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Eco-Development Impact of Coca-Cola Industry on Biodiversity Resources at Asejire Area, Ibadan; Nigeria

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Abstract: The study of eco-development impact of Nigerian Bottling Company, PLc (NBC), Coca Cola Industry was carried out to assess its activities (both positive and negative) on the biodiversity of the Area (Asejire in Egbeda L.G.A. of Oyo State). The study was carried out to determine the ecological and socio-economic impacts within the area. Ecological parameters were assessed by the use of two methods, first is the use of SYSTANAL checklist of ecosystem and random sampling of two sample plots (10 mx 10 m) in three villages (Iseke, Olukeye and Iyalode) of Asejire area. Secondly is the socio-economic parameter that was measured through the use of One hundred and fifty structured questionnaires, which were distributed to the three villages in the area. Analysis of water samples collected at 3 points was performed for water qualities parameters suitable for human use and aquatic survival. Parameters analyzed were Dissolved Oxygen Concentration, pH, temperature, turbidity and some heavy metals. Results showed that family *Palmae* (flora) and *Archachatinidae* (fauna) have the largest population abundance with 24.32 and 18.64%, respectively. Out of the 120 questionnaires retrieved, 52.50% attributed vegetational degradation from anthropogenic activities to proliferation of subsistence agriculture activities, while 18.33% was to industrial development through clear felling. About 35.83% indicated provision of water taps by industries as positive support to the community. The water sample collected showed a pH of 5.7, 6.3 and 6.5 at the point 'A', 'B' and Dam, respectively. This is an indication of acidic water and might be toxic for human consumption except treated to comply with the WHO recommended pH 7, for safe and drinkable water.

Key words: Biodiversity, eco-development, flora, fauna, impact

INTRODUCTION

Our generation has witnessed unprecedented changes in the balance of nature. Many in no doubt have benefited from the resulting economic growth and technological progress, but the society as a whole has continued to suffer from increasing pollution resulting from intensive industrialization and the breakdown of ecological balance caused by widespread destruction of flora and fauna diversities[1].

The need for industrial development for the sake of labour absorption, economic emancipation, self-reliance and national pride has been traded for polluted environment especially in the developing countries like Nigeria in the recent times Okotere[2].

Nigeria, like other developing countries of Africa, Asia and Latin America, sees this need to develop the quality of life of her people. In this regard her abundant natural, material and human resources are great assets, which cannot be left untapped. However, the impact of our economic activities is felt not only in the rapid depletion of our natural resources (land, water, forest, oil and minerals, wildlife e.t.c.), but also in the alarming rate at which the natural environment is being heavily polluted, due to an accumulation of waste[1]. This resource exhaustion coupled with the overloading of the environmental mechanism for assimilation of waste poses serious threats to the survival of the Nigerian populace.

Africa is endowed with abundant biological resources of different forms and sizes from the minutest micro-organism to the large plants and animal with each occupying a niche within the environment and playing important role in environmental sustainability. The uncontrolled use and degradation of our environment for industrial development among others pose a serious threat to the survival of the abundant diverse species of plants and animal. Apart from allowing local extinction of important species, their role in nature balance is disturbed. And this has led to untold consequences of desertification, flooding, climatic change, heat wave/temperature rises and so on. If human must survive,

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careful use of earth's resources through conservatory principles must be employed.

Furthermore, the depletion of earth's resource is like opening door for the incoming of lethal environmental consequences. When the land is degraded, agricultural production is hampered leading to food shortages. There is a way the nature regulates itself, however untold human interferences have brought about health hazards with killer diseases.

One major reason why there have been many environmental problems associated with our industrial development is the lack of environmental considerations in the planning and building of our major projects. Projects are usually sited or embarked upon to satisfy the social and economic needs of our peopled without consideration of the possible impact on the environment. Rapid industrialization and intensive urbanization have not only made a greater demand for water supply but have also led to increase discharge of industrial and domestic effluents. Water pollution and air pollution (from cars and industries) are areas of concern for environmental control.

