

SCIENCE FOR SUSTAINABILITY: ADDRESSING ENVIRONMENTAL CHALLENGES IN NIGERIA

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Abstract

Over the years, science has attained a somewhat hegemonic status as a both a discipline and an activity that makes life easier for the human race. This status has been maintained by the successes of scientific endeavours and innovations, and the fact that science is a progressive field endeavour seeking to reinvent itself. This paper analyses the most common of environmental challenges Nigeria as a country is faced with, and proffers ways through which these challenges can be mitigated by science. While science has made life easier, brought about many comforts and innovations, and has the potential to address environmental challenges, it has also contributed to a number of these challenges in the world today. The paper explores the role of science and its application – technology – in addressing these challenges and aims to contribute to a better understanding of Nigeria's environmental challenges, the scientific interventions necessary to mitigate them, and increase environmental awareness for environmental sustainability.

Keywords: Science, Environment, Pollution, Climate change, Environmental Sustainability.

Introduction

As with many parts of the world, there are a significant amount of environmental challenges in Nigeria today. These environmental challenges pose a threat to Nigeria's human and non-human populations, economic development, natural resources, and indeed its sustenance and continued existence. A number of factors have contributed to the myriad of environmental challenges bedevilling Nigeria, some of which are: population growth, industrialisation, urbanisation, deforestation, desertification, and pollution – air, water, land/soil –, and loss of biodiversity (extinction or thinning of species of plant and animal life). These have all played significant part in climate change and the attendant environmental imbalance and fragility. Environmental challenges come in different forms and vary in their impact. They can either be natural or caused by human activities - artificial (Bello 124), (Ibimilua and Ibimilua 248).

Focusing on the human-nature relationship, this research examines the scientific and philosophical underpinnings of environmental issues, analysing their impact on environmental sustainability in Nigeria. It is the aim of this research to explore and identify the root causes of all these environmental challenges, as well as proffering scientific solutions to mitigate their effects and get rid of them entirely, where possible. The research will consider the current state of environmental degradation, that is, the extent to which environmental challenges have affected Nigeria, those caused by science or its application, and the technological interventions needed to tackle these challenges.

Conceptual Clarification

The significance of clarification of concepts cannot be overemphasised as one cannot discuss an idea without knowing what it means. Here, we shall attempt a clarification of the concepts science and environment. The term environment can be different for many people as it is used to suit the various interests or needs of its users. The term can be seen from a number of perspectives: sociological, geographical, ecological, political, and economic, making for multifaceted opinions. For the purpose of this paper, we will consider the ecological perspective. For the ecologist, the environment encompasses the external conditions and factors that surround an organism, comprising physical, biological, and chemical elements that influence its ability to survive, grow, and reproduce. This idea is comprehensive

because it includes all aspects/components of the environment: abiotic (non-living) and biotic (living). (Isife 23-24). Ojo and Olaniyi hold a similar idea of the environment. For them:

[E]nvironment can be viewed as all physical, non-physical, external, living and non-living situations surrounding an organism or groups of organisms that determine the existence, development and survival of organism(s) at a particular time. It encompasses constantly interacting sets of physical (natural and man-made) elements and non-physical, living and non-living (e.g. social, cultural, religious, political, economic) systems which determine the characteristic features, growth and sustainability of both the component elements of the environment and the environment itself (101-102)

From the foregoing, it is evident that human life is inextricably linked to nature; without the environment, the human race and indeed all life would cease to exist. The relationship between man and the environment is thus, such that should be nurtured for the continued existence of both; for where humans fail to protect the environment, they make themselves vulnerable to the negative conditions that failure necessitates.

What is science? Science may be defined as “any system of knowledge that is concerned with the physical world and its phenomena and that entails unbiased observations and systematic experimentation... involves a pursuit of knowledge covering general truths or the operations of fundamental laws” (Britannica 2024). It is a methodical and structured approach to investigating the natural world and the laws governing it, involving the collection of data through observation, formulation of hypotheses, and the rigorous testing of same through experimentation and analysis. Science is seen by its practitioners as the paradigm of rationality for the very fact that it puts forth a method through which theories derived from the experience of facts are objectively appraised. The scientific method necessarily gives credence to the various scientific theories due to the rational pattern through which these theories are arrived at. The scientist goes through the process in which observes of natural phenomena, formulates a hypothesis, subject the hypothesis to test, present consistent findings gotten from the tests conducted to the scientific community who vets it and makes it a theory. Science is thus a systematic and rational inquiry into the natural world with the intent of discovering ways through which it can be understood and explained. Science goes beyond understanding and explaining the natural world; it attempts to use the understanding of the natural world to make life easier for humans.

