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Ecological Characterization and Human Impact Assessment of the Flora of Imo-Awka River Watershed in Awka, Anambra State, Nigeria.

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ABSTRACT
Watersheds in Anambra State are characterized by wanton deforestation, indiscriminate land use patterns and poor management. The study was therefore carried out to assess the impact of these unwholesome practices on the ecological characteristics and flora development of the watershed. The study site was situated along a perennial stream which was 1490 meters long with an average width of 3 meters. The area was divided into three segments namely, head, middle and tail covering both sides (aspects) of the stream. The segments and aspects were further divided into three plots, each measuring 60 meters by 20 meters. At each segment and aspect, sampling of plant species was done using the quadrat method(2 meters by 3 meters quadrat) to determine species abundance and diversity. Soil samples at three depths (10 cm, 30 cm and 50 cm) were also collected in each segment and aspect to determine the soil pH and micro organisms. The various land use practices on the watershed were also noted by segment and aspect. The importance value index was used to determine the species abundance while Shannon Weiner index of diversity was used to determine the species diversity of the watershed. Analysis of Variance (ANOVA) and Regression Analysis were employed in data analysis The findings of the study showed that nearly all parts of the watershed were disturbed at varying intensities through human activities ranging from wood lumbering, farming and construction. The study showed also that with respect to segment, the species diversity of the watershed was higher at the head segment (0.81) and lower at the tail segment (0.72). Also with respect to the aspect, the study revealed that the species diversity was higher towards the left aspect (0.68) than the right aspect (0.66). The study showed a negative significant relationship between land use patterns in the watershed.
Keywords: Ecological, Human Impact Assessment and Flora

INTRODUCTION

A watershed is the area of land that forms the drainage system for a stream or river. According to [1], it is that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water courses and where, as human settled, a simple logic demanded that they become part of a community [2]. Watershed serves as an important source of water, energy and biological diversity [3]. They are also a source of such key resources as forests, agricultural products and of recreation. From a planning stand point, watershed has been considered the most ideal unit for analysis and management of natural resources [4]. For optimal use of environmental resources in a region, integrated watershed development approach is still viewed by many to the most ideal as it happens in maintaining the ecological basis of resources utilization [4]. As a key part of the global ecosystem, watershed represents a complex and interrelated ecology of plants, animals, soil and climate [5]. Plants community represents an important biological component which

determines to a great extent the stability of the watershed. Generally, plants help to slow runoff and reduce soil compaction in watershed, allowing the better percolation of rainfall into soils and ground water, which creates better water storage for summer based flows [6]. In addition, the patterns, sizes, and composition of the vegetation can affect many wildlife species. Vegetative composition and density can reduce or prevent soil erosion. For instance, leaves and branches may intercept the falling rain and reduce the effect of rain drop splash [7]. Vegetative litter from dead leaves and the branches on the other hand builds up an organic surface that provides protection of the soil layer [8]. Equally of key element n determining watershed wellbeing is biodiversity (which is the diversity of ecological communities, species, and genetic variants). In more explicit term, species diversity represents the number of species and their evenness and this may have direct influence on watershed cover [9,10]. However, in spite of laudable significance of the watershed, recent studies have shown that many watersheds have been lost due to excessive exploitation. Various activities such as farming, fishing, forestry, construction, mining, urban development and land pollution are some of the human activities that are negatively affecting watershed structure and stability [11]. These activities affect habitat structure, flow regime, food web and biotic interactions in the reservoir [12]. In developing countries like Nigeria, agriculture is already a leading cause of land degradation. [13], observed that while vegetation composition affects the underlying soil and other biotic components, the decline of natural forests in developing regions will continue in total loss and the disappearance of many watersheds. Industrialization, population growth and related agricultural expansion, and forest trade are the main driving forces in reducing forest covering in Nigeria [4]. Meanwhile, while human activities may have aadverse effect on the stability of the watershed, lack of scientifically based assessments of the functional effects of land use practices on the biodiversity and soil properties of the watershed is already constraining effort aimed at conserving and managing the watershed.The main objective of this study is to examine the ecological characterization and human impact assessment on the flora of a watershed (Imo Awka River) in Awka,Anambra State.

