Ilorin Journal of Science
Volume 3, Number 1, 2016, pp. 40 – 68 (Printed in Nigeria)
ISSN: 2408 – 4840 © 2016 Faculty of Physical Sciences, University of Ilorin
https://doi.org/10.54908/iljs.2016.03.01.004

ILORIN
JOURNAL OF SCEINCE

ILJS-16-032

Tree flora and their environmental services to man: a case study of University of Benin

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Abstract

University campuses may be characterized by their plant species which add value to the environment. Tree species in the Ugbowo campus of University of Benin, Benin City, Nigeria were identified in this study. Using field surveys and structured questionnaires, trees species were inventoried based on their names, habit, environmental roles, and economic values. The study area was divided into 3 sites to enable accurate sampling of tree species. Number of individual species, total count of tree flora, relative density and relative abundance were assessed using appropriate ecological models. A total number of 268 trees comprising 24 species of trees from 14 families were encountered. *Tectona grandis* had the highest relative density and abundance of 27.99 and 0.28 respectively. About 181 trees (67.54 %) were dicots, and 87 (32.46 %) were monocots. More so, 202 (75.37 %) of the trees were exotic and 66 (24.63 %) were native. Margalef species richness was 2.339, 1.717 and 2.463 for sites A, B, and C respectively. Furthermore, Shannon-Wiener diversity index were 4.926, 57.555 and 227.654 for sites A, B, and C respectively. The different diversity values are supported by Sorenson's similarity index, which suggest the sites are not similar. Some of the environmental services of the campus tree flora include; nutrient sink, add to the overall campus aesthetic, serve as shield from UV rays, contribute to student education, environmental monitoring, reduce air pollution, erosion control and bio resource conservation. Therefore, majority of the respondents (72 %) strongly disagreed with continuous felling of trees. This study suggests an increase in the cultivation of native tree species as an avenue to improve the diversity of trees in the campus.

Keywords: Tree flora, Plant diversity and conservation, Ethnobotany, Ecological models, Environmental services

1. Introduction

Plants are critical to life on earth because they provide oxygen, form the basis of food webs and provide important raw materials (Osawaru and Ogwu, 2014; Ogwu *et al.*, 2014a, b;

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2016). Therefore, it is impossible to think about the environment without plants (Robbins *et al.,* 1965). In the same vein, humans have long had a profound influence on the ecosystems (Schroth and Sinclair, 2003). Some activities have led to minor effects, while others have led to significant changes in vegetation.

Continuous increase in human populations has caused pronounced reductions in forest and tree cover as forests are converted to urban centers. Trees are a major component of our environment with a vital role including improving soil fertility, erosion control, moisture and organic matter conservation, alternative food, fodder, firewood, medicine and nutrient supply and income generation, household tools and utensils (Brown, 2001; Warner, 1993; Tian *et al.,* 2001; FAO, 2002; Sangha *et al*., 2005; Ladipo, 2008; Oboho, 2012). Trees remain an important element of most human-dominated landscapes almost throughout the world. These trees contribute to nutrient cycling in addition to providing a wide range of important products, service and functions (Sharma, 1997; Young, 1997; Schroth and Sinclair, 2003; Tesfaye, 2005; Osawaru *et al.,* 2014a). Thus, woody species diversity can contribute to ecosystem productivity and sustainability under conditions of heterogeneity in species traits and environmental characteristics in agricultural landscapes (Kindt *et al.,* 2005). Trees in urban centres provide benefits such as conserving energy, improve air quality, reduce erosion and flood risks, add to the aesthetics of the environment, promote biodiversity and ethnobotany, support education and research and enhance the health of urban dwellers.

It is understood that views of trees and nature are known to reduce stress, help improve mental wellbeing and recovery from illness (Taylor *et al.*, 2001). It has been shown that humans derive pleasure from trees as they facilitate greater interactions among local residents, which improves neighbourhood socializing (Lewis, 1996; Kou *et al.,* 1998). Some products obtained from trees include timber, which in Nigeria is supplied by Mahogany (*Khaya* species), Obeche (*Triplochiton scleroxylon*) and Iroko (*Milicia excelsa*). Ingo dye comes from *Lonchocarpus cyanescere*. Raphia supplies broom and roofing materials, shear-butter fat comes from *Butyrespermum paradoxum*. Tannins are inorganic compounds, which are also employed in oil drilling to reduce the viscosity of the drill without reading specific gravity and can be obtained from the red mangrove tree, *Rhizophora mangle*, abundant in South Eastern Nigeria (Naqui 1975). Air pollution is a major public health issue in urban areas, which may be remediated by abundant trees (Beckett *et al.,* 1998; Bolund and Hunhammar, 1999; Tiwary *et al.,* 2009; Ogwu *et al.,* 2014b). However, coniferous trees are sensitive to air pollution and deciduous trees are better at absorbing gases (Stolt, 1982). Trees also provide valuable shading from excess solar radiation. An individual tree can provide a Sun Protection Factor of 6 to 10, which means a level of exposure to ultraviolet radiation of one sixth to one-tenth of full sun (NUFU, 1999).

This study aims to assess the tree flora of Ugbowo campus, University of Benin, Nigeria and their environmental services. To achieve our aim, we will conduct an inventory of tree species, study their diversity and record their environmental roles as perceived by the inhabitants. This will foster an understanding of potential and actual value of the tree flora. It will also contribute to the future development of a Flora for University of Benin. This study will also contribute to proper identification of tree flora in the study area and highlight appropriate method to conserve and utilize their germplasm. More so, it will contribute towards understanding urban diversity and utilization of tree species.

2. Materials and Methods

Study area: This study was conducted in the University of Benin main campus, situated at the Ugbowo axis of Benin City (6.20 – 5.37 ˚N) with a land area of 361 hectares. The study area falls within Ovia – North East Local Government Area of Edo state with a land area of 2,301 Km^2. The geography is hilly and flat type, moats and gully site, with lots of vegetation. It lies at an elevation level of about 500 feet in the south and up to 1800 feet in the north. It has a red soil, mostly loamy in some areas with a little bit of clay present. The vegetation is comparable to the rainforest. With tall trees and rich soil which creates a good and conducive environment for the growth and development of rich vegetation with both indigenous and exotic trees. Great anthropogenic alteration over a long period of time had replaced the previous forest with mosaic or secondary forest (Dania-Ogbe *et al.,* 1992). All waters in the campus are drained into Ikpoba River, this flows across the campus at the northern axis into the Ikpoba dam situated about 3 km away from the site of the university. Farming activities are mostly carried out by members of residential quarters on marginal lands, to substitute the income and dietary needs of the members of the household and these activities are mostly carried out by the women.