In large industrial towns and cities, there appear to be no organized programmes for disposal of effluents and industrial wastes. Many factories discharge their waste directly into our streams or rivers or unashamedly into open gutters, causing serious environmental perturbation. The pollutants generated affects water, plants and animal, resulting in large scale death[2]. The Nigerian Bottling Company plc (NBC), which is a part of Coca-Cola HBC, incorporated in November 1951 to bottle and sell carbonated non d-alcoholic beverage, is a company that has the sole franchise to bottle coca-cola products in Nigeria. Production of coca-cola began in 1953 at a bottling facility in Lagos and new plants at Kano, Port Harcourt and Ibadan were opened shortly afterwards (Mokola and Asejire factories). NBC became a public company in 1972 with it getting listed of the Nigerian stock Exchange. NBC generates power and it is self-sufficient in carbondioxide and other gases production. It has 16 bottling facilities around the country and it uses 82 distribution warehouses and 200 distribution outlets. The Company's head office is at Lagos mainland at Ebute-Metta.

Community and environmental programmes NBC is a key sponsor of the Nigerian Conservation Foundation (NCF), a non-profit organization focused on conserving natural resources and improving the quality of life/. NCF is an associate of the Worldwide Fund for Nature and work closely with World Conservation Union and the Society for the Protection of Birds.Efforts by NBC include: Donating writing material (2,000 exercise books, 1000 pencil and 500 T-shirts. Also delivery of daily supplies of bottled water Donating computers and printers to the local community of Oginigba by the Port-Harcourt plant to help support socio-educational development in the region: Football and Golf support, Lawn-tennis support. Broad community support has helped to make NBC one of Nigeria's most admired companies.

- To assess the composition of flora and fauna diversities within the Asejire area.
- To assess the impact of industrial activities in terms of the physio-chemical properties of water samples collected at Iseke stream and Asejire river.
- To profer mitigation measures towards the conservation of natural resources and anthropogenic importance.

The environment is the base of all natural resources for both human and industrial consumption. The abundance of biological and mineral resources shows that human may never lack as the need may be. However, the race towards economical emancipation, industrial development and agricultural production maximization among others with population explosion has put the environmental resources under continuous exploitation. Even though this natural resource was there to fulfill human need, uncareful use might portends exhaustion especially with most renewable/biological resources like wildlife. It is therefore worthwhile to harmonize industrial development with environmental sustainability using the principles of conservation and evolvement of appropriate extractive and wastes disposing technologies that inflict minimal harm on the environment.

In view of this, it is necessary that all development project asses their ecological impacts; as indicated in the studys of Ebosiem[3] that all oil exploration processes must conduct environmental impact assessment and that indigenous industries evolve recycling technologies for their own waste management.

MATERIALS AND METHODS

The study site is Asejire Town in Egbeda Local Government Area of Oyo state in which the Nigerian Bottling Company Plc is located. The town lies between longitude 3°10' N and latitude 9°36'E, respectively. It lies within the rainforest vegetation belt of Nigeria.

The annual rainfall range is 1500-2500 per annum. Temperature range of 21°C-36.9°C and relative humidity range of 50-92% have been recorded since 2000 till date.

