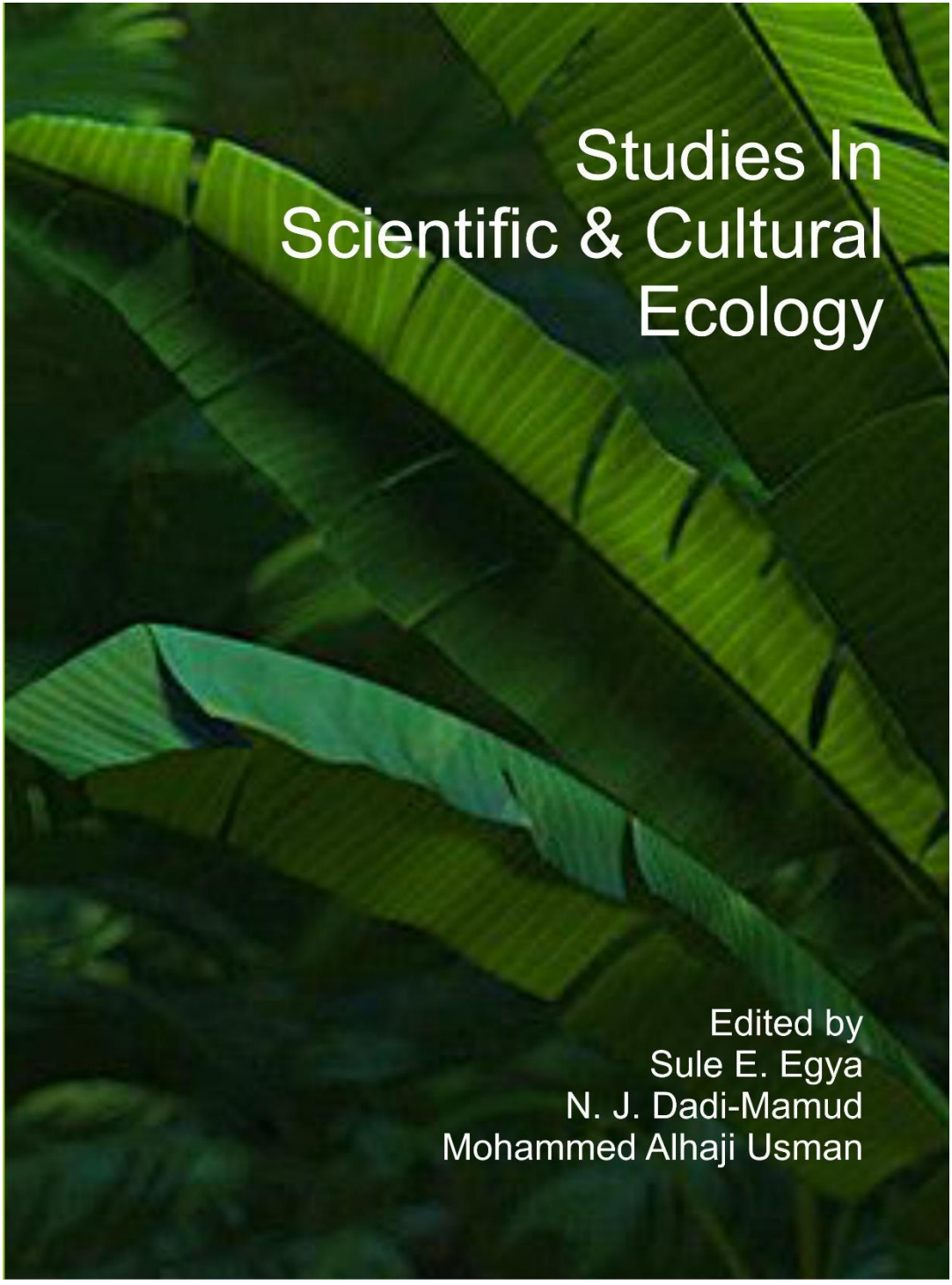
Studies In
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CONTENTS

Chapter One

INTRODUCTION: THE CASE FOR TRANSDISCIPLINARITY IN ECOLOGICAL STUDIES

Sule E. Egya

I

As a student (at undergraduate and postgraduate levels) of English studies, I was frustrated by disciplinary restrictions. I did not only endure it but also confronted it in my own way. At the onset of 400 Level in Department of English, University of Jos, Jos, it became compulsory for me to choose to specialise in either Language or Literature. I liked both subfields and performed excellently in them. And as far as I could see, both of them were intertwined. In my estimation, a graduate of English should not miss any of the courses in either subfield. As soon as I got over wondering about what I saw as the irrationality of the system, I decided to choose the Language subfield, even though I had my ambition of becoming a writer and professor of Literature. I explained to my mates who showed surprise at my choice that as a future writer and expert in Literature, I needed Pragmatics (which was being introduced at 400 Level) and deeper understanding of Syntax, Semantics, Psycholinguistics, among others, which were now the exclusive preserve of those in the Language subfield. At the postgraduate level, I became even more worried as I faced conservative notions of intra-disciplinary restrictions. My best course during my MA programme at Benue State University, Makurdi, was Literary Theory, and I had endless arguments with my theory lecturer. He saw and taught Literary Theory within the strict division between those theories that are contextual (such as Marxism, Feminism, etc.) and those that are textual (Formalism, Structuralism, etc.). I always argued for a collapse of this division, which for him was inviolable in theory. Somehow, I found my way into Poststructuralism, a theory undermined by my Literary Theory lecturer, and yet one that liberated me totally from his oppressive divisionism. With Poststructuralism, boundaries/restrictions are interrogated and possibly collapsed.[1]

My learning in Poststructuralism is a crucial prelude to my research interest in environmental humanities. My research adventures, in my formative years, were often to break boundaries, to shift paradigms, and to radically confront conventions. I found ecocriticism (the study of literature and environment) in the summer of 2010 at the Institute of Asian and African Studies, Humboldt University, Berlin, while I was there as an Alexander von Humboldt postdoctoral fellow. The first book I encountered was Graham Huggan and Helen Tiffin's *Postcolonial Ecocriticism: Literature, Animals, Environment*. The categories of literature, animal, and environment overspill the boundary of literary scholarship, in that there are inevitable forays into other disciplines such as biology, zoology, geography, geology, among others. The authors bring understandings from these different fields to produce a theoretical and analytical discourse that shows the capacity of the human intellect to indulge transdisciplinarity. At once, ecocriticism, for me, appeared to be the field of research my restless spirit had been longing for. It provides the latitude to bring the sciences and the humanities into a symbiotic dialogue, one that conservative academics have long resisted in Nigeria. In our institutions of learning, there is always that division between the sciences and the humanities, accentuated and complicated by an institutional superioritisation of the sciences and a corresponding inferioritisation of the humanities. The result, especially in the Nigerian context, is a display of crude ignorance whereby those in the sciences assume that the humanities scholars do not undertake research; and even if they do, their research is not as significant to the society as the one undertaken by the sciences scholars.[2] I had in mind to confront this narrative when I convened a Humboldt Kolleg/conference in Lapai, with a generous support from the Alexander von Humboldt Foundation and the Management of Ibrahim Badamasi Babangida University. The conference was held in mid-2018 and nearly all the chapters of this book are papers presented at the event.

The theme of the conference was Ecology and the Convergence of the Sciences and the Humanities. The central question powering the deliberations was: How much can the study of ecology – either from the perspective of humanities or that of natural/social sciences – benefit from a convergence of scientific and humanistic theories and methodologies?In tackling this question, there is the contention that a researcher in the humanities, say, a literary scholar or a theatre artist working on ecology should fruitfully interact with, say, a geologist, a geographer, an atmospheric chemist, or even a science educationist working on ecology (each benefiting from the

other). Ecology here is conceived as a broad field of research that encompasses the earth, the water, the air, biodiversity, the flora and fauna, physical and human environment, among others. Although ecology appears to be the domain of natural sciences (since the science revolution age), social scientists and humanities researchers have increasingly taken an interest in it, raising questions that concern environmental degradation and its effects on humans (environmentalism of the poor), social justice for biodiversity, and the prevention of global warming. Climate change, as a discourse and as a reality, appears to have liberalised the study of ecology, unhinged it from the rigidity of Newtonian scientists who think humans should be separated from nature or have to detach themselves from nature to study it. The outcome of the conference is that participants were able to share knowledge on the natural components of ecology, the interdependence of humans and ecology, and the need to recognise the rights of biodiversity to exist side by side with humans with the understanding that any predicament faced by ecology is one with which humans will also contend. In other words, humans need not detach themselves from nature, as studying nature implies studying themselves – a prognosis that bridges the gap between the sciences and the humanities.

II

Expectedly, as this book exemplifies, there are many gains from a multidisciplinary and interdisciplinary research on environmental studies. There is a sense in which we can say all humans, all beings, all activities engaged by humans do have a link to their environment. In other words, each discipline, as long as it is occupied by humans and nonhumans, as long as it has something to do with the atmosphere, the biosphere, and the lithosphere, ought to have something to do with the environment. If this be the case, then there ought to be a platform, a convergence, a certain kind of dialogue that disciplines should have with one another concerning environment. Many researchers, either in the sciences (natural, social, applied) or in the humanities have suggested the need for transdisciplinary research in environmental studies (Shah et al., 2018; Brondizio et al., 2016; Lewis and Maslin, 2015; Palson et al., 2013). There are certainly points of relation, for instance, between what a physicist and an anthropologist say about environment. Foregrounding such relations and harnessing them towards solving environmental problems should be the uttermost concern of cross-disciplinary scholarship. The crux of the matter here is that environment is such

a broad context for all disciplines that the best approach to solve problems related to it ought to be, at least, multidisciplinary.

I would like to invoke the concept of Anthropocene to demonstrate here the necessity of transdisciplinarity in the study of ecology. That is, to show that, in the light of contemporary environmental scholarship, there is the need for the natural sciences, the social sciences, the applied sciences and the humanities to converge in tackling climate change and other environmental problems. Anthropocene, generally defined as "the time when human activities have significant impact on the Earth System" (Nichols and Gogineni, 2018), is the geological epoch meant to account to contemporary ecological reality globally. The atmospheric chemist Paul Crutzen and the biologist Eugene Stoermer first used the term in 2000, calling attention to the huge impact of human activities on the environment, and the need to spatially and temporally describe a geological epoch that would succeed the Holocene. This has attracted scholars in geosciences, especially stratigraphers who have been working to identify the specific period, in human history, when the impact of human activities on the earth became significant in the world. The Anthropocene Working Group, AWG, was established to formulate a definition and periodisation for Anthropocene.[3] It defines Anthropocene as "the present time interval, in which many geologically significant conditions and processes are profoundly altered by human activities" (AWG, 2015). It pegs the time of the emergence of Anthropocene to 1945, when the atomic bomb was first detonated, but fails to provide data as to how the impact of that could be justified as the beginning of Anthropocene thereby generating controversies (Nichols and Gogineni, 2018).

Today, Anthropocene is considered as a geological concept claimed by stratigraphers and midwifed by the AWG. Within the field of geology and the broader spectrum of Earth Sciences, the term continues to wax stronger in debates and controversies surrounding its definition and periodisation. For instance, what is considered the best period of high human impact by one discipline may not be the same for another discipline. Moreover, different disciplines define Anthropocene in line with their ontological and epistemological exigencies. The social sciences, for instance, views Anthropocene from the perspective of human impacts in terms of social and political institutions and their effects on the environment (Crosby, 2015; Moore, 2003; Richards, 2003). This perspective, Toivanen et al. write, "produces knowledge on how the changes in biosphere are connected to both world-systemic as

well as national and regional social hierarchies, power and economic structures or political interests" (2018, p. 190). In the humanities, on the other hand, Anthropocene becomes a subject of critical and speculative knowledge whereby representations and interpretations are deployed to not only apprehend the connection between human activities and environmental crises, but also create alternative realities through the lens of art, writing and cultural-critical production (Cohen and Colebrook, 2016; Heise, 2016; Morton, 2013). Nevertheless, Anthropocene has gained incredible currency across disciplines in natural sciences, social sciences, applied sciences and the humanities. It has been variously appropriated by these disciplines to account for the increasing pressures the world ecosystems face; it has, in point of fact, become a rallying concept, in spite of inter-disciplinary tensions in terms of description and periodisation, suggesting that all disciplines are concerned with the impact of human activities on the planet.

Tiovanen et al. have described four approaches to Anthropocene by way of identifying the disciplines that have been concerned to appropriate the concept to deal with environmental crisis. In their words:

> We propose four different *approaches* to Anthropocene that already exist in the disciplines of natural sciences, social sciences and humanities: The 'geological Anthropocene', which should be defined based on stratigraphic evidence, as outlined by the ICS; the 'biological Anthropocene' which focuses on the longer term anthropogenic changes on the biosphere; the 'social Anthropocene' which intertwines the geological and biological Anthropocene in social, societal and historical processes; and, finally, the 'cultural Anthropocene', which refers to the cultural understanding of various creative and speculative reactions and representations of the geological, biological and social Anthropocene. (p. 187)

The four approaches are arrived at after the scholars assess the different ways in which the disciplines of natural sciences, social sciences, and the humanities have appropriated the term. Each discipline-specific Anthropocene has been proven to have limitations that suggest the parochialism of disciplinary resistance to transdisciplinarity. For instance, the geological Anthropocene, defined and periodised by stratigraphers and other geoscientists, may provide an endorsement that authoritatively recognises the impact of human activities on earth by the gatekeepers of the geological timescale (Nichols and Gogineni, 2018). But even the geoscientists

themselves acknowledge that there is more to it than just scientifically identifying the epoch on the timescale. There are social and cultural issues that shape Anthropocene, and they can only be accounted for by the disciplines of the social sciences and the humanities.

Scholars studying Anthropocene, across disciplines, have therefore called for multi-(inter)disciplinary protocols that enable a fuller and better understanding of the concept and its application in different fields of study, all aimed at improving the lots of the earth. Transdisciplinary tensions cannot and should not be ruled out in this call for convergence. Disciplines, that is, are likely to clash and generate debates on why Anthropocene is useful or not so useful, on the extent to which to deploy it, in their epistemological boundaries. But if, as my argument so far has been, the aim of any environmental research is to confront the problems of world ecosystems, then transdisciplinary tensions in terms of mapping a term, such as Anthropocene, would be less significant. The main tensions, if one might guess, especially given the Nigerian situation, would be between the natural sciences, on the one hand, and the humanities and social sciences, on the other hand. It is possible that the natural sciences may consider any discourse on the environment from the humanities/social sciences inadequate, in that such discourse does not necessarily need to be backed up with the kind of empiricism preferred by the natural sciences. Similarly, the humanities/social sciences may consider the approach of the natural sciences to environment too burdensome, ahistorical and rooted in sterile precision. To this extent, this advice to both disciplines is crucial:

> The natural sciences would have to be more open to the critical and speculative modes of knowledge production fostered in social sciences, arts and humanities. In return, the social scientists and humanities scholars should be precise and open about the limitations and possibilities of their concepts and methods, and perhaps more importantly, listen closely [to] what kind of questions biologists are asking about the connection between society, culture and material planetary conditions. (Tiovanen et al., 2018, p. 193)

An openness of mind and a readiness to shift disciplinary boundaries, to challenge the paradigms, and to allow the fringes to matter are some of the ways that the suggested transdisciplinary understanding can be achieved. As it is increasingly becoming clear in this postmodern age, there is no subject that is exclusive to any one discipline, and a significant example here is ecology. Once the exclusive subject of

some disciplines in the sciences, especially the geosciences, it has now grown to become a transdisciplinary subject. Ecology, as a subject, is bridging the gap between the humanities and the geosciences, which initially appeared far apart, in that, with environmental humanities, scholars in traditional humanities find themselves having to embrace and use terms and concepts from the geosciences, one of which is Anthropocene (Bauman, 2014).[4]

III

The essays collected in this volume attest to the values of transdisciplinarity. Its uniqueness lies in the ease with which it juxtaposes research findings from an array of disciplines cutting across natural sciences, social sciences, applied sciences and the humanities. The subject of ecology is the chief beneficiary here as it enjoys a transdisciplinary discourse, which is a result of diverse methodologies and theoretical frameworks. Ecology is approached from different perspectives, suggesting the many ways in which scholarship can contribute to the wellbeing of the earth. It is noteworthy that most of the chapters are empirical and textual studies (as opposed to theoretical ones) dealing with the condition of the earth in its various manifestations within the Nigerian ecosystems.

The second chapter is a contribution that reports the findings of a research concerned with alternative energy source, especially in a country that faces acute problems of electricity generation, transmission and distribution. Titled "Processing Nigerian Coal Deposits for Energy Source: The IBBU Initiative", the chapter reports the work that Obaje et al. have done in foregrounding the values of coal as a source of energy in Nigeria, given the imperatives of harnessing natural resources to take care of the country's energy needs. Of utmost interest in this work is the claim that coal energy is one of the safest and sustainable means of energy, somewhat neglected by the Nigerian authority since colonial time. Nuhu Obaje, a professor of Geology and Mining, initially presented the work as a keynote paper at the Humboldt Kolleg.

Chapter three takes us to Philosophy, a field that appears far removed from Geology and Mining and yet underscores the connectivity of all things related to the earth through the concept of biodiversity. It is Augustine Akwu Atabor's contribution, titled "Biodiversity and the Connectivity of Life: A Discourse of the Ecological Import of the Metaxocological Philosophy." Hinging the discourse on the notion of metaxology developed by the philosopher William Desmond, which implies the infinite and

inexhaustible nature of reality, Atabor argues that there is a need for a framework of philosophical understanding in which humans become receptive to other-than-human beings co-existing with them. Although this framework is not divested of the instrumental use of the nonhuman beings, as we see in Obaje et al.'s harnessing of coal-making matters for the purposes of alternative energy, Atabor maintains that humans should learn to suppress their superior feelings over other beings if the world is to achieve an ecological balance of biodiversity and life connectivity.

In chapter four, Douglas Kaze and Rejoice James-Songden take us to literary studies with their striking reading of Niyi Osundare's poetry volume *The Eye of the Earth*. Deploying the concept of agriculture in a speculative context, Kaze and James-Songden, in the title "Agriculture in Niyi Osundare's Poetry: Time and the Space between the Sciences and the Humanities," present the poetry of Osundare as a literary locus for the realisation of the goals of the Humboldt Kolleg, which, among others, include the meeting point for the rigid exactitude of the sciences and the critical discourse of the humanities. They identify the themes and stylistics of agriculture in Osundare's poetry, especially in the context of African sustainable pastoral practices versus the ecological sterility of modernity, and conclude that *The Eye of the Earth* demonstrates "the relationship between humanity and the surrounding physical world."

Closely related to Kaze's study in terms of disciplinary connection is Afutendem Lucas Nkwetta's study in Applies Linguistics. Titled "Language Ecology in Cameroon Anglophone Writing: An Analysis of Ambanasom A. Shadrack's *Son of the Native Soil* and Nkemngong J. Nkengasong's *Across the Mongolo*," the study is an investigation in eco-linguistics with the aim of finding out the behaviour and fate of the English language in an ecology of other languages. In other words, the research traces a bilingual and/or multilingual context in the two literary texts and seeks to answer the question: "What happens to English language (a mOL in Cameroon,) when it interacts with French (a MOL) as well as with other languages?" This is one eco-linguistic way of analysing the use of language in the environmental context in which it is used along with other languages, paying keen attention to colloquialism. Obviously, the use of the English language in the selected texts, as Nkwetta finds out, is conditioned by its application to the reality of the physical environment in which it is used as well as the co-existence of other languages in a multilingual setting.

Chapter six takes us to the natural sciences. It is a study by four biological scientists led by N. J. Dadi-Mamud titled "Diversity Index of Selected Vertebrates in Relation to Freshwater Quality Influenced by Anthropogenic Activities and Ecological Status of River Ndakotsu, Nigeria." As stated at the beginning, the aim of the research is "to assess some physicochemical parameters of River Ndakotsu, using amphibian birds and mammals as pollution indicators, as water quality plays a vital role in the distribution, abundance and diversity of aquatic vertebrate." Experiments carried out on the river suggest that human activities in and around the river have been responsible for pollution which account for the behaviour of the amphibian birds and mammals.

We have a leap to the social sciences in the seventh chapter. Mercy Gambo of Department of Marketing, University of Jos, Jos, introduced us to eco-tourism in her work "Strategic Tourism Management and Preservation: A Study of Eco-Tourist Destinations in Plateau State, Nigeria." The work spotlights the eco-tourist potentials of Plateau State, known for its unique weather and hospitality. Gambo makes the crucial point that although eco-tourism is at the heart of tourism, given its focus on nature, the natural world, the fauna and flora, it is equally prone to degradation. According to her, eco-tourist systems "are by their nature environmentally fragile, depleting, and commonly endangered by human activities." She offers five recommendations that will help the preservation of the eco-tourist systems, one of which is that "Tourists/visitors need to be adequately educated of the restrictions at tourist sites according to the peculiarities of the destination."

We return in chapter eight to the humanities, specifically the field of Linguistics with the title "Ecolinguistics of Nupe Myths and Superstitions." In this interesting study of the Nupe traditional life, Mohammed Alhaji Usman foregrounds what one might call the ecological unconscious that runs in Nupe traditional practices. Situating the study in the meeting point of language, culture and environment, Usman is of the view that the pre-scientific (by which he means before the advent of western civilisation) life of the Nupe people is characterised by the ways in which people make sense "of the complexities of their environment by carrying hundreds of images and stories in their minds." These images and stories are, in his view, over-determined by ecology. They form the core of the people's sociolinguistics. As such, Usman sees eco-linguistics as being "concerned with the analysis of language influenced, occasioned or shaped by ecosystem (physical environment) and social system (sociocultural beliefs

and practices) of the language users or speech community." Usman concludes his study by asserting that the myths and superstitions of the Nupe people, which still exist in spite of the pressures of foreign religions (Islam and Christianity), will remain a locus of eco-linguistic investigation in Nupe culture as well as in other cultures of Nigeria.

Chapter nine is also a linguistic study in which Peace Benson interestingly looks at what one might call the ecology of contrast between the Hausa language and the Jenjo language – a language spoken in Adamawa State, Gombe State, and Taraba State in Nigeria. Benson's central argument appears to be that the ecology of Jenjo, as a less known language, is threatened by that of Hausa, a much more known language, with its predatory tendencies. She goes as far as claiming, though backed up by other studies, that the Hausa language is not only a threat to Jenjo but to other less known languages in northern Nigeria. She cautions that "Just as in biology, exotic species (languages of wider communication), in this case, Hausa, has become invasive to Jenjo/Jen within the ecology of the language. This needs to be uncovered before the language (Jenjo) is extinct as it is already endangered." Beyond uncovering, Benson recommends that speakers of Jenjo need to guard their language "consciously and religiously" in the face of the Hausa invasion.

Chapter ten is titled "Ecology and Biodiversity Sustainability in Pandam Game Reserve, Plateau State, Nigeria: A Review of Progress, Challenges and Opportunities." It is an eco-tourism research undertaken by three scholars namely Samson A. Da'an, Adams A. Chaskda and Georgina S. Nwansat. The main concern of the work is to trace the development of the Pandam Game Reserve in Plateau State and the challenges it has faced over the years. The work involves fieldwork that takes the researchers to see what opportunities are available for the sustainability of biodiversity within the premises of the Reserve. The researchers conclude by recommending that ecological studies of the Pandam Game Reserve should be a continuous thing in order to make the best use of the place, especially in the ways in which different lives, human and nonhuman, biotic and abiotic, can be sustained.

Chapter eleven by Chinonye C. Ekwueme-Ugwu takes us to ecocriticism. Titled "Beyond the Rhetoric: Institutional Recognition, and the Triumph of African Environmental Literature," the chapter is interested in the ways in which institutions of higher learning, especially those that have department of literary studies, have not taken into consideration the significance of environmental humanities. Ekwueme-Ugwu makes a case for what she calls the "full flourishing" of ecocriticism in Nigerian

universities, urging authorities to consider making ecocriticism a mainstream course. She samples the courses offered in departments of English studies in universities in Africa and concludes that there is the need to pay a closer attention to ecocriticism as an emerging field of studies. Ekwueme-Ugwu is optimistic that ecocriticism will flourish, pointing out that "Besides the other postcolonial issues of subjectivity, identity loss, displacement, migration and so on, the environment, as a subject in postcolonial African discourses, has come to stay."

Chapter twelve, written by Ehoche E. Elijah and Henry Y. Adeyemi, is a research in the field of Biochemistry, titled "The Effect of the Traditional Fermentation Processes on the Nutrient Content of Some Common Nigerian Diets." The researchers contend that given our developing economy in which issues of foods, feeding and dieting ought to be taken seriously, "it is necessary to investigate... effects of traditional fermentation processes on the energy-rich macro-nutrients (carbohydrates, lipids and proteins) content of some fermented foods common to the Nigerian state." Results of the experiments carried out favour the notion of traditional fermentation, in that, as the researchers conclude, fermented foods have low carbohydrates and lipids and have high protein. In their view, the high protein content may be useful in "the management of diseases relating to protein under-nourishment like kwashiorkor", and the low carbohydrate and lipid levels "can help in the management of disease conditions where only little of the dietary intake of the respective nutrient is required."

In chapter thirteen, Oshonebu S. Egya takes us to the field of science education with her title "Teaching Ecological Concepts in Chemistry Education in Senior Secondary Schools in Nigeria: Implications for the Chemistry Teacher." The chapter dwells on the importance of the environment to the study of chemistry as a subject in secondary schools. Thereafter, it identifies some ecological concepts such as the oxygen cycle, carbon (IV) oxide cycle, nitrogen cycle, sulphur cycle, air pollution, and others. Egya's concern is how these concepts can be effectively taught in a chemistry class. Her conclusion is that "Chemistry teachers should teach ecological concepts by linking them to the processes in nature and everyday life situation.. making us aware about the consequences of our activities and actions on the ecosystem."

Last but not least, chapter fourteen takes us back to the humanities, specifically the field of music studies. Written by Aduloju Abimbola Adenike and Olusegun Stephen Titus, it is titled "Nigerian Popular Music Narratives on Solid Waste in Lagos State, Nigeria." The chapter foregrounds the notion of eco-musicology, "which emphasises

the triangularity of culture, environment, and human beings." That is, how the culture and environment of the people shape the kind of attitude they have. This perspective enables the researchers to identify and analyse the response of musicians in Lagos to the environmental condition of the city. Paying a textual attention to a number of songs by popular musicians in Lagos, the authors conclude that "music can be a tool and vehicle for environmental sustainability." It, therefore, follows that music as an art form should be encouraged and instrumentalised towards a better ecological future.

From the brief survey of the chapters in this book, it is clear that all spheres of human endeavour, all disciplines, have a contribution to make to ecology. Each discipline has what one might term an environmental language. I refer here to dictions, terminology and concepts that each discipline uses to describe the environment. The context of transdisciplinarity enables each discipline to share its language with other disciplines, a practice that will leave each discipline enriched in its discourse on the environment. The free-flow and penetration of dictions, terminology and concepts tend to unify environmental humanities and environmental sciences, insisting on frameworks that suggest concerted efforts towards dealing with environmental crises.

It is hoped that this book, a modest contribution by people of diverse disciplines, would not only present a bouquet of transdisciplinary knowledge. It would also serve as a trigger for further research in multi(inter-)disciplinary collaborations.

Notes

1. It is important to note that there are equally many students who enjoy this division, in that it allows them to escape the tedium of reading many prescribed books in the Literature subfield. In my days, many students preferred the Language subfield because one did not have to read many literary works. This in a way – to sustain the logic of my argument – inheres on the quality of a graduate of English who is not widely read.
2. Here is one instance of the kind of crude ignorance to which I refer. The Kenyan anthropologist Mary Amuyunzu-Nyamongo reports that an epidemiologist once "asked [her] why it took so long to train a social scientist to do what is 'not so difficult.' He said that what a social scientist does 'can be done by anyone because it is based on common sense'" (2006, p. 237). In the view of the epidemiologist, an anthropologist does not undertake a scientific research. Many people, like the epidemiologist, need to

be re-educated that all researches are scientific. That is why in other places all scholars, all researchers, in whatever field, are called scientists.

3. The AWG has been criticised for being dominated by natural scientists even though it is expected to cut across all disciplines and serve interests that are not restricted by disciplinary boundaries.

4. The emerging area of new materialism or material ecocriticism, for instance, is one way in which the marriage of disciplines via ecology has proved fruitful. For more on new materialism and material ecocriticism, see Iovino and Opperman (2014).

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Chapter Two

PROCESSING NIGERIAN COAL DEPOSITS FOR ENERGY SOURCE: THE IBBU INITIATIVE

Nuhu G. Obaje
A. K. Aweda
U. M. Umar
T. M. Ozoji
Aisha M. Obaje

Introduction

Whether generated from dams, gas turbines, or thermal sources, electricity supply has been acutely insufficient in Nigeria; yet the country has far more oil, gas, and coal resources than it has the demand for them. The country is currently challenged by series of energy crises with concomitant economic and social implications. Electricity generation and energy availability are in gross shortfall, which has resulted in the shutting down of many industries with the attendant job losses and escalating unemployment. Power supply to many homes is very epileptic, covering not more than 10% of the total average domestic daily demand. 23 out of 26 present power-generating stations in Nigeria are gas-dependent. With these enormous energy challenges, the government of Nigeria is working on a reform that will embrace appropriate energy-mix, enabling power generation/energy production from nuclear, coal and renewable sources (solar, wind, biomass) in addition to the conventional hydro and thermal sources. Nigeria is blessed with abundant coal resources deposited widely in 15 states of the federation.

Experimental defusinization is a new technique proposed in this investigation to enhance the performance of coal and thus the production of a new brand of smokeless fuel. Domestic cooking in Nigeria is done through the use of electric-power, kerosene and gas cookers and the use of firewood derived through heavy deforestation. Electric power is in short supply; kerosene emits lots of greenhouse gases while the use of firewood leads to deforestation. In order to curb the alarming rate of deforestation in

Nigeria which stands at 400 hectares per annum resulting in erosion and negative climate change effects and in order to contribute to the Nigerian energy mix and energy supply and availability, this research has been conducted to determine the suitability of some Nigerian coal deposits as raw materials for electrical power generation and production of smokeless coal fuels for domestic energy and industrial heating as a substitute to firewood and an augmentation of other energy sources. The study has generated data that will promote the use of Nigerian coal deposits for environmentally friendly electrical power generation and in the production of smokeless coal fuels, thereby further promoting varied energy-mix economy and mitigating deforestation, negative climate change impacts and biodiversity loss.

Some Reviews

Nigerian Coal Resources

Coal is found in about 15 federating states of Nigeria, namely, Enugu, Imo, Kogi, Delta, Plateau, Anambra, Abia, Benue, Edo, Bauchi, Adamawa, Gombe, Cross River, Ebonyi and possibly Niger (at Kudu, although not yet properly documented). Geologically, these coal deposits are mainly within the Anambra Basin and the Benue Trough (Fig. 1) outside some minor deposits reported within the Bida and Sokoto Basins (Shekwolo, 2009; Obaje, 2009). Some aspects of these coal deposits have been succinctly discussed by De-Swardtand Cassey (1961), Akande et al. (1992) and Wuyep and Obaje (2010). Coal was first discovered in 1909 near Udi (Eastern Nigeria). In 1950, the Nigerian Coal Corporation (NCC) was formed and given the responsibility for the exploration, development and mining of coal resources. The NCC is 100% owned by the federal government and is headquartered in Enugu. NCC operated two underground mines, Okpara and Onyeama, and two surface mines, Owukpa and Okaba, located on the eastern edge of the Anambra Coal Basin. Between 1950 and 1959, coal production in the Enugu mines increased annually from 583,487 tonnes to a peak of 905,397 tonnes. After 1959, production decreased significantly each year, including the Civil War period of 1966 to 1970 when no coal production was reported. Production in the 1980s was less than 100,000 tonnes annually and decreased further in the 1990s. Much of this production was utilized by the railroad and some smaller tonnages were exported. NCC has not operated any coal mines for several years. The agency has recently entered into several joint ventures with outside entities to mine coal, but those efforts have met with limited success. Nigeria's only significant coal

mine is the Okaba mine (Okaba coal field), which is operated under a production sharing agreement with Nordic Industries Limited. Production of 2,712 tonnes was recorded in 2001.

Petro-Geochemistry of Coals

Coal is not a homogeneous substance but consists of various basic components comparable with minerals of inorganic rocks. These components which are called macerals are the basic and relatively homogeneous organo-petrographic entities of coal which by their chemical and physical characteristics determine its properties and utilization (Diessel, 1992). In coals, they are normally classified into three groups, namely vitrinite, liptinite and inertinite (Table 1, Fig. 2). This classification is based either on similar origin (e.g. the liptinite group) and / or on the difference in preservation (e.g. the vitrinite and inertinite groups). Chemical and physical properties of the macerals such as elemental composition, moisture contents, hardness, density and petrographic characteristics differ widely and are also subject to changes in the course of diagenesis and coalification (Bustin et al., 1985; Stach et al., 1982).

Besides the parental material and initial decomposition before and during the peat stage, the degree of coalification (rank) is decisive for microscopic appearance of the macerals. Morphology and reflectance under incident light are the main properties in distinguishing macerals and macerals groups under the microscope (Teichmueller, 1989). In low rank coals, relatively hydrogen-rich liptinite show the lowest reflectance, the relatively oxygen-rich vitrinite a medium reflectance, while the relatively carbon-rich inertinite the highest reflectance. Amongst the inertinites, fusinite presents a special problem. High content of inertinite, represented mainly by fusinite and semi-fusinite, reduces the combustibility and smokeless fuel production capability of coals (Schapiro and Gray, 1964; Bustin et al., 1985). Inertinites (fusinite + semi-fusinite) along with the ash content (mineral matter) must greatly be reduced or removed completely to increase the quality of the coals for smokeless fuel production.

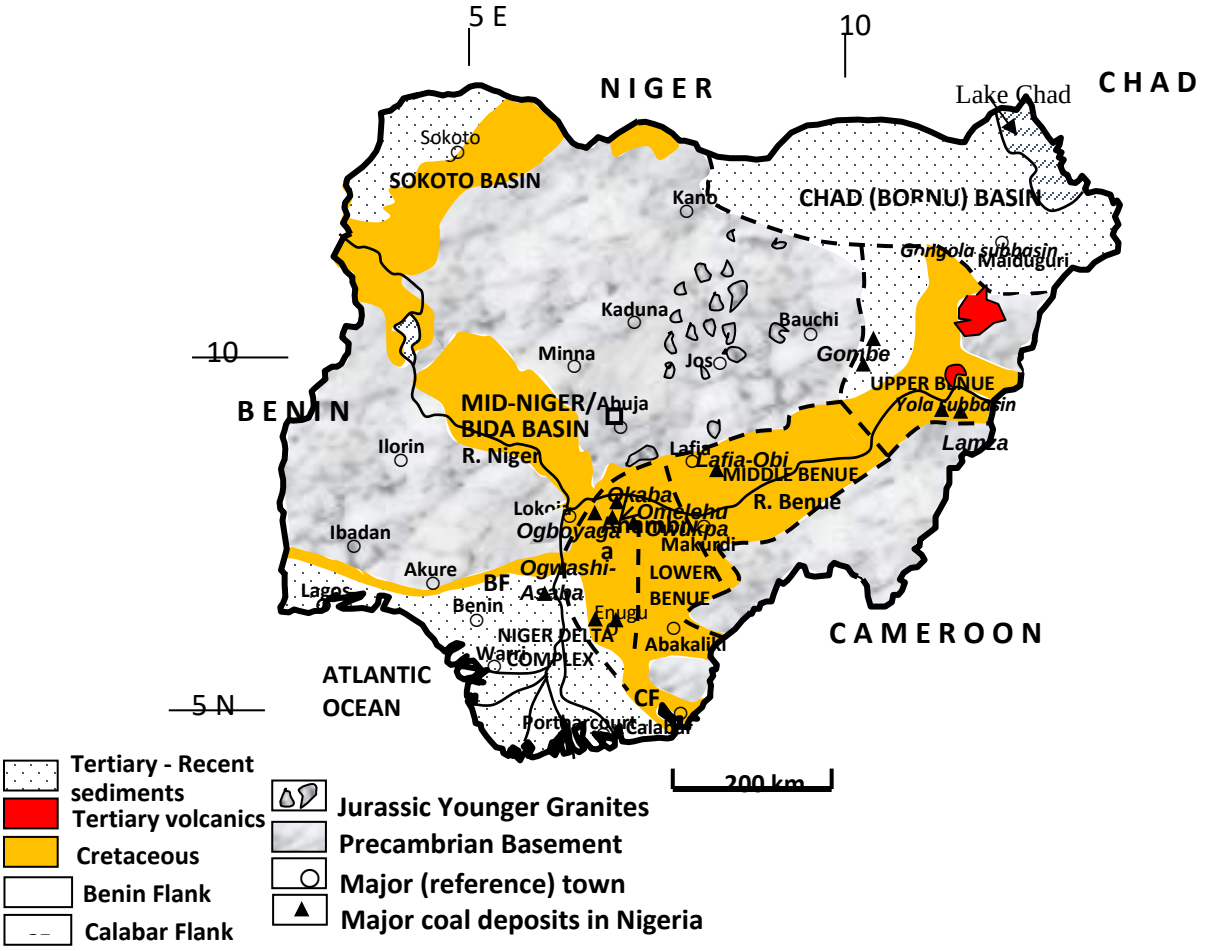


Fig.1. Generalized geological map of Nigeria

Maceral Group	Maceral / Submaceral	Source / Origin	Reactivity During Smokeless Fuel Production
Vitrinite	Telinite Collinite - Telocollinite - Desmocollinite - Gellocollinite - Corpocollinite Vitrodetrinite	Woody tissues, bark, leaves, etc	Reactive; promotes smokeless fuel production
Liptinite	Sporinite Cutinite Resinite Flourinite Alginite Liptodetrinite Bituminite Exudatinite	Spores, pollen Cuticules Resins, waxes. Plant oils. Algae Detritus Degradation products of organic matter Secondary products, exudates	Highly reactive when content equals or more than 30%; Essential to smokeless fuel production
Inertinite	Fusinite Semifusinite Macrinite Micrinite Sclerotinite Inertodetrinite	Woody tissues, barks, leaves Degradation product of liptinite Fungal sclerotia, hyphae Detritus	Inert; Demotes smokeless fuel production; Content must be greatly reduced through defusinization processes

Table 1: Coal macerals: origin, properties and reactivity during smokeless fuel production (after Stach et al., 1982; Bustin et al., 1985; Teichmueller, 1989)

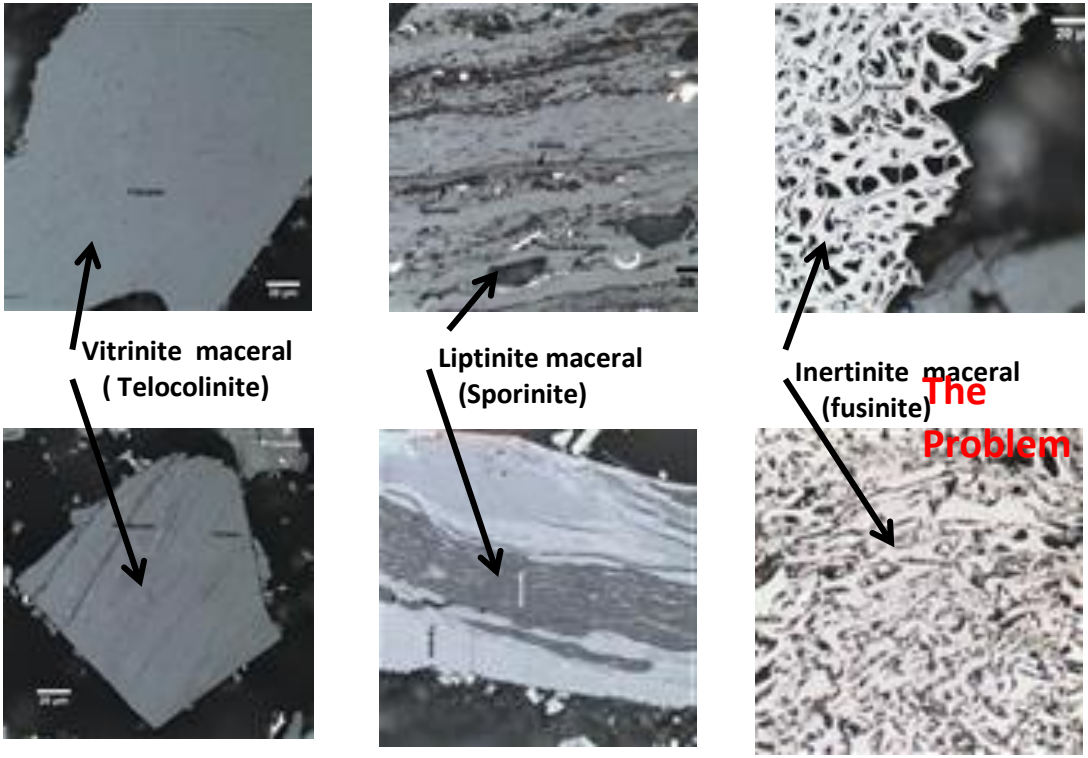


Fig. 2. Photomicrographs of the three maceral groups in coal

Defusinization

Defusinization is a new concept proposed by researchers at IBBU after some reviews of literature on coal utilization. The concept is based on the very early studies on coal carbonization by Schapiro and Gray (1964) and Davis et al. (1976). The studies discovered that during the carbonization process, coal softens, fuses and resolidifies to form the porous carbon-rich material that is called coke. The capability of a coal to behave in this manner is very essential, and only the bituminous part of the coal series has such a capability, reaffirmed by Bustin et al. (1985). In several previous studies by Obaje et al. (1994), Obaje (1997), Obaje et al. (1999a,b), Jauro et al. (2006), it was discovered that inertinite macerals (fusinites) constitute great obstacle to the performance of coal during carbonization, combustion and liquefaction and would not act differently in its capability for the production of smokeless fuel. In relation to

bulk organic geochemistry, the TOC of the coal sample is the burnable organic matter content, the HI is the inherent fuel, the OI depicts the smokability, greenhouse gases content and the amount of retardants. The Tmax is a measure of the coal maturity and rank (see Table 2).

