Impact of Farming on Riparian Vegetation Along Ona and Orogun Rivers, Ibadan, Oyo State, Nigeria

Impacto da Agricultura na Vegetação Ciliar dos Rios Ona e Orogun em Ibadan, Estado de Oyo (Nigéria)

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RESUMO: A agricultura tem dominado a zona ribeirinha (ripária) por causa de sua alta fertilidade que suporta e permite o alto rendimento de culturas. Neste estudo, foi feita uma tentativa para estabelecer o impacto da agricultura sobre a estrutura de espécies, composição florística das espécies e padrões de diversidade de espécies na mata ciliar. As parcelas foram dispostas em mata ciliar cultivada e não cultivada. Ao todo, um total de 20 parcelas (amostras), 10 parcelas de mata ciliar cultivada e outras dez de floresta virgem. Um quadrado do tamanho de 20m por 20m foi delimitado em cada parcela para a amostra da vegetação. Os dados foram submetidos à técnica de análise fatorial multivariada que mostrou a forte diferença de densidade das árvores entre savana ciliar cultivada e a não cultivada. A correlação entre a densidade de espécies arbóreas na cultivada e as parcelas não cultivadas utilizando o teste t-caudal mostrou que tipo de uso da terra teve uma correlação positiva com a densidade de árvores em p≥0.05. A comparação entre os dois níveis de uso do solo mostrou uma diferença significativa na estrutura, bem como a composição florística da vegetação, o que sugere um efeito da agricultura sobre a vegetação ciliar da savana. A diversidade calculada usando o índice de diversidade Simpsons revelou que as maiores diversidades foram encontradas nas parcelas não cultivadas (0,102) na zona ribeirinha e as menores (0,600) foram encontrados dentro das parcelas cultivadas da zona ribeirinha. Os resultados da pesquisa concluem que o impacto da agricultura no ecossistema ciliar leva ao esgotamento da diversidade de espécies de árvores e, finalmente, sobre a vegetação. As pessoas de dentro da comunidade devem ser envolvidas ativamente nos processos de gestão de matas ciliares e uma campanha de educação ambiental holística deve ser desenvolvida para a sustentabilidade do ecossistema ribeirinho.

Palavras chave: Área cultivada, área inculta, análise fatorial, mata ciliar.

ABSTRACT: Agriculture has been known to dominate the riparian zone because of its high fertility which supports and allows the high yield of crops. In this study, an attempt was made to establish the impact of farming on species structure, species floristic composition and patterns of diversity of species on the riparian vegetation. Plots were laid out in cultivated and uncultivated riparian forest. In all, a total of 20 plots were sampled, 10 plots from the cultivated riparian forest and the other from the uncultivated forest. A quadrant of size 20m by 20m was delimited in each plot for vegetation sampling. The data was subjected to multivariate ordination technique of factor analysis which showed the strength of the differences in tree density between cultivated and uncultivated riparian savanna. The correlation between tree species density in the cultivated and the uncultivated plots using t-tailed test showed that land use type correlated positively with tree density at P≥0.05. A comparison of the two levels of land use showed a significant difference in the structure as well as the floristic composition of the vegetation, suggesting an effect of farming on riparian vegetation of the derived savanna. The calculated diversity using the Simpsons diversity index revealed that the highest diversities were found within the uncultivated plots (0.102) on the riparian zone and the least diversities were found within the cultivated (0.600) plots of the riparian zone. The research results concludes that the impact of farming

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on riparian ecosystem leads to the depletion of tree species diversity and ultimately on vegetation. The local people within the community should be involved actively in riparian forest management processes and a holistic environmental education campaign should be embarked on for the sustainability of the riparian ecosystem.

***Key words**: cultivated, uncultivated, factor analysis, riparian forest*

INTRODUCTION

Of all human activities, agriculture has been known to dominate the riparian zone because of its high fertility which supports and allows the high yield of crops planted there. Farming and the environment are intricately entangled, Man in his use of the environmental resources has abundantly affected the vegetation cover, soil, water, air and even wildlife (Ellis & Pontius, 2007) The continued exploitation of natural resources has a huge impact on other parts of the economy. This can be seen through the rapid disappearance of forest cover that facilitates erosion process, inauspicious hydrological changes and soil degradation (Aweto 1990; Aweto and Ekiugbo 1994;). The impact of agricultural activities on the natural environment includes the creation of new habitats, the fragmentation and degradation of the existing habitats, which is brought about by the clearing and the cultivation of plant species at the expense of others (Areola, 1991). This causes a forceful change in the species composition of plant communities, with an extended destruction of the natural vegetation.

Riparian vegetation comprises of plants which grow partially or wholly in the water, clearly distinguishable in the natural state from the non-riparian communities (Alpert *et al*, 1999). The land use type practiced on a piece of land influences the floristic composition (species diversity) of the plants on that particular piece of land (Briggs and Cornelius, 1998; Álvarez-Yépiz *et al* (2008). The type of land use has both positive and negative impacts on the vegetation and other plant resources. The negative impacts include the indiscriminate felling of trees, bush fire, graffiti and litter loss of plant cover.

Land use influences the rate of change in tree and plant communities over time. Detailed scientific studies illustrate the apparent effect of farming activities resulting in modification of the original vegetation (Aduradola, 2004; Baudry *et al.,* 2000; Naiman & Décamps, 1997; Aguiar & Ferreira, 2006). Forest and natural vegetation are being lost annually due to agricultural land use.

Many of the activities of humans have had direct influence on vegetation (Busch, 1995; Flannigan *et al.,* 2005). This anthropogenic activities have an effect on the structure as well as the floristic composition of vegetation on flood plains. Indiscriminate advantageous use of savanna resources endanger both plant and animal species that are in danger of the extinction (Emuh and Gbadegesin, 2009).

The riparian zones are important natural bio-filters, protecting aquatic environments from excessive sedimentation, polluted surface runoff and erosion. They supply food and shelter for many aquatic animals and shade, which is a vital part of stream temperature regulation. When riparian zones are damaged by construction, agriculture, biological restoration can take place, usually by human intervention on erosion control and re-vegetation.