METHODOLOGY

Six plots measuring 20 meters by 60 meters were delinated using pegs and ropes at each segment of the stream,(three at each side of the stream). In vegetative sampling, a quadrant size of 2 meters by 3 meters was used. The sampling was done by counting the number of plants by species found rooted within the quadrant. All the species encountered were identified using the services of experts and employing relevant flora. A species inventory of the plant species was also prepared. In other to quantify human interference on species abundance across and within the watershed sites, the frequency, relative frequency, density, relative density and species diversity were calculated.

Data Computation

In other to determine the species abundance and the diversity index of the watershed, the following computations were used:

A) Density = $\frac{\text{total number of individual species}}{\text{total area sampled}}$

B) Frequency = $\frac{\text{number of times a species occurred}}{\text{total number of times searched folr it}} \times 100$

C) Relative Density = $\frac{\text{density of individual species}}{\text{total densities of all the species}} \times 100$

D) Relative Frequency = $\frac{\text{frequency of individual species}}{\text{total frequencies of all the species}} \times 100$

E) Importance Value Index (ivi), that is summation of the relative density and the relative frequency

F) Species Diversity = Shannon Weiners index of diversity

$$H^{-} = -\sum(pi) \times (\ln pi)$$

$$H_{max=lns}$$

$$Equatability = \frac{H -}{H_{max}}$$

$$where\ H- = Shannon\ index\ of\ diversity$$

S = number of species
i-I = individual species to one
pi = proportion of individual species
In pi = natural log of the proportion of individual species

Statistical Analysis

In the analysis of the data, one-way, two-way and three-way Analysis of Variance (ANOVA) were utilized.

RESULTS

Land Use Pattern of the Watershed

Table 1 shows the land use pattern of the watershed. The table indicates that lumbering of woods constitutes the most land use practice at the head segment of the watershed, lumbering of woods and agricultural practices for the middle segment while agricultural and construction activity constitute the main activity at tail segment.

Table 1: Land Use Pattern of the Watershed

Segment	Aspect	Land Use Practices	Intensity of Practices
Head	Left	Lumbering of woods	Mild
	Right	Lumbering of woods and Agricultural	Mild
Middle	Left	(farming)	High
	Right	Lumbering of woods	High
Tail	Left	Agricultural (farming) and logging	Very high
	Right	Agricultural (farming)	Very high
		Construction and Agricultural (farming)	

Species Abundance and Biodiversity Status of the Watershed

Tables 2, 3 and 4 show the species abundance status of the watershed by the different segments of the stream. The tables indicate that the tail segment of the watershed was dominated by *Andropogon tectorum*, while the middle segment was dominated by *Panicum laxum* whereas the head segment was dominated by *Panicum*

maximum. In tables 5 and 6, the species abundance status of the watershed by aspect of the watershed is shown. The tables indicate that both aspect of the watershed was mainly dominated by *Andropogon tectorum*. In table 7, the species diversity of the watershed by segment and aspect of the stream is shown. The table indicates that the species diversity of the watershed is higher at the head segment (0.81) and lower at the tail segment (0.72). With respect to aspect of the stream, the species diversity of the watershed is higher at the left aspect of the stream (0.68) and lower at the right segment of the stream.