Having conceptualised the key terms in this research, we will now turn to some of the numerous challenges plaguing the Nigerian environment.

Urbanisation

Urbanisation refers to the geographic change or difference that occurs in a country when people migrate from rural area to urban areas. The extent to which people relocate from rural areas to urban areas is also considered as urbanisation. Urbanisation is one of the environmental challenges in Nigeria which has brought about an imbalance in the ecosystem. One may ask, “How does urbanisation or the desire of people to move from a rural and less developed area to an urban and more developed area pose a threat to the environment?” Onyenechere avers that urbanisation increases by 3.9% every year and that it is the

[C]ontinuous clearing of bush and forest areas that leads to huge numbers of migrants congregating to form new urban centres and enlarge existing ones. Rural-urban migration is a major factor in increasing environmental degradation. The daily influx of people from rural to urban areas is due to greater chances of obtaining better employment, the presence of infrastructure and an abundance of functional facilities in cities (5).

The influx of people to urban areas, more often than not, worsens the environmental state of these urban areas because the population growth is inversely proportional to availability of infrastructure and social services. This triggers a pollution problem – land, water, and air pollution – as wastes are disposed indiscriminately, and carbon emissions from vehicles fill the atmosphere in congested road traffic. This is only a fragment of the attendant issues of urbanisation as there are a number of others. In maximising the available land, urbanisation has led to the construction of houses, workspaces, and other kinds of infrastructure in areas that should remain untouched or protected, consequently causing environmental congestion and flooding (Omofonmwan and Osa-Edoh 54). One very glaring manifestation of environmental degradation in Nigeria is the unsanitary condition in urban areas. The rapid rise of urban settlements and population has resulted in pressure on urban land as well as urban utilities and services. The management of these utilities and services have proven insufficient leading to waste increase and health problems associated with them (Egunjobi 35).

Overpopulation

Overpopulation is the phenomenon whereby there is an increase in the number of people and or animals occupying a given location such that the resources found there are insufficient to meet their needs. Overpopulation is a key factor threatening the sustenance of the environment as the environment is forced to accommodate more people than it can ordinarily and conveniently accommodate. Overpopulation and urbanisation are similar in the sense that they both trigger the same consequences – stress on the environment and its resources – ; however, while urbanisation stresses the urban environment, overpopulation stresses the environment in general – both urban and rural (Onyenechere 6), (Omofonmwan & Osa-Edoh 54). Another attendant consequence of overpopulation is food insecurity. Food insecurity refers to a situation where individuals or households can either not access or afford sufficient food for an active and healthy life; or both. Food insecurity may be caused by a number of factors, namely, poverty or limited financial resources, climate change and environmental degradation, insufficient land for agriculture, unreliable access to food supplies, lack of food storage and preservation facilities, social and economic inequalities, and conflict and political instability. In the context of this research, climate change and environmental degradation due to pollution (Omokaro 19), (Elum et al., npag.), insufficient land for agriculture due to rapid urbanisation and overpopulation (Ojo and Olaniyi 104), and unreliable access to food supplies stand out as causes of food insecurity as human exploitation of the environment reduces its productivity making for insufficient supply for the growing population. Food insecurity is a challenge for every component of the environment – the various ecosystems, human and animal populations – one so severe that it can do significant damage to one of the factors that make for its possibility, that is overpopulation; this is because where there is a lack of food due to rising demand, those who depend on it will in time die off. Overfarming is another challenge brought about by overpopulation due to the need to increase food production. This phenomenon leaves no time for the replenishment of the soil.

Deforestation

Deforestation has to do with the replacement of wildlife with other non-natural elements in the environment. It is generally regarded as the felling of trees for the purpose of agriculture, fuel, commerce, or infrastructure without the intention of replacing them (Babanyara et al. 138-139). Deforestation displaces wild animals and destroys/endangers species of trees, thereby threatening biodiversity, and making the environment vulnerable to erosion, climate change, floods, wildlife extinction, and acidic rains. Urbanisation and overpopulation play a major role in deforestation as the human population encroach into wild lands, thereby destroying the ecosystem of wild animals and plants/trees. With deforestation, every component of the environment is endangered, animal and plant species, the soil, and water bodies (Omofonmwan and Osa-Edoh 54).