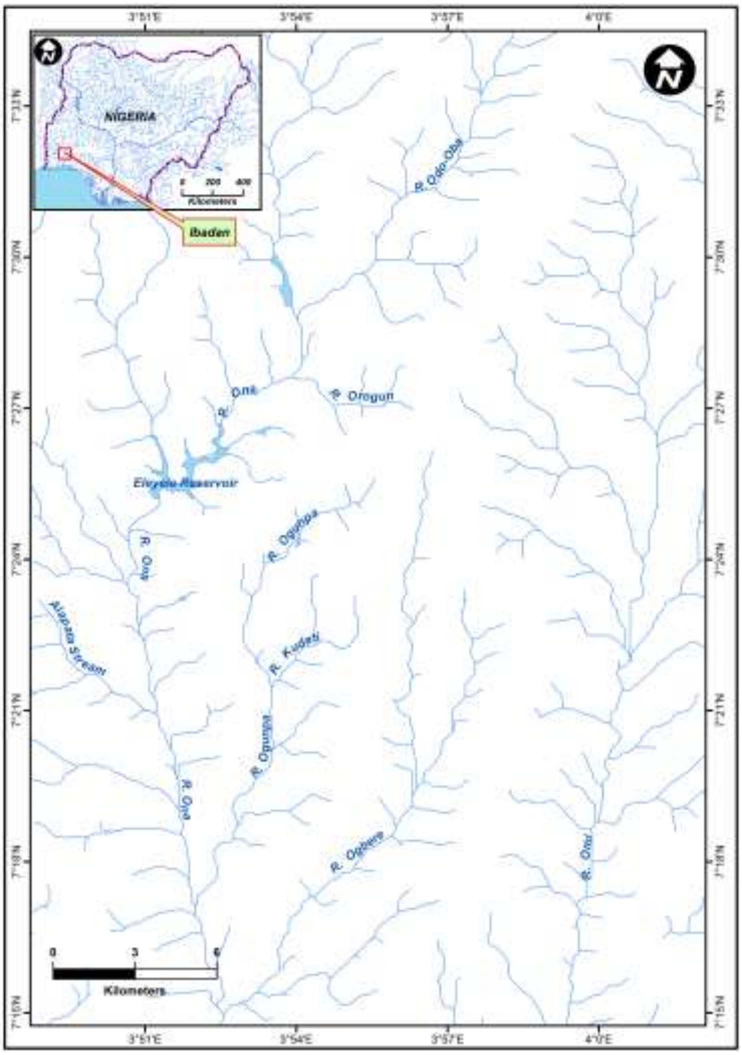
The riparian zone is mostly used for agriculture through it provide other help in the ecosystem like increase biodiversity, and provide wide life habitat, enabling aquatic and riparian organisms to move along river systems avoiding isolated communities, they can also acts as an apparatus to lessen the impacts of factors including climate change, increased runoff from urbanization and increased boat wake without damaging structures located behind a setback zone, but majorly riparian zone is utilized for agriculture. Among the activities of agriculture done at the riparian zone includes; the various farming activities and systems, lumbering, as well as the extraction of medicinal plants. These activities have promoted the growth of certain plants such as the *Imperata cylindrical* and reduced the regeneration of the original native plant species. This is because, these activities have culminated and brought about a reduced specie density, diversity and lowered the sustainability of plant species. This study therefore seeks to examine the effect of farming on vegetation (floristic composition and vegetation structure) on riparian zone in the study area, with a view to assessing the impact of this farming activities on the floristic composition and vegetation structure on the floodplain of the study area, as well as its influence on the species diversity of the plant community.

STUDY AREA

The study area is located near the forest grass land bounding south western Nigeria and located at longitude 7^0 15'S and 7^0 34'N of the equator and latitude 3^0 45'S and 4^0 5'E of Greenwich meridian. Due to this location, it experiences two major session, the wet and the dry. The annual rainfall at the study area is 1200mm of rainfall, most of which falls within the April and October. With a mean annual temperature of 27.08^0 (Egbinola and Amanambu, 2013), the dry season ranges from November to March.

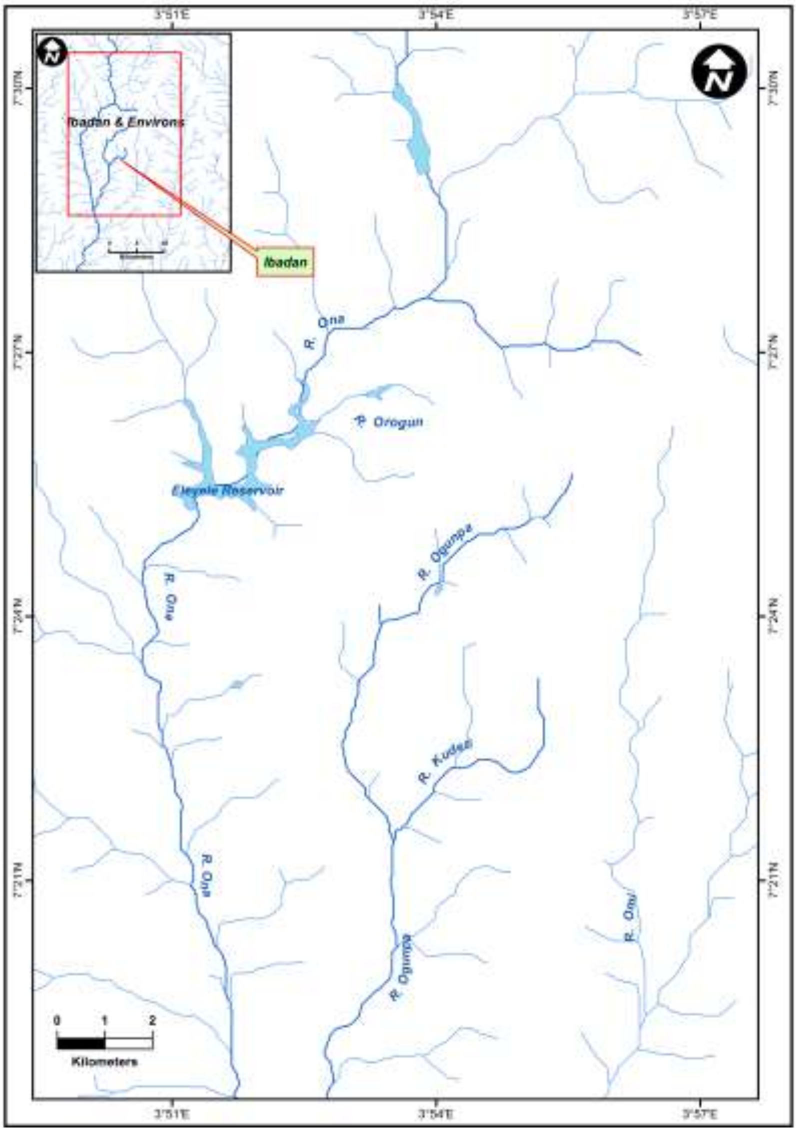
Three major landforms which are hills, plains and river valleys dominate the whole landscape of Ibadan region. Two main types of hills are recognized such as the quartzite ridge and gneissic inselbergs. Of these the quartzite ridge are by far the most impressive, widespread and the best known within the region. The plains form the most extensive landform system in the area. The general elevation is between 180m and 210m above sea level. According to Akintola (1994) this landforms makes up about 80 percent of the total surface area of the region. It covers essentially with the area between the hill bases and usually in trenched value bottoms. The river valley though not necessarily the least extensive and forms in the area. The most important feature of this landform system is the prominent incision of the rivers into the flood plain Akintola (1994). The general layout in the area conforms to the dendritic pattern, showing irregular branching in all directions with tributaries joining at all possible angles. The drainage morphology of Ibadan can be described as consisting of three river basins systems, River Ona in the western part of the region, river Ogunpa in the centre and river Kudeti (Figure 1a and 1b).