Table 2: Species Abundance Status of the Tail Segment of the Watershed

Species	No	Count in Quadrat	Frequency (%)	Relative Frequency	Density (/m²)	Relative Density	(IVI)
Andropogon	1317	76	63.33	13.87	1.829	27.55	41.42
tectorum	698	39	32.5	7.116	0.969	14.6	21.72
Cyperus iria	463	39	32.5	7.116	0.643	9.685	16.8
Kyllinga bulbosa	306	26	21.67	4.744	0.425	6.401	11.14
Clappertonia ficfolia	190	30	25	5.474	0.264	3.974	9.448
Phyllantus amarus	136	23	19.17	4.197	0.189	2.845	7.041
Oplismensus	176	18	15	3.284	0.244	3.681	6.966
burmanii	60	31	25.83	5.657	0.083	1.255	6.912
Nephrolepis	226	10	8.33	1.825	0.314	4.727	6.552
biserrated	144	18	15	3.284	0.2	3.012	6.296
Hyptis lanceolata	103	22	18.33	4.014	0.143	2.154	6.169
Sporobolus	108	21	17.5	3.832	0.15	2.259	6.091
pyramidalis	136	10	8.333	1.825	0.258	3.891	5.715
Podoccocus bacteri	81	20	16.67	3.649	0.113	1.694	5.344
Eclipta alba	128	13	10.83	2.372	0.178	2.677	5.049
Microsorium	60	16	13.33	2.919	0.083	1.255	4.175
pteropus							
Panicum laxum	27	19	15.83	3.469	0.038	0.565	4.032
Abrus precatorius	55	15	12.5	2.737	0.076	1.15	3.887
Maricus alternifolias	65	12	10	2.19	0.09	1.36	3.549
Platycerium	29	16	13.33	2.919	0.04	0.607	3.526
stagelophantotis	82	8	6.667	1.46	0.114	1.715	3.175
Elaesis guineensis	11	10	8.333	1.825	0.015	0.23	2.055
Diplazium sammati	27	8	6.667	1.46	0.038	0.565	2.025
Chamaecrista	27	8	6.667	1.46	0.038	0.565	2.025
mimosoides	9	9	7.5	1.642	0.013	0.188	1.83
Cnestis ferruginea	14	8	6.667	1.46	0.019	0.293	1.753
Leucas martinicensis	8	7	5.833	1.277	0.011	0.167	1.445
Musanga	28	2	1.667	0.365	0.039	0.586	0.951
cecropoides	5	4	3.333	0.73	0.007	0.105	0.834
Fimbristylis	4	4	3.333	0.73	0.006	0.084	0.814
ferruginea	4	2	1.667	0.365	0.006	0.084	0.449
Mucuna pruriens	2	2	1.667	0.365	0.003	0.042	0.407
Dalium guineenes	2	2	1.667	0.365	0.003	0.042	0.407
Cyperus rotundus		Total	456.7	99.99	6.64	100	200
Alstonia boonei							
Perotis indica							
Baphia nitida							

Myrianthus arboreus							
Cochlospenum planchoni							
Anthocleista vogelii							
Artocarpus altilis							

Table 3: Species Abundance Status of the Middle Segment of the Watershed

Species	No	Count in Quadrat	Frequency (%)	Relative Frequency	Density (/m²)	Relative Density	(IVI)
Panicum laxum	1235	73	60.83	11.21	1.7153	14.68	25.89
Andropogon tectorum	1584	26	21.67	3.994	2.2	18.83	8
Aspillia Africana	691	50	41.67	7.68	0.9597	2.216	22.82
Imperita cylindrical	1083	18	15	2.765	1.5042	12.88	8
Cyperus haspan	606	41	34.17	6.298	0.8417	7.205	15.89
Andropogon gayana	565	20	16.67	3.072	0.7847	6.718	7
Kyllinga bulbosa	342	32	26.67	4.916	0.475	4.066	15.64
Paspalum scorbiculata	294	32	26.67	4.916	0.4083	3.496	2
Maricus alternifolius	306	26	21.67	3.994	0.425	3.638	13.50
Clappertonia ficfolia	191	34	28.33	5.223	0.2653	2.271	3
Ludwigia repens	244	26	21.67	3.994	0.3389	2.901	9.790
Phyllanthus amarus	154	24	20	3.687	0.2139	1.831	1
Urena lobata	96	25	20.83	3.84	0.1333	1.141	8.981
Andropogon gayanus	181	14	11.67	2.151	0.2514	2.152	9
Chromolaena odorata	87	16	13.33	2.458	0.1208	1.034	8.411
Fimbristylis ferruginea	76	15	12.5	2.304	0.1056	0.904	2
Panicum maximum	127	11	9.167	1.69	0.1764	1.51	7.632
Ageratum conyzoides	97	13	10.83	1.997	0.1347	1.153	2
Cida acuta	51	14	11.67	2.151	0.0708	0.606	7.493
Echinochloa colona	74	12	10	1.843	0.1028	0.88	8
Ipomea involucrate	17	14	11.67	2.151	0.0236	0.202	6.895
Smilax anceps	19	12	10	1.843	0.0264	0.226	1
Milletia aboensis	14	12	10	1.843	0.0194	0.166	5.517
Oplismensus burmari	25	9	7.5	1.382	0.0347	0.297	7
Physalis angulata	16	9	7.5	1.382	0.0222	0.19	4.981
Veronia cinerea	27	8	6.667	1.229	0.0375	0.321	7
Nephrolepis bisserrata	44	5	4.167	0.768	0.0611	0.523	4.302
Goose berry	26	6	5	0.922	0.0361	0.309	7
Mimosa pudica	34	5	4.167	0.768	0.0472	0.404	3.492
Elaesis guineensis	6	6	5	0.922	0.0083	0.071	2
Platycerium stagelophantotis	28	4	3.333	0.614	0.0389	0.333	3.207
Mimosa pudica	11	5	4.167	0.768	0.0153	0.131	8
	7	5	4.167	0.768	0.0097	0.083	3.199
	6	5	4.167	0.768	0.0083	0.071	8
	5	5	4.167	0.768	0.0069	0.059	3.150
	19	3	2.5	0.461	0.0264	0.226	3
	6	4	3.333	0.614	0.0083	0.071	2.756
	5	3	2.5	0.461	0.0069	0.059	9
	3	3	2.5	0.461	0.0042	0.036	2.723
	2	2	1.667	0.307	0.0028	0.024	2
	2	2	1.667	0.307	0.0028	0.024	2.352

