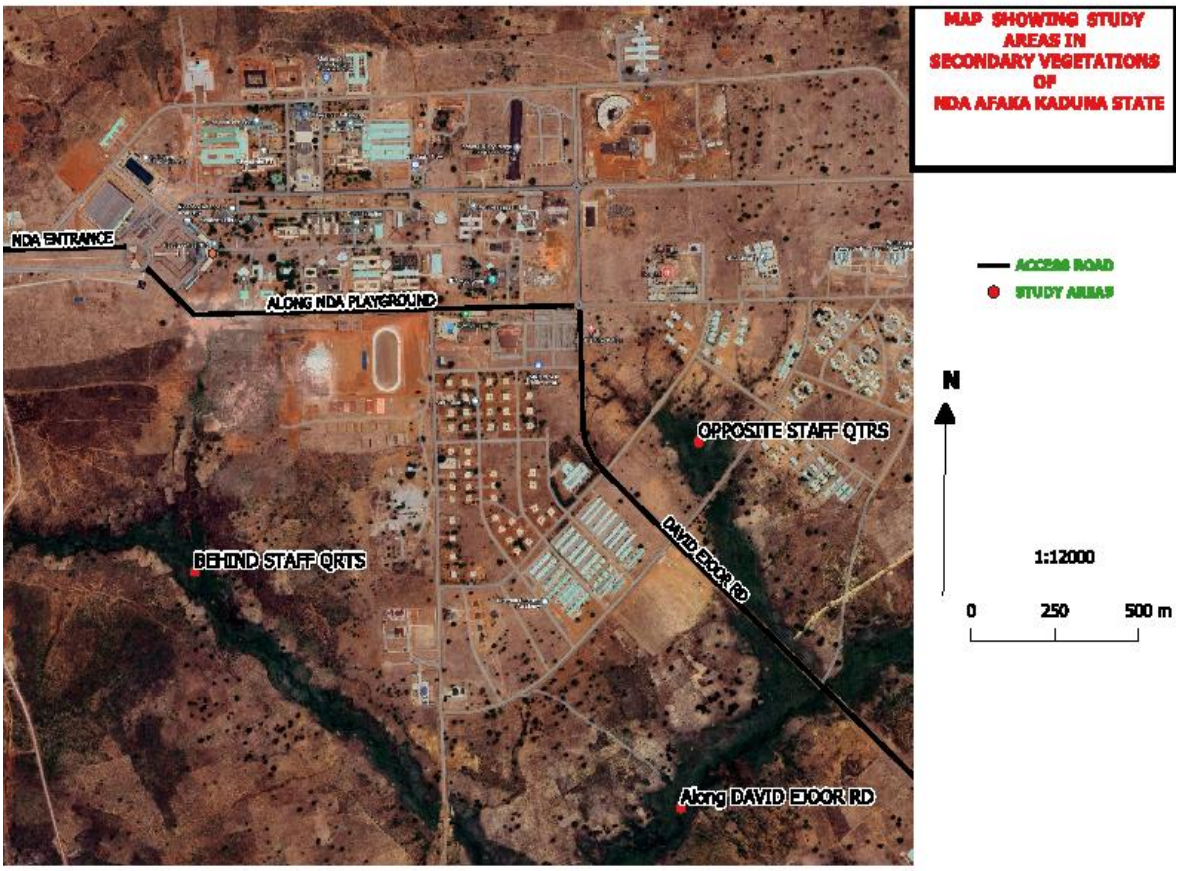

Figure 1: Map of the Study Area showing Study Sites

The red dots in the map showed the study areas and in all the 15 plots studied. The black line showed the access road to the study areas.

2.2 Laying of Plots
Sampling Plots,25m by 25m each was laid along transect at 200m interval. Each plot was demarcated using measuring tapes and cutting thin lines after allowing 10 meters from the road to avoid edge effects.

2.3 Plant Identification
Plant identification was done in the field according to Hutchinson and Dalziel (1952) using the Flora of West Africa and Trees in Nigeria by Keay (1989).

2.4 Attributes Derived from the Enumeration
Species composition; species diversity; tree stem density in each plots; percentage (%) contribution of the poisonous plants species to the overall stem density and the percentage (%) contribution of the anti trypanosomal potential medicinal plants species to the overall stem density.