Figure 1a: Map of Nigeria, showing rivers in Ibadan



Source: Author’s elaboration, 2014

Figure 1b: Map of the studied rivers in Ibadan

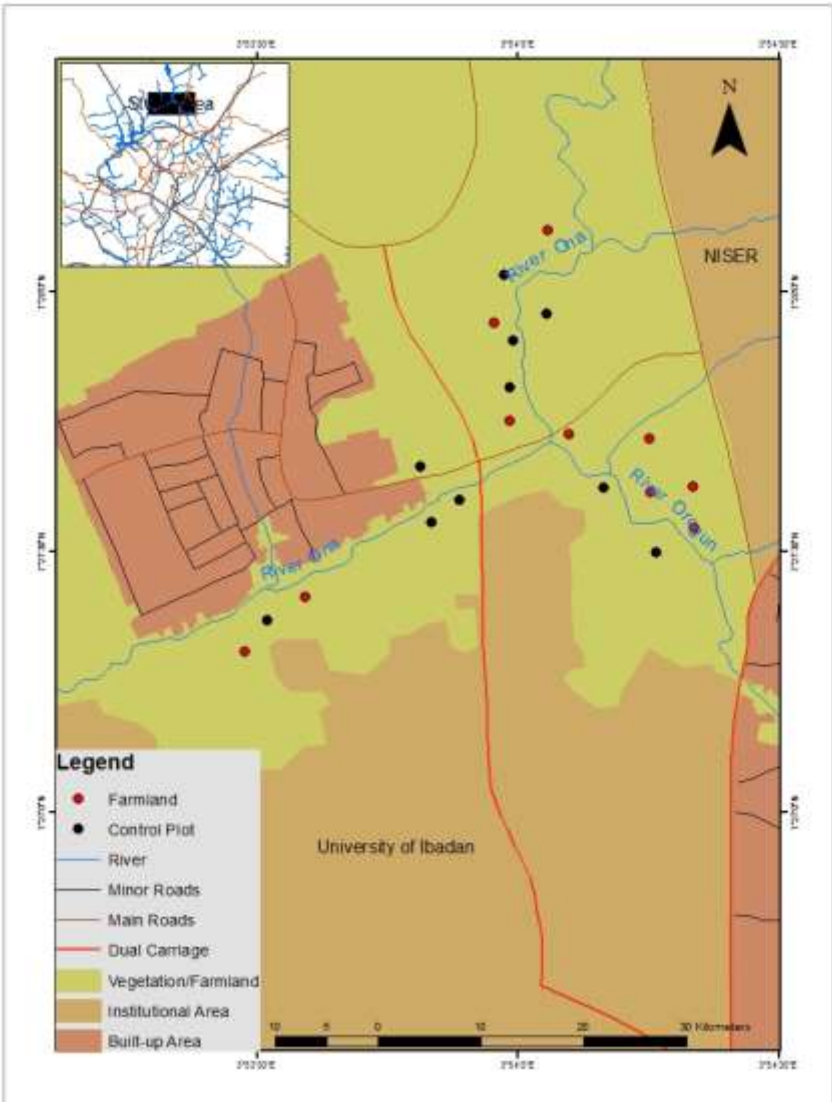


Source: Author's elaboration, 2014

The vegetation consists of secondary forest, derived savanna, farmlands and bush fallowing.The vegetation of the study area mostly consists of a patchwork of fallow regrowth which are either forest or savanna in structure at various stages of development and also matrices of tree and food crop farms. The area which was previously covered by high forest plant species is increasingly dominated by secondary regrowths of invasive herbaceous species such as the weed *Imperata cylindrical, Andropogun tectorum* (savanna grasses) in younger fallows with the presence of relict forest species such as the *Elaies guineensis* in older fallow regrowth.

Variations in soil types are largely influenced by slope and parent materials the nature and character of the soil profile in this study area is determined by the nature of the parent rock. The soil is freely drained, mildly acidic with colluvium deposits in the river valley and numerous outcrops of granite, gneiss rock on higher ground and underlain by resistant crystalline rocks of varying degrees and regolith of deeply weathered sedimentary rocks. The soil of this study area falls within the Okemesi soil associations which are formed from quartz gneisses, schist and quartzites under moist semi-deciduous forest cover (Hopkins, 1965) and belong to the ferruginous soil group which is fertile but also acidic. These soils also have a high clay content and good drainage.

