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Dynamics in Vegetation Floristic and Structural Composition in Varying Fallows of Agoi-Ekpo, South-Southern Nigeria

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ABSTRACT

The study aimed at evaluating vegetation structure and composition across successional fallows communities that ranged from 10yr-old -3yr-old and farmlands in the study area. 10 quadrats of 0.04 ha each were delineated across the fallow communities for the collection of vegetation data. The study area is Agoi-Ekpo community, Yakurr Local Government Area of Cross River State, Nigeria. Data obtained was further analyzed using One-Way Analysis of Variance (ANOVA)**.** A total of 3057 tree/shrub stems ≥0.05m diameter at breast height within 22 were enumerated. Vegetation structure varied significantly among10yr-old, 5yr-old, 3yr-old and farmland quadrats ($P<0.01$). The vegetation stem population varied significantly at a value of $P<0.01$ across the various fallows. Invariably, diversity index showed that more diverse and heterogeneous fallow was 10yr-old as compared to the 5yr-old fallow and farmland with diversity indexes of 0.89, 0.86 and 0.85 respectively. Variation in vegetation characteristics among the vegetation fallows showed that farming activity resulted in the alteration of forest vegetation. To facilitate rapid vegetation regeneration, bush burning and trunk uprooting should be discouraged.

Key Words: Fallow Vegetation, Simpson's Diversity Index, Stem Density, Agoi-Ekpo

Introduction

Globally, agricultural practices alongside other anthropogenic activities have been able to leave distinctive imprints on flora communities. In Nigeria however, sustainable farming is hardly practiced mostly among peasant farmers during land preparation for food crop cultivation. Considering the fact that farming activities are still highly associated with the complete clearing and burning of forest vegetation, these practices result in the modification of the forest, giving way to land degradation mostly by soil erosion processes. The burning of forest leaves, twigs and woods after clearing hinders rapid vegetation regeneration, due to the fact that the propagules that would have facilitated ecological succession and regrowth are destroyed by the fire (**Aweto A. O., 2001; Makana J. R, Thomas S.C, 2006**). The burning of forest after clearing alters the floristic and structural composition of vegetation therein. This has implication on soil nutrient loss, increase in surface erosion, variation in microclimatic attributes, and changes in soil nutrients thereby causing disequilibrium in forest resources **(Iwara A. I, Offiong R. A, Njar G. N, Atu J. E, Ogundele F. O., 2012)**. Farming activities induces reduction in species evenness, richness cum diversity. An area enriched with tree/shrub components can enhance, sustain and promote forest ecosystem resources and attributes (**Hooper D.**

U, Chapin F. S, Ewel J. J, Hector A, Inchausti P, Lavorel S, Lawton J. H, Lodge D. M, Loreau M, Naeem S, Schmid B, Setala H, Symstad A. J, Vandermeer J, Wardle D. A., 2005). Clearing and subsequent burning of forest has the potency of reducing ecosystem complexities and diversity by replacing a thick forest that will later be occupied by scanty species (**Verburg A. P. H, Veldkamp A, Willemen L, Overmars K. P, Castella J. C., 2004).**

(**Guariguata M. R, Ostertag R., 2001**) argued that a degraded forest that have been allowed to fallow again over time often does not follow predictable pattern of ecological succession trajectories due to prior land use which in turn generally causes land degradation. Therefore, the intensity of land use is proportionate to vegetation regrowth (**Uhl C, Buschbacher R, Serrao E. A. S., 1988)**. The abandoned agricultural lands are usually invaded by grasses and herbs. Grasses have high level of competition that is capable of inhibiting rapid regeneration of tree/shrub species **(Nepstad D. C, Uhl C, Pereira C. A, Cardosa da Silva J. M., 1996), Hooper E, Condit R, Legendre P., 2002)**. Also, recovery and rejuvenation of mature-forest tree/shrub species composition on highly cultivated lands can be very slow (**Guariguata M. R, Ostertag R., 2001)** as a result of intensive land use and agricultural practices removes tree/shrub species for easy regeneration (**Uhl C, Buschbacher R, Serrao E. A. S., 1988)**, **(Nepstad D. C, Uhl C, Pereira C. A, Cardosa da Silva J. M., 1996), Hooper E, Condit R, Legendre P., 2002)**, thus, leaving seed dispersal as the critical mechanism for quick forest regeneration. Vegetation structure (basal cover, girth, height and crown cover among others) is an ecological term that describes the spatial arrangement of vegetation biomass (**Fosberg F. R., 1967**). In assessing vegetation structure, these elements must be considered in order to adequately manage the floristic and structural patterns of flora communities (**Pauchard A, Ugarte E, Millan J. A., 2000**).