2.5 Species Diversity
The species diversity per plot was calculated using the Shannon Weinners index. The Shannon index is an information statistics index which means it assumes all species are represented in a sample and are randomly sampled. The index is given by , $H_S = \sum_{l=1}^{S} P^i l^{n_{pi}}$, Where p^i is the proportion of individuals of one particular specie (ithspecies), n denotes the total number of individuals found, ln denotes natural logarithm, ∑ is the sum of the calculations and s is the number of species.

2.6 Stem Density
Stem density is the number of stems per hectare (ha) = Number of stems in each plot (25 m × 25 m plot) × 10,000/25 ×25) where, 10,000/25 × 25) is the conversion factor.

2.8 Identification of Poisonous Plants
Poisonous Plants identification in the study area was done in the field according to Agroforestry data base 4.0 (Orwa *et al*.,2009).

3.0 RESULTS
The coordinates of the 15 study plots were taken using phone GPS and were recorded accordingly as per the table 1. A total of 33 plant species spread across 17 families were identified with 1 unidentified species during this study (Table 2). The result showed that the species *Dichrostachys cinera* has the highest stem density of 435 followed by *Isoberlinia doka* which has 365 and *Monotes kerstingii* with 358. While, *Diospyrus mespiliformis* and *Borassus*

aethiopium each has 1 stand respectively. For this number of species analysis of the result shows that the family Leguminaseae/Fabaceae has the highest density of 1,227 followed by Mimosaceae 435 and Dipterocarpaceae 358. The families Palmae and Ebeneceae each has the least density of 1 respectively.

The result from (figure 2) shows that 17 families that comprised of 33 species were also identified in the study area with the family *Fabaceae*(Leguminoceae) (33.33%) having 11 species thus has the highest percentage, followed by *Euphorbiaceae*: (9.09%) 3 species, *Meliaceae*: (9.09%) 3 Species, *Combretaceae* : (6.06%) 2 Species, *Rubiaceae*: (6.06%) 2 species and *Annonaceae, Bombaceae, Palmae, Mimosaceae, Ebeneceae, Moraceae, Anacadiaceae, Ochnaceae, Dipterocarpaceae, Polygalaceae, Myrtaceae, Sapotaceae* each having (3.03%) 1 species respectively. The result revealed that the family Fabaceae occupied three quarter (1/3) of the plants in the study area. Presence of 1 species shows that they are rare in the study area.

The result of the plant species diversity (Table 3) in the study area showed that Plot 3 has the highest diversity of 2.37271 followed by plot 15 having diversity of 2.31727 while, Plot 2 has the least diversity of 1.6331. Result from table 4 shows that the highest stem density was 4672 (Plot 3), followed by 4256 (Plot 4) while the least was recorded in study Plot 9 (1520) but, the whole study area has total stem density of 45,584.

The poisonous plants species and poisonous plants components were presented in table 5. The Fourteen poisonous plants identified and their percentage contribution in the study area were as follows: *Acacia polyancantha* (0.628%), *Annona senegalensis* (5.649%), *Azadirachta indica (2.615%), Bridelia ferruginea* (1.255%),*Dialium guineense* (0.313%), *Entanda africana* (1.151%), *Gardenia spp* (1.255%), *Isoberlina doka* (38.180%), *Khaya senegalensis* (6.59%), *Parkia biglobosa* (8.264%), *Prosopis africana (6.904%),Securindaca longipedunculata* (16.736%), Syzygium *guineense (5.021%)* and *Vitelleria paradoxa (5.439%)*.The total percentage distribution of all the poisonous plants in the study area (15 study plots) = total number of poisonous plants/total number of plants inventoried × 100% = 956/2867 ×100% = 33.38%.

Total number of poisonous plants = 956 stems. Therefore, stem density of the poisonous plants(see 2.6 Stem Density) = 956 × 10,000/625 = 15,296 stems/ha .The total percentage contribution of the poisonous plants to the overall stem density in the study area (15 study plots) = stem density of the poisonous plants × 100% /overall stem density of the 15 study plots = 15296 /45584 × 100% = 33.56 %.The number of stem per species of the six medicinal plants with anti trypanosomal potential identified in the study area as shown in table 6 were as follows: *Annona senegalensis* 54*, Azadirachta indica* 75 *Cassia sieberena* DC 36*, Entanda africana* 11, *Khaya senegalensi*s 11, *Terminalia avicennoides* Guill and Perr 193.