Figure 1c: Map of Studied farm area



Source: Author's elaboration, 2014

Methodology

This research was based on the analysis of vegetation data collected from the study area of which primary data alone was used. The collection of the primary data at the study area Ona river floodplain, Oyo state was carried out in two ways or stages:

1. The reconnaissance data collection
2. The actual data collection

The study area (Figure 1c) was classified into two based on the farming activities of the area. They are the cultivated (farmed) and the unexploited or untouched part. The cultivated part is referred to as the Experimental plot while, the untouched part is referred to as the Control plot.

The sample plots were randomly chosen, using a table of random numbers. In the study area (site), a total number of 20 plots were delimited for study, 10 plots from the cultivated area and ten plot from the uncultivated area, the uncultivated area being the control plot as described above, left unhampered for more than 20 years. A quadrant of size 20m x 20m was measured using a tape, four ranging poles, set squares and ropes for demarcation. The number of trees within the plots were counted and recorded, and the branches from the different species were taken, tagged and put in the specimen bag. For accurate enumeration of trees, the plot was further divided into strips of 5m. Three smaller quadrants of 1m in dimension were randomly located within each of the larger quadrates for the sampling of all herbs and grasses (Adejuwon and Adeshina, 1988). While collecting different plant species in the field, it was absolutely necessary to collect plant with flowers or fruits, as it facilitates plant species identification. The sampled species were taken to the laboratory for identification.

DATA ANALYSIS

The degree of species diversity was obtained using the Simpson’s diversity index, while the Multivariate techniques of Factor analysis was used, percentages of species floristic composition parameters were obtained. The data was also subjected to the two tailed t-test.

In evaluating the impact of farming on riparian vegetation, various vegetation parameters were measured and they include: Species frequency, Tree density, Species crown cover, Girth at breast height (GBH), Tree height, Life form composition, Species abundance and Species diversity.

1. **Species frequency** was determined by distributing sample plots in the vegetation randomly, the number of plots in which the species was observed is then expressed as a percentage of the total number of plot distributed. This was done using this formula;

$$\textbf{Frequency (\%)} = \frac{\text{Number of quadrants in which the species occurred}}{\text{Total number of quadrants studied}} \times 100$$

2. **Tree density** was obtained by counting the number of trees that were present in each quadrant. In this way, the average number per quadrant was determined.

$$\textbf{Density} = \frac{\text{Total numbers of individual specie in all quadrant}}{\text{Total number of quadrants studied}}$$

3. **Species Crown Cover**: The Line intercept index method was used to determine the species crown cover. A tape (50m) was stretch in each quadrant, the portion of the tree crown lying across the tape were measured as intercepts. They were added up and expressed as a percentage of the total length of the tape used.

$$\textbf{Crown Cover} = \frac{n_1+n_2+n_3+\ldots n_{10}}{\text{Length of tape (50m)}} \times 100$$

Where, $n_1+n_2+n_3\ldots\ldots n_{10}$ = the individual specie crown cover in each quadrant

4. **Girth at Breast Height (GBH)** was measured at breast height, 1.5m above ground level. This was measured with the aid of a diameter tape, the diameter tape was wrapped around the tree at breast height to determine the circumference of each plant species.

5. **Tree Height** was obtained using the Clinometer type instrument. A clinometer measures the percent slope between the eye and both the top and bottom of the tree with consideration of the distance from the tree. Tree height was determined using the formula below;

Tree Height= % slope tree top + % slope tree bottom × Distance from the tree

6. **Specie Abundance** is the number of individual of any species per sampling unit of occurrence.

$$\textbf{Specie Abundance} = \frac{\text{Total numbers of individual of a specie in all quadrant}}{\text{Total number of quadrats in which the species occurred}}$$

Specie abundance was then expressed into five arbitrary group five arbitrary groups as Very rare, Rare, Common, Frequent and Very much frequent, depending upon the number of plants

7. The plant species found in the study area were grouped into different life form on the basis criteria outlined by Raunkiaer (1934), as modified Muller- Dombois and Ellenberg (1974)

Life-form Description

Megaphanerophyte, above 30 m high ;Mesophanerophyte ,8–30 m high; Microphanerophyte, 2 – 8 m high; Nanophanerophyte Up to 2 m hig; Chamaephyte, Up to 0.3 m high (low woody plants or Geophyte Underground herbs) and Theophyte Survival in unfavorable condition through seeds (annual plants)

8. **Species Diversity** was calculated using the *Simpson's index* of species diversity. This is expressed by $D = \sum (p_i)^2$

Where,

D = Simpson index of dominance

p_i = the proportion of important value of the i^{th} species ($p_i = n_i/N$, n_i is the important value index of i^{th} species and N is the important value index of all species)

As D increases, diversity decreases and Simpson's index was therefore usually expressed as 1 – D or 1/ D.

Factor Analysis (FA)

Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. Factor analysis searches for such joint variations in response to unobserved latent variables. The observed variables are modeled as linear combinations of the potential factors, plus "error" terms**.**

FA can be expressed as:

$F_i = a_1 x_1 j + a_2 x_2 j + \ldots + a_m x_m$

Where, Fi= factor

a = loading

x = measured value of variable

i = factor number

j = sample number

m = total number of variables

The factor analysis is one of the earliest techniques used in the construction of axes for ordination of vegetation parameters. A basic goal of all ordinations is the derivation of an ecological space from the input data in which all relationships among the entities are clearly depicted. In this study the FA proved to be the most satisfactory. This was done using the statistiXL software.

