

# Rural Development and Environmental Protection in Nigeria

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## Abstract

This study examines rural development and environmental protection in Nigeria. It assesses specifically the natural occurrences and human activities such as rainfall, agriculture, mining, quarrying, lumbering, and water derivation from the subterranean interstices which degrade the rural environment owing to negligence of acceptable ecological principles and eco-development paradigm by the rural development agencies. It observes that inadequate resource data for planning, careless resource extraction and refinement, dumping of wastes into the ecosystems, heavy rainfall, absence of environmental scientists, inadequate funds and suitable technology, and poor community participation in rural construction activities contribute to environmental deterioration in Nigeria. Adequate resource inventory for planning, environmental impact assessment, scientific agricultural practices, forest regeneration and reforestation programs, sanitation of ecosystems, education of the rural people, and utilization of climate information, suitable technology and experts' services in construction activities should be carried out by the rural development agencies to reverse these trends and ensure effective rural environmental protection in Nigeria.

**Keywords:** Rural Development, Human Activities, Environment, Degradation, Protection.

## Introduction and Research Problem

Most developing countries in the humid tropics of the world of which Nigeria is one are currently facing a fundamental development dilemma with two crystal characteristics. The first of these characteristics concerns the mandatory quest by the authorities to provide the material needs of the population by exploiting the available environmental resources. In carrying out this essential primary activity, the resource regenerative capacity of the environment must not be over exploited and destroyed through mismanagement. There is no doubt that this challenge is more apparent in rural development as of today. Although rural development programs in their form and dimension share a multiplicity of objectives geared towards improving the living standards of the rural people, their physical operation involves the exploitation and utilization of both renewable and non-renewable resources. This leads to some irreversible transformation of the natural environment. In an attempt by the different physical development agencies to modernize the rural environment through the provision of beneficial infrastructural facilities to the rural people and to earn life-saving income through the extraction of natural resources, a huge price of environmental degradation may be paid (Okafor, 1988).

The second characteristic of the development dilemma places attention on the need to maintain a healthy balance between the relentless pursuit to increase the welfare of the people and the continuous preservation of rural environmental quality. This essential concern for environmental quality maintenance in the rural area is justified because in the process of rural development, the natural environment might be exploited beyond its available resource strength. Consequently, the natural rural environment would be exposed to various forms of degradation. The local, foreign and government development agencies which activities are haphazardly carried out on the rural environment are to blame in this regard. As of today in Nigeria, the issue of the environment, its resources, refinement, utilization, sustenance, and impact should constitute a fundamentally recurring theme in rural development because it is in the rural environment that the harmony between man and nature can be maintained. This vital harmony, in physical reality, diminishes in either the poorly built-up urban environment or its vastly degraded rural counterpart (Okafor, 1988; Okafor and Onokerhoraye, 1994).

Throughout the developing humid tropics of Africa and particularly in Nigeria, the rural areas are known as the authentic sources of important environmental resources which are routinely extracted, processed and utilized for different domestic and public purposes. These include vegetal, geomorphic, hydrological, atmospheric, and human resources. A simple break-down of these environmental resources includes the forests and grasses, fertile soils, hills, slopes, stones, mountains, and the deltas, different water bodies, renewable and non-renewable minerals, natural sunshine, breezes, rain waters, cloud covers, and evaporated moisture. These essential rural environmental resources do serve different functions. The fertile soils provide food and cash crops for domestic, national and foreign consumption. The fresh grasses serve as nutritious pastures for animals being raised on the environment. The geomorphic components serve as the watersheds of rivers and deltas for renewable and non-renewable minerals specifically crude oil, gas and coal while the vast water bodies serve as natural habitats for numerous species of wild animals, fish, reptiles and beneficial insects. These water resources also provide important alluvial sands for utilization in different constructions on the physical environment. Buildings, roads, bridges, tarmacs, and harbours are the most common facilities in this consideration. Natural sunshine, fresh breezes, clean rain water, cloud cover and atmospheric moisture do sustain mankind, animals,

plants, crops, and different colonies of reptiles, pollinating insects and soil fertilizing micro-organisms. Of course, the rural areas represent the original sources of skilled and unskilled populations who migrate to the urban areas to provide essential services in the secondary and tertiary sectors of the urban economy. Above all, the rural areas of the humid tropics serve as the natural habitats for rewarding tourism, costless health, sufficient nutrition, relaxation, and relative peace for mankind. It is a suitable place where man communes adequately with nature in terms of extraction of abundant resources, inhalation of fresh breezes and consumption of clean rain and river waters (Akinbode, 2002; Okhakhu, 2014).