Abrus precatorius	3	1	0.833	0.154	0.0042	0.036	7
Mucuna pruiens	1	1	0.833	0.154	0.0014	0.012	2.069
Merremia aegyptia		Total	542.5	100	11.681	100	2
Podococcus barteri							2.009
Tephrosia							8
pedicellata							1.679
Cissus araliodes							7
Musanga ceropoides							1.572
Dailium guineensis							7
Hyptis lanceolata							1.549
Crotalaria retusa							9
Croton hirtus							1.291
							2
							1.230
							8
							1.172
							3
							0.993
							0.947
							4
							0.898
							8
							0.851
							3
							0.839
							4
							0.827
							5
							0.686
							7
							0.685
							8
							0.520
							3
							0.496
							5
							0.331
							0.331
							0.189
							3
							0.165
							5
							200

Table 4: Species Abundance Status of the Head Segment of the Watershed

Species	No	Count in Quadrat	Frequency (%)	Relative Frequency	Density (/m²)	Relative Density	(IVI)
Panicum maximum	463	51	42.5	7.739	0.643	13.17	21.44
Peperomia	334	62	51.67	9.408	0.464	9.887	19.29
Chromolaena	231	79	65.83	11.99	0.321	6.838	18.83
odorata	289	40	33.33	6.069	0.401	8.555	14.62
Aspillia Africana	251	42	35	6.373	0.349	7.43	13.8
Ludwigia repens	235	42	35	6.373	0.326	6.956	13.33
Phyllanthus amarus	195	41	34.17	6.221	0.271	5.772	11.99
Urena lobata	140	43	35.83	6.525	0.194	4.144	10.67
Spigelia	192	30	25	4.552	0.267	5.683	10.24
Euphorbia	200	28	23.33	4.249	0.278	5.92	10.17
heterophylla	199	26	21.67	3.945	0.276	5.891	9.836
Cyperus rotundus	147	27	22.5	4.097	0.204	4.351	8.448
Cida acuta	117	14	11.67	2.124	0.163	3.463	5.588
Ageratum	33	22	18.33	3.338	0.046	0.977	4.315
conyzoides	23	14	11.67	2.124	0.032	0.681	2.805
Cyperus iria	22	14	11.67	2.124	0.031	0.651	2.776
Mitracapus villosus	56	7	5.833	1.062	0.078	1.658	2.72
Elaesis guineensis	24	13	10.83	1.973	0.033	0.71	2.683
Cissus araloides	47	8	6.667	1.214	0.065	1.391	2.605
Kyllinga bulbosa	21	10	8.333	1.517	0.029	0.622	2.139
Mucuna pruriens	30	7	5.833	1.062	0.042	0.888	1.95
Melochia	44	4	3.333	0.607	0.061	1.302	1.909
corchorifolia	20	6	5	0.91	0.028	0.592	1.502
Xanthosoma	15	6	5	0.91	0.021	0.444	1.354
mafaffa	20	4	3.333	0.607	0.028	0.592	1.199
Maricus alternifolias	14	4	3.333	0.607	0.019	0.414	1.021
Nephrolepis	4	3	2.5	0.455	0.006	0.118	0.574
biserrata	3	3	2.5	0.455	0.004	0.089	0.544
Gonferena	3	3	2.5	0.455	0.004	0.089	0.544
Mitracapus	2	2	1.667	0.303	0.003	0.059	0.363
Tridax procumbens	1	1	0.833	0.152	0.001	0.03	0.181
Elusien indica	1	1	0.833	0.152	0.001	0.03	0.181
Bambusa vulgaris	1	1	0.833	0.152	0.001	0.03	0.181
Euphorbia hirta	1	1	0.833	0.152	0.001	0.03	0.181
Musanga			549.2	99.99	4.692	99.99	200
cecropoides							
Mangifera indica							
Anacadum							
occidentalis							
Anthocleita vogelii							
Ceiba pentandra							
Musa sapientum							