Table 1: Species Type, Frequency and Abundance

SPECIE	FREQUENCY (%)	ABUNDANCE
Ageratum conyzoides	15	Rare
Discorea alata	30	Frequent
Discorea bulbilifera	30	Frequent
Tridax procumbens	25	Common
Alchornea laxiflora	35	Frequent
Tithonia diversifolia	20	Common
Asystasia gangetica	25	Common
Azadiractha indica	45	Very Frequent
Peperomia pellucida	25	Common
Byrsocarpus coccineus	25	Common
Centrosema pubescens	25	Common
Mitrocarpus villosus	25	Common
Chromolaena odorata	10	Very Rare
Alternanthera brasiliana	5	Very Rare
Lecaniodiscus cupanioides	10	Very Rare
Manihot esculentus	5	Very Rare
Colocasia esculentus	5	Very Rare
Commelina diffusa	5	Very Rare
Phyllanthus reticulates	10	Very Rare

Oplisemus burmannii	5	Very Rare
Talinum triangulare	10	Very Rare
Morus mysozygia	25	Common
Albizia adianthifolia	25	Common
Morlonantha alnifolia	40	Frequent
Ceiba petandria	15	Rare
Manancantha alnifolia	20	Common
Spondea mombois	10	Very Rare
Antiaris africana	20	Common
Cedrela odorata	5	Very Rare
Cola milenii	20	Common
Holarrhena floribunda	10	Very Rare
Senna siamea	15	Common
Elaeis guineensis	20	Common
Afezelia African	10	Very Rare
Chlorophora excels	5	Very Rare

Source: Author's Filed work, 2013

RESULTS AND DISCUSSION

FLORISTIC COMPOSITION

Floristic composition refers to the types of plant species that occur in a plot of vegetation. It indicates the quantitative composition of plant species in a given area. The floristic composition of a stand helps to determine the species richness of the vegetation stand.

Species Density

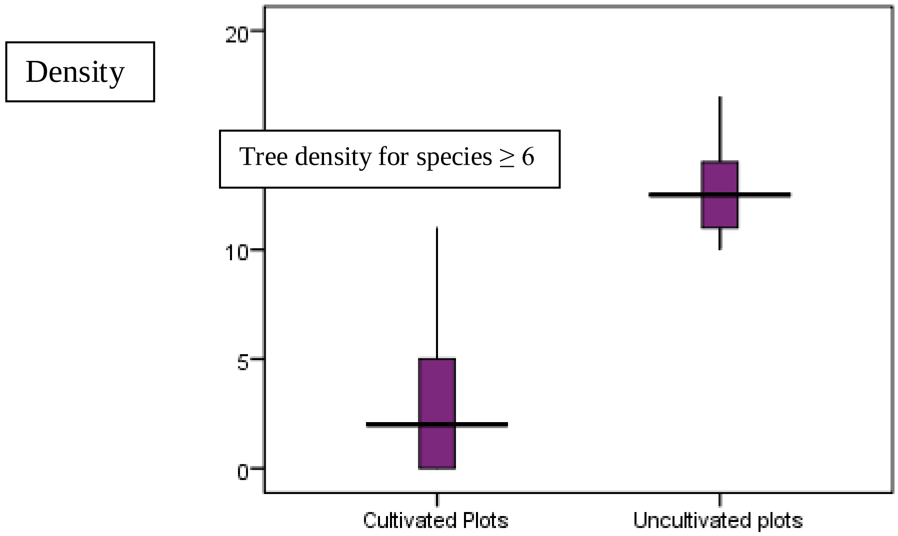
The correlation of the cultivated plot with that of the uncultivated plot showed greater density of trees in the uncultivated plot compared to the cultivated plot. Tree density (Figure 2) showed a particular increasing trend in the cultivated plot, except in plots 2,3 and 10 where the tree density were zero (0) due to the absence of trees in those plots. Table 2 shows the density values for trees in the cultivated and uncultivated plots. There was a particular increasing trend from plot 5 in the cultivated plot

Figure 2: Tree density for cultivated plot and uncultivated plot

Source: Author's Filed work, 2013

However, the reduced number of trees as found at the cultivated plot in comparison with that in the uncultivated plot with a mean of 3.1 and 12.8 (figure 3) respectively can be attributed to intensive farming activities being carried out, coupled with its associated land preparation operations and clean clearing of vegetation. Aweto (1990) pointed out that frequent burning of such fallows will reduce be invasion by forest species which are sensitive to fire and it is maintained in that state by periodic annual farmers. Pivello (2011), collaborated this view

Figure 3: Variation in tree density of species in the cultivated and uncultivated plot.



Source: Author's elaboration, 2013

Table 2: Correlation of tree densities in the cultivated and uncultivated plot (T-test Analysis)

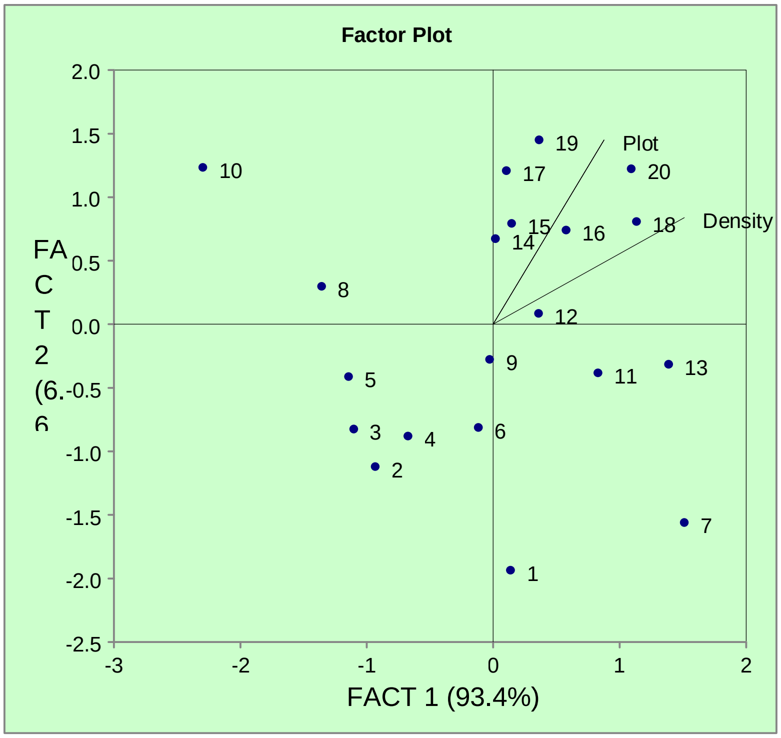
		Cultivated	**Uncultivated**
Cultivated	Pearson Correlation	1	-0.073
	Sig. (2 tailed)		0.841
	N	10	10
Uncultivated	Pearson Correlation	-0.07	1
	Sig. (2 tailed)	0.841	
	N	10	10

Source: Author's Filed work, 2013

The correlation between tree species density in the cultivated plot and the uncultivated plot, using the two tail t-test depicts that the land use type correlated positively with tree density at $P \geq 0.05$ because as crop cultivation is reduced/absence in the uncultivated plot, density of trees increases (table 2).

