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MAN AND
ENVIRONMENT
THE NIGERIAN
SITUATION

by A. M. A. Imevbore



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by

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MAN is an organism and his environment includes all things, living and non-living, which influence his life.

The study of man's relationship with his environment dates back to the time of his emergence as the dominant species on earth. In the beginning was the land, the plants and the animals. Plants and animals respond to the forces of nature and this involves interaction with the environment. During such interaction animals alter their behaviour to adapt to changing conditions, but this rarely causes trouble. If they are unable to change, they simply die out, and become extinct. More often than not it is only man that upsets the delicate balances of nature, creating environmental problems. This trouble would of course be overcome if man became extinct. However, this is not a solution I would wish to advocate.

Early man—the food-gathering and hunting peoples—were integral parts of the biological communities in which they lived. Tools and language made them efficient hunters but not really different in their impact on the life of the time from other kinds of social animals.

Later, with his skills, man began drastically to modify the environment. This really began when man first learnt the use of fire for warmth and to cook his food. Fossil evidence has established that man in America some 12,000 years ago was responsible for the extinction of seventy percent of the land mammals of large size such as the mammoths, horses and camels. In Africa he wiped out something like thirty percent of the megafauna.

As early as 8,000 B.C. he began, first in Asia Minor, to practice agriculture. This change brought about a revolution in his way of life, which has continued unabated until the present day, enabling man to at least reduce death from starvation. By the seventeenth century, the agricultural revolution was joined by two further revolutions, the industrial and the biomedical. These newcomers also contributed to a further lowering of the deathrate. In tropical Africa the maternal and infant mortality rate is still inordinately high, the latter reaching 400 per 1,000 live births in certain areas in spite of efforts being made to remedy this appalling state of affairs.

Success in reducing the death rate creates a cruel paradox by exacerbating the problems of imbalance between food supply and demand. The birth rate is high because the death rate is high, otherwise man would have disappeared from Nigeria long before now. **If the birth rate remains high when the death rate is reduced, the result is a population explosion.**

In our time, the human population of three and a half thousand million is more than 700 times what it was at the start of the agricultural revolution. Ehrlich and Holdren (1971) have calculated that about five million human beings are added to the world population every twenty-six days. This increase in numbers together with resources

depletion is now on a scale without historical precedent. If the world's food supply becomes less than adequate in the future, crippling malnutrition will affect the population, as it is already doing in parts of Asia. Resistance to diseases will be lowered and the death rate will rise again. Nature will, in the final analysis, establish an equilibrium. Our task is to ensure that this equilibrium is attained without detriment to the quality of life.

There are even some people who claim that the survival of man and every other thing on this planet is now being threatened by the persistent and ever-increasing damage to the environment. Even if this assertion is exaggerated, nobody can deny that the technology of production now outstrips human ability to preserve an environment which is not hostile to life. Day by day our air, water, soil, living space and other resources are seriously deteriorating and if present trends are maintained the prospects will be gloomy indeed. The situation is of course much more serious in the industrial nations but the high level of world economic inter-dependence, the universal nature of the elements of the earth which we pollute, and the rapid communication system make it imperative that the global picture should concern all of us. After all, environmental problems are not restricted to national boundaries. In consequence, we all share a collective responsibility for the survival of and the happiness of the human race on this planet. In any uses, then, to which we put the environment, we must not lose sight of this fact. It must also be recognised that the principles which govern the inter-relationships between organisms and their environment make it clear that the world or for that matter any part of it does not belong to us, rather we belong to it.

This is the background against which we must consider environment issues.

Nigeria

The Federal Republic of Nigeria lies between longitudes 3°E and 14°E and latitudes 4°S and 14°N of the equator. It has an area of 355,174 square miles. Physically it presents many significant contrasts. The range of surface elevation is from sea level to over 4,000 feet on the Jos Plateau. Climatic conditions also vary from torrential equatorial rainfall (more than 200 cm) in the south to semi-desert conditions in the north. Because of its location, the country has a hot climate but again there are variations from north to south. Resultant plant life also varies from dense tropical rain forest, open forests and grasslands to the desert in the extreme north.

A look at the map shows that the country is divided into three

segments by the rivers Niger and Benue; there are several other important rivers of considerable magnitude. Culturally the country is very heterogenous. There are as many as 200 ethnic groups with distinct languages. Also in religion, there is a great diversity from pagan and tribal beliefs to adherency to world religions. Family and ethnic links are strong and for a long time before the advent of colonial rule, the traditions and governments of the different geographical groups were distinct. There were also kingdoms which had provided native and indigenous civilisations. Historical records reveal a long series of conflicts between groups.

In 1963, the population was fifty-six million. Recent estimates indicate a significant rise in numbers since then to about sixty million. If the present growth rate is maintained, it is expected that the population will increase to more than eighty-two million by 1980.