Sampling frame: The study area was divided into three sites A, B and C. Using the main road as a transient to enable an accurate sampling and proper counting of tree species. From the University main gate towards Anikulapo roads, through the University farm project, senior staff quarters, and to the blocks of flats. Trees were counted to the right and to the left. Site A begins from the main gate and ends at the farm project. Site B begins from the senior staff quarters and ends at Faculty of Arts. While site C begins from Faculty of arts and ends at blocks of flats. Sampling site is represented as Figure 1 where,

Site A = from university main gate to farm project.

Site B = from senior staff quarters to faculty of arts

Site C = from faculty of arts to blocks of flat.

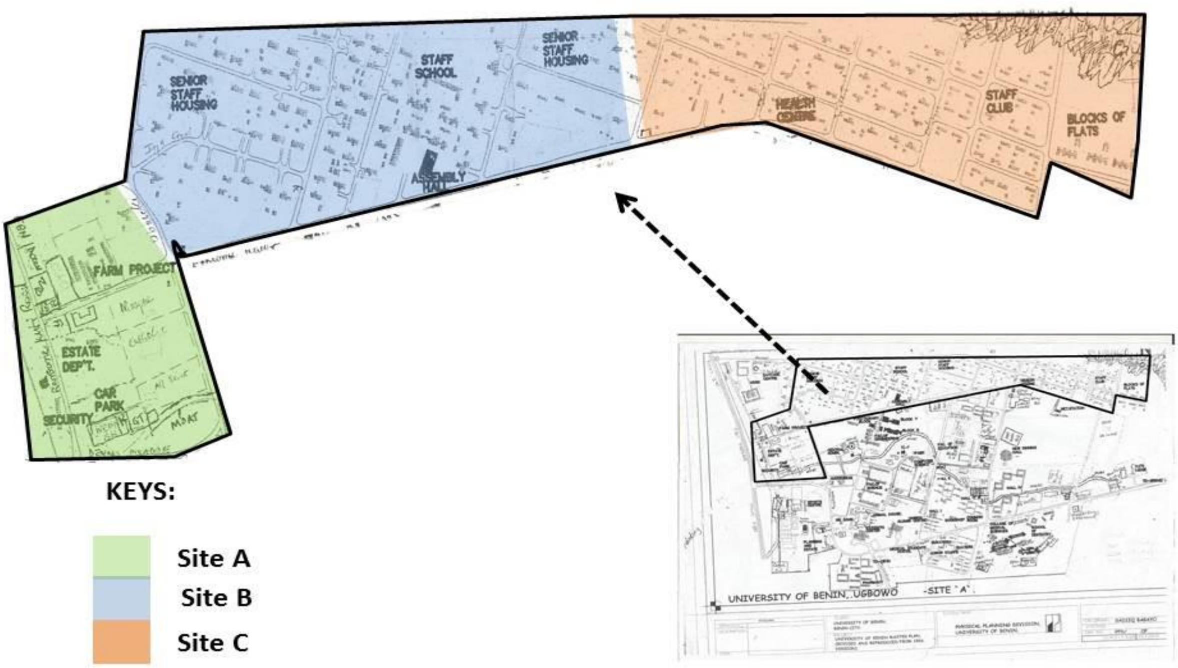

Figure 1: Map of study area with sampling site highlighted

Identification of tree flora: Three field surveys were conducted with two weeks interval between each survey. Through these surveys, all the tree flora encountered within the sample area were recorded as well as their frequency of occurrence. Species identification was done with the aid of Tropical Tree Crops Okpeke (1987), Trees of Nigeria (Keay, 1989), Flora of West Tropical Africa (Hutchinson and Dalziel, 1958 -1968), Useful Plants of West African Tropical Africa (Burkill, 1985; 1994; 1995; 1977 and 2000). Herbarium collections were made and referred with dose of Forest Herbarium Ibadan and local names were also used to identify taxonomic species. Vouchers of trees collected were deposited in the Herbarium unit, Department of Plant Biology and Biotechnology, University of Benin, Benin City.

Data analysis: In other to get an open and public view on tree flora and their environmental services, semi structured open and close ended questionnaires were used to sample opinions of inhabitants through interviews.

The Margalef species richness index (d), Shannon Weiner index (to determine diversity; H) and Sorenson similarity index (Cs) were determined according to Strin (1981); Osawaru *et al.* (2014b); Yu and Yoo (2015). Data obtained from tree species composition was analysed to obtain relative density (%) and relative abundance.

$$\text{Relative density of species (RD)} = \frac{\text{Number of individual species} \times 100}{\text{Total number of trees}}$$

$$\text{Relative abundance of species (Pi)} = \frac{\text{Relative density of species}}{100}$$

The various species were scored according to their relative densities (RD); i.e. abundant ($RD \geq 5.00$), frequent ($4.00 \leq RD \leq 4.99$), occasional ($3.00 \leq RD \leq 3.99$), rare ($1.00 \leq RD \leq 2.99$) and threatened/endangered ($0.00 < RD \leq 1.00$). The information obtained from the questionnaire were analysed using percentages and means of the distribution.

3. Results

The results of this study are represented in Tables 1 – 8 and Figures 2 – 4.

Table 1 represents the tree flora encountered in the study area, identified by their botanical and common names alongside their families, habitat and economic values. All species identified were terrestrial. A total of 24 different tree species belonging to 14 families were recorded.

Table 1: List of tree flora in the study area and their economic values.