Deforestation destroys ecosystems that are vital to wildlife and humans alike. Lush green forests offer a home to some of the world's most iconic wild animals, from the jaguar to the panda, along with countless diverse species of vegetation. But the importance of forests doesn't stop there. Like the ocean, forests absorb excess atmospheric carbon dioxide, serving as a much-needed buffer against irreversible climate change. In short, forests help sustain life around the world—far beyond where their tree lines end (The Humane League: Effects of deforestation on humans and the environment (thehumaneleague.org)).

Pollution

Pollution is the contamination of the environment with substances that are harmful and cause degradation. There are different types of pollution: air, land, and water. Pollution in Nigeria comes in different forms: indiscriminate dumping of refuse, bush and waste burning, oil spillages, gas flaring, among others. Moses Udoh and Iniobong Umotong define pollution as the “contamination of the earth's environment with any substance that disturbs human health, the quality of life or the natural functioning of the ecosystem (the living organisms and their physical surroundings)” (252). Isiaq and Lawal consider environmental pollution from the angle of oil exploration and exploitation, noting that these activities make the environment vulnerable and prone to degradation. For them, environmental degradation in Nigeria's Niger Delta is the result of “oil spills, gas flaring, pipeline leakages, illegal oil bunkering, and inadequate waste management practices” (149). These bring about the release of harmful substances and gas to the environment, reducing the quality of life of all components of the environment. C. O. Ikporukpo avers that:

Oil spillages have considerable impact on the natural resources of the petroleum-producing Niger Delta upon which the people of the area depend. One immediate result of a spill, often aggravated by the riverine nature of much of the producing region, is the widespread pollution of rivers, creeks, ponds and wells which are the usual sources of water for drinking and general domestic use in the rural Niger Delta. The problem is particularly serious because, in certain cases, even where new wells are sunk, they are likely to strike oil-affected water. The experience of spillages in the country indicates that, in such a situation, infections such as diarrhoea and dysentery become very common (199-200).

Babanyara et al. consider the major causes of pollution in Nigeria to be rapid and unplanned urbanisation, poor sanitation, use of chemical fertilisers and insecticides, solid waste disposal, mining, and effluent discharge (139). Gas flaring, as have been noted, is another means through which the environment is polluted, and the emissions from it are really toxic to all components of the environment. Going further to explain the extent to which oil exploration and exploitation has contributed to the degradation of the Niger Delta, Elum et al., note that:

Oil exploitation in the Niger Delta has resulted in a number of environmental impacts such as soil, water and air pollution... Pollution from the activities of oil multinational mostly has to do with air, land and water. Air pollution affects humans and other living organisms. Land pollution affects the land soil and destroys plants and living organisms in the soil while water pollution affects aquatic life.... Air, water and land pollution can be caused by oil spillage, gas flaring, above or below ground oil pipeline leakage and oil waste dumping (npag.).

This indicates that oil exploitation alone constitute a grave environmental challenge to all aspects of the Nigerian environment , polluting air, land, and water, as well as producing the ripple effects of food insecurity, loss of biodiversity, loss of livelihood, climate change, etc. This is a testament to the interconnectedness of every component of the environment such that a challenge to one part constitutes a challenge to other parts. This is summed up in the assertion, “One environmental problem can lead to other environmental problems. Flooding, for instance, can cause erosion. Erosion, on the other hand, can lead to land, water and air pollution. Pollution causes flooding and health problems. Pollution can also result in global warming, and global warming can lead to heavy rains which could cause flooding” (Onuoha et al. 10).

Climate Change

To discuss climate change and appreciate its status as an important subject, one must have a good understanding of the term climate. What then does the term climate mean? Climate may be said to be the prevalent atmospheric conditions in a given area – sub regional, regional, or global – over a period of time; thirty years, as stated by the World Meteorological Organization. (Climateurope: What is Climate? What is climate change?). Hayden et al. (npag.) consider climate as “conditions of the atmosphere at a particular location over a period of time; it is the long-term summation of the atmospheric elements (and their variations) that, over short time periods, constitute weather.” That is to say that climate has to do with the long-term state of the weather – temperature, wind gauge, precipitation (rain, hail, or snow), cloud cover, humidity, etc. – in a given area which determines human health and disease patterns, water availability and quality, agricultural productivity and food security, economic activity and development, sea level and ocean currents among others. Climate change refers to the variations in weather and atmospheric conditions caused by ever-increasing levels of greenhouse gases in the earth’s atmosphere, and the continuous degradation of the environment by means of pollution, deforestation, desertification, urbanisation, etc. W. N. Rom avers that:

The commonly accepted theory that human or anthropogenic activities are contributing to climate change by altering the atmospheric composition of heat-trapping chemicals is known as global warming. Global warming is the major challenge facing our planet, our youth, and future generations. We need to end our dependence on fossil fuels and their attendant pollution and develop novel strategies to enjoy technology without the consequences of global climate change. (180)

It is crucial to state that climate change is not the solely caused by human activities as there are natural causes of global warming; however, human activity is responsible for a greater percentage of global warming as it is today (Agbebaku 6), (*The Encyclopaedia Britannica Guide to Climate Change: An Unbiased Guide to the Key Issue of Our Age* 4).