Today, as in the past, the vast majority of the people live in villages with strong tribal loyalties. In recent years, however, there has been a sharp rise of urbanisation with people migrating from the villages to the towns. In 1963, about nineteen percent of the population lived in towns; today it is reckoned to be nearer twenty-five percent. New cities are mushrooming as a consequence of the creation of twelve states, each with its own administrative and industrial centres. The social forces in operation are many and complex and exhibit tribal and geographical peculiarities. By the same token the conurbations are equally dissimilar. For example, Ibadan and Kano date back to the glories of former kingdoms; they were built by their local leaders and their followers. In contrast New Bussa (a future conurbation) being newer is entirely the result of government planning. The houses, shops and mosque built with concrete blocks with asbestos roofs have a simple unifying architectural style running through the whole town. Similarly, Warri now described as an oil city because of the recent growth of the petroleum industry there, is being transformed by a booming economy.

Essentially, Nigeria still remains a country of small peasant farmers with about eighty percent of the total working population engaged in agriculture. Until a few years ago, earnings from agricultural sources and export crops dominated the economy. A variety of food and export crops are grown, such as cocoa, oil-palm, ground nuts, rubber and cotton for export, and yams, cassava, rice, plantains, beans, sugar cane and citrus fruits for consumption in the home market.

Mining also plays a major part in the economy. Already the country is one of the leading African exporters of oil, coal, tin and columbite.

In order to diversify and expand the economy, the Federal and State governments have been actively encouraging the growth of various kinds of industry. As a result of this active policy, the number of industrial establishments has increased substantially

over the last three years. Today there are more than 1,000 industrial establishments and these include textiles, cement, building materials, dairy products, cigarettes, furniture, tanneries, soap, breweries and glass manufacture. Major industries have been developed on the tin, oil and coal deposits. In his recent budget speech, General Gowon announced that plans are nearing completion for the establishment of an iron and steel works, two motor car assembly plants, and a second oil refinery.

From all this information it is evident that in Nigeria today, a careful consideration of the future of our environment is of paramount importance especially in view of the complexity of the social forces in operation. Any discussion of the ecology of man, even if confined to the situation in Nigeria must, in the context of a single lecture, suffer from the sin of omission. Being a biologist, I am interested in studying the human environment in the context of a natural and viable biological system. In doing this, I am aware that in certain instances social and economic considerations as well as technological innovations, will complicate the picture. I shall attempt to view the complex natural systems as governed by the interactions among the constituent parts and to discern the role which man has played in them. I shall also indicate the role he can and should play in the future. Man after all is not only part of the ecosystem, he is the most powerful influence within it.

It is evident that the vast majority of our people are still engaged in maintaining a minimum level of subsistence. Therefore, it becomes a humane objective for all of us, governments, institutions and individuals alike, to resolve to provide the people with the wherewithal to attain a better quality of life. What can we do to aid our underprivileged, ill-fed, ill-housed and uneducated fellow countrymen? We can do much provided we put sufficient effort into resource management.

This calls for development and as Okigbo (1972) stressed, this involves the application of natural resources, human, material and agricultural for the enrichment of the lives of the population. Such enrichment should show economic growth and a degree of improvement in the standard of living of the people. If these aims are to be achieved, we must not ignore the vital role that science and technology can play. Technological change is clearly an important factor in development. But we must also recognise its weakness and deficiencies as we apply it to bring about improved standards of living or to invoke economic growth.

As is now patently obvious the world over, the bitter truth is that those nations with the highest technological know-how and whose populations are enjoying a high standard of living are those which have plundered the earth's surface disfiguring it with vast scars.

They are also those with a multiplicity of the most serious pollution problems affecting the environment. Modern technology provides them alike with a bountiful supply of food, with industrial power, high speed transportation and military power unprecedented in history, but also with grave difficulties in environmental management. The symbols of progress now encompass dirty water, huge garbage dumps, foul air, overcrowded cities with high crime rates. The essence of technological pursuits is constantly clashing with fundamental ecological principles. But it need not be so. The basic problem has been that the attempt to achieve a harmonious pattern of relations with the environment often runs counter to people's immediate economic desires. The short-term view on the management of the nation's affairs and the maintenance of productivity tends to carry the day. Not enough attention has been paid to the fact that the major resources on which we depend are not inexhaustible.

As international attention is now being drawn to the need for longer term perspectives, it seems right that we should first make a critical analysis of the present situation in Nigeria.

Environmental Problems

There are two kinds of environmental problems facing Nigeria. First, there are the problems that are the result of ignorance and of the poverty of society. These form natural stresses which affect not merely the quality of life but all too often life itself. Then there are the problems that are the direct result of the introduction of a cash economy, modern technology and mechanised agriculture. These are entirely man-made. They create an imbalance between man and nature by imposing their own imperatives on the landscape leaving little or no choice for restoring an ecological equilibrium.