Indeed, the structure and floristic components of vegetation serve as bio-indicators for assessing vegetation change, as they are one of the most obvious ways to describe a forest. This is important because they can help to determine ecosystem change by providing information on vegetation cover, species abundance among other vital ecological information. Knowledge of the floristic composition and structure of fallow vegetation is critical to understanding the diversity and heterogeneity of fallow ecosystems. Therefore, vegetation composition and structure constitute essential factors for assessing the biological diversity of forest ecosystems. Agoi-Ekpo has about 70% of her forest intact. But shifting cultivation is gradually modifying and degrading the rich forest vegetation of the area. The practice of slash and burn of land preparation is seriously inhibiting the regenerative capacity of plant species in abandoned farmlands. The literature is rich on the effect of farming activities on vegetation composition across different regions of the world, but in Agoi-Ekpo, the role of shifting cultivation on the development of fallow communities as well as cataloguing tree/shrub species of fallowed farmlands are lacking, which therefore suffice that there is a dearth of data in the study area. This study will therefore contribute to the hitherto scanty of information on the subject matter as well as serve as a resource material for upcoming researchers in the area and beyond. The aim of this study is to evaluate the vegetation composition, and also compare the structural and floristic pattern of fallowed vegetation that is found in the study area.

Study methodology

Study area

Agoi-Ekpo, is geographical located between latitude 5° 50' 0" North and longitude 8° 16' 0" East (**Maplandia.com, 2005**). Agoi-Ekpo is a settlement that has about 11,406 persons. The relief is undulating with some places having gentle sloping hills and valleys. The area is within the humid tropics. It has an average annual temperature of 27^0C, average rainfall of 2000-3000mm per annum and about 80% relative humidity. Vertisols are the main soils type found in the area. The geology of the area is mainly sedimentary formations **(Oden M. I, Okpamu T. A, Amah E. A., 2012**), also the topography is relatively flat. The vegetation of the study area is mainly the tropical rainforest ecosystem with some patches of derived savanna and fresh water swamp vegetation.

Procedure for Vegetation data collection

This study seeks to evaluate the variations in the patterns structural and floristic attributes of vegetation in fallows of 10yr-old - 3yr-old and farmlands. The sampled areas are of the same soil parent materials, topography, land use histories and climate. The reconnaissance survey was carried out in order to identify and establish fallow communities of different ages as provided by informants. Through this approach, patches of fallow vegetation were delineated for sampling. In the identified fallows, twelve quadrats of 20 meters x 20 meters were established, hence 10 quadrats of 20 meters x 20 meters were selected using simple random sampling technique. The selected plots were used to obtain vegetation data. Across the quadrats, woody stems with >0.05m dbh were selected measurement and enumeration as tree/shrub species (**Hall J. B, Okali D. U. U. A., 1979).**

The quadrats were used to obtain floristic (composition, density, diversity, relative dominance and frequency) and structural (girth/tree size, crown cover, basal cover and basal area) and litter depth. Data on crown cover and basal cover were determined using the line intercept method (**Coulloudon B, Eshelman K, Gianola J, Habich N, Hughes L, Johnson C, Pellant M, Podborny P, Rasmussen A, Robles B, Shaver P, Spehar J, Willoughby J., 1999)**. Tree girth (tree size) was determined using diameter at breast height of 1.3m from the ground (**Hall J. B, Okali D. U. U. A., 1979).**

. Invariably, litter depth was measured using a ruler that is calibrated centimeters. Hence, the ruler was dropped into the ground until it struck a firm surface (**Tievsky D. A., 2005**). Direct field observation and counting was adopted in determining tree/shrub species composition in each quadrat. Further, herbaceous species composition was determined using subplots of $1m^2$.Tree/shrub species identification was done with aid of a taxonomist.