In the current pursuit of rural development in Nigeria, ecological safety and environmental protection must be strongly adhered to by the local development agencies and the immediate rural community. Also, authentic human prudence should be exercised in the processes of raw resource extraction, refinement in the industries, utilization, and wastes disposal on the environment. Of course, the growth and development of the rural areas which are certainly demonstrated in different infrastructural provisions on the environment and wealth production referred to as socio-economic development must incorporate the concept of ecological prudence. The concept of ecological prudence advocates the essential need to ensure the safety and continuous viability of the environment being visited by different extractive activities. It also stipulates the relevance of engaging the services of suitable management expertise who can reliably prevent or reverse the careless march to environmental ruin and complete destruction (Okafor, 1988). In discussing the concept of eco-development which is also relevant in this current study, Sachs (1978) opines that each environment has a maximum load of development it can carry. Below it, the environment is not impaired and above it, it is grossly damaged. In the rural areas in Nigeria, environmental resources are always carelessly extracted by the primary industries and haphazardly utilized on the earth's surface by the physical planning and rural development agencies. These activities directly lead to series of environmental challenges such as land denudation, formation of trenches, deforestation, surface subsidence and soil pollution (Okafor and Onokerhoraye, 1994; Akinbode, 2002; Okhakhu, 2014).

As Akinbode (2005) observes, poor environmental planning, non-engagement of the services of experts, inadequate knowledge of continuous environmental processes and interactions, utilization of obsolete technology in agricultural production and establishment of socio-economic facilities, youths' drift to cities, and uncontrolled extraction of environmental resources which leads to environmental degradation represent the current challenges of rural development in Nigeria. These observed challenges rightly suggest that the current rural development in Nigeria negates to some extent the acceptable principles of ecological safety and environmental quality which sum up as environmental protection. Based on these experiences, this current study examines the physical occurrences and human activities in the rural areas in Nigeria which directly degrade the natural environment thus leading to ecosystem imbalance and environmental destruction. The study concludes by recommending suitable policy measures to tackle these occurrences and activities in the rural environments in Nigeria.

### **Rainfall**

Rainfall is a natural occurrence on the earth's surface. It is the observed aggregate result of the continuous mutual interactions among essential climatic elements which include radiation, evaporation, wind, humidity, pressure and temperature. More so, rainfall is a realistic positive consequence of a functional water cycle within the natural and human-modified environments. It can also be induced artificially using current scientific techniques which involve the combination of silver iodide, building of modern dams and practising vast reforestation of bare lands which overall objective is to release abundant moisture into the troposphere for subsequent rain formation. The sources of rainfall include vegetal resources, rivulets, streams, bays, lagoons, ponds, lakes, wells, springs, dams, rivers, impermeable subterranean rocks, permafrost, seas, and the oceans which waters are spurred in motion currents in the atmosphere by the prevailing radiation and warm turbulent winds. The subsequent changes in atmospheric pressure and the attainment of saturation vis-à-vis dew point result to rainfall on the environment (Ayoade, 2004; Okhakhu, 2014).

Atmospheric observations by scientists over the years have shown that rainfall is normally higher and of regular torrential frequency and intensity in the rural areas than the urban environments owing to the presence of abundant vegetations, viable watersheds, diverse hydrological bodies and the continuous reception of moisture-inducing radiation from the sun (Oguntoyinbo, 1994; Ayoade, 2004). In the rural areas of Nigeria, deforestation is widely practised by the people. It is a sustainable source of firewood, income and employment. Factors such as mining and quarrying activities, poor agricultural practices, lumbering, establishment of buildings and the construction of rural feeder roads on the virgin lands have exacerbated the practice of rural deforestation. These activities have directly exposed the natural rural lands to various agents of denudation particularly torrential rains, sea waves and gusty winds. Relevant studies on severe environmental deterioration in the rural areas of Nigeria over the years are available in published literature (Ebisemiju, 1988; Sada, 1988; Aziegbé, 2004; Ofomata, 2008; Okhakhu, 2010; 2014).