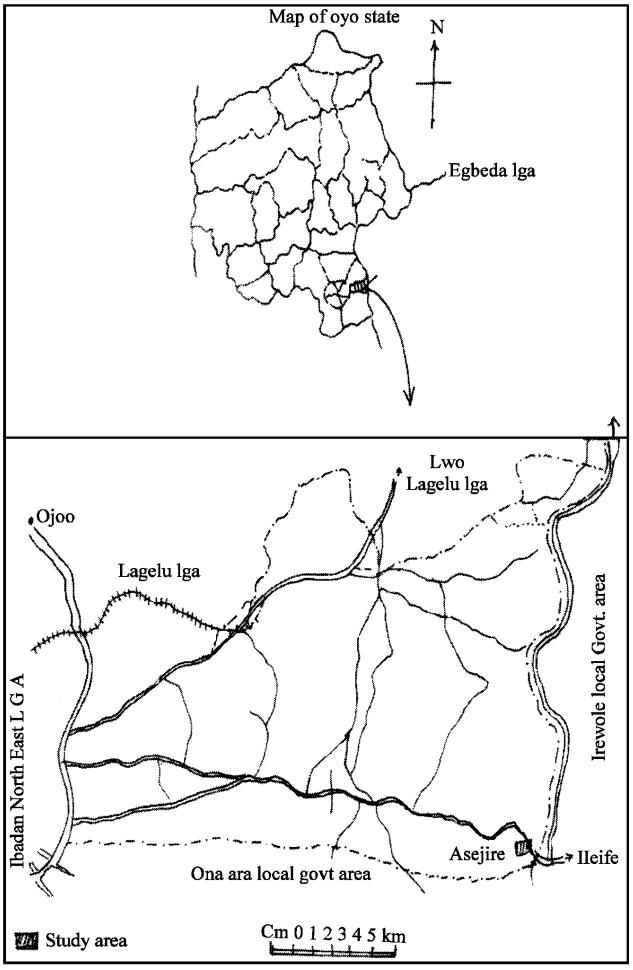

Fig. 1: Map of Oyo State showing Asejire area in Egbda local Govt

Although the town vegetation has a rich biotic diversity, recent trends in industrial development and agricultural production has left few patches of secondary forest. The soil is characteristics clayey loam with thin organic humus layer. The town lies at the Ibadan border of Oyo state with Osun state beside Ikire town Fig. 1 and 2.

The population is relative less than a few thousand with a land area of approximately 40 km^2. The origin of the town is traced to be founded in the 15th century with migration of traders from the old-oyo empire. Villages and communities include:

-ISEKE
-OLUKEYE
-IYALODE

there is Oshun river flowing through the town. The dam supports aquatic lives and source of water to the populace. The people involves in intensive agriculture (crop and animal especially poultry production), with few working in government offices and in the NBC plc, Asejire factory. Much of the natural environment has been degraded for this purpose.

The materials used were:

- 50 metre rule tape
- Record books
- Photographic camera
- Questionnaires

Data for the study were obtained from December to January 2005/2006 at Asejire town, with the period classified as dry season. Four approaches were used for the study. The first approach is the use of SYSTANAL checklist for describing the ecosystem of the study area. The second approach involves taking the inventory of the abundance of tree and animal species using random sampling of 2 samples plots 10 mx 10 m, established in the 3 villages for trees and a line transect of 2 km for fauna