Science and Environmental Sustainability

Having considered the various challenges of the environment today, it is requisite to explore ways by which we can mitigate the effects of these challenges for a sustained universe. The cruciality of science in overcoming the environmental challenges cannot be overemphasised. First, we must consider the environment worthy of being saved and prioritise the environment when we formulate policies and carry out our various activities geared to making human life easier and more enjoyable, knowing that jeopardising the environment is tantamount to jeopardising human existence. Scientific endeavours should thus be ecocentric instead of anthropocentric; that is to say that the environment should be given pride of place. Anthropocentrism is the view that humans are the most important beings in the environment (Mitchell 487), an idea that influenced human activities to neglect the need of protecting the environment for far too long. In fact, even today, the environment is not given the care and attention it

deserves, hence the continued degradation through the burning of fossil fuels, deforestation, pollution, etc. It is noteworthy that science, though applied to making life easier and more enjoyable for humans, has contributed a great deal to the challenges we now face. The scientific strides in transportation, infrastructure, exploration of natural resources, health, entertainment, and indeed all areas we can think of, have had attendant challenges that have brought about environmental imbalance and degradation. Ecocentrism is the position that the environment or ecosystem is intrinsically valuable; while it is valuable to humans its value is not tied to humans (Mitchell 487).

Although science has brought about unintended negative consequences to the environment, there are ways through which it can mitigate them. To mitigate environmental challenges, it is crucial to utilise scientific knowledge not just for maximizing output but for prioritizing sustainability. The following are some practical ways through which science can be applied to mitigate these challenges.

Renewable Energy: This refers to energy gotten from the natural resources that can easily be replenished, hence cannot be depleted. These energy sources include the sun, wind, water, the earth's core, and organic matter. Renewable energy help limit the use of fossil fuels, thereby reducing the effects of climate change on the environment. With renewable energy, we can tackle the problem of pollution by reducing gas emissions, and improving the quality of water and air we consume. These renewable energy sources help to generate electricity, water, agricultural crops, etc. (United Nations), (Elum and Momodu 72-73). The issue of deforestation can also be tackled when renewable energy is made accessible to people in rural areas as an alternative for fuel (Nwanya 198). Humans can still enjoy the luxury of quick transportation without the emission of harmful gas by using eco-friendly vehicles.

Waste Management: Lack of effective waste management systems, careless disposal of waste, and inadequate availability of waste collectors hinder proper waste disposal, posing a significant environmental and public health challenge. Indiscriminate disposal of domestic and industrial wastes have resulted in blocked drainages and canals, leading to frequent flooding, damage to infrastructure, and increased risk of accidents. Mitigating this challenge requires the establishment of a proper waste management system across the country to ensure that wastes are disposed in an environmentally friendly manner, and that recyclable waste are made useful for the environment. The process of recycling and proper waste management requires the application of scientific principles and technologies.

Conservation and Modern Agriculture: Environmental conservation is crucial for a sustainable future. The fact that the environment has intrinsic value requires that its resources are protected and secured from misuse. Human activity must then be geared toward ensuring that these resources are not depleted. It is, at this point, common knowledge that environmental resources are quickly being depleted due to mindless human activities. One way of remedying this challenge is to preserve what is left of these resources to prevent them from extinction. Conservation or environmental reserve centres should be established for preserving and growing of endangered species of trees and animals. With the application of science, the problem of food security can be addressed. This would involve the use of modern and scientific technologies for plant and animal engineering, indoor farming, pest management, and food storage among others, all through process that are not inimical to the components of the environment.

Conclusion

Within this paper, we have seen that the Nigerian environment is faced with similar challenges as other countries. We have also considered various environmental challenges and their underlying causes, noting that human activity is the primary cause and has the most devastating effects to our fast degrading environment. The first step to solving the various environmental challenges is to adopt an ecocentric approach acknowledging the intrinsic value of the environment and considering ourselves as an integral part of an interdependent ecological system. Although science has in some ways contributed to the

challenges we face in our environment, it has the potential to mitigate these challenges. In order to ensure environmental sustainability, we have to adopt scientific principles and formulate eco-friendly policies for managing the environment.

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