Another striking characteristic of the rural convective rainfall in Nigeria derives from its unpredictability with regard to atmospheric formation, occurrence, frequency, intensity and distribution on the environment. This observable rainfall feature is further complicated owing to the fact that most rural areas in Nigeria are inadequately served and connected with functional synoptic meteorological stations which would have provided reliable meteorological data for effective atmospheric observations and prognostications. Were these weather stations established in the rural areas by the government authorities, absence of experts and the preponderance of high illiterate populations would have negated the envisioned objectives of the weather stations. Little wonder that poor weather observations and predictions have resulted to occurrence of unpredictable torrential rains which continually damage established infrastructures and degrade the upper earth's crust in the Nigerian rural areas. The rural areas of Auchi, Benin City and Igarra in Edo State and some rural parts of Enugu, Ibadan, Okene, Markurdi, Kaduna, Kano, Jos and Warri are currently facing severe soil denudation caused by poor anthropogenic activities on the land and occurring torrential rains.

### **Soil Degradation**

Soil erosion often develops from several forms of careless resource extraction and utilization and the construction of different physical structures on the environment which are poorly planned. Increased demand for firewood, furniture items, building materials, logs and saw-dusts by the rural population has resulted to uncontrolled deforestation in different degrees on the rural environment. The physical realities of over-cropping, concentrated animal domestication and over-grazing on the land pastures, shifting cultivation, land fragmentation and bush burning have exacerbated this environmental hazard which leads to extensive soil erosion particularly in the rural areas of Nigeria. The construction of feeder roads and different patterns of buildings in the rural areas has created another fundamental conflict with the natural flow of run-off, forest ecosystem stability, sustenance of wildlife in the forests and the natural stability of arable soils. Of course, in the process of road construction, sizeable portion of land is taken by the highways while adjacent land is also carelessly destroyed. The natural land excavated by caterpillars is used for the filling of some depressed portions on the roads. Also, road cutting and indiscriminate land excavation have left series of exposed pits and dumps on the natural rural environment. These indiscriminate human activities have triggered off intensive soil degradation as a result of the uncontrolled run-off on the upper surface of the rural environment. It must be borne in our mind that the benefits of road development should not be negated by the costs of environmental damages in the rural areas in Nigeria. This is the current experience in these parts of Nigeria as observed during the reconnaissance surveys.

### **Agriculture**

Agriculture is a widely recognized rural activity. However, it is carried out by both the rural semi-literate and the urban literate communities in Nigeria. The activity refers to the production of crops, husbandry of animals, soil maintenance, provision of scientific principles and techniques including their applications in different farm operations, the utilization of agricultural outputs for human's consumption, sale, income provision, improved welfare, and the realization of other essential societal purposes. In Nigeria, this primary activity is broadly practised on the plains and undulating fertile soils which are found in the rural environments. By its relevance, agriculture employs over 65% of the rural populations (Akinbode, 2005; Okhakhu, 2013). The occupation provides almost all the standard food requirements for both the rural and urban dwellers such as carbohydrates, proteins, fats and oil, minerals and vitamin needs. It supplies essential herbs for local medication, provides vital vegetables for the prevention of human diseases and supplies net-income to the rural people. It also provides cheap rural building materials like ropes, bamboos, tree-trunks, leaves and palm fronds to the local builders and facilitates the establishment of village markets for the exchange of money for the surplus food and cash crops. In some rural areas in the North and South of Nigeria, the presence of cash crops such as rice, beans, groundnuts, millet, cocoa, kola-nuts, rubber, palm oil, pineapples and pawpaw has stimulated the construction of rural feeder roads for the smooth evacuation of the produce to the city markets for sale. These contributions represent the benevolent aspects of agriculture in the rural areas of Nigeria which suitably demonstrate the need to adhere to the philosophy of eco-development vis-à-vis the maintenance of acceptable environmental quality.