The factor analysis was used to show the relationship between ecological sites and their degree of tree density which basically depended on land use type. Ordination of tree density using factor analysis (table 3) revealed that plots clustered based on their levels of tree densities. The ordination diagram as shown in figure 2 indicates that plots 12 to 20 clustered on the upper right of the plot area in the ordination program where essentially uncultivated savanna plots and clustered due to their high level of tree density. Plots 1 to 11 and 13, which are scattered in the plot area are cultivated plots and their scattered nature indicates a low level of tree density.

Figure 4: Factor Plot



Source: Author's elaboration, 2013

Table 3: Summary of Eigen values of FA on 20 plots

Explained Variance (Eigenvalues)

Value	Factor 1	Factor 2
Eigenvalue	1.868	0.132
% of Variance	93.386	6.614
Cummulative Variance %	93.386	100

Source: Author's elaboration, 2013

Table 4: Casewise factor scores for the ordination diagram of the sampled plots.

Casewise Factor Scores		
Case	Factor 1	Factor 2
1	0.137	-1.935
2	-0.933	-1.12
3	-1.103	-0.826
4	-0.675	-0.879
5	-1.145	-0.411
6	-0.117	-0.812
7	1.511	-1.56
8	-1.357	0.298
9	-0.029	-0.276
10	-2.297	1.234
11	0.829	-0.383
12	0.359	0.085
13	1.387	-0.315
14	0.017	0.674
15	0.147	0.794
16	0.575	0.741
17	0.105	1.209
18	1.133	0.808
19	0.364	1.45
20	1.092	1.223

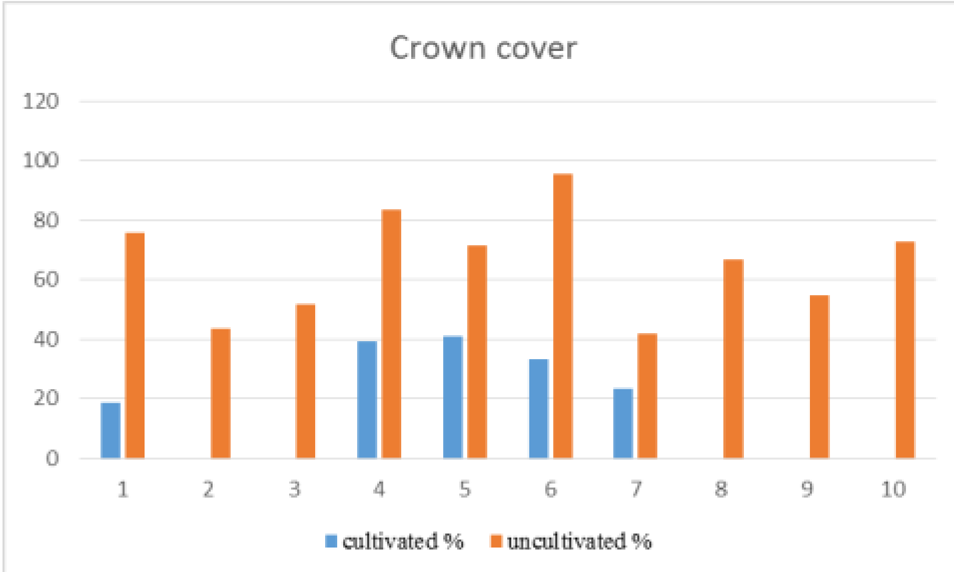
Source: Author's Filed work, 2013

Crown Cover

Correlation of tree crown cover between the cultivated plot and the uncultivated plot revealed that tree crown cover were higher (greater proportion) in the uncultivated savanna compared to the cultivated plot. This is attributed to the greater number of trees that was found on the uncultivated plot, due to the relative absence of trees in those plots.

As opposed to the uncultivated plot with the highest and lowest crown cover of 95.45% and 42% in plots 6 and 7 respectively (Fig 5), the cultivated plots had a low crown cover with a highest crown cover value of 41% and a lowest value of 0%. This is actually due to the reduced number of trees and less ground covered attributed to the influence of tree felling, cultivation and other related farm activities.

Figure 5: Variation in crown cover according to plots in the sampled sites



Source: Author's elaboration, 2013

The correlation of crown cover in the cultivated plot with that of the uncultivated plot, using the two-tailed t test indicates that land use type correlated positively with tree density at $P < 0.05$ (table 5)

Table 5: Correlation of crown cover in the cultivated and uncultivated plot (**One-Sample Test**)

Eigenvalue	1.868	0.132
% of Variance	93.386	6.614
Cummulative Variance %	93.386	100

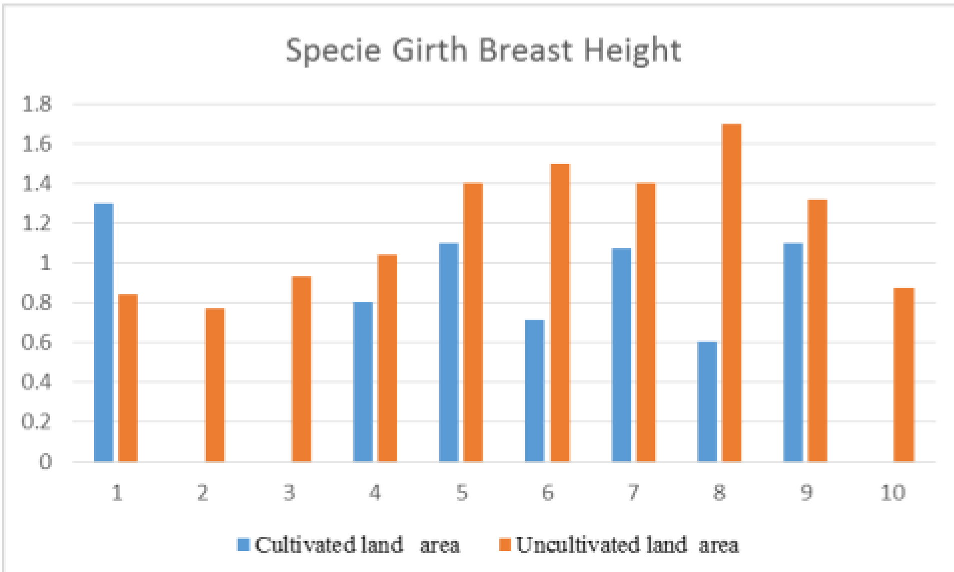
			Test Value = 0			
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
cultivated %	2.786	9	0.021	15.48	2.91	28.05
uncultivated %	11.876	9	0	65.835	53.29	78.38