The total percentage contribution of the six medicinal plants with anti trypanosomal potential in the study area (15 study plots) = The total number of stems of the six medicinal plants with anti trypanosomal potential /total number of plants inventoried X 100% = 380/2867 x 100% = 0.83%

The total number of stems of the six medicinal plants with anti trypanosomal potential = 380 but, stem density of the poisonous plants per hectare = 380 x 10,000/625 = 6080 therefore, the total percentage contribution of the six medicinal plants with anti trypanosomal potential = stem density of the poisonous plants x 100% /overall stem density of the 15 study plots = 6080 /45584 x 100% = 13.338%.

Table 1: Coordinates of the study plots

Plot	Longitude	Latitude
1	10.606720	7.378800
2	10.603256	7.386096
3	10.604149	7.377864
4	10.605761	7.370131
5	10.605399	7.370582
6	10.605731	7.370099
7	10.605350	7.379632
8	10.605248	7.379610
9	10.605399	7.370582
10	10.603366	7.378231
11	10.603989	7.379787
12	10.602966	7.379197
13	10.601647	7.387726
14	10.602586	7.387244
15	10.601036	7.388220

Table 2: Species, families and total number of stems per species in the study area

s/No	Species	Local name (Hausa)	Family	Total number of Stems per species
1	Acacia polyocantha	Farcen shaho	Leguminoceae	6
2	Afrormosia laxifora	Baki / Farin Makarho	Leguminosae	349 Musibau *et al*., 2015
3	Annona senegalensis	Gwandar daji	Annonaceae	54
4	Azadirachta indica	Dogon yaro	Meliaceae	25
5	Bombax buonopozense	Gurjiya	Bombacaceae(APG:Malvaceae)	25

6	Bridelia ferruginea	Kirni / Kizni	Euphorbiaceae/Phyllanthaceae/Combretaceae	12
7	Borassus aethiopium	Giginya	Palmae	1
8	Cassia sieberena	Malga / Marga	Fabaceae,Caesalpiniaceae	36
9	Daniellia oliveri	Maje, Kadaura	Fabaceae	80
10	Deterium microcarpum	Taura	Fabaceae	135
11	Dialium guineese	Tsamiyar biri	Leguminaseae/Fabaceae	3
12	Dichrostachys cinera	Dundu	Mimosaceae	435
13	Diospyrus mespiliformis	Kanya	Ebeneceae	1
14	Entanda africana	Tawatsa	Fabaceae-Mimosoideae	11
15	Ficus spp	Baure	Moraceae	18
16	Gardenia erubescens	Gaude	Rubiaceae	12
17	Isoberlinia doka	Doka	Fabaceae	365
18	Khaya senegalensis	Madaci	Meliaceae	63
19	Lannea microcarpa	Faru	Anacardiaceae	12
20	Lophira lanceolate	Namijin Kadanya	Ochnaceae	4
21	Monotes kerstingii	Hantso	Dipterocarpaceae	358
22	Nauclea diderrichii	Tafashiya	Rubiaceae	43
23	Parkia biglobosa	Dorawa	Fabaceae	79
24	Piliostigma thonningii	Kalgo	Fabaceae	97
25	Prosopis africana	Kiriya	Fabaceae/Mimosoideae-Leguminosae	66
26	Pseudocedrela kotschyii	Tunas	Meliaceae	18
27	Securidaca longipedunculata	Sanya, Uwar magunguna	Polygalaceae	160
28	Syzygium guineense	Malmoo	Myrtaceae	48
29	Terminalia avicennoide	Baushe	Combretaceae	19
30	Terminalia macroptera	Kwandari	Combretaceae	14
31	Uapaca guineense	Kafaffago	Euphorbiaceae	37
32	Unidentified	—		16
33	Vitellaria paradoxa	Kadanya, Taabo	Sapotaceae	52
34	Vitex doniana	Dinya	Lamiaceae	29
	Total Stands =			2867