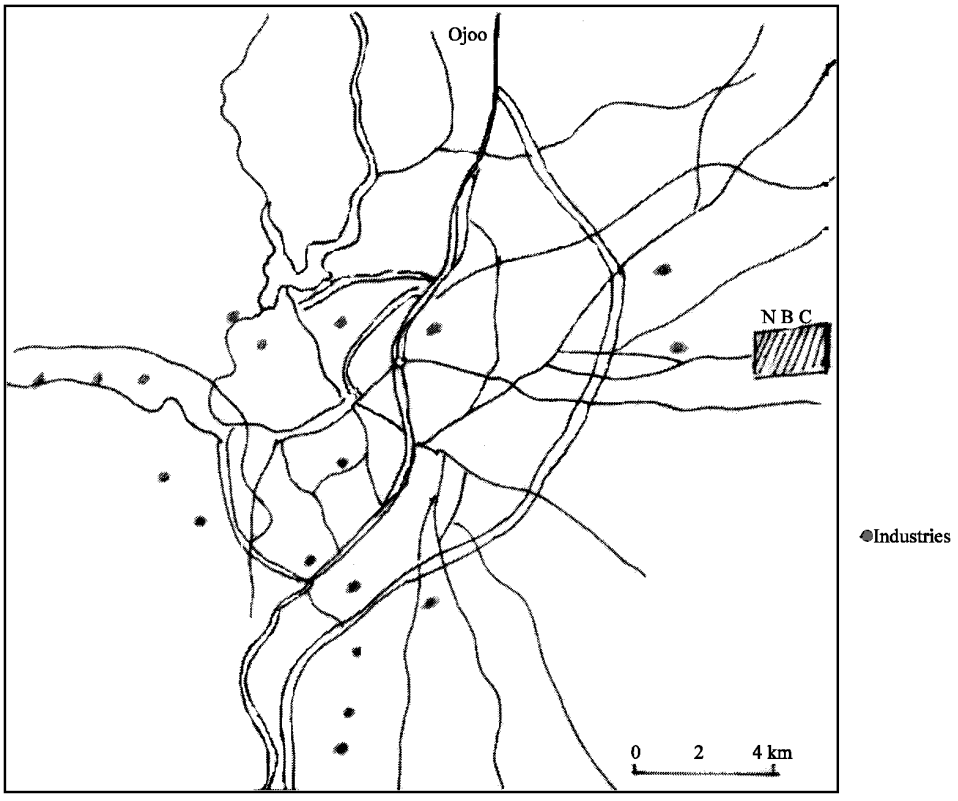

Fig. 2: Map of industries in Ibad an showing Nigerian bottling company Asejire

assessment. The third approach is the use of questionnaire for the ecological and social impacts of the Nigerian bottling Company, plc Asejire factory on the Asejire communities (anthropogenic view).

The fourth approach is the analysis of water samples collected from two points at an adjoining stream where the company empties its liquid waste/effluent and from the Asejire dam site for water physiochemical parameters. The water quality parameters that were assessed include dissolved oxygen concentration, heavy metals temperature and turbidity.

Data analysis and presentation: Two sample plots of 100 m^2 area were established in the 3 villages by random sampling method for estimation of tree population and abundance. The indirect method was used to estimate faunal types and population. The indirect method is the use of footprints and other signs. The formular for the method is:
Indirect method; Formula:

$$Pi = \frac{Di}{Ri \times Ti}$$

Where Pi = relative density

Di = mean sample (Ndi)
Ri = spoor rate per day
Ti = No of days

This was done 3 days consecutively for 3 weeks in the sample plots and collection were done in the dry season Plate 1, Plate 2.

Assumptions of the point count for both plant and animals' resources are as follows;

- points are not too close in woody/forest vegetation, so that faunal resources would not be counted at more than 1 point.
- each individual fauna resources is counted once only.
- there is a functional relationship between tree cover (habitat) and faunal resources and can be used where possible to quantitatively predict the behaviour of fauna resources.

Socio-economic impact analysis: 150-structured questionnaire were distributed randomly within the 3

Plate 1: Sampled Area (secondary forest) at Iyalode village showing oil palm trees and some climbers

Plate 2: The Asejire river where water samples were collected

villages. Out of the 150 questionnaires distributed 120 were retrieved. The analysis of the questionnaire was done by the use of tables to assess the percentage socio-economic and ecological impact of the NBC plc on the Asejire area. Parameters considered were waste dumping within the environment, environmental conservation, infrastructure provisions, job employment (percentage employed) and so on.

Water parameters analysis: Three water samples were collected from ISEKE steams adjoining the NBC, plc Asejire and at the Dam site and were tested for water physiochemical parameters.

Dissolved oxygen concentration: Dissolved oxygen (D_o) of the water samples collected in 50 mL BOD bottles and fixed on site with Winkler's method as described. The readings were recorded in mg/litre D.O.

Heavy metals: Determination of some heavy metals was performed on collected samples using atomic absorption spectrophotometer. Metals tested were Mercury (Hg), Cadmium (Cd), Nickel (Ni),Lead (Pb) and Iron (Fe).

Temperature: Temperature readings were done on site using a mercury glass thermometer calibrated in degree celsius (°C).

Turbidity: Determination of turbidity and total suspended solids was done using a 200 mL calibrated cylinder and a graduated line with a ball top.

pH: The hydrogen ion concentration (pH) of samples was determined with the aid of a pH indicator study dipped into samples.

RESULTS

The ecosystem diversity description in Table 1 shows that Iseke village has predominantly farmland ecosystem 50%. At the Olukeye village, the grassland ecosystem 47% is dominant as much of the original forest and woodland ecosystem 5% have been degraded for industries, houses and farming. The extensive forest ecosystem 45% at Iyalode village is a secondary forest predominantly oil palm and *Glicirida* sp.