Environmental Constraints

With the first group of problems, health hazards are particularly prominent. The large number of diseases prevailing, such as dysentery, malaria, small-pox, tetanus, tuberculosis, measles, leprosy and bilharzia cause a considerable general lowering of the vitality of the population with consequent adverse effects on the overall economy. The gravity of the problem is illustrated by the following figures. In 1964 in Lagos alone, 79,000 cases of dysentery were reported, and more than 10,000 cases of tuberculosis are recorded annually. During 1967, again in Lagos, 44.6 percent of deaths were from pneumonia, malaria, dysentery, tetanus, tuberculosis and measles. According to the World Health Organisation 15,000 children die of measles every year in Nigeria. The health problem is compounded by a

number of other factors, such as the lack of proper drinking water, particularly in the rural areas, poor housing, inadequate sanitation and the absence of proper waste disposal systems as well as the ever-present malnutrition. All these factors lower people's resistance. And fighting malaria, for example, in these circumstances is uphill work. The population is generally scattered as well as being constantly on the move. The construction of buildings and the very climate renders the war against the mosquito an arduous task, to say nothing of the mosquito itself developing immunity to insecticides.

As Adegbola (1972) has pointed out, the dearth of animal protein in Nigeria is particularly striking. He showed that the daily per capita protein intake in the country was only 52.7g of which 9.29 or 15.6 percent only was of animal origin. This is about a third of the amount required to ensure an adequate supply for healthy growth. The gap between demand and supply of fish is similarly wide. In 1970 the total national supply of fish was estimated as 148,000 metric tons, about a third of the demand. Supply of livestock, cattle, sheep and goats is also poor. This has been attributed to feed shortages particularly during the dry season, poor feed quality and a high degree of parasitisation.

Our natural environment is heavily infested with crop pests of all kinds. Locusts, weaver birds, termites, other insects and fungi do extensive damage. In the midst of this serious situation crying out for massive efforts in animal production, man has to bow to the tse-tse fly. The country has about 150 million acres of natural grassland covering about sixty percent of the total land area. However, wide tracts of this potential ranching land are now more or less sterilised by the tse-tse fly, with the result that the lowest density of both human and livestock populations occur there.

Remedies for malnutrition are being sought in developments of various kinds, such as stock raising, fish farming, the introduction of new crop varieties and the focussing of attention on supplementary items in the diet. In spite of these efforts, demand far exceeds supply. There is a food shortage in Nigeria. Although this situation was no doubt aggravated by the civil war it is imperative that it be checked with the utmost urgency before it is too late.

At the same time that the tropical environment allows a high level of productivity, it also presents a perennial hazard from rapid decay. When large quantities of crops are produced, the rapid rate of turnover of biological cycles at the high temperatures which prevail, makes it difficult or near impossible for the food to keep. Food if not processed or prepared quickly for storage will rot and have to be thrown away. A great deal of wastage occurs annually and the attempt to avoid such wastages of fresh foods has provided the basis for a wide variety of the traditional diets of Nigerians.

More important it compels the peasant farmer to sell his crops at a time when supply far exceeds demand. This creates a glut, which only lasts for a relatively short time. It is then followed by a period of scarcity which continues until the next harvest. This cycle of events illustrates the inevitable conflict which confronts man in the tropics—the conflict between productivity and stability.

A further environmental constraint on man comes from natural hazards. Such a one is rainfall. It blesses but it also can be a curse on the land when it is too heavy. In hilly countryside, the upland soil loses its ability to absorb and retain water. The water runs downhill carrying with it sediment. The rivers and streams cannot contain the floods and excessive spates occur through the lowlands washing down the soils derived ultimately from the uplands. Soil fertility is impoverished by one of nature's agencies. In many areas, roads and bridges are periodically washed away. The heavy rainfall also assists leaching in those soils that have not been eroded away.

Man's Impact on the Environment

I shall now consider the effects of man's activities on the environment. In doing this it should not be forgotten that there have been beneficial as well as destructive consequences. For example, although we have removed much of the forest cover in many regions, this reduction was patently necessary to allow us to diversify the environment and to be able to raise crops and domesticated animals without which it would have been impossible to support the human population. The study of man's impact on the environment is an exceedingly complex one, for there is a tremendous number of variables acting upon one another. According to Worthington (1972), "we must apply the scientific method in the study of human ecology. We must try and reduce the number of factors operating in such a way that a few variables can be measured to give significant results that will enable us to assess the effects of change". This method is adopted here for the consideration of a number of selected case histories.

Agriculture

In considering man in relation to agriculture in Nigeria, two questions will be discussed. First, how does the environment affect the methods of agriculture and second, what effect does man's agricultural activities have on the environment.

Although statistics are not available, it is believed that thirty to forty percent of the total available land is either used or is useable for agriculture. Throughout ancient and modern times agriculture has played the dominant role in the total economy of Nigeria.