Peak	Usual Interpretation for Hydrocarbons	Measured Indices	For Smokeless Coal
S_1 mg HC/g rock	The free hydrocarbons present in the sample before the analysis. Can be thought of as a residual hydrocarbon phase. When S1 is large relative to S2, an alternative source such as migrated hydrocarbons or contamination should be suspected	Free Hydrocarbon Index: FHC (mgHC/gTOC): = 100xS1/TOC	Not much meaning
S_2 mg HC/g rock	The volume of hydrocarbons that formed during thermal pyrolysis of the sample. Used to estimate the remaining hydrocarbon generating potential of the sample	Hydrogen Index: HI(mgHC/gTOC) = 100xS2/TOC. HI is a parameter used to characterize the origin of organic matter. Marine organisms and algae, in general, are composed of lipid- and protein-rich organic matter, where the ratio of H to C is higher than in the carbohydrate-rich constituents of land plants	Measure of the pyrolyzable organic matter (usually the **FUEL**) in the coal
S_3 mg CO_2/g rock	The CO_2 yield during thermal breakdown of kerogen.	Oxygen Index: OI(mgCO2/gTOC) = 100xS3/TOC OI correlates with the ratio of O to C, which is high for polysacharride-rich remains of land plants and inert organic material (residual organic matter) encountered as background in marine sediments	Measure of the **smoke elements, green-house gases contents and combustion retardants** in coal
Tmax	Tmax = the temperature at which the maximum release of hydrocarbons from cracking of kerogen occurs during pyrolysis (top of S_2 peak).	Tmax is an indication of the stage of maturation of the organic matter.	Measure of the **coal rank**. Coal rank increases with higher values of Tmax

Table 2: Pyrolysis indices extrapolated from hydrocarbon source evaluation to smokeless coal fuel production assessment (modified from Hunt, 1991)

Methods of Study

Field mapping and sampling were done in Kudu (Niger State), Okaba, Omelehu, Ogboyaga (Kogi State), Owukpa (Benue State) and Lafia-Obi (Nasarawa State).

There were combustibility assessments to determine the combustion efficiencies of the respective coal deposits by burning the same amount of coal and determining the

time it takes to bring the same volume of water to boiling point; as well as the combustion pathways through recording of temperature achieved after every 2 minutes of continuous burning.

There was bulk organic geochemical evaluation comprising Leco Carbon-Sulfur analysis and Rock-Eval pyrolysis to determine the values of TOC, HI, OI, Tmax as a basis for determining the burnable organic matter, the inherent fuel, the level of retardants and smoke and the maturity/rank of the coals respectively.

There was also petrological evaluation of the coals through embedding, polishing and maceral analysis of the polished samples to evaluate the relative proportions of individual maceral groups namely, vitrinite, liptinite and inertinite.

Experimental defusinization studies (removal of fusinite and semi-fusinite) through digestion of the coal samples in series of organic acids. Eight organic acids were used; re-measurements after the defusinization will indicate the best organic acids and organic solvents most appropriate for fusinite digestion and removal. The organic used comprised **Benzoic acid**(carboxybenzene or phenylmethanoic acid) C_6H_5COOH; **Butyric acid** (butanoic acid) $CH_3CH_2CH_2COOH$; **Carbolic acid** (phenol or hydroxybenzene) C_6H_5OH; **Carbonic acid** (hydroxymethanoic acid) OHCOOH or H_2CO_3; **Citric acid** (2-hydroxypropane-1,2,3-tricarboxylic acid); **Formic acid** (methanoic acid) HCOOH; **Lactic acid** (2-hydroxypropanoic acid) $CH_3CHOHCOOH$; **Malic acid** (2-hydroxybutanedioic acid); $(COOH)CH_2CHOH(COOH)$; **Oxalic acid** (ethanedioic acid) (COOH)(COOH); **Uric acid** (7,9-Dihydro-1H-purine-2,6,8(3H)-trione) $C_5H_4N_4O_3$.

Pelletization of the defusinized coals (already ground to fine aggregates or to "coal marsh") at the Pilot Production stage using the Coal Miller/Mixer machine to convert the coal marsh into uniformed sized smokeless coal fuels (1cm and 5cm diameters) that can be fed into industrial furnaces and/or domestic smokeless fuel cooking stoves. Epoxy-resin with some hardner and sub-ordinate bentonite will be used as the binder.

Results

Field Mapping and Sample Collection / Core Driiling

Field mapping and surveys have been carried out on the coal fields at Okaba, Omelehu, Owukpa, Lafia-Obi and Kudu-Makera and coal deposits encountered are shown in the following figures with explanatory captions. Drilling for subsurface sample collections were undertaken at Okaba and Owukpa.

Fig. 3. Logging and sample collection at the Okaba coal field. Note the heavy acid minewaters within the mines

Fig. 3b. Logging and sample collection at the Okaba coal field (underground) (2nd visit)


Fig. 4. Direct sample collection of coal in-situ at the Omelehu coal field


Fig. 5. Logging and sampling at the Owukpa coal field

Fig. **6. Logging and sampling (in different views) at the Lafia-Obi coal outcrop site at Shankodi near Jangwa, Nasarawa State**

Fig. 7. In the absence of any coal exposure in Niger State, the team relied on the shaley coalsamples collected during the earlier study on Bida Basin hydrocarbons. These shaley coals are more suitable for oil and gas generation than for the production of smokeless fuel

Combustibility Studies

Combustibility studies were carried out on coal deposits from Okaba, Omelehu, Owukpa and Lafia-Obi (Fig. 8). The combustibility studies comprised combustion efficiency based on the time it took same weight of coal from each of the deposits to bring same volume of water to boiling point and combustion pathway based on

temperature for every 2 minutes of continuous boiling with same volume of water. The results are shown in the following figures and tables.

Fig. 8. Combustibility studies for the determination of the coal energy efficiencies and coalcombustion pathways by measuring the time it takes same quantity of each of the coaldeposits to bring same volume of water to boiling point as well as the temperature achieved at every 2 minutes using local cooking stove

Coal Deposit	Time to Boiling (Minutes)
Okaba	10.00
Omelehu	11.37
Owukpa-1	13.22
Owukpa-2	25.02
Lafia-Obi	Did not bring to boiling
Ogboyaga	Not used
Kudu-Makera	Too shaley. Suitable for oil/gas generation ony

Table 3: Time to bring water to boiling using same quantity of coal and same volume of water on a local cooking stove (combustion efficiency).

Coal Deposit						
	2	4	6	8	10	Time (mins)
Okaba	50	62	77	88	95	Temperature (^oC)
Omelehu	28	62	74	86	93	
Owukpa-1	46	50	68	78	87	
Lafia-Obi	27	28	28	27	27	
Ogboyaga	Not used					
Kudu-Makera	Too shaley. Suitable for shale gas					

Table 4. Progressive boiling of same volume of water on same quantity of coal using local cooking stove for the evaluation of the combustion pathways for the coals

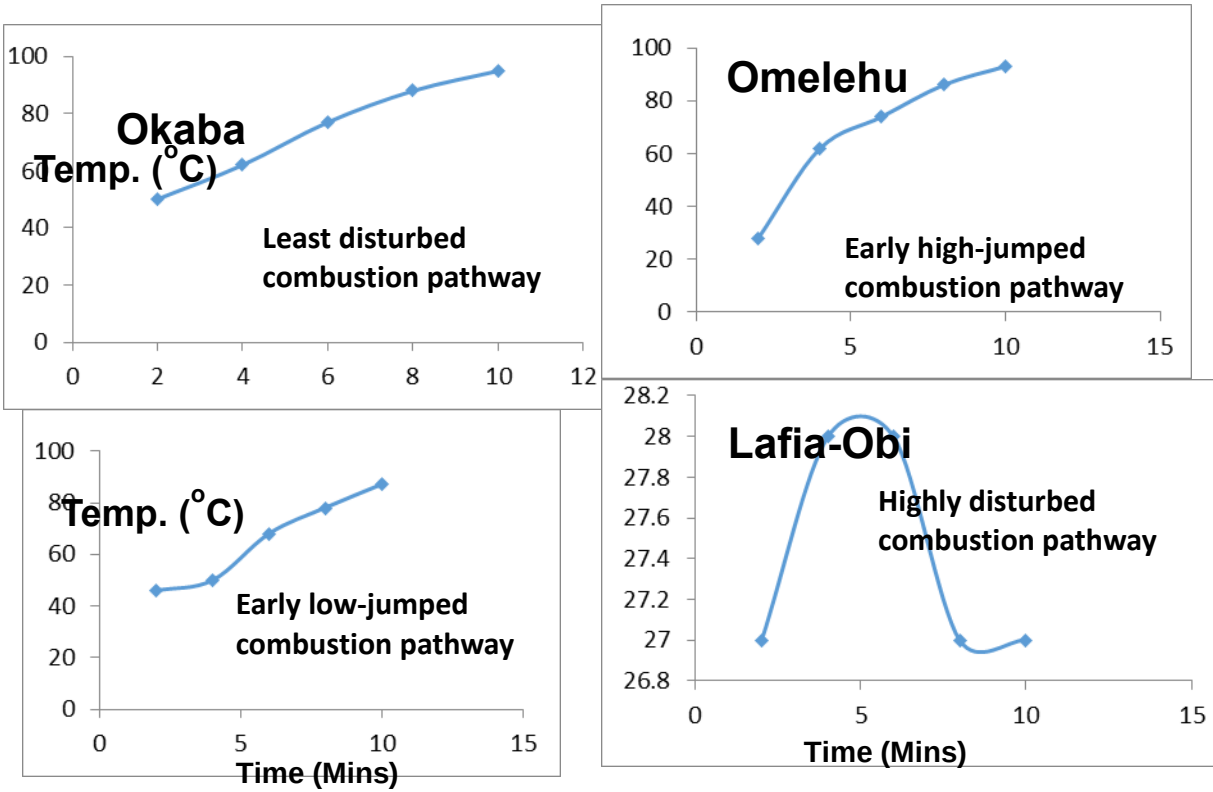


Fig. 9. Results of combustion pathway studies on four of the coal deposits showing the Okaba coals as having the best predictable (least disturbed) combustion pathway and the Lafia-Obi as the most unsuitable for combustion.

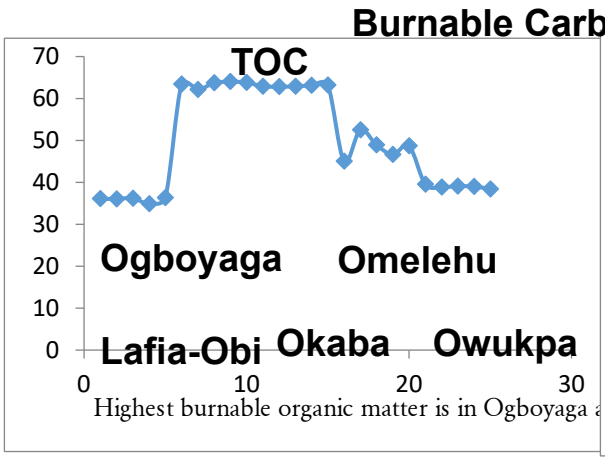
Bulk Organic Geochemistry

Leco CS and Rock-Eval pyrolysis analyses were carried out on five coal samples from each of the studied coal deposits as a basis for the determination of the TOC (burnable carbon), HI (inherent fuel, OI (smokes and retardants) and Tmax (coal maturity and rank). The results are shown in the table and figure below.

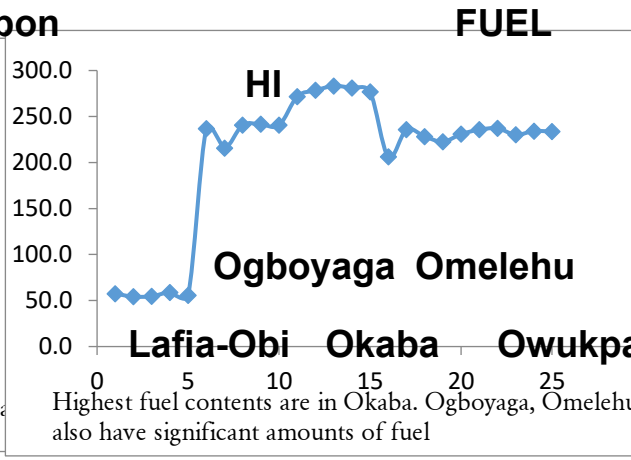
Sample ID	Coal Deposit	S2 mg/g	S3 mg/g	Tmax °C	TOC	S	HI	OI
LBI-001	Lafia-Obi	20.72	11.36	451	36.075	0.54	57.4	31.49
LBI-002	Lafia-Obi	19.54	10.85	451	36.05	0.493	54.2	30.10
LBI-003	Lafia-Obi	19.76	11.04	452	36.2	0.508	54.6	30.50
LBI-004	Lafia-Obi	20.56	10.71	451	34.9	0.498	58.9	30.69
LBI-005	Lafia-Obi	20.16	10.99	450	36.3	0.543	55.5	30.28
OGB-001	Ogboyaga	150.06	23.8	425	63.4	0.62	236.7	37.54
OGB-002	Ogboyaga	133.89	25.65	423	62.1	0.713	215.6	41.30
OGB-003	Ogboyaga	153.36	24.12	424	63.7	0.638	240.8	37.86
OGB-004	Ogboyaga	154.59	24.05	424	64	0.663	241.5	37.58
OGB-005	Ogboyaga	153.44	24.28	424	63.8	0.636	240.5	38.06
OKB-001	Okaba	170.92	12.14	421	62.9	1.28	271.7	19.30
OKB-002	Okaba	174.84	12.11	420	62.8	1.08	278.4	19.28
OKB-003	Okaba	178.08	12.05	423	62.9	1.18	283.1	19.16
OKB-004	Okaba	177.36	12.14	419	63.1	1.08	281.1	19.24
OKB-005	Okaba	174.95	12.22	419	63.2	1.1	276.8	19.34
OML-001	Omelehu	92.73	13.47	421	45	0.639	206.1	29.93
OML-002	Omelehu	123.78	14.11	420	52.5	0.794	235.8	26.88
OML-003	Omelehu	111.62	13.49	423	48.9	0.753	228.3	27.59
OML-004	Omelehu	103.76	13.71	423	46.6	0.713	222.7	29.42
OML-005	Omelehu	112.42	13.63	422	48.7	0.736	230.8	27.99
OWU-001	Owukpa	93.23	8.03	426	39.55	0.374	235.7	20.30
OWU-002	Owukpa	92.12	8.13	427	38.85	0.363	237.1	20.93
OWU-003	Owukpa	90.01	7.77	427	39.1	0.378	230.2	19.87
OWU-004	Owukpa	91.32	8.14	427	39	0.348	234.2	20.87
OWU-005	Owukpa	89.76	8.01	428	38.4	0.357	233.8	20.86

Table 5. Rock-Eval pyrolysis raw data (courtesy Federal Institute for Geosciences and Natural Resources – BGR, Hannover, Germany)

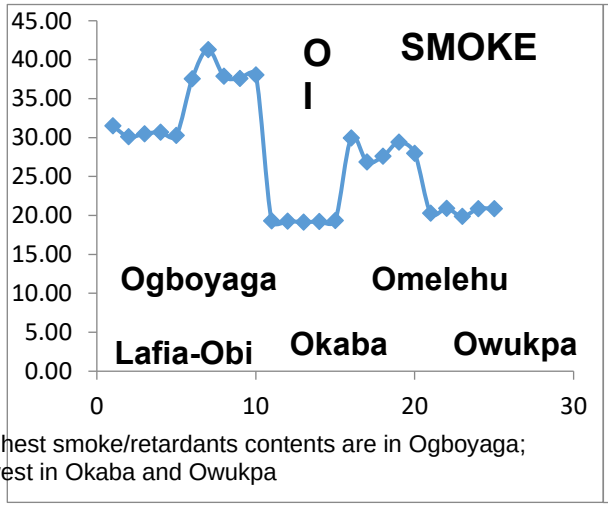
Tmax = Temperature of S2 pyrolysis → Maturity / Rank of Coal; TOC = Total Organic Carbon (Burnable Organic Matter); HI = Hydrogen Index (Inherent Fuel), OI = Oxygen Index (Smoke, Retardants); S = Sulfur Content



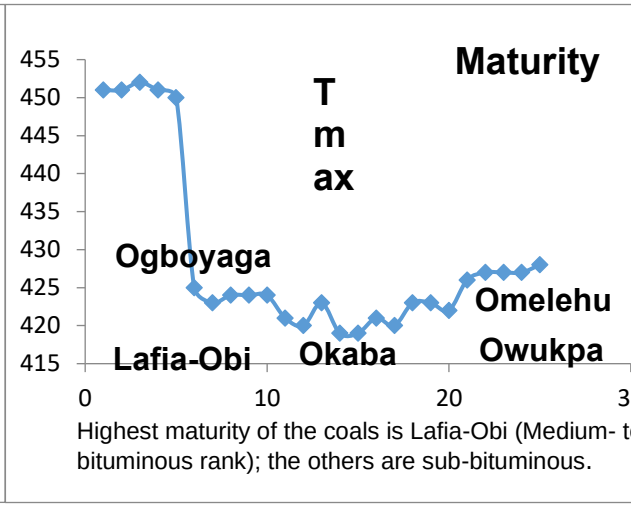
Highest burnable organic matter is in Ogboyaga a



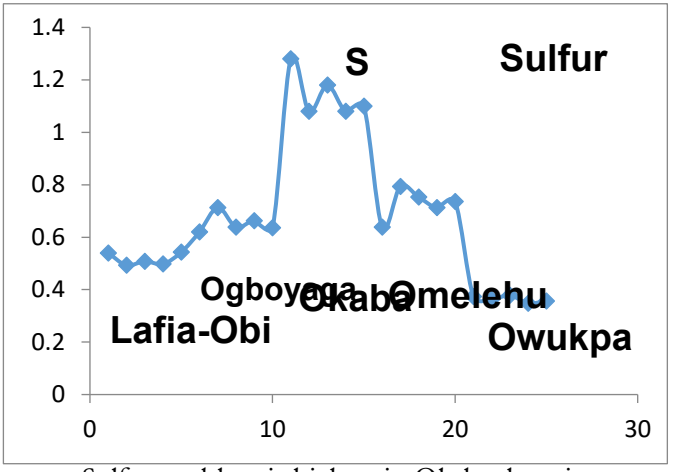
Highest fuel contents are in Okaba. Ogboyaga, Omelehu also have significant amounts of fuel



Highest smoke/retardants contents are in Ogboyaga; lowest in Okaba and Owukpa



Highest maturity of the coals is Lafia-Obi (Medium- t bituminous rank); the others are sub-bituminous.



Sulfur problem is highest in Okaba; least in Owukpa.

Fig. 10. Interpretation of Rock-Eval pyrolysis data shows that the Okaba coal deposit with the highest burnable organic matter, highest inherent fuel and least amounts of smoke is most suitable for smokeless coal fuel production and electricity generation in its present form. However, sulfur content presents some problems. The Ogbayaga and Omelehu coals will need defusinization.

4.4 Defusinization Experiments

Defusinization experiments using eight types of organic acids to digest the fusinite (inertinite) contents as basis for reducing the OI which is the major cause of smoke, greenhouse gas emission and retardation in coal combustion for electricity generation and smokeless coal fuel production were carried out on twenty coal samples (exempting the Okaba coals) (Fig. 11). The defusinized samples were subjected to another round of Leco CS and Rock-Eval analyses. The organic acids used attacked all the macerals in the coal and hence affected both the Hydrogen Index (Fuel) and the Oxygen Index (Smoke). The concept was not perfectly successful as none of the acids was able to diminish the Oxygen Index considerably. However, Benzoic and Formic acids at 30% concentration showed significant promises to reduce the smoke content.

Fig. 11. Defusinization experiment involved digestion of the pulverized coals with different types of organic acid and kept to react for 48 hours.

Interpretation and Discussion of the Results

The results achieved so far have been used to evaluate the energy conversion efficiencies of the respective coal deposits while defusinization experiments to convert the coals to smokeless fuels are ongoing. Field data, local combustion, organic geochemical Leco CS and Rock-Eval data were generated on the coals. Field mapping and core drilling to 50m depth at Okaba and Owukpa show that the Okaba coal field has a surface area exposure of 5,408 sq m measuring 52m x 104m. Drilling shows that there are 9 seams of average 3m thick from the present surface into the subsurface. It has an operating mine. Omelehu coals are exposed sparingly only along a stream channel but geophysical surveys indicate 6 seams of average 5m thick in the subsurface. Omelehu does not have an operating mine at present but some companies have acquired licenses for exploration works. The Owukpa field with exposed coals measures 50m x 20m (1,000 sq m). Core drilling to 50m depth proved 9 coal seams of average 3.5m in the

subsurface. The Ogboyaga coal deposits are also exposed along a stream channel in the village of Odu Okpakili in Kogi State with1.7m thick coal seam. No core drilling was undertaken and subsurface information is not available. There are also no operating mines. Coal deposits of the Lafia-Obi are also sparingly exposed along the bank of River Dep in the village of Shankodi near Jangwa in Nasarawa State. The thickest seam is ca 0.5m. Core drillings by the National Steel Raw Materials Exploration Agency indicate several subsurface seams with thicknesses of up to 5m for a seam. The earlier reported coal exposures at Kudu (Shekwolo, 2009) were not found anywhere in the reported Kudu-Makera areas. However, earlier drillings and other subsurface information indicate some shaley coal occurrences with the shallowest at about 30m beneath the surface.

Combustion studies recording the time it takes same quantities of water to attain boiling point using same quantities of coal show that the Okaba coal is the most efficient with 10.0 minutes; followed by Omelehu (11.4 minutes), Owukpa (13.2 minutes and 25.0 minutess) while the Lafia-Obi coal never brought the water to boiling point (Fig. 20). The Kudu coals were too shaley for this experiment. Leco CS shows that higher Corg (TOC) values equivalent to burnable carbon are recorded in the Okaba and Ogboyaga coals. Rock-Eval data show that highest Hydrogen Index (HI) values equivalent to fuel contents are recorded in the Okaba coals followed successively by Ogboyaga, Omelehu, Owukpa and the least in Lafia-Obi coals. High Oxygen Index (OI) values equivalent to smoke or retardants are recorded in the Ogboyaga coals, followed successively by the Lafia-Obi, Omelehu, Owukpa and the least in Okaba coals. Maceral (petrological) studies support the high HI contents in the Okaba coals which have equally highest content of liptinite and high relative abundance of C_{28} sterane biomarkers. Rock Eval Tmax values indicate that the Lafia-Obi coals have higher rank/maturity than the deposits in the Anambra Basin.

Integrating and combining the results, the coals from Okaba have the best energy conversion efficiency and therefore most efficient for use in smokeless fuel production and electricity generation, in the present form, with little negative impacts on man and the environment. The Ogboyaga, Lafia-Obi and Omelehu coals have too much of retardants and will produce too much smoke. Although the Ogboyaga coals were not used during the combustion experiments, a test-run conducted based on the results of the Rock-Eval pyrolysis (relatively high Oxygen indices) corroborates the envisaged high smoke emission compared to the Okaba coals with least smoke emission. The

Owukpa coals, though low on retardants and with appreciable inherent fuel, have low burnable organic matter (TOC). The Lafia-Obi coals are deficient in fuel and have high retardants in addition to being poorly combustible. The Kudu-Makera coals are too shaley and suitable only for the generation of gaseous hydrocarbons. For the ranking of their use in the present forms for smokeless coal fuel production, the order will be Okaba, Owukpa, Omelehu, Ogboyaga, Lafia-Obi, Kudu-Makera in descending order.

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Chapter Three

BIODIVERSITY AND THE CONNECTIVITY OF LIFE: A DISCOURSE OF THE ECOLOGICAL IMPORT OF METAXOLOGICAL PHILOSOPHY

Augustine Akwu Atabor

Introduction

The impact of contemporary humanity on the natural environment has been unprecedented. This, of course, is an ecological emergency that calls for a shift in the behavioural pattern of our species. This unprecedented toll taken on nature by humans, according to Lawrence Vogel can be attributed to a certain "ethical vacuum" caused by the orientation of traditional ethics and modern natural science (Vogel, 1995, p.30). While technology today has continued to make unrestrained advances, traditional ethics has presumed that the impact of our actions are quite limited. It is also obvious that this orientation of traditional ethics and modern technology is attributed to a Western Christian reading of Genesis 1 where man is represented as the apex and culmination of God's creation. Thus, "From this privileged position, humans are commanded to exercise dominion over all of nature, which God gave to them for their benefit. According to this reading, no item in the physical creation had any purpose save to serve man's purposes (Vogel, 1995, p.30).

The implication of the above reading and interpretation was evident in the early modern mechanistic approach to nature which ordinarily deprived it of any inherent meaning and hence only good to be used by man. This reading was part and parcel of a Medieval Latin worldview that demythologised nature and gave rise to technological exploitations of the natural world and eventually to science. Nature had become a mere object that could be exploited (Vogel, 1995, p.30). This objectification of nature bred a culture of meaninglessness, for if the whole of nature is without meaning, then man who is at the center of nature must be himself a being that is without meaning and purpose. Vogel captures this more aptly as he posited:

> Herein lies the deepest root of our cultural crisis: nihilism. Lacking grounds for judging nature to be good and deprived of any stable

> image of humanity to which we owe reverence, we are unable to answer the fundamental ethical challenges posed by our novel powers: why should we care about the distant future of mankind and the planet? Unable to justify why the existence of humankind on the earth is a categorical imperative, we are unprepared for the attitude of stewardship that we must cultivate if we are not to squander the future in the interest of a profligate present. This is the emergency of ecological ethics today. (Vogel, 1995, p.30)

It is in response to this emergency that this paper makes a case for the metaxological orientation towards nature. Exploring the works of Aldo Leopold, Hans Jonas, Paul Taylor and *Laudato Si* of Francis this work is intended to be able to mould a framework for human operation that is not only receptive to the otherness of beings with which we share a "common home", but also to present man in the position of leadership where the question of superiority and inferiority becomes irrelevant.

Metaxological Philosophy as Ecological Metaphysics

Metaxological philosophy is any philosophy that calls our attention to the inexhaustible character of reality with regards to what can be known; it is a philosophy that evokes humility before the manifold of realities with which we are always in interaction. It is also a philosophy of the other and for the other as it seeks to heal the disequilibrium that has existed within modern philosophy as it pertains to identity and otherness. As a matter of fact, modern philosophy seems to have favoured identity over otherness. However, within the framework of this paper, metaxological philosophy is employed to chart a new path in respect of the ethical bases of man's interaction with his ecosystem.

The word metaxology came into popular use in the work of William Desmond. However, it has an ancient origin in Plato's concept of the Metaxu. Metaxology gained currency in the twentieth century philosophy of Simone Weil. Weil had used the term to express her conviction that every separation is a link. This interconnectedness is also central to Desmond's thought (Griffioen, 2010, p. 8). Since we are employing the word basically within Desmond's usage it is good that we try to show how he used the word. George Allan commenting on the usage of the term in Desmond opines that:

> Metaxology is a metaphysical schema rooted in the claim that beings of every sort, including we human beings, exist in a region of change, of coming to be and perishing. We are neither elements of

> a single timeless whole nor discrete momentary unities. We are beings in the metaxu, between Being and nothing at all – astonished that we exist, pleased even if also troubled by the existence of so many other beings, affirming that it is good we and they are alive, dwelling together. (quoted in Griffioen, 2010, p. 8)

Desmond draws our attention to a "between," a community, where we are in relation to the "other." Thus, metaphysics for Desmond arises from an urgent need to be mindful of, interpret, and grasp the plenitude of the intimate strangeness of the enigmatic happening of being in the world around us.

The kind of metaphysics that Desmond proposes is a re□ective mindfulness of the community of being. This community of being, which is a plurivocal community that sustains otherness in relation is called "the ethos" or "the ontological ethos" or "the between" in Desmond's work. Within the framework of this ethos lies the experience of astonishment. Astonishment has the character of gripping us with the sense of wonder. Thus astonishment connects us with the mindfulness that is characteristic of the original wonder. This theme of astonishment is key to Desmond's philosophy and he elucidates it as follows:

> We are struck into astonishment. We do not think our way into astonishment; we are overcome by astonishment. There is a certain shock or bite of otherness in astonishment. Astonishment is aroused when there is, so to say, a 'too-muchness' about the givenness of something that both overcomes us and fascinates us. (Desmond, 2012, p. 8.)

He further explains this "too-muchness" as not just merely indeterminate but rather "overdeterminate," where this "overdeterminateness" denotes a positive sense of indeterminateness. Thus the reality of this original wonder that arouses this astonishment is not determinate, nor indeterminate but overdeterminate. It is this overtness that is characteristic of this primordial ground that begins to get lost as we begin to render, explain and want to communicate this rich experience. However, Desmond says that this indeterminate/overdeterminate quality of experience is not antithetical to determination. Rather it exceeds every determination we will later attempt, exceeds complete encapsulation in a definitive and exhaustive way (Desmond, 2012, p. 9.).

Thus, Desmond's explanation of astonishment calls into question the idea of "definition." Whenever we define a thing, something of that thing is lost, because

definition in itself is a style of reduction of reality into comprehensible form, it is a type of determinate rendering of reality so as to be able to understand it. Thus, definition is by character restrictive of some certain aspect of reality. This, to my thinking, is accountable for why the classical mechanistic theory of physical science has not been able to account for the reality of thought and consciousness. It is this reductive character of definition that the idea of astonishment calls into question.

The emergence of the attempt to reduce being into determinate forms is not a feature of the original primordial ethos. Definition emerges as result of the perplexities that characterize the reconfigured ethos. This reconfigured ethos is now a second ethos or milieu where meanings are to be created. It is important to point out that while the first ethos is characterized by astonishment, the second ethos which is a reconfigured one is characterised by perplexity. Perplexity arises when the mind becomes troubled about the meaning of the original astonishment and what is given to thought in it. There is something indeterminate about perplexity, but there is also a more concerted movement to overcome the indeterminate. There is a sense of lack and desire in perplexity. It is a movement towards the other not for the sake of the other but for the sake of the self-fulfilment or completion arising from the feeling of lack.

The reconfigured ethos has come to be the prevailing ethos in modern time. It is not surprising then that this modern ethos is pervasively instrumental and pragmatic, seeking to have determinate knowledge and thus control over beings. This impulse comes to manifestation in the twofold processes of the objecti□cation of being and the subjecti□cation of value. These two processes are identified as the "double face of modernity" (Desmond, 2001, p. 41). This objectification of being is seen by Desmond (2012, p.99) as a form of neutralisation or devaluation or evacuation, such that being is emptied of any value or worth or goodness and made into a merely empirical mechanism. Then as values are being revaluated in terms of only human self-determination, subjecti□cation is enthroned. Thus the objectification of being is necessary for the subjectification of value. For being becomes instrumental and would only have value as it is conferred on it by human beings. The result of this twofold process and its instrumentalisation of the ethos translate to the creation of distrust, hostility, and ultimately a kind of nihilism, thus creating a devalued soil of otherness (Desmond, 2001, pp. 19 & 27).

In the parlance of Desmond, the astonishment that characterises the original or primordial ethos is "agapeic" while the perplexity that characterises the second ethos

is "erotic." What Desmond means by calling astonishment "agapeic" is that it arises from a surplus or excess out of which an affirmative movement of the mind as self-transcending emerges. By contrast, he calls perplexity "erotic" because it arises out of a troubled sense of lack and desire: because as ignorant, one lacks definite knowledge of the other that is given to mindfulness in astonishment; and yet one desires to overcome that lack of ignorance (Desmond, 2012, p.11).

From the understanding given above, the agapeic consciousness is mindful of the overdetermination of the ethos and thus is a very viable ground for establishing a relation to the other. According to Desmond:

> I do not go out from myself toward the other to appropriate the other and through the other to return to myself. I go toward the other because the other is for itself and always irreducible to what it is for me. It is its being for itself that is affirmed, celebrated in this movement of going beyond self. It is the stunning beauty of the moon that the child's exclamation celebrates, not the child's own feelings. This agapeic relation to the other as other must be kept in mind by metaphysical thinking, especially since other possibilities can come to distort its promise, as indeed does a certain rendition of dialectic. (Desmond, 2012, p.11)

Otherness from this perspective reserves intrinsic goodness, value, and worth. The overdeterminate nature of this goodness calls for metaphysical mindfulness. It is the discursive engagement that happens in the metaxu – the between – that is properly called by Desmond as metaxological. However, relation to otherness takes on a different flavour if it is grounded in eros. From the erotic perspective, Desmond opines that:

> While the other sought can be acknowledged as other, and must be so in some sense, the seeking is qualified by the aim of alleviating perplexity's own troubled mindfulness. In this regard, it is tempted to turn the self-transcending into a search that finally is for the sake of returning the self to its own epistemic peace or satisfaction with itself. Then I go toward the other out of my own lack, I tend to the other not primarily to attend to the other, but as perhaps requiting my own lack. I am tempted to possess the other to enable my own achieved self-possession. (Desmond, 2012, p. 11)

We can see that the two perspectives are very different in orientation. We can also see that the two orientations are also very available and always in a contest struggling for

relevance. With regards to ecology, it is the agapeic respectful orientation towards otherness that I seek to here defend. It is from the perspective of the agapeic understanding that human beings' relations to nature can be fruitfully founded. It is this same understanding that allows man to see that there is an original prior goodness that is associated with being. All the multiplicities of beings share in this original goodness and are therefore good. From this perspective of an intrinsic goodness of beings, nature cannot but be seen as valuable and worthy of respect.

The human mind is, however, always on the move towards a more determinate and definitive characterisation of reality. This movement is essentially erotic in nature and has implications for metaphysics. If being were to be definitively characterised and nature is truly mechanised, then there will be a sense of loss of the intimate strangeness of being.

Epistemic Progression of Cognition and the Dislocation of Metaphysics

From the foregoing, it is almost obvious that one can see a pattern of progression of thought or cognition. So far we have talked about astonishment and perplexity. However, perplexity is not the terminus of the quest of definitive cognition. It is curiosity that brings thought or cognition to its *terminus ad quem.* If determinate cognition or definitive thought that is the quest of cognition were to be the end of it all then metaphysics would have been properly dislocated. The possibility of a resurgence of a second perplexity and a second astonishment retains the hope of metaphysics.

It is from this ground of possible resurgence of a second perplexity and a second astonishment that we can come against determinate cognition which is the sole characteristic of mechanistic science. But first, what is curiosity? According to Christopher Simpson, "Curiosity is Desmond's name for the state of relations between mind and being in which the mystery of being is reduced to a series of determinate questions with determinate answers whereby being is domesticated, calculated and cut to □t our purposes (2009, 38).

However, we can identify some reasons why curiosity can lead to its own self-destruction. First, if curiosity is able to achieve its aim which is the total determination of being, then it will orchestrate its own end (Desmond, 2001, p. 40). Second, the quest for determinate intelligibility is not itself determinately intelligible. Thus there is equivocality inherent in the univocal quest of curiosity (Desmond, 2001, 119). Third,

the obvious failure of curiosity in attaining its goal which is evident in those residual fragments that resist determination is also one sign of curiosity bringing itself to destruction (Desmond, June, 1995, p. 740). Finally, curiosity can lead to the enthronement of nihilism, for if being is meaningless and worthless then even the human agent who seeks to project value is himself valueless (Desmond, 1995, p. 71). It is these breakdowns of curiosity that Simpson identifies as what can also be the occasion for the breakthrough of a second perplexity in Desmond's thought (2009, p. 39). "This is the breakdown of the pretension of complete and absolute (erotic) self-mediation enclosing all otherness within univocal categories in order to be instrumentally utilized" (Simpson, 2009, p. 39).