Table 5: Species Abundance Status of the Right Aspect of the Watershed

Species	No	Count in Quadrat	Frequency (%)	Relative Frequency	Density (/m²)	Relative Density	(IVI)
Androgon tectorum	4038	60	50	6.3091	5.608	36.11	42.42
Panicum laxum	747	47	39.17	4.9422	1.038	6.681	11.62
Aspillia Africana	686	52	43.33	5.4679	0.953	6.135	11.6
Phyllanthus amarus	385	62	51.67	6.5195	0.535	3.443	9.963
Cyperus haspan	606	41	34.17	4.3113	0.842	5.42	9.731
Maricus alternifolius	452	43	35.83	4.5216	0.628	4.042	8.564
Ludwigia repens	353	40	33.33	4.2061	0.49	3.157	7.363
Androgen gayanus	565	20	16.67	2.103	0.785	5.053	7.156
Chromolaena	236	47	39.17	4.9422	0.328	2.111	7.053
odorata	218	44	36.67	4.6267	0.303	1.95	6.576
Urena lobata	225	35	29.17	3.6803	0.313	2.012	5.693
Cida acuta	301	24	20	2.5237	0.418	2.692	5.216
Cyperus iria	226	28	23.33	2.9443	0.314	2.021	4.965
Clappertonia	214	26	21.67	2.734	0.297	1.914	4.648
ficfolia	169	29	24.17	3.0494	0.235	1.511	4.561
Panicum maximum	108	28	23.33	2.9443	0.15	0.966	3.91
Perperomia	200	19	15.83	1.9979	0.278	1.789	3.787
Spigelia	102	22	18.33	2.3134	0.142	0.912	3.226
Kyllinga bulbosa	136	18	15	1.8927	0.189	1.216	3.109
Fimbristylis	181	14	11.67	1.4721	0.251	1.619	3.091
ferruginea	129	16	13.33	1.6824	0.179	1.154	2.836
Ageratum	87	19	15.83	1.9979	0.121	0.778	2.776
conyzoides	201	7	5.833	0.7361	0.279	1.798	2.534
Andropogon	74	12	10	1.2618	0.103	0.662	1.927
gayanus	20	13	10.83	1.367	0.028	0.179	1.546
Paspalum	19	12	10	1.2618	0.026	0.17	1.432
scorbiculata	18	12	10	1.2618	0.025	0.161	1.432
Oplismensus	48	9	7.5	0.9464	0.067	0.429	1.376
burmanii	22	11	9.167	1.1567	0.031	0.197	1353
Sporobolus	56	8	6.667	0.8412	0.078	0.501	1.342
pyramidalis	66	7	5.833	0.7361	0.092	0.59	1.326
Echinochloa colona	18	11	9.167	1.1567	0.025	0.161	1.318
Mitracarpus	13	10	8.333	1.0515	0.018	0.116	1.168
Smilax anceps	16	9	7.5	0.9464	0.022	0.143	1.089
Cissus araloides	59	5	4.167	0.5258	0.082	0.528	1.053
Eclipta alba	24	7	5.833	0.7361	0.033	0.215	0.951
Hyptis lanceolata	15	7	5.833	0.7361	0.021	0.134	0.87
Chaecrista	12	7	5.833	0.7361	0.017	0.107	0.843
mimosoides	20	6	5	0.6309	0.028	0.179	0.81
Podococcus barteri	14	6	5	0.6309	0.019	0.125	0.756
Eleasis guineensis	12	6	5	0.6309	0.017	0.107	0.738