The farmer has always been limited in his choice of crops. Hitherto,

farming was of local staples grown mainly on a subsistence or local exchange basis. Latterly, the major change affecting the whole economy of farming and its operations has been the development of a high degree of commercialisation of a few commodities. There has been a significant shift away from subsistence farming towards plantation farming purely for the immediate economic advantage. Producers doing this followed the current market requirements. As a result large plantations of cocoa, coffee, rubber and oil palm were established in various areas. The introduction of these export crops produced large monocultures of these different plants. Admittedly, incomes from these were considerable. For example, in the five years 1951-1955, the value of agricultural exports rose to £N132.5 million which was eighty-four percent of all export earnings. Nevertheless, large monocultures are notoriously vulnerable to plant diseases. The cocoa farms and rubber plantations by themselves became an invitation to ecological breakdown. They offer no defence in depth to the attack of pests. Had the farms, on the other hand, been ones with naturally mixed stands of trees, the damage by pests would have been significantly less. The other aspect of monocultures is that they are peculiarly sensitive to the vagaries of changes in world market prices and this can be ruinous to a country relying on a small number of cash crops.

More serious, however, in the longer term, is that the shift towards monocultures has brought about significant changes in the ratio of home produce to that for export. Comparatively far less attention was paid to food products and with increasing population and higher incomes, came a serious and urgent need to increase food production. Furthermore, the new types of farm seriously and adversely affected land use.

In order to maintain these plantations, modern technology was introduced to a greater or lesser extent depending on the financial resources of the individual farmers in question. The four technologies of modern agriculture, namely, mechanisation, irrigation, fertilization and the chemical control of weeds and pests, were employed. Each of these has no doubt made important contributions to the success of agriculture and should continue to do so. However, I would like to sound a word of caution.

The studies by Moss and Morgan (1970) have clearly shown that the choice of crop enterprise, the market value and the cost of clearance or reclearance and weeding operations are major considerations. I would like to suggest that these purely economic exogenous considerations are not enough. By far the greatest weight should be given to conserving the productivity of the land itself. Already soil depletion and soil erosion are widespread in many parts of the country. In the East Central State overfarming has led to serious and extensive gully

erosion. Uncontrolled large-scale mechanisation will only aggravate the problems, as it did in the Congo region when over a period of six years, 30,000 sq. km. of soil was destroyed. Over the last sixty years the island of Madagascar has had its splendid forests transformed into grasslands. Today, seventy percent of the island is occupied by tough grasses, ravaged by fires and moreover is unsuitable for grazing cattle. Again, in Chile and Swaziland, vast forest areas cleared for growing wheat have now lost their top soil. Another historical abuse of the soil is the now classic dustbowl experience of the United States during the 1930's. All these should be remembered as the likely consequences of the folly of overploughing.

Soil is a vital resource. It is not just a collection of decomposed rock. It is a complicated world of biological activity including a collection of different types of micro-organisms. It has been estimated that a biological community of fertile top soil is produced at the rate of one inch every 300 to 1,000 years. Hence any fertile soil washed away in one lifetime, such as the gully erosion in eastern Nigeria, will be lost for centuries if not for all time.

It is vital therefore that the land used for agricultural purposes is not denuded of its mantle of life-sustaining soil.

During the past few years, there have been important irrigation projects developing, notably in the Northern States. These efforts are most praiseworthy. However, like so many other of man's interventions in the biosphere they are bound to have unwanted side effects. One of these is the great increase in the incidence in bilharziasis which frequently follows the waterlogging of the land. This disease is not easy to avoid or prevent and it is exceedingly debilitating. It is vital, therefore, that in formulating the steps needed for the realisation of such schemes, full cognisance be taken of the ecological implications. Adequate research into all environmental ramifications is required before, during and after any major projects have been or are to be executed.

Undoubtedly, the shortage of trained manpower can affect the success or otherwise of such studies, but this is not the entire story. In many cases it is a matter of attitudes. The planner views the development as the means to an immediate good life and sets aside the problems of environmental concern which only arise at a much later stage of the development. The result is that, when the harm is done, the cost of restoring the damage goes far beyond imagination. It follows that prevention is the only truly economic alternative.

As Husain (1971), Deputy Commonwealth Secretary General warned at a conference in London: "for the poor nations preventive measures must be built into the whole process of planning and implementing development programmes".

This was done successfully with the Kainji Dam Development

and it can be done for other similar projects. The research started several years before the actual project. Evidence accrued suggested that the bush should be cleared before impoundment in order to avoid weed infestation and other harmful effects on the fishery resource of the lake. Other results of socio-economic and ecological consequences are now accumulating and provide a valuable experience for river basin development in any other part of the country. There is also no doubt that the significant research findings have guided administrative decisions, helping in no small measure to make the entire scheme not only a success but a model for future planners.