The breakdown of the univocal mind does not only point to its own deficits but also to mindfulness of the original richness of the beginnings. It is the ineluctability of this primordial richness that brings definitive cognition to its knees and then retrieves and restates metaphysics from the dislocation of the modern mind. The imperative of this exposition is to show that the modern instrumental mind which tries to reduce everything only to its functional value is a forgetfulness of the overdeterminate origin of wonder. It is only from this ground that we can talk of being as having an intrinsic worth and value. It is also from this ground that "to be" must be regarded as "to be good." Hence we must retrieve and reinstate nature from modern univocal instrumentalisation, objectification and mechanisation. Doing this would eventually bring us to the portals of what we can call metaxological ecology. For according to Desmond, "Nature is not a neutral aggregate of manipulable neutral forces but a togetherness of beings marked by inherent order and harmony. The harmony of the community of nature points to the integrity of creation, which manifests an inherent worth that is to be respected" (Desmond, 2012, p. 510). He further draws our attention to the human belongingness to the community of nature by posing a question, "If the land belongs to you, but you do not belong to the land, can you make a real home there, an abode" (Desmond, 1990, p. 277)? Thus there is a primary source of goodness in which human beings and other beings share in. From this ground of the communion of shared goodness, every relation within the ecosystem must be founded.

Biodiversity and the Connectivity of Lives

The biotic community is composed of great diversities. Apart from mammals and birds, which we are very much familiar with, there are fungi, algea, worms, insects, reptiles and a host of other varieties of microorganisms. But as highlighted by the *Laudato Si*, in assessing the environmental impact of any project most of the time concern is usually shown for its effects on soil, water and air generally without careful studies on the impact on biodiversity as though the loss of species or animals and plant groups were of no importance (Bergoglio, 2015). There is "dignity in difference" and we must respect it as a gift. The beauty of biodiversity lies in their interconnectedness so that within the framework of ecology, the earth is our common home, humans and other beings alike.

What we shall be doing here is to explore the thoughts of Aldo Leopold, Hans Jonas, Paul Taylor and Francis to further corroborate the ideas of metaxological mindfulness towards ecology. Leopold points out in his *A Sand County Almanac* (1949) a certain pattern and bias he notices with scholarship in the biological science. According to Leopold, professors of biological science are restrained by some sorts of ironbound taboo that decrees that the construction of instruments is the domain of science, while the detection of harmony belongs to poets. Leopold is said to have pointed out that for man to be able to relate with the beauty and diversity of our ecology, there must be a reversal in the idea of specialisation, so that instead of learning more and more about less, we begin to learn more and more about the whole biotic landscape. Leopold identifies a special virtue which he calls "perception"; this he posits as sensitivity to the complex interrelationships and causal connections that underlie the natural world. "Perception" for him requires an eye trained to notice apparently insignificant facts, and the context of knowledge necessary to relate those facts to deeper patterns (Hinchman, 1995, p. 243).

Leopold requires people to extend the moral meaning of "community" beyond people, to include soils, waters, plants, and animals. People must abandon the role of conqueror of the land community and think themselves as its citizens. In doing so, they show respect for individual components of the land community as well as the community. Thus, the land has an intrinsic value that is not instrumental nor derived from arbitrary human processes but from itself. So human being has an obligation to preserve the biotic community to which he is also a member. In this sense, Leopold concludes that a thing can only be right when it tends to preserve the integrity,

stability, and beauty of the biotic community (Hinchman, 1995, p. 235). In quest of a framework to preserve this biotic community, Hans Jonas developed his ethics of responsibility.

In *The Imperative of Responsibility*, Jonas provides us with essential arguments that facilitate an ethical response to the environmental threats we face due to our phenomenal technological advancement. These problems he identifies as climate change, loss of biodiversity, resource depletion, pollution from the manufacturing of goods and the additional accumulation of waste products, which threaten the future of our planet and its living beings. Jonas sees the ecological crisis originating in unrestrained scientific and technological development occurring without an objective ethical framework to serve as guide. Thus, Jonas's work criticises some ethical systems and theories as deontology, consequentialism, virtue theory, social contract theory, etc. While these theories account for the life of man in society, they do not really consider the reality of biodiversity. Thus Jonas calls for an ethics of responsibility that would make man to have some sense of responsibility towards the diversities of lives.

In a similar vein, Paul Taylor developed a thought in his own ethics of respect for nature. He proposes a bio-centric approach to the environment, whereby he also draws on the analogy of a natural community. However, he deliberately rejects holism and instead bases his sense of respect for nature in the assertion that all living things have a good of their own, where this good implies that they have inherent worth. Thus Taylor's outlook is essentially bio-centric and he outlines the following four beliefs (1986, pp. 99 – 100) as constitutive of his framework:

(a) The belief that humans are members of the Earth's Community of Life in the same sense and on the same terms in which other living things are members of that community.

(b) The belief that the human species, along with all other species, are integral elements in a system of interdependence such that the survival of each living thing, as well as its chances of faring well or poorly, is determined not only by the physical conditions of its environment but also by its relations to other living things.

(c) The belief that all organisms are teleological centres of life in the sense that each is a unique individual pursuing its own good in its own way.

(d) The belief that humans are not inherently superior to other living things.

Though one might need more space to properly x-ray the four beliefs to see how tenable they are, that is not going to be our concern here. The important thing to us here is that Taylor is also able to express ideas that are very similar with the metaxological philosophy. Finally, we will now present the outlook of Pope Francis as made evident in his *Laudato Si*.

This document accentuated the human roots of the ecological crisis. This, according to Francis, is founded on the technocratic paradigm. Against this background, the document calls for integral ecology, which is tied to understanding the common good. Integral ecology brings together the people in an intimate relationship with the environment.

A Critical Look at the Ecological Import of Metaxological Philosophy

So far, we have tried to show that a being has an intrinsic value through the exploration and exposition of metaxological philosophy. But there are critical questions to be answered. Is the intrinsic-value argument able to sustain or preserve a healthy relationship between human beings and other lives? To begin with, when we say that nature is intrinsically good, what are the implications? One thing that immediately comes to mind is that if nature is all good, every form of intervention must be avoided. That is to say, the cutting-off of a cancerous leg to prevent cancer from spreading to other parts of the body must be considered immoral; it would also mean that the general intervention of man through medication to heal diseases is obviously an error as it has led to over-population. For people getting sick and dying is nature's way of preserving its own equilibrium.

Today John Stuart Mill is considered one of the greatest critics of the intrinsic-value argument. His published diatribe entitled *Nature* was an attempt to show that if nature could inflict humanity with all the myriads of torments as have been experienced over the centuries, then there must be nothing intrinsically good about it. As Mill points out in *Nature*, the maxim that people should "live according to nature" is ambiguous. If we take nature to mean "the aggregate of the powers and properties of all things, the sum of all phenomena," then the maxim gives no sensible advice since it would be impossible not to follow it. All human actions embody natural laws; therefore, strictly speaking, nothing can be done "contrary to nature."

On the other hand, we may take nature to mean the spontaneous course of things when left to themselves. But in this narrower sense, Mill argues, the maxim of

"following" nature proves to be absurd and self-contradictory. Anything done with forethought and purpose would be a violation of that perfect order (Hinchman, 1995, p. 234).

According to Mill, if one maintains that natural, spontaneous processes have moral superiority over artificial interventions, one would have to conclude that the whole human artifice rested on morally dubious foundation. Mill goes on to show nature not simply as a problem to technological progress but also as humanity's supreme moral antagonist. He numbers the endless horrors of nature from sickness and death to hurricanes and floods, pointing out that these "everyday performances" would warrant the death penalty if humans had committed them. Strictly speaking, living according to nature could spell much doom. If we are to follow nature, then we should kill because nature kills, then we should not go to school to develop our instincts and capabilities for that is the way nature made us, and of course, nature does not go to school (Hinchman, 1995, p. 232).

In responding to Mill's critique of the maxim, "follow nature," we must first grant that humankind cannot leave everything to spontaneous processes. There are always pragmatic reasons which call human beings to action because staying alive is a moral responsibility. Thus, people must modify nature in order to survive and prosper; there are sometimes sound economic reasons to build dams, highways, and farms. However, to concede this much does not commit us to the more radical conclusion that it is always better to impose our own will and interest. Nor must we accept Mill's concomitant idea of nature as lacking features that might guide us in choosing a path in life (Hinchman, 1995, p. 248).

Conclusion

There could be varied background ideas that seek to define what human being's relationship to nature must be. However, the unique thing about the metaxological framework is that it suggests that we begin from the realisation that nature is intrinsically good and valuable. This must be our point of call if there is to be any sustainable development. It is one thing to have development, it is entirely another thing to have a sustainable one. The humanity in us must be shown through the way we treat our environment. Thus, anthropocentricism would only become truly anthropocentric when human beings are fully aware of the responsibilities of their humanity and are disposed to act as such.

The earth is our only environment and the only field of interaction that is available to us. Hence, whether we will perish or flourish depends on what we choose to do with our environment. Since the earth is the only planet that supports the rich diversities of lives, we must do all within our reach to preserve it. The same Judeo-Christian tradition that commanded humans to dominate and rule the earth also gave humans the responsibility to tend and to keep the earth as a garden. What we get from these two instructions for me is a call to leadership and within this understanding the question of inferiority or superiority is not important at all.

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Chapter Four

AGRICULTURE IN NIYI OSUNDARE'S POETRY: TIME AND THE SPACE BETWEEN THE SCIENCES AND THE HUMANITIES

Douglas Kaze
Rejoice James-Songden

Introduction

The tension between the sciences and the humanities resonates at all levels of African education. Despite the growing emphasis on interdisciplinary research, these domains of knowledge generation have always been treated as polarised and exclusive. In fact, they are usually hierarchised with the sciences at the top of the scale. This is reflected, for instance, in the Nigerian secondary school system where students transiting from the end of their nine-year basic education to senior secondary education are placed in the science or arts class based on their performance on the Junior School Certificate Examination (JSCE). Those who score high grades are placed automatically in the science classes, while those who perform poorly are kicked to the arts section. It is obvious that this privileging of science education by African educational institutions, even though poorly funded, results from the desire to catch up with the rest of the world technologically and economically. Is this dualism, however, the best route for African institutions of education and the emerging economies of Africa? In this chapter, we explore the relationship between these domains of knowledge through the poetry of Nigerian poet Niyi Osundare. The thrust of the chapter is to explore the poet's engagement of empirical knowledge and creative imagination as a means of addressing the perceived tension between the sciences and the humanities. His poetry in the collection *The Eye of the Earth* has shown deep interest in agriculture and the relationship between humanity and the surrounding physical world. As such, the discussion is interested in the status of the work as ecopoetry and in its engagement with elements of time such as history, memory and nostalgia. Therefore, to discuss these ideas, we situate the discourse within the domain of postcolonial ecocriticism,

which instead of appealing to its 'mainstream' scholars, turns to Osundare's own ecotheory expounded in the preface to the collection under study.

Time, Nostalgia and the World: Osundare's Ecotheory

There is no reason why Osundare's preface to his collection *The Eye of the Earth*, in fact, the whole collection should be disregarded as a significant early contribution to the development of ecocriticism or postcolonial ecocriticism (Parini, 1995). It was published in 1986, far earlier than the texts that are now regarded as textbooks of the field of postcolonial environmental criticism and Euro-American ecocriticism. Perhaps this was not available to a wider audience. Or it was simply swept aside as imaginative rather than theoretical. But that is exactly the kind of divisive thinking this work seeks to challenge. The gap between creative works and theory must be problematised since creative works can theorise and theorists do make use of poetic and narrative modes to develop and present their ideas. In his early poem "Poetry Is", for instance, Osundare theorises about the need for poetry to be taken out of the intellectual sphere into the arena where the general public can access it (Egya, 2017).

Osundare's ecological thought conveyed in the preface is embedded in the trope of time. Through certain key ideas such as nostalgia, memory and history, Osundare projects interest in the role that time has played, or is playing, in how we imagine or theorise the earth and how we can explore the connections between humanity and earth. For the poet who draws massively from both the Yoruba and modern worldviews, time must be viewed in rather complex ways. According to Wole Soyinka, "for the Yoruba, [..] the concept of time is not linear" (Tutuola vi). Though the non-linearity of time in the Yoruba cosmology is often described as cyclical, the Yoruba do not deny the concepts of past, present and future. In fact, they "believe that 'the future co-exists with the present without being co-extensive with it'" (Kazeem, 2016, p. 37). In Osundare's work, time is an important trope that works within the framework of this complexity in order to highlight the complexity of the relationship between humanity and the nonhuman physical world and how we can think about it.

In utilising the idea of time, Osundare mainly employs the concepts of nostalgia, memory and history. Nostalgia, a very subjective concept, is normally associated with sentiment and idyllicism, and with a strong *desire to return* to a distant time or place. Memory, on the other hand, simply points to the mental storehouse of experiences and events in the life of the host. History is collective memory that purportedly seeks

objectivity as opposed to the subjectivity of nostalgia and personal memory. In Osundare's work and many other African literary works, however, we find that we cannot neatly separate these three. They inform and shape one another. For instance, nostalgia and personal memory have been displayed in different degrees in African literature in the way that writers reinvent the precolonial past of Africa as almost 'pristine'. According (Nnolim, 2009, p. 51) "utopian literature has somehow influenced African writers who, in protest against the damages and ravages of colonial intrusion into their culture and way of life, have begun to return to a romanticized vision of their past with the ardour of a convert." He further identifies the idea of *retour aux sources* as forming part of several African or Black anti-colonial movements such as Negritude, Afro-Cubanism, the Harlem Renaissance, Indigenism in Haiti, Marcus Garvey's Return to Africa Movement and Rastafarianism.

Osundare's preface begins with a recollection of a personal past, a past in which he experienced a level of African 'pristineness' deeply entwined with the natural environment. He writes, for instance, that he "encountered dawn in the enchanted corridors of the forest, suckled on the delicate aroma of healing herbs, and the pearly drops of generous moons," (Osundare, 1986, p. xi). In the "early days", Osundare remembers nostalgically a living nature and a reverent and uninterrupted relationship with nature. He says, "[e]arth was ours, and we earth's" (p. xi). The poet's removal from this bucolic agrarian life came when he had to leave home in pursuit of western education. In his words, the "schoolyard jilted the farmstead" (p.xi). He, as a member of the African society, therefore embodies the "story before the virulent advent of Europe's merchants" (p. xi). We should note, however, that the inclusion of his personal experience is not meant to serve an allegorical or metaphorical purpose only as the personal is a real and autonomous domain. However, it is intricately involved with the collective experience of the society to which he belongs. Below is how he describes this collective rupture caused by colonialism:

> Thus, then, the story before the virulent advent of Europe's merchants who turned native farmers into cocoa-coffee-cashew croppers, while yamfields succumbed to weeds and granaries rang out like the mourning shells. A cancerous god called MONEY crashed in from across the seas, a blind sword and a crown of noisy gold, smashing old customs, assailing the very core of ancient humanistic ethos. Africa abandoned what she ate, committing her

> fertile soil and rugged energy to those alien crops which cushioned the European stomach. (p.xii)

The memory now moves from personal nostalgia to a collective trauma, which the poet feels on behalf of the continent. For him, Africa's environmental problems cannot be separated from colonialism and the history of Empire. Africa's pre-colonial economy was strong enough to supply food to its people without harming the environment. However, according to the poet, the coming of Europeans turned African farmers into cash croppers, who now produced not for their immediate need but for Europe. At the centre of this was capitalism's drive for profit. Capitalism, as quoted above, did not only impact the economy, but affected the environment and culture as well. An example is the fertile soil lost to "alien crops" (p. xii). This is based on the fact that colonialism did not only stop at political and cultural domination, but extended to domination of the physical land, the soil, by introducing foreign crops, thereby dominating the local varieties of crops and subjecting the land to undesirable use. This extended into altering the agricultural system that, according to Osundare, should be seen as responsible for the image of hunger that Africa has come to be identified with. He writes that, "Whoever still doesn't know the roots of Africa's hunger should run a rapid eye back to uneasy epochs" (p. xii).

In dealing with this trope of time, Osundare writes about what he calls the "embattled present" (p. xii), evoking the postcolonial in terms of colonial persistence. This is where the pastness of nostalgia, memory and history fail to remain in the past but work as *present* witnesses. In doing this, Osundare draws from postcolonial dependence on history as the lens through which to examine, question and address the present. This "embattled present" makes it rather difficult to work out a great future. He says it "makes forward thrust difficult" (xii). For him, this is important because "looking back is looking forward" (p. xii). The embattled present is described not only in terms of political and economic instabilities, but as is the focus of the text, in environmental rhetoric:

> Left mostly now are echoes whispered in the stubborn ears of memory. Most of those trees so vivaciously native to this forest have met a rapid death in the hands of timber merchants [..]. In a land where vision and humanistic sympathy have taken leave of the ruling class, hardly is there any policy aimed at stopping the parlous depletion of our natural being. Hardly is anyone aware that today's

> profit (for them) is tomorrow's irreparable loss for universal humanity. (p. xiii)

Nostalgia, memory and history are important for postcolonial ecology because the colonial mission was based on narratives that either misunderstood or ignorantly misrepresented Africa's land and landscape. These three show an awareness of what has been lost and needs to be recovered. Postcolonial nostalgia, therefore, becomes necessary for counter-narrating these ideas. Anthony Vital, writing about the need for an African or postcolonial ecocriticism says,

> there is no good reason not to develop an African ecocriticism, one which engages in debating what a society's assigning of significance to nature (in varieties of cultural products) reveals about both its present and past. Such debate, by opening to question the ways modernity in African contexts transforms human relations with nature and, as a result, the impact of societies on natural environments, would join the struggle to enable social worlds find more equitable, sustainable, and healthy ways of inhabiting their place – as well as strengthen historical self-understanding. (Vital, 2008, p. 88)

In this exploration of the use of the trope of time by Osundare to respond to the need to encourage conversation and collaboration between scientific knowledge and the humanities, we find the work by Kate B. Showers quite important. Her work, which covers a history of African soils, opens with the assertion that "African soils cannot be separated from African history because they are, in themselves, *historical bodies* and they have interacted with human history since its beginning" (Showers, 2006, p. 118, emphasis mine). She points out the ways in which African soils suffered misconceptions and homogenisations in the minds of European colonialists. These perceptions, more importantly, did not end in the mind, but resulted in practices that were not favourable to the African soil, practices whose results are still being battled today. In other words, perception, which is perhaps the forte of the humanities, has long affected colonial scientific practices on African soil. One of the major points missed about the African soil or landscape is its diversity which suffered "excess generalizations and misrepresentations" (p. 122). A huge section of Showers' work captures sophisticated soil knowledges and practices that existed in precolonial Africa, showing how Africans had an understanding of their local soils and had developed practices that suited their local environments.

Agriculture and Imagining the Return to Earth

Osundare's poetry in this collection has imagined agriculture not merely as an economic activity or an exploitation of the earth, but as a relationship between humanity and nature. It is this relationship that is imagined in conversation with time and its role in nostalgia and history. The section of the collection titled "Back to Earth" contains poems that explore the overlap of the past and present embodied by the natural environment in relation to history, society and ecology. More importantly, however, the title of the section suggests a disconnection from the relationship mentioned above, which the poet has undertaken to address by acts and imagination of returning, a sort of reconciliation. In this case, therefore, we are not only faced by a threatened ecology, but a threatened relationship, a separation, which manifests in various individual and collective ways. This seems to suggest that before we can address a damaged earth or threatened agriculture, we must address the damaged relationship.

The poem "Forest Echoes", although not specifically about agriculture, depicts Osundare's conception of time as closely linked with space or even rooted in the earth. Via the image of the "wanderer", the poet's reverence for nature in typical Theruvian excursion – leaving urbanity and the mundane to *visit* nature outside human society – is depicted. But in this case, the return is not only an individual return to nature as in the Romantic sense, but to a lost past, a past stolen by the colonial encounter. Osundare writes:

> A green desire, perfumed memories,
> A leafy longing lure my wanderer feet
> To this forest of a thousand wonders. (Osundare, 1986, p. 1-3)

These lines contain nostalgia in the words *desire*, *longing* and *memories*, creating a vision that allows a crossing of subjective experience of time and a physical world that is subject to time's impact. The phrases *green desire*, *leafy longing* and *perfumed memories* which contain the poet's passion to reconnect also destabilise the divide between the internal and the external, the physical and the subjective. All of these occur within the function of time as the platform on which they interact.

The poet paints a picture of the forest's interaction with time. He calls it a "forest of milling trees, this, / wounded though by time's axe" (p. 72). He goes on to show how trees such as the *Iroko* have been able to stand the test of time:

> roof of the forest
> ironwood against the termites of time
> *Iroko* wears the crown of the forest

its baobab foot rooted against
a thousand storms. (pp. 78-83)

The *oganwo* is also a strong tree, but not as the *iroko* (pp. 88-95). The *ayunre* is nothing but "the clown of the fireplace" (p.105). The palm is also resilient (pp. 106-120). Then there are "bevy of birds, a barrack of beasts" (p. 139) – partridge, weaverbird, squirrel, chameleon, praying mantis, termites, etc. The biodiversity of the forest is presented as a nation of tribes, responding differently to time's impact. In short, bringing the forest into this larger context of the earth (what the collection is all about) creates the image of the earth as home, but ambivalently, a home to which the human has become a mere visitor due to the ruptures of experience and history. The multiplicity of nature is of importance here, showing the earth as more than just that lifeless part of our existence on which living things operate, but as that which is an embodiment of all these existences. While this poem does not mention urbanity and technology, the silence simply points to them. The poetic voice comes from the unmentioned world of urbanity, technology and capital, where human profit is emphasised to the detriment of the interactions that inherently characterise the ecosystem. By time in this poem, therefore, Osundare does not merely refer to a flow of temporality, but to events such as the storms (which could also be a metaphor for human activities), to lumbering and other acts of deforestation.

As earlier stated, this poem is not primarily about agriculture, but it confronts us with the ruptures that have tampered with the idea of agriculture as a relationship with the land instead of a means of exploitation. The return to the forest by the poetic voice is sadly short-lived as portions of the poem speak about his parting. Technology, urbanisation and development patterns inherited from the colonial era have not only created a gap between humanity and the rest of nature, but have introduced an exploitative and commercialised relationship, which the poet seeks to overcome through this transient communion and reconnection. Agriculture should therefore be an act of returning to nature.

Agriculture in Time

Agriculture is a clear interest in *The Eye of the Earth.* In the collection's opening poem, "Earth", Osundare eulogises the earth as a "breadbasket / and compost bed" (pp. 5-6). But it is in the poem "Harvestcall" and the section named "rainsongs" that he most presents the agricultural dimensions of his ecology. "Harvestcall", in three sections,

nostalgically celebrates the agriculturally rich past of three communities namely Iyanfoworogi, Oke Eniju and Ogbese Odo. The poem is also an exploration of the speaker's sense of time-space, or the intertwinement of space and time, in close relation to agriculture. Two divisions of time are represented: the past and the present. The past is depicted as a time that deserves to be celebrated; the present a time of regret. In doing this, Osundare treats farmlands as historical bodies, to use Showers' terminology. According to her, "African soils cannot be separated from African history because they are, in themselves, historical bodies and they have interacted with human history since its beginning" (p.118).

Being a part of the section that addresses a lost past, this poem recalls how the communities in question were prosperous in agriculture in the past. Osundare describes Iyanfoworogi in a voice that coveys a clear ambivalence that expresses both celebration and sadness at the same time. Iyanfoworogi used to be known for producing yams of praiseworthy quality. But in the use of both the past and present tenses, we sense a sadness that points to the land as only an embodiment of a prosperous memory and a present identified as a time of loss. In the first stanza, for instance, the speaker says,

> This is Iyanfoworogi
> Where, garnished in green
> Pounded yam rested its feted arms
> On the back of stooping stakes.
> This is Iyanfoworogi
> Where valiant heaps cracked, finally,
> From the unquenchable zeal of fattening yams. (pp.1-7)

In the ensuing stanzas, Osundare does not only praise the beauty of the yams produced in this town, but also depicts them as a solution to hunger and of economic benefit to the community. In the first two stanzas, he depicts the early stages of the crop from when it was only "garnished in green" (p.2) and "rested its feted arms / on the back of stooping stakes" (pp.3-4) to where "valiant heaps cracked, finally, / from the unquenchable zeal of fattening yams" (pp.6-7). In this, Osundare shows his knowledge of the trajectory that plants take from their early stages to the point of maturity. This process of the development of crops is one of the ideas experts in the science of agriculture are interested in. However, Osundare, without subjecting the plant images to metaphor or allegory, also shows deep interest in the physicality and autonomy of the plant as a subject of interest. It is in this kind of shared interest that we can find

the middle space to challenge the artificiality of the fissure between the sciences and the humanities. Although agricultural science would focus more on factuality and empirical dimensions of these plant's growth process, the poet, in this case, the agro-poet, would dip into his imagination in order to draw innovative ways of talking about the same plant that speaks of both the personal and collective or cultural value attached to the plant. For instance, the use of expressions like "garnished in green", "feted arms", "valiant heaps" and "unquenchable zeal of fattening yams" does not oppose the scientific, factual or empirical knowledge of the plant, but reveals how artistic freedom with the imagination can convey other ways that human communities relate with and think of crops.

The second section of the poem turns attention to a place called Oke Eniju, "where coy cobs rocked lustily / in the loins of swaying stalks" (pp.30-31). This land used to be known for its abundant harvest of maize. The poet imagines the course of the corn crop, showing how from the month of May to June the crop matures from green to brown. In this section, the poet interestingly gives subjectivity to the plants by anthropomorphising them as in the lines below:

> And when June had finally grabbed the year
> by her narrow waist
> corn cobs flashed their milky teeth
> in disrobing kitchens. (pp. 40-44)

In the third section of the poem, we are drawn to a place that used to produce cotton in abundance. It reads as follows:

> (Finally) Ogbese Odo
> Where cotton pods, lips duly parted
> By December's sun
> Draped busy farmsteads
> In a harvest of smiles.
> Here a blooming loom curtailed
> The tiger claws of the harmattan
> And earth's wardrobe lent a garb
> To every season. (pp. 48-57)

In the last section of the poem, the second part of the ambivalence, sadness, is revealed further with a series of rhetorical questions which show a rupture between the prosperous past and the poor present. The poet is saddened by a disappearance of these harvests that the three places earlier celebrated. It turns into a lament in which the poet cries, "But where are they?" (p.59). Nostalgia then becomes a tool for

examining or weighing the economic shift that has happened from an agrarian economy to a capitalist economy driven by profit and technology. In the case of Nigeria, though not mentioned in the poem, agricultural production has been replaced by the petroleum economy. The relations to the earth where agriculture used to be a kind of relationship with the earth have been replaced by an exploitative relationship in which the earth is used and impoverished. This returns us to the idea of the soil or farmlands as historical bodies which contain the history of human activity on the soil and its negative impact.

Returning to Showers, we would like to point out her comparison between western scientific and local knowledges of the soil. In the poem "Farmer-Born", the speaker celebrates the kind of local or first-hand knowledge he used to have of the soil as someone who was raised on the farm. In the poem, we are not taken into the developmental stages of a plant; rather, our attention is drawn to the relationship between the farm – its earth, its plants, its whole unity – and the farmer. The poem draws from the poet's agrarian background as stated in the preface, which begins with the same line as the poem, "Farmer-born, peasant-bred" (Showers, 2006, p.xi). The intimacy of the farmer boy with the farm is delivered through the use of a series of active verbs acting on concrete nouns in ways that point to both the emotional and physical dimensions of this relationship. Examples: (read marked lines from the poem) frolicked (p.2), fondled (p.5), traced (p.8), plucked (p.12) and rattled (p.15). These verbs also convey the idea of *direct contact* between the speaker and the farm environment. In fact, the core idea in this poem is to show agriculture or farming as an intimate relationship between the farmer and the farm. Note that in each of these stanzas, the action of the farmer is followed by a response from the natural items involved, or point in some way the activity of the land or plants.

The poem ends on a sad note. The last stanza speaks of a kind of rupture that occurs between the speaker and the earth, between Africans and their farmlands. In this part, he describes himself as "Farmer-born, peasant-bred / classroom-bled" (pp. 26-27), adding the third part to show how western education built on the ideas of modernity is responsible for the separation. Note that the poem does not blame education at all as responsible for the break, but a certain kind of education. There is a subtle sense in which the poem's dwelling on the farmer's direct contact or relationship with the earth and its plants is shown as a form of education, making the comparison not only between two economic systems or between two different cultures,

but between two different forms of education. This again echoes Showers' discussion of two kinds of soil knowledges in Africa – the local one drawn from this kind of direct contact with the earth and the western scientific one acquired from the classroom. This poem simply shows that by abandoning indigenous knowledge systems for western ones, Africans have invited hunger into their homes. The poet says, by this unwise action, "I have thrown open my kitchen doors / and asked hunger to take a seat, / my stomach a howling dump / for Carolina rice" (pp. 28-31).

Osundare also thinks about the future in his agricultural imagination. His appeal to the past and present has also served as a platform for projecting into the future. The poem "Ours to Plough, Not to Plunder" (p. 48) introduces the idea of stewardship, responsibility and care towards a better future earth. It tries to differentiate an interdependent, responsible relationship from an exploitative one to that end. Earth is placed in a sort of maternal position in which the inhabitants are her children, fed and provided for by her. But the calling is to be responsible children who care about the wellbeing of the source. The use of technology or implements that are largely seen as destructive to the environment can be used responsibly on the earth. The poem looks at both farming and mining as ways that the earth provides for humanity. An irresponsible relationship with the earth is one that is wasteful, showing wastefulness of our modern consumerist culture. The resources that we enjoy must be treated with care and respect.

Conclusion

In this chapter, we have only explored a piece of a subject that invites deeper exploration. The relationship between the sciences and the humanities can be explored from many other angles such as their underlying ontologies. But here we have taken the route of the role of creative imagination as one of the many ways to address the artificial borders between the domains. Osundare does not only create this link by writing about a traditionally scientific subject but also his approach in doing so, which does not engage in mindless subjection of the physical world to the metaphorical or allegorical status. By placing the physical world in conversation with time, nostalgia and history, he assigns each domain its own life at the same time allowing them to overlap and create complexities. We hope approaches to literary studies that consider the kind of intersections identified in this chapter will continue to multiply for productive interdisciplinary knowledge production in African scholarship.

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Chapter Five

LANGUAGE ECOLOGY IN CAMEROON ANGLOPHONE WRITING: AN ANALYSIS OF AMBANASOM A. SHADRACK'S *SON OF THE NATIVE SOIL* AND NKEMNGONG J. NKENGASONG'S *ACROSS THE MONGOLO*

Afutendem Lucas Nkwetta

Introduction

Language ascertains and sustains the reality of every society, determining the performative experiences of the users, though the users may not be reflexively aware. The Republic of Cameroon is a multilingual country comprising some 250 indigenous languages, one lingua franca, and two official languages. The language question in Cameroon can be traced to the colonial period, a period characterised by language conflict between the colonial administrations on the one hand and missionaries on the other. French and English are official languages; they are the heritage of Franco-British rule in the country between the end of the First World War and Independence. This peculiar heterogeneous language situation does not facilitate linguistic communication.

On the contrary, it constitutes a major handicap in view of the absence of a nation-wide lingua franca that serves as a common nationally intelligible medium. Moreover, the policy of official language bilingualism is hampered by the unequal distribution in the usage of English and French. This makes the language policy in the country to fall short of clear-cut objectives and orientation because it fails to guarantee the appropriate implementation of official language bilingualism. Hence, official language bilingualism, originally aimed at guaranteeing political integration and unity of the Cameroon state, now seems to constitute a source of conflict and political disintegration.

Language plus *ecology* gives us language ecology, linguistic ecology, eco-linguistics. In the same vein, ecology plus philosophy equals *ecosophy,* which we have adapted to

guide us in selecting the writers. Today's interpretation of what language ecology is ranges widely. Many researchers use 'ecology' simply as a reference to 'context' or language 'environment' to describe language setting. Here, 'ecology' has often become a fashionable term for simply situating language in (micro and macro) sociolinguistic, educational, economic or political context as exemplified in literary works. The concept of *sustainability* originates in environmental science where it is defined as a path of economic and social development whose impacts on the natural environment are constrained within ecological limits. While the main concern of environmental policy is the way states influence market behaviour towards environmental ends in a global capitalist economy, language ecology is concerned with the study of interactions between any given language and its environment (Haugen, 1972). Most of these definitions on ecology and sustainability examine natural environment but our study is based on language choice and uses in fictional texts by two Anglophone Cameroon writers in the English Language.

Anglophone Cameroon writers here refer to those of them from the former Southern Cameroons or the present-day north-west and south-west regions. When a minority language interacts with another language, it is affected in one way or the other. What happens to English language (a mOL in Cameroon,) when it interacts with French (a MOL) as well as with other languages? We are using *Son of the Native Soil* by Ambanasom A. Shadrack and *Across the Mongolo* by Nkemngong J. Nkengasong to demonstrate what happens when English interacts with French across the "Mongolo" or in Yaoundé, the spatial capital of Cameroon.

Problem Statement, Questions and Hypotheses

The numerical imbalance between English and French in Cameroon has led some Francophones to take English, and indeed bilingualism, for granted and some have hastily concluded that they can operate adequately without having to learn English. However, with the world becoming a global village and the upsurge in technology, many of them have understood the place of English as an international language and are going in for it. Prior to this, French was a more dominant and established language and it continued to propagate while English, the less dominant language, was pushed into irrelevance and obscurity by many Francophone Cameroonians in authority. How is this situation represented in *Son of the Native Soil* and *Across the Mongolo*? We seek how and what are Anglophone Cameroonians doing to promote, protect and sustain

English in multilingual Cameroon. We analyse the trends and perspectives in language ecology and sustainability of English as mOL and how these are constructed in the selected corpus. Finally, we question how the authors' language style, choices, and utilisation in the texts can impact English as mOL in Cameroon.

The hypotheses are that the writers represent what is actually taking place in Cameroon vis-a-vis the place and position of English in the face of French and the close to 250 home languages. The perception of English in selected texts, especially when it encounters other languages, is a phenomenon on its own and reflects what is happening in the real world.

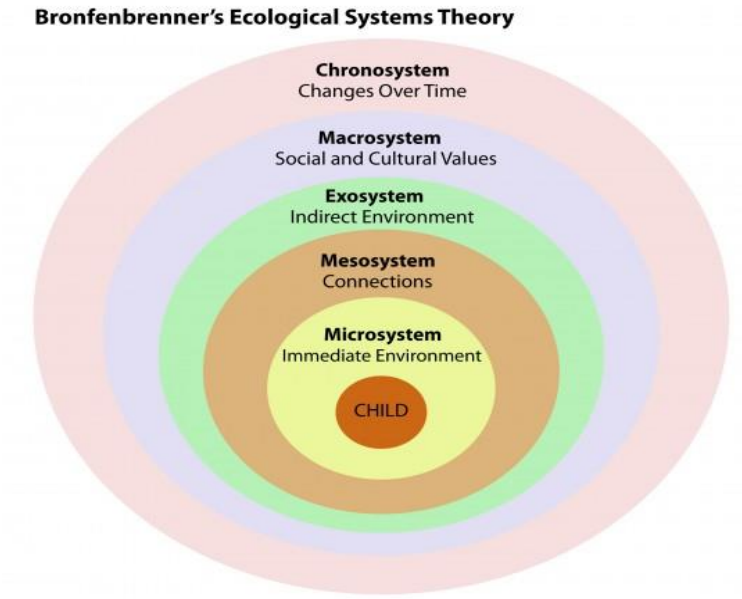
Literature Review and Theoretical Framework

According to Condon (1975, p. 23), language does not provide a "one-to-one mirrored representation of experience" but does shape one's thoughts and interpretations of that experience. Thus, words and language cannot represent fully and accurately all aspects of a person's experience and we are able to see and think only as much as our language permits. Ambanasom A. Shadrach and Nkemgong J. Nkengasong,like all humans, use words and language to filter, differentiate, categorise, and label their lived experiences. In a multilingual context, the choice of language, the words and the categories people use provide them with building blocks of their works. To make life coherent and meaningful, they pay attention to those experiences that are consistent with their assumptions about reality and ignore those that do not at the time of writing. Language has long been understood as a powerful determinant of moods, views, behaviour, and decisions, and this power of language to influence perception and the development of self-fulfilling prophecies can create negative or positive outcomes. It is no doubt that during the launch of the Nkemngong J. Nkengsaong's novel in 2005, Atatah (2005, p. 14) wrote that the "Southern Cameroons' problem of marginalization took central stage" and that the novel "was a simulacrum of the stark reality of Anglophone subjugation in Cameroon." Tembong (2013, p. 47) says, "African writers have realised that Western literary influences could never after all replace African values, or that 'colonial exploitation and cultural domination' from the West died with the decline of imperialism." He adds that "the book is a critical analysis of the Anglophone problem in Cameroon and is constructed against a background of political liberation in Cameroon since 1990."

Concerning ecosophy, it was developed by Arne Næss and Félix Guattari who settled to develop thoughtful axiology based on ecological wisdom and promoted it bottom-up. Arguably, ecosophy is axiomatised semiotics. From this novel perspective, human communities are dynamically partaking in signifying processes, in a space at once an ecosphere, a semiosphere, and a vast political territory. As there is growing evidence that environmental degradation lessens our quality of life and the sustainability of our communities, ecosophy might help reform values and practices. We used ecolinguistics to analyse language in literary texts; to reveal the stories and events lived by the characters in their respective environments. We examine these events and stories according to ecological philosophy or *ecosophy*, pointing out how each linguistic item or element refers to attempts by Anglophone Cameroon writers in English to protect, maintain and sustain English Language, which is threatened in the country by French and Home Languages. In other words, we used ecolinguistics to explore linguistic phenomena in the selected texts, examining inter-language, inter-human, and human-nature relationships from the perspective of ecological philosophy.

The field of ecology also investigates the dynamics of languages in relation to the groups of people who are centrally concerned with the problems of cultural change, continuity and transformation. Linguistic ecology looks at how languages interact with each other in the spaces they are spoken in, and frequently argues for the preservation of the endangered languages as an analogy of the preservation of biological species. The life-sustaining interactions in language, of humans, other species and the physical environment are considered ecological. We also used the Ecological System Theory by Branner (1979, p. 65) and the Complexity Theory to examine the texts. American psychologists used it to explain how the inherent qualities of a child and his environment interact to influence how he/she will grow and develop. The theory holds that we encounter different environments that may influence our behaviour in varying degrees throughout our lifespan. These systems include the micro system, the mesosystem, the exosystem, the macrosystem, and the chronosystem. Just as a person's development is affected by everything in his/her surrounding environment so also a language development in a multilingual context is affected by other languages in this same context. The Urie Bronfenbrenner model organises contexts of development into five levels of external influence, categorised from the most intimate level to the broadest. It is represented in the diagram below:

Figure 1. Ecological Systems Theory Model



Source: https://www.psychologynoteshq.com/bronfenbrenner-ecological-theory/

Accordingly, the complexity theory is a set of concepts that attempts to explain complex phenomenon not explainable by traditional (mechanistic) theories. It integrates ideas derived from ecosophy to deal with the natural and artificial systems as they are. It recognises that complex behaviour emerges from a few simple rules, and that all complex systems are networks of many interdependent parts, which interact according to those rules. We chose the Complexity Theory but had to apply it from the perspective of language that is itself a complex adaptive system. It is a complex system in which complexity is emergent, one in which language grows and organises itself from the bottom up in an organic way. Using their language resources, characters in *Son of the Native Soil* and *Across the Mongolo* assemble language patterns on a given occasion. They cobble together their language resources, responding to the contingent demands and pressures of the communicative situation. They adapt their speech for the sake of their interlocutors.