Agricultural activities in the rural areas of Nigeria are confronted by physical and human challenges and these include inadequate fertile soils, erosive torrential rains, drought and desertification effects, polluted soils, and urban encroachment on fertile lands. Other problems relate to poor technology, absence of extension experts, inadequate seeds and seedlings, shortage of funds, poor market performance, dysfunctional feeder roads, inadequate processing of agro-items, and existence of poor storage and packaging facilities. Added to these agricultural challenges are the inadequacies characterized by persistent land fragmentation, shifting cultivation, haphazard application of fertilizers to the soils, poor crop rotation practices, continuous deforestation and burning of cut-down vital vegetal resources which lead to the demise of different species of pollinating insects and soil fertilizing micro-organisms. Extensive deforestation of rural environments spurred by

rudimentary agricultural activities has led to serious environmental constraints particularly the flooding of built-up physical facilities, soil erosion and related soil infertility, and the formation of impassable ravines on the earth's surface. Consequently, the vastly degraded lands are left wasted and abandoned for several years without beneficial socio-economic activities. These are the observable malevolent aspects of rural agriculture which run counter to the concept of standard environmental quality as practiced in the western world as of today.

### **Lumbering and Deforestation**

Lumbering, like the rural agriculture, has become a very lucrative occupation in the rural areas of Nigeria. It is a primary activity which involves the cutting down of different species of selected forest trees and related vegetal resources which are processed for utilization in a number of socio-economic, political and strategic activities. In specific terms, the cut down trees are processed into refined logs, electric poles, furniture items, and straight woods which are used for the erection of houses, construction of roads, bridges, airport tarmacs, ship harbours, underground tunnels, erosion channels, and for sale in local and foreign markets. Lumbering activities provide both domestic revenues to the rural lumbers and foreign earnings to the government through the sale and distribution of refined logs and woods to different consumers. The saw-dusts produced during the processing and refining stages of the logs are bought and used by the local people for the making of domestic fires required for different cooking purposes. The refined tropical hard woods are used for the construction of essential house furniture, roofs of buildings, chairs and tables required for learning in schools, and the realization of corporate responsibilities in both private and public offices. Of course, planned lumbering activities as observed in some rural parts of Western Europe are beneficial both to the rural people and their respective government authorities in the aspects of infrastructural provision, employment generation, supply of industrial raw materials and revenue generation and accumulation (David, 1995).

On the contrary, most current lumbering activities in the rural areas of Nigeria are confronted directly by inadequate planning, poor research and absence of relevant innovations. Besides these observed challenges, there are other serious problems associated with indiscriminate deforestation devoid of planned future regeneration of the lost forest resources. For example, Nigeria has a high forest cover of 12.41 million hectares out of her total 91.1 million hectares of land space. Of these 12.41 million hectares of dense forest cover, 600,000 hectares of the forest trees are cut down every year (Food and Agricultural Organization, 1984; Okafor, 1988; Akinbode, 2005). With this extensive environmental deforestation in place in the rural areas, it is certainly not possible for the Nigerian high forests to regenerate in time without a myriad of adverse consequences. First, the amount of rainfall in the South and North of Nigeria would decrease in frequency, duration and intensity. Second, pronounced seasonal fluctuations in the volumes of waters in rivers and streams would be observed. Third, drought incidents would occur and exacerbate in the Middle Belt of Nigeria with increased diurnal temperatures. Fourth, the mild consequences of desertification would spread towards the marginal Sahel and Sudan North of Nigeria. Fifth, reduced agricultural production would occur in the forest and savanna ecosystems owing to decreased annual rainfall and soaring temperature incidents in the country. Consequently, the prices of food and cash crops would soar in the markets while some very useful species of plants, wild animals, pollinating insects and micro-organisms would be displaced from their normal habitats. Also, the migration of certain species of birds, insects and wild animals would be observed in the disrupted rural rainforests. Some essential categories of herbs and special vegetal resources would be lost permanently in the forests. Above all, wasted vast lands which negate the philosophy of environmental protection would be observed in some rural areas in Nigeria. Better described, the physical consequences of climate change would be experienced in these parts of the country side.