As Oluwasanmi (1960), has pointed out, the basic problem of Nigerian agriculture is the low level of its yield. He has shown that this is a function of both the techniques and implements of farming, as well as the social organisation underlying agricultural production. In view of the current efforts to increase yields by the expanded use of fertilisers, it must be pointed out that fertilisers too can be both a blessing and a curse. The tendency is to use too much with the resulting run-off of the excess into lakes, rivers and underground waters. This creates chemical pollution of drinking water, excessive algal growth and consequent mass mortality of fish. The widespread eutrophication, as this phenomenon is termed, of freshwaters in the United States and Europe is directly attributable to the indiscriminate application of fertilisers to agricultural lands. This is a development we must strive to avoid here in Nigeria.

Similarly herbicides and pesticides are being increasingly used. Overwhelming evidence now exists that DDT and other chlorinated hydrocarbons used as pesticides and herbicides threaten many species of animal life. These chemically stable compounds become dangerously concentrated as they progressively accumulate in different animals moving up the food chain. In many countries, the use of DDT is now prohibited by law, yet in 1948, Paul Hermann Muller was awarded the Nobel Prize for his discovery of DDT. This surely emphasises how little man knows about the long-term effects which the chemicals he uses have on the biosphere. Therefore their uses in Nigeria should be carefully monitored and if found to be necessary, stringent controls should be introduced. A dramatic case in point was recently reported in the Nigerian press on Saturday, 29th January, 1972 in which five-hundred villagers met their death after eating fish that had been caught by the application of poisons to the water.

Forestry

Forest land accounts for about thirty-five percent of the total land area in Nigeria. Of this 36,104 sq. miles or approximately ten percent of the total land have been designated forest reserves. Timber is

produced from only twenty-one percent of the land area which is forest reserve. Nevertheless, Nigerian forests contain about 600 potential timber species of which at present only some fifty are being exploited. Among these the export market demands are dominated by less than ten species, of which mahogany (*Khaya* spp), obeche, (*Triplochiton sclerozylon*) and iroko (*Chlorophora excelsa*) are predominant. Obeche alone makes up more than seventy percent of the volume of logs exported. In 1965, 16,167, cu. feet of timber was exported from Nigeria. As with cocoa and rubber the exploitation of timber was developed almost entirely in response to overseas demand. Here again the local farmer had no choice because the trees felled were determined by outside economic considerations. In consequence certain species were over-exploited while other species (dismissed as of less timber value and designated as secondary) have been under-exploited. This is because many of these secondary species are little known botanically and the quality of their timber has yet to be investigated. Therefore further exploitation of timber on a sustained yield basis demands the utilisation of the so-called secondary species. Our Department of Agricultural Engineering has done just that. In putting up their workshops, they have used dahoma (*Piptadeniastrum africanum*) which is not commercially important. Although the species is abundant locally and is resistant to termite attack, it is not commercially important because it is difficult to kiln-dry it and because sawmills find that it blunts their saws. So far the department has successfully used 500 cu. ft. of this wood. These kinds of studies will enable local uses of timber to be developed. They may also help the export market now that overseas buyers seem to prefer timber from other West African countries.

It is equally important that afforestation keeps pace with exploitation. Without this we would lose valuable forests. Already forests in Lagos State and Abeokuta province of the Western State have been destroyed.

Protecting the forests as an effective means of land preservation should also be vigorously pursued. Adeyoju (1970) has suggested for example that the places near Adazi, Agulu and Enugu in the East Central State where the soil has been seriously eroded could be protected from further damage by constituting them into reserves.

Future developments in timber exploitation would also demand improved logging operations. Redhead (1960) reported that the present practice of timber extraction and haulage causes damage to the forest. In removing 2.3 trees per acre, twenty-five percent of the stems in each acre were destroyed; that is approximately ten percent of the stems in each acre were destroyed by the removal of one single tree.

Various industries have also developed locally as a result of the

availability of timber. There are now 133 sawmills and a number of other wood-based factories in various parts of the country. There are two plywood mills in Epe and Sapele and a veneer mill at Calabar. Other industries such as furniture and joinery, match, boat building, housing (prefabricated flooring boards), containers, carving, brush backs, shoe lasts, vehicle parts, rulers and pencils have also developed to utilise local timber.

Our valuable non-timber resources include indigo dye from *Lonchocarpus cyanescens*, baskets and mats from *Pandanus* spp, roofing materials, brooms from *raphia*, shea-butter fat from *Butyrospermum paradoxum*, palm oil and palm kernels from *Elaeis guineensis*. There are about four million acres of wild palm in Nigeria, producing more than 300,000 tons of palm oil and up to 400,000 tons of palm kernels annually. In cash terms, this must amount to several millions of pounds revenue for the country. The palm tree is also important for producing palmwine, a sweet refreshing drink without which our Palm Wine Drinkards Club would not exist.