Data analysis

Data obtained from the field were quantitatively analyzed using the following formula given as:

- Species density (stems/ha) was calculated using the formula given by (**Kathiresan K., 2007**) and (**Adam J. H, Mahmud A. M, Muslim N. E., 2007**) as:

$$\text{Density (stems/ha)} = \frac{\text{No. of stem of tree/shrub species per plot}}{\text{Area of plot in } m^2 \ (400\ m^2)} \times 10{,}000\ m^2$$

- Relative dominance and relative frequency for every species in each plot was calculated using the equation given by (**Cintron G, Novelii Y. S., 1984**) and (**Adam J. H, Mahmud A. M, Muslim N. E., 2007**) as:

$$R_d = \frac{\text{No. of trees/shrubs of species A}}{\text{Total No. of all tree species}} \times 100$$

$$R_f = \frac{\text{Frequency of occurrence of species A}}{\text{Total frequency of all species}} \times 100$$

- Species Diversity Index for the four fallow communities was calculated using Simpson's index of diversity given as:

$$D_S = 1 - \sum_1^i [n_i*(n_i-1)]/ [N*(N-1)]$$

Where = D_S = Simpson's index of diversity; n_i = the number of individuals in the i^{th} species collected, and N = the total number of organisms in the sample.

- Test of significance: One-way analysis of variance was used to determine the variation in vegetation characteristics across the fallow plots.

RESULTS AND DISCUSSIONS

Tree/shrub species composition on the 10yr-old fallow

The information on Table 1 reveals that 12 tree/shrub species with stand population of 1681 were enumerated on 10yr-old fallow. The information further shows that Sterculia tragacantha, Cnestis ferruginea, Baphia nitida, Napoleona vogelii and Alchornea cordifolia were the abundant species as each species had a density of 5975 ha^{-1}, 5500 ha^{-1}, 5450 ha^{-1}, 5275 ha^{-1}, and 4975 ha^{-1} and relative frequencies of 10.6%, 9.6%, 10.6%, 8.5% and 10.6% respectively. Microdermis puberula and Glyphaea brevis were least abundant and distributed on the 10yr-old fallow with densities and relative frequencies of 1200ha^{-1}, 4.3% and 625ha^{-1}, 6.4% respectively. These dominant tree/shrub species showed wide range of distribution and speciation on the 10yr-old fallow; which may be attributed to the cultivation history or fallow history. The elongation of fallow periods and absence of any form of anthropogenic perturbation encourages the rapid establishment of vegetation with luxuriant canopy as shown by the 10yr-old fallow. The established vegetation helps in suppressing soil erosion.

Table 1: Tree/shrub species composition on the 10yr-olf fallow

Trees/shrubs species	Family	No. of stems	F	R_d (%)	R_f (%)	Density (ha^{-1})
Sterculia tragacantha	Sterculiaceae	239	10	14.2	10.6	5975
Cnestis ferruginea	Connaraceae	220	9	13.1	9.6	5500
Baphia nitida	Fabaceae	218	10	13.0	10.6	5450
Napoleona vogelii	Lecythiadaceae	211	8	12.6	8.5	5275
Alchornea cordifolia	Euphorbiaceae	199	10	11.8	10.6	4975

Mallotus oppositifolius	Euphorbiaceae	171	7	10.2	7.4	4275
Margaritaria discoidea	Euphorbiaceae	143	6	8.5	6.4	3575
Allophylus africanus	Sampondaceae	88	8	5.2	8.5	2200
Cola millenii	Sterculiaceae	64	7	3.8	7.4	1600
Millettia obanensis	Fabaceae	55	9	3.3	9.6	1375
Microdermis puberula	Pandaceae	48	4	2.9	4.3	1200
Glyphaea brevis	Tiliaceae	25	6	1.5	6.4	625
Total		1681	94	100	100	42025

F = frequency of occurrences of tree/shrub species

Tree/shrub species composition on the 5yr-old fallow

On the 5yr-old fallow, 9 tree/shrub species with stem population of 1313 were encountered (Table 2). Alchornea cordifolia, Harungana madagascieriensis, Napoleona vogelii, Millettia obanensis and Albizia zygia were the most abundant species with individual density of 6425 ha^{-1}, 5825 ha^{-1}, 5425 ha^{-1}, 5225 ha^{-1} and 3475 ha^{-1} and relative frequencies of 13.5%, 13.5%, 12.2%, 12.2% and 10.8% respectively. These dominant species showed wide range of distribution on the 5yr-old fallow vegetation. Their large numbers were attributed to the reduction in anthropogenic disturbance vis-à-vis the age of abandonment. On the other hand, Eleais guineensis was the least abundant and distributed tree species with densities of 75ha^{-1} and relative frequencies of 4.1%. The felling down of palm trees during land preparation as well as its inactive propagule could be responsible for its low speciation. The practice of cutting and burning the truck of palm trees hinders rapid regeneration.

