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CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH

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PREFACE

There is a growing concern on the adverse impacts of climate on biodiversity. This phenomenon is greatly manifested in form of shifting weather patterns threatening global food security, health and species existence. Humanity is at the receiving end of the consequences of climate change hence there is a need to step up actions on all fronts- overtime, everywhere all at once.

This calls for collaboration, partnership and networking to strengthening synergy among relevant stakeholders in a bid to tackling climate change menace. This forms the basis for the theme of this year world Environmental conservation conference: **CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH.** The theme is conceived with a view to create an interface for information sharing and offer opportunities for participants to refine their commitments and pledges in the quest to achieving Sustainability in the face of climate change.

This year World Environmental Conservation Conference is memorable in the sense that it received overwhelming funding from the host - West African Science Service on Climate Change and Adapted Land use). WASCAL is posed to provide information and knowledge at the local, national and regional level to cope with the adverse impacts of climate change. Thus, this conference will offer opportunities for participants to learn from good practices demonstrated and showcase by WASCAL during the course of the conference. It will also strengthen staff-student exchange and provide prospect for Doctorate Research Doctoral Research in West Africa Climate System Programme (DRP WACS) – WASCAL among others.

Special appreciation goes to the management of The Federal University of Technology, Akure the host institution, National Park Service and African Regional Center for Space Science and Technology Education-English (ARCSSTE-E) that co-host this conference. We equally acknowledge other private, individual and corporate organizations that have contributed towards the success recorded in this event.

All the submitted articles were subjected to strict double blind peer-review process by the reviewers that are experts in the area of the particular submitted manuscript. The accepted manuscripts are published in WECC 2023 proceedings and also available for download on the organization website (www.necorng.org).

The accepted manuscripts fall within the underlisted subthemes:

- Climate change adaptation strategies in Agriculture, Forestry and Other Land Use (AFOLU)
- Climate smart city and architectural landscape design
- Retrofitting and decarbonization in tourism and hospitality industry
- Indigenous knowledge and local innovation in climate change adaptation
- Climate risk management, health, safety and hygiene
- Carbon credit-offset marketing/circular economy
- ICT development in environmental conservation (image processing and acquisition, computer vision, graphics, speed, interface technology, HMD devices, GIS: Body Tracking, AI and IOT, VRT, IVE).

We commend our keynote speaker Prof. Douda Kone Director Capacity Building Department, WASCAL Headquarter, Ghana and other guest speakers Prof. Babatunde Rabiu, Director General, Chief Executive Office, African Regional Centre for Space Science and Technology Education-English (ARCSSTE-E) and Dr. Goni I. M., Conservator General National Park Service.

It is hoped that researchers, students and policy makers will find the papers in this book very useful. Even though all the papers were reviewed and edited, the content and option expressed remain essentially that of the authors and not necessarily that of Netlink Environmental Conservation Organization.

Dr. Oladeji S. O.

President Netlink Environmental Conservation Organization

Convener World Environmental Conservation Conference

TABLE OF CONTENT

URBAN HOME GARDEN PRACTICE AS BIODIVERSITY CONSERVATION STRATEGY IN BENIN CITY, EDO STATE, NIGERIA.

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ABSTRACT

Home gardens have been identified as one of the possible means of conserving biodiversity in urban areas, as some urban dwellers engage in the management of multipurpose trees and shrubs in association with agricultural crops and livestock. This study seeks to investigate the tree species diversity, occurrence, and the multiple ecosystem services generated at urban home gardens in Benin City metropolis, Nigeria. A multi stage sampling technique was used to select 200 respondents for the study. Data for the study were collected through administration of questionnaire and interview conducted among respondents in the study area. Data collected were analyzed using SPSS version 23, descriptive and inferential statistics tools such as percentage, frequency, mean were used to present results. The results revealed that the management practices adopted by respondents were weeding; harvesting, digging and sales of woody species and other home garden produce. A total of 24 woody species were identified in home gardens of the study area. Moringa oleifera (19.166%) and Magnifera indica (14.583%) we rerecorded as the most occurring woody species in the study area. Fruits and nuts (78.5%); provision of shade (75.5%) were the most important benefits derived from home gardens, according to the respondents. Lack of funds, theft and inadequate farm land in urban areasranked first, second and third respectively among the major challenges facing home garden owners. The study provides relevant information on the economic and environmental importance of home gardens in the study area and its potentials as a conservation tool.