Sustainability in language is considered when patterns become stable through use, and are transformed with further usage. Language is constantly in flux with variation in all features at all times. We examined linguistic signs in media texts as not being

autonomously isolated objects of any kind, either social or psychological, but are contextualised products of the integration of various activities by individuals in particular communicative situations. It logically follows that they are continually created to meet new needs and circumstances. Semiotics was at the background when we deconstructed the language choice in relation to the ideology of multilingualism. Apart from these two, we also deployed *ecosophy* as a normative theoretical framework to examine the philosophy behind the writers' choice of environmental-related elements. We pulled the word to our normative framework in analysing the texts.

Presentation of Corpus, Analysis and Findings

The methodology was based on secondary source of data collection: reading and applying the appropriate theoretical framework in sorting out examples of language choice, ecology and sustainability in *Son of the Native Soil* and *Across the Mongolo. Son of the Native Soil* is set in Dudum, inhabited by two consanguineous people sharing a common ancestor in the North West region of Cameroon. The principal character is Achamba. Despite their common ancestry, these two main villages are often in conflict for three reasons: land dispute, whether the chief of Anjong or that of Akan should be the paramount chief of Dudum and which of the two should be the administrative headquarter. They agree on a traditional method of settling disputes called "The Squirrel". At Iteubugi, representatives from both villages assemble and a squirrel is to appear from among the palm trees. Some rites are performed; an *either / or* option is put to the squirrel, and its response constitutes the judgment. On two occasions, the judgment goes in favour of Anjong and in reaction, some Akan people destroy a village in upper Dudum. The culprits are arrested and jailed in Mbambe, the Divisional Capital. Achamba intervenes and the prisoners are treated humanely.

Another conflict arises when the Divisional Officer (DO) visits Dudum and settles the land dispute, irrespective of the judgment of the Squirrel. Henceforth, the disputed land belongs to the government and all trespassers should be warded off. Seeking to bridge the chasm that has ravened the Dudum clan, Achamba becomes a peace broker and reaches out to Akaya, the chief of Anjong. He travels to Yaounde, the capital town, to research the paramount chieftaincy problem from the national archives' records. His finding is that Anjong is the rightful place to have the paramount chief and, consequently, the administrative seat. When he tries to share these findings with his village people, he is detested. His opponents are led by Chief Umeitoh of his village,

and Abaago the chief political activist of Akan. Undeterred, Achamba convenes a national conference of all sons and daughters of Dudum

Chief Akaya's daughter falls in love, with the promise of marriage; Akan considers it an act of treason. This opposition notwithstanding, Achamba and Echunjei get married. However, this union is short-lived. Achamba's rising fame and popularity kindles the envy, hatred and ire of some of his people, including Abaago. Achamba is eventually assassinated. But by some twist of events, the murderers confess their crime, among other ones, and point Abaago as a master-mind. Some of the members of Achamba's family seek to wreak vengeance, but are counselled by traditional occult forces to wait till the opportune time destined by the ancestors. Abaago is ostracised and he eventually commits suicide six years after he orchestrated the assassination of Achamba. The death of Achamba brings some unity to Dudum, as exemplified by the fact that even chief Umeitoh eulogises Achamba at his funeral. A few months after Achamba's death, his widow Echunjei bears a son, Uyaka Achamba, who comes to serve as a symbol of unity for the Dudum clan. *Across the Mongolo* tells the story of Ngwe Nkemassah, an intelligent young man from the English speaking part of his fatherland, Kamagola. Ngwe's dream is spurred by his father Ndi Nkemassah to become another Babajoro, the ruler of the country. So, after getting four A/L papers at the G. C. E, he crosses the River Mongolo to the lone University of Besaadi to pursue his dreams. At Besaadi, Ngwe does not achieve academic excellence. He meets with physical, emotional, intellectual and psychological frustration, which pushs him inevitably into madness and near tragedy.

The novelist presents the consciousness of Ngwe, the major character. His actions, thoughts, assessment of events and appraisal of situations give the novel its unity. Indeed the novel shows a keen interest in unveiling the psychic responses of its protagonist to events. Ngwe is presented as an extremely sensitive individual who goes through harrowing experience which unhinges his mind and leaves him drifting like a lunatic, full of bitterness against the system in which he lives and operates. The piece ends with a welcome announcement that Ngwe's ordeal is preparing him for a messianic role set out for him by the gods (that of liberating his people from suffering in a faraway land).

Table 1. Environmental Ideologies in *Son of the Native Soil*

Environmental Signs and symbols	Significance
Age honoured-squirrel	Peace and the Akan and Anjong people depend on its judgment after fighting over this piece of land
Kolanuts, cashew nuts, groundnuts	To signify love; if a man receives a bundle of cashew nuts from a woman, it symbolises her love for the man.
Umbilical cord, native soil	A return of humans to the local natural environment
Pigs, goats	They feed on nature and are food and income providers
Cloud	Natural symbols; reading of clouds to foretell weather conditions
Stream	Self-centred element; it acts as a boundary between two tribes, that is between upper and lower Dudum.
The location of the Dudum clan	Crooked landscape, with rugged hills and rock jutting out here and there

Source: Personal computation

In *Son of the Native Soil*, the author uses signs and symbols that help enhance our reading and understanding of the text as a whole and the society from which the writer hails. Our main focus here is how Ambanasom uses the aspects of geolinguistics in his work, having ecosophy in mind. These aspects include the calling drum ("ndek"), age honoured-squirrel, kolanut, calabash of palm wine, umbilical cord, the geographical location of Dudum clan, and the geographical setting of the plots of the novel. These issues and others are summarised in the table above.Applying ecosophy, we realise that the age honoured squirrel symbolises peace and the Akan and Anjong people depend on its judgment after fighting over this piece of land. This symbol brings in fairness

and peace in the community. The sons and daughters of Dudum understand the language of the squirrel. When Abaago says "[..] age honoured squirrel come to our help [..] the people of Akan [..]" (p. 42). Ubeno on the side of the Anjong people addresses the squirrel when he says "[..] squirrel, you are the last word when all else fails. You the impartial judge that have pass judgement over countless cases since the day of Ngiekum" (p. 23). The ecology of geolinguistics is glaring in this point in that the author uses language and nature. He makes us understand that the people believe strongly in the verdict of the squirrel and it is the superstition of the people of Ngie. The burying of the umbilical cord of Echunjei's son by Embuta is an important symbol in that the object is being put into the soil in which the baby hails. "[..] Embuta takes the umbilical cord of his grandson and buries it among plantain suckers behind his house" (p. 231). According to the people, when a child's umbilical cord is put back into the soil, the child will forever remain son or daughter of the soil. Thus, umbilical cord is linked to nature in that when a son of the soil dies, he or she is buried where his or her umbilical cord was buried. Other important geolinguistic symbols are palm wine, kolanuts, groundnuts and cashew nuts. These symbols make us to see the link between nature and language. The language of the natural object kolanut in divinity is seen when chief Umeitoh uses kolanut to determine the aim of the visit of chief Akaya's *chindas* (chief's servants) in his palace. The kolanut tells him they are messengers of peace and not war. Here we can say the author presents the tradition of his society through characters and natural objects.

Ambanasom makes use of realistic and fictitious characters in order to attain his objectives. We have to look at the characters, plot, and settings to enhance our understanding of the work. Characters like Niba and Ndifon are *real* in the locality of Bafut in the North West Region of Cameroon and others like Abaago, Ebitor, Achamba, and Echunjie are *fictitious*. The mention of *realistic* characters like Niba, and Ndifon and names of physical places like Yaounde, Ngie and Bamenda Regional Hospital is to illustrate the setting and plot of the text. The novel is set in the North West Region of Cameroon and these names are used by the inhabitants of these real geographical environments. Fiction is an imaginary part of the writer, but it represents the real environment and society of the writer. Daylight/dawn symbolises or stands for hope and life. This can be seen when chief Akaya says "[..] rather the return of life outside [..]" (p.13). Daylight which is a natural symbol stands for new beginning and offers human a chance to start back. "The cloud" as Ambanasom uses in his work

represents or stands for sadness. He uses it to describe the sad mood of Embuta who feels sad and darkens his face when the people of Akan excitedly pronounces the name of war in their mouth: "[...]his face became clouded" (p.19). The author uses metaphor to describe the sadness in Embuta's face. Whenever it wants to pour heavily, the cloud becomes dark to show the signs of rain. When places are dark, the cloud becomes dark to signify darkness, bringing about fear and terror so that darkness in Embuta's face can be linked to fear and hatred. A clear cloud brings about joy, and happiness and vice versa. So the use of cloud is significant as an element of ecology, and the way the author uses figurative language to link it to human being is pertinent in this study since it enhances our understanding of geolinguistics which is the portrayal of nature through the use of language. "The stream", as a natural symbol, portrays them as elements who live alone and do not depend on other natural symbols or element for advice. Ambanasom further makes us understand that the stream goes astray because it fails to listen to advice from other natural elements. He strongly stands against disunity. Chief Akaya uses this symbol to appraise the courage and advice given to the Anjong people by Ubeno and Ndifon. He satirises the action of the stream or self-centred people when he says "[..] the stream went astray because it was alone [..]" (p. 21). Though the stream is a self-centered element, it is important because it acts as a boundary between two tribes that are between upper and lower Dudum.

Another means through which environmental ideologies are sustained is in the geographical setting of the plot of S*on of the Native Soil.* The author makes use of varied places such as Mbambe where the Akan detainees are being taken to. Achamba, a secondary school teacher, lives in Mbambe; Echunjie the daughter of chief Akaya schooled in Nkoman. The author mentions different geographical areas like Bamenda where Achamba's body is being taken to; Bafut where his friend Neba comes from; Yaounde the capital of the nation of the writer where the national archive of the people of both upper and lower Dudum is; and Dudum a place where the Akan and Anjong people live. The author also talks about the different economic, political and social activities of these inhabitants.

In S*on of the Native Soil,* Ambanasom brings in the idea of togetherness in characters like Chief Akaya and the protagonist of the novel Achamba. Chief Akaya brings peace through his leadership roles and skills. Another instance of togetherness is seen in Achamba. Though he hails from Akan, he does not support the wrong things people from his village are doing. When the Akan people seize the hoes of the Anjong women,

he rather goes to the village and advises Chief Umoitoh and Abaago on the impact of what they have done. English survives in multilingual Cameroon because Anglophones show an attachment to the English language. The author tries to sustain the use of English language in that when the protagonist Achamba goes to Yaounde to the national archive to check information about chieftaincy in Dudum, the workers there speak to him in French but he responds in English. This makes us to understand that the author sustains the use of English. The officer also speaks to the magistrate in French but the magistrate replies in English. All these instances affirm that the author aims to sustain the use and promote the growth of the English language in his work. A dual theory system was used to analyse these characters. Minister Wankili is under the System One Processing: very fast, automatic, involuntary, an unconscious process that we are not in control of. The French ruling method makes Minister Wankili act the way he does whereas Dr. Amboh falls under System Two Processing that is slow, deliberate, and voluntary. It is a conscious process in that we are aware that the processing is occurring. Dr. Amboh is controlled by his mind. All this constructs people's interactions in the text. Thus, Dr. Amboh's attachment to the English language in the text is one of the ways that English survives in a multilingual Cameroon.

In the text, environmental ideologies are pushed through the use of language. English and French are the two main languages used in *Across the Mongolo*.

Environmental/Ecological signs and symbols	**Significance**
kolanuts, cowries, njieh, calabash of palm wine, palm oil	Egussi; food for the gods Pacification of the gods seek for solutions, advice and blessings
Nkeng leaves,	Peace leaves
Goats and fowls	Used as offerings
Cave, shrine	Home for the gods
Concoction of herbs and alligator pepper	Mystical powers to send away evil spirits, protection

A rat-catcher and return to the village and till the soil.	Someone who feeds on nature without due investments

Table 2. Environmental Ideologies in *Across the Mongolo*
Source: Personal Computation

In *Across the Mongolo*, we have material objects like kolanuts, cowries, Njieh, a small calabash of palm wine, palm oil, Nkeng leaves, goats and fowls that are used to appease the gods in the Attah village, which means that they are symbols of peace. Achiabieuh, the Fon of Ngwe's village, says "If the gods of the land are angry with him, we shall give them salt, palm oil and goats" (p. 2). Also, when Ngwe, Nwolefeck, Etiendem and Bengangancha pass through the Giant Rock, inside the cave of the shrine are found offerings like "coins, cola nuts, cowries, Njieh, a small calabash of palm wine, Nkeng leaves, lamps and other possessions that had been offered to the gods by the early travellers" (p. 33). Attah people believe that these cultural objects serve as a source of communication with their gods and ancestors to appease the gods, seek solutions, advice, and blessings. When Ndi Nkamasaah is sick, the traditional herbalist tells him that "You shall look for a goat, and two cocks for a sacrifice [..] palm oil, sail, melon, Nkeng leaves and Ndindi" (p. 85*)*. We realise that the Attah people strongly believe and value their culture through these cultural objects and symbols. Based on this study of the ecology of language in *Across the Mongolo*, the Attah people use concoctions to cure the sick; alligator pepper is essential to the people. The author says: "He made a strong concoction out of leaves, roots and back of trees unknown to the eye of man and anointed it with alligator pepper [..]" (p. 5). The author also says: "He blew again into Ngwe's eyes; chewed [..] with alligator pepper, spat the paste [..] struggling to see a vision" (p. 5*)*. The mixture of herbs and alligator pepper acts as stimulants to Ngwe's recovery from his unconscious state, thereby helping him narrate his life's agony. According to the Attah people, the alligator pepper has mystical powers to send away evil spirits.

The River Mongolo is also a symbol in *Across the Mongolo*. He says "The River Mongolo. It is the Great River, the boundary between the English colony of Kama and the French colony of Ngola; the two federated states that gave birth to the Federal Republic of Kamangola" (pp. 35-36). The river shows immediate separation just after

you cross the colony of Kama (Anglophones) and enter the colony of Ngola (Francophones). The gendarmes asked the passengers their "piece! Idendite! Impot!" (p. 36). To Ngwe and others who do not understand French, the driver says "wuna shu wuna book" (p. 36). Normally, the coming together of the two colonies means learning two languages and integrating both cultures. Looking at the discrimination of the Anglophones by the Francophones, we see that though the two states come together, they have different cultures and mentalities towards each other and the French are believed to be the masters as Ngwe says "I was the Anglo, the pariah, the slave and the voice in the high and decent life across the Great River. At the cost, I had to learn the language of my masters [...]" (p. 61). In a passage at the "scolarite" or Admission Office, students mock Ngwe saying "pauvre Anglo!' Anglo for koromba. Vous ne pouvez pas rester chez vous a koromba, Anglo?" (p. 57). This is, therefore, what the mentalities of these two cultures are. They prefer separation rather than integration. It can be said that this River Mongolo symbolises the difference existig between the French and English cultures brought by the two different colonial masters, France and Britain.

These natural creatures are seen physically, but we get the sounds and from them, we can identify them. Nkengasong also uses *Across the Mongolo* to incorporate natural geographical environment. He compares Gwe's madness to a dog as he says "he picked things to eat from the rubbish like the dog that sends thunder; dirty like the pig that bathes in mud" (p.1). Again, simile is seen in the text through the paramount priest of Fuandem who treats the most grievous illnesses: "Aloh-Mbong knew all the leaves and herbs in the bush [...]. He knew the past, the present like a god [...]. In the morning of the third day, he appeared from the bushes, furious and frightened like someone chased by leopards" (p. 3). This combination shows how the chief witch-hunter combines the strength of his ancestors with the hand of Fuandem.

Kamangola is made up of two cultures with two different languages: the English and the French languages. The two languages symbolise two groups with different cultures, beliefs and mentalities. Immediately after Ngwe and other Anglophone passengers cross the River Mongolo, we are told that a young gendarme drags an old man of about 60 year old to sit on the ground because his picture on his identity card is not clear. When Ngwe goes to sign his documents at the Prefecture of Besaadi, the secretary tells him "'Ne m'ennouille pas, je ne suis pas la pour les Anglo'" (p. 53). And still when the man at the scolarité flings the documents at Ngwe, we are told that the Francophone students mock Ngwe saying "'Pauvre Anglo!' Anglo for Koromba. Vous

ne pouvez pas rester chez vous a koromba, Anglo?"(p. 57).When Ngwe gathers his courage and asks for an explanation of a notion in English in the constitutional law which he does not understand, he says "Catcalls and screaming came out from all directions. Twisted papers and assorted objects flew from every direction and landed on me" (p. 60*).* All these different mentalities of the Francophones towards the Anglophones show that the so called Federal Republic of Kamagola belongs to the Francophones. Anglophones fail in the University of Besaadi not because they are dull but because the system does not consider their presence in lecture halls as their language is considered inferior as they themselves are considered. Ngwe says "I was the Anglo, the pariah, the slave that had no voice in the high and descent life across the Great River" (p. 61). These frustrations lead to Ngwe's failure at the University followed by his loss of mind.

We see Pidgin in the text fighting to survive as well, and it helps the flow of interactions and messages. For instance, Monsieur Andre-Marie-François-Xavier Manganga the French teacher in government school Miemfi, in order to communicate with the pupils speaks a kind of crude Pidgin quite remote from what the pupils know. He calls a bucket 'alunga', and a girl 'njaah'. When he invites female pupils to his house to carry water from the tap he says "Dat njaah dem go toot me ndiba fo ma hoss joss noh" (p. 61). If the buckets are not full, he sends the children back for another trip shouting: "Mua ndiba fo alunga sote e fullop. Salade.. espèce de cong" (p. 62*).* In this novel, Nkengasong has effectively handled a number of issues on the situation of a marginalised fraction of Cameroon, which unsuspectingly surrenders its freedom, traditions and overall way of life to the oppressor brother. The major character's travails come about largely because he is from this oppressed minority.

Conclusion

We have analysed*Son of the Native Soil* and *Across the Mongolo*and examinedthe relationship between language and the environmental contexts in which it is used. This is because discourses are systems of meaning embedded in certain institutions, which in turn are determined by ideologies in response to larger social structures. The two authors are of Anglophone Cameroon origin and do not just tell stories for entertainment purposes but their works carry strong ecological messages. They live in and understand the difficult terrain in which English language is operating in Cameroon. Their choice and use of environmental diction (landscape, flora and fauna)

carry strong messages for those committed to ecology and environmental education. These can be summarised as a series of separate points, though they are clearly interrelated thus:

a. Concern for the environment is concern for humanity. It relates to human interaction with the environment and this interaction is judged by human values.
b. The environment has a symbolic, as well as a physical, existence for us.
c. The environment has moral connotations.
d. We 'read' the environment as part of a complex process of generating and responding to texts. Our responses to environment form an element in the network of shared meanings, which embodies society.
e. We are impelled to express our values through our interaction with the environment. These values change from society to society and from time to time.

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Chapter Six

DIVERSITY INDEX OF SELECTED VERTEBRATES IN RELATION TO FRESHWATER QUALITY INFLUENCED BY ANTHROPOGENIC ACTIVITIES AND ECOLOGICAL STATUS OF RIVER NDAKOTSU, NIGERIA

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Introduction

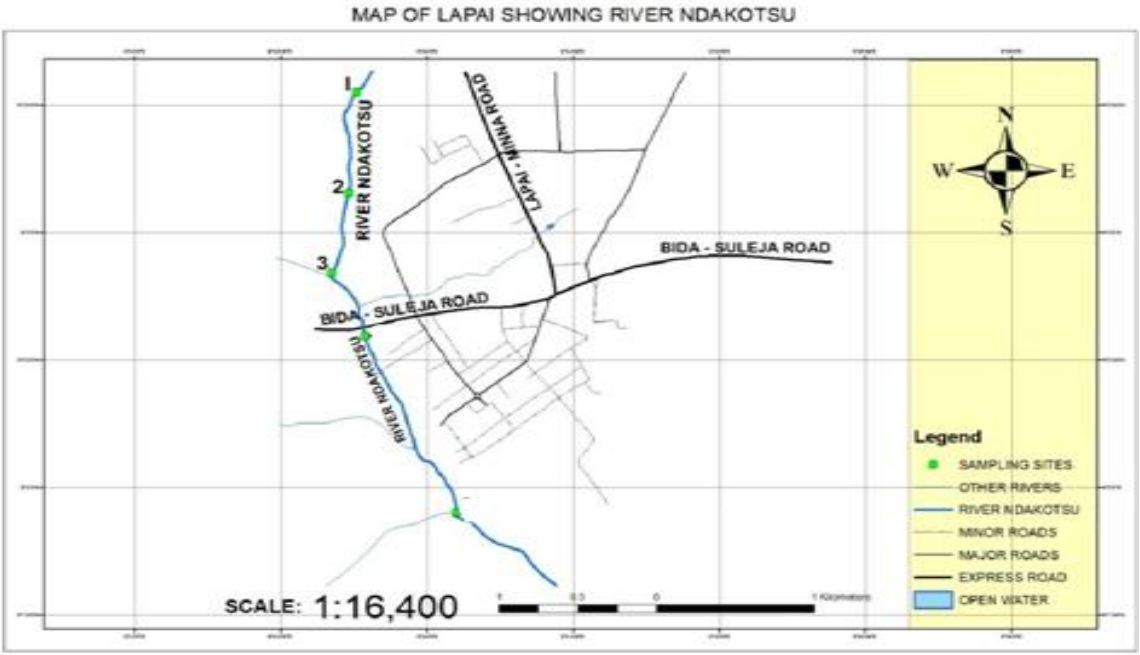
Freshwater ecosystems are among the most special resources in the world (Arthing and Gessner, 2006) and globally over 126,000 described species inhabit freshwater systems, including fish, mollusks, amphibians, reptiles, insects, plants, and mammals, all of them concentrated in less than 1% of the world's surface area (Balian, Segers, and Leveque, 2008). The various marketable and domestic activities in the communities of the rivers have contributed to the release of pollution, solid wastes, and emissions to rivers, the atmosphere, and soils as a result of the lack of sufficient waste management facilities. Domestic pollution and combustion processes contribute to pollution on the physicochemical parameter in the environment, posing a health hazard to humans and the environment. Over the years, studies have been done on assessing heavy metals present and their effect on life of the aquatic organism. However, little or no work has been done to ascertain water quality assessment, using birds and mammals as an indicator, even though recent years have witnessed increased efforts to estimate the richness of freshwater vertebrate species at a global scale (Hoekstra, et al., 2010). These impacts on freshwater biodiversity may also diminish the provision of freshwater ecosystem services, such as food security and nutrition, which are essential to human populations. Therefore, in order to implement conservation and management

programmes for freshwater groups, a better understanding of species distributions and diversity patterns is essential, as freshwater serves as the sources of drinking water. Consequently, domestic activities and artisanal fishing are suffering from ecological degradation, which results in a decline in some biodiversity due to human and industrial activities such as pesticides, insecticides, chemicals leading to partial or complete depletion of oxygen (Tisseuil, Cornu, and Beauchard, 2013). The aim of this study is to assess some physicochemical parameters of River Ndakotsu, using amphibian birds and mammals as pollution indicators, as water quality plays a vital role in the distribution, abundance and diversity of aquatic vertebrate.

Materials and Methods

Study Area

Lapai town is the headquarters of Lapai Local Government Area in Niger State. It is on A124 highway to the west, covering an area of 3,051km.^{2} According to the 2007 census, it has a population of 11,721. River Ndakotsu is located at 9º 03" 00" N6º 34" 00" E in Lapai local government of Niger state, Nigeria. It has the characteristic tropical climate of two distinct seasons, a dry season (November to April) and a wet season (May to October); the mean annual temperature is approximately 28ºC (range 22-34ºC) with a mean annual relative humidity of 85%. The river is fed principally by precipitation municipal effluent and surface runoff from riparian communities. It flows through the outskirts of the town from Makara and then joins with River Dangana forming confluence which empties into River Baro and finally empties into River Niger. It serves as a source of drinking water, domestic needs, artisanal fishing as well as dumping site of effluent. The municipal runoff as well as the runoff from fertilizer and herbicide residue use for agricultural purposes, are also discharged into the river (Dadi-Mamud, et al., 2012).



Sample Collection

Samples were taken twice a month over a period of six months (May to October, 2017), covering wet and dry seasons. Three stations were selected from upstream (A), which act as control, while midstream (B) and downstream (C) were selected based on the anthropogenic activities and ecological status of the River.

Field Determinations

Water and Air temperatures, pH, Conductivity and Total Dissolved Solids were measured in-situ using a HANNA portable combo waterproof pH/EC/TDS/Temperature, Tester model HI 98130. Transparency was evaluated using Secchi disc as described in Borg (Borg, 1983). Water velocity was determined using the Ping-pong floatation technique, and water depth was measured using a rope and a meter rule. Dissolved Oxygen (DO) was determined using Digital D.O meter model 6 11-R Labtech (APHA, 2005). Water samples were collected in sterilized 2 liters plastic sample bottles, labelled appropriately, stored in a portable iced box at 4^0C and transported to Biological Sciences Department, Ibrahim Badamasi Babangida

University (IBBU) laboratory for determination of parameters that were not determined on the study site.

Laboratory Analysis

BOD was determined by modified Winkler Azide method as described in ALPHA (APHA, 2005), while COD and Alkalinity were determined as described in ASTM (ASTM, 2001). Nitrate-Nitrogen and Phosphate-Phosphorus were determined using the methods described in HACH DR/2010.

Bio-indicators Identification

Each bio-indicator (amphibian, mammals and birds) were sampled from the River Ndakotsu at 100m elevation intervals at each of the stations, and the numbers were recorded. Collected individuals were identified to the species level at the IBB University, Lapai, a museum to the operational taxonomic unit using pictorial chart (Guide).

Statistical Analyses

Individual and combined ANOVA were used to determine the level of significance among the parameters measured, and if significant. Shannon-Wiener diversity index, dominance and species evenness were determined using PAST for windows (2007) statistical software. Correlation coefficient was used to determine the relationship between the different parameters.

Results

The summary of the physicochemical parameters of the study area is given in Table1. The mean, minimum and maximum values, and standard deviation are observed at the three (3) selected stations A, B and C as revealed by multivariate analysis of variance (MANOVA). The spatio-temporal air temperature of the study area varied between 28.0 ^{O}C ± 0.50 to 26.92 ^{O}C ± 0.35, while that of water temperature was 27.6 ^{O}C ± 0.88 to 28.0 ^{O}C ± 0.57 (table 1). Multivariate analysis of variance (ANOVA) shows significant variation at ($P<0.05$) for the stations' means (Table 1). Also, there was significant difference between the water temperatures at all stations within months, with station C the source of variation according to (HSD). The monthly water depth ranged from 7.24± 0.2cm to 40.39± 1.75cm. MANOVA shows that there were significant differences

in the months and stations in the study period. Honest significant difference tests revealed that station A had no significant difference with station B, but had significant difference with stations C (table 1). The monthly mean water velocity varied between 0.18± 0.07 cm/s to 0.39± 0.04 cm/s, while two ways analysis of variance showed significant differences ($P<0.05$) during both stations.

The mean separation showed significant differences between mean water velocity stations in C (Table1). The pH value was generally within the range of 6.80 to 7.33 throughout the study period. Mean pH of 7.03 ±0.12 to 6.98±0.18 were recorded in station A and B respectively (Table 1), the dissolved oxygen (DO) concentration fluctuated between stations with the mean of 3.32 ±0.52 mg/l to 2.83± 0.32 mg/l. Dissolved oxygen had no significant differences within the months but have significant difference among the stations. Stations A and C are the sources of the differences observed in this study. Conductivity values determined in this study were within the range of 0.02*ppm* to 0.55*ppm*, the mean of conductivity recorded were 0.20±0.110 to 0.25 ± 0.16 for stations, respectively. There were no significant differences ($P> 0.05$) between the mean water conductivity within the months (table 1).

Table 1: Summary of Some Physical and Chemical Parameters in Study Sites from May to October 2017, in River Ndakotsu, Lapai, Niger State, Nigeria

	STATION A			STATION B			STATION C		
PARAMETERS	Mean	SD	Min Max	Mean	SD	Min Max	Mean	SD	Min Max
W.Temperature ^{O}C	27.6±0.88[a]		26.0 29.0	27.3 ±0.33[a]		27.7 28.00	28.0 ±0.57[b]		27.00 29.0
Air temperature ^{0}C	28.0±0.50[a]		26.04 27.0	26.03±0.15[b]		26.0 26.02	26.92±0.35[b]		28.02 26.0
Ph	7.03±0.12[a]		6.80 7.20	6.98 ±0.18[a]		6.80 7.33	7.03 ±0.07[a]		6.90 7.10
DO mgl^{-1}	2.83 ±0.32[a]		2.18 1.20	3.32 ±0.52[c]		3.80 2.36	3.01 ±0.03[a]		3.98 1.08
Conductivity (ppm)	0.20 ±0.11[a]		0.03 0.41	0.29 ±0.21[a]		0.02 0.71	0.25 ±0.16[a]		0.02 0.55
Water depth (m)	13.25 `±0.67[a]		11.80 13.30	15.96 ±0.61[a]		15.81 16.32	7.24±0.26[c]		7.10 7.34

BOD (mgl^{-1})	10.57 ± 1.96^{a} 8.25 10.61	12.48 ± 204^{b} 12.32 13.40	14.55 ± 1.46^{a} 14.45 14.72
Total alkalinity ($mgl^{-1}CaCO_3$)	38.46 ± 3.72^{a} 36.0 38.57	39.92 ± 3.11^{a} 39.85 41.25	188.25 ± 17.94^{c} 187.20 188.30
Water Hardness (mgl^{-1})	39.75 ± 4.31^{a} 35.06 39.82	32.92 ± 5.51^{a} 30.83 32.98	183.96 ± 17.34^{b} 180.11 184.00
COD (mg/l)	20.25 ± 3.60^{a} 18.32 20.35	23.26 ± 3.8^{b} 3 22.30 23.36	28.69 ± 2.81^{c} 27.03 28.77
Velocity (m/s)	0.18 ± 0.07^{a} 0.02 1.10	0.19 ± 0.0^{a} 0.07 0.21	0.31 ± 0.03^{a} 0.27 0.38
NO_3-N (mgl^{-1})	0.87 ± 0.07^{a} 0.16 1.23	0.85 ± 0.20^{b} 0.50 0.93	3.01 ± 0.19^{a} 2.80 3.10
PO_4-P (mgl^{-1})	0.71 ± 0.13^{a} 0.08 0.88	0.77 ± 0.11^{a} 0.16 0.98	2.26 ± 0.34^{b} 1.30 2..32

Biological oxygen demands (BOD) concentration values varied from 10.57± 1.94 mg/l to 14.55± 1.46 mg/l. There were no significant differences ($P > 0.05$) between the mean water BOD at all the stations and within the months (Table 1). Chemical oxygen demand (COD) concentrations ranged between 20.25± 3.60 mg/l and 28.69± 2.81 mg/l. Multivariate analysis of variance (ANOVA) revealed that there were significant differences observed among the stations and within the months during the study period for COD (Table 1). Total alkalinity had significant differences among all the stations sampled within the months during the test as revealed by ANOVA (table 1). The hardness of the river water varies within the month and among the stations, with station C differing from stations A and B which are not significantly different. Nitrate-Nitrogen (NO_3-N) concentrations show significant variations among the stations in months, and within the stations A and C being the source of the significant variations as revealed by turkey's honest significant difference test.

Table 1 shows that there was an insignificant difference ($P > 0.05$), but significant ($p < 0.05$) as observed within the months in Phosphate-phosphorus concentrations. The assemblage of thirteen taxa comprising nine hundred and seventeen (917) individuals were recorded during the entire study period. The total number of taxa and individuals

analyzed at stations A, B and C were 13(187), 11(479), 11(259), respectively (Table 2). Comparisons of abundance values demonstrated high significance ($p < 0.05$) between the control stations at the upstream (station A) and impacted downstream (station C). Mammals were more evenly distributed species than amphibians and Aves. Station C had the highest species richness, evenness, and diversity, while the anthropogenic activities in station C altered the water chemistry (Table 3). In station B, species richness patterns had the correlation value ($r=0.814$), followed by station A where correlation was moderate ($r=0.782$). In station C the correlation was weak ($r=.644$) compared to the other two stations.

Table 2: Number of Individual Vertebrates Recorded in Study Sites from May to October 2017 in River Ndakotsu, Lapai, Niger State, Nigeria

	Mammals	Amphibians	Aves
Taxa_S	3	3	3
Individuals	447	236	234
Dominance_D	0.3348	0.3371	0.3586
Simpson_1-D	0.6652	0.6629	0.6414
Shannon_H	1.0960	1.0930	1.0580
Evenness_e^H/S	0.9978	0.9944	0.9599
Margalef	0.3277	0.366	0.3666
Equitability_J	0.9980	0.9949	0.9627

Table 3: Diversity of Vertebrates of River Ndakotsu from May to October, 2017

Taxa (Group)	SITES			
	STATION A	STATION B	STATION C	TOTAL
MAMMALS				
Cow	25	183	95	447
Sheep	9	26	24	
Goat	17	26	12	
Dog	4	5	2	
Ram	10	14	3	
AMPHIBIANS				
Frog	30	52	35	236
Toad	28	58	33	
AVES				
Dove	4	22	14	234
Baya Weaver	30	55	27	
Turkey	9	-	-	
Duck	1	29	6	
Pigeon	15	9	8	
Hen	5	-	-	
TOTAL	187	479	259	**917**
%	**20.4%**	**52.2%**	**28.2%**	

Table 4: Correlations between Vertebrates with the Sampling Stations of River Ndakotsu.

Stations	Mammals	Amphibians	Aves	Average
Station A				**0.782**
Mammals	0.923**	0.714	0.711	
Amphibians	0.3348	0.3371	0.3586	
Aves	0.6652	0.6629	0.6414	
Station B				**0.814**
Mammals	0.944**	0.637	0.861	
Amphibians	0.9978	0.9944	0.683	
Aves	0.3277	0.366	-0.190	
Station C				**0.644**
Mammals	0.834	0.675	0.424	
Amphibians	0.675	-0.148	0.879*	
Aves.	0.424	-0.177	0.918*	

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)

Discussion

Temperature values recorded during the sampling period fall within the optimal range for tropical freshwaters. The range of temperature is similar to what (Abell, Thieme, and Revenga, 2008) obtained. The focus of the study on freshwater varieties is a very important underpinning for natural resource organization and protection in humid basins (Galacatos, Stewart and Ibarra, 1996). In River Ndakotsu, these studies have been limited, most likely since the complication of addressing its great difference in groups to explore the region's diverse ecosystem. These groups of Amphibians, Mammals and Birds increase in abundance with decreasing temperature because they prefer cooler waters for their feeding, metabolism and reproduction (Arimoro and Ikomi, 2008). The pH value obtained from this study ranged from slightly acidic to

neutral. Most vertebrates such as Amphibians, Mammals and Birds are only slightly affected by acidification hence their abundance in Station B. Others are acid sensitive and are mostly found in clean waters that are alkaline in nature, Dissolved Oxygen (DO), concentration in River Ndakotsu Lapai Niger State was related to species abundance in station B. This is because as water temperature increases, dissolved oxygen decreases; also, it may be due to respiration and other processes such as the breakdown of organic matters. Species difference was highest in Station B where DO was high. The results show that dissolved oxygen had the strongest influence on the community structure at River Ndakotsu. At concentrations below 6.80 mgL^{-1}, pollution tolerant species dominated the stream, while concentrations above 7.00 mgL^{-1} promote high abundance and diversity of sensitive water vertebratess in the River. Representatives of aquatic vertebratess like Amphibians, Mammals, and Birds were considered an index of pollution for diverse perturbation levels in the River Ndakotsu. The low group differences could be due to some physicochemical conditions like fast flow, high pH, low dissolved oxygen, and low water conductivity (Jayalakshmi, Lakshmi and Charya, 2011) that diversity tends to be low in physically controlled systems. These factors probably cause disruption of life cycle, reproductive cycle, food chain and migrations or imposed physiological stress on even the tolerant vertebrates (Adakole and Annune, 2003).The significant role of dissolved oxygen in the abundance and diversity of vertebrate is well correlated in the study, where high abundance and species diversities were recorded in stations with the highest dissolved oxygen levels. The presence of high numbers of mammal and amphibians present in station C, the impacted station, and B, which is partially impacted, could be a characteristic of polluted waters.

Conclusion

This study provides information on the present status of the water quality and a baseline survey of vertebrates in River Ndakotsu. The high abundance and conveyances of pollution tolerant orders of aquatic vertebrates in stations A, B, and C indicate the relative pollution of the River Ndakotsu. This shows the mean difference between various Amphibians, Mammals and Birds, among three groups at three sampling sites. By corroborating the evidence of the relatively polluted nature of the River, this shows that the various human activities around the River Ndakotsu might have brought about pollution.

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Chapter Seven

STRATEGIC TOURISM MANAGEMENT AND PRESERVATION: A STUDY OF ECO-TOURIST DESTINATIONS IN PLATEAU STATE, NIGERIA

Mercy Gambo

Introduction

Eco-tourist destinations are considered the hub of tourist attractions because they provide the natural habitats from which ecological attractions (fauna and flora) strive; thus, they are referred to as the nucleus of tourist attractions. As important as eco-tourist systems are, they are by their nature environmentally fragile, depleting, and commonly endangered by human activities. It has been observed that persistent human tourist activities over time expose these destinations.

Research has shown that there is now a greater emphasis on individual/self-determined holidays; educational, and active recreational pursuits, which have no doubt added to the pressure of tourist activities as spotted tourist destinations suffer a high influx of tourists resulting in overcrowding and reckless development, which harmfully impacts on eco-destinations (Sannie, 2015). Delicate historical, archaeological, and natural sites suffer physical wear and tear; and landscapes fall victim to resort and vacation home sprawl. When tourist destinations experience such potential dangers, the balance of the ecosystems is most often grossly affected as the organisms within these habitats seek refuge away from the discomforts and disturbances of human activities and thereby get displaced from their natural habitats. Eco-tourist destinations are also reckoned as conservers of biodiversity because they provide the natural breeding habitats for ecological reproduction and growth.

Activities carried out by strategic business stakeholders within and outside eco-tourist destinations and how these sites are managed by the stakeholders (such as managers, employees, gatekeepers, customers, government agencies) are said to affect them either positively or negatively (Freeman, Harrison & Wicks, 2007). Eco-tourist

destinations are primarily dependent on stakeholder activities and how they are managed. Studies show that the tourist industry in east and west African countries, Nigeria in focus, suffers fromshortage of skilled employees or suitably qualified and experienced workers, forcing the countries to rely on foreign nationals for the required expertise resulting in additional cost. The struggle to retain good professionals due to low wage and salary levels and the service levels tend to be relatively poor in international terms. This report is no doubt a reflection of the relevance of strategic management of tourist destinations, particularly viewed from the lens of strategic stakeholders' activities.