Ipomea involucrate	11	6	5	0.6309	0.015	0.098	0.729
Physalis angulata	25	4	3.333	3.333	0.035	0.224	0.644
Nephrolepsis	7	5	4.167	0.5258	0.01	0.063	0.588
biserrata	5	5	4.167	0.5258	0.007	0,045	0.57
Platycerium	5	5	4.167	0.5258	0.007	0.045	0.57
stagelophantis	6	4	3.333	0.4206	0.008	0.054	0.474
Abrus precatorius	4	4	3.333	0.4206	0.006	0.036	0.456
Cnestis ferruginea	7	3	2.5	0.3155	0.01	0.063	0.378
Microsorium	3	3	2.5	0.3155	0.004	0.037	0.342
pteropus	2	2	1.667	0.2103	0.003	0.018	0.228
Xanthosoma	2	2	1.667	0.2103	0.003	0.018	0.228
mafaffa	2	2	1.667	0.2103	0.003	0.018	0.228
Diplazium sammati	2	2	1.667	0.2103	0.003	0.018	0.228
Mucuna pruriens	3	1	0.833	0.1052	0.004	0.027	0.132
Clappertonia ficfolia	2	1	0.833	0.1052	0.003	0.018	0.123
Cyperus rotundus	1	1	0.833	0.1052	0.001	0.009	0.114
Alstonia booneii	1	1	0.833	0.1052	0.001	0.009	0.114
Merremia aegyptia	1	1	0.833	0.1052	0.001	0.009	0.114
Tephrosia	Total		7.92.5	100	15.53	99.99	200
pedicellata							
Musanga ceropoides							
Leucas martinicensis							
Euphorbia hirta							
Baphia nitida							
Dailium guineensis							
Mangifera indica							
Myrianthus arboreus							
Crotolaria retusa							
Bambusa vulgaris							
Anacadum							
occidentalis							
Anthocleista vogeli							
Croton hirtus							

Table 6: Species Abundance Status of the Left Aspect of the Watershed

Species	No	Count in Quadrat	Frequency (%)	Relative Frequency	Density (/m²)	Relative Density	(IVI)
Andropogon	2814	42	35	4.751	3.908	30.157	34.91
tectorum	661	59	49.17	6.674	0.918	7.0838	13.76
Kyllinga bulbosa	1083	18	15	2.036	1.504	11.606	13.64
Imperata cylindrical	674	36	30	4.072	0.936	7.2231	11.3
Pannicum laxum	514	29	24.17	3.28	0.714	5.5084	8.789
Cyperus iria	376	36	30	4.072	0.522	4.0295	8.102
Panicum maximum	82	48	40	5.43	0.114	0.8788	6.308
Chromolaena	294	27	22.5	3.054	0.408	3.1507	6.205
odorata	196	34	28.33	3.846	0.272	2.1005	5.946
Aspillia Africana	207	31	25.83	3.507	0.288	2.2187	5.725
Phyllanthus amarus	165	33	27.5	3.733	0.229	1.7683	5.501
Cyperus rotundus	192	30	25	3.394	0.267	2.0576	5.451
Peperomia	246	24	20	2.715	0.342	2.6363	5.351
Euphorbia	142	28	23.33	3.167	0.197	1.5218	4.689
heterophylla	205	22	18.33	2.489	0.285	2.1969	4.686
Clappertonia ficfolia	108	22	18.33	2.489	0.15	1.1574	3.646
Ludwigia repens	165	16	13.33	1.81	0.229	1.7683	3.578
Nephrolepis	38	26	21.67	2.941	0.053	0.4072	3.348
biserrata	73	22	18.33	2.489	0.101	0.7823	3.271
Ageratum	40	22	18.33	2.489	0.056	0.4287	2.917
conyzoides	73	18	15	2.036	0.101	0.7823	2.818
Paspalum	46	20	16.67	2.262	0.064	0.493	2.755
scorbiculata	88	15	12.5	1.697	0.122	0.9431	2.64
Elaesis guineensis	97	14	11.67	1.584	0.135	1.0395	2.623
Urena lobata	74	13	10.83	1.471	0.103	0.793	2.264
Hyptis lanceolata	55	13	10.83	1.471	0.076	0.5894	2.06
Abrus precatorius	32	15	12.5	1.697	0.044	0.3429	2.04
Mucuna pruriens	45	10	8.333	1.131	0.063	0.4823	1.613
Microsorium	14	12	10	1.357	0.019	0.15	1.507
pteropus	43	9	7.5	1.018	0.06	0.4608	1.479
Podoccocus bacteri	47	8	6.667	0.905	0.065	0.5037	1.409
Oplismensus	36	9	7.5	1.018	0.05	0.3858	1.404
burmanii	75	5	4.167	0.566	0.104	0.8038	1.369
Eclipta alba	11	10	8.333	1.131	0.015	0.1179	1.249
Spigellia	17	9	7.5	1.018	0.024	0.1822	1.2
Mimosa pudica	9	9	7.5	1.018	0.013	0.0965	1.115
Milletia aboensis	26	6	5	0.679	0.036	0.2786	0.957
Diplazium sammati	20	6	5	0.679	0.028	0.2143	0.893
Melochia	15	6	5	0.679	0.021	0.1608	0.839
corchorifolia	25	5	4.167	0.566	0.035	0.2679	0.834
Platycerium	8	6	5	0.679	0.011	0.0857	0.764