Table 1: Percentage diversity Component for ecosystem description in study area

Ecosystem	Iseke village (%)	Olukeye village (%)	Iyalode village (%)
Grassland	25	47	20
Woodland	10	05	10
Forest	10	20	45
Shelterbelt	05	05	04
Farmland	50	33	26

Table 2: Tree family and percentage of occurrence at the study site

Family	Number of occurrence In each family	Percentage (%)
Palmae	18	24.32
Moraceae	7	9.46
Sapotaceae	10	13.51
Sterculiaceae	1	1.35
Bombaceae	1	1.35
Combretaceae	2	2.70
Polygaceae	4	5.41
Rubiaceae	5	6.76
Rutaceae	5	6.76
Sapindaceae	7	9.46
Ceasalpiniaceae	3	4.05
Mileaceae	3	4.05
Flacourliaceae	3	4.05
Bignomiaceae	1	1.35
Papilionaceae	4	5.41

Assessment of the flora composition has shown in Table 2 indicated *Palmae* 24% as the highest occurring tree species within the study area. Followed by *Sapotaceae* 13.51%. The least occurring families include *Sterculiaceae, Bombacaceae* and *Bignomiceae* each with 1.35 percentage of occurrence.

Table 3 above indicated the respondents' opinion on the impact of the anthropogenic activities (such as Nigeria Bottling Companies and others) on the environment. It was shown that agricultural activities has the highest effect 52%, while others such as loging, hunting and industrial activities as the following rates 10, 8.33 and 18.33%, respectively. The most abundant tree species are *Elaeis guinnenses* 47.5 and *Glicirida sepium* 34.17%. While the animals mostly abundant are *Archachatina* sp, *Thryonomys swinderianus* and *Crecetomys gambianus* with 46.67, 30.0 and 20.0%, respectively.

The fauna composition shows that the family *Achachatinidae* 18.64% has the largest species composition within the study area. Family *Cricetidae* 15.25% also occur substantially at all sampled plots. There are also the occurrence of families like *Grapsidae* and *Ploceidae* with 6.78 and 16.95%, respectively, as stated in Table 4 above.

The mean concentration of some water quality parameters including selected heavy metals in collected water sample analyzed was shown in Table 5. The Turbidity level of the point "A" (305.1FTC) was high compared to the point "B" (304.8FTC) of the steam adjoining the company's location and least at the dam site (233.4FTC). The results of heavy metals like Cadmium,

Table 3: Respondents' opinion on anthropogenic impacts on the study area

Parameters		Frequency	Percentage
Most abundant	Elaeis guineensis	57	47.50
Tree spedes	*Glicirida sepium*	41	34.17
	Ficus sp.	22	18.33
Most abundant	Thryonomys swinderianus	36	30.00
Animal species	Crecetomys gambianus	24	20.0
	Archachatina sp.	56	46.67
	Du i kers	14	11.67
Type	Secondary forest	89	74.17
Vegetation	derived savanna	31	25.83
	Others	-	
Richness of			
	High	25	21.35
Vegetation	Low	30	24.67
Composition			
	Not known	--	
Activities effect	Agricultural production	63	52.50
On biodiversity	longing of tree	12	10.00
	Hunting		10
	Industrial development	22	18.33
	Through clear felling		
	Others	08	6.67
Industrail effect			
Vegetational	Yes	30	25.50
Composition	No	-	-
Should industries	Yes	115	95.83
()NBC Oyo state,e	Yes		
water corporation			
e.t.c) compensate			
community			

Table 4: List of mammals found at the sample areas

Family	Common name	scientific name	percentage (%)
Bovidae	Duiker	*Cephalphus monticola*	5.08
Cricetidae	Cane rat	Thryonomys swinderianus	15.25
	Giant rat	*Cricetomys gambianus*	11.86
	Giant forest	*Protoxerus stangeri*	
	Squirrel		10.17
Achachatinidae	African giant snails	*Achachatina* sp.	18.64
	Common crab	*Cardiosoma armatum*	8.47
	Hermit Crab	*Clibanarius armatum*	5.08
Grapsidae	Toad	*Fuscatus* sp.	6.78
	Frog	*Fuscatus* sp.	
Ploceidae	Village weaver	*Ploceus cacullatus*	16.95

Table 5: Chemical analysis of water samples of the study area

Parameters	Point A	Point B	Dam Site	Mean
Dissolved Oxygen Concentration(mg/ltr)	50.3	56.4	60.5	55.71
Temperature(°C)	28.5	27.7	24.0	26.7
Turbidity(FTC)	305.1	304.8	233.4	281.1
PH	5.7	6.3	6.5	6.1
Heavy metals				
Mercury(Hg) (mg L^{-1}	0.004	0.003	0.001	0.003
Cadmium (Cd) (mg L^{-1})	0.044	0.036	0.036	0.037
Iron (Fe) (mg L^{-1})	0.19	0.24	0.28	0.24
Lead (Pb) (mg L^{-1})	0.01	0.01	0.01	0.01

Nickel, Iron and Lead were obtained and highest at the dam site for Iron. The dissolved oxygen concentration

increases from point "A" (50.3 mg ltr^{-1}) to point "B" (56.4 mg ltr^{-1}) and highest at the dam site (60.5 mg ltr^{-1}).

