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EVALUATION OF THE EFFECTS OF PLASTIC POLLUTANTS ON THE ENVIRONMENT AT THE UNIVERSITY OF CALABAR, NIGERIA

Joy Eko ATU

Department of Geography and Environmental Science
University of Calabar, Nigeria
Email: joye.atu@gmail.com; joye.atu@unical.edu.ng

Abstract

Globally, Universities have dignified environment, devoid of the pollution that plague the secular environment. However, in recent times Universities in Nigeria have degenerated to places of unwholesome plastic pollution. Therefore, the study determined the causes, types, hub and effect of plastic pollutants on the environment at the University of Calabar, Nigeria. Visual identification of plastic pollutants and polluted areas, filtering and questionnaire administration were employed to collect data. Two hundred and fifty (250) copies of questionnaire were randomly administered and retrieved at purposively determined study sites comprising of the Main campus, Malabo and Library axis. These areas experience the highest learning, living and social activities on the campus. Descriptive statistics (tables, frequency counts and aggregated percentages) were used to analyze the responses from the retrieved copies of questionnaire and results presented as aggregate. Single use plastic (non-reusable) was identified as the main pollutant in the study area as they constituted 80 percent of the campus litter. Paper debris accounted for 12 percent and other forms of debris 8 percent. Higher percentage of plastic litter was caused by habit (60 percent), inadequate waste receptacles 25 percent, non-regular clean-up and evacuation 10 percent and access to affordable packaged food and water 5 percent. The effects of plastic pollutants on the environment included degraded aesthetics and unwholesome litter. Attitudinal change awareness campaign, regular clean-ups, evacuation, restriction of sale and consumption of single use plastic water (sachet water) and food packs on campus was suggested as short- and long-term measures to curb the menace of plastic pollutants at Institutions of higher learning in Nigeria.

Keywords: Debris, Effects, Environment, Plastics, Pollutants, University of Calabar,

1. Introduction

Universities are globally renowned for their serene, clean and beautiful environment, devoid of the menace and challenges of pollution that plague the secular society. However, in recent years Universities in Nigeria have become centres of malaise plagued with diverse forms of pollution like air pollution from vehicular traffic, noise pollution, solid and hazardous waste, insecurity and in the very recent time pollution from plastic waste. University campuses in Nigeria are daily inundated with plastic waste arising from consumption of mobile foodstuff such as sachet and bottled water, confectionary and packaged food (takeaways) boxed and platted in plastic containers. Plastic pollutants are accumulated plastic products

in the environment that have adverse effects on habitat and humans. Plastic pollutants are categorised into micro, meso or macro debris depending on the size. Plastics materials are loved by modern society for their durability, affordability, versatility and lightweight, qualities that have led to an increased demand for the product around the world resulting in high levels of production and consumption (Moore, 2008). However, this same lovable quality of plastic makes the plastics, resistant to the natural processes of degradation, thus, allowing plastic debris to persist in the environment (Welden 2020, Andrady 2015). Generally, plastic degrade in about 500-1000 years all culminating in high levels of plastic pollutants in the environment (Moore, 2008).

In the past 50 years a staggering 6.3 billion tonnes of plastic has been produced and in 2013 an estimated 299 million tonnes of plastic was produced, up 4 percent from 2012 confirming a rising trend in the production of plastic products. A report by Global Industry Analyst in 2016, stated that plastic consumption is expected to reach 320 million tons by 2020 (Beachapedia.org, 2018). Plastic pollutants have adverse effects on receptacle environment. For instance, habitat destruction, (Sheavly & Register, 2007), transport of invasive species across habitats (Kiessling et al., 2015), leading to potential impacts on the animals that live and forage in the benthos of sediments impacted by invasive species deposited by plastics (Brandon et al., 2019). A study on plastic pollution on the marine environment indicate that plastic debris poses severe harm to marine wildlife either by ingestion of microplastic, entanglement by macro plastic products (Lusher et al., 2018) and interference with their bodily processes through mutations by chemical toxins secreted and absorbed by plastic products (Beachapedia.org, 2018). Other study on plastic pollutants and marine aesthetic claims the loss of revenue from tourism due to degradation of beach/shoreline aesthetic by plastic pollutants (Moore, 2008). Plastic pollution results in the loss of tourist days, resultant harm to tourism infrastructure, harm to commercial activities reliant on tourism, the impairment to fishery activities, and harm to the local, national, and international image of a tourist attraction. One such example was a case in New Jersey, USA in 1987 and Long Island, USA in 1988 where news reports of medical waste, such as syringes, vials, and plastic tubes, along the coastline, resulted in an estimated loss of between 127 and 337 million user days at the beach and between 1 and 5 billion dollars in tourism-related expenditure (Moore, 2008). Atu and Atu (2018) concluded that plastic pollution is a serious threat to the Marine environment already suffering from overfishing, climate change and other forms of anthropogenic disturbance.