Tourist destinations in Nigeria are said to suffer a lot of challenges from stakeholders' negative activities within and outside the environment and poor stakeholders' management. Weak strategic management plans, poor job performance, unprofessional employees/caregivers, poor management practice, reckless abandonment of eco-tourist destinations and the unwholesome activities of gatekeepers such as housing developments, encroachment, environmental pollution, and poaching are spotted as challenges that negatively affect the sustainability of biodiversity resulting in distorted reproduction and growth, gradual depletion, and the eventual endangering of ecologies in eco-tourist destinations.

The research question here is: Is there a relationship between strategic stakeholders' (management, employees, and government agencies) management of eco-tourist destinations and ecology conservation in eco-tourist destinations? Is there also a relationship between gate-keepers (immediate host communities) activities and ecology conservation in eco-tourist destinations? The answers to these questions lie in the objective of this chapter which aligns with the United Nations World Tourism Organization's declaration of the year 2017 as the international year of Sustainable Tourism Development around the world. This clarion call by the United Nations is seen as a reflection of the problems bedeviling the tourism industry, hence the emphasis for sustainable tourism and the conservation of biodiversity/ecology in eco-tourist destinations. The United Nations World Tourism Organization (UNWTO) in its 2017 report mentions ecology as one out of the three factors (aside from social and economic factors) considered in directing the future of tourism worldwide; hence, the aptness of this study in examining the relationship between strategic stakeholders' activities and the conservation of ecology, as well as examining the relationship between gatekeepers' activities and ecology conservation in eco-tourist destinations.

The Role of Strategic Stakeholder Theory

Scholars have defended stakeholder theory using a wide variety of theoretical perspectives, including integrated social contacts theory (Donaldson and Dunfee, 1999), Kantianism (Evan & Freeman, 1993), the principle of fairness (Phillips, 2003), and the principle of the common good (Argandona,1998; Freeman, Harrison, Wicks, Parmar & deColle, 2010 in Harrison, Freeman & Sa'de Abreu, 2015). Numerous scholars have also tested and supported this theory across several industries, in both domestic and international firms, in a variety of context (Choi& Wang, 2009); hence the choice of this theory as a support for this study.

Freeman's stakeholder theory holds that a company's stakeholders include just about anyone affected by the company and its workings. It propounds that a company's stakeholders are those groups without whose support the organization would cease to exists; these groups would include customers, employees, suppliers, political action groups, environmental groups, communities, the media, financial institutions, governmental groups and more. This view paints the corporate environment as an ecosystem of related groups, all of whom need to be considered and satisfied to keep the company healthy and successful in the long run. A corporate stakeholder can affect or be affected by the actions of a business as a whole. Freeman defines stakeholders as individuals, groups and organisations that have an interest in the processes and outcomes of the firm and upon whom the firm depends for the achievement of its goals (Freedman, 1984; Freedman, Harrison & Wicks, 2007). Stakeholders include internal and external partners, including shareholders, managers, employees, customers, communities, suppliers, and special interest groups (www.smartsheet.com.). Stakeholder's theory promotes a practical, efficient, and ethical way to manage organisations in a highly complex and turbulent environment (Freeman, 1984; Freeman, Harrison and Wicks, 2007). Applying the theory to the study is apt considering the enormous challenges facing eco-destinations as a result of stakeholders' activities and the practical management required to address the issues. The study considers tourist destination managers, employees, government agencies (the Plateau Tourism Corporation), and the immediate host communities (gatekeepers) of the selected eco-tourist destinations in Jos as the strategic stakeholders whose roles and activities impact the conservation of ecology.

Literature Review

Tourism is vast and typically consists of eco-tourism (natural tourism), artificial or man-made tourism and cultural tourism. Natural or eco-tourism refers to natural formations that are habitats to species of animals and reptiles; these include forest vegetation, mountains, caves, wildlife reserves, waterfalls, air, water, fauna, flora and more (Copper et al, 1999). Tourist destinations in Nigeria cut across the country's six geo-political zones with each region having its distinct tourist attractions. The Jos Shere hills and Kura Waterfalls in Plateau State; the Idanre hill-heights of natural wonders in Ondo State; and the Yankari Games Reserve in Bauchi State are typical reserves of eco-tourist destinations in Nigeria. Plateau State stands tall as a famous tourist destination. The state's beautiful sceneries, plateaus, cool and friendly weather, topography, hills, vegetation, and rich cultural heritage attract tourists from far and near.

The Industrial Development Corporation (IDC) Tourism Report (2012) indicates that tourist arrivals in Nigeria increased from 103,000 in 2005 to 1,186 800 in 2009, representing 15.1% growth. The number of business tourists, in turn, grew by 17.2% over that period from 618,600 to 725,200. Business arrivals accounted for 61% of tourist arrivals while leisure arrivals represented 39% of the total, with the UK and USA being Nigeria's largest sources. The World Tourism Travel Council (2010) estimated Nigeria's in-bound tourism flows to have increased at a Compound Annual Growth Rate (CAGR) of 3% since 2007. Nigeria NG: International Tourism recorded arrivals data was reported at 1,889,000.000 persons in December 2016. This depicts an increase from the previous 1,255,000.000 persons for December 2015. International Tourism number of arrivals data is updated yearly, averaging 887,000.000 persons from December 1995 to 2016, with 21 observations. The data reached an all-time high of 1,889,000.000 persons in 2016 and a record low of 486,000.000 persons in 2012. Number of arrivals remains in active status in Census and Economic Information Centre (CEIC) and is reported by World Bank. (https://www.ceicdata.com/en/nigeria&https://www.proshareng.com/news/tourism). These statistics largely reveal the growing presence of tourists into the country and consequently the growing pressure on tourist destinations. Pressures on eco-tourist destinations affect the ecological balance of the ecosystems which are by nature fragile; consequently, stakeholders' activities within and without these destinations must be

strategically planned and supervised to preserve the ecology for a sustainable eco-tourism.

Challenges of the Tourism Business Industry

Challenges commonly facing the tourism industry in Nigeria seem enormous for a striving sector; the challenges emanate from inside and outside the industry. The Industrial Development Corporation (IDC) Tourism Report (2012) spotted some common challenges bedevilling tourism in east and west African countries to include shortage of skilled employees or suitably qualified and experienced workers which makes the country to rely on foreign nationals for the required expertise resulting to additional cost; and the struggle to retain good professionals due to low wage and salary levels. Consequently, the service levels tend to be relatively poor in international terms. Inadequate physical support infrastructure, poor transportation and logistics, and the impact of corruption are amongst the common challenges.

Eco-tourist destinations suffer more from these challenges largely because they are by their natural formations fragile and so more susceptible to threatening activities in their environment. The American travel reports (2015), in a similar outlook, asserted that growing modernisation, greater emphasis on individual or self-determined holidays, educational and active recreational pursuits, deliberate holidays by the senior or active middle class are indices of pressures on tourist destinations as tourists move in cross-border travels in search of leisure and recreation. More commonly now are domestic tourists who move or travel locally for business, job, and educational pursuits such as academic, professional, and business conferences, workshops, and assignments. Studies also reveal that more and more tourists now seek and appreciate more natural/serene environments that would offer them some forms of relief and quiet away from the hustle and bustle of everyday work and busy life. This accounts for the high influx of tourists to eco-tourist sites. Tourist destination managers must thus take strategic measures that would address the growing scenario. Otherwise, they fall victims to negative tourism. Human activities such as the growing demand for first-hand research, the shift to python therapeutic remedies, and growing urban development are also typical of the pressures on ecology and eco-tourism. Harmful human activities such as poaching, illegal hunting of animals for human consumption, commonly referred to as bushmeat (e.g., antelopes, gazelles, and porcupines), endanger ecology. Gatekeepers' activities fostered by population growth, housing explosion, growing

urbanisation, environmental and human pollution (noise, air or water) and encroachment of green areas around eco-tourist destinations equally stand as potential threats to ecology.

Strategic Tourism Management

As more industries become global, the underlying need for strategic positioning becomes more eminent. Companies are not just looking at their immediate environment and how to satisfy them but far into their businesses' long-term performance and sustenance. Strategic tourism management looks at the set of managerial decisions and actions that determine the long-run performance of tourism. It includes the internal and external environmental scanning, strategy formulation (strategic or long-range planning), strategy implementation, evaluation, and control. Strategic management emphasises long-term performance, and research has shown that organisations that engage in strategic management generally out-perform those that do not (Wheelen & Hunger, 2010).

Strategic management gives a sense of future direction to organisations; it looks at changes to meet up and where the organisation will be in the future, thus the long-run sustenance of organisations. It encompasses the internal and external business environment, existing capabilities of companies, and required new competencies. It connotes strategic stakeholders, including directors, managers, customers, employees, government agencies, owners (shareholders), suppliers, unions, and the external environment (community), creating a balance between stakeholders. Stakeholders can affect or be affected by the organisation's actions, objectives and policies (Wheelen & Hunger, 2010). In a review of the academic literature on stakeholder theory, Freeman et al. (2010) in Harrison & Sa de Abreu (2015) found a critical mass of scholarly works that use stakeholder theory in strategic management, finance, accounting, human resource management, production, information technology, marketing, law, health care, public policy, business ethics and corporate social responsibility (CSR), (Harrison, Freeman Sa de'Abreu, 2015); hence, the choice of the theory for the study.

Stakeholder Concept

The concept of stakeholders is commonly inter-used with corporate governance and social responsibility, particularly in the formal sector, but this study adopts the definition of stakeholders from the perspective of the stakeholder theory. Freeman

defines stakeholders as individuals, groups, and organisations that are interested in the processes and outcomes of the firm and upon whom the firm depends on achieving its goals (Freedman, 1984; Freedman, Harrison & Wicks, 2007). Stakeholders here include internal (employees, managers and shareholders) and external stakeholders, including customers, communities, suppliers, and special interest groups. Edward Freedman's stakeholder theory holds that a company's stakeholders include just about anyone affected by its workings. It propounds that a company's stakeholders are those groups without whose support the organisation would cease to exist. This view paints the corporate environment as an ecosystem of related groups, all of whom need to be considered and satisfied to keep the company healthy and successful in the long term. This implies that corporate stakeholders can affect or be affected by the actions of a business as a whole.

Types of Stakeholders

Organisation stakeholders vary; primary or internal stakeholders engage in direct decisions or economic activities in the business– for instance, stockholders, customers, employees, and suppliers creditors. Secondary stakeholders are external stakeholders, who, although do not engage in direct economic exchange with the business, can be affected by its actions– for instance, the general public, communities, activists, business support groups and the media. However, excluded stakeholders are those, such as children or the disinterested public, who originally have no economic impact on business. As the concept takes an anthropocentric perspective, some groups like the general public may be recognised as stakeholders, while others remain excluded. Such a perspective does not give plants, animals, or even ecology a voice as stakeholders, but only an instrumental value in relation to human groups or individuals.

Stakeholders' Roles in Eco-Destinations

Individuals, groups and organisations are easily defined as stakeholders because of their involvement in the value-producing processes of the firm. Strategic stakeholders affect and are affected by businesses differently, as explained in their roles herein. Managers are among primary stakeholders who have an economic interest in the organisation. They also have the responsibility to maximise returns to shareholders; consequently, managers are responsible for promoting environmentally friendly tourism acts that will enhance sustainable tourism and enact environmental and

ecosystem controls that curtail the flow of tourists from causing harm to the frail environment.

Employees put life to the organisation's activities to achieve organisational goals through tactical and operational implementation of the organisation's strategic plans. Employees demand better compensation for their efforts; and are responsible for working hard and remaining loyal to the organisation even during difficult times. The stakeholder theory at its core is about creating more value (Harrison, Freeman& Sa de Abreu, 2015). Therefore, Eco-tourist employees must see the best management (professional and diligent care) of tourist sites to preserve ecology and sustain the tourism business as their sole responsibility and drive for greater profits.

The immediate host communities (gatekeepers) where tourist destinations are situated also contribute to ecology preservation. The lifestyle and overall activities of inhabitants within and outside eco-tourist destinations impact on the environment. Negative environmental acts such as environmental pollution, land encroachment, and poaching by the inhabitants of host communities endanger the ecological balance and conservation of ecology in most eco-tourist destinations.

Government agencies are responsible for creating and monitoring the implementation of environmentally friendly policies that would reduce the natural milieu and promote the preservation of the environment. Thus, the conservation of ecology and sustainable tourism for the future. Studies have also revealed seven ways of creating value for stakeholders, which is at the core of stakeholder theory to include better stakeholder relationships, stakeholder dialogue, better work environment, environmental preservation, increased customer base, local development, and improved reputation (Harrison, Freeman, & Sa de Abreu, 2015). The above theoretical suggestions/recommendations are captured as the culminating purpose of the study.

From the discussions and findings of the study, the gap provided in literature from this study is that eco-tourist destinations are not just tourist attraction sites; they also form the natural habitats from which ecology and biodiversity strive. They provide the breeding homes from which eco-tourist attractions are multiplied and sustained. Eco-tourist destinations are thus the nucleus from which future tourism can be sustained through ecology conservation.

Methodology

The study employed the method of qualitative content analysis with the use of both primary and secondary data. Primary data was obtained through concerted observation by the researcher and employed personnel (tourist attendants and research assistants). The use of structured and unstructured interviews conducted for selected respondents amongst tourist employees, managers, and members of the immediate host communities at the selected eco-tourist destinations in Jos was also employed. The ranking scale questionnaire was distributed to tourist destination workers in eliciting primary data. Secondary data was obtained from journals, textbooks, the United Nations World Tourism Organization (UNWTO) reports; reports/bulletins of other acknowledged bodies such as the Census and Economic Information Centre (CEIC), National Bureau for Statistics, and the Central Bank of Nigeria; and the IDC Tourism reports. Electronic sources and records from the Plateau Tourism Corporation were also used. The population for the study and the sample size was the same. It comprises of randomly selected employees from the three selected eco-tourist destinations, viz Jos Wild Life Park, Kura Water Falls in Barkin-Ladi Local Government Area, and the Jos Shere Hills situated in Furbor Jos East, Plateau State of Nigeria. The eco-tourist destinations were selected taking into cognizance the ecology formations, biodiversity, proximity, and convenience.

Findings

Data gathered through primary and secondary sources was critically examined and the following findings drawn. There is an existing correlation between the activities of strategic tourist stakeholders such as employees, managers, designated government agencies and the conservation of ecology in eco-tourist destinations. Any form of activity by strategic tourist stakeholders has a consequential impact on ecology. Negative stakeholder activities affect ecology negatively, while positive activities such as eco-control measures and the preservation of green areas promote ecology conservation and sustainable tourism. Tourist managers are responsible for recruiting professional employees, keeping and continually training them to carry out their duties with utmost professionalism. Managers also have the responsibility of seeing that government policies that promote sustainable tourism are actually implemented at tourist destinations. Environmental and ecosystem controls need to be put in place and monitored by managers to ensure compliance by all concerned. When managers

diligently perform their role and adopt good management practice, it by implication enhances the conservation of ecology and, consequently, tourist destinations' overall sustainability.

Poor job performance by tourist employees and lack of professionalism negatively impact on the conservation of ecology. The study revealed that poor feeding of animals in tourist sites, uncontrolled visit periods, high noise levels, unchecked snapping of pictures, frequent disturbances, and throwing of objects at organisms result in disturbances, distorted reproduction and growth, and in worst scenarios movement of organisms to safer havens or eventual displacement. Some species of birds, butterflies, grasshoppers and monkeys have been displaced from their habitats due to high influx of tourists and undue pressures and noise. Gatekeeper's activities around eco-tourist destinations also have a consequential impact on the conservation of ecology at eco-destinations. Negative communal activities such as environmental pollution (smoke from bush burning, industrialisation, threatening noise from the buzzing activities around) easily disturb and frighten organisms around. Our findings reveal that some species of birds, and reptiles like snakes, lizards, squirrels have been dislodged from their abodes. The falling of trees for domestic or commercial purposes (deforestation), poaching, urbanisation, developmental projects around tourist destinations and encroachment of green areas affect biodiversity. Such negative activities result in disturbances, discomforts and endangering of ecology.

Conclusion

Eco-tourist destinations provide the natural habitats from which ecology and biodiversity strive. Increased tourist activities and high influx of tourists to spotted tourist destinations have exposed these destinations that are by nature environmentally fragile to potential dangers that negatively impact the ecology of eco-tourist destinations. Strategic stakeholders' activities such as poor management practice, non-professionalism and encroaching developmental activities are also said to affect ecology conservation negatively. The activities of key strategic tourist stakeholders at selected eco-tourist destinations in Jos were critically examined. Freeman's stakeholder theory was employed to determine the relationship between strategic tourist stakeholders' activities and ecology conservation in eco-tourist destinations. Findings through reviewed related literature, observation, and data gathered from primary

sources revealed that the negatives in tourism can outnumber the positives without responsibly strategic management.

Future Research

The study recommends that future researchers may conduct an empirical study that would validate the degree of correlation between strategic stakeholder's activities and ecology conservation. Future researchers should also find other ways that the tourism industry can mitigate the obstacles in ecology conservation at eco-tourist destinations other than the strategic stakeholder's lens.

Recommendations

From the findings of the study, the following recommendations are proffered:

a. Tourists/visitors need to be adequately educated on the restrictions at tourist sites according to the peculiarities of the destination. For instance, visiting time, noise level, picture-snapping or social interactions must be put in place and ensure strict compliance. Greater public awareness about tourism also needs to be promoted through the various available channels such as tourist education at entry points, media chats and announcements.

b. Owners and managers of tourist destinations should encourage environmentally-friendly tourism acts that promote sustainable tourism by embracing environmental and ecosystem controls to ensure that the flow of tourists does not damage the frail environment. Managers should also encourage professionalism and good rewards for their employees to motivate them.

c. Provisions for more education, training and retraining of personnel for professional and effective tourism should be implemented and closely monitored for better efficiency.

d. Government should focus more on supportive policies that would encourage sustainable tourism through constructive collaborations with industry players to enact and monitor the implementation of eco-friendly policies such as restricted time and influx of tourists, promoting environmentally friendly programmes such as reforestation, volunteerism, partnerships, and campaigns that promote the conservation of ecology in society. Government can also encourage public-private sector partnership and cooperation through the creation of Destination Management Organisations (DMOs) which will act on behalf of all tourism stakeholders in the state

by professionally managing tourist sites and providing the needed facilities and services.

e. Gatekeepers' activities must be closely monitored and good distance created between host communities and tourist sites to avoid harmful acts like noise, or air pollution harming the biodiversity or displacing organisms from their habitats. Strategic involvement and participation of gatekeepers in tourism; for instance, engaging them as paid tourist guides or custodians of the destinations will give a sense of ownership that motivates responsible care and conscious guarding of ecology and sites and consequently help in promoting the sustainability of these destinations.

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Chapter Eight

ECOLINGUISTICS OF NUPE MYTHS AND SUPERSTITIONS

Mohammed Alhaji Usman

Introduction

Before the advent of modern science and technology, people made sense of the complexities of their environment by carrying hundreds of images and stories in their minds. The images and stories in people's minds form part of their worldviews, perceptions of themselves, and the world around them. Shared images and stories form society's worldview, and people and societies use their worldviews to interpret information and formulate actions. The images and stories that societies share about the ecosystem are the basis for their perception of nature, which has a central role in shaping the social system. Perception shapes the interpretation of information when it enters a social system from an ecosystem, and perception shapes the decision-making process that leads to an action affecting the ecosystem. Different cultures and people in the same culture have different perceptions of how ecosystem functions and how they respond to human actions. Recognising different perceptions can help us understand why different individuals and societies interact with the environment differently (Marten, 2001, p. 121).

Statement of the Problem

Most of the life-ways of traditional societies, especially myth and superstitious narratives and their functional linguistic significance, are fast going extinct. This should not be because, as Ferraro (2008, p. 338) observes, human beings face a series of important life challenges that cannot be overcome by applying modern science alone. A number of these challenges remain because of the limitation of science – science does not give help to human beings when they are faced with spiritual challenges, but humanity does through words of mouth, certain performances or folk practices. Furthermore, out of hypocrisy, modern science in particular and elite in general see folk beliefs and practices (i.e. myths and superstitions) as not only primitive

but also unworthy of a full scholarly attention. Because of these, there is (to the best of the researcher's knowledge), little literature on ecolinguistics of myths and superstition. These constitute a problem that this study investigates, with a view to establishing the interconnectivity between language, culture and environment (through Nupe myths and superstitions) and how these shape the perception or worldview of a typical Nupe community.

Methodology

A total of fifteen (15) myths and superstitious narratives were collected and analysed. The data are categorised into myths and superstitions concerning celestial bodies (i.e sun, moon and stars) and terrestrial bodies (animals and plants, flora and fauna). The data were collected from some elderly men and women within and outside the author's community. The researcher analysed his data based on the information he gathered (on his sample data's functional or sociolinguistic values) from members of his community and beyond. The author is a Nupe man himself.

Theoretical Framework

Being a blend of linguistics and folk literature, this study adopts Cheryll Glotfelty's perspective of Ecocriticism and M. A. K. Halliday's Systemic Functional Linguistics (SFL). Ecocriticism was used by Glotfelty at a meeting of Western Literature Association in 1989 as a substitute for William Roeckert's (1978) "Literature and Ecology" (Ajima, p. 2018:35). Ajima reports Glotfelty to have submitted that ecocriticism is concerned with how culture and physical world are connected and how they affect each other. Ecocritics, she further states, urge people to thoroughly think about human-nature relationship and how language and literature transmit values with profound ecological implication. Similarly, Aliyu (2013, p. 160) reports Jonathan Levin (1999, p. 1097) to have opined that ecocriticism emphasises the restorative capabilities studies could have on nature and human cultures. SFL which was developed from the works of M.A.K. Halliday who was himself influenced by his teachers such as Malinowski, Firth and Worf (Byram, p. 2000) seeks to analyse how language users construct meaning (Ogungbe, 2018). SFL is built on three meta-functions of language: ideational or experiential, interpersonal, and textual functions. The experiential or ideational function concerns the ability to construe human experiences such as naming or attaching meaning to certain entities and events in the

environment. The interpersonal meta-function has to do with establishing, promoting, and sustaining social relationships between the language users (Ogunsiji, 2001, p. 77). The textual meta-function facilitates the earlier two meta-functions. Its thrust is the use of language to create texts and discourses (Ogungbe, 2018, p. 162).

Ecolinguistics

Ecology is the study of the relationship between living organisms and their environment. Therefore, the emerging subfield of sociolinguistics referred to as ecolinguistics is concerned with the analysis of language influenced, occasioned or shaped by ecosystem (physical environment) and social system (socio-cultural beliefs and practices) of the language users or speech community. It uses a wide range of linguistic tools, including critical discourse analysis, rhetoric and systematic functional linguistics, to reveal the underlying worldviews of the stories we live by. These stories we live-by are cognitive structures in individuals' minds and influence how members of society treat one another, animals, plants, rivers and heavenly bodies such as sun, moon and stars, etc. Ecolinguistics resist stories that destroy or damage nature and uphold the stories that protect biodiversity, cultural diversity and linguistic diversity. Marten (2001, p. 1) views ecolinguistics as a human social system, including their population, psychology, and social organisation, which influence their worldviews – values, norms, and knowledge.

Ecosystem and Social System

Ecosystem is everything in a specified area, celestial and terrestrial, including physical structures erected by man. These environmental constituents, especially the natural ones and their behaviour or changing conditions, are often attached or associated with certain meanings in tribal societies. Social system, on the other hand, concerns the perception or folk beliefs and practices of a people as often reflected in their language. In other words, things and events do not make sense on their own; we give them meanings by the way we represent them, and the principal means of representation in culture is language (Gay, et al., 2013, pp. 7-8).

In traditional societies, people emphasise that everything in nature is interconnected. It is thus part of their cultures to treat nature with care and respect by being observant of the events in their physical environment so as to avoid adverse consequences of those events or changes in the condition of the environment.

Therefore, people are often warned to desist from radically changing the environment from its natural condition (Marten, 2001, pp. 122 - 123). Ecosystem affects social system when it influences or shapes the language, knowledge, values, beliefs, attitudes or the entire meaning of life to a people. In view of this, Gardiner and Kosmitzki (2005, p. 292) opine that culture is largely a people's response to their physical environment, ancestral heritage, and developmental niche. Similarly, Jurmain, et al. (2004, p. 359) submit that human beings are increasingly using culture as a means of adapting to their natural environment.

Defining Myth and Superstition

There are many definitions of myth and superstition based on the belief of individuals. Some of the online definitions see myth as:

- A folklore genre consisting of narratives that are ostensibly historical, though often supernatural, explaining the origins of a cultural practice or natural phenomenon (https://en.m.wikipedia.org>wiki.myth).
- A sacred narrative with religious or spiritual significance to those who tell it (https://en.m.wikipedia.org>wiki.myth).
- A traditional story of ostensibly historical events that serves to unfold part of the worldview of a people or explain a practice, belief or natural phenomenon (https://www.merriam-webster.com> myths).
- A popular belief or tradition that has grown up around something or someone, especially one embodying the ideals and institutions of a society or a segment of society (https://www.merriam-webster.com> myths).
- An ancient story or set of stories, especially ones explaining the early history of a group of people or about natural events or facts (https://dictionary.cambridge.org).

Some online sources define superstition as:

- A religion not practised by the majority of a given society (https://dictionary.cambridge.org).
- Pejorative term for any belief (religious or otherwise), practice or action arising from irrationality (https://en.m.wikipedia.otg>wiki>super).
- Beliefs and practices surrounding luck, prophecy and certain spiritual beings (https://en.m.wikipedia.otg>wiki>super).

- A belief or notion not based on reason or knowledge and concerning the ominous significance, proceeding or the like (www.dictionary.com> browse> superstit).
- An irrational belief usually founded on ignorance or fear and characterised by obsessive reverence for omens and charms, etc., (www.dictionary.com> browse> superstit).
- An irrational abject attitude of mind towards the supernatural, nature or God (www.merriam.webster.com> super).
- A notion maintained despite evidence to the contrary.

Similarities between Myth and Superstition

Based on the above online definitions, it is glaring that the commonest features that myth and superstitious narratives share are that the two are associated with tradition, nature, supernaturality, unverifiability of their claims, anonymity of their originator or authorship and irrationality of their faithful. Therefore, in so many respects, the definitions of myth and superstition could overlap but they do not completely mean the same thing as we can see in the following table:

The Differences between Myth and Superstition

Myth	Superstition
Usually a story	Usually a statement
Regarded as a false claim or invented story	Connected to magic and luck and believed to have come about as a result of certain actions, appearances or circumstances of ecosystem
Sometimes revered and believed, and sometimes debunked (but when widely debunked, it dies)	Becomes an emerging science if a reliable and valid proof is demonstrated in its favour
Less connected with religion	More connected with religion

Irrationality, unknown authorship, and falsehood associated with myths and superstitious stories are not in any way considered in this study. This is because the researcher considers truth (lack of which is the basis of most, if not all the negative criticisms against myth and superstition) as a relative term; belief has an edge of truth. In other words, truth does not have a universally accepted definition; it is defined by an individual or a group's belief or faith. Therefore, to this study, all the negativities

associated with myth and superstition do not render the duo baseless or unworthy of scholarly attention. Any story or statement that is revered or considered sacred to an individual or a group cannot easily be said to be false even if it is not scientifically verifiable (Simpson and Roud, 2000, p. 254). Every myth or superstition presents itself as an alternative factual account no matter how much at variance it is with natural order, ordinary experiences or science. Both myths and superstitions have their authority, not by proving themselves but by presenting and making themselves relevant, affective or believable to the people who tell them.

Myth, Superstition, and Modern Science

The folklore genres such as myths and other superstitious stories exist in every society. In fact, it could be agreed that they are the basic constituents of human culture. Myth and history in particular, are the alternative ways of looking at the past, adjusting the present and preparing for the future. Human societies developed in stages: from the magical state through the religious stage to the scientific age, and myths, rituals or superstitions survived even into the scientific age. Therefore, if myth and superstition are seen as the product of the past era, it would be difficult to determine with certainty, the actual moment or point at which that era ended. It is thus virtually impossible to state precisely when myth or superstitious stories are completely irrelevant and no longer being created (https://www.britanica.com/topic/myth). In other words, every human being, irrespective of his or her level of education, exposure, creed and status, is directly or indirectly a faithful of one myth or superstition or the other. The study of myth in particular, provides the key to human society. To support this point, here is a story:

> In the middle of 19th century, a newly appointed British Governor of New Zealand, Sir George Crey, was confronted by the problem of how to come to terms with Maori, who were hostile to the British. He learnt their language but that proved insufficient for an understanding of the way in which they reasoned and argued. In order to be able to conduct negotiations satisfactorily, he found it necessary to study the Maori mythology to which they made frequent reference and this facilitated his communication with them and his eventual acceptance as their leader (https://www.britanica.com/topic/myth).

This shows that myths, and by extension, superstitions, provide guidance in crucial moments of war and peace, life and death, truth and falsity, and good and evil.

The Nupe

In brief, Nupe natives are predominantly found in the north-central states (especially, Niger and Kwara States) of Nigeria (https://en.m.wikipedia.org> Nupe). Nupe language has dialects such as Dibbo, Gana-gana, Kakanda, Basange and Gupa which (except for Dibbo spoken in Lapai Local Government Area of Niger State) are found in Kogi State and Federal Capital Territory, Abuja. The intelligibility between the "Mother-Nupe" (primarily spoken in Niger and Kwara states) and other dialects listed above is unidirectional. Most if not all native speakers of Dibbo, Gana-gana, Basange, Kakanda and Gupa understand and communicate effectively in "Mother-Nupe", popularly called Bida dialect but natives of Bida dialect of Nupe do not understand nor communicate in any of the other dialects. In addition, there are variations even in "Mother-Nupe". Bida and Lapai Nupe, for example, differ significantly in terms of vocabulary and accent. Similarly, the Nupe spoken by the natives of Bida town differs from the one spoken in the satellite villages of Bida, but mainly in terms of accent.

Myth, Superstition and Other Folk Narratives

Other folk narratives especially proverb and fable relate to and differ from myth and superstitious stories in some ways. The main feature they share is unknown originator(s). While proverbs are didactic, terse and definite, most myths and superstitious stories are sacred, religious and often associated with nature and supernatural beings. According to Akporobaro (2004, p. 85), proverbs are mostly current and always deeply integrated into everyday speech and discussions unlike other folk narrative forms. Similarly, Arewa (1970, p. 431) opine that of all the various forms of folklore, proverbs are the most frequently used in all manner of situations. Furthermore, fables and myths feature personified animals or natural objects, but fables are considered fictitious and untrue than myths. Myths, proverbs and superstitious narratives, unlike fables, deal with serious challenges of life that human beings grapple with; fables deal with trivial issues, hence entertaining and more associated with children.

Data Presentation and Analysis

In typical Nupe speech communities, some changing conditions or behaviours of celestial bodies such as moon, sun, star, etc. are attached certain meanings. Examples:

1. An eclipse of the sun or moon is an announcement of calamity about to occur. Therefore, natives, especially the religious leaders are always engaged in fervent prayers in order to avert or drastically reduce the effect(s) of the incident. Similarly, when the moon continuously forms a circle round itself in the dry season, it implies that death, especially of influential members of the society (i.e. emirs, village heads, political leaders and/or the rich) will occur sooner than later. However, if the incident occurs in the rainy season, it signifies a heavy rain about to fall.
2. Unlike in the case of moon, if the sun forms a circle round itself, it reveals that unrest, chaos or violence (not necessarily death) among the populace or members of the society will break out. The alternative linguistic significance of this event is that bad elements such as witches and wizards in the society will die in significant numbers across the world.
3. Hot and sunny weather symbolises danger. Hence when the weather is hot and sunny, especially around 1-3pm, people, especially women and children are disallowed from going to river or going near certain conspicuous or unique physical objects such as large trees, forest, mountains and hills which are believed to be the habitats of the spirits. During this period, devils or evil spirits are said to be on the rampage; they go preying on weaker creatures of God. The victims of the attack (by the invisible supernatural forces) among human beings suffer from life challenges, ranging from possession, madness to death.
4. A lightning movement of a star from one direction of the sky to another is a God's attack on some supernatural forces (Satan and spirits), who go to spy on Him in His heavenly kingdom. It is believed that spiritual leaders such as the priests, herbalists and soothsayers derive their powers of revelation from these forces who spy on God. Therefore, God uses any of his heavenly bodies, especially the stars to attack or destroy the spies. This myth originated from Islam. When the incident occurs, typical Nupe people in particular and Muslims in general are urged to pray against Satan and all his agents among humans (i.e. sooth sayers) and *jinns* (spirits).
5. A thunderstorm on any plant or physical structure is a deadly attack on the owner of the plant, the owner of the land where the tree is or the owner of the structure. The attack is believed to have been carried out by the enemy or enemies of the

victim through the help of spirits. The effect(s) of the attack will begin to manifest in the victim, latest before the end of the second week of the attack and if no offerings are quickly made to the spirits (as may be guided by a priest or a traditionalist) to avert or drastically reduce the effect of the thunderstorm on the victim, he/she or any of his immediate relations (i.e. wife, child, mother, father, brother or sister) is most likely to die before the end of forty days from the day of the attack. This myth or superstition has high and wide currency in Nupeland up to now.

6. The appearance of a rainbow connotes that heavy rain is about to fall. Similarly, hot weather is a sign of rain about to come. Even though this claim may be scientifically provable, it was a mere myth or superstition before the advent of modern science.
7. The appearance of many shining stars and /or bright moon in the rainy season means that even if there is cloud or any other signs of rain, rain will not fall until the condition of the moon and stars change; until the stars and brightness of the moon disappear.

Some animals' cries and actions are of linguistic significance in Nupe societies. Hence, they influence, shape or affect the life-ways of typical Nupe speech communities. Examples:

8. The incessant cry of night birds signifies either a death about to occur or the arrival of the witches and wizards in the vicinity of their target. Similarly, the cry of *gbigbi* (a night bird-like creature) in the night announces that the death of an influential member of the community or of any of the neighbouring communities or something very tragic is about to happen. This bird cries deeply, loudly and occasionally. It does this when it is far away from the village and in the bush. It is said that the bird sheds tears when it makes the sound to announce a death in advance. The researcher gathered that in those days, elderly people wake up in the night on hearing the cry of this bird to trace its whereabouts. When they established that tears are running down the cheeks of this bird, they become sobered, praying for God's intervention and solace in anticipation of the death.
9. Spirits are believed to be residing in dogs and ducks, especially the big and old ones. Therefore, in most Nupe communities, the two creatures connote evil or danger. Hence, it is widely held that any vehicle that hits them will eventually be involved in a fatal accident. To avert this, an offering such as money, however little, is expected to be dropped on the hit and/or dead dog or duck before the driver leaves

the incident scene. It is equally held that a big and old duck changes to a snake in the night. It is therefore very dangerous to keep it in the house.

10. If you tie growing leaves or hammer a nail into the ground while dogs are mating, it means that the dogs will not be able to separate or discontinue even after they are sexually satisfied and want to part. This myth is widely held among Nupe children.
11. When a multitude of small ants roams or moves around the threshold or entrance of one's room, it means that goodies will soon come the person's way or that the person will prosper in life. Similarly, the accidental wearing of clothes inside-out to the public connotes good fortune or success.
12. If a ewe rubs its waist against a wall or any concrete surface continually, it will automatically be pregnant. In other words, in typical Nupe societies, the eco-linguistic implication of a ewe rubbing its waist against a wall is automatic pregnancy of the ewe with or without mating with a ram. However, the pregnancy will produce only female lamb(s). An ewe will produce a male lamb only when a ram mate with it. It will equally produce either of the sexes of a lamb after mating with ram.
13. Baldness of human head signifies riches and fame. That is, in typical Nupe societies, by the time a male child or adult starts going bald, it means that he will in future be great, rich and/or famous.
14. A mother of twins must occasionally carry them (the twins) for street begging. Otherwise, the twins will not grow well, normal or fast; they can hardly stand on their feet to walk even after they have come of age. In extreme cases, failure to observe this tradition means that the mother of the twins would sooner or later run mad, or something tragic will befall her.
15. It is a sign of bad luck if, having set out for a walk early in the morning, your left foot accidentally first hit an object (i.e. stone, wood or an elevated part of the ground). It, however, means good luck if it is the right foot that accidentally first hit an object.

Findings and Discussion

It is clear from this study that myths and superstitious narratives surrounding celestial and terrestrial bodies, among others, exist in Nupe speech communities. These myths and superstitious stories shape the worldview of a typical Nupe man and woman

socially and religiously and are therefore highly revered or considered sacred. Predominantly, myth and its related folk narratives have predictive values; some are believed to be revelations of bad fortunes such as death, conflict, illness or failure, etc. as we can see in samples 1, 2, 3, 4, 5, 7, 8, 9, 10, 14 and 15. Others are considered as prophecies of good fortunes such as chances to be rich, knowledgeable or successful in life as exemplified in our analyses in samples 6, 11, 12, and 13. It is found that some of the Nupe myths and superstitious narratives originated from and/or are shaped by Islamic religion. When a myth loses its believability in a speech community where it was once held, it becomes a mere folktale, but a myth and a superstitious narrative whose verifiability is scientifically established becomes an emerging science. In fact, experiences have shown that the widely held communicative imports of some Nupe superstitions become, to some extent, real.

Conclusion

Myths and superstitious narratives are exploited by man to fill the gap created by the limitations of science and technology in man's effort to overcome his increasing physical and spiritual challenges of life. In one way or the other, every human being (including the scientists and the educated generally) directly or indirectly exploit folk practices (such as rituals and cults, etc.) or folk narratives (i.e. myths, superstitious stories and proverbs) or both to solve their spiritual and psychological problems, using language as an instrument. In conclusion, therefore, despite the threat that Islam and Christianity seem to have been to the existence and relevance of myth and superstition to their adherents among Nupe people, they (myth and superstition) still exist in Nupeland; they are still told and held by many.

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Chapter Nine

HAUSA AND JENJO: THE CASE OF AN INVASIVE SPECIES

Peace Benson

Introduction: A Comparison of Hausa and Jenjo

It is because language is so important to mankind that almost all disciplines in the humanities try to give their view of what language is. It is so vital to us as Africans that the reputable South African leader Nelson Mandela said "If you talk to a man in a language he understands, that goes to his head. If you talk to him in his language it goes to his heart." The word Jenjo is a name of an ethnic nationality and a language. The people are found in three states in the northeastern part of Nigeria. These are Adamawa, Gombe and Taraba. Jenjo people are found in Lamurde Local Government and Numan Local Government of Adamawa State. In Gombe State, they are found in Balanga local government and Akko local government while in Taraba they are found in Karim-Lamido, Lau, Jalingo, Ardo-Kola, Bali and Ibi local governments. Jen is the capital home of the Jenjo people. This is the place where all cultural activities take place. "Jen is located between latitude 9-10ºN and longitude 11-12ºE within the Benue River floodplains (Faith, 2016).