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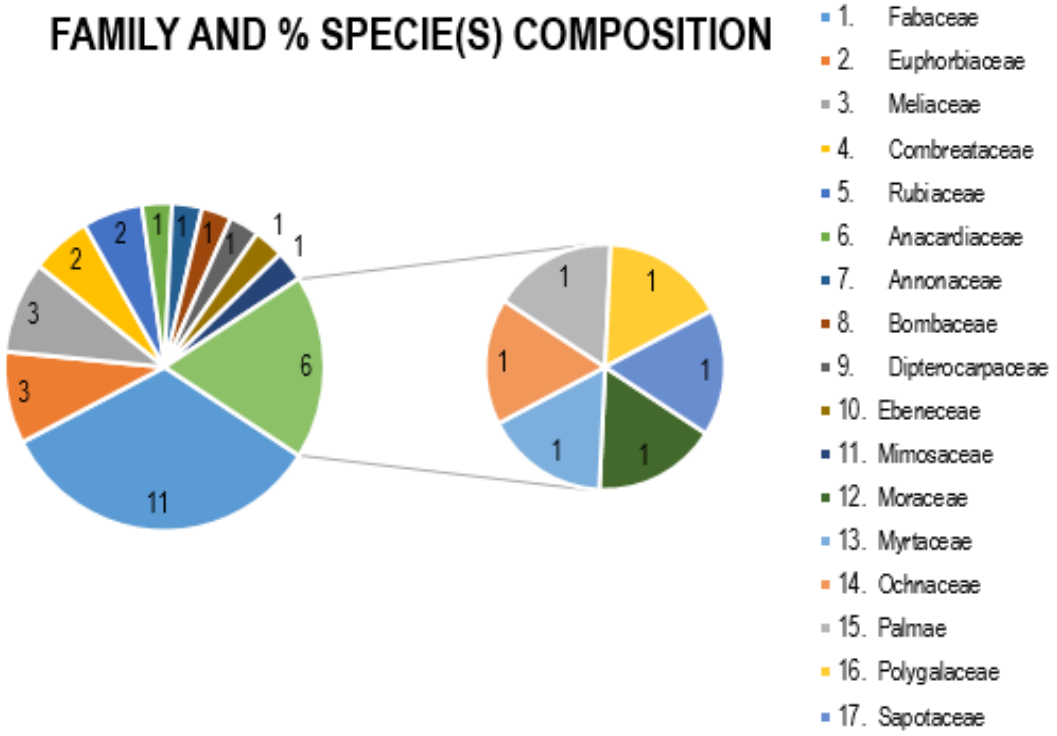

Figure 2: Family Composition and Percentage (%) Specie Contribution in the Study Area

Table 3: Species Diversity (using Shannon weiners index)

Plot	Species Abundance	Pi	Species Diversity Index(pi ln pi)	Percentage (%)
1	141	1	2.12087	6.77274
2	124	1	1.63331	5.215777
3	292	1	2.37271	7.57696
4	266	1	2.07759	6.634531
5	159	1	2.04836	6.541188
6	229	1	2.24067	7.155307
7	214	1	2.09065	6.676236
8	224	1.006884	2.09209	6.680835
9	95	1	2.36968	7.567284
10	199	1	1.7687	5.648128
11	214	1	2.27353	7.260241
12	193	1	2.20238	7.033032
13	136	1	1.79065	5.718223
14	191	1	1.91634	6.119598
15	190	1.005291	2.31727	7.39992
Total	**2867**	**15.01218**	**31.3148**	**100**

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Table 4: Stem Density Per Plot in the Study Area (15 plots)

S/No.	Total Number of stems/625m² plot	Total species Stem density/ hectare	% Total species Stem density/ hectare
1	141	2256	4.949
2	124	1984	4.352
3	292	4672	10.249
4	266	4256	9.337
5	159	2512	5.511
6	229	3664	8.038
7	214	3280	7.196
8	224	3472	7.617
9	95	1520	3.335
10	199	3184	6.985
11	214	3424	7.511
12	193	3088	6.774
13	136	2176	4.774
14	191	3056	6.704
15	190	3040	6.669
Total	2867	45584	100.001

Table 5: Poisonous Plants Identified and their Percentage contribution in the study area

S/no	Frequency	Plant Species	Poisonous Component	Percentage Contribution	References
1	6	*Acacia polyantha*	not specified	0.68	Orwa *et al*,2009
2	25	*Azadirachta indica*	Azadirachtin	2.615	Orwa *et al*,2009
3	45	*Annona senegalensis*	Rutin, quercetin	5.649	Bever, 2009
4	12	*Bridelia ferruginea*	Tannins and saponosides	1.255	NNMDA .2006
5	3	*Dialium guineense*	Tripernoids and glycosides	0.313	Houghton *et al*.,1994
6	11	*Entanda Africana*	Rotenone saponoside	1.151	Bever, 2009
7	12	*Gardenia erubescen*	Mannitol	1.255	Safety data sheet pdf
8	365	*Isoberlinia doka*	not specified	38.18	Dimask *et al*.,2015
9	63	*Khaya senegalensis*	Oleoresin in gum or resin	6.59	Orwa *et al*,2009
10	79	*Parkia biglobosa*	Alkaloid parkine	8.264	Orwa *et al*,2009
11	66	*Prosopis Africana*	Tannins	6.904	Orwa *et al*,2009