Botanical name	Common name	Family	Habitat	Economic value
Peltophorum pterocarpum (Dc.) Bater ex K. Heyne	Yellow flamboyant, Yellow flame tree.	Fabaceae	T	Dyes and Tannins, Forages, Timbers, Auxiliary plants, Medicinal plant.
Ficus saussureana (Dc.)	Loquat–leaf fig.	Moraceae	T	Medicinal plant.
Ficus benjamina (Linnaeus)	Oval-leaf,Fig tree, Weeping fig.	Moraceae	T	Timbers, Essential oil, Medicinal plants, Exudates, Fibres.
Terminalia catappa (Linnaeus)	Indian almond, Tropical almond.	Combretaceae	T	Dyes & Tannins, Fruits, Timbers, Medicinal plants,Vegetable oil.
Jacaranda mimosifolia (D.Don).	Blue jacaranda,Argentinian/Brazilian Rosewood	Bignoniaceae	T	Dye & Tannings, Timbers, Auxiliary plants, Fuel.
Mangifera indica (Linnaeus)	Mango	Anacardiaceae	T	Medicinal plants, Fuel, Forages, Timber, Fruits, Essential oils and Exudates.
Ficus umbellate (Vahl)	Fig tree	Moraceae	T	Ornamentals,fruits, fuels, dyes and tannins.
Ficus elastica (Roxb. ex Hornem)	Rubber fig	Moraceae	T	Ornamentals, essential exudates.
Hura crepitans (Linnaeus)	Sand-Box Tree, Catalia, Cuba Amarilla, Javillo.	Euphorbiaceae	T	Timbers, Auxiliary Plants, Medicinal plants.

Cocos nucifera (Linnaeus)	Coconut Palm, Copra, Porcupine Wood	Euphorbiaceae	T	Fibres, Medicinal plants, Essential oil, Fuel plants, Condiments.
Terminalia ivorensis (A.Chev.)	Black Afara, Satin Wood, Ivory-Coast Almond	Combretaceae	T	Dyes & Tannins, Auxiliary Plants, Medicinal.
Delonix regia (Bojer) Raf.	Royal poinciana, Gold mihur, Flamboyant.	Fabaceae	T	Plant dyes & Tannins, auxiliary plants, medicinal plants, essential oil.
Bauhinia morandra (Kurz)	Butterfly-flower,Jerusalem-date, Pink bauhinia.	Fabaceae	T	
Anacardium occidentale (Linnaeus)	Cashew, Cashew tree.	Anarcadiaceae	T	Medicinal plants, Fuel plants, Essential oil, Vegetable oil, Dyes & Tannins.
Elaeis guineensis (Jacq.)	Oil palm,African oil palm.	Arecaceae	T	Medicinal plants, Spices, Condiment, Stimulants, Fuel, Plants, Fibre.
Ricinodendron heudelotti (Baill.)	African wood-oil nut tree, Erimado.	Euphorbiaceae	T	Fruit, Fuel plant, Medicinal plant, Vegetable oil, Miscellaneous.
Cordia millenii (Baker)	African Cordia, Drum tree, West African Cordia, Drum tree.	Boraginaceae	T	Ornamental, Medicinal plant, Miscellaneous.
Hildegardia barteri (Mast.) Kosterm.	Kariya.	Malvaceae	T	Ornamental, Timber, Vegetable oil, Fibre.
Tectonia grandis (Linnaeus)	Bankok teak, Indian-oak, Teak.	Verbenaceae	T	Dyes & Tannins, Ornamental, Fruit.
Musa paradisiaca (Linnaeus)	Plantain.	Musaceae	T	The leaves are used for the preservation and storage

				of cocoyam. Eaten and sold in the market
Carica papaya (Linnaeus)	Papaya, Paw-Paw.	Caricaceae	T	Essential oil, Fibre, Condiment, Miscellaneous.
Eucalyptus camaldulensis (Dehnh.)	Blue gum, Murray red gum, River red gum.	Myrtaceae	T	Ornamental, Timber, Auxiliary plant, Medicinal plant.
Eucalyptus todtiana (F. Muell)	Coastal black butt, prickly bark.	Myrtaceae	T	Ornamentals, Auxiliary plants, timber.
Citrus sinensis (L.) Osbeck	Orange, Sweet orange.	Rutaceae	T	Timber, Medicinal plant, Essential oil and Exudate.

Table 2 presents plant families and number of individual species encountered in the study area. A total of 14 families were recorded.

Table 2: List of families and number of individual species

Family	No of individual
Fabaceae	3
Moraceae	4
Combretaceae	2
Bignoniaceae	1
Anacardiaceae	2
Euphorbiaceae	3
Arecaceae	1
Boraginaceae	1
Malvaceae	1
Verbenaceae	1
Musaceae	1
Caricaceae	1
Myrtaceae	2
Rutaceae	1

The total count of tree flora in the study area is presented in Table 3. Site C had a higher number of individual trees with a total of trees 196, Site B with a total of 59 trees and Site C with a total number of 13 trees. The family Verbenaceae had the highest number of individual trees.

Table 3: Total count of tree flora from the different sites.

Tree species	**Site A**	**Site B**	**Site C**	**Total**
Peltophorum pterocarpum	1	-	-	1
Ficus saussureana	1	-	-	1
Ficus benjamina	1	-	-	1
Terminalia catappa	3	5	13	21
Jacaranda mimosifolia	1	-	10	11
Mangifera indica	1	-	4	5
Ficus umbellate	-	3	-	3
Ficus elastic	-	9	-	9
Hura crepitans	-	4	-	4
Cocos nucifera	-	6	-	6
Terminalia ivorensis	-	17	-	17
Delonix regia	-	14	-	14
Bauhinia morandra	-	-	1	1
Anacardium occidentale	-	1	-	1
Elaeis guineensis	-	-	8	8
Ricinodendron haudelotii	-	-	1	1
Tectonia grandis	-	-	75	75
Cordia millenii	-	-	4	4
Hildegardia barteri	-	-	3	3
Musa paradisiacal	-	-	29	29
Carica papaya	5	-	6	11
Eucalyptus camaldulensis	-	-	18	18
Eucalyptus todtiana	-	-	21	21
Citrus sinensis	-	-	3	3
Total	13	59	196	268

Table 4 represents the relative density, relative abundance, Margalef species richness index and Shannon-Wiener diversity of the tree species in the study area.

Table 4: Relative density and abundance of the tree species in the study area.