Table 2: Tree/shrub species composition on the 5yr-old fallow

Trees/shrubs species	**Family**	**No. of stems**	**F**	**R_d (%)**	**R_f (%)**	**Density (ha^{-1})**
Alchornea cordifolia	Euphorbiaceae	257	10	19.6	13.5	6425
Harungana madagascariensis	Hypericaceae	233	10	17.7	13.5	5825
Napoleona vogelii	Lecythidaceae	217	9	16.5	12.2	5425
Millettia aboensis	Fabaceae	209	9	15.9	12.2	5225
Albizia zygia	Fabaceae	139	8	10.6	10.8	3475
Spondias mombin	Anacardiaceae	110	10	8.4	13.5	2750
Allophylus africanus	Sapindaceae	96	7	7.3	9.5	2400
Margaritaria discoidea	Euphorbiaceae	49	8	3.7	10.8	1225
Eleais guineensis	Arecaceae	3	3	0.2	4.1	75
Total		**1313**	**74**	**100**	**100**	**32825**

F = frequency of occurrences of tree/shrub species

Tree/shrub species composition in the 3yr-old fallow

On the 3yr-old fallow, 5 tree/shrub species were recorded with stem population of 35 (Table 3). Anthonotha macrophylla and Rauvolfia vomitoria were the most predominant species with densities of 325 $ha^{-1}$and 225 ha^{-1} as well as relative frequencies of 34.8% and 26.1% respectively. The low composition of species in the 3yr-old fallow plot could be attributed to the slash and burn agricultural practices. This practice of land preparation for food crop cultivation reduces the complexity of the ecosystem vis-à-vis vegetation composition. Species with low range of distribution were Spondia mombin and Margaritaria discoidea with densities of 100ha^{-1}and 50ha^{-1}, and relative frequencies of 13%, and 4.3% respectively.

Table 3: Tree/shrub species composition in the 3yr-old fallow

Trees/shrubs species	**Family**	**No. of stems**	**F**	**R_d (%)**	**R_f (%)**	**Density (ha^{-1})**
Anthonotha macrophylla	Fabaceae	13	8	37.1	34.8	325
Rauvolfia vomitoria	Apocynaceae	9	6	25.7	26.1	225
Trema guineensis	Ulmaceae	7	5	20.0	21.7	175
Spondias mombin	Anacardiaceae	4	3	11.4	13.0	100
Margaritaria discoidea	Euphorbiaceae	2	1	5.7	4.3	50
Total		**35**	**23**	**100**	**100**	**875**

F = frequency of occurrences of tree/shrub species

Tree/shrub species composition on the farmland

Table 4 shows that 6 tree/shrub species with a stand population of 28 were enumerated on the farmland. Alchornea cordifolia was the most dominant tree/shrub species with density and relative frequency of 175ha^{-1} and 20% respectively; Millettia obanensis was sparsely distributed with density and relative frequencies of 75 ha^{-1}and10% respectively. The system of land preparation as earlier mentioned is responsible for the low population of these species, as they are usually cut down during land preparation.

Table 4: Tree/shrub species composition in the farmland

Trees/shrubs species		**No. of stems**	**F**	**R_d (%)**	**R_f (%)**	**Density (ha^{-1})**
Alchornea cordifolia	Euphorbiaceae	7	4	25.0	20.0	175
Bombax breviscupe	Bombacaceae	5	5	17.9	25.0	125
Nauclea latifolia	Rubiaceae	5	4	17.9	20.0	125
Allophylus africanus	Sapindaceae	4	3	14.3	15.0	100
Ficus exasperata	Moraceae	4	2	14.3	10.0	100
Millettia aboensis	Fabaceae	3	2	10.7	10.0	75
Total		**28**	**20**	**100**	**100**	**7000**