12	160	*Securidaca longipedunculata*	Triterpenic saponins	16.736	Bever, 2009 and Orwa *et al*,2009
13	48	*Syzygium guineense*	not specified	5.021	Orwa *et al*.,2009
14	52	*Vitellaria paradoxa*	not specified	5.43	Orwa *et al*.,2009

Table 6: Some medicinal plant species with antitrypanosomal potential in the study area

S/N	Plant Species	Local and other names	Parts with antitrypanosomal potential	Reference
1.	*Annona senegalensis*	Wild custard apple(English), Gwandar daji(Hausa), Uburu-ocha(Igbo),Abo(Yoruba)	leaves, stem bark, root	Okhale *et al.*,2016
2.	*Azadirachta indica*	Indian Lilac, Margosa tree(English), Neem (Arabic),Dogon yaro(Hausa)	Neem extract	Raphael *et al.* 2009.
3.	*Cassia sieberena* DC	West African Laburnum(English) Malga/Marga(Hausa),	Bark , leaves ,root	Biu *et al*.,2014
4.	*Entanda africana*	Tawatsa(Hausa) Ogurobe(Yoruba)	Root bark	Sara, *et al*.,2004 Maurice Iwu,2014
5.	*Khaya senegalensis*	African mahogany(English) Madaci(Hausa), Ono(Igbo) Ogonwo(Yoruba)	stem bark	Cokou et aL,2013
6.	*Terminalia avicennoides* Guill and Perr.	Baushe(Hausa), Idi(Yoruba) Kpayi(Gwari)Kpace(Nupe)	stem bark root bark	Musibau *et al*.,2015

4.0 DISCUSSION

A total of 2867 plants belonging to 17 families and 33 species were identified with the family Fabaceae having the highest number of species (11 species) and the families: Annonaceae, Bombaceae, Palmae, Mimosaceae, Ebeneceae, Moraceae, Anacadiaceae, Ochnaceae, Dipterocarpaceae, Polygalaceae, Myrtaceae, Sapotaceae each having 1 species respectively .In a study in Dutsinma local government area of Katsina state 75 species were identified Tukur *et al*.,(2013).Uwalaka *et al.*,(2022) identified 77 woody trees species belonging to 30 families in Ile ife . The low number of species in this study in comparism with the study of Tukur *et al*., (2013) at Dutsinma might be attributable to the fact that NDA stays for many years undeveloped, consequently, the surrounding communities carried out extensive farming activities in the area this farming activities which is always preceeded by fair cutting of trees and burning. It might also be attributable to the differences in the size of the area of the study. Similarly, the number of species recorded by Uwalaka *et al*., (2022) in Ile ife situated in the rainforest is higher than that than one in the present study this can be explained by the fact that Ile ife in the rain forest belt of Nigeria has highest species richness. Furthermore, presence of one species in this study area indicate that such species are rare and rarity is a precursor to extinction. This rare plant need urgent conservation attention to prevent them from becoming extinct.

Fourteen species of poisonous plants were identified in the study area with the species *Isoberlina doka* majorly occurring (38.180%) while *Dialium guineese* (0.313%) had the least value. Toxicity of poisonous plants according to Kerala *et al*; 2012, depend primarily on the concentration and location of the toxin however, Alsop,2016 showed that the taxonomic relationships of plants may also assist in toxicity.

In the study area, six medicinal plants with potential antitrypanosomal activity were also identified and those plants might also have other medicinal values. *Entada africana* have taxonomic relationship with *Entada abyssinica*. According to Onwumere,2017 all parts of most plant species are useful in treating one ailment or the other this showed that a single plant species can be used to deal with various health problems and even a part of the same plant can be effective against different ailments. Alsop,2016 also showed that the taxonomic relationships of plants

may also assist in toxicity since dose differs what is poisonous from what is medicinal it is envisaged that *Entada africana* may also have antitrypanosomal activity. since manufactured drugs are unavailable and more expensive to rural population and when they are effective, these drugs are harmful to environment because of their reminiscences (Alowanou *et al.*,2015) this called the need to intensify research of proved effective herbal drugs for isolation of active constituents, the right vehicle for use so as to ensure therapeutic effect for drug development, patency right and marketing.