Another vital resource from the forests is firewood. Although no statistics are available, the amount of wood taken as firewood must be considerable. Usually when only dead dry wood is removed, there are hardly any ill effects on the forest. But in the Northern States notably Kano and Benue Plateau, the bush is literally being erased of trees taken for firewood. Around Jos, I have seen people cutting live shrubs and small trees which are later sun-dried and sold. It is fortunate therefore that the Kano State authorities are now taking deliberate steps to correct the situation. *Bagaruwa* (*Acacia nilotica*) is now being replanted in areas depleted of this plant which is of considerable local importance as a source of tanning material.

All these factors add to the conclusion that our forests are vital resources which must be managed wisely. It is hoped that the £N3.9m allocated for developing forest industries in the 1970-74 National Development Plan will provide both the capital and incentive which will transform the forest industry in Nigeria into a highly efficient and productive one. Enabor (1972) has suggested that the task should be assigned to a Forest Industrial Development Council, which should be set up with representatives from both government and industry.

Wild Life

Another vital resource from the forests and savannahs is the wild life. This is an important source of protein yet the last century has seen a rapid decline of wild animals as a result of habitat destruction and direct over-exploitation. This is an unwise use of a national resource. For example, the eland and rhinoceros are known to have

disappeared from Nigeria as a result of habitat destruction and hunting. Available evidence indicates that bush meat constitutes as much as twenty-five percent of the animal protein in parts of the country and that in the southern portion of the country, the resource is valued at more than £N9,000,000 per annum. In one year in the sixties, 14,100 tons were eaten in the Western State, 19,600 in the Midwestern and 28,000 in the Eastern State. (Henshaw, 1971)

Rapid action is needed to evaluate and save what remains of the present fauna and to draw up a long-term wild life restoration programme in order to build up the animal population to optimal levels, where they can support cropping on a sustained yield basis.

At present we have twelve game reserves in Nigeria covering an area of over 10,000 sq. miles. These are not enough. We need to establish more on the different biomes in the country. Furthermore, the practice of merely designating reserves constituted primarily for forest and savannah products as game reserves is not good enough. Especially selected game reserves such as those in Kenya and Tanzania are needed and, who knows, the tourist trade may flourish here too. After all, our Francophone neighbours in West Africa have already succeeded in developing their tourist trade and there is no reason whatsoever why we should not do so.

Water Resources

Water is a vital resource to the whole economy. For example, the river Niger is now being used for hydroelectric power at Kainji. Nigeria has water supply problems even though nature has blessed it with a large number of rivers and it receives 375 million acre/ft of precipitati annually. This amount of rain should in theory be adequate to cover the estimated demand, which is 767 million gallons per day. In fact, actual consumption does not exceed 1,035,500 acre/ft per annum or 0.27 percent of the estimated surface water flow (Shonuga, 1971). Therefore, it is evident that there is still an enormous potential to be developed. Any development of this resource must include conservation if it is to be effectively utilised. Already, the rapid rate of deforestation and over-cultivation in the vicinity of settlements, has encouraged increased rapid run-off and water loss. In order to remedy this, land around reservoir sites is now planted with teak plantations. Some of these, known as water-work plantations, are also useful for the provision of firewood and poles.

Today large population increases, high rates of urbanisation and rapid industrial growth, all contribute to the increased need for water. Industry especially is a huge consumer. For example, 240,000 gallons of water are required to produce a single ton of newsprint and 650,000 gallons for one ton of steel. According to Shonuga

of the Faculty of Engineering, University of Lagos, an increase of a 1,000 people in the population would require the provision of up to a further 40,000 gallons of water per day. Allocating existing supply to satisfy the demands of both industry and domestic consumers is fraught with difficulties. In Lagos, the water consumption increased from four million gallons a day in 1945 to nine million in 1960 and to 24 million in 1972. Water shortages, which may reach crisis proportions, are becoming increasingly frequent as supply is often unable to meet demand.

Information on the hydrological data for effective water resource management is still lacking in this country. We urgently need a network of gauging stations on all our major rivers and streams.

Aluko (1971) of the University of Lagos has castigated the absence of municipal water-borne sanitation systems in Nigeria. His review of the situation showed that the bucket latrines and packaged type sewage system now widely used in Nigeria create health hazards. The septic tank sewage disposal system which is also used would seem to offer most promise for the future as all the effluents are disposed of within the premises of the buildings. Abiodun (1972) of the Department of Agricultural Engineering in this University has suggested that the system could be improved by replacing the septic tank with non-permeable tanks so that the sediment can be filtered and used as fertilisers on the farms.