The same scenario is replicated in urban areas of developing countries like Nigeria where the quality of the environment is degraded by waste generally and plastic waste specifically. Dumbili and Henderson (2020) asserted that the production of single-use plastic and the uncontrolled release of plastic debris enhance plastic pollution in Nigeria which they attributed to waste management behaviour that facilitate indiscriminate waste disposal. The degradation of the quality of the Nigerian

secular environment has gradually seeped onto the campuses of Higher Learning such as campuses of Universities and Colleges of education. It has become a norm to be assailed with littered plastic wraps and discarded plastic bottles in lecture rooms, walkways, carparks, and hostel of student residence. The study therefore sought to evaluate the effects of plastic pollutants on the environment at the University of Calabar, Nigeria Calabar. Thus, the specific objectives of the study were to:

i. identify the causes and types of plastic waste generated on campus of the University of Calabar, Nigeria.
ii. identify the hub of plastic waste pollution on the campus of the University of Calabar.
iii. evaluate the effects of plastic pollutants on the campus environment.

2. Materials and method

2.1 Study area

The study was carried out at the campus of the University of Calabar, Nigeria. Calabar is located at the Southern region of Cross River State between latitudes 4˚50′00″ and 5˚10′00″N and longitudes 8˚17′00″ and 8˚20′00″E Fig. 1. Calabar covers an area of about 1480sqkms. Calabar is bounded to the north by Odukpani Local Government Area and to the East by Akpabuyo Local Government Area. Calabar is sandwiched between the Great Kwa River to the East and the Calabar River to the west. The city of Calabar covers two Local Government Area (Calabar Municipal and Calabar South). University of Calabar located off Etta Agbor Road between 4º 57′ 13″ N and 8 º 20′ 25″ E falls within the two Local Government Areas. The University of Calabar evolved from the Calabar campus of the University of Nigeria (UNN) Nigeria which started off in 1973 academic session with 154 students. In 1975 as part of the development strides of the military government created seven new universities, Unical was one of the Seven. The University of Calabar, Nigeria stands on 17 hectares of land at the eastern side of Calabar between the Great Kwa and the Calabar River The university commenced with three faculties (Arts, Science and Social Sciences) with an initial enrolment of 896 students (University of Calabar n.d). Presently the University of Calabar has eleven Faculties, one Graduate School, three Institutions and a student population of over 40, 645 (University of Calabar n.d).