The encroachment of Hausa language into most communities of the non-Hausa societies in the northeastern part of Nigeria was through Islam during the Jihad of Uthman Danfodio and his Hausa followers. "This Jihad led to the emergence of Hausa over a large part of Nigeria. Hausa triumphed over Fulfulde and became everyday language (Aremu, 2011). For the Jenjo people, it is different. The encroachment was through Christian Missionaries. They used Hausa to communicate their messages. According to Markus Maigida Musa, "The missionary Rev. Karl Kuglin had studied Hausa language in Jos before coming to Jen. There, he taught converts how to read in Hausa with the help of his entourage from Bambur" (2009, p. 62). Therefore, all converts at that time spoke Hausa. Islam was introduced to Jen first during the Jihad but the people vehemently rejected it. 15 years later, Christian missionaries arrived in the land and the Jenjo people believed in the God the missionaries talked about. They

accepted the Christian faith. "The word *Fi* in Jenjo language means God as they believed He is a supernatural ruling power beyond human imagination" (Musa, 2009, p. 25). Despite their traditional way of worship, they accepted the Christian belief.

Hausa and Jenjo are distinct languages, though they share the same typology (SVO). Their internal structure is different. Note the structure in Hausa and Jenjo below:

Yaa	fa	nufi	gida (Hausa)
3.ms.PERF	indeed	head-II	home

He headed home (Abdoulaye, 1992, p. 23).

The Hausa 'subject' nominal is totally optional and the verb with only the person-tense/aspect marker can stand on its own as a full clause.

O	tah	və (Jenjo)
3Sg	go	home

He/she went home.

The Jenjo 3SG *O* could mean he or her. In the same vein, there are 12 vowel and 39 consonant sounds in Hausa; Jenjo has 31 consonant and 13 vowel sounds. Jenjo has a language project called Jenjo Language Development Project that has been moving at a slow pace since it was founded in 2004. They were the first to come up with the Jenjo alphabet, consonants, vowels, Nigeria national anthem and the Lord's prayers in Jenjo. Both languages are from different language groups. There is no relation whatsoever between them in terms of their language phylum. According to Ethnologue, "Jenjo falls under Niger-Congo, Atlantic-Congo, Volta-Congo, North, Adamawa-Ubangi, Adamawa, Waja-Jen and Jen" (Lewis, Simons and Fennig, 2015). The name of the language is Dzə; other names are Jen, Janjo and Jenjo. They are popularly known as Jenjo. However,

> Hausa is an Afro-Asiatic, Chadic, West Chadic and Hausa-Gwandara (A.1). Hausa has the highest number of speakers of any language in sub-Saharan Africa. It is the first language of some 30 million people in northern Nigeria, the Niger Republic and in scattered communities of settlers and traders in large towns throughout West Africa. It is widely spoken as a second language and is spreading rapidly as a lingua franca (Newman, 1996, p. 537)

There are approximately 500,000 Jenjo people across the three states of Adamawa, Gombe and Taraba. The exact number of Jenjo native speakers is unknown, and few people speak it as a first language.

In addition, Hausa has a rich linguistic study in the aspects of grammar, dictionaries and encyclopedias. It has an established written system such as the Arabic script, Latin script and Braille script. The language is well developed; there are media programmes and news in Hausa both on radio and TV. Jenjo has no written grammar, dictionary or encyclopedia. Its writing system is still under debate. The only written document in Jenjo is the Jenjo New Testament Bible. Hausa has more strength linguistically and numerically compared to Jenjo.

It is believed that Hausa has endangered a number of languages in northern Nigeria. Aside from the 29 million Hausa speakers in northern Nigeria, Hausa is being spoken by nearly all the other language groups to the detriment of their ethnic tongues (Agantiem, 2017, p. 23). There is no doubt that the language is a threat to small group languages in northern Nigeria. Evidently, Hausa is the language of wider communication in the northern part of the nation. Agantiem states that "a layperson from the south would, without a second thought, conclude that Hausa is the only language in northern Nigeria and would be confounded on knowing about the multiplicity of languages there because of their low use" (2017, p. 21). Michael Krauss states that "The subject of language endangerment i.e. languages ceasing to be spoken, becoming extinct (with or without documentation), is certainly not new, but is as old as human history and prehistory" (2007, p. 4). Paul M. Lewis and Gary F. Simons contrast 3 tables of GIDS, the Fishman's 8-levels of GIDS (Graded Intergenerational Disruption Scale), UNESCO's (United Nations Educational, Scientific and Cultural Organisation) 6-level scale of endangerment and Ethnologue's 5 categories of characterising language vitality. They use these three-level systems to elaborate the scale to 13 levels which are:

- Level 0 (international): the language is used internationally for a broad range of functions. 'Safe'.
- Level 1 (National): the language is used in education, work, mass media, and government at the national level. 'Safe'.
- Level 2 (Regional): the language is used for local and regional mass media and governmental services. 'Safe'.
- Level 3 (Trade): the language is used for local and regional work by both insiders and outsiders. 'Safe'.
- Level 4 (Educational): literacy in the language is being transmitted through a system of public education. 'Safe'.

- Level 5 (Written): the language is used orally by all generations and is effectively used in the written form in parts of the community. 'Safe'.
- Level 6a (Vigorous): the language is used orally by all generations and is being learned by children as their first language. 'Safe'.
- Level 6b (Threatened): the language is used orally by all generations but only some of the child-bearing generation are transmitting it to their children. 'Vulnerable'.
- Level 7 (Shifting): the child-bearing generation knows the language well enough to use it among themselves but none are transmitting it to their children. 'Definitely endangered'.
- Level 8a (Moribund): the only remaining active speakers of the language are members of the grandparent generation. 'Severely endangered'.
- Level 8b (Nearly Extinct): the only remaining speakers of the language are members of the grandparent generation or older who have little opportunity to use the language. 'Critically endangered'.
- Level 9 (Dormant): the language serves as a reminder of heritage identity for an ethnic community. No one has more than symbolic proficiency. 'Extinct'.
- Level 10 (Extinct): no one retains a sense of ethnic identity associated with the language, even for symbolic purposes. 'Extinct' (Lewis, Simons and Fennig, 2010).

Hausa falls under the 'safe' language. It is obviously a regional, trade, educational and written language; whereas Jenjo falls under the definitely endangered language.

The idea of language ecology or ecology of language dates back to Einar Haugen in 1972. His ideas were on the interaction of languages and their environment. This environment could be of language's lexicon and grammar, the society that uses it as its codes, how it exists in the minds of its users, its functions in relating these users to one another and to nature i.e. their social and natural environment. Also, part of the ecology of language deals with interaction with other languages in the minds of bilingual and multilingual speakers; interaction with the society in which it functions as a medium of communication (sociology). People who learn it, use it and transmit it to others determine it. Exotic species in this study means non-native languages that are not indigenous to a particular region, brought by education, religion, trade and so on. An exotic species become invasive species when it has developed and become harmful to the region's language. The invasive species become a threat to native

language in its ecology. Jenjo is endangered in its ecology because of an invasive language (Hausa).

This chapter depicts Hausa as a species invading Jenjo in its ecology. In biodiversity, exotic species that become invasive are considered the main drivers of loss across the globe. Just as in biology, exotic species (languages of wider communication), in this case, Hausa, has become invasive to Jenjo/Jen within the ecology of the language. This needs to be uncovered before the language (Jenjo) is extinct as it is already endangered. Invasion by majority languages (usually non-native) into minority languages environment poses one of the significant but least addressed threats to language endangerment within the ecology of language. The invasive language, Hausa, has rendered these minority languages either extinct, threatened or endangered.

Previous Studies

In the past, studies on Hausa and other languages deal with how these languages influence each other. Many of these studies are on variation, contrastive analysis, sociolinguistics and so on. Various linguists have investigated minority languages and their endangerment in Nigeria.

Hamisu Hamisu Haruna looks at "linguistic diversity and language endangerment: towards the revitalization of Bole language in Nigeria" (2017, p. 108). Herbert Igboanusi and Lothar Peter consider "the threats of Hausa to Nigeria's minority languages" (2004, p. 131). However, the language of wider communication in the north (Hausa) has not been looked at as an invasive species on the minority language (Jenjo) ecology. Looking at it in this light may make the minority language speakers wake up to the use of their languages.

Following the influence of the invasive species (Hausa) on the future of minority languages in northeastern Nigeria, this research is necessary because language preserves the identity and culture of any ethnic group. The Jenjo people need to preserve their language in order to preserve the culture that they love. Language and culture go hand in hand; one can truly know a person by the language he/she speaks. It is because of this that Jenjo (a minority language) needs to strive for survival in its ecology despite the invasion by Hausa as Andrew Haruna rightly observes, "if you want your language to survive, speak it" (2014).

Methodology

The study uses a descriptive research design. Data was collected through interviews, observations and texts. A total of 100 persons were interviewed for this study. The interviewees were those who understand the language and have at least a secondary school certificate. Observation of speakers was done for the period of two weeks to know their language preference. Observation took place at homes, schools, churches and marketplaces.

The Threat to Jenjo

According to Paul M. Lewis and Gary F. Simons' expanded graded intergenerational disruption scale (EGIDS), Jenjo is threatened. Hausa has the highest population among the over 500 indigenous languages in Nigeria with 29 million people. It has the largest geographical area in the country and the highest number of speakers. Hausa is spoken by almost all the speakers of the other indigenous languages in northern Nigeria. Jenjo has no well-established linguistic studies like Hausa. No written document, no grammar, and no dictionary. The invasion by Hausa is seen in the following conversation that ensued between a 13-year-old girl and the researcher.

Researcher:	Ndə (Jenjo)
	Excuse
TheGirl:	Mmhhh..
Researcher:	Sako (Jenjo)
	Hello
TheGirl:	Sannu (Hausa)
	Hello
Researcher:	Aji ifa yang (Jenjo)
	Good morning
Comfort:	Lafiya (Hausa)
	Fine
Researcher:	Dzung mə wə? (Jenjo)
	What is your name?
TheGirl:	Comfort.
Researcher:	Nah mə lə ve? (Jenjo)
	Is your mother home?

Comfort: Mama na bata nan (Hausa)
My mother is not around.
Researcher: O tah bə de? (Jenjo)
Where did she go?
Comfort: Ta je kasuwa (Hausa)
She went to the market.
Researcher: Toh na la (Jenjo)
Okay! Later.
Comfort: Sai an juma (Hausa)
Later.

Such cases are common amongst children. When you speak to them in Jenjo, you get replies in Hausa.

The Language Situation in Jen

Before the coming of the missionaries to Jen, Jenjo is the only language used in Jen and it is the language of education (non-formal), trade and court. The Jenjo people started speaking Hausa because of their zeal for the new religion (Christianity) without the foresight of its future challenge in their own language. Markus Maigida Musa notes that "The missionary came to Jen through the Emir of Muri of that time and had to study Hausa in Jos before coming to Jen" (2009, p. 56). Hausa is spoken at home, school, market, church, and mosque. Hausa is the only medium of communication in all these places except the marketplace where there are switches between Hausa and Jenjo depending on the buyer and seller. Hausa came as an exotic species, and now it is an invasive species as children barely speak Jenjo at home. The population of people who reside around the market in Jen do not speak Jenjo completely though they understand when spoken to but reply in Hausa.

In a family home at Sabon Layi, Jen, the couple is Jenjo. They understand and speak Jenjo but do not speak Jenjo in their home to themselves or to their two children. Every conversation in their home is in Hausa despite that the head of the family is a teacher. In another home in Sabon Layi, they speak Hausa and sometimes switch to Jenjo at home and outside the home with outsiders. One hears statements filled with Hausa lexicons like:

Dɨ Fi bɨn (Jenjo) rama (Hausa) mi lə lɨ (Jenjo)
(Is God that will avenge for me)

Dɨ Fi bɨ (Jenjo) saka (Hausa) mi lə lɨ (Jenjo)
(Is God that will reward me)
A tami (Jenjo) gwado (Hausa) (code mixing of Jenjo and Hausa)
(Give me padlock)

Most children whose houses are around the market area in Jenjo do not speak Jenjo completely. Most people do not know what it means when a language is not spoken. A 14-year-old girl in one of the areas in Jen never speaks Jenjo though she is being scolded several times for the need to speak the language. She never does, she understands but finds it difficult to speak. Hausa seems to be her first language or language of preference. The following conversation took place in one of the homes observed.

Lady: Yalena! Antonia ta na cin (Hausa) tcwi (Jenjo) ne (Hausa)? (Code mixing Hausa and Jenjo)
(Yalena, does Antonia eat catfish?)

Yalena: O (Jenjo) ta na (Hausa) ta la (Jenjo)
(Yes! She does)

This kind of situation is very common in all the areas. This invasion has become a serious threat to Jenjo and may cause the language to go extinct. Jenjo has no immunity to fight the invasive species. Similarly, the language has no socio-economic value. The invasive species may be consciously spreading to gain more territorial power in this part of the nation.

The Invasion

This invasion has affected the ecosystem of the language. The names of streets/areas in Jen have been changed as a result of this invasion. Some of the areas are:

- Nwabang-Saratunde
- Nwalomwe-Angwan Harisu
- Ve pukwəh- Garwadi
- Ve bɨng dza-Angwan Mission
- Hywa-hyɛ̃-Sabon layi
- Tsəka-Jaka
- Nyadung-Nasarawo

Also, Jenjo children are now given Hausa/Islamic names such as Asabar, Asabe, Laraba, Mansur, Butu. Songs are now composed in Hausa. These songs have detached the

people from their natural environment and make them forget their true identity. People no longer call the original names of these streets/areas in their native forms, and songs sung at dance ground during festivities are in Hausa and at best a code-mixed and code-switched song of Hausa and Jenjo. This makes them forget the attachment they have with their environment.

In addition, the words ku ndzwifo, nyi ndzwifo, pu ndzwifo and ndzwifo (an artificial hill and its different parts) which Hausa call *juji* "dump" is one of the effects of the invasion by Hausa. The change that is happening to the language and its ecosystem has distanced the people from their environment. For instance, they think ndzwifo is an ordinary *juji* dump. The invasion by Hausa has watered down the true meaning of the names of these things and places. Thus, the younger and unborn generations' worldview is limited because the actual value of what they mean in Jenjo is lost.

It is usually said that everything has its advantages and disadvantages. The invasion has increased the Jenjo vocabulary in loan/borrow words and bilingualism amongst some of the children who still speak Jenjo in that society. In addition, it has brought development to the capital home of the Jenjo people. Petty trading and the influx of people during the annual Mihu (hunting) festival have brought about some sort of recognition of the Jenjo people in the entire states. So far, there is no contention of rulers, lands and other resources by the non-native invaders.

However, the invasion is obviously destructive linguistically, as the speakers of this language are not aware of the status of their language. Their culture and identity would be lost if the language eventually goes into extinction. Jenjo is a threatened (endangered) species in its ecosystem. The use of the exotic language and eventually the invasive language (Hausa) was not an issue to the people undervaluing their language because they perceive the other languages to be more valuable. It is rather an unconscious act whereby the Jenjo people do not know the danger of not speaking their language. This exotic species (Hausa) is threatening the native species (Jenjo) through invasion. Jenjo was a dominant language in that locality. The Jenjo people love their culture. It can be seen through the massive turnout of Jenjo people from the cities and towns for their yearly Mihu festival, and the conversation about its success that goes on for at least a week on social media after the event.

Result and Findings

The typological, ecological features of our natural environment are the bedrock of our material culture, beliefs and worldviews. These are all embodied in our language. Hausa brought a shift from using the language. It came along with some different worldviews. For example, the word ndzwifo "a kind of man-made hill used by elders for key decisions" is a strong philosophical term in Jenjo but it is now called *juji*, a Hausa word meaning refuse or dump. This is a result of the invasion by Hausa. Other words are nyi ndzwifo "centre of the man-made hill", ku ndwifo "top of the man-made hill", pu ndwifo "foot of the man-made hill." These words inspire a sober reflection about eventuality of death whereby a person will turn to dust. But the invasion of Hausa has turned it to *juji* "dump or refuse." The names of things and places that are supposed to mean a lot to a Jenjo person have been disregarded as they are now given Hausa names.

Similarly, pupils of lower primary schools in Jen are taught in Hausa. Activities in court and other forms of administration are in Hausa. Some children speak Hausa at home, others codeswitch/mix the languages. While in the marketplace, codeswitching/mixing of Hausa and Jenjo depends on the buyer-seller. Preachers preach in Hausa both in churches and in mosques. In all the churches observed, both preachers preached in Hausa. When the parishioners were asked if this had been the custom, they all agreed that this had been the custom right from the beginning. When asked if they would like to listen to the preacher who preaches in Jenjo, a good number of them said yes while others were indifferent. This confirmed the assertion by Herbert Igboanusi and Lothar Peter that "Hausa is the main language of Christian worship and sermon by non-Hausa pastors and cleric in Kaduna, Plateau, Nasarawa, Taraba, Adamawa, Gombe, Bauchi, Kebbi and Borno states" (2004, p. 134).

Conclusion

We conclude that Hausa is an exotic invasive species and an agent of language endangerment to Jenjo. Jenjo is a threatened species in its own ecology. Jenjo people are beginning to distance themselves from their ecology by accepting and using some of the terms used by Hausa. Hence, Hausa is harmful to the language. Just as a moth needs a certain amount of water to grow, Jenjo needs to be spoken to survive. The language needs to be guarded consciously and religiously.

Some of the interviewees are indifferent on whether Hausa or Jenjo should be spoken at home, school and churches. It is not enough to document the language in grammar, dictionary, literary works, etc. It is well known that an average person does not like to read. Although documenting the language in literature, grammar and so on is a great way to start, teaching and learning the language through media, especially social media would also make a huge impact. Both print and visual forms can be used on social media. People can have access to the language easily with their smartphones. An average Nigerian has a smartphone. The Jenjo Language Development Project can create awareness of the importance of actively speaking the language in all domains. Simple grammar books can be written for the pupils of the lower primary school, and teachers of lower primary schools can be trained on how to use the book to teach. This can be an attempt to affect the policy of pupils learning in the language of their immediate environment. This may help resist the invasion in the Jenjo language ecology system.

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Chapter Ten

ECOLOGY AND BIODIVERSITY SUSTAINABILITY IN PANDAM GAME RESERVE, PLATEAU STATE, NIGERIA: A REVIEW OF PROGRESS, CHALLENGES AND OPPORTUNITIES

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Introduction

Biodiversity refers to the different life forms in the earth's ecosystems while ecology refers to the interactions between living and non-living components of the ecosystems (Groom, Meffe and Carroll, 2012). Interactions can be between living organisms and between living components and non-living components in the ecosystem (Adetoro, Lawal and Adetola, 2011). Ecological studies are therefore critical as they aid man's understanding of characteristics such as species composition, diversity, richness, abundance and distribution of populations in ecosystems. Living and non-living factors that are important in the dynamics of these populations (SodhiNavjot and Paul, 2010) can also be determined through ecological studies. Ecological studies are, therefore, very important for providing guidelines on the sustainable utilisation of biological resources.

The protected area network (Sandra *et al*, 2014) has remained the mainstay of conserving biodiversity globally (Chase, 2014). Four categories of protected areas have been recognised in Nigeria as follows: National Parks, Game Reserves, Forest Reserves, and Sacred groves (Ezealor, 2002). National Parks are set aside and managed by the federal government, whereas, State governments manage game Reserves and Forest Reserves. Sacred groves are mostly community reserves, hence, taken care of by local communities. The history of biodiversity and wildlife protection in Nigeria predates Nigerian independence (Usman and Adefalu, 2011). However, the military regime headed by retired Major General Yakubu Gowon was the first to direct a general

implementation of biodiversity and wildlife protection in the states of Nigeria. This was done in honour of a regional charter of the Organisation of African Unity (OAU) (Owuamanbam, 2014). Part of the mandate by OAU to African Heads of State was to establish biodiversity conservation areas in one third of the landmass of their respective countries. Therefore, in compliance with that directive, the then governor of Benue-Plateau State, Late Mr. Joseph D. Gomwalk, established Pandam Game Reserve, Jos Wildlife Park, Pai River Game Reserve and many others. Presently, the Pandam Wildlife Park (08°48'N 09°09'E) is owned by the Plateau State Government and managed by Plateau State Tourism Cooperation. Since its establishment in 1972, Pandam Game Reserve (PGR) has been a foremost conservation and ecotourism destination in Plateau State of Nigeria. This chapter reviews from available literature spanning about two decades progresses made in ecological studies at PGR. Major challenges faced and opportunities that abound for people and biodiversity sustainability are also discussed.

Progresses

A landmark progress made in ecological studies is the execution of the Important Bird Area (IBA) programme by the Nigerian Conservation Foundation with funding from the Royal Society for the Protection of Birds (RSPB), United Kingdom (Augustine, n. d). This was supported by the federal government of Nigeria through the Federal Ministry of Environment (FME), Federal Department of Forestry and National Parks Service. Other institutions that partnered in the programme were: Hadeja-Nguru Wetland Project and Ahmadu Bello University, Zaria. PGR is one of the 27 sites identified as critical sites for biodiversity conservation through the IBA programme, which used birds as indicator species. The studies determined endemic species, threats and conservation issues in each of the sites.

In all, over 900 species of birds were identified in Nigeria during the programme, with over 217 recorded in PGR. The IBA programme has remained a reference for many ecological surveys in PGR and all over Nigeria. For example, the floristic component of PGR has been investigated and characterised after the IBA programme (Akosim, Kwaga, Ali and Mamman,2007). Studies on indigenous knowledge of plant species and their usefulness to the locals have also been conducted (Unanaonwi and Amonum, 2013). In the study, locals were able to identify ninety-nine percent of the chosen tree species as having medicinal uses. Furthermore, effects of time of day and

vegetation variables on birds have also been determined (Dami and Manu, 2008). This was done by comparing species diversity indices between PGR and the surrounding farmlands. The study recommended that the management plan of the reserve be reviewed. This was because the study results showed no significant difference between the diversity indices of bird species in the reserve and that of surrounding farmlands. This suggested the presence of disturbance to bird ecology in the reserve. Another research in the reserve has suggested that education generally and environmental and conservation education specifically have positive influence on the attitudes of people living at the fringe communities of the reserve (Da'an, 2016). PGR has continued to be a foremost tourism (Henry and Emelue, 2009) and research destination. For example, students from both secondary and tertiary institutions have been visiting the reserve for educational purposes.

Presently the department of Biological Sciences, Federal University, Lafia, use the reserve for undergraduate field courses. Furthermore, three doctoral degree students are currently collecting data for their research projects on different aspects of ecology in the reserve. Despite these progresses PGR is faced with many challenges that must be addressed urgently for sustainability to be ensured.

Challenges

Lack of funding has been reported as the basic challenge facing protected areas in Nigeria (Gbadebo, 1993).This has also been the case with PGR. This has ripple effects such as low staff strength, poor staff welfare, poor continuous manpower development and lack of implementation of management plans (Mwanfupe, 1998). Furthermore, human population is observed to be on the increase in the fringe communities of PGR; this agrees with reports about protected and biodiversity rich areas in many developing countries (Joppa, 2012). High human population around protected areas mount undue pressures on biodiversity due to corresponding increased demand of bio-resources. However, it has been opined that rural communities dwelling around protected biodiversity areas utilise wildlife resources more sustainably than the civilised urban dwellers (Githiru, 2007). The overall effect of high-density anthropogenic activities is biodiversity loss (Emma-Okafor, 2009).

Anthropogenic activities such as poaching, livestock grazing, bush burning, timber and fire wood collection have been reported in PGR in the past (Augustine, n.d)and is reported to have persisted in recent times (Da'an, 2016). Presently, persistent

anthropogenic activities such as firewood collection, farm encroachment, cattle grazing, poaching, and logging. Particularly, logging is on a large scale and has been widespread in reserve within the past five years. Recently, indigenous communities surrounding PGR have been reported to protest a deforestation policy by the Plateau State Government of Nigeria (Vanguard, April 1, 2016). This policy may have resulted to the widespread logging observed in the reserve (Leadership, March 26, 2016). Similarly, widespread logging, particularly of the African rosewood *Pterocarpus erinaceus* across Nigeria (Ogunwusi and Ibrahim, 2017) and the entire West Africa (William and Bandoh, 2016) has also been reported. This has been attributed largely to the activities of Chinese wood merchants (International Center for Investigative Reporting, 2016). It has been posited that governments are more concerned with investing funds on projects that win political support thereby constituting several logistic and institutional obstacles to biodiversity conservation (Gbadebo, n. d). This is manifested in the types of policies that are formulated by government at different levels.

Another daunting challenge to biodiversity conservation in PGR is weak and outdated guiding laws. For example, since the Reserve was established in 1972 and gazetted (Benue-Plateau State, 1975), little or no reviews have been done on the laws protecting it. This has been reported as the case for many protected areas in Nigeria (Gbadebo, n. d). Therefore, poachers and other trespassers prefer to pay fines if caught and prosecuted to desisting from their activities. This is simply because the penalties of such offences, which are fines paid in lieu of prison terms, are meagre compared to the proceeds of the trespasses.

The challenges highlighted and discussed so far are the most important ones undermining biodiversity conservation in PGR; these can be surmounted using a multi-stakeholder approach. Handling biodiversity conservation challenges from the corporation's viewpoint and collaboration by critical stakeholders is increasingly becoming the trending success strategy (Julius, Paulinus and Hazell, 2007). Therefore, the challenges being faced in PGR presents several opportunities that can be exploited for human advantage and biodiversity sustainability.

Opportunities

An array of opportunities abounds in PGR which if properly harnessed will be of great benefit to man and ensure biodiversity sustainability. These are presented in avenues for collaborations between PGR management and stakeholders like indigenous host

communities, tertiary institutions, research institutions, non-governmental organisations and interested private individuals. In 1999, the International Union for Conservation of Nature (IUCN) and the World Wide Fund (WWF) adopted Principles and Guidelines on Indigenous/Traditional Peoples and Protected Areas based on the following premises (Jaime and Angela, 2007):

> protected areas will survive only if they are seen to be of value, in the widest sense, to the nation as a whole and to local people in particular;
> governments and protected area managers should incorporate customary resource use and indigenous land tenure, as well as control systems, as a means of enhancing biodiversity conservation;
> knowledge, innovations, and practices of indigenous and other traditional peoples have much to contribute to the management of protected areas. (Beltrán, 2000)

The principles and guidelines have served as a reference for organisations to develop their own policies and practices regarding indigenous people (Fernández-Baca and Martin, n. d). Similarly, PGR can benefit immensely from collaboration with host and/or surrounding communities especially as it relates to protection and law enforcement. For example, PGR is in the category 6th classification of reserves (Augustine, n. d); in this category, a controlled level of exploitation of resources is allowed. The PGR management may therefore make commitment to biodiversity protection within areas around each community a condition for allowing them to exploit resources in the reserve. Several success stories from partnership between reserve managements and host communities have been recorded. For example, in the Arabuko-Sokoke forest in Kenya, community support groups have contributed immensely to biodiversity conservation through collaborative projects (Thompson,2007). A number of successes have also been reported in participatory protected area management in Latin America and the Caribbean (Fernández-Baca and Martin, n. d). Globally, participatory management of protected areas is being advocated (Peter, et al, 2002) and is becoming a popular opinion and option (Arinnaitwe, and Thompson, n. d).

PGR management can seek further collaborations with tertiary institutions in specific aspects such as research and manpower development. Many research opportunities still abound on different aspects of ecology of the reserve. While a

number of researches have been conducted on the ecology of fauna and flora in PGR, little has been done on the interactions between human livelihoods and biodiversity conservation. Hence, research institutions such as Forestry Research Institute of Nigeria (FRIN), departments of Zoology, Botany, Wildlife Management, Biological Sciences, Sociology, Tourism and Hotel Management in Universities and other tertiary institutions can be formidable research collaborators. Research implementations can be done strategically through students' projects at different levels. In order to ameliorate the challenge of funding PGR management can seek funding from national and international nature conservation donor agencies. This can be for the implementation of specific projects and/or manpower development. The Nigerian Conservation Foundation (NCF) and the World Wildlife Fund are examples of agencies PGR can partner with for funding. The NCF and WWF have executed a number of projects locally (Ijeomah and Emelue, n.d). Furthermore, WWF has supported manpower and capacity development in wildlife management and species conservation for about 60 years worldwide.

The hotel section of PGR also presents opportunities for collaboration with stakeholders. Revenues generated at PGR which were majorly from the hotel section have dwindled through the past twenty years[1]. Presently, the hotel section is operating far below capacity due to poor patronage. Collaboration with private individuals to run the hotel facilities promises to provide greater efficiency in services and income generation. If done, this will open up more job opportunities for locals and provide more satisfactory and consistent services for scientist and tourist without compromising the ecological integrity of the reserve.

Conclusion

Many ecological studies that can inform specific conservation interventions have been conducted at PGR. These have underscored the local and global importance of the reserve. Challenges have been identified as arising mainly from livelihood issues of the increasing human population around the reserve and lack of adequate support from the government. These challenges have been viewed as great opportunities if properly harnessed through a multi-stakeholder collaborative approach. This is understood as the trending global best practice for biodiversity sustainability and meeting needs of

local communities. Since ecological studies provide information that guides conservation action, it is strongly recommended that the enabling environment for such studies be continuously provided in PGR.

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Chapter Eleven

BEYOND THE RHETORIC: INSTITUTIONAL RECOGNITION, AND THE TRIUMPH OF AFRICAN ENVIRONMENTAL LITERATURE

Chinonye C. Ekwueme-Ugwu

Introduction

With the earlier African ecocritical experimentalists like Williams Slaymaker, Rob Nixon, Juliana Nfah-Abenyi, and Byron Caminero-Santangelo, African ecocriticism, now said to be in its embryonic stage, might just be on its course to fully flourishing, if only it can gain institutional attention. These scholars blazed the trail of African literary environmentalism with their ecocritical publications in an anthology of African literary thoughts (Olaniyan and Quason, 2007). From that initial publication of his "Different Shades of Green: Ecocriticism and African Literature", Byron Caminero-Santangelo has expanded, in 2014, his African literary environmental treatise to include environmental justice and political ecology in a book that expounds the theory and practice of ecocriticism, using many of Africa's classical literary texts – poetry, drama and fiction – to illustrate the viability of this area of study in African literature and the humanities.

The celebration of fifty years of Chinua Achebe's *Things Fall Apart* alone produced some ecocritical assessments of that early African novel. Salisu Barau, Augustine Nchoujie and Asoo Iorbee present some of these perspectives in ways that leave no doubt about the sustainability of ecocriticism in African literature. Drawing copiously from the novel, Iorbee affirms "a perfect gathering together of man, the birds, the forests and the rain ... the integration of the human with natural cycles of life and living" (Asoo, 2009, p. 73). He concludes that although "Chinua Achebe did not set out to write a novel that answers ecological questions the way Sembene Ousmane or Ngugi wrote socialist novels ... there is sufficient evidence [in *Things Fall Apart]* that the methods of ecocritical assessment can very well be applied in analysing it" (Asoo, 2009, p. 75)." Senayon Olaoluwa, in his rereading of the text, sums it up as an

exemplifier of "an African epistemic order" (2015, p.210)." In the East, Nebata Sangili's exploration of the ecocritical significance of Maragoli songs further lends credence to the viability of ecocriticism as both theory and method of analysing African literature even at the level of orality (Sangili, www.academia.edu/839796/shifting_toward_east_african_ecological_criticism_in_oral_literature_an_ecoanalysis_of_the_maragoli_songs).

Ecological tropes have also been identified in more recent African narratives, though without the authors' implicit desire to tackle the environment as an entity. Instances abound in the novels of Bina Nenghi-Ilagha (2002), Isidore Okpewho (2003) and Kaine Agary (2006), set in Nigeria's Niger Delta. These novels *Condolences*, *Tides*, and *Yellow-Yellow*, respectively, predate the afore-mentioned critical entries and, no doubt, create consciousness of prevailing negative impacts of oil exploitation on the Niger Delta physical environment and the organisms – human and non-human – within it. The issues of degradation, destruction and destabilisation in the region, exposed in the texts, are central to ecocriticism, even though the works may not be seen to adapt to the Euro-American concepts of ecological praxis.

African literary environmentalism has thus continued to engage the thoughts of African literary artists and critics. Through the thick rainforests, the creeks and mangrove swamp regions of West Africa, through the varied topography of the South and the grassy and open Sahel regions of the North and the East, ecocriticism has continued to make its way to gain recognition and adoption by individual African authors and critics, paving way for an authentically African environmental praxis, fashioned to deal with specific African ecological crises. The avalanche of references, positive and otherwise, made to this issue in the last decade by African writers and critics attests to this. Differing opinions, published and unpublished, continue to generate arguments in various quarters regarding ecocriticism's viability towards assessing African thoughts as embedded in African literary texts. While some critics are yet to admit ecocriticism's practicability, others assert its literariness and practicality and the interdependence of the two – literature and the environment – in a plethora of ways. Uzoechi Nwagbara, from an African perspective, views ecocriticism as a tool for challenging "ecological imperialism in the dispensation of neo-colonialism" (http://artslasu.org/journal_eng/contents/vol5/nwagbara). Through the literary modes of plot, themes, characters, settings, etc., the authors depict (in their

various primary texts) ecological ills and call for a reversal of actions that degrade those texts' physical environment/settings.

Despite these individual gains, however, institutional participation remains cold, judging from the curricula of language and literature studies of different African universities. Some of our conventional formalist/structuralist authors and critics have continued to jettison ecocriticism as an approach to literary scholarship, thereby threatening the triumph of this field in African literature. Therefore, the place of the environment in African literature is examined under the basic assumptions gleaned from the curricula of literary studies of some African universities, from the four main regions – North, South, East and West – of Africa. The universities are those of Cairo, Cape Town, Stellenbosch, Nairobi, Makerere, Lagos, Ghana, and the University of Nigeria, Nsukka. An ecocritical assessment of the curriculum of the universities' English language and literature studies proves that the field is yet to be accepted. It reveals the stark reality of a near-total absence of the environment in class discussions.

Except for the University of Nigeria, the curricula examined are electronic downloads from the universities' websites. Added to these primary data is secondary information, which suggests that despite the clear absence of the environment from the curricula of literary studies of Africa's major universities, overwhelming evidences from individual publications prove that literary environmentalism has steadily gained visibility in Africa, and assumed a strong force to reckon with in African literary discourses. Though on literary criticism from ecological points of view, the primary focus of the study transcends literary boundaries to embrace the broad fields of arts and humanities. In other words, findings from the literary perspective are recommended to be experimented and replicated in the other specific disciplines within arts and humanities.

The core contents of each course are examined as posted. However, due to insufficient space, only those courses that reference the physical environment and others that could be potentially expanded or modified to accommodate environmental issues are highlighted and presented for examination in this final submission. In this process, while the contents remain the same as posted on the universities' websites, the structure of the courses have been adjusted to fit into the format of this paper. In the course of these analyses, references are made only to specific contents of the curricula, while the reader is advised to apply to the links on references page for details. Course descriptions that make references to the

environment are examined to ascertain the viability of such for promoting synergy between arts and the sciences. The reason for this is that while the West has gone beyond appropriation of the gains of technology and is concerned solely with maintaining environmental purity and with environmental aesthetics, Africa is still grappling with understanding how technology works and how it can be applied without degrading the environment and causing other ecological hazards.

The Universities of Lagos and Ghana

From a survey of her thirty-eight undergraduate courses, the Department of English of the University of Lagos offers no course that directly addresses the environment or any of its modern concerns. This is despite the avowal in the introduction to the listed programmes of the department that:

> A regular review of the programmes offered by the Department is carried out as the need arises to do so. Thus the courses taught to students are often reviewed to accommodate current trends in the global arena in the field of humanities. This current review has been done with a view to making the Course and the graduate of English more relevant to the present-day needs of the country as it advances in sciences, technology, commerce and industry, etc.

Even though the department's 'ENG 473: Approaches to Literary Theory and Criticism' is said to provide "students with a working knowledge of the critical concepts and approaches in literary theory and criticism", it is limited to only "such movements as (I) Impressionistic criticism (2) Historical criticism (3) Sociological criticism (4) Psychological criticism (5) Mythic and Archetypal criticism (6) the New (Practical) criticism (7) Marxist-political criticism (8) Formalist (Practical) criticism (9) Structuralism and Deconstruction" (http://arts.unilag.edu.ng/wp-content/uploads/2017/08/english-departmental-programme%e2%80%99s-structure.pdf)." There is no hint of ecological criticism in this age of ecological woes.

The absence of any course on the environment is clearly an indication that it is not one of the "current trends in the global arena in the field of humanities" at this time when so many authors, local and global, have taken to the environment as a subject of their primary and secondary texts. When Greg Mbajiorgu makes climate change the subject of his drama *Wake up Everyone!*, he echoes the threats of climate change, an aspect of environmental issues. As Nigeria advances in the "sciences, technology, commerce and industry," clearly emphasised in the curriculum of English studies of

the University of Lagos cited earlier, so does she advance in the accumulation of wastes; so does she progressively advance in the destruction of natural ecosystems, to feed the industries and for urban expansions, in obedience to the dictates of science, technology, commerce and industry. The urban expansions have also steadily created imbalances in the ecosystems, as natural species are regularly sacked from their environments and replaced with science and technological structures. Thus if this trend is left unmediated through a carefully planned curricula of language, literature and other humanistic studies, the individual efforts may not yield much towards the sustainability of humanity, the biosphere and all that is within it will be greatly jeopardised. A detailed study of such environmental texts, as part of a course on the environment, will go a long way towards building environmental harmony in our English and other humanistic classrooms.

Of the University of Ghana's twenty-eight courses examined, ten, including ENGL 460: Long Essay, are language-based, while the remaining eighteen are literature courses. But not one of these is designed to reflect the environment as an issue. If Ghana's 400 level students could offer the course ENGL 449: The Language of Religion, with focus on "recurring structures in religious tracts, sermons and other such religious texts" (http://www.ug.edu.gh/english/courses?field_department_tid=3&page=1), which are strictly for the Religion Department of that university to study, why would a course entitled "The Language of the Environment" not be designed for them to study recurring structures in written texts of the environment, its organisms; or to study ecological tropes in texts? The obvious answer is that religion has become so much more problematic to the country than the physical environment where those religious activities are practised. Are there indeed no environmental concerns in the country, which language and literature could mediate? These questions are not for Ghana alone, but for all other African countries. Consider this also: "It [the course ENGL 449] will also consider meaning mechanisms and the effects they [the meanings in the religious texts] are expected to produce" (http://www.ug.edu.gh/english/courses?field_department_tid=3&page=1). How about if we study meaning mechanisms and their effects (the meanings in environmental texts, largely utterances and actions by characters) are expected to produce? The only explanation is that Africans are yet to consider the environment

enough threat to warrant its study by more than a half of her population of university students, which those in the arts and humanities are believed to constitute.