One other point emphasises the lack of a proper water utilisation policy in Nigeria. It is the way we handle our spent water. Apart from creating dangers to health, waste water could be recycled and used again. The ugly sights in our cities created by filthy open drains can hardly be excused. These drains hold stagnant pools of evil smelling sludge. They are the "no-man's land" receiving all human wastes from the homes bordering the streets. Dr. Abiodun's suggestion that these be replaced by closed pipes deserves careful consideration.

I would like to make a plea that a substantial part of the 3.1 percent of the total budget for the 1970-74 Four-Year Development Plan be set aside for providing vital information required for implementing a totally new water utilisation programme for Nigeria. It is also hoped that the sewage disposal proposals for Lagos and Benin City and the storm drainage and refuse disposal plan now being investigated for Ibadan will be implemented in the very near future, and that other towns and cities will quickly follow suit.

Mineral Resources

The other major resource on which man draws is that of minerals. Nigeria's mineral wealth includes petroleum, tin, columbite, coal

and limestone. Iron ores are present but they have yet to be exploited commercially. Industrial activities have been developed in relation to the other minerals listed. With the exception of limestone, almost all other minerals extracted are exported. Today, Nigeria produces ninety-five percent of the world's columbite—the main source of the elements niobium and tantalum—which are used for the production of the high grade alloys used in the manufacture of high speed jet engines.

Tin production stands at about 12,000 tons per annum. Crude oil is currently being produced at a rate of 1.7 million barrels a day, which is equivalent to about eighty-five million tons a year. Revenue from oil now stands at about £N489 million, accounting for seventy-three percent of the country's export earnings. The rise in oil extraction from a level of 849,203 tons in 1960 (revenue N£4.4 m) to 85,000,000 tons in 1972 has been really remarkable.

Some people now worry about the irrational exploitation and depletion of mineral resources. With respect to tin for which information has been obtained, a ten year reserve is assured. On the other hand, crude oil exploitation, being a much younger industry, is still rising exponentially. However, the Federal Government has realised that minerals are valuable but ephemeral resources, with finite quantities and has evolved a definite policy in the field of mining. The Federal Government has decided that it must no longer leave the exploration and production of minerals solely to private firms. It must now participate actively in all facets of mineral utilisation. Accordingly, a National Prospecting and Mining Company is being set up for solid minerals and a national oil corporation for the exploration, extraction, refining, distribution and marketing for petroleum products.

Tin and columbite mining in the Jos Plateau is already causing an appreciable reduction in the amount of rich farmland. Most of the prospecting is done in the alluvium as there is no primary mining of tin near Jos itself. Cassiterite (tinore) containing rocks are found as placer deposits within the catchment basins of ancient river systems. Tin is a typically erosion resistant mineral found in areas which coincide with present-day watersheds. As these areas are also the ones available for agriculture, it is sad to note the enormous wastage of land caused by tin mining. Massive quantities of earth are removed daily from the countryside rendering it unfit for agriculture for many years. The laws under which the prospecting companies now operate seem adequate for ensuring land reclamation and restoration. But they were not in the past. Consequently, open pits and paddocks some more than one-hundred feet in diameter can be found scattered all over areas where mining activities were intense in the past. "Lotto" mining, a term used to describe open

surface quarrying in stream beds also left vast scars on the landscape. A further misuse of the land which I found quite unjustifiable were the unfilled prospecting pits. These are generally three to four feet in diameter, and between twelve and eighteen feet deep, dug at intervals of about one hundred yards for obtaining samples. They were left unfilled and now constitute real dangers to both man and cattle. Many accidents are reported of cattle falling down these pits as they are now overgrown with grass and thus obscured. Even though the Department of Mines has a vigorous programme of land reclamation, and trees are planted and other restoration measures are undertaken, the efforts to date appear to be insufficient in the context of the magnitude of the problems faced.

With respect to the oil industry, we have been subjected in the press recently to numerous inspired "publicity agents for the environment" making statements about oil pollution in the Niger Delta area. Some of these articles are shrill and exaggerated and the sad thing is that the layman and non-specialist will gain the mistaken impression and become quite convinced that the oil industry is indulging in regional vandalism and doing devastating damage to the environment. In order to ascertain the truth or otherwise of these allegations, I conducted an on-the-spot survey of the situation. While it must be admitted that there have been some deleterious effects on the environment as a consequence of the activities of the oil industry, to equate the one with the other is not helpful. There are a number of important factors that we must not ignore. In the first place, safeguards for environmental quality have been built into the law under which the oil companies are permitted to operate. A consequence of this is that the oil companies are constantly made aware that their activities are under close surveillance. It is recognised by all concerned that whatever the value to the nation of the oil, no-one is going to tolerate for one moment pollution of any kind to the land, the water or the air.

The Delta region from which the oil is derived is difficult terrain so the risk of accidents of all kinds is great. I saw bits of shoreline polluted by oil slicks as well as "blow-outs" of wells which had exploded. The one at Bomu cost the oil company concerned the grand total of £N169,000 in compensation. A number of "barrow" pits twenty by thirty feet in area and three to six feet deep were seen which had been left unfilled and containing rain water. These should certainly have been covered up. The land is furthermore under pressure for pipeline channels or "way-leaves".