Key words*: Conservation; Home gardens; Woody species; Respondents*.

INTRODUCTION

The decline in the surface area and vegetation quality of natural forests in recent times can be ascribed to the increased demand for arable land and tree products with increasing demographic pressure (Boffa, 2000). Due to their intrinsic worth, contribution to natural and cultural heritage, feeling of place, ability to reduce noise and pollution, water sensitivity in urban planning, and contribution to human health, house gardens are extremely important. This emphasizes the need to broaden the scope of forest conservation beyond the boundaries of protected forest areas (McDonnell and Hahs, 2012). Urban vegetation areas can offer high impact ecosystem services (Dearborn and Kark, 2009), such as reducing the urban heat island effect and mitigating climate change by increasing carbon storage and uptake. They can also play important part in maintaining biodiversity that are under risk of disappearance in the natural habitat by offering a unique opportunity for preservation (Mengistu and Alemayehu, 2017).

Plant domestication and preservation can lead to the sustainable use and conservation of plants (Tuli and Jafari, 2009). The ecosystem and biodiversity are negatively impacted when plants leave their natural habitats (Kajembe *et al*., 2003). In order to preserve significant plant species that are close to extinction, very few individuals attempt to grow them in their own backyards. Domestication of wild variants of certain plant species occurs in home gardens as well. They serve as test grounds for new crop varieties, serving as a point of entry for new crop types into our agricultural system. Economically important trees species are usually conserved in home gardens. Several studies have reported the potential of agroforestry in conservation of biodiversity. Hence, this study assessed woody tree species diversity and conservation in urban home gardens of Benin City Metropolis, Edo State with a view to appreciate their immense contributions to the social, economic and ecological ecosystems.

MATERIALS AND METHOD

Study Area

The study was conducted in Benin Metropolis Edo State, Nigeria. Benin City, the capital of Edo State. It has a land area of 1,219.626km^2 and bounded by latitude 6^o 20^1 North and longitude 5^o 39^1 East. There are four Local Government Areas (LGAs) in Benin metropolis; Oredo, Egor, Ikpoba-Okha and Ovia North-East. Benin City.

Sampling Procedure

A multi-stage sampling technique was adopted in selecting the sample size for the study. The first stage was a random selection of the urban centers from the four local government areas in Benin metropolis which include Oredo, Egor, Ikpoba-Okha and Ovia North East Local Government Area (Figure 1). The second stage was a purposive selection of one community from each Local Government Area comprising of Ohovbe in Ikpoba-Okha LGA, Okun in Ovia North East LGA Ekehuan in Oredo L.G.A. and Ogida in Egor LGA. The communities were

selected based on a pilot study showing the communities had more residential areas. The third stage involved a simple random selection of 50 home gardens in each community and was achieved through snowball sampling techniques giving a sample size of 200 respondents for the whole study.

Data Collection and Analysis

Data for the study werecollectedthroughtheuseofstructuredquestionnaireadministeredto the home gardens owners in the selected communities. Data were collected on the woody species available in the home garden visited, occurrence of the woody species, management practices by the home garden growers, benefits derived from woody species and constraints to woody species retention or cultivation. Data obtained from the study were quantitative and were analyzed using descriptive and inferential statistics such, frequency percentages, means and analysis of variance.