Source: Author's Filed work, 2013

Species Girth

The girth (circumference) of a tree is a reflection of its maturity. The more matured a tree is under favorable physiologic conditions, the wider its girth. Comparing the girth breast values in the cultivated and uncultivated plot, showed with an exception of plot 1 which had a higher girth value of 1.3 m compared to its counterpart in the uncultivated plot with a lower girth value of 0.84m (fig 6). Plots 2, 3 and 10 in the cultivated savanna had no girth value, due to the absence of trees in those plots.

Figure 6: Girth values for cultivated and uncultivated land area



Source: Author's elaboration, 2013

In general, the cultivated plots had a much lower tree girth compared to the uncultivated plots. This can be attributed to the different farm land preparation operations being carried out, most especially clearing vegetation, bushy burning which not only affect the physiologic growth of trees present on farmlands but also those around the farmlands. The higher tree girth in the uncultivated plot is attributed to the greater number of trees and favorable physiologic growth conditions due to the absence of farming activities.

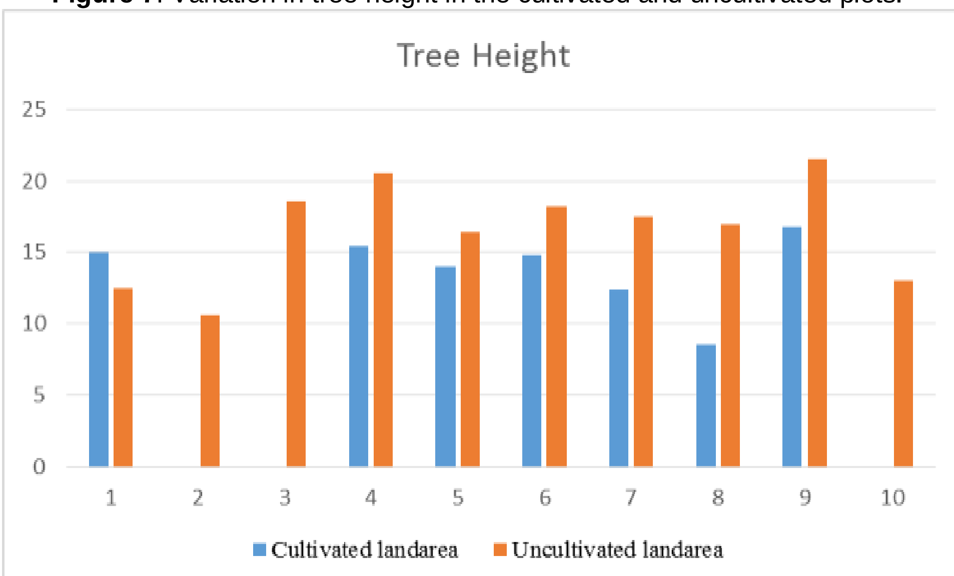
SPECIES STRUCTURE

Species structure refers to the spatial arrangement in space of plants occurring in the vegetation i.e. the horizontal and vertical distribution of plant individuals in space. It is often referred to as the spatial arrangement of plant individuals that characterize a vegetation stand.

Tree Height

The mean tree height in plots in the cultivated plots was found to be lesser than the plots in the uncultivated plots with the exception of plot 1 which had a greater mean height of 15m compared to its counterpart in the uncultivated with a mean height of 12.5m (fig 7). This is due to the presence of a lot of fallen trees in plot 1 of the uncultivated plots. However, the reduced tree height in the other plots at the cultivated plots is attributed to be as a result of the reduced number of trees, increased farm/land preparation operations (bush burning) and other physiologic stress (branch cutting) induced by farming activities.

Figure 7: Variation in tree height in the cultivated and uncultivated plots.



Source: Author's elaboration, 2013

Life Form Composition

The life form composition gives an expression to the structure of the plant community Hopkins (1965). The plant individuals in the sampled plots of the cultivated and uncultivated plots were assigned to the life form classes they belonged.

Table 6: Life Form Spectrum.

	Cultivated		**Uncultivated**	
Life form	**Number of Individuals**	**Percentage %**	**Number of Individuals**	**Percentage %**
Megaphanerophytes	-	-	-	-
Mesophanerophytes	31	19.38	119	94.49
Microphanerophytes	-	-	9	5.51
Nanophanerophytes	-	-	-	-
Chamaephytes	29	18.13	-	-
Hemi cryptophytes	27	16.88	-	-
Cryptophytes	8	5	-	-
Therophytes	65	40.63	-	-
Total	160	100	129	100

Source: Author's Filed work, 2013

According to classes (table 6), the uncultivated and the cultivated plots had no proportion of Megaphanerophytes (plants over 30m). The relative absence of Megaphanerophytes in the cultivated plots is attributed to the intense cultivation being carried out coupled with its associated farming systems and land preparation operations which involves cutting down trees.

Mesophanerophytes (plant species 8m-30m tall) Accounted for more than 50% of the species present in the uncultivated plots and less than 20% in the cultivated plots, with a mean of 94.49% and 19.38 % in the uncultivated and cultivated plots respectively (Table 6). The lower percentage on the cultivated plot is consequently the influence of farming activities and tree felling.

The proportion of Microphanerophytes (plants with their perenating buds between 2-8m) is also quite high in the uncultivated plots due to the evident gap in the tree canopy. Its relative absence in the cultivated plots is due to the influence of continuous weeding, tree felling, tree stump removal and bush burning.

The proportion of Hemicryptophytes and Cryptophytes recorded high in the cultivated plots and there was an absence of both in the uncultivated plot. The proportion of Hemicryptophytes and Cryptophytes in the cultivated plots was put at 16.88 and 5% respectively, with the relative absence of these two in the uncultivated plots.