Tree species	**Relative density (RD)**	**Relative abundance (Pi)**	**Margalef (d)**	**Shannon-Wiener (H)**
Anacardium occidentale	0.37	0.004	0.000	1
Bauhinia monandra	0.37	0.003	0.000	1
Carica papaya	4.10	0.041	1.789	0.98
Citrus sinensis	1.12	0.011	0.358	0.10
Cocos nucifera	2.24	0.022	0.894	0.00
Cordia millenii	1.49	0.015	0.537	0.10
Delonix regia	5.22	0.052	2.325	0.98
Elaeis guineensis	2.99	0.030	1.252	0.99
Eucalyptus camaldulensis	6.72	0.067	3.041	0.97
Eucalyptus todtiana	7.84	0.078	3.577	0.96
Ficus benjamina	0.37	0.003	0.000	1
Ficus elastic	3.34	0.034	1.431	0.99
Ficus saussureana	0.37	0.003	0.000	1
Ficus umbellate	1.12	0.011	0.358	0.10
Hildegardia barteri	1.12	0.011	0.358	0.10
Hura crepitans	1.49	0.015	0.537	0.10
Jacaranda mimosifolia	4.10	0.041	1.789	0.98
Mangifera indica	1.87	0.019	0.715	0.99
Musa paradisiaca	10.82	0.108	5.008	0.93
Peltophorum pterocarpum	0.37	0.003	0.000	1
Ricinodendron heudelotii	0.37	0.003	0.000	1
Tectona grandis	27.99	0.280	13.236	0.78
Terminalia catappa	7.84	0.078	3.578	0.96
Terminalia ivorensis	6.34	0.063	2.862	0.97

The relative density, relative abundance, Margalef species richness index and Shannon-Wiener diversity for the families encountered in the study area are presented in Table 5

Table 5: Families of tree species and their relative density, abundance, Margalef species and Shannon –Wiener diversity.

Family	Relative density (RD)	Relative abundance (Pi)	Margalef (d)	Shannon-Wiener (H)
Anacadiaceae	14.29	0.143	0.379	0.96
Arecaceae	7.14	0.071	0.000	1.00
Bignoniaceae	7.14	0.071	0.000	1.00
Boraginaceae	7.14	0.071	0.000	1.00
Caricaceae	7.14	0.071	0.000	1.00
Combretaceae	14.29	0.143	0.379	0.96
Euphorbaceae	21.43	0.214	0.758	0.91
Fabaceae	21.43	0.214	0.758	0.91
Malvaceae	7.14	0.071	0.000	1.00
Moraceae	28.57	0.286	1.136	0.85
Musaceae	7.14	0.071	0.000	1.00
Myrtaceae	14.29	0.143	0.379	0.96
Rutaceae	7.14	0.071	0.000	1.00
Verbenaceae	7.14	0.071	0.000	1.00

Table 6 represents the tree flora and their origin. Dicotyledonous trees were more abundant in the study area with a total of 181 trees, while monocots were 87. The exotic trees were also more abundant with a total of 202 trees while native trees were 37 and cosmopolitan trees were 29.

Table 6: Tree species, their origin and plant group.

Tree species	Origin	Plant group
Anacardium occidentale	E	D
Bauhinia morandra	E	D
Carica papaya	E	D
Citrus sinensis	E	D
Cocos nucifera	E	M
Cordia millenii	N	D
Delonix regia	E	M
Elaeis guineensis	N	M
Eucalyptus camaldulensis	E	M
Eucalyptus todtiana	E	D
Ficus benjamina	E	D
Ficus elastic	E	D
Ficus saussureana	N	D
Ficus umbellate	N	D
Hildegardia barteri	N	D
Hura crepitans	E	D
Jacaranda mimosifolia	E	M
Mangifera indica	E	D
Musa paradisiaca	E	M
Peltophorum pterocarpum	E	M
Ricinodendron heudelotti	N	D
Tectonia grandis	E	D
Terminalia catappa	E	D
Terminalia ivorensis	N	D

Key: E= Exotic, N= Native, M= Monocot, D= Dicot

The distribution of tree flora based on number of cotyledons is represented in Figure 2. The results show that dicotyledons are 181 (67.54 %) while monocotyledons are 87 (32.46).

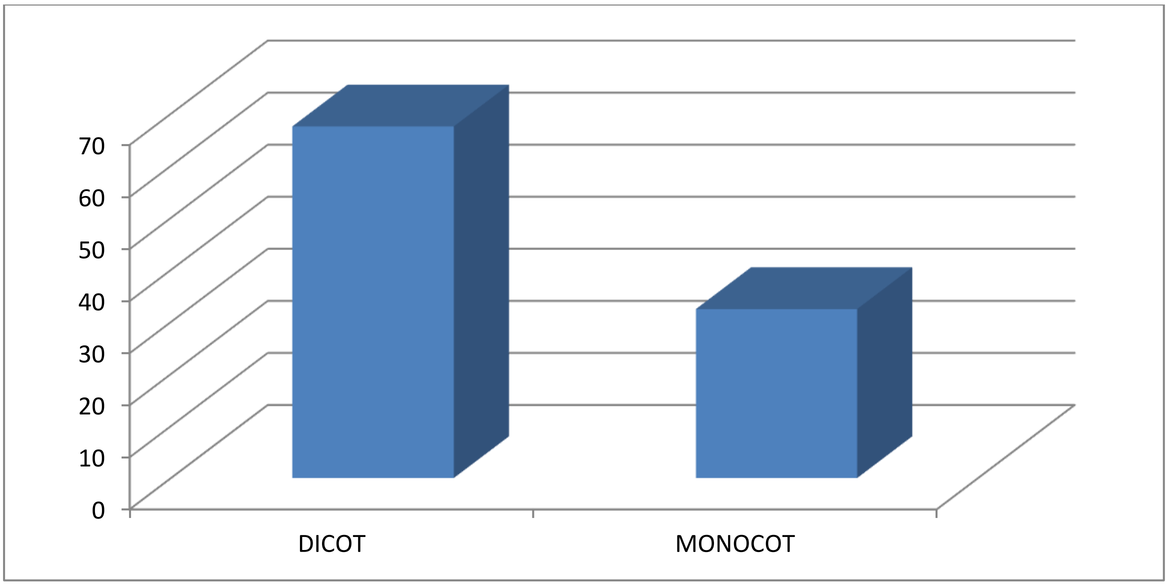

Figure 2: Distribution of tree flora based on number of seed leaf.

The origin of tree flora encountered in the study area is presented in Figure 3. The results show that 202 (75.37 %) are exotic, 66 (24.63 %) are native.