Source: Fieldwork, 2010; F = frequency of occurrences of tree/shrub species

Floristic and structural pattern of vegetation

In consideration of the floristic and structural attributes of vegetation within the fallow communities is depicted in Table 5. However, 1,681 tree/shrub species with a mean value of 168 stems per quadrat was documented on the 10yr-old fallow, while the 5yr-old fallow had 1313 tree/shrub species with a mean of 131. For the 3yr-old fallow, 35 shrub species with a mean of 4 was obtained, while in the farmland, 28 cassava stem/shrub/tree species with a mean of 5 stems per plot was obtained. Tree/shrub species composition were observed to have varied significantly among the different fallows (F =

3216.223, $p<0.01$). Thus, across the entire fallow quadrats, 3,057 tree/shrub stems ≥0.05m diameter at breast height of 22 tree/shrub species which belonged to 17 families were documented within the entire sampled quadrats. The composition of herbaceous species was high on the 3yr-old fallow and low on the 10yr-old fallow with mean values of 21.5 and 7.4 respectively. Crown cover varied significantly ($F = 594.350$, $p<0.01$) among the fallow communities with the 10yr-old fallow quadrat having a more dense and luxuriant cover as shown in Table 5. Crown cover percentage was high on the 10yr-old fallow, as compared to the 5y-old fallow and 3yr-old fallow with mean values of 91.1%, 74.92% and 36.48% respectively.

Ground cover percentages showed significant variation among the fallow plots ($F = 2171.779$, $p<0.01$). In addition, tree girth (tree size) also varied significantly ($F = 149.085$, $p<0.01$) among the fallows with mean of 0.29m, 0.21m, 0.12m and 0.18m for the 10yr-old, 5yr-old, 3yr-old and farmlands respectively. Litter depth was higher in the 10yr-old fallow than the farmlands with mean values of 0.06m and 0.04m respectively. In the same vein, 5yr-old and 3yr-old fallows, litter depth showed higher values of 0.05m as measured in the 3yr-old fallow. Therefore, litter depth variation was significantly observed among the fallow treatments ($F = 48.939$, $p<0.01$). Furthermore, basal cover varied substantially across the various fallows ($F = 538.754$, $p<0.01$) with 10yr-old fallow having the higher mean of 17.9%, 5yr-old fallow (11.17%) and the farmland (7.1%). Further, Simpson's index of diversity indicated that the 10yr-old fallow was more diverse and heterogeneous than the 5yr-old fallow and farmland with diversity indexes of 0.89, 0.86 and 0.85 respectively. The 3yr-old fallow was least diverse with Simpson's index of diversity of 0.76. This is evident as there were few shrubs stands ranging from 4 – 6 on this fallow plot, as it was principally composed of herbs.

Table 5: Summary of the result of ANOVA of vegetation characteristics across fallow treatments

Parameters	Mean values of the various fallow treatments				F-ratio
	10yr fallow	5yr fallow	3yr fallow	Farmland	
Crown cover (%)	91.11	74.92	36.48	40.65	594.350*
Basal cover (%)	17.90	11.17	4.05	7.09	538.754*
Girth (m)	0.29	0.21	0.12	0.18	149.085*
Litter depth	0.06	0.04	0.05	0.04	48.939*
Ground/ herbaceous cover	29.64	51.94	91.29	42.15	2171.779*
Trees/shrubs composition	168.1	131.3	3.5	4.5	3216.223*
Herbaceous composition	7.4	9.2	21.5	8.8	227.643*
Simpson's index of diversity	0.89	0.86	0.76	0.85	3.619^{+}

***Difference among means is significant at 1% confidence level**

$^{+}$Difference among means is significant at 5% confidence level

Discussions

The variation in vegetation characteristics among the vegetation fallows indicates that human continuous cultivation of land to meet the food needs of the present teeming population results in the alteration of forest. The result indicates increase in tree/shrub species composition in the 10yr-old and 5yr-old fallow quadrat. The variation in vegetation characteristics in the fallow plots identifies fallow period as a factor in vegetation regrowth, as its density varies with fallow period. This is consistent with the findings of (**Binelli, E. K, Gholz, H. L, Duryea M. L., 2012**) when they observed that in forest succession, species composition and ecosystem structure all change gradually over time. Thus, the spatio-temporal variation in disturbances depending on the nature (anthropogenic or natural) brings about different fallow stages and species density and diversity. The survey shows that Alchornea cordifolia and Millettia obanensis dominate the entire fallow, as they have wide range of speciation and distribution. The vegetation characteristics of the studied fallow vegetation shows that the 10yr-old fallow was densest more composed and most diverse, followed by the 5yr-old fallow and the least dense was the farmland. The somewhat low tree/shrub species density in the 3yr-old fallow and farmlands may be attributed to land preparation practices in the study area which is associated with slashing and burning of trees/shrubs removal of trunks that speeds up regeneration. This according to (**Aweto A. O., 2001; Makana J. R, Thomas S.C, 2006**) destroys buds, stems and seeds of trees in the soil which inhibits regeneration. This may have been what affected the regenerative capacity of trees in the 3yr-old fallow, as it will require more than 8 years for trees to fully establish. This observation also applies to the farmland.