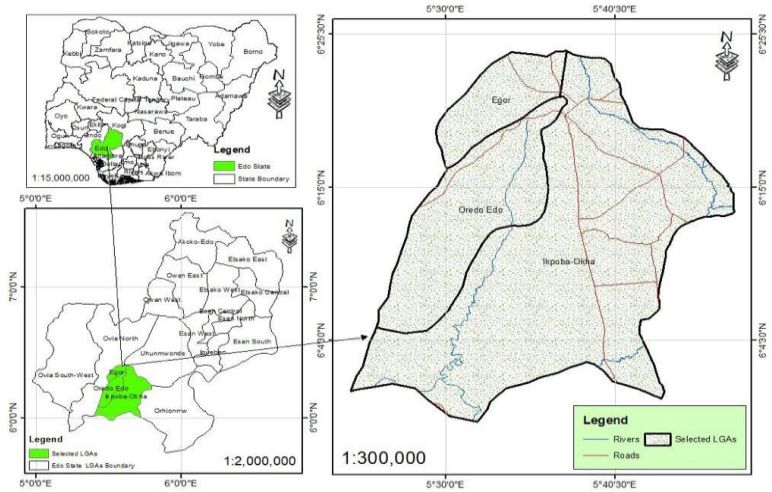

Figure 1: The map of Edo state showing the LGAs of study

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

The results on the gender, age, educational qualification is presented in Table 1. Majority (74%) of the respondents were males while 26% were females, indicating that most households were dominated by males who were involved in home garden as an occupation. The result is similar to that obtained by Amenu (2017), indicating that the male gender was dominant with a percentage frequency of 60%. Seventy–three percent of the respondents were above 50 years of age and 25.5% were between the age of 41 – 50 years while only 1.5% were between the age of 21 – 30 years. This can be attributed to the fact that majority of the respondents were household heads with vast experience that could guide in tree species identification in the gardens. A high proportion of respondents had household size of between 6 – 9 (56.5%) persons while about 31.5% had household size of 3 – 5 persons and 12% having household size of less than 10 persons. On the contrary, Kassa *et al*. (2023) reported that the family of 3 – 10 had the highest mean value of 7.64 in the home garden study of Gamo zone of Southern Ethiopia. The results revealed primary education recorded the highest number of respondents (47%) with only about 3% obtaining tertiary education level. Also 5.5% of respondents had no formal education. This implies that majority of respondent are medium to small scale farmers practicing home gardens. The major sources of farmland were purchased (60%) and inherited (36%) lands. This result indicates since most urban dwellers are immigrants from different parts, majority of them people purchase their lands. Thirty–six percent of respondents said they inherited the land they use for farming and practicing of home garden. Hence, respondents spend little ornocostin acquiring their lands. It has been reported that inherited lands can be used for cultivation of permanent tree crops and woody species (Schupp *et al*., 2015).

Table 1: Socioeconomic Characteristics of Respondents

Variable	Frequency	Percentage
Gender		
Male	148	74.0
Female	52	26.0
Total	200	100
Age		
21-30years	3	1.5
41-50years	51	25.5
>50years	146	73.0
Total	200	100.0
Marital Status		
Married	161	80.5
Divorced	31	15.5
Widow	8	4.0
Total	200	100
Household Size		
3-5	63	31.5
6–9	113	56.5
>10	24	12.0
Total	200	100
Educational Qualification		
No formal education	11	5.5
Primary education	94	47.04
Secondary education	89	44.5
Tertiary education	6	3.0
Total	200	100.0
Source of Farmland		
Communal	2	1.0
Inherited	72	36
Government	2	1.0
Purchased	120	60.0
Lease	4	2.0
Total	200	100.0

Result of Management Practices, Woody Species Occurrence and Arable Crops Cultivated in the Study Area

The respondents acknowledges that they engaged in different management practices (Figure 2). Some common management practices from their responses were pruning, thinning, composting, weeding, digging, watering, harvesting and sales. Result further showed that weeding, digging, harvesting and sales of products of home garden agroforestry products are the most practiced management woody home garden species management respondents involved in. Jegora *et. al*. (2019) identified these management practices among farmers in Ethiopia who reported that majority of home garden owners practice weeding and digging.

Woody species are managed in species in home gardens of different areas for a number of reasons, including household consumption and boosting household finances. Farmers' preference for tree species is a basic criterion for selecting a tree (Osadolor *et al*., 2020). A total of 23 woody species are categorized in surveyed home garden (Table 2). *Moringa oleifera* was the most occurring species (mention the frequency of occurrence or percentage, followed by *Magnifera indica.* Others include *Dacryode seduli, Ficus exasperata, Cola acuminata, Terminalia catapa, Elaeis guineensis, Theobroma cacao,* which provided multiple contributions for households. Panyadee *et al*. (2016) reported *Mangifera indica* as the most occurring woody species identified in urban home garden in Northern Thailand.

Also, the results in Table 3 indicates that the home garden growers engaged in the cultivation of some arable crops. Cassava (31.78%), yams (27.81%) and cocoyam (13.24%) were the major crops cultivated according to the response of the home garden owners. In a study conducted by Kassa *et al*. (2023) in the home gardens of Gamo zone in southern Ethiopia, tubers (such as yams and cocoyam) recorded a percentage frequency of 41.65% of the total arable crop inventories. This was closely followed by cereals (such as maize and sorghum) which had a percentage of 30.81% percent respectively.