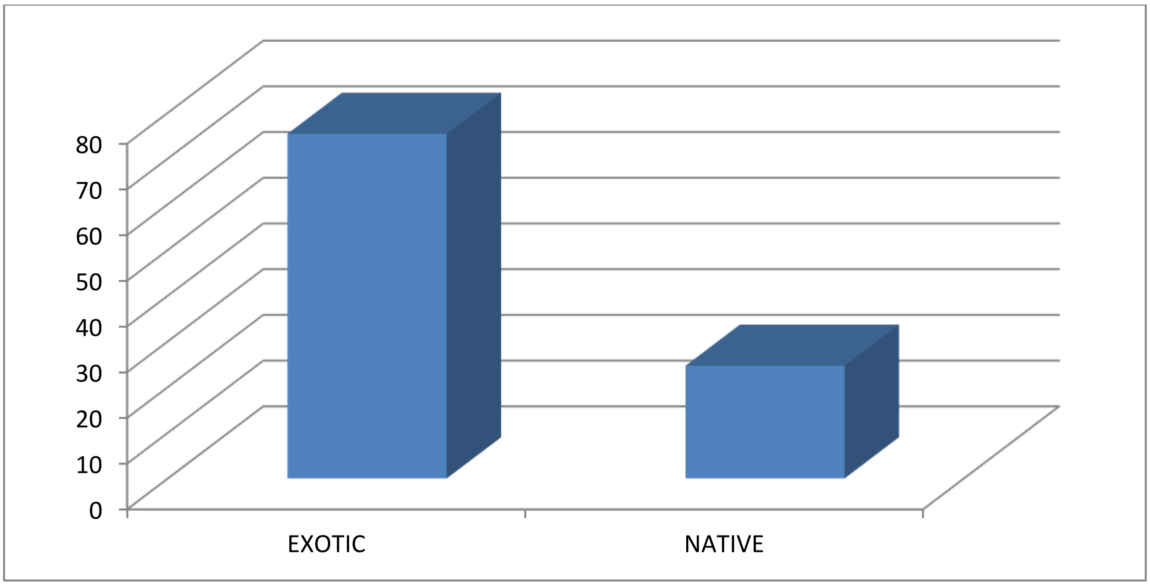

Figure 3: Distribution of tree flora based on origin.

Table 7 shows the phytosociological characteristics of tree flora in the study area.

Table 7(i): Represent computed values of Margalef species richness index and Shannon-Wiener diversity for site A, B and C.

Sites	Margalef (d)	Shannon-Wiener diversity (H)
A	2.339	4.926
B	1.717	57.555
C	2.463	227.654

Table 7(ii): represents the comparison of level of diversity between sites using t test at confidence level and computed values of Sorenson's index for comparing similarities between sites A, B and C.

Sites	Sorenson's index (50%)	Inference
A and B	13.33	A not similar to B
B and C	9.10	B not similar to C
A and C	38.10	A not similar to C

Table 8 presents the demographic characteristics and biodata of the inhabitants of the study area and respondents to the open and close ended questionnaire that were distributed. From the table below it is evident that most of the respondents were students of the institution. The tribes of the respondents also showed diversification

Table 8: Demographical characteristics of respondents.

Characteristics	Respondents (%)
Age	
15-25	76 %
26-35	16 %
36-50	8 %
>50	-
Gender	
Male	60 %
Female	40 %
Occupation	
Public servant	12 %
Civil servant	4 %
Student	84 %
Marital status	
Single	76 %
Married	24 %
Tribe/ethnicity	
Ibo	12 %
Bini	40 %
Yoruba	20 %
Urhobo	12 %
Others	16 %
Residential status	
Resident	88 %
Visitor	12 %

Figure 4 represents the different views on continuous felling of trees of the inhabitants of the study area. Respondents, who went for strongly disagreed was highest with 72 % followed by disagreed with 16 %, agree 8 % and strongly agree 4 % respectively.

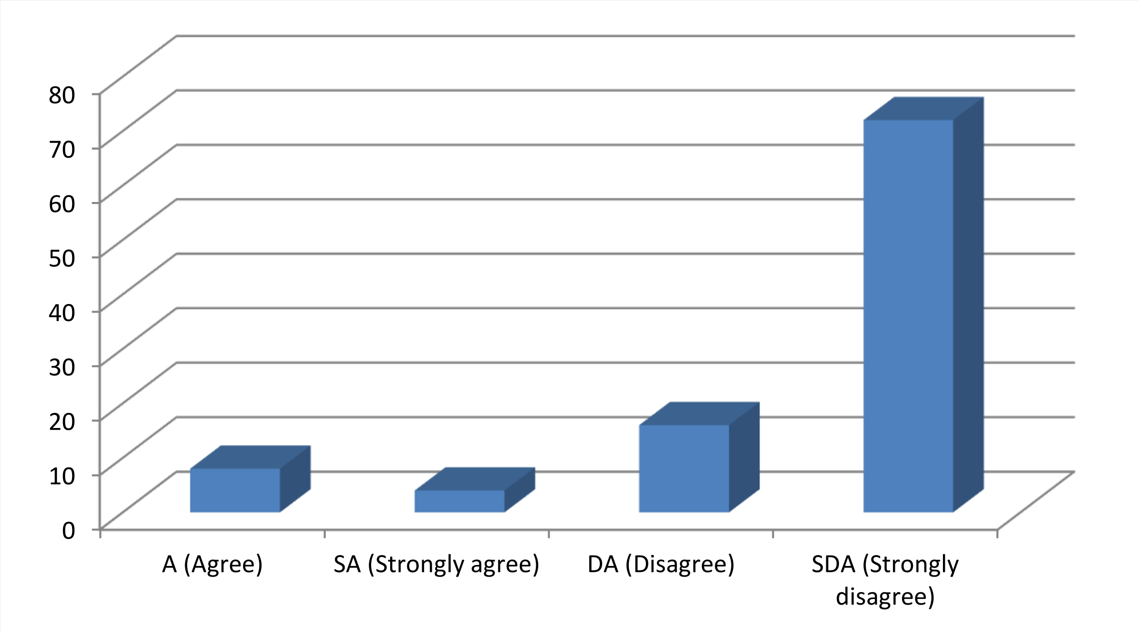

Figure 4: Views of respondents regarding the felling of trees within the study area.

PERCEPTION AND ATTITUDE OF RESPONDENTS TO TREES WITHIN THE STUDY AREA

1. **Uses of trees**
   - The tree flora add to the aesthetic value of the environment.
   - The canopies of these trees serves as shield from ultra-violet rays of the sun therefore inhabitants utilize these features for relaxation and parks.
   - Arboretums should evolve thereof to ensure proper conservation of these tree species and attract tourists and visitors.
   - For taxonomic studies and learning facility for botanists and herbal doctors.
   - Nutrient recycling and erosion control.