### **Water Derivation from the Subterranean Interstices**

Water is another very important rural environmental resource. It is rather more important than food and related vegetal resources to some extent. It is always available in rivulets, bays, lakes, lagoons, streams, rivers, seas, oceans, permafrost and subterranean impermeable interstices throughout the world (Okhakhu, 2014). According to Ayoade (2004), water as a resource had contributed significantly to the development of ancient civilizations in Egypt, Babylon, Arabia, Rome, India, China and Mexico. In the rural areas in Nigeria, water resources are used for fishing, navigation, transportation, tourism, irrigation, and the establishment of local dams for water distribution and power generation. At home, in public offices and in the sites of small-scale industries, clean water is used for drinking, washing, cleaning, sanitation, maintenance of machinery, fire extinguishing, sprinkling of house lawns, and for local studies by primary and secondary schools. As a result of these essential contributions to rural development, water is considered as a very mandatory natural resource which should be utilized continually by the humans for their survival in the environment (Ayoade, 2004).

A profound change in the planetary wind direction, extensive deforestation, air pollution, preponderance of cold currents and reckless modifications of the natural environment could obstruct the natural frequency of rainfall which provides adequate recharge to different water sources within and above the earth's surface, water as a resource is routinely needed for utilization in different socio-economic and strategic activities

in the rural areas. Of course, most times, adequate water which is clean, potable, accessible and useable is not physically available to the rural dwellers. This deficiency of water becomes a huge rural challenge particularly during the dry season in these parts of Nigeria. However, the water deficit situation currently motivates the rural people to seek alternative means of water provision from the rural subterranean impermeable water interstices. In this regard, different boreholes and domestic wells have been sunk on the environment through the combined efforts of private-public interests. However, the process of water derivation from the subterranean interstices using the boreholes and domestic wells is frequently sustained, excessive in nature, unregulated and poorly managed by the rural youths. Accelerated physical pressures induced by torrential rains, gusty winds, human trekking and heavy-duty vehicles have been exerted continually on the surfaces of these hydro-geomorphic basins. These exerted pressures have made these basins to cave in leading to vast land subsidence like a natural rift valley system. There are valid scientific indications that excessive water derivation from a number of established boreholes could cause the collapse of large areas of the earth's surface, man-induced earthquakes, and environmental bareness in the rural areas in the humid tropics (Aziegebe, 2004; Okhakhu, 2014).

### **Mining and Quarrying Activities**

Mining is a primary extractive activity which is extensively practiced by some semi-skilled and unskilled miners in the rural areas in Nigeria. It involves the extraction of surface and subterranean mineral resources such as limestone, lead, zinc, marble, tin-ore, bauxite and crude oil. Specifically, the open cast and shaft methods are adopted during the rural mining operations. Quarrying, on the other hand, involves the mechanical and chemical break down and separation of boulder rocks into smaller rock fragments which can be handled conveniently for sale, distribution, research, and for different construction purposes particularly the erection of communication masts, television, radio and internet towers, houses, roads, tarmacs, harbours, markets, and tourist facilities.

Mining and quarrying activities provide domestic revenues and foreign currencies to the local miners and government authorities in Nigeria. These activities also provide employment to the rural communities. The revenues and foreign exchange provided by the mining sector of the economy are used for the construction of rural feeder roads, primary and secondary schools, hospitals, primary health care centers, police stations, post offices, markets and local libraries for rural studies. However, these mining, quarrying and refining occupations are confronted by a series of challenges which include poor management, employment of unskilled labour, insecurity of lives and properties of the miners which emanates from the reactions of the rural communities and the non-incorporation of research experts into the daily mining and quarrying operations. These visible inadequacies have led to poor environmental management in these parts of Nigeria. As Omofonmwan (2013) observes, the environmental degradation which results from the continuous oil drilling, open cast mining and extensive quarrying activities has constituted a major source of rural environmental pollution in Nigeria. In the rural communities in Bayelsa, Delta and Rivers States in Nigeria, extensive oil spills and reckless deposition of crude oil and drilling wastes on the environment have damaged most fertile agricultural soils, destroyed important species of plants, wild animals and fish, polluted the sources of drinking water, and decimated a whole colony of useful insects and micro-organisms which activities are extensively required for successful agricultural harvest and production.