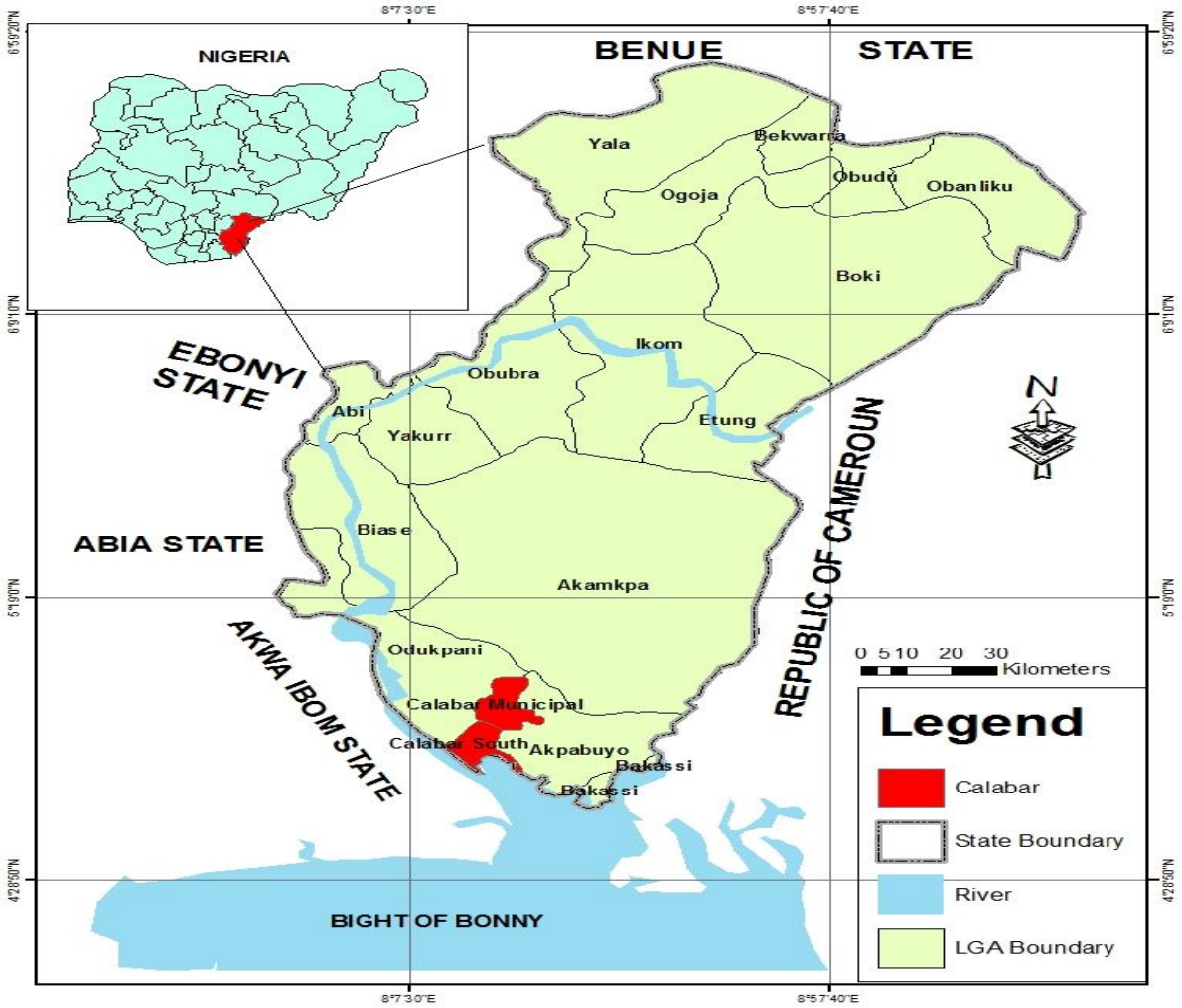

FIG.1: Study Area
Source: Adapted and modified from Inyang, (2019).

2.2 Methods

A combination of methods was adopted for the study. First, a pre-survey of the study area was done from 3rd – 5th February 2021 to identify the hub of plastic waste pollution. Thereafter, sampling was carried out simultaneously by the researcher and two research assistants between March 31st – 7th April, 2021. Multi-staged sampling method was adopted: first three sample areas on campus were purposively chosen for the study based on the authors prior knowledge of the areas of residence of