The total stem density per hectare in the study area was 45584. This study had showed that NDA secondary vegetation had higher stem density than the Ngomeni I and Ngomeni II. This can be attributed to the fact that Ngomeni I and Ngomeni II belong to a Mangrove vegetation known to be water logged as such is less accessible to human perturbation while the present study was carried out in the Guinea savannah which is easily accessible and this suffered a lot of disturbance.

In this study Shannon Weinners index shows that the highest species diversity of 2.273 is more diverse compared to the least diversity of 1.633 which is less diverse, this shows that some plots are more diverse than others. This is expected because the different plots have different species composition and are at different stages of succession. According to Susan *et al*., (2021), the diversity index is at its peak when all the plant species in the study area are equally abundant. Furthermore, high species diversity is a reflection of species composition and local variation in soil type. Other factors include, chance, seed rain, and environmental disturbances.

Conclusion

The inventory of woody plants in the secondary vegetation of the Nigerian Defence Academy Afaka revealed the presence of 17 families and 33 species amongst which 14 species of poisonous plants were identified. Six plants with antitrypanosomal potentials were also identified.

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REFERENCES

Akther Nasima Roshni, Mohammad Kamrul Hasan, Rojina Akter, 1 A. K. M. Azad-Ud-Doula Prodhan, and Ashaduzzaman Sagar 2(2022); *Hindawi International Journal of Forestry Research* Volume 2022, Article ID 3959617, page 2 https://doi.org/10.1155/2022/3959617

AlamgirA.N.M.,2017: Therapeutic Use of Medicinal Plants and Their Extracts: Volume 1 Pharmacognosy. ISSN 0071-786X ISSN 2297-4555 (electronic) Progress in Drug Research, ISBN 978-3-319-63861-4, ISBN 978-3-319-63862-1 (eBook) DOI 10.1007/978-3-319-63862-1 Library of Congress Con trol Number: 2017947480

Alowanou GG, Olounlade AP, Azandoevb D. VFGN, Daga FD, Hounzangbeadote S M :2015: A review of *Bridelia ferruginea*, *Combretum glutinosum* and *Mitragina inermis* plants used in zootherapeutic remedies in West Africa: historical origins, current uses and implications for conservation. Journal of Applied Biosciences 87:8003– 8014 ISSN 1997–5902

Alsop A. Judith and John F. Karlik, 2016: ANR Publication 8560, www.anrcatalog.ucanr.edu .

Asrat Z. and Tesfaye Y.,2013: Hawassa University, Wondo Genet College of Forestry and Natural Resources, *Training manual on: forest inventory and management in the context of SFM AND REED +, WONDO GENET ETHIOPIA*. FAO document

Bever Bep Olier ,2009: The medicinal plants in tropical west Africa, pages 185-7

ISBN 978-059-26815-8(Hard cover),978-051-10544-6 Paper Backs https://www.researchgate.net/publication

Biu A.A., Danzeri A. M., Abdulkadir M. studies on the trypanocidal and haematological effects Of *Cassia sieberena* DC(Caesalpinaceae) stem bark aqueous extract in *Trypanosoma brucei brucei* infected Albino rats, medicine, environmental science, biology, Arid zone journal,2014 Corpus ID:86271472

Box E., Kazue F.;2013: Vegetation Types and Their Broad-scale Distribution, *Vegetation Ecology*. DOI:10.1002/9781118452592 https://www.researchgate.net/publication/287854687

Bundotich, G., Karachi, M., Fonda, E. N, Kairo, J.: Structural inventory of mangrove forests in Ngomeni, African studies center. ASC-1253935-16 pdf

Carol T. and Deborah M. ,2010: *The Encyclopedia of Poisons and Antidotes* ISBN-13: 978-0-8160-6401-4 (hardcover: alk. paper) ISBN-10: 0-8160-6401-6

Chokkalingam U. and Jong W.,2001: Secondary forest: a working definition and typology Center for International Forestry Research (CIFOR) *International Forestry* Review 3(1), 2001 19

Dimask Z. A., Sunday AO, Isyaka MS, Said J.,2015: Qualitative Investigation of Phytochemicals and brine shrimp lethality test of the root, stem bark and leaves extract of Isoberlina doka(Fabaceae); *International journal of chemical studies*2015,3(3)38

Evans J. (2001): *The forests handbook, volume 1 an overview of forest science*; ISBN 0-632-04821-2 1

Houghton R.J, Odukuja O.A., Sanderson L.and Whitfield P.,1994: Molluscicidal Saponins from Dialium guineese *Journal of Natural products*; the U.K Association of pharmaceutical scientist, pages 632-634.