DISCUSSION

African environment is enriched with diversities of lives and forms in flora and fauna. The study shows that uncontrolled exploitation of the environmental resources can lead to its loss especially vegetational degradation and wildlife migration and, or extinction. The ecosystem component of the study area shows that more of the natural environments have been loss due to degradation by industrial development and intensive agriculture (Table 1). The dominance of wild oil palm is characteristics of an ecosystem that has loss its original natural diversities according to the work of Allen and Shinde,[4].

The population of wild oil palm thriving Table 2 around the villages sampled corroborates this. However, the abundance of this crop plant has made local oil palm production thrived especially at Iyalode village. The secondary ecosystem is able to sustain rodents, snails and small sized antelopes Table 3 since the dense natural forest no longer exists.

Majority of the respondents are young adults with little educational background. They are also predominantly farmers which is evident with large parches of farms Table 4. Most of the respondents blamed agricultural production and industrial development for loss of biological diversities and requested for compensations by inhabiting industries. However in a village where appropriate technology and education is lacking; such will be difficult.

The social impacts of NBC PLC, Asejire were most felt in the areas of water projects and electricity Table 4. The company collaborated with the state water corporations in the installation of water taps around the village square.

Respondents opined that the extent of environmental damage is by liquid waste dumped in the Iseke steam by the company; which although does not serve as their source of drinking water, but their farm-land and domestic livestock depended on it. Samples of water collected at Iseke stream at the point where waste empty into the stream and at the dam site revealed that heavy metals like cadmium, mercury and lead were present. These elements are toxic to plant, animal and man. The gradual accumulation of toxic elements within the vegetation consumed by domestic and wildlife species portends a greater danger for the ultimate consumer, which are human beings. The liquid effluent was observed to have a greyish-brown colour and runs through an open drain from the company to the stream.

CONCLUSION

Natural vegetation provides us with an arrays of goods and services that play important roles in our natural economy and general well being. Prominent amongst products from forests is wood, versatile raw materials, the use of which is almost infinite. Non-wood components of forests and natural vegetation are also of importance. In many parts of Nigeria, leave, fruits, nuts and oils of wild plants provide a significant portion of the food supply for human, livestock and wildlife consumption. The leaves and barks of many tropical forest trees also serve as sources of drugs, resins gums and latex. Importantly, the vegetation cover forms habitants for a great variety of wildlife, which are of economic and aesthetic value. Many Nigerians depend on wildlife as their main source of protein. In addition to the above functions, vegetation also plays indispensable roles in creating and preserving a stable and high quality environment by moderating local climates, reduces soil erosion and regulates stream flow by forming a protective screen over land. Vegetation is abused largely of because of the strive to meet short-term needs for farmland, fuel wood, timber, grazing, hunting and gathering of natural products. Also infrastructure building and activities related to industrialization and urbanization particularly oil exploration and production.

In view of the need to harmonize industrial development at Asejire area with ecological sustainability, the following recommendations are made from the study.

- It should be mandatory to carry out an environment impact assessment according to decree 86 of 1992 (Environmental protection Act) before any project commences an, or modified for more production. These should be done to assess the impacts on the environment and people around and should be properly monitored. Mitigation measures must be put into the environmental impact statement.
- The NBC plc, Asejire and other companies (corporations) should compensate for the use and degradation of the Asejire Area by establishing artificial plantations, which must be heterogeneous in composition.
- Exploitative hunting should be discouraged by the Egbeda Local Government Authority and Game Reserves be established to improve fauna composition of the Asejire Area.
- Farmers should organize into cooperative unit such that agricultural land use will be on a large scale to prevent the proliferation of large subsistence units as it was seen in Asejire to ensure proper land use options and ecological sustainability.

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