The Universities of Cape Town and Stellenbosch

University of Cape Town's Department of English Language and Literature currently offers 300 level course: "Contemporary Literary Studies - ELL3001S (Second Semester)" with an outline of ten themes, the last of which is "the potential of 'writing back the land" (http://www.english.uct.ac.za/current-courses-3). This clearly replaces the previous curriculum (2018) with the theme "Literature and Environmentalism". Whatever the caption, this suggests a wide spread institutional recognition of the environment as a subject of enquiry in arts and the humanities. Nevertheless, environmental consciousness here still does not transcend the classroom. To evolve an African ecocriticism, curriculum contents need to transcend the classrooms to include the natural world. With an introduction of environmental writing and discourses, detailed below, to the undergraduate curriculum, greater consciousness of the environment and related issues will be inculcated in the scholars, more than half of whom would move out of the world of academics at the end of that level of scholarship.

While the Stellenbosch University does not provide details about its courses, the following general statement on their website is helpful:

> The undergraduate core courses range widely over different periods, genres and localities, providing instruction in traditional areas of English literary studies as well as in postcolonial literary studies and cultural studies... . Here staff teach in their areas of research and students choose from a range of topics as diverse as nineteenth century studies, contemporary East African studies, literary practices, narrative theory, ecocriticism, biographical studies and modernity. (http://www0.sun.ac.za/english/about/)

Considering the volume of environmental primary and secondary texts from that region, it is hoped that a significant content of the postcolonial and cultural issues hinted will be of environmental nature. Also, that "staff teach in their areas of research" and that ecocriticism is one of these areas of research is an indication of the eventual triumph of environmentalism in African literature.

The University of Nairobi and Makerere University

The University of Nairobi's full department of literature offers core and elective courses of regional and global literatures. On the list are included specialised literatures, such as "children literature," "travel literature," "biography and autobiography," and "literature of war and peace" (http://literature.uonbi.ac.ke/uon_degrees_display/undergraduate). However, literature of the environment has no place in the list. Although there is no detailed description of the contents of any of the courses, the absence of the environment as a core area of concern is indicative of institutional neglect of the most important aspect of humanistic endeavours in the twenty-first century. Similarly, Makerere University's School of Language, Literature and Communication offers no course that is of environmental concern. The following description characterises the broad area of concern of the department:

> The department runs a three-year undergraduate program on the following subjects offered: Literature, Linguistics, English Language Studies, Communication Skills, French, German, Chinese, Spanish, Arabic, Luganda, Lwo, Kiswahili and Runyakitara. (http://llc.mak.ac.ug/content/bachelor-arts-arts)

The department also offers a two year master in literature, but proffers no further detail about any of the subjects. As such, no real comment can be made regarding the department's involvement with literary environmentalism. Considering the significant agro-environmental activist publications of Wangari Maathai, and her more practical "Green Belt Movement", the ecocritical discourses of Nabeta Sanghili and others, environmental literature should be on its way to being, if not already, comfortably established in eastern African region.

The University of Cairo

The University of Cairo's Department of English Language and Literature (http://www.edcu.edu.eg/bylaws-with-descriptions.php) does not have the word 'environment' in its available course descriptions. It offers an introduction to iterature that aims at studying "the relationship between literary works and their temporal context." Indefinite as to what constitutes temporal context, the course could not be assumed to be of environmental concern. Similarly, one of the department's "third division" courses' target to introduce students to "scientific thinking in the fields of

human sciences" provides no details. However, it could be expanded to incorporate environmental thinking as one of those scientific areas of thinking.

The University of Nigeria

Of the fifty-three listed undergraduate courses (core and elective) of the Department of English and Literary Studies, none is devoted to the study of literature and the environment or examining ecocriticism as a theory and approach to literary analysis. Few of the courses that, in passing, refer to ecology employ the term as an ancillary metaphor in the description of trends in modernist literature. ELS 102: Introduction to Nigerian Literature and ELS 103: Introduction to African Literature adopt, for example, the same expression: "and such topical issues as literature and ecological change and adaptation", indicative fortunately of the curriculum planners' awareness of current debates on literature and the environment, but with a tacit decision not to get involved in the debate. Similarly, the reference to "ecological aesthetics" in the description of ELS 471: Modern Literary Theory is suggestive of the 17th and 18th century Anglo-American romantic traditions that are but precursors of modern-day ecocriticism. While the Romantics beheld and apprehended ecological beauty and transcendence, they never anticipated humanity's capacity for nature's exploitation and relegation to its current state of obsolescence. Therefore, this situation warrants a new approach – ecocriticism – in literature and the humanities, for the purpose of forestalling the scientific arrogance that is at the heart of the issue and advancing more viable options for environmental sustainability.

ELS 310: Contemporary African Authors says: "Students will be familiarized with African writers whether based on the continent or abroad whose works are currently gaining critical attention". But, as the description provides no list of authors and works to be studied, it is not possible to ascertain whether or not the authors' works are actually "currently gaining critical attention". As it stands, it leaves whoever teaches the course to appoint any author that catches his or her fancy as currently gaining critical attention. Understandably the curriculum planners lack a grasp of ecocriticism's underlying currents, as theory and approach that relate literature and criticism, and other humanistic studies, to ecology and ecological principles. As such, they will have only vague expressions to offer scholars, a situation most unbecoming.

Environmentalism in Arts and Humanities

Having argued first for the "capacity of environmental texts to model ecocentric thinking", Lawrence Buell devotes subsequent chapters to an exploration, in practical terms, of this plausibility. However, his concern, as earlier mentioned, is with the Western literary writings, more specifically, as he says, with "American writing" (1995, p. 144)." Since the concern of this study is with the African literary and other humanistic environmental representations, this segment is devoted to further explorations of possibilities of ecocentric thoughts in African literature and other art forms. Having observed, furthermore, the absence of environmental thoughts in the scheme of work of the departments of English and literary studies of African universities and faculties of Arts, this segment is equally an attempt to suggest plausible ways of engaging the nonhuman world in African literary writing and criticism.

The Inter-Departmental Collaborative Option

Through series of environmental outreach programmes in the various departments of arts and humanities collaborative ideas may be shared in the forms of workshops and symposia where environmental issues will be discussed. Creative ways of ridding the environment of unwanted materials initiated by Fine and Applied Arts department could be shared with other departments. Dramatisation of climate change and its effects, initiated by the department of Theatre and Film Studies could be shared with other departments. Anthropological findings from sociolinguistics and related departments could be disseminated through discussions organised at the faculty level. Moreover, academics in different departments could collaborate to work on an environmental issue and publish their findings. This is different from a situation where an individual researcher, to ease the financial burden of publication, 'adds' the name(s) of others as co-authors of the finished work. Ingraining the ecological principles and culture in humanities scholars will not occur this way.

The Interdisciplinary Option

"Connecting science and literature", says William Howarth, "is difficult, for their cultures have grown widely apart" (1996, p. 76). Yet, it is one challenge that the ecocritical instructor and scholar must overcome. Stressing the interdisciplinary nature of literary environmentalism, Howarth identifies the ecocriticism library and

fields to include “Natural Sciences”, “Geography”, “Social Sciences”, “History” and “American Studies”. In place of this, African Studies may be included as ecocritical scholars of other regions of the world include theirs. Examining these fields more closely, Howarth ((1996, pp. 76-77) recommends a list of ecological non-fiction authors and titles from each of these fields, which he believes to be of immense guide to the ecocritical reader. However, there is a thick line of intersection between appraisal of those texts and the actual engagement in imaginative writing that Howarth does not address. Secondly, the list comprises works that address Euro-American environments, thereby necessitating endeavours into works in Natural Sciences, Geography that mirror the African environment. This way, literary scholars break the boundaries, advance beyond the libraries and the four walls of their classrooms, and embrace the wider scholarship world. This is directly linked to the pilgrimage option that affords arts and humanities scholars opportunities for collaborations with scholars in natural sciences.

Interdisciplinary collaboration with the Education faculties proves to be a captivating experience as a recent report of outreach programmes by some American Environmental Literary scholars shows:

> This past June, the second annual Environmental Literature Institute (ELI) brought secondary school teachers from around the country together at Exeter Academy, New Hampshire for a week of professional development in environmental humanities pedagogy. Continuing to build on the 2014 ASLE strategic plan’s goal to improve public discourse about the environment through community-based, K-12, and undergraduate programs, in 2017 ELI provided a space for educators of all experience levels to develop courses and curricula for a variety of secondary school settings, to explore how environmental approaches could inform and enliven their teaching, and to build community in the environmental humanities (http:/www.asle.org)

Collaborations between arts and humanities scholars, with their counterparts in the education sector, will undoubtedly help increase students' environmental consciousness and boost Africa’s environmental rating.

The Pilgrimage Option

Drawing a parallel between pilgrimage experiences to religious sites, the re-enactment of the sacred passions, with the experiences of pilgrims to Concord, Massachusetts,

"America's most sacred literary place" (1995, p. 316), Lawrence Buell seems to declare ecological retreats potent for instilling bio-centred consciousness, for drawing consciousness away from the busy, over-commercialised, noisy, polluted urban enclaves. Such a retreat could equally become potent for providing viable materials for inscribing the wilderness experiences into environmental fiction and non-fiction. From his examination of the volume of "pilgrimage literature" that have emanated from the Thoreauvian site, he asserts that: "As far as the history of the environmental imagination is concerned", what matters is not that prominent literary figures "visited Concord but that they inscribed in their work variants of the Thoreauvian narrative of departure from town to Walden, works that have sometimes inspired Walden-styled pilgrimages in their turn" (p. 336)." He further avers that:

> To visit Thoreau's retreat... has always offered a chance to emulate Thoreau's own gesture of shaking the dust of urbanity and materialism from one's feet.. . In this inclination we see not only the capacity for pilgrimage to promote cozy smugness but also its capacity to promote reflective detachment. If Thoreau's reputation has benefited from his connection with the literary and publishing power centers, it has benefited at least as much from the societal desire to free ourselves from the quotidian entanglements that threaten to compromise us much more than they did him. (pp. 336-337)

The environment has not attained the sacred status accorded it in the West. As such, pilgrimages into African natural environments, away from the technologically urbanised classrooms, have not become a tradition of African arts and humanities scholarship. But it could be, though not in the romanticised American style. Nature surrounds us in Africa, but we hardly think of them as composite elements of our being. We treat natures and the natural world as 'other' in our anthropocentric consciousness. As such, rather than replicate the American model, creating synergy with scholars in the fields of physical sciences departments, the fields of agricultural, horticultural, environmental and biological sciences – botany, zoology, animal sciences, etc. – may be a better option. This way, from time to time, students in the faculty of arts could undertake a visit, consciously planned to expose them to the natural life, even in an academic setting. Through such visits, the students will become familiar with some botanical or zoological names of plants and animals in our environment that would subsequently enlarge their vocabulary stock of non-human

organisms, thereby engendering their apt representation in imaginative and other writings. Using English and Literary Studies as model, this synergy could be created through the following ways:

1. Inclusion in the curriculum of English and literary studies of a field trip to those departments in order to familiarise them with scholars in the fields as well as the names of animal and plant species in our African environment that will help in creating natural scenes within the plot of any story.
2. Inclusion of creative writing courses with exercises strictly on environmental writing. This way, students will get to apply the zoological and botanical names, the various aqua organisms, and such physical or geographical entities as mountains, valleys, and hills surrounding us in writings.
3. In our readings and literary appreciation classes, inclusion of environmental writings from Africa and around the world. This way the student gets to appreciate them and draw from the experiences of global ecocritics.
4. Collaborating with scholars in the various departments of our African languages to keep abreast of developments in the vocabulary contents of the various languages.

The Activist Option

Eco-activism in the sense applied in this paper does not in any way support violence. Rather, literary scholars foster awareness and active participation in seeking solutions through their artistic expressions to perceived environmental injustices experienced in different parts of Africa. Tanure Ojaide's eco-activist postulation of the interconnectedness of "language, literature, environment and human rights" (2012, p. 66), for instance, is predicated on the capacity of literary environmentalism to provide the necessary platform for addressing environmental injustices and human rights abuses occasioned by exploitation of Africa's natural resources. With a careful selection and incorporation of African environmental texts, along with others "that the world's biggest technological power has produced", African literary environmental scholarship, like others from around the world, "may find disclosed ... both the pathologies that bedevil society at large and some of the alternative paths that it may consider" ((Buell, 1995, p. 2)." Tracing "how modern conventions of reading block out the environmental dimension of literary texts" (1995, p. 14), Buell further argues that "environmental interpretation requires us to rethink our assumptions about the

nature of representation, reference, metaphor, characterization, personae, and canonicity" (p. 2). Through active research and representations of the research findings, African literary authors and critics will be found to participate in this endeavour.

Many in Africa and other parts of the world have taken to environmental activism to ameliorate pressures to their various ecosystems. To be an eco-activist in the humanistic sense is to develop an interest in and participate in activities that are aimed at reducing current global environmental stress, mainly in the form of degradation. For literary scholarship, the object of enquiry remains environmental texts. Therefore, activism begins with environmental discourses and writings – fiction and non-fiction. On what constitutes an environmental text, Buell draws parallels between environmental fiction and non-fiction, stressing that "Darwin's *Origin of Species* was as catalytic an event for American thought as John Brown's raid on Harpers Ferry ... the environmental nonfiction of Celia Thaxter, Mary Austin, and John Burroughs counts for as much as the novels of William Dean Howells and Mark Twain" (pp.6-7). Similarly, Wangari Maathai's ecological non-fictive writings that document the activities of her Green Belt Movement provide as much ecological insights into the African physical environment as scenes from the same Kikuyu settings of Ngugi's novels or the Umuofia and Umuaro settings of Achebe's *Things Fall Apart* and *Arrow of God*. The over forty-five titles in the *Department of Geography, University of Nigeria, Nsukka Conference Proceedings* on the theme of climate change and the Nigerian environment provide as much ecological readings and insights as Isidore Okpewho's environmental novel *Tides*. With this understanding, the students get to pick interest in reading texts of all sorts. But the onus is on institutional recognition and integration of the ecocritical praxis into the curricular of arts and the humanities academic programmes.

Finding a correlation between environmental degradation and the impoverishment of local Kenyan farmers, Wangari Maathai had undertaken environmentalist activist steps to remedy the situation. Talking about Kenya of the 1940s where she grew up, Maathai is said to have recalled that:

> There were no books or gadgets in the houses, but there were leopards and elephants in the thick forests around, clean water, rich soils, and food and work for everyone.. . Now the forests have come down, the land has been turned to commercial farming, the tea

> plantations keep everyone poor, and the economic system does not allow people to appreciate the beauty of where they live. (www.theguardian.com/world/2011/sep/26/wangari-maathai)

A concern such as this over the influence of technological advancements on the pristine African environment soon translates into actions for the restoration of biodiversity in the region, and creates the environment for African environmental non-fiction, and hopefully fiction as well.

Conclusion

From Cairo to Cape Town, from Lagos to Nairobi, eco-centred approaches to the writing and reading of literature are yet to be recognised in African literature, and in the practice of the larger fields of African arts and humanistic studies. But it will be. The volume of individual enterprises in the ecocritical field strengthens this conviction, despite the very great odds presently against it. Therefore, it is no longer tenable to assert that ecocriticism is new in Africa or assume that it is a mere concept, devoid of the practical elements that confer theory on mere assumptions. What is true is that African environmental authors and critics have not been able to organise themselves into formidable forces to confront contemporary African ecological realities and forge a peculiarly African humanistic perspective to the study of the environment. It is also true to say that environmental courses are not taught as a part of art and humanistic studies in the various African universities and colleges. Yet, taking literary ecology, for instance, the intellectual foregrounding of the principle of ecocriticism and the subsequent breakthroughs in its application to literary criticism in America, Europe, and Asia have proven ecocriticism as theory and method of analyses of humanistic instincts vis-à-vis the environment, the organisms within it, and the contemporary issues of degradation and sustainability. Besides the other postcolonial issues of subjectivity, identity loss, displacement, migration, and so on, the environment has come to stay as a subject in postcolonial African discourses. From critical essays on the theory itself to its practical approaches to the analyses of primary works of art, ecocriticism has gained sufficient grounds in Africa to be accorded a permanent place in the region through (1) a more vibrant recreation of the African environment to reflect the changes in climate and culture that are sweeping across the continent; and (2) organisation of conferences and bodies strictly

for engaging the environment in African arts and humanistic studies, literature and criticism.

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Chapter Twelve

THE EFFECT OF TRADITIONAL FERMENTATION PROCESSES ON THE NUTRIENT CONTENT OF SOME COMMON NIGERIAN DIETS

Ehoche E. Elijah
Henry Y. Adeyemi

Introduction

Food is a material that provides living things with the nutrients they need for energy and growth (World Health Organisation, WHO, 2012). It is usually of plant or animal origin. Food nutrients include carbohydrates, protein, lipids (which are macronutrients) vitamins, minerals, and water (which is of no caloric value). Food nutrients are contained in different diets, the sum of food consumed by a person or other organisms (Andrew et al., 2014; Chandra et al., 2015; Zygmunt et al., 2009). In all their cultural variety, the diets people eat define to a large extent people's health, growth and development (United Nation International Children Emergency Fund, UNICEF, 2016 and WHO, 2012). Although fermenting foods traditionally have constituted a significant proportion of our diets, Nigerians have exhibited an ambivalent attitude in terms of consumers' taste and preferences for food (Osho, et al., 2010). The introduction of foreign high technology products especially processed ones, radically changed the Nigerian food culture into a mixed grill of both foreign and local dishes (Ojo, 1991). Sold at relatively high prices, these imported (highly processed) items now command respect (irrespective of the accompanying nutritive hazards). This is worsened by the harsh economic condition ravaging the country (Ameh, 2018).

Fermented foods remain of interest since they do not require refrigeration during distribution and storage (Osho et al., 2010) due to the biochemical changes in them that supports their natural preservation. They do not require any serious specialisation, training or the use of any advanced technology that could command the involvement of scarce resources in a developing economy like ours (Steinkraus, 1997). Fermented foods can bring many benefits to people in developing countries.

Fermented foods play an important role in providing food security, enhancing livelihoods and improving the nutrition and social wellbeing of millions of people worldwide, particularly the marginalised and vulnerable (FAO, 2011). Fermentation processes also play important roles in food technology in developing countries (UNICEF, 2016).

In traditional fermentation processes, natural micro-organisms are employed to prepare and preserve different types of food (Robert, 2011). These processes add to the nutritive value of foods and enhance flavour and other desirable qualities associated with digestibility and edibility. The fermentation techniques are often characterised by the use of simple, non-sterile equipment, chance or natural inoculum, unregulated conditions, etc. Nigeria is endowed with a wide range of fermentable indigenous staple foods that serve as raw materials for agro-allied cottage industries.

During fermentation process, microbial growth and metabolism result in the production of a diversity of metabolites (FAO, 2004). According to Achi (2005) and Ajibola et al. (2016), food fermentation is regarded as one of the oldest food processing and preservation methods. Fermented foods can be classified as fermented starchy foods (e.g. Garri, *Akpu* from cassava roots or tubers); fermented cereal-based foods (e.g. *Ogi* and *Kunuzaki or* cereal-based *fufu*); alcoholic beverages (e.g. *Pito, Burukutu, Obiolor*); fermented legumes and oilseeds (e.g. *Dawadawa, Iru, Ogiri, Okpiye*); and fermented animal proteins (e.g. *Nono and Yoghurt*) based on their contents of the major nutrients, carbohydrates, proteins and lipids (Egwim et al., 2013). This is as tabulated below:

Table 1: Fermented Foods of Nigeria

FOOD SUBSTRATE(SOURCE)			FERMENTED FOOD PRODUCT	
TYPE	EXAMPLES	MAJOR NUTRIENT PRESENT	CLASS	EXAMPLES
Cereals	Corn, Sorghum, Rice, Millet,	Carbohydrates	Non alcoholic beverages, weaning gruels&pastes	*Ogi/Akamu*, various *kunu*types, etc; and *agidi, tuwo and masa pastes.*

			Alchoholic beaverages	*Pito, Burukutu, Obiolor,etc*
Tree sap	Palm tree sap			*Ogogoro, Palmwine*
Tubers/Roots	Cassava, yam		Starchy foods	*Garri, Abacha, elubo, fufu, kokobela, etc.*
Legumes and oil seeds	Locust bean, soy bean, water melon seed,etc	Oil/Proteins	Indigenous Condiments	*Dawadawa/ Iru,Ogiri , Okpiye, Ogbonti, Ugba etc.*
Meat and sea foods	Meat and fish		Meat and sea foods	*Affonnama, Azukpo, Nsiko and Oporo*
Milk	Animal milk and 'plant milk'		Fermented Milk products	*Nono, yorgurt, wara, etc.*

Source: Ukwuru and Ohaegbu (2018); Latunde-Baba (2011); and Achi (2005).

According to Dorota and Danatu (2018); Robert (2011); Latunde-Dada (2011); Steinckraus (1995); the role of fermentation in nutrient availability of food may be summarised into five main purposes:

I. Enrichment of the diet through the development of a diversity of flavours, aromas, and textures in food substrate;
II. Preservation of substantial amounts of food through lactic acid, alcohol, acetic acid and alkaline fermentations;
III. Biological enrichment of food substrates with protein, amino acids essential fatty acids and vitamins as in *dawadawa;*
IV. Elimination of antinutrients (example in *garri* production), and decrease in cooking times and fuel requirement (Chikeze and Ojiako, 2013).

It is noteworthy that in a developing economy like ours faced with serious challenges like economic depression, poverty as well as increased food crises and prevalence of food-related diseases especially diseases related to energy malnutrition (Ameh, 2018; FAO, 2011a), it is necessary to investigate some of the above-mentioned effects of traditional fermentation processes on the energy-rich macro-nutrients (carbohydrates,

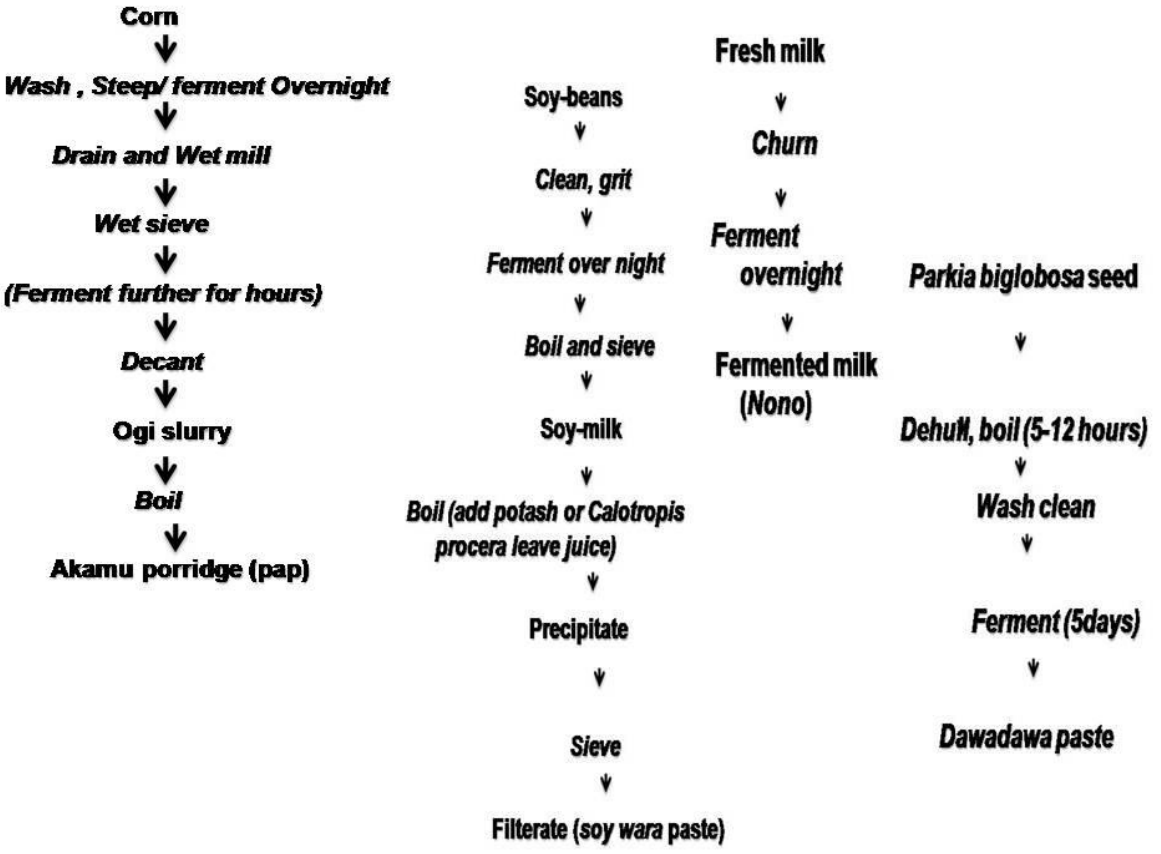
lipids and proteins) content of some fermented foods common to the Nigerian state. Since the traditional fermentation process is cheap, a positive evaluation could therefore be valuable.

Materials and Methods

Sample Collection and Treatment

Samples of dry corn (*Zeamays*) and soy bean (*Glycine max*) were bought in Bosso local market, samples of *Parkiabiglobosa* seed were bought from Kure market, Fresh milk sample was bought from the Fulani camp site near Bosso Dam – all from Minna, Niger State. Prototypes of the foods were produced in the laboratory using the traditional methods of fermenting foods in Niger State. Solid (dry) samples of corn (*Zeamays*), *Parkiabiglobosa*, and soy bean (*Glycinemax*) seeds were pounded to powder and sieved and the filtrates were collected. *Dawadawa* pastes were also homogenised by pounding using a mortar and pestle. The dry samples were preserved in laboratory cupboards at room temperature while the wet samples were refrigerated.

Corn (*Zeamays*) and its product (pap or *Akamu),* fresh milk (*Kindurumu*) and *Nono* were analysed for their carbohydrate content. *Parkiabiglobosa*, *Dawadawa* paste, *Kindurumu* and *Nono* were analysed for proteins. Soy bean seed (*Glycinemax*), soy-cheese (*wara)* and milk were analysed for lipids. The carbohydrate, lipid, protein and moisture contents before and after the fermentation process were thus taken. The flow chart below shows the traditional methods used in processing the substrates (raw materials) to the various finished food products.



Flow chart for the traditional fermentation processes used.

Apparatus

The apparatus used for the analyses of the samples include: Gallenkamp Hotbox oven (size2), Brainweigh B modelled weighing balance, table top bucket centrifuge and double beam spectrophotometer (UV. 2800 model).

Determination of Total Carbohydrates (as Sugars)

The method for determining the effect of traditional fermentation processes on the carbohydrate foods is the DNS colorimetric method. 0.2g of each sample was weighed into a boiling tube, cooled and 12ml of 10% NaOH was carefully added. It was mixed and filtered into a 100ml volumetric flask, washing the tube into the flask with distilled water. And was made up to volume with distilled water and mixed well by inversion.

Standard glucose solutions of 0.25, 0.5 0.75, 1.0, 1.25 and 1.5 mg glucose per ml by dilution of the stock glucose solution containing 15mg/ml, using distilled water and 100ml volumetric flasks was prepared. 1.0ml of distilled water was pipetted into a test tube (blank) and into 5 other labelled test-tubes. 1.0 ml of each standard glucose solution was pipetted (0.25mg-1.5mg). DNS reagent (1.0ml) and 2.0ml water to each tube using pippetes was added. The sample (1.0ml) prepared above was pipetted and 2.0ml water and 10ml DNS reagent was added. All tubes were heated in a boiling water bath for 5 minutes to allow the reaction between glucose and DNS to occur and cool; then each volume was adjusted to 20ml accurately with distilled water, using pipettes or a burette, and mixed well. The absorbance of each solution at 540 nm was read calculated thus:

Available carbohydrates in cereals (as glucose) = C× 10/W

Where C = concentration in mg of glucose per 20ml, and W = weight of sample used (g).

Protein Determination by Biuret Method

The specific modified method by Amadie et al. (2004) was used. Serial dilution of the standard protein solution was made: egg albumin in the range 0-2.5 mg/ml. This was done by measuring the standard albumin in the range of 0.0, 0.5, 1, 1.5, 2, and 2.5mg, and with 0.2N of NaOH making them up to 1ml. Biuret reagent *(*3ml) was added into each test tube, mixed and warmed for 15 minutes at 37°C and cooled. The absorbance of each tube was measured at 540nm.

Each food sample (1g) was introduced into physiological saline (2ml), further diluted to 1 volume: volume with normal saline. To 1ml diluted solution was added 0.1% SDS (1ml) and 2ml chloroform was added which was then vortexed for 10 seconds followed by centrifugation at 1800g for 5 minutes. The extract (supernatant) was taken (1ml) and 4ml biuret reagent was added and vortexed and allowed to stand for 20 minutes and read at 540nm within 10 minutes and calculated below. Available proteins in samples (as egg albumin) = C× 50/W. Where C = concentration in mg of glucose per ml, and W = weight of sample used (1g).

Determination of Total Lipids

The lipid fraction includes fats, phospholipids, sphingolipids, waxes, steroids, terpenes and fat-soluble vitamins. In real terms, fat makes up 99% of the lipid fraction of food.

While Bligh- Dyer (1959) technique was used for wet samples, Isopropanol (IPA) determination was used for the powdered soy bean as described by Lam and Proctor (2001). Soy powder (1g) was vortexed for 4 minutes in 5mls of IPA. The extract was centrifuged at 2500 revolutions per minute for 10 minutes. The weight of the lipid was determined after evaporating the solvent on a hot plate at the lowest setting. For each sample (1m), 3.75ml1:2(V/V)$CHCl_3$: Methanol was added and well vortexed (5minutes)and 1.25 $CHCl_3$ and vortexed for 5 minutes with 1.25 ml distilled water and vortexed for another 5 minutes. The resultant was centrifuged at 3000rpm with a tabletop bucket centrifuge for 15minutes at room temperature to give a 2 phase system (aqueous top and organic bottom). The bottom phase containing the lipid was recovered carefully using a micro-pippette. Weight was determined after evaporation. Percentage composition of lipid= (weight of dry flask containing sample -weight of dry clean empty flask)/weight of sample X 100

Moisture Content Determination

The moisture content was determined by drying the sample to a constant weight, and the water content was expressed as percentage by weight of the dry sample. Each of the samples was weighed (1g) in a crucible placed on a zeroed weighing balance, dried in the oven for about 24 hours at 100oC, cooled in the desiccator, and weighed again. The sample's moisture content was calculated using the following equation: %W = (A/B) X 100. Where A = weight of wet sample in grams. B = weight of dry sample in grams.

Statistical Analysis

The statistical analysis was done using the mean and standard deviation formulae, charts and graphs.

Mean $(\bar{x})=\sum_0^n x/n$

Standard deviation (SD) $=\sqrt{\sum_1^n(x-\bar{x})}2/n-1$

Results and Discussion

Carbohydrates (as Sugars) in Samples

Table 2: Standard Glucose Reading

s/n	Conc.(mg/20ml)	Absorbance@540nm
1	0.500	0.3400
2	1.000	0.6859
3	1.500	1.0137
4	2.000	1.3344
5	2.500	1.5187

Values are expressed as mean.

Table 3: Percentage Carbohydrates in (Substrates e.g. corn powder) Samples before and (final products e.g. *akamu*) after fermentation:

	Corn powder	***Akamu***	**Fresh milk**	***Nono***
	56.23± 9.09	**7 .63± 2.67**	**42.3± 1.60**	**11.99± 2.67**

Values are expressed as mean ± standard deviation.

The noticeable falls in the percentage carbohydrate contents during the conversion of corn to *Akamu* and fermentation of cow milk to *Nono* (Table 3) were mediated by many factors. For example, microbial activities are paramount in the breakdown of carbohydrates to ethanol in the fermentation process. There will also be addition of water during processing. Since carbohydrates (especially simple sugars) are primary energy metabolites, the loss in the carbohydrate content could be due to (the hydrolytic activity of the microbial enzymes into simple sugars and) the using up of the available sugars as energy source for the growth and reproduction of the fermentation microbes. The physical cause for the loss in the percentage total carbohydrate content could be in the traditional fermentation processes that allow for increased content water to the processing substrate into the fluid state of the product. With increased amount of water in the same substance, there will also be a percentage fall in the other nutrients (Egwim et al., 2013).

Proteins in Samples

Table 4**:** Standard (egg) Albumin Reading

s/n	Conc.(mg/20ml)	Absorbance @280nm
1	1.500	0.200
2	1.250	0.213
3	1.000	0.123
4	0.500	0.070
5	0.250	0.050

Values are expressed as mean.

Table 5: Percentage of Proteins in Samples

s/n	*Parkia b.* seed	*Dawudawu*	**Fresh milk**	***Nono***
1	31.62± **0.83**	34.17± **3.6**	25.25± **0**.59	37.74± **1.8**

Values are expressed as mean ± standard deviation.

In Table 4, in the fermentation of protein foods there was an increase in the percentage protein in the traditional manufacture of *dawudawu* and in *Nono.* This is probably due to the increase secretion of microbial enzymes such as cabohydrases, lipases, as well as the release of proteinacious substances from the sample by fermentation and indirectly by the loss of the other food macro-nutrients during the process. The physical processes that possibly helped increase the percentage yield is in the dehulling since more proteins are rather concentrated in the seed leaves than in the hulls. This increase is in agreement with the reports of Filli, et al. (2010).

Percentage Lipids in Samples

Table 6: Percentage Total Lipids in Samples

Soybean powder	Soy milk	*Soy wara*
41± 7	5.6± 2.2	7.6± 2

Values are expressed as mean ± standard deviation.

Table 6 shows the percentage total lipids in samples. Like in the carbohydrates, the drastic reduction of total lipids can be attributed largely to increased addition of water

during the fermentation procedure and increased microbial lipase action that hydrolysed the fat, thereby reducing their content.

Table 7: Moisture Content (%)

Sample	*Akamu*	*Nono*	*Dawadawa*	Soymilk	Soy*wara*
Substrate	9.00 ± 0.00	89.0± 0.58	13.0± 0.87	5.0± 0.00	5.0± 0.0
Products	90.0± 0.70	92.7± 0.98	33± 0.00	39± 1.41	31 ± 1.4

Values are expressed as mean ± standard deviation.

Table 7 shows an increase in the moisture content as expected, Nono having the highest content due to increased water involved during the fermentation processes. Thus the observed changes in the percentage nutrient (and water) content can be either of biochemical and/or physical cause and can be attributed to fermentation and its agents. All these results above follow the same trends in other literature reports for fermented food products like Cheese (Thao et al., 2017), *Ogi* or pap (Ikese, et al., 2017) *Dawadawa* (Adeyeye, 2011), *Ugba*, *Nono* and *Iru* (Eka, 1980), and other fermented diets (Egwim, et al., 2013).

Conclusion

From the results obtained, it can be concluded that fermented foods are relatively low in carbohydrates and lipids but high in proteins (when compared to their substrates). The high protein content may be useful in the management of diseases relating to protein under-nourishment like kwashiorkor while the reduced carbohydrate and lipid levels can help in the management of disease conditions where only little of the dietary intake of the respective nutrient is required, for example diabetes and arterial sclerosis.

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Chapter Thirteen

TEACHING ECOLOGICAL CONCEPTS IN CHEMISTRY EDUCATION IN SENIOR SECONDARY SCHOOLS IN NIGERIA: IMPLICATIONS FOR THE CHEMISTRY TEACHER

Oshonebu Sule Egya

Introduction

Science is discovering. Science is a dynamic human activity concerned with the working of the world. This understanding helps the scientist probe further into nature of things and events and control and harness such things and events for the benefit of humankind (Ogunniyi, 1986). Science is an attempt by human beings to organise their experiences about nature into meaningful explanations (Otuka & Uzoechi, 2009). Science is concerned with the search for knowledge and understanding of the physical world and man's attempt to understand the universe. According to Idoko (2011), science is a body of knowledge arrived at and accumulated by following some well-known procedures generally referred to as scientific method. The scientific method comprises four main phases: observation, formulation of hypothesis, making a prediction based on hypothesis and experimental test of hypothesis. Bajah (1982) simply defined science as the study of our environment. Environment is a natural world of living and non-living things and the global scheme of water, air and soil. Chemistry is a science subject that deals directly with the environment. It is science of molecular behaviour. It deals with composition, properties and uses of matter (Ababio, 2016). It cannot be isolated from human life. Chemistry finds application across every sphere of human life, both in the area of food, shelter, clothing, transportation, among others. It occupies a pivotal position in science education. According to Njoku (2004), the enviable position which chemistry occupies in the educational system is perhaps justifiable in the sense that chemistry can exert a dominant if not decisive influence on the life of individuals in the area of industry, agriculture and infrastructure as well as the development of the nation.

Chemistry plays a pivotal role in the industrial set-up (e.g. fertilizer, petroleum, cement, pharmaceutical) and the execution of other professions (e.g. engineering, agriculture, medicine) and improving citizenry quality. Nwaka, Egbo and Okechieke (2016) asserted that virtually no production process involves one aspect of chemical process or chemical principle employed in the oil refineries, petrochemical industries, and manufacturing industries. It is the backbone of the chemical industry, mainly concerned with providing material and processes that support human needs and make human life meaningful. Most of the waste products and pollution generated from these industries in an attempt to make life comfortable for humans are harmful to life. They have equally made the environment unclean and endangered the lives of plants and animals, thereby altering the ecosystem, which the humans depends mainly on for basic life support service. The interaction of man and his environment has resulted in an imbalance within the ecosystem (Ogunbiyi, 2007). An ecosystem is a community made up of living organisms and non-living components such as air, water, and mineral soil.

In this paper, an attempt is made to discuss some of the ecological concepts in chemistry education, how human activities disrupt the ecosystem through pollution, the role of a chemistry teacher in teaching ecological concepts in secondary school chemistry and the challenges to effective teaching of secondary school chemistry in Nigeria.

Ecological Concepts in Chemistry

Ecological chemical reactions are the result of interaction among human and their physical and chemical environment. Certain common chemical substances are kept fairly constant in this interaction process, except otherwise disrupted by human activities. Some of the natural compounds of environmental significance include oxygen, water, carbon (IV) oxide, and nitrogen. The studies of some of their cycles are very crucial to the ecological balance of the environment.

Oxygen Cycle

Oxygen cycle portrays how the flow of oxygen occurs through several parts of our vast ecosystem. Oxygen is found in several parts of our vast ecosystem: the air we breathe (Atmosphere), the water bodies on the planet (Hydrosphere), inside the biological beings (Biosphere) and inside the earth's crust (Lithosphere). Oxygen is consumed in

the form of burning or oxidation of organic matter like oil, coal and others contained in ancient sedimentary rocks. Modern organic material burning also consumes oxygen as oxidative decay of vegetation in soil and even in the respiration process. In geological exploration, oxidation of reduced inorganic species also occurs, such as iron (II) bearing minerals exposed by erosion and reduced gases from volcanic activity. The major way of returning oxygen to atmosphere is through photosynthesis. Photosynthesis is a process of synthesising food when terrestrial and marine green plants use water and bring back oxygen to the atmosphere.