In the rural environments in Jos, Nkalagu in Anambra State and Okpella in Edo State, the mining, quarrying and refining of limestone, tin ore, columbite and marble have destroyed the natural aesthetic values of the original landscape leaving behind a visibly dusty, rough and rugged terrain for the rural inhabitants to dwell and suffer. The huge dusts ejected into the rural atmosphere by these activities have also caused air pollution leading to human respiratory and sight ailments like cough, catarrh, poor visibility and redness of the eyes in the rural areas. Polluted rain waters containing different particulates have also been observed in these parts of Nigeria (Ololade, 2015). Recent scientific studies by Umukoro (2013) and Okhakhu (2014; 2015) have provided detailed environmental consequences of the mining, quarrying and crude oil refining activities in the Niger-Delta Region of Nigeria.

Some observed characteristics of the mining and quarrying operations in the Nigerian rural environments include the random dynamite blasting of boulder rocks found in higher elevations which scatter carelessly down slope sporadically striking the unsuspecting rural miners to death and the creation of deep mine pits and associated depressions which form dangerous ponds during the wet season. These ponds have drowned a number of miners, farmers, hunters, herdsman and their cattle during the grazing process. In the rural Mambila Plateau of Jos, particularly in the Bukuru region, the careless mining of tin-ore with accessory minerals such as iron and columbite has led to the destruction of fertile farmlands, wild forests and the pollution of many sources of drinking water. Recent reconnaissance surveys of some mineral exploitation sites in Jos show over 4,000 abandoned mining ponds, several craters, gullies and dumps, and the presence of shining particles and unidentifiable sediments in rural sources of drinking water. These human-created hydro-geomorphic features have posed serious threats to the natural environment and the survival of the rural inhabitants.

There is no doubt that mining and quarrying activities when carried out by unskilled miners could upset the natural equilibrium in the geological environment and these may cause serious geological hazards such as rock-falls, landslides, huge land subsidence, flooding, and erosion in the immediate mining environment. Scientific studies carried out at different times in Barkin Ladi Local Government Area over the years indicate that tin-ore contains some toxic crystalline silica which have been associated with human lung cancer and other respiratory diseases (Ololade, 2015). Currently, these human ailments are yet to be confronted with appropriate medical treatments. The prevailing yearly harsh weather called harmattan has also exacerbated the adverse consequences of these respiratory and sight diseases on the inhabitants of this Local Government Area in Jos. It is clear from the on-going assessment that mining, quarrying and the refining sector of the Nigerian economy which has provided so much revenues, foreign earnings and socio-economic infrastructures to Nigeria has also become the greatest suspect in the pollution and degradation of the same Nigeria's rural environment.

### **Research Findings**

The study observes the presence of abundant vegetations, viable watersheds, diverse hydrological bodies and heat-induced moisture in the rural areas of Nigeria. These physical features produced rainfall of regular torrential frequency and intensity which, owing to deforestation caused by poor agricultural practices, mining, lumbering, and infrastructural construction, resulted to rural environmental deterioration.

The study observes the existence of exacerbated rural deforestation induced by the realities of over-cropping, concentrated animal husbandry and over-grazing of land pastures, shifting cultivation, bush burning and the construction of physical structures on the environment. These practices led to intensive soil degradation in the rural areas in Nigeria.

Poor agricultural practices, indiscriminate lumbering and careless mining activities have contributed to soil degradation, soil infertility, inundation of some built-up structures, and the destruction of over 600,000 hectares of rural forest trees in Nigeria.

As a result of the persistent water withdrawal from the subterranean interstices and accelerated pressure exerted by torrential rains, gusty winds and heavy-duty water tankers on the surfaces of hydro-geomorphic basins, some marked environmental subsidence and warping of landscapes have been observed in some rural areas in Nigeria.