- The trunks and pruned branches are utilized as fuel woods for cooking as well as a source of timber for construction of houses, water logging, and production of papers.
- Recreational activities such as picnics are carried out in environments where trees are dominant for shade against adverse sunlight.
- Fruits and nuts are gotten from these trees which serve as food for humans and animals also. Some parts of these trees serves as herbal medicines, it could be the leaves, bark, flowers, or the fruits.
- The trees serve as wind breakers.
- Due to the exchange of carbon dioxide and oxygen in the atmosphere, carbon dioxide is taken up by these trees and oxygen is released to man thereby creating a pure atmosphere for humans.
- Safe haven and habitat for animals' shelter and procreation.
- They helps to demarcate houses that are not fenced it also serves as borders.
- Bio-remediation and bio-indicator to assess the quality of the environment

2. **Perception of their relevance**
   - They replenish oxygen and purify the atmosphere.
   - They serve as wind breakers.
   - They provide good shade for relaxation.
   - They reduce air pollution.
   - They beautify the environment especially with their flowers.
   - They serve as wood fuels and provide timbers.
   - Some tree species have cultural or spiritual relevance (ethnobotanical importance).
   - Helps in nutrient recycling.
3. **Environmental contribution of trees**
   - They beautify the environment, provide shade, and create a perfect site for relaxation.
   - Trees are known to reduce the emission of green-house gases.

- Trees control erosion.
- Trees create ecological balance in the environment.
- Trees prevent global warming and save the environment from heavy rainfall that causes flooding.

4. **Constraint to trees availability**

- Infrastructural developments and urbanization.
- Habitat disturbance and alteration.
- They occupy space and fallen leaves from trees litter the environment.
- Anthropogenic activities.
- Poor knowledge about their usefulness and ethnobotanical relevance.
- Fear of deadly animals such as snakes contributes to inhabitant continual felling of plant trees around them as well as hatred for trees as some believe the leaf fall constitute dirt.
- Disinterest in replanting of fallen trees
- Adverse weather conditions for example wind breaks down weak branches and most times the tree as a whole.

4. Discussion

Using the model of Osawaru *et al.* (2014b), a study of tree flora and their environmental services to man have been conducted using the University of Benin, Ugbowo Campus to ascertain the abundance and diversity of tree flora in the institution as well as their environmental roles to humans and the ecosystem in general. Results obtained from this study suggest that tree flora is abundant and diverse, which enhances their environmental roles and services to man. The diversity of tree flora in the study area is of great importance and could be improved through proper conservative measures should be adopted. It is also evident from the study that most inhabitants of the study area find it difficult to identify trees around them although their uses and benefits are considered paramount. According to Babalola (2010); Nowak *et al*. (2001), a prime focus in the past for developed countries was the management of urban forest for aesthetic purposes, whereas now, as urban population have grown, intensified and expanded, it has shifted to management for enhancing ecosystem services. In developing countries, a more important focus may be managing vegetation to provide materials such as fire woods, fruits and timber at local scale. Over time, each city and region may manage its urban forest for an increasingly broader and more inclusive range of benefits.

A total of 268 individual trees with 24 tree species, 14 families were encountered in the study area, with diverse ecological and ethnobotanical values. The presence of these diverse trees are intricately related with human economic, cultural, social, spiritual and recreational activities. All the trees found were terrestrial; this also correlates with that of Osawaru *et al.* (2014b). Where most of the weeds recorded in the same study area were mostly terrestrial weeds. This can be attributed to the location of the campus. In comparison with Federal University of Technology Akure (FUTA), the diversity of tree flora of Ugbowo campus, University of Benin, is less diverse. This is supported by the results of Agbelade and Akindele (2013) wherein a total of 632 trees spread across 21 families belonging to 42 species were recorded in FUTA. Our Results also suggests that trees are most abundant in Site C compared to Sites A and B. This could be as a result of less infrastructural developments and the presence of fields, lawns and large landmass with trees dominating them. Total count of tree flora on the various sites suggest that site A had a total number of 13 trees, site B 59 and site C 196 respectively.

More so, it is evident that *Tectona grandis* from the family Verbenaceae was the most abundant tree species with relative density 27.99 and also had the highest relative abundance of 0.280. Followed by *Musa paradisiaca* of the family Musaceae with relative density of 10.82. *Eucalyptus todtiana* of the family Myrtaceae and *Terminalia catappa* of the family Combretaceae both have same relative density of 7.84 respectively. With this result it is evident that the family Moraceae has the highest Relative density of (28.57), followed by Euphorbaceae and Fabaceae with the same relative density (21.43) each. Arecaceae and seven other families had the least relative density of (7.14). So also their Relative abundance, Moraceae had the highest Relative abundance (0.286), closely followed by Euphorbaceae and Fabaceae. Dicotyledonous trees were more abundant in the study area with a total of 181 trees (67.54 %), while monocots were 87 (32.46 %). The abundance of dicot trees is as a result of their possession of long tap roots which helps them to penetrate more into the soil especially for such an environment as the study area which more or less aquatic. Their leaves also help via their reticulate venation for proper circulation of nutrient materials. The different origin of trees encountered were Exotic, Native and cosmopolitan. The exotic trees were more abundant with a total of 202 (75.37 %) trees while native trees were 66 (24.63 %).

The abundance of exotic trees is as a result of reoccurrence and they are mostly used as ornamentals. For example, *Eucalyptus camaldulensis*, *Carica papaya* and some others. The phytosociological characteristics of tree flora for the different sites A, B and C correlates with the results of Osawaru *et al.* (2014b). Species richness is often used to make quick assessment and comparison of different habitats (Wiens, 1989). Species richness is therefore a useful consideration when assessing tree communities (Hutchinson, 1970). From the values obtained it is evident that site C is more rich in species and diverse than sites A and B. Biological diversity has become a widely recognized descriptor of the status of communities and ecosystems for its role in community stability (Radosevich *et al.,* 2007).