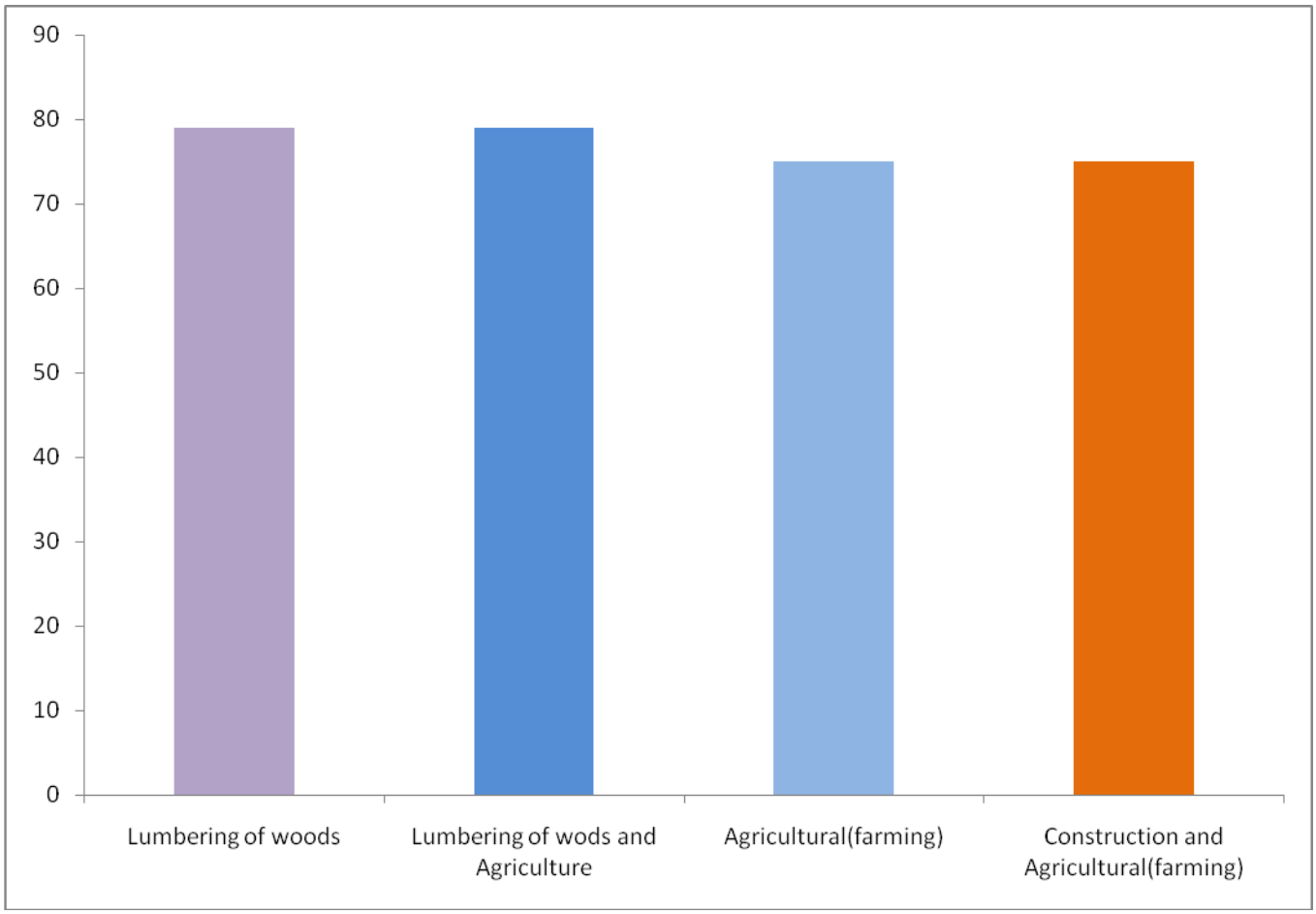
stagelophantotis	28	4	3.333	0.452	0.039	0.3001	0.753
Leucas martinicensis	27	4	3.333	0.452	0.038	0.2894	0.742
Musanga	20	4	3.333	0.452	0.028	0.2143	0.667
cecropoides	9	5	4.167	0.566	0.013	0.0965	0.662
Cnestis ferruginea	25	3	2.5	0.339	0.035	0.2679	0.607
Dailium guineenses	9	4	3.333	0.452	0.013	0.0965	0.549
Gooseberry	7	4	3.333	0.452	0.01	0.075	0.527
Gonferena	28	2	1.667	0.226	0.039	0.3001	0.526
Cissus araloides	4	4	3.333	0.452	0.006	0.0429	0.495
Cida acuta	12	3	2.5	0.339	0.017	0.1286	0.468
Mitracapus spp	5	3	2.5	0.339	0.007	0.0536	0.393
Platycerium	14	2	1.667	0.226	0.019	0.15	0.376
stagelophanto	4	2	1.667	0.226	0.006	0.0429	0.269
Veronia cinerea	3	2	1.667	0.226	0.004	0.0322	0.258
Tridax procumbens	3	2	1.667	0.226	0.004	0.0322	0.258
Cissus araloides	2	2	1.667	0.226	0.003	0.0214	0.248
Sporobolus	2	2	1.667	0.226	0.003	0.0214	0.248
pyramidalis	2	2	1.667	0.226	0.003	0.0214	0.248
Chamaecrista	2	2	1.667	0.226	0.003	0.0214	0.248
mimosoides	2	2	1.667	0.226	0.003	0.0214	0.248
Xanthosoma	1	1	0.833	0.113	0.001	0.0107	0.124
mafaffa	1	1	0.833	0.113	0.001	0.0107	0.124
Perotis indica	1	1	0.833	0.113	0.001	0.0107	0.124
Ipomea involucrate	Total		736.7	100	12.98	100.12	200.1
Maricus alternifolius							
Mitracapus villosus							
Elusien indica							
Cochlospenum							
planchoni							
Alstonia boonei							
Baphia nitida							
Anthocleista vogelii							
Artocarpus altilis							
Bambusa vulgaris							
Musanga							
Myrianthus arboreus							
Ceiba pentandra							
Fimbristylis							
ferruginea							
Musa sapientum							