It also observes the pollution of some water sources and emergence of respiratory and sight ailments in the rural mining areas in Jos, Okpella and Nkalagu in Nigeria owing to careless and unrefined mining and quarrying activities. Also observed in the rural communities in Bayelsa, Delta and Rivers States in Nigeria are extensive crude oil spills and reckless deposition of crude oil and drilling wastes on the natural environment which have damaged most fertile soils, destroyed important species of plants, wild marine animals and fish, polluted some sources of drinking water, and decimated a whole colony of useful insects and micro-organisms which roles are vastly needed for successful agricultural harvest and production.

Finally, the study observes that the rural development agencies in Nigeria do not have authentic facts on the resource potentials and acceptable maximum load of development the rural environment can carry. This is one overriding challenge which leads to continuous environmental degradation in the rural areas in Nigeria.

### **Recommendations**

The current study observes the presence of abundant vegetations, viable watersheds, diverse hydrological bodies and reliable natural energy which produced rainfall of regular torrential frequency and intensity in the rural areas in Nigeria. Based on this background, it is suggested that these adequate water resources in the rural areas should be developed sufficiently through the combined efforts of the people and government using current technology which is environmentally friendly and adequately responsive to daily ecological dynamics. Environmental scientists with proven scientific skills and hydrological engineers should be employed and entrusted with the construction of these rural water supply facilities. To this end, some of the rural rivers should be transformed into water supply sources, boreholes are to be constructed in secure geomorphic basins while underground, overhead and surface water tanks should be established at the least economic points where they are nearest to most living homes.

Scientific agricultural practices premised on the use of adequate human skills and adaptable soil friendly technology should be adhered to without any deviation in the rural areas in Nigeria. These agricultural practices reliably recognize the elimination of rudimentary shifting cultivation, deforestation, over-cropping, annual burning of cut grasses and excessive animal grazing of the land pastures. These scientific practices also embrace regular innovations and research in agriculture, employment of agro-extension experts, assessment of the rural soil potentials for present and future agricultural activities, and the request for adequate government funding of agricultural activities through the provision of adequate loans to the farmers in the rural areas. These agricultural innovations would help obliterate the rudimentary practices contributing to different environmental degradations in the rural areas in Nigeria.

A proper rural resource inventory paradigm should be instituted and implemented in the rural areas in Nigeria. This inventory paradigm should focus on adequate location, identification, mapping, quantity, quality, and monitoring of the resource potentials in the rural environments. Having provided the required facts on the rural environmental resources, this inventory approach would now serve as a valid guide for charting the course of rural development unlike the imaginative approach of old which led to fundamental environmental destruction. Also, this resource inventory approach would help satisfy the diverse needs of the rural people and promote acceptable conservation practices which minimize environmental degradation. In addition, it would ensure adequate planning of rural resources that incorporates adherence to ecological prudence and environmental protection.

The practice of reckless deforestation which led to the destruction of useful habitats of wild insects, micro-organisms, animals and the extinction of rare species of plants was observed in the rural areas. First, continuous forest regeneration and reforestation programs are suggested for implementation in these parts of Nigeria. These programs require the employment of competent forest scientists, utilization of suitable technology and adequate government funding to succeed. A detailed knowledge of the rural climate with effective irrigation practice must be incorporated in the program. Second, some legal enactments are essential in this regard to restrain the rural farmers and lumberers from this act of indiscriminate forest destruction on the environment. Also, there should be permanent maintenance of relevant ecological zones for realistic preservation of endangered flora, fauna, insects and micro-organisms. Of course, these measures would help arrest the persistent challenges of deforestation, soil and wind erosion, improve soil fertility, enhance acceptable rural ecological balance, and resuscitate the ground water quantity for continuous derivation and utilization by the rural people.