The relative absence of Cryptophytes and Hemicryptophytes in the uncultivated plots was due to the presence of broad tree crown cover which provided shade for the ground from sunlight, thus providing an unfavorable condition for the survival and growth of Hemicryptophytes and Cryptophytes. Their abundant presence at the cultivated plot can be attributed to the open canopy nature (reduced / no crown cover) in the farmlands which allow access to solar radiation in association with other farming activities, hence allowing and favouring the growth of Hemicryptophytes and Crytophytes.

Therophytes (annual plants that survive the unfavorable season as seeds) were also absent in the uncultivated plots but present at the cultivated plots with a mean of 40.63% and Chaemaphytes was present at the cultivated plot with a mean of 18.13% (Table 6)

Diversity Patterns

High levels of floristic diversity were found within the uncultivated plots at the riparian zones of the two rivers, while the cultivated plots had lower levels of floristic diversity.

Table 7: Species Diversity values on the cultivated plots on the riparian zone

Species	**Ni**	**ni/N**	**$(ni/N)^2$**
Agaratum conyzoides	11	0.069	0.005
Discorea alata	11	0.069	0.005
Discorea buibilfera	10	0.063	0.004
Tridax procumens	10	0.063	0.004
Alchornea laxiflora	14	0.088	0.008
Tithonia diversifolia	9	56	0.003
Asystasia gangatica	10	0.063	0.004
Azadraetha Indica	19	0.119	0.014
Peperomia pellueida	6	0.038	0.001
Byrsocarpus coccineus	6	0.038	0.001
Centrosema pubescens	8	0.05	0.003
Mitrocarpus villosus	4	0.025	0.001
Chromolaena odorata	3	0.019	0
Alternanthera brasiliana	3	0.019	0
Lecaniodiscus cupanioides	4	0.025	0.001
Manihot esculentus	2	0.013	0
Colocasia esculentus	2	0.013	0
Commelina diculatusiffusa	2	0.013	0
Phyllanthus reticulates	3	0.019	0
Oplisemus burmanami	3	0.019	0
Talinum triangulare	4	0.025	0.001
Elaeis guineensis	9	0.056	0.003
Cola milemii	4	0.025	0.001
Albizia adianthifolia	1	0.006	0
Total	160		0.6

Source: Author's Filed work, 2013

Using the formula ƹ (ni/N), for Simpson's diversity index, an index of 0.600 is realized.

As depicted in the table above, the Simpsons diversity index showed a relatively higher floristic diversity in the uncultivated plot as compared to that of cultivated plots on the riparian zones with a diversity value of 0.600 (table 7) and 0.102 (table 8) and respectively for Simpson's index. The rationale for species diversity is based on the injunction that the higher the Simpsons value, the lower the level of species diversity and vice-versa.

The low level of species diversity obtained in the cultivated plots (Table 7) explains the rate of flora biodiversity loss that takes place in the riparian forest. This of course is directed to the incessant and continued felling of trees and indiscriminate clearing of the vegetation for the purpose of crop cultivation, bush burning which led several fire-sensitive plant species to extinction and, the various adopted farming system including shifting cultivation which goes a long way in reducing flora biodiversity. As forest landscape becomes increasingly cleared (altered) and previously isolated core-habitats become exposed to external conditions all of which result in a progressive erosion of biological diversity (Tilman & Thompson, 1997; Diamond *et al.,* 2002).

Table 8: Species Diversity for the uncultivated plots of the riparian zones of the two rivers.

Species	**ni**	**ni/N**	**$(ni/N)^2$**
Morus mesoygia	18	0.137	0.019
Albizia adiarithifolia	16	0.122	0.015
Marlaneartha alniofia	24	0.183	0.034
Ceiba petandria	8	0.061	0.004
Spondea mombis	6	0.046	0.002
Chlorophira excels	3	0.023	0.001
Elaeis guineensis	2	0.015	0.000
Senna siamea	8	0.061	0.004
Holarhena floribunda	9	0.069	0.005
Antiaris Africana	11	0.084	0.007
Cola milenmi	8	0.061	0.004
Cedrela odorata	5	0.038	0.002
Alfezia Africana	8	0.061	0.004
Azadirachta indica	2	0.015	0.000
Chlorophera excelsa	3	0.023	0.001
Total	131		0.102

Source: Author's Filed work, 2013

COMPARATIVE EVALUATION OF RESEARCH FINDINGS.

The sampled sites in the study area can be divided into two groups based on their land use type. The uncultivated plots composed essentially of forest and savanna species, here Trees were majorly found while the cultivated plot mainly consisted of grasses, herbs, shrubs and savanna trees. A closer examination of the species structure suggest that land use affects the species composition of the area under investigation, which means that without man's anthropogenic activities through crop cultivation, bush burning in the study area, the cultivated plots will not differ significantly from the uncultivated plots in terms of their flora biodiversity and species composition (Clayton, 1958). A great deal of ecological evidence suggests a change from forest to savanna vegetation type in some areas as a result of cultivation and burning, and the destructiveness of late burn. It was evident in most plots of the cultivated plots (plot 7 and 9) of the cultivated plots, we had the presence of forest tree species, supporting the point that if such sampled sites are left undisturbed for a long period of time, they will be invaded by plants and tree species thus, increasing its flora biodiversity. It is therefore reasonable to summarize that in the absence of human factor (anthropogenic activities) which in the cultivated plots are mainly bush burning and crop cultivation, the forest tree species will occupy the sites now being cultivated.

CONCLUSION

The study area is within the derived savanna, the derived savanna within the study area consists in addition to the forest and savanna species, a matrix of food crops and farmer driven savanna trees. The cultivation of crops is essential for the production of food, but lack of competent managerial and conservational practices can and has led to the depletion of riparian vegetation. Farming and its associated traditional farming practice of bush burning and shifting cultivation on the riparian zone has led to an increased flora biodiversity through specie removal that led to species depletion and the dominance of obnoxious grasses, herbs and weeds. For the conservation of the riparian ecosystem, it is important for the local people within the community to be involved actively in riparian forest management processes and a holistic environmental education campaign should be embarked on for the sustainability of the riparian ecosystem.

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