students and areas of learning activities. These are Main campus, Library axis and Malabo. Second the study areas were segregated based on their activities thus the study area 1:The main campus had 8 activity hubs sites: Social Sciences Lecture block (SSLB), Old law (OL), New Arts Theater (NAT), Institute of Education (IE), Social Science Faculty Block (SSFB), Faculty of Education (FE), Faculty of Environmental Sciences Block (FESB) and Hall 2 (H2). Library axis had 5 activity hub sites: Library complex (LC), Science Faculty (SF), Medical school (MS), Centre for Educational Service (CES) and Graduate school (GS). While Malabo also had 5 activity hub sites: Hall 4, 5, 6,8 & 9. Then random method was used to select study site, here all together 18 high impact areas of human activity that lead to plastic pollution were enumerated. The symbols of these sites were written on tiny pieces of paper folded individually, dropped in a closed box, thoroughly mixed then 12 of the folded papers were randomly picked from the box to form the sampled sites (that is 70.59 percent of the activity hub sites formed the sampled sites). At each of the sampled sites data were collected at 3 sampled point. Thus, data were collected from a total of 36 sampled points for the study. The pollutants were segregated and grouped into confectionery wraps, food packs, packages, sachet and water bottles that all constitute single use plastics, papers and other. The frequency of occurrence of each category of plastic was group-based at each sampled site counted 0 - 1. Zero (0) signifying no presence and one (1) signifying presence. The number (quantity) of a specific plastic pollutant was not the determinant therefore, five food packages waste is 1 and two hundred food package waste is 1. Where there are no food packages is 0. Thus, the total number for each category of plastic pollutants evaluated was sampled site based, that is, 36. The hub of plastic pollutants was noted, and a camera was used to capture the image of the pollutants on the environment. The types of plastic waste generated were identified visually and through filtering. To identify the causes of discarded waste pollutants on the environment 250 copies of close ended questionnaire were distributed randomly (every 3rd individually was administered the questionnaire) at pre-designated venue. One hundred and twenty (120) copies of questionnaire were administered on main campus, 85 copies at the library complex axis and 55 copies at Malabo axis. The dis-proportionate number of questionnaires administered at the study sites is borne out of the identified activities, number of lecture rooms and offices at the designated sites that were identified during the pre-survey. Results were cross tabulated and presented as percentages for both the questionnaire output and the plastic counts output.

3. Results and discussion

3.1 Types of plastic pollutants

Consumables are the main sources of plastic pollutants Table 1. This type of plastic pollutants is primarily from single-use source like food packages (packets/wraps for snacks/confectionery) that were highly prevalent in all the 36 sampled sites, that is 100% occurrence Table 1. and Plate 1. Plastic food packs had 83.33 occurrence. Others are sachet and plastic water bottles 69.44 and 55.55 percent, respectively. The study also found out that plastic water bottle though having the capacity of been reused and are most times reused by refilling and used for selling locally produced liquid product such as liquid soap, and drinks still constitute

55.55 percent of the plastic pollutants at the University of Calabar.

Table 1: **Types of plastic pollutant on the Campus of the University of Calabar** (n=36)

S/n	Sources	Types	Frequency	Percentage occurrence
1	Snack/ confectionery	Packages & wraps	36	100.0
2	Food packs	Packages and wraps	30	83.33
3	Sachet water	Packages	25	69.44
4	Water	Bottles	20	55.55
5	Electronics	Ceiling fan etc.	5	13.88
6	Teaching aids	Markers/pen etc.	30	83.33
7	Switches/wires/packers	Mixed debris	10	27.77

Source: Researcher Field Survey 2021

Plate 1: Plastic pollutants at Unical Main Campus
Source: Researcher Field Survey 2021

3.2 Causes of plastic pollutants

Respondents were asked what causes the plastic litter on campus bearing in mind that the University has agents tasked with the campus clean up. The responses tabulated on Table 2. demonstrated that the unwholesome plastic litter on campus is attributed to a combination of factors ranging from attitude of the stakeholders (students, staff & visitors). Sixty percent of the respondents do not care to properly discard their plastic waste in designated area. The attitude/behaviour finding of the study on Table 1 collaborates the study of (Dumbili and Henderson 2020) that attributed problems with waste management, specifically plastic waste management challenges in Nigeria to habit/behaviour. Inadequate waste bins accounted for 25 percent of the causative factor of plastic debris at the university of Calabar. Irregular clean-up and evacuation 10 percent and 5 percent access to package food Plate 2. show no visible waste receptacle by walkways and hawkers in the background.