Hutchinson and Dalziel (1952): Flora of west tropical Africa ISBN 978-3-319-17899-8 ISBN 978-3-319-17900-1 (eBook) ISBN 978-3-319-17901-8 (print and electronic bundle) DOI 10.1007/978-3-319-17900-1 Library of Congress Control Number:2017930938 http://www.ville-ge.ch/musinfo/bd/cjb/africa/

Kerala S. S, Vinod R., David B., Komera S., 2012: Plant toxins-useful and harmful effects https://www.researchgate.net/publication/228072884

Keay Ronald William John.,1989: Nigerian trees.Oxford Clarendon press New York, Oxford university press. isbn 0198545606. www.archive .org

Sanjoy Kumar Pal1, Yogeshwer Shukla 2002: Herbal medicine: Current status and the future Article in Asian Pacific journal of cancer prevention: APJCP November 2002 , 4, 281-288 https://www.researchgate.net/publication/8914668 ·

Maurice M. I.,2014: Handbook of African Medicinal Plants

International Standard Book Number-13: 978-1-4665-7198-3 (eBook – PDF)

Morales D. and Marco P.,2023: Forest inventory; Module developed with the kind collaboration of FAO, CATIE; CIFOR; IUFRO; Tropenbos International). www.fao.org

Musibau A. A., Yekeen T. A., Animasahun DA., Durodola FA.and Bello OB.,2015: *Terminalia avicennoides* as a Potential Candidate for Pharmaceutical Industry: A Review. *ResearchJournal of Pharmaceutical, Biological and Chemical Sciences* RJPBCS 6(2) Page No. 748ISSN: 0975-8585

NNMDA,2006: Medicinal Plants of Nigeria, North Central zone volume I, Nigeria Natural Medicine Development Agency

NNMDA,2006: Medicinal Plants of Nigeria, South west volume I, Nigeria Natural Medicine Development Agency

Okhale S. E, Edifofon A., Omolola T. F., Kevwe B. E., Oluyemisi F. K., 2016: *Annona senegalensis* Persoon (Annonaceae): A review of its ethnomedicinal uses, biological activities and phytocompounds, *Journal of Pharmacognosy and Phytochemistry*, E-ISSN: 2278-4136 P-ISSN: 2349-8234 JPP 2016; 5(2): 211-219

Onwumere B. G. ,2017: Mechanized infantry training exercise as a threat to the vegetation resources in the savannah ecological zone, Nigeria; *Journal of Natural sciences research* volume 7 No.19,2017 ISSN 2224-3186(Paper), ISSN 2225-0921(Online).

Orwa C; Mutua, A; Kindt, R; Jamnadass, R.; Anthony, S. ,2009: Agroforestry data base 4.0.www.worldagroforestry.org Ostberg Johan,2013: Tree inventories in the urban environment methodological development and new applications. Doctorate thesis Swedish University of Agricultural sciences Alnarp, Print SLU Repn, Alnarp 2013 pages 1125. ISBN:1652-6880, ISBN:978-91-575-7796-6

Owen W. and Boise R.,2008: *Poisonous Plants of Southeast Idaho*, United States Department Of Agriculture (USDA) Forest Service, Idaho Falls, Idaho March 2003

PFAF Plant data base Cassia sieberiena West African Laburnum pfaf.org>user pfaf.org

Pizzorno J., ND,2017: The toxin solution, how hiden poisons in the air, water, food and products we use are destroying our health and what we can do to fix it. The encyclopedia of Natural Medicine, google books)

Poisonous Outdoor Plants,2010: AGDEX 666-2 Published by: Alberta Agriculture and Rural Development Information Management 7000 - 113 (Alberta Agriculture and Rural Development). Reprinted 2010.