Most of the respondents (76 %) were students of the institution within the ages of 15 – 25, the sex of the respondents includes; male (60 %) and female (40 %). While, the marital status of the respondent went thus; single (76 %) and married (24 %). Residents had the highest percentage of (88 %) and visitors (12 %). The demographical characteristics of the respondents varied a lot, as this lead to a general distinctive view of each respondent. An overwhelming majority of the respondents find the presence of trees in their environment very appealing. This also correlates with the studies done by (McPherson *et al*., 2002), Studies have shown that people develop emotional attachments to trees that give them special status and value. Majority of the respondents strongly disagree with the continuous felling of trees. Their reasons stem mainly from the benefits accrued from the presence of diverse trees including shade, beautification, timber, edible fruits, aesthetics, source of energy and so much more. Uses and benefits of trees in the institution also correlate with the results of Faleyimu (2014). The major constraints to tree availability in the study area pointed out by respondents are; infrastructural development, urbanization, personal distaste, little knowledge about the usefulness of trees by inhabitants, adverse weather conditions such as wind breaking down tree branches, disinterest in replanting of felled trees. Most of these trees are not properly tended to and they are affected by diseases and leads to death of some parts of the tree and also causing poor production of fruits.

In conclusion, the study has emphasized the relevance of tree flora in the Ugbowo campus of the University of Benin. The diverse tree species have been documented along with their diverse benefits, which made residents to have strong attachment and appreciation of these trees. The trees in the study area are not very diverse yet they are continuously been fell. There is need for focused policies and investments aimed at protecting and managing trees in and around cities are needed to strengthen urban livelihoods and improve city environments, as the world becomes increasingly urbanized (FAO, 2011). Consequently, there is a crucial need to regulate and adopt better means of tree flora management, which may be done by maintaining and regularly updating a tree inventory as well as their distribution and density, consideration of tree flora in any structural and physical changes to the campus facilities. Units or stations should be incorporated to checkmate and ensure proper maintenance of trees in the institution. A tree manager may be assigned and tasked with the management of the tree flora. The proximity of certain trees to roads within the campus poses environmental risk.

Thus, requires regular checks including pruning and identification of weak trees that may fall and obstruct traffic or damage facilities. The diversity of tree flora in the Ugbowo campus of University of Benin is quite impressive in spite of the continuous felling of trees. Sustainable conservative measures should be encouraged. The disappearance of many plant species due to human activities is depleting the world’s genetic resources and is putting man’s heritage of biodiversity under serious threat. There is therefore the urgent need to preserve genetic diversity including plant resources of known and unknown regardless of economic importance. Proper enlightenment and awareness campaigns should be carried out on the need for conservation of natural resources by establishing more Arboretum, Botanical gardens and Herbarium to ensure sustainability of the resources and the services they provide man and the environment.

References

Agbelade, A. D. and Akindele, S. O. (2013): Land use mapping and Tree species diversity of Federal University of Technology, Akure. *American International Journal of Contemporary Research.* **3**(2), 104 – 113.

Babalola, F. D. (2010): Issues and option for appropriate management strategies of Campus tree at University of Ibadan, Nigeria. *Nigeria Journal of Ecology*. **11**, 33 – 42.

Beckett, K. P., Freer-Smith, P. H. and Taylor, G. (1998): Urban woodlands: their role in reducing the effects of particulate pollution. *Environmental Pollution*. **99**(3), 347–360.

Bolund, P. and Hunhammar, S. (1999): Ecosystem services in urban areas. *Ecological Economics*. **29**, 293–301.

Brown, G. (2001): *Center for Forestry and Ecology.* Available at Alabama A and M University, School of Agricultural and Environmental Sciences, Department of Plant and Soil Science.

Burkhill, H. M. (1985): *The useful plants of West Tropical Africa*. Edition 2, Volume 2, Families A – D, Royal Botanic Garden, Kew. 960.

Burkhill, H. M. (1994): *The Useful Plants of West Tropical Africa*. Edition 2, Volume 2, Families E – I, Royal Botanic Garden, Kew. 969.

Burkhill, H. M. (1995): *The Useful Plants of West Tropical Africa*. Edition 2, Volume 3, Families J – L, Royal Botanic Garden, Kew. 857.

Burkhill, H. M. (1997): *The Useful Plants of West Tropical Africa*. Edition 2, Volume 4, Families M – R, Royal Botanic Garden, Kew. 969.

Burkhill, H. M. (2000): *The Useful Plants of West Tropical Africa*. Edition 2, Volume 5, Families S – Z, Royal Botanic Garden, Kew. 969.

Dania-Ogbe, F. M., Adeboye, O. C. and Bamidele, J. F. (2001): *Ethnobotany of indigenous food crops and useful plants; Leafy Vegetables of Southwest Nigeria; their identification, nutritional studies and cultivation of farmer assisted selected endangered species.* Paper presented at the biennial meeting of the UNU/INRA College of Research Associates. 19-20 April, 2001, Accra, Ghana.

Faleyimu, O. I. (2014): Public perceptions of Urban Forests in Okitipupa, Nigeria: Implication for Environmental Conservation. *Journals of Applied Sciences and Environmental Management.* **18**(3), 469 – 478.

FAO (2011): As world goes urban, new focus on roles of trees in cities. Food and Agriculture Organization of the United Nations, Rome, Italy. Available online at: http://www.fao.org/news/story/en/item/92329/icode/ Accessed on: 14th January, 2016.

FAO. (2002): *Resource Assessment of NWFP's; Experiences and Biometric Principles. NWFPs No. 13.* FAO, Rome. 23.

Hutchinson, J. and Dalziel, J. M. (1958 - 1968): *Flora of West Tropical Africa.* Edition 2, Volume 2 (Revised by Keay, R. V. and Happer, F. N.). Crown Agent for Oversea Government and Administration, London. 424.

Hutchinson, K. (1970): A test for comparing diversities based on Shannon formula. *Journal of Theoretical Biology*. **29**, 151 – 154.

Keay, R. W. J. (1989): *Trees of Nigeria*. Oxford University press, New York 476.

Kindt, R., Noordin, Q., Njui, A. and Ruigu, S. (2005): *Biodiversity conservation through agroforestry: managing tree species diversity within a network of community-based non-governmental, governmental and research organizations in western Kenya.* ICRAF Working Paper nr 2. Nairobi: World Agroforestry Centre.

Kou, F. E., Bacaicoa, M. and Sullivan, W.C. (1998): Transforming inner city landscapes: trees, sense of safety, and preference. *Environment and Behavior*. **30**(1), 28–59.