Table 2: Causes of plastic pollution on the campus of the University of Calabar (250)

S/n	Causes of plastic pollutants	Frequency	Percentage
1	Access to affordable packaged food, water and hawking	12.5	5.0
2	Inadequate waste bins	62	25.0
3	Non-regular cleanup-and evacuation	25	10.0
4	Attitude	150	60.0

Source: Researcher Field Survey 2021

Plate 2: Indiscriminately discarded plastic wraps at walkway at university of Calabar
Source: Researcher Field Survey 2021

3.3 The hubs of plastic pollutants at the University of Calabar Campus

Plastic pollution has become a menace to the qualitative academic environment of the University of Calabar, Nigeria as illustrated on Table 3.and Plates 3-5. Even the lecture rooms are not free from the threat of plastic pollution. The walkways, car parks and green areas are all affected. It is the case of plastic everywhere. Mobile eating habit of both staff and students is especially responsible for the plastic litter on walkways. The mobile eating habit is fueled by the hawking and easy access to package food and water which accounted for 5 percent. Immediately one is done with the eating of hawked items, the tendency is to drop the waste at the point it gets finished thus distorting the aesthetic of the campus. Others believed that the University does not have clearly designated refreshment (cafeteria) and food vendors are all over the campus as such waste is generated at multiple points making clean up difficult and the lack of trash cans on walkways encourage litter Plate 3-5.

Table 3: **The hub of plastic debris, types of pollutants and polluters at Unical Campus**

S/n	The hubs of plastic debris	Types of pollutants	Polluters	Source
1	Lecture hall	Sachet water pack, Snack confectionary: sweets, bubble gum, biscuit etc./wraps/packaging	Students	Hawking
2	Walkways & Car parks	Sachet water pack, Snack confectionary: sweets, chewing gum, biscuit etc. packaging	Students, Staff & Visitors	Hawking Brought in
3	Designated waste deposal sites	Food packs water packs carrier bags assorted plastics	Students, Staff Management	Everywhere

Source: Researcher Field Survey 2021

Plate 3: Plastic pollutants littered on walkways.
Source: Researcher Field Survey 2021

Plate 4: Plastic pollutants on Green areas
Source: Researcher Field Survey 2021

Plate 5: Plastic waste litter at Car Park at the Main campus.
Source: Researcher Field Survey 2021

3.4 Effects of Plastic Pollutants on the campus environment

The unwholesome display of discarded plastic on campus degrades and distort the aesthetic of the University of Calabar as seen on Plates 6-8. Plate 6 is the sideview of New Arts Theater which was meant to be a green area servicing the Faculty of Agriculture, Old Law and the theater complex and Plate 7 is the New Library. These sites should have been a key attraction to students and staff but as it is, it repeals rather than attract. Plate 8 is a demonstration of blocked drains and over-flowing waste receptacle at Malabo axis.

Plate 6: Broken waste receptacle inundated by plastic pollutants.
Source: Researcher Field Survey 2021

Plate 7: Plastic waste at new library complex axis
Source: Researcher Field Survey 2021

Plate 8: Blocked drains at Malabo
Source: Researcher Field Survey 2021

4. Conclusion

Plastic material is important to modern society because of its unique quality but the negligent disposal of the debris on the environment at the University of Calabar as determined by the study is the cause of the prevalence of plastic pollutants at the campus. The negligent disposal behaviour borne out of the belief that one tiny improper discarded plastic waste (e.g., a sachet of water or wrap) does not matter. Unfortunately, it is one insignificant plastic bottle plus another insignificant plastic sachet plus another insignificant food pack that add up to the challenge of plastic pollutants at the campus of the University of study and the larger society.

5. Recommendations

The study thus recommends attitudinal change awareness campaign, regular clean-up, evacuation, restriction of sale and consumption of single use plastic water (sachet water) and food packs to designated areas on campus as short and long-term measures to curb the menace of plastic pollutants at the University of Calabar, Nigeria.

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