Effect of Oxygen Cycle

Residence time of atmosphere oxygen is given as 7600 years (Garrels, Lerman and Mackenzie, 1976), implying that large consumption of oxygen should not significantly affect depleting oxygen reservoir. It has also been used to determine spatial variability of atmosphere gases on a global scale. Residence time is also interpreted; in this case, representing the minimum time O2 reservoir can be exhausted assuming constant recuperation through photosynthesis. However, man's activity has betrayed this expectation. Processes such as burning fossil fuels, large-scale deforestation, and destruction of vegetation for building and desert encroachment have had direct bearing on the depletion of the reservoir of oxygen. Obstruction of the photosynthesis process by anthropogenic influence therefore constitutes a potential calamity. The envisaged problem is more of starvation which is triggered off than the inadequacy of oxygen that also results. In either case, man is at a receiving end. Oceanic and terrestrial reservoirs of oxygen are more affected by depletion. This spells doom for living organism inhabitants.

Carbon (IV) Oxide Cycle

Carbon (IV) oxide is introduced into the atmosphere by respiration and other combustion forms, organic materials and fossil materials such as coal and petroleum. It is drawn from the atmosphere through the process of photosynthesis. The exchange of carbon (IV) oxide is mainly through degassing or dissolution. This is done between water and the atmospheric environment.

Effect of Carbon (IV) Oxide

The residence time of carbon (IV) oxide is put around 20 years. Low residence time indicates that there is rapid depletion of its reservoir (Woodwell, 1978). Human activities over time introduce a reservoir that increases the amount of carbon (IV) oxide present in the atmosphere. This is by burning of fossil fuels and other reactions, which emit carbon (IV) oxide. This result in the presence of more carbon (IV) oxide and has climate implications. Radiation from the solar energy is trapped in water vapour, ozone and carbon (IV) oxide. Carbon (IV) oxide absorbs radiation at longer wavelength. The heat reflected from the earth's surface is at a longer wavelength than the incoming solar radiation because the earth's surface temperature is cooler. This reflected heat is absorbed by carbon (IV) oxide and partly re-radiated back to the surface. The earth atmosphere becomes warmer since less heat is re-radiated to the outer space. This is the greenhouse effect, which result to global warming. In this regard, the carbon (IV) oxide is said to be at pollution level. There is also the dissolved carbon (IV) oxide (H_2CO_3). This is the carbon acid. It is formed when rain washes down the carbon (IV) oxide gas leading to an acid rain situation. Other forms of carbon whose presence in the atmosphere have detrimental effects on the environment are carbon monoxide and soot. Carbon monoxide is the choking gas produced during the incomplete combustion of gasoline in vehicle engines or industries. Carbon monoxide harms human beings in that it interferes with oxygen transport in the body.

Nitrogen Cycle

Nitrogen is one of the primary nutrients for the survival of all living organisms. It is a necessary component of many bimoleculars, including protein and chlorophyll. Although nitrogen is abundant in the atmosphere as nitrogen gas (N_2), it is largely inaccessible in this form to most organisms, making nitrogen a scare resource and often limiting primary productivity in many ecosystems. Only when nitrogen is converted from nitrogen gas to ammonia (NH_3) does it become available to primary producers, such as plants. In addition to N_2 and NH_3, nitrogen exists in many different forms, including both inorganic and organic forms. Thus ammonia undergoes many different transformations in ecosystems, changing from one form to another as organisms use it for growth and, in some cases, energy. The reaction processes involved in the nitrogen cycle are combustion and the effect of lightening, evaporation, mineralisation, dentrification and fixation.

Effect of Nitrogen

The application of fertilizers in agricultural settings to crops and plants brings about excessive run-off of nitrogen into the streams or lakes, rapidly increasing the algae population, which subsequently deplete other important nutrients like phosphorus in the water environment. These algae themselves die and the decay of their cell materials through aerobic process reduces the oxygen content of water, leading to eutrophication, whereby fish and other oxygen-dependent organisms are destroyed.

Sulphur Cycle

Sulphur element is introduced to the environment naturally. Human activities have over the time added more artificially. The atmospheric form of sulphur is obtained as sulphur (IV) oxide (SO_2) gas and hydrogen sulphide (H_2S) gas, whereas the hydrosphere and the lithosphere form of sulphur exists as acid and in complex organic contents like coal, vegetation, crude oil, etc.

Effect of Sulphur Cycle

Human activities have increased the emission of sulphur (IV) oxide to the atmosphere through the combustion of fossil fuel, coal, wood, etc. The washing of sulphur (IV) oxide present in the atmosphere results in an acid rain situation. Acid rain is harmful to plants and animals, buildings and metal structures. Sulphur (IV) oxide is probably most dangerous atmospheric pollutants being one of the major constituents of photochemical smog. Photochemical smog is a complex meteorological phenomenon, which is an accumulation of various gaseous and particulate pollutants. The sulphur (IV) oxide pollutants in the smog cause respiratory irritation as well as obscure visibility. Other constituents of photochemical smog are ozone, oxide of nitrogen, ammonia, soot, methane, etc.

How Human Activities Disrupt the Ecosystem

The alteration of cycles of chemical concepts above can lead to the alteration of the ecosystem mainly through pollution. Pollution is the process of releasing substances into any of the environmental mediums capable of causing harm to man or any other living organisms supported by the environment. The introduction by man directly or indirectly of substance or energy into the environment results in deleterious effects of

such a nature as to endanger human health and the ecosystem. There are different types of pollutions such as air, water, soil, radioactive, light, noise and heat. All kinds of pollution have impact on the ecosystem. For the purpose of this paper, focus will be on air, water and land pollution.

Air Pollution

The atmosphere surrounding the earth contains air. Air is a mixture of gases, composed mainly of nitrogen and oxygen, with small amounts of carbon (IV) oxide, noble gases and water vapour. A delicate balance of nature determines the composition of the air we breathe in. Process such as photosynthesis, respiration, combustion and decay play an important role in the balance of the ecosystem. Many human activities increase the amount of carbon (IV) oxide in air and introduce undesirable substances known as pollutants into air. Within limit, the natural process can remove the pollutants. Over the last few decades, industrialisation has caused tremendous increase of pollutants into the air. Some of the sources of air pollution are as follows:

a. Biomass combustion
b. Bush burning
c. Refuse burning
d. Industrial emissions
e. Traffic emission

Biomass Combustion

Biomass in form of firewood, bamboo trunks and dead leaves are common sources of cooking fuel in most villages in Nigeria. Firewood is frequently used. The combustion of firewood releases gaseous pollutants and particulate matter. From literature the gaseous pollutant from cooking emissions are carbon (IV) oxide (CO_2), carbon monoxide CO, sulphur (IV) oxide SO_2, nitrogen (IV) oxide NO_2, volatile organic compounds VOCs and particulate matter. The particulate matter generated in the form of carbon black, soot, and fly ash is a major component of smoke.

Bush Burning

Bush burning is a common phenomenon in Nigeria. Most time bush burning is done prior to land cultivation as one of the initial steps of land preparation. This constitutes part of the pre-planting preparation. The process of bush burning leads to the release

of various types of gaseous pollutants and particulate matter. Most times, the gas stream is inundated with volatile organics, oxides of carbon (COx), oxides of nitrogen (NOx), and oxides of sulphur (SOx), depending on the fuel composition and intensity of the flame.

Refuse Burning

Refuse disposal is a significant problem in Nigeria, especially in urban areaa. The refuse is usually from multiple sources, including domestic, municipal, agricultural, and industrial sources. One method of managing waste in Nigeria is by open burning either on nearby lands or open dumps within residential vicinities. The composition of the refuse, age of the dump, and the flame's intensity usually determine the nature of the air pollutants. Oftentimes, the air within refuse burning sites is inundated with oxides of carbon (COx), oxides of sulpur (SOx), oxides of nitrogen (NOx), volatile organic compounds VOCs, among others.

Industrial Emission

There are different processing and manufacturing industries in Nigeria, such as refineries, petrochemical industries, chemical fertilizer, paper, cement, food industries, wood, and textile industries. All the industries emit various kind of air pollutants such as carbon (IV) oxide, methane (CH_4), sulphur (IV) oxide (SO_2), nitrogen (IV) oxide NO_2, nitrogen (II) oxide NO, ammonia (NH_3) and volatile organic compounds VOCs.

Traffic Emission

Traffic emission is produced by vehicles. Vehicular emissions account for a huge source of urban air pollution in Nigeria. Most automobiles in Nigeria are run with combustion engines mostly mechanically worn out and therefore emit overbearing quantities of fumes from their exhaust. Automobiles in Nigeria use hydrocarbon fuel like premium motor spirit (gasoline) and gas oil (diesel) to run their engines, and they emit carbon (IV) oxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), sulphur oxides(SO_x) in the atmosphere. Carbon monoxide is a very toxic air pollutant, frequently associated with automobiles because of the ground level discharge of exhaust fumes and heavy exhaust buildup during traffic congestion. The increase in the number of fairly used cars, trucks, trailers and tankers with worn-out engines plying the rural and urban centres in Nigeria, as in many African countries, has

resulted in an increased amount of automobile exhaust fumes released into the environment (FEPA, 1991).

Smog

Smog, which mainly occurs from air pollution, can be defined as a mixture of various gases with dust and water vapour. The atmospheric pollutants or gases that form smog are released in air when fuel is burnt. When sunlight and heat react with these gases and fire particles in the atmosphere, smog is formed. Smog is purely caused by air pollution. Smog can cause or aggravate health problems such as asthma, bronchitis, other respiratory problems, and eye irritation. Smog can also cause harmful effects on the vegetation.

Control of Air Pollution

Some methods of controlling air pollution are:

a. Passage of strict laws on factories and industries and ensuring they are complied with.
b. Creation of awareness on the causes and dangers of pollution.

Water Pollution

Water is one of the most common substances known. It is good solvent for many substances and rarely occurs in pure form in nature. Sources of water include rain, springs, rivers, lakes, wells and the sea. Rain is the purest form of natural water because it is formed due to the condensation of water vapour in the atmosphere. Water pollution is mainly caused by the release of harmful materials into water bodies rendering them unsuitable for human and animal use. So to say, water pollution is caused by the indiscriminate dumping of solid and liquid waste into water bodies. The common water pollutants are:

a. Refuse and sewage
b. Industrial and agricultural waste
c. Crude oil spill

Refuse and Sewage

It is a common practice for most inhabitants of villages and towns located near streams and rivers to dump refuse and human waste into the streams and rivers for easy

disposal in Nigeria. With the use of water-closet (WC) lavatories, human water and the liquid from these lavatories are emptied either into septic tanks or sewers. (Sewers are large underground pipes for carrying wastes or sewage). In most cases, sewers empty the waste directly into rivers and seas without treatment. The waste is mostly organic matter. It is broken down into simple substances by decomposers, mainly bacteria. In the process, the bacteria use up the dissolved oxygen. Too much waste/sewage in water bodies can cause an increase in the bacteria population. This reduces the oxygen level in the water. If the oxygen level falls too low, the aquatic organisms start to die and eventually, the water body becomes clogged up and foul-swelling.

Industrial and Agricultural Waste

Many factories and industries empty their chemical wastes directly into the stream, river or sea without converting them into harmless substances. This chemical includes acid alkalis, mercury compounds, organic solvents, and detergent, among others. Fertilizers, herbicides and insecticides used in agriculture are washed by rain into the soil and eventually find their way into streams, rivers and seas. Many chemical wastes like detergents and insecticides are non-biodegradable. They remain in water and cause harm to the aquatic life. Mercury compound tend to accumulate in the body of aquatic organism like fish.

Thermal Pollution

Several industries like the refineries, steel mills, breweries, food processors, and rubber industries, among others, use water for cooling. Usually, water from a nearby river or stream is pumped in and used for the cooling process. The resulting warm water is emptied back into the river or stream. This causes an increase in the water temperature; as a result, less oxygen dissolves in it.

Crude Oil Spill

An oil spill is the release of liquid petroleum hydrocarbon into the environment, especially in the marine ecosystem, due to human activity. Oil spills may be due to release of crude oil from offshore platforms, drilling rigs, wells, tanks and leakages from hydrocarbon pipelines. The spillages resulting from tanks and pipelines result from a lack of regular maintenance of the pipelines and the storage tanks. Some of the facilities have been in use for decades without replacement. Sabotage is another

major cause of oil spillage in Nigeria. Some citizens in collaboration with people from other countries, engage in oil bunkering. They damage and destroy oil pipelines in order to steal oil from them. In Nigeria, oil spill mainly happens in the Niger Delta region. The oil floats on water, kills most marine lives, and makes the water unfit for human use. Cleaning up of large oil spill is an extremely expensive process. In Nigeria, fifty percent (50%) of oil spill is due to corrosion, twenty-eight percent (28%) to sabotage and twenty-one percent (21%) to oil production operation, one percent (1%) of oil spill is due to engineering drills, inability to effectively control oil well, failure of machines and inadequate care in loading and unloading oil vessels (Peter & Olusegun, 2006)

Other sources of water pollutants are:

a. Dumping of plastic materials such as bottles, polythene bags, and rubber parts/materials into water bodies.
b. Acid rain; sulphur (IV) oxide and nitrogen oxides react with water in the atmosphere producing sulphuric acid and nitric acid. These acids come down with the rain. This phenomenon is called acid rain. The pH of acid rain varies from 3 to 6.

Control of Water Pollution

Some methods of controlling water pollution are:

a. Refuse should be buried or burnt in incinerators with in-built devices to prevent air pollution.
b. Sewage should be processed, treated and converted to useful fertilizers in sewage plants.
c. Chemical wastes should be converted to harmless biodegradable substances before being dumped in the sea.
d. Safety measures must be implemented to prevent a crude oil spill.
e. Strict laws must be passed to control water pollution by individuals and companies.
f. The use of plastic materials should be reduced. In addition, the government should put areas in place where used and damaged plastic materials can be recycled.

g. Education is also an essential anti-pollution measure. It makes each of us aware of the dire consequences of polluting our precious water supplies. This knowledge acts as a major preventive measure in controlling water pollution.

Land Pollution

Land pollution is the degradation of land by man through harmful activities like dumping harmful materials such as chemical input that are dangerous to the environment. Some of the causes of land pollution are deforestation and soil erosion, agricultural activities, mining activities, overcrowded landfill, industrialisation, construction activities, sewage treatment and nuclear waste.

Teaching Ecological Concepts: The Role of Chemistry Teacher

A teacher is a person who impacts knowledge to a learner. A teacher can be referred to as a catalyst that brings about change in students' or learners' behaviour or learners. He/she plays a central role in the actualisation of educational goals. He does this through his method of teaching. Methodology is vital in any teaching situation. Some teaching methods involve the learner and add meaning to everyday life. Chemistry is in everyday human life; therefore, it should be taught with methods that will help learners to learn better and make good use of it, in that the method adopted by the teacher may promote or inhibit learning. In chemistry teaching, teachers are expected to have competence and mastery of the subject matter before introducing it in the classroom. Teachers need to develop the interest and the attitude of the students with regard to the subject through the method. There is a variety of methods for teaching chemistry. The methods and contents of science emphasise guided inquiry, field trips, guided discovery, laboratory technique and activity-based learning (FGN, 2013). In Nigeria, the instructional method used by teachers for teaching chemistry is heavily premised on the conventional method. Fatokun, Egya & Uzeochi (2016) reported that 60% of Nigeria secondary school chemistry teachers use the conventional method in teaching in chemistry classroom. The conventional method is teaching where the teacher gives information regarding various concepts and the learner only listens. Researchers believe that theory is taught as an absolute knowledge with the conventional method; hence student-centred activities for developing scientific reasoning, skill processes are lacking. Fatokun, Egya & Uzeochi (2016) maintained that chemistry should be taught with methods in which current ideas and innovations are

introduced into it and that merely teaching chemical concepts in the classroom may not be enough to achieve the desired mastery of the concepts. Teaching ecological concepts in chemistry with field trip could be helpful in this regard. Field trip is a method of teaching that involves taking the students on an excursion outside the classroom to make relevant observation necessary for understanding the concept under study. Oftentimes, such trips/excursions enable students to obtain scientific and technological information. Field trip offers students firsthand experience since they see and observe processes in natural settings. Field trips are rich in educational possibilities as students learn from actual hands-on experience rather than by simply reading or hearing about something. The key to success in science is providing students with a science immersion of experience and enabling them to conceptualise science as a creative process. According to Yusuf (2011), the most natural learning is realised through personal experience. Students involved in their work will make them learn and enjoy it. According to Ilori (2010), field trip is a method of teaching that involves taking the students on an excursion outside the classroom to make relevant observations necessary for the topic under study. According to Muoneme (2018), field trip is an important component of science teaching, which involves taking students outside the classroom to make relevant observation and obtain some specific information. It could be a nearby school farm, national park, zoo, geological area, manufacturing industry, or factory. Field trip is an outdoors type of laboratory activity or learning exercise undertaken by teacher and students in a particular aspect of a subject to allow students to acquire knowledge. Field trip offers direct observation and interpretation of the substance in the surrounding.

A central component of Piaget (1962) development theory of learning and thinking involves the learner's participation. He said knowledge is not merely transmitted verbally but must be constructed and reconstructed by the learner. Piaget asserted that for a child to know and construct knowledge of the world, the child must act on objects and it is the action that provides knowledge of those objects, as the mind organises reality and acts upon it. Since field trip involves taking the students or learners to the natural environment of the object(s), the learner has the ability to act on the object(s) by observing and identifying the object(s) in a natural environment. Piaget stressed the interaction between the individual's level of maturation and the environment that offers the right experiences. Piaget believed that thought is an internalised action (1971). This would imply that the product of learning needs to be

produced through an individual acting and exploring the environment. In support of Piaget, Brunner (1960) held the view that learning occurs by self-discovery. The students are exposed to basic concepts to discover things for themselves. In chemistry, during field trips, students are exposed to real world situation and current happenings in their environment. Based on the preceding, teaching and learning ecological concepts in secondary school chemistry may be anchored on the aforementioned learning theories.

Challenges to Effective Teaching of Chemistry in Secondary School

In Nigeria today, some issues and challenges are militating against effective chemistry education in secondary schools. Some of these challenges are:

1. Insufficient and dilapidating infrastructure: With explosion in students' population, most public secondary schools do not have classroom to accommodate students. There are no enough tables and chairs for sitting.
2. Lack of laboratory and obsolete equipment: Most of the public secondary schools in Nigeria are without laboratories. Even in a school where you find a laboratory, it is either not functioning or no chemicals to carry out practical lessons. The few available types of equipment in some schools are either obsolete or broken down due to lack of maintenance culture in Nigeria.
3. Overcrowded classroom: Chemistry classrooms are normally overcrowded.
4. Over-reliance on imported materials/technology which has the nation technologically undeveloped.
5. Low funding: despite the goal of science education which has been stated in the national policy of education, science education is poorly funded.
6. Poor learning environment: The physical environment in which chemistry students take lessons in most public schools is pathetic. The problem could be in form of dilapidated classrooms, overcrowded classes and poor ventilation.

Conclusion

Chemistry is an integral part of our society. In a bid for chemistry to solve humanity's problems, it has contributed positively and negatively. Human actions contribute to making the earth a difficult place to live in. Our environment is constantly changing. We should become aware of the problems that surround our livelihood, air, water and land pollutions resulting from human activities. The chemistry teachers as custodians

of chemical knowledge have a key role to play in our schools. Chemistry teachers should use natural and urban environments as laboratory for discovering, observing, demonstrating, experimenting, and testing concepts. Chemistry teachers should teach ecological concepts by linking them to the processes in nature and everyday life situation, making students curious and interested in natural phenomena and making us aware about the consequences of our activities and actions on the ecosystem.

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Chapter Fourteen

NIGERIAN POPULAR MUSIC NARRATIVES ON SOLID WASTE IN LAGOS STATE, NIGERIA

Aduloju Abimbola Adenike
Olusegun Stephen Titus

Introduction

Music is deployed as a cultural and communal act in many African societies today. The place of music in every segment of life connotes our emphasis as it is developed in festivals, religious gatherings, health and healing centres. Music is performed with a wide range of instruments and vocal techniques ranging from singing to rapping. As a result, music can reveal much about a people and their way of life. This means that music is strongly influenced by culture, tradition, and the environment and, as a result, music is directly associated with the traditional religious and political systems. Music generates social experiences that go deep and serve as a link that binds each ethnic group and society, giving everyone a sense of belonging.

Ecomusicological theory informs this study because it emphasises the triangularity of culture, environment, and human beings (Allen and Dawe, 2016). There are various applications of the term 'ecomusicology' in existing scholarship. These include Titon (2016) who sees ecomusicology as the study of music, sound and nature in a period of environmental crisis. Pedelty (2012, 2013) argues that ecomusicology is the intersection of music and environment and provides new opportunities and challenges to music creators, new sonic experiences to audiences, new objects of study, and prompting revised perspectives to earlier works. Following a similar line of argument, Allen (2011) sees ecomusicology as the use of music and culture by a society to structure and classify the world in its own way, based on its view of nature, the supernatural, the environment and society. Titus and Titus (2017) have used the theory to examine popular music narratives on the environment on flood disaster in Ibadan, Oyo State, Nigeria; ocean degradation and oil exploitation in Niger Delta.

Environmentalism has occasionally been a topic in music since the 1940s. Musicologists and ethnomusicologists have focused on music and environmental issues and music educators are increasingly emphasising the intersection of music and nature. However, there are many artistes across the world who advocate for environmentalism such as Pearl Jam, Dave Matthews, Olamide Baddo, Adeolu Akinsanya. This study, however, focuses on the term solid waste, the music on solid waste in Lagos State.

According to the NYSDEC (Department of Environmental Conservation 2018), solid waste means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage. There are, however, songs that condemn the act of inappropriate disposal of such materials and are being used as a means of communication to individuals and government in general as a means of education and tool of awareness. Ecomusicology, therefore, relates to this subject based on environment and nature. Ecomusicology, as used in this paper, is not only in the context of music about environmental issues but that the music is an admonishment to the people. Ecomusicology within the confines of this research work borders around the music that addresses the various environmental issues and challenges faced by different people living within Lagos State. This study aims to examine musician engagement with environmental issues in Lagos State, analyse the structure of music on solid waste in Lagos State, and examine the function of music on solid waste in Lagos State.

Lagos City and Its Environment

Until 1975, Lagos City was the capital of Lagos State, and until December 1991 it was the federal capital of Nigeria. Ikeja replaced Lagos as the state capital, and Abuja replaced Lagos as the federal capital. Lagos, however, remained the unofficial seat of many government agencies. The city's population is centred on Lagos Island, in Lagos Lagoon. Lagos (Yoruba: Èkó) is the largest city in Nigeria, as well as on the African continent. In 1960, Lagos became the capital of independent Nigeria. After 1975, a decision was taken to create a new national capital, centrally situated in Abuja, to replace Lagos, which by then suffered from slums and environmental pollution. It is

one of the most important homes of afro beats. City artists and performers deeply feel the social, political, and environmental issues facing Nigeria, and a new generation has expressed these issues in films, plays and songs. Overall, Lagos is gaining the formal structures it needs for its many burgeoning creative industries to do business in the wider world. The music of Nigeria includes many kinds of folk and popular songs that address different issues in the country. The sub-urban lagoon coastal environment of Lagos, like any other marine environment, is not immune to the problems of environmental pressures.

In Lagos State, solid waste has become the number one serious environmental problem facing the country with its consequent effects on the pollution of water, air and land, not to mention its hazards to women's health and their social well-being (Uchegbu, 2002). The problem of solid waste in our urban and rural areas can be said to be a recent development. The oil boom era with its high pace of consumption and population opened the floodgate for serious waste generation. Now, virtually all major cities and towns across the country are faced with the problems of solid waste management. In Lagos State, for instance, these heaps limit the roads to single narrow lanes, resulting in perennial traffic jams as well as the production of offensive odour. Apart from that, several communicable diseases such as typhoid, dysentery, cholera, malaria, yellow fever, and relapsing fever that affects women are associated with improper disposal of wastes. The transmission mode can either be through biological vectors, physical and mechanical means, the air, water supply, food supply, direct contact, or other means related to the socio-economic status of women and their households. In addition, water supply by leaching and run-off during rains and others may kill valuable and rare vegetation of wildlife (Uchegbu, 2002). As women who are engaged in street markets spend most of their time at homes where these eyesores litter, there is the possibility that this may affect their health and socioeconomic well-being. In the realisation that inadequate solid waste management's environmental and public health implications are considerable, Nigeria urgently needs institutional, attitudinal, and infrastructural reforms to tackle solid waste problems in Lagos State effectively.

Popular Music and Environmental Sustainability

Some musicians have composed songs on nature and environmental sustainability. Such performers include Olamide Adedeji, a popular Nigerian musician, born on 15 March 1989 in Bariga, Lagos State. Olamide is known as the voice of the streets as his

music depicts the street hustles and lifestyle, which is a typical reflection of the life of an average Nigerian youth. Olayinka Sodipo, a drummer and band member of Olamide Adedeji, in a personal interview observed that Olamide is an indigenous rapper who is fluent in Yoruba and conversant with its culture and tradition. He further noted that Olamide's international recognition compelled him to add English and some other languages within the major tribes in Nigeria into his music. In 2017, Olamide released a song titled "Environmental makeover" sponsored by Sterling Bank to sensitize the entire community of Lagos regarding environmental sanitation. He said in the song that we can overcome various diseases by maintaining a clean and hygienic environment. As he noted in Yoruba, "imo toto lo le se'gun aarun gbogbo" which means "a clean environment translates into a healthy life."

An excerpt from Olamide's song:

Ohun ani lan nani 'Nani'	What you have is what you cherish
Spread love to your friends and family	Spread love to your friends & fam
Sterling environmental makeover	*Sterling environmental makeover*
All over the world, create great example	All over the world give an example
Imototo lo le segun arun gbogbo	Cleanliness is the cure to every dis
Imototo lo le segun arun gbogbo	Cleanliness is the cure to every dis
Imototo ile, imototo ara	Home and body cleanliness
Imototo lo le segun arun gbogbo	Cleanliness is the cure to every dis
[Bridge]	
Won ni ko gbale 'gbale',	You are encouraged to sweep
nule 'nule',	Mop the floor
fo ile 'fo ile',	and wash the floor
Repeate	Repeat
Won ni ko gbale 'gbale',	You are encouraged to sweep
nule 'nule',	Mop the floor
fo ile 'fo ile',	and wash the floor
Repeate	Repeat
Won ni ko gbale 'gbale',	You are encouraged to sweep
nule 'nule',	Mop the floor
fo ile 'fo ile',	and wash the floor
Repeate	Repeat

Won ni ko gbale 'gbale',	You are encouraged to sweep
nule 'nule',	Mop the floor
fo ile 'fo ile',	and wash the floor
Repeate	Repeat
stop shay be	Stop that

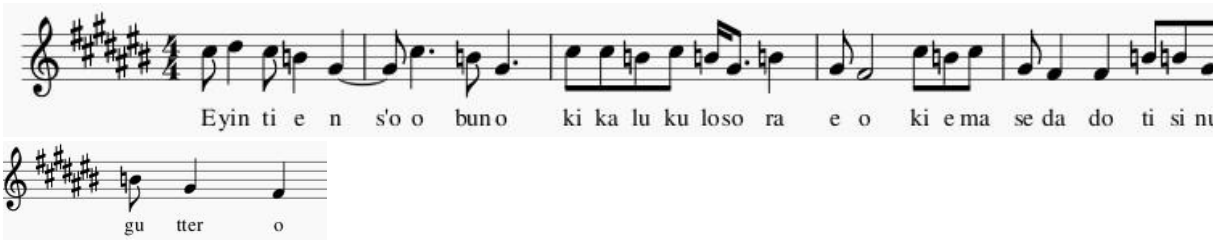
Olamide in the song above expresses the Yoruba adage of holding fast to values that could help increase eco-resilience and reduce anxiety. The song encourages personal, community and national responsibilities for environmental sustainability. The song further reminds us of the need to care and plan intentionally for the environment, noting that we are cohabitants and need each other to continue to exist as humans. The song also emphasises that the environment where we live is the only place we can survive since we do not have another planet. It advocates the removal of solid wastes from the surroundings and the city. He also mentions in the song how pertinent it is to treat with importance the environment we live in. Olamide proceeded on the project to create awareness which was the sponsors' intention. It is observable in the music video that the primary cast wore the LAWMA uniform, an agency of sanitation by the Lagos State government. In an interview with Yinka Shodipo, the music manager of Olamide, on 12 June 2019, he explained that:

> the song 'Environmental Makeover' came about as a result of Olamide Adedeji being a 'keep Lagos Clean ambassador' and he wrote the song so as to always perform it at their campaigns and rallies to sensitize the public about improper solid waste disposal.

Ayinla Kollington was born in 1953 in the city of Ibadan in Oyo State, Nigeria, although he hails from Ilota, a village on the outskirts of Ilorin, Kwara State, Nigeria. Between the mid-70s and late 80s, Kollington ranked with Barrister as the leading star of Nigerian fuji music – like *apala* and *waka*, a Muslim-dominated relation of juju, retaining that style's vocal and percussion ingredients but abandoning its use of electric guitars in order to obtain a more traditional, roots-based sound. Popular musicians like Olamide and Kollington made corrective statements in their songs that would reach out to the listeners. These songs have also been used to correct the listeners about their improper disposal of solid waste and its consequences and stop dumping refuse at the rivers to sustain and manage their environment. For instance, in one of the songs, Kollington addresses the listeners by saying:

E yin ti e n sobun o, eyin ti e n sobun o,	For those dirty community members

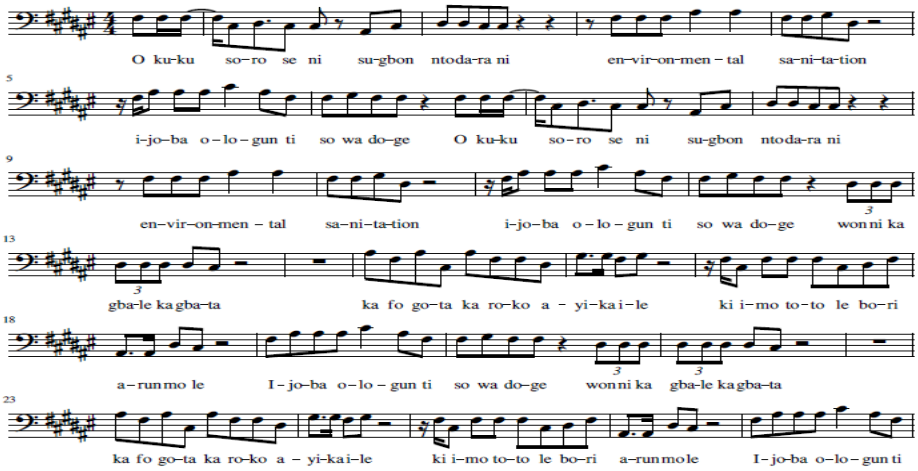
k i kalukᴜ lo so rare o,	you should have attitudinal *change*
Ki e maa se da 'doti si'nu gutter o	change and stop dropping dirt on the waterways



In a personal interview with Kollington Ayinla on 19 July 2019, he says:

> My music can serve as a great source of inspiration for people from various works of life and it goes without saying that music is pivotal to the existence of the human. More so, we feel music could help correct people to be responsible as far as solid waste management in our environment is concern.

Adeolu Akinsanya released a song titled "Environmental Sanitation" where he highlighted the health benefits of keeping a clean environment. He specifically encouraged his listeners to make it a way of life to maintain a hygienic environment. He opined that most of the health challenges people encountered stems from a dirty environment most of which can always be overcome by keeping the environment clean. This song by Adeolu Akinsanya derived its title from the environmental sanitation that is practised in Lagos State. This environmental sanitation is a monthly cleaning schedule for Lagosians whereby solid wastes are properly disposed, wastewater channels are cleared to ensure free flow and the general surroundings are kept clean. This is an order from the Lagos State government that ensures the state residents partake in keeping the state clean at all times. To ensure that this is thoroughly done, a government injunction restricts vehicular and people's movements during the monthly exercise. This is Adeolu Akinsanya's song:



O kuku soro se ni sugbon ohun to dara ni
Environmental sanitation

It is task, but it is a good thing

Ijoba Ologun ti so wa doge

The military regime has made us good looking

O kuku soro se ni sugbon ohun to dara ni
Environmental sanitation

It is a task, but it is a good thing

Ijoba Ologun ti so wa doge

The military regime has made us good looking

Won ni ka gba'le ka gba'ta

We are encouraged to clean our homes within and without

Ka fo gota, ka rook ayika ile

Clean the gutters and the surroundings

Ki imototo le bori arun mo'le

So that cleanliness will conquer every disease

Ijoba Ologun ti so wa doge

The military regime has made us good looking

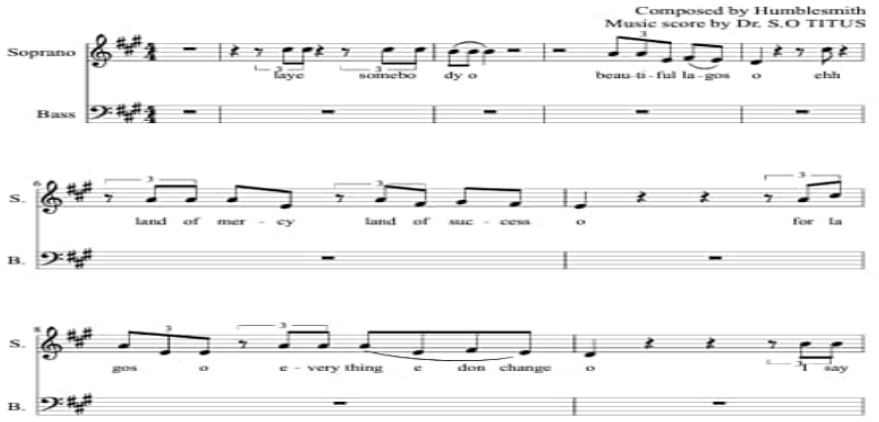
Won ni ka gba'le ka gba'ta

We are encouraged to clean our homes within and without

Ka fo gota, ka rook ayika ile	Clean the gutters and the surroundings
Ki imototo le bori arun mo'le	So that cleanliness will conquer every disease
Ijoba Ologun ti so wa doge	The military regime has made us good looking

According to Mrs. A.B. Oladipupo (October 2019, personal interview), "music has always been used to pass across messages where ordinary words are limited." She stated that "music has a way of making the central message interesting and easy to the ears but most importantly has a retentive power to educate on environmental issues." From the texts of the song and the interview conducted, it is critical to know that solid wastes are a phenomenal environmental pollutant that humans must work hard to contain and control. Lagos has experienced solid wastes, especially in areas like Ojota. And it is very horrible. There is the need to attend to some of these areas urgently. The song says the government policy to get rid of solid wastes in Lagos is good though the policy may not be too rosy for humans.

Ekenedilichukwu Ijemba, popularly known by his stage name as Humblesmith, is a fast-rising Nigerian afro-pop singer, songwriter, recording artist, stage performer, actor, and model. He is very handsome, gifted, skilful, creative, and talented. He was born on 14 May 1991 in Abakaliki, Ebonyi State in the south-eastern part of Nigeria. He sings mostly in Igbo, Pidgin and English. Humblesmith is one of the few artists that recognise the efforts of the Lagos State government to keep Lagos clean and beautiful always. In his song titled "Beautiful Lagos", he commended the efforts of the immediate past governor of Lagos, Mr. Akinwunmi Ambode, for the tremendous works he did in bringing out the beauty in Lagos and mentioned how these efforts had made Lagos State the land of mercy and the land of success. It had made it more conducive to transact business and also attractive to investors. This is the song:



Stanza 1

Beautiful Lagos o ehh	Lagos is beautiful
land of mercy land of success o	It is a land of mercy and success
for Lagos o everything e don change o	Everything has changed in Lagos
I say Governor Ambode is doing a great job	Governor Ambode is doing great
lale street light all over Lagos o	Electricity street light is now restored
its bringing out the beauty in Lagos	It is bringing out the beauty in Lagos
from 3rd Mainland to Ikeja no more traffic	Third Mainland to Ikeja is traffic free
Iyanoworo, Alakpere e don set o (laye)	There is a new road from Iyanoworo to Alapere

[Chorus]

A in't no place like Lagos o	There is no place like Lagos
Beautiful city	Beautiful City
A in't no place like Lagos o	There is no place like Lagos
Beautiful people	Beautiful people

Humblesmith said, "ain't no place like Lagos, beautiful people and beautiful city, beautiful Lagos." He used the music to redefine the state of Lagos, the environment, the roads, the improvement in the aspect of sanitation that some parts of Lagos are

already experiencing. The proper disposals of solid wastes in those areas make Lagos more beautiful.

Popular music is music that has been mass-produced and disseminated on local radio and television. However, the process of distributing the music to the local community by playing the record in community meetings, during festive times, and over radio and television is incredibly significant. Language is a system of communication consisting of a set of sounds and written symbols used by the people of a country or region for talking or writing. Language is the medium by which humans exchange knowledge, beliefs, opinions, wishes, threat, commands, thanks, promises, declarations, and feelings. Language is an exclusively human property. Language is an important asset that will promote a lifetime of effective communication. Due to the importance of language, as stated above, it can be noted that language plays a unique role in arts, culture, human occupations, etc. And as a result, language is part of music. The texts of any music are written in a language, making such music more relatable to people who speak and understand the language. The language used in the selected songs is *Yoruba*, *English* and *Pidgin English.* Yoruba is predominantly spoken in the south-western region of Nigeria, Pidgin is a simplified means of speaking the English language derived to enhance better understanding by non-native speakers. For instance, in "Environmental Makeover", Olamide Adedeji made use of Yoruba language when he said "*Imototo lo le segun arun gbogbo*" while in "Environmental Sanitation", Adeolu Akinsanya also made use of Yoruba when he said "*O kuku soro se ni sugbon ohun to dara ni.*" In "Beautiful Lagos," Humblesmith used Pidgin when he said"*for Lagos o everything e don change o.*"In "Environmental Makeover", the artist made use of English language when he said"All over the world, create great example" while in "Beautiful Lagos", the artist also made use of English when he said "It's bringing out the beauty in Lagos".

Structurally, the songs selected are composed in different keys, ranging from A Major to C Major. Also, the harmony of the songs is in seconds and thirds. The melodic movements are in steps and sometimes in leaps.

Conclusion

From this study, it can be concluded that music can be a tool and vehicle for environmental sustainability. Music as a medium for social awareness was used by various artists as seen from the study to inform the public about environmental

degradation issues, especially the ones that result from improper solid waste handling and disposal. Also, the songs selected for the study touched on the health dangers associated with solid waste mismanagement and how they can be prevented. This paper has argued for ecomusicology, not only in the context of music about the environment, but also that the music is an admonishment to people. Here, the music is also a reminder to people of how they have abandoned the care of the environment by throwing solid waste into the river, and the music is a reminder of how flooding in the past had devastating effects on people and their livelihoods. The study shows that music can be used for entertainment purposes while it conveys educational elements that can be used to sensitise the listeners about the happenings in their environment. This study also shows that there are limited songs that have been composed to tackle the menace of improper solid waste disposal and as such, this is the first formal documentation of those songs.

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