Praveen Garg and Rajesh Garg, (2019): *The Pharma Innovation Journal*; 8(2): 16-21 ISSN (E):2277- 7695 ISSN(P): 2349-8242 NAAS Rating: 5.03 TPI 2019; 8(2): 16-21 © 2019 TPI www.thepharmajournal.com

Raphael I M. Ngurea, Bosire Ongerib, Stephen M. Karoria, William Wachiraa, Ronald G. Maathaib, J. K. Kibugic, Francis N. Wachiraa,2019: Anti-trypanosomal effects of Azadirachta indica (neem) extract on Trypanosoma brucei rhodesiense-infected mice, R.M. Ngure et al / Human trypanosomosis chemotherapy Original Article 2 *Eastern Journal of Medicine* 14 (2009) 2-9

Rasool F, Nizamani ZA, Ahmad KS, Parveen F, Khan SA. And Sabir N ;2022: Phytotoxicological study of selected poisonous plants from Azad Jammu & Kashmir. PLoS ONE 17(5): e0263605. https://doi.org/10.1371/journal.

Ray Samit and Arun,2016: Biodiversity and Biotechnology, Pages 12-44. ISBN:81-7381-505-4

Rita Serrano ,2020: Toxic Plants: Knowledge, Medicinal Uses and Potential Human Health Risks Article in *Environment and Ecology Research*:6(5): 487-492, 2018 http://www.hrpub.org DOI: 10.13189/eer.2018.060509: https://www.researchgate.net/publication/328805883

Romano James A., Jr. Brian J. Lukey and Harry Salem S., 2008: Chemical Warfare Agents Chemistry, Pharmacology, Toxicology, and Therapeutics: Pages 20-36.

Sadimu A. I. Yilwa V.M. and Onwumere GB,2017: The impact of gas flaring from the Kaduna Refinery and Petrochemical industry(KRPC)on plant diversity in Kaduna Northern guinea savanna Ecoregion of Nigeria; *world scientific news.* EISSN 2392-2191, WSN 69(2017)168-178 (www.worldscientificnews.com) Safety data sheet pdf: www.carlroth.com>medias>sob

Sahira B.K and Cathrine L. (2015), General Techniques Involved in Phytochemical Analysis, *International Journal of Advanced Research in Chemical Science* (IJARCS) Volume 2, Issue 4, PP 25-32 ISSN 2349-039X (Print) & ISSN 2349-0403 (Online) www.arcjournals.org

Samuel J. Black, J. Richard Seed,2002: The African Trypanosomes World Class Parasites Volume 1 eBook ISBN: 0-306-46894-8 Print ISBN: 0-792-37512-2 ©2002

Sara Hoet, Frederik Opperdoes, Reto Brunc and Joëlle Quetin-Leclercq, 2003: Natural products active against African trypanosomes: a step towards new drugs; First published as an Advance Article on the web 5th May 2004 Covering: mid-1980s up to June 2003

Sarfo Fredrick-Antwi, Emikpe Bejamin, Larbre Christopher, Appiah Regina Opong,2021: Ethnobotany, Phytochemistry and Pharmacology of *Periscopsis laxiflora*(Baker)Meeuwen (Leguminosae)-A Review; *International Journal of Biochemistry Research.* A-Review https://www.researchgate.net/publication/351564494

Sekhar Chandra J, Sandhya S, Vinod KR, David Banji, Sudhakar K, Chaitanya RSNAKK ;2012: Plant toxins useful and harmful effects PDF. www.researchgate.net>publication

Shayne C. Gad,2006: Animal Models in Toxicology, Library of Congress Cataloging-in-Publication Data Animal models in toxicology, Page 43 ISBN 13: 978-0-8247-5407-5 (alk. Paper) ISBN 10: 0-8247-5407-7 (alk. paper)

Simon J McKirdy, Greg Shea, Darryl Hardie, David Eagling (2014): Why plant biosecurity? https://www.researchgate.net/publication/228628141

Smith, James P. Jr, 2007: Plants and Civilization; An Introduction to the Interrelationships of Plants and People, Botanical Studies. http://digitalcommons.humboldt.edu/botany_jps/2

Swami S., Suman H.P., Singh K. G., Longo D., Rakesh D.,2008: Extraction Technologies for Medicinal and Aromatic Plants; Earth, Environmental and Marine Sciences and Technologies International Centre for Science and High Technology ICS-UNIDO, AREA Science Park Padriciano 99, 34012 Trieste, Italy, 2008.