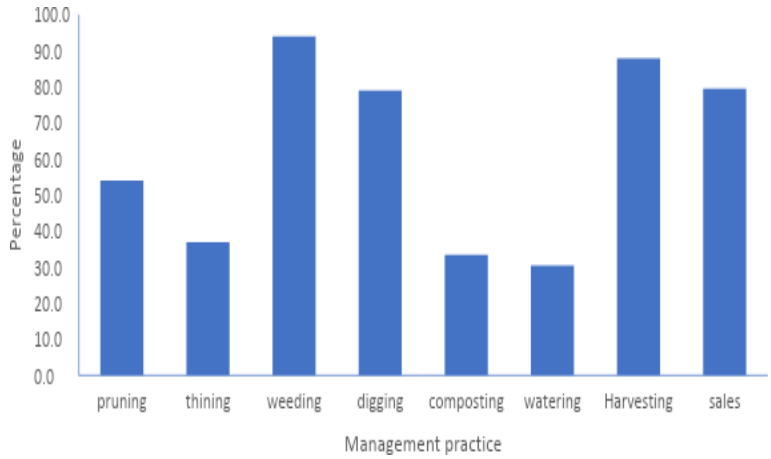

Figure 2: Management practices by the home garden growers

Table 2: Occurrence of woody species grown in urban home gardens across Local Government Areas

Tree species	Common name	Family	Category	Frequency	Percentage
Mangifera indica	Mango	Anacardiaceae	Food	35	14.58
Dacryodes edulis	Bush pear	Burseraceae	Food	27	11.25
Ficus exasperata	Sandpaper tree	Moraceae	Medicine	13	5.42
Cola acuminata	Kolanut	Malvaceae	Food/Medicine	7	2.92
Terminaliacatapa	Almond	Combretaceae	Food	11	4.58
Elaeisguineensis	Oil palm	Arecacae	Food	22	9.17
Theobromacacao	Cocoa	Malvaceae	Food	15	6.25
Psidium guajava	Guava	Myrtaceae	Medicine	8	3.33
Moringa oleifera	Moringa	Moringaceae	Food/Medicine	46	19.17
Naucleadiderrichii	Opepe	Rubiaceae	Shade/windbreak	4	1.66
Gambeya albida	African star apple	Sapotaceae	Food	4	1.66
Irvingiawombulu	Bush mango	Irvingiaceae	Food	3	1.25
Tectonagrandis	Teak	Lamiaceae	Timber/Windbreak	1	0.42
Sarcocephaluslatifolius	Agbai /African peach	Rubiaceae	Medicine	1	0.42
Hura crepitans	Sandbox tree	Euphorbiaceae	Medicine	1	0.42
Newbouldialaevis	Ikhiwin /boundary tree	Bignoniacaeae	Boundary Plant	1	
Milicia excelsa	Iroko	Moraceae	Shade/Timber	1	0.42
Annona muricata	Soursop	Annonaceae	Food/Medicine	20	8.33
Spondiasmombin	Okhikhan/ hog plum	Anacardiaceae	Food/Medicine	1	0.42
Artocarpus altilis	Breadfruit	Moraceae	Food/Medicine	2	0.83
Alstoniaboonei	Alstonia	Apocynaceae	Medicine/Shade	1	0.42
Gambeya albida	African star apple	Sapotaceae	Food	3	1.25
Garcina kola	Bitter kola	Clusiaceae	Medicine	1	0.42
Vernoniaamygdalina	Bitter leaf	Asteraceae	Food/Medicine	12	5.00
				240	**100**

Table 3: Arable crop cultivation from the responses of the urban home garden owners

Arable crop	Common name	Family	Frequency	Percentage
Elfairiaoccidentalis	fluted pumpkin	Cucurbitaceae	12	7.95
Manihot esculenta	Cassava	Euphorbiaceae	48	31.79
Colocasia esculenta	Cocoa yam	Araceae	20	13.25
Zeamays	Maize	Poaceae	1	0.66
Capsicum_annuum	Pepper	Solanaceae	9	5.96
Dioscoreacayenensis	Yellowyam	Discoreaceae	42	27.81
Abelmoschus esculentus	Okro	Malvaceae	8	5.30
Musa paradisiaca	Plantain	Musaceae	9	5.96
Solanum lycopersicum	Tomato	solaneaceae	2	1.32
			152	**100**