Ladipo, D. (2008): *Harvesting of Irvingia gabonensis and Irvingia wombolu in the Nigerian forests: Potentials for the development of sustainable systems.* Available at: http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/Y4496E/Y4496E32.htm. Accessed: 15/08/2015.

Lewis, C.A. (1996): *Green Nature/Human Nature: The Meaning of Plants in Our Lives*. University of Illinois Press, Chicago, USA. 148.

McPherson, E. G., Simpson, J. R. and Scott, K. (2002): *Actualizing Micro-Climate and air quality benefits with parking lot three shade ordinance.* Welter and Leben, **4**, 98.

Naqui, S. Z. (1975): *Plant and Man.* Inaugural lecture delivered at the University of Lagos. UNILAG Press, Lagos, Nigeria. 46.

National Urban Forest Unit (NUFU) (1999): *Trees and healthy living*. Proceedings of the National Conference, Wolver Hampton, UK. 17 November, 1999.

Nowak, D. J., Nobel, M. H., Sisinni, S. M. and Dwyer, J. F. (2001): People and trees: Assessing the U.S. urban forest resources. *Journal of Forestry*. **99**(3), 37 – 42.

Oboho E. G. (2012): *Trees in poverty alleviation for rural women in Nigeria*. Proceedings of the 2nd annual AWIFE conference: Reorganizing Nigerian forestry.

Ogwu M. C., Osawaru, M. E. and A. O. Chime, A.O (2014a): Comparative assessment of plant diversity and utilization patterns of tropical home gardens in Edo State, Nigeria. *Scientia Africana.* **13** (2), 146-162.

Ogwu, M. C., Osawaru, M. E. and Ahana, C. M. (2014b): Challenges in conserving and utilizing plant genetic resources (PGR). *International Journal of Genetics and Molecular Biology*. **6**(2), 16 – 22.

Ogwu, M. C., Osawaru, M. E., Aiwansoba, R. O. and Iroh, R. N. (2016): Status and Prospects of Vegetables in Africa. Proceedings of NTBA/NSCB Joint Biodiversity Conference on MDGs to SDGs: Toward Sustainable Biodiversity Conservation in Nigeria held at University of llorin, Nigeria. 47 - 57.

Okpeke, L. K. (1987): *Tropical Tree Crops.* Spectrum Books Limited, Ibadan, Onitsha, Zaria, Nigeria. 327.

Osawaru, M. C. and Ogwu, M. C. (2014): Conservation and utilization of plant genetic resources. *In*: Omokhafe, K. O., Ohikhena, F. U., Imoren, E. A., Ajayi, O. I. (eds). *Proceedings of 38th Annual Conference of the Genetics Society of Nigeria at Benin City, Nigeria*. 105-120.

Osawaru, M. E, Ogwu, M. C and Aigbefue, D. (2014a): Survey of ornamental gardens in Five local government areas of Southern Edo State Nigeria. *The Bioscientist*. **2**(1), 87-102.

Osawaru, M. E., Ogwu, M. C., Chime, A. O. and Ebosa, A. B. (2014b): Weed flora of University of Benin in terms of diversity and richness using two ecological models. *Scientia Africana*. **13**(2), 102 – 120.

Radosevich, S. R., Holt, J. S. and Ghersa, C. M. (2007): *Ecology of weeds and Invasive Plants Relationship to Agricultural and Natural Resource Management.* Third Edition. John Wiley and Sons, USA. 477.

Robbins, W. W., Weier, T. E. and Stocking, C. R. (1965): *Botany: An Introduction to Plant Science.* Wiley international, New York, USA. 578.

Sangha, K. K., Jalota, R. K. and Midmore, D. J. (2005): Impact of tree clearing on soil pH and nutrient availability in grazing systems of central Queensland, Australia. *Australian Journal of Soil Research*, **43**(1), 51 – 60.

Schroth, G. and Sinclair, F. L. (2003): Impacts of trees on the fertility of agricultural soils. *In*: Schroth G. and Sinclair F.L. (eds), *Trees, crops and soil fertility*. CAB International, London, UK. 1 – 12.

Sharma, B.M. (1997): Nutrient cycling in agroforestry. In: Gupta J.P. and Sharma B.M. (eds), *Agroforestry for Sustained Productivity in Arid Regions*. Pawan Kumar scientific publishers, India. 69 – 77.

Stolt, E. (1982): Vegetationens formaga att minska expositionen for bilavgaser (The ability of vegetation in decreasing exposure to car fumes). Goteborgs Universitet pa uppdrag av Goteborgs Halsovardsavdelning (quoted from Svensson and Eliasson 1997, in Swedish).

Strin, J. (1981): Manual of Methods in Aquatic Environment Research, Part 8. Ecological Assessment of Pollution Effects. Guidelines for the FAO/ GFCM /UNEP Joint Coordinated Project on Pollution in the Mediterranean. 36

Taylor, A. F., Kuo, F. and Sullivan, W. C. (2001): Coping with ADD: The Surprising Connection to Green Play Settings. *Environment and Behavior*, **33**(1), 54 – 77.

Tesfaye, A. (2005): *Diversity in homegarden agroforestry systems of Southern Ethiopia*. Doctoral thesis, Wageningen University. 143.

Tian, G., Salako, F. K. and Ishida, F. (2001): Replenishment of C, N, and P in a degraded Alfisol under humid tropical conditions: Effect of fallow species and litter polyphenols. *Soil Science.* **166**, 614–621.

Tiwary, A., Sinnet, D., Peachey, C., Chalabi, Z., Vardoulakis, S., Fletcher, T., Leonardi, G., Grundy, C., Azapagic, A. and Hutchings, T. (2009): An integrated tool to assess the role of new planting in PM10 capture and the human health benefits: A case study in London. *Environmental Pollution*. **157**, 2645–2653.

Warner, K. (1993): *Patterns of farmer tree growing in Eastern Africa: A socio-economic analysis*. Tropical Forestry Paper. ICRAF No. 27, Nairobi. 270.

Wiens, J. A. (1989): *The Ecology of Bird Communities.* Cambridge University Press, Cambridge. 539.

Young, A. (1997): *Agroforestry for Soil Management.* CAB International, Wallingford, USA. 319.

Yu, D. S. and Yoo, S. H. (2015): VBioindex: A Visual Tool to Estimate Biodiversity. *Genomics and Informatics*. **13** (3), 90 – 99.