Table 7: Species Diversity Status of the Watershed

Segment/Aspect	No of species	H^-	H_{max}	Equitability
Segment				
Head	34	2.83	3.52	0.81
Middle	33	2.62	3.49	0.75
Tail	43	2.71	3.76	0.72
Aspect				
Left	64	2.82	4.16	0.68
Right	59	2.71	4.08	0.66

H^-= Index Diversity

H_{max} =Maximum Equitability



Land Use Practices

Figure 1: The Species diversity in the watershed according to land use practices. Vertical lines indicate 95% confidence interval.

DISCUSSION

This study was conducted to assess the characterization and impact of human activities on a watershed (Imo Awka stream). The result of the study showed that nearly all part of the watershed have been disturbed through human activities ranging from wood lumbering, farming and construction. The less disturbed part of the watershed is the head segment and this was found to have higher species diversity. This supports the findings of [2] who observed that human activities of deforestation and agriculture have reduced the diversity and structure of most watersheds. The study shows the land use practices of the watershed under study include farming, wood lumbering and construction. There are difference in the soil and species characterisation of watershed by segment, aspect and depth. The study shows that the land use practices in the watershed had negative effect on the species diversity.

RECOMMENDATIONS

Since in watershed, vegetation functions to slow off, reduce soil compaction, allow better percolation of rainfall into soils and groundwater, which creates better water storage for summer base flows, there is need for increased commitment in terms of management, planning and legislations that will aim at reducing deforestation and excessive exploitation of watershed. There is also need to introduce and sustain reforestation practices in watershed so as to promote re-vegetation, protect the watershed soil and reduce shrinking of stream by sediments as a result of runoff.

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