Benefits derived from Cultivating and retaining woody species by urban home garden owners

The study revealed the benefits respondents derived from practicing home garden of woody tree species and arable crops in the study area (Table 4). Majority (78.5%) of respondents strongly agree that fruits and nuts production are the benefits derived from home gardens while 75.5% also strongly agreed that provision of shade is also a benefit derived from woody species grown in urban garden, provision of shade by woody tree species in their garden is one of the most important benefits derived from practicing urban home garden. Additional income (65.5%) and wind break were also important benefits derived from the practice of urban agroforestry of woody tree species. This implies that the practice of urban agroforestry has contributed to household income through sales of fruits, fuelwood and timber. In a study conducted by Amenu (2017), all the respondents agreed that provision of food was the most important benefit derived from home garden in Dawuro zone of Adis Ababa while fuel wood was among the least benefit asserted by the respondents.

Challenges to urban home gardens

In the management of home garden and adopting agroforestry practices, there are a lot of hindering factors to effectively and efficiently manage and sustainably utilize woody species in the home garden agroforestry practices. The result obtained from the study indicate that home garden owners encountered different problems in establishing, conserving of woody species in the study area which may be the limiting factor to the successful establishment of home gardens. According to Asfaw (2003), the farmers' ability to plant woody species in their homestead gardens was negatively or favourably impacted by the market's location. Lack of funds was the most serious challenge affecting woody species composition and home garden in the study area (Table 7). On the other hand, animal damage, insect pests, diseases were identified as additional variables impacting the composition of the woody species in home gardens.

Similarly, the study conducted in Bangladesh also revealed the problems of animals, storms, and insect pests in tree establishment and management in home garden (Alam *et al*., 2005; Zuman *et al*., 2010). These also agree with the findings of Shupp *et al*., (2015) who also reported similar factors as barriers to home garden practice.

Table 4: Benefits Derived from Planting and Retaining Woody Species by Urban Home Garden Growers

Benefits	Strongly agree		Agree		Uncertain		Disagree		Strongly disagree	
	Frq.	%	Frq.	%	Frq.	%	Frq.	%	Frq.	%
Fruits and nuts production	157	78.5	7	3.5	26	13.0	-	-	10	5.0
Medicine	125	62.5	33	16.5	26	13.0	-	-	16	8.0
Food and vegetables	83	41.5	22	11.0	41	20.5	8	4.0	46	23.0
Additional income	131	65.5	17	8.5	31	15.5			21	10.5
Provision of shade	151	75.5	18	9.0	29	14.5	2	1.0		
Protects soil and improves fertility	52	26.0	33	16.5	77	38.5	2	1.0	36	18.0
Timber	50	25.0	22	11.0	76	38.0	-	-	52	26.0
Fuel wood	90	45.0	39	19.5	53	26.5			18	9.0
Windbreak	109	54.5	28	14.0	50	25.0			13	6.5

Table 5: Challenges encountered by urban home gardens owners

Challenges	Mean	Std. Deviation	Ranking
Lack of funds	3.1950	1.63719	1st
Theft	2.9500	1.56837	2nd
Inadequate farm land in urban area	2.9450	1.64178	3rd
Insect and pest attack	2.6200	1.56777	4th
Wildfire	2.3650	1.33065	5th
Disease	2.2850	1.36495	6th
Lack of market access	1.6100	0.99137	7th

Conclusion

The study revealed that there was a significant difference in the distribution and occurrence of woody species across the Local Government Areas at $P<0.05$. Farmers utilize management techniques to increase the variety of woody plants in home gardens. Most respondents agreed that they greatly benefited from retaining woody species in their home gardens. However, problems related to lack of funds, theft and inadequate land for farming in urban areas were the major challenges confronting farmers in the study area. It was concluded that woody species in home gardens are of economic and environmental importance to the study area. Based on the information derived from this study, cultivation of trees in urban centers can become a strategy for regaining the urban ecosystem and to combat global climate change Also, encouraging the practice will serve as a tool for conserving useful trees/shrubs. Consequently, socioeconomic factors that can encourage home gardening activities should be institutionalized in this area.

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