The high species composition on the 10yr-old and 5yr-old fallows can be associated with the abundance of saplings, and less influence from anthropogenic disturbances as well as the cultivation history (age of abandonment) that facilitate vegetation regrowth. Ground cover percentage happened to be high on the 3yr-old fallow as a result of the dominance of herbaceous species, followed by the 5yr-old. This is obvious because during vegetation succession, herbs are the first colonizers of an abandoned land, which thereafter give way to shrubs and then trees. Their population reduces or is faced out with the development of close canopy as noticed in the 10yr-old fallow. However, the low herbaceous composition recorded on the farmland compared to the 5yr-old fallow plot is attributed to site disturbance of weeding by farmers. This affects the diversity and density of herbaceous species, as they are seen as weeds by the farmers. The canopy gaps observed on the 5yr-old fallow could be responsible for its high percentage of ground cover compared to the farmland as well as the fallow history of the sites. Thus, the soil was protected from erosion and its associated losses in the various fallows due to the protection offered by the crown and ground cover percentages. The girth measured in the 10yr-old fallow served as an indication of a resilience and less disturbances (**Attua E. M., 2003); Reddy, S., Babar S., Giriraj A, Reddy, K. N, Thulsi, R. K., 2008)**. Plant girth intercepts and depletes raindrops thereby reducing the impacts of splash erosion. Interception by plant stems (girth) diminishes rainfall energy resulting in the concentration of water at the stem bases (**De Ploey J, Savat J, Moeyerons D., 1976); Martinez-Meza E, Whitford W., 1996)**. The low girth on the 3yr-old indicates young successional vegetation whose stem size is not fully matured. This corroborates the findings of (**Finegan B., 1996**) when he observed that successional change in an ecosystem can bring about sequential physiognomic dominance by species due to their differences in their coppices, resilience, growth rates, shade tolerance, longevity, functionality and size at the time of maturity.

The variation in girth across the fallow plot is attributed to the age of site abandonment as well as the growth rate of some plant species. Litter depth suppresses erosion effectiveness by forming a mat surface which limiting runoff velocity (**Choi J, Choi Y, Lim K. J, Shin Y.C., 2007**). The low litter depth recorded on the farmland can be attributed to the practice of clear weeding practices and low diversity of tree/shrub species. For the 5yr-old fallow, the low litter depth is attributed to the composition of vegetation on the plot, as the leaves had small area index. The high basal cover recorded in the 10yr-old fallow is attributed to the dense nature tree/shrub species, while the low basal cover on the 3yr-old fallow is presumably due to its low density of tree/shrub species as well as the age of the fallow. Similar finding was reported by **(Iwara A. I, Offiong R. A, Njar G. N, Atu J. E, Ogundele F. O., 2012)**. The basal cover accounted on the farmland is attributed to the tree species allowed to grow by farmers as a result of their ecological values (basically for shading). This finding somehow corroborates the result of (**Makana J. R, Thomas S.C, 2006**) that high presence of basal area in the secondary forest, was as a result of the remnant tree/shrub species in the study area. Nevertheless, the observed poor basal cover in the 3yr-old fallow and farmland is attributed to site disturbance before abandonment. The percentage basal cover measured across the fallow treatments has implication on the absorption capability of stems and gradual moisturization of soil.

Conclusion

This study reveals that human quest for food crop cultivation plays a significant and distinctive role which brings about changes in floristic and structural composition in Agoi-Ekpo community. The area’s rich and dense forest is being gradually destroyed and simplified. The system of land preparation, slash and burn as well as trunk uprooting affects the regenerative capacity of some of the tree/shrub species as it destroys seeds in the soil. The increase in population is gradually modifying and simplifying community structure. However, to maintain the vegetation diversity of forest in the area, bush burning and trunk uprooting should be discouraged during land preparation for farming to facilitate rapid regeneration.

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