The challenges of environmental subsidence and related warping of the landscapes should be remedied effectively through reduced water withdrawal from the subterranean interstices by the rural people and physical prohibition of heavy-duty tankers from the surfaces of the geomorphic basins. Specifically, heavily reinforced solid parking lots built with concretes and iron rods should be provided for water tankers to draw water from most rural borehole sites. The collapsed portions of the earth's surface should be filled and covered using granites and clay materials reinforced with cements. The persistent release of mining and quarrying dusts and the careless ejection of crude oil wastes with gas flaring into the natural environment should be reduced to their minimum quantities in the rural areas. Environmental clean-up exercise by experts is most necessary in this regard. The clean-up exercise requires adequate funding and utilization of suitable technology to be successful. The funds should be provided by the private, government, and foreign owned industries sited in the rural areas of Nigeria. The rural communities polluted by the mining, quarrying and crude oil refining industries should be compensated adequately with different financial rewards, beneficial socio-economic infrastructures, life-saving jobs, and effective security. These measures and provisions would lead to permanent ecological resuscitation of the devastated rural environments. Consequently, the observed cases of respiratory and sight ailments would be warded off in these rural locations.

A scientific Environmental Impact Assessment (EIA) should always precede any current rural development activity in Nigeria. The EIA, according to Munn (1975) and corroborated by Okafor (1988), is an activity designed to identify, interpret and communicate essential information about the impact on man's health and well-being including the well-being of ecosystems on which man's survival depends, of proposed or on-going human activity on the environment. This scientific activity helps to observe, assess, and present realistic detailed facts on the proposed, on-going, and likely completed development activity in terms of its beneficial and malevolent effects. In most situations, where its merits directly outweigh its demerits, the rural activity takes place on the environment, and where the demerits supersede the physical merits, there is a discontinuation of the proposed or on-going development activity. Current EIAs can be carried out, analyzed, and conveniently interpreted through computer simulation techniques. Remote sensing methods and Geographic Information Systems are very efficient in this consideration. No doubt, this rewarding scientific undertaking has been physically absent in the concept of rural development over the years, and this has contributed to the implementation of haphazard development activities which led to different components of rural environmental degradation assessed in the current study.

There is mandatory need to implement a comprehensive education of the rural people and the physical development agencies in rural Nigeria. This measure can be timely achieved using the radio jingles and television advertisements in simple rural languages, public address systems at market and recreational sites, and paid announcements at school premises, churches, mosques, village assemblies, and in strategic rural streets. The specific focus of the rural education would be on the available rural resources and guidelines for exploiting, processing and using these resources without causing immense damages to the ecosystems. The incorporation of essential ecological principles in the resource use and related development activities is suggested in this regard. Of course, adherence to eco-development paradigm which involves the integration of the resource potentials and limitations of the environment including the requirements of the beneficiaries into the development program is necessary.

The overall success of these measures is anchored on effective rural security, community acceptance of modernization, adequate government funding, management and sustenance of rural infrastructures, provision of suitable technology, rural land reforms, community participation in rural development activities, even distribution of the benefits of development, environmental clean-up, regeneration and monitoring, and appreciation of the physical development agencies. A body of environmental and development scientists with infallible records and trustworthy traits on rural infrastructural construction should be employed and empowered to carry out this vital rural activity. The vital role of climate must be observed and integrated in the program. This would help prevent the incidents of environmental flooding, soil degradation, mudflows in the streets, and infrastructural decay in the rural areas in Nigeria.

### Summary and Conclusion

This study assesses rural development and environmental protection in Nigeria. It observes that most of the rural development activities which include agriculture, lumbering, mining, water derivation from the subterranean impermeable interstices and the construction of infrastructures owing to inadequate environmental facts, poor planning, funding, research, innovations, absence of suitable technology and inadequate community participation, run counter to acceptable ecological principles and eco-development paradigm. These drawbacks led to rural environmental challenges in different forms. Environmental flooding, soil deterioration, land subsidence, pollution of water courses, extinction of useful species of plants, migration of wild animals, and human respiratory with sight ailments occurred, inter-alia. The practice of forest regeneration and reforestation of devastated lands, controlled animal grazing on pastures, maintenance of ecological zones, legal enactments to restrain people from indiscriminate lumbering, minimized water withdrawal from the beneath interstices, environmental clean-up, adherence to resource inventory method and environmental impact assessment, alongside the integration of vital ecological and eco-development principles in rural resource extraction, processing, utilization, and waste disposal on the environment are suggested for implementation to standardize rural development and ensure sustainable environmental protection in rural Nigeria.

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