The total area under lease or licence or otherwise committed is 54,000 sq. miles. Way-leaves normally are up to 200 ft. wide but in the Rivers State, where they pass through potential farm land their size must be reduced to fifty feet.

As a result of the high gas/oil ratio, substantial quantities of natural gas are produced with the crude oil. This natural gas is given off at the rate of 1.14×10^9 cu. ft. per day. Of this amount 80×10^6 cu ft/day are used by the exploration companies. About 130×10^6 cu ft per day is supplied to industries. The rest is flared. As the crude is sweet, i.e. not sulphurous (it contains less than 0.2 percent sulphur) there is neither sulphur dioxide pollution of the air nor the unpleasant "bad-egg" smell of hydrogen sulphide from the oil tanks.

Although gas flared is a resource lost forever, to see this in its perspective, it is important to realise that it forms but a minute proportion of the consumer energy market. Unless external capital is found, for developing the cost of preparing it for export, the markets for gas in Nigeria are not sufficient to absorb such large quantities of gas to make its development an economic proposition. For example, the total domestic consumption of liquified petroleum gas in Nigeria during 1971 amounted to only 11,698 long tons (Anon, 1972).

Towns and Cities

Though the least urbanised of all the continents, Africa has the highest rate of urbanisation. The average for Nigeria is about 4 percent, but is up to five percent for cities with a population of more than 200,000. Towns and cities in Nigeria are characterised by over-crowding, water pollution, high crime rates, and garbage dumps. One must admit however that the rapid rate of population growth makes it increasingly difficult for the expansion of the social services to keep pace with the peoples' expectations. Worse still, many people have rural concepts which are singularly inappropriate to urban areas and this results in slums and squalor of the worst kind.

The proliferation of housing to be found in every town and city is on a vast and ever-increasing scale. The great sprawl of bricks and mortar and the constant vista of unfinished and new houses is a significant feature of the urban environment in Nigeria. Yet it is hardly adequate. It is estimated that from 1974 Lagos alone will require an extra 8,000 houses every year.

There is a danger that we may become so preoccupied with the outdoor environment that we forget the other environment, that indoors. Better housing is required everywhere. The quality of this will have a considerable influence on the quality of life of the people.

In Lagos, atmospheric pollution from automobiles is already beginning. Traffic jams cause a degree of carbon monoxide poisoning to say nothing of constantly frayed tempers. Excessive noise is an overwhelming feature of all large towns and cities. Studies undertaken elsewhere have shown that noise is a factor in such stress-

related conditions as peptic ulcers and hypertension. It is necessary for us to recognise that noise in our communities is also a form of pollution. Therefore it is vital that cities of the future or redesignation of the old should be healthy and aesthetically pleasing as well as economically sound.

Institute for Ecology

I have discussed a number of case histories to illustrate the variety and complexity of the problems with which man is faced in his relationship with his environment. In comparison with the so-called advanced nations we might think that as yet there are no ecological crises in Nigeria. There are pollution problems at this moment and the signs of worse problems in the future are becoming apparent. It is up to us whether, having read the writing on the wall, we choose to heed the warning or to ignore it.

Unlike the situation in Europe and America, we will not be able to plead that we did not know what we were doing. We know. But we need to know more. We can recognise the obvious signs of environmental deterioration. We ought to know long before such stages are reached. Our immediate duty then is to acquire knowledge. As our present stage of knowledge is grossly inadequate, knowledge is the first weapon in our armoury. This we must have before we can take the necessary action.

As Halstead (1972) has rightly stressed: "it will not benefit mankind one iota if he can unlock the mysteries hidden in a single cell, if at the same time through his ignorance he continues to upset the delicate balances of nature on which his survival ultimately depends. The study of the environment and man's place in the scheme of things will be neglected at our peril".

But as I hope has been made clear in this lecture, the problems with which we are confronted span many disciplines. Although I am a biologist, I have been obliged to consider areas far removed from biology. This is how it should be. It just illustrates the point that the immediate need is for experts concerned with the many aspects of the environment and man's multifarious activities in relation to it to be brought together, for collectively tackling the fundamental ecological problems facing us.

In our view, this complex task can best be undertaken by an Institute for Ecology. We believe that the University of Ife is particularly well-suited for operating such an institute. The university has a very large campus (14,000 acres) allowing for expansion and for field experiments of all types. It is located within a centre of a series of vegetation zones with varied ecological problems. Many departments in the university in the biological, agricultural and social science

fields are already operating ecological research projects which are of direct assistance and economic importance to the community. For example, the Industrial Research Unit within the Department of Economics has been studying the structure and functioning of small scale industries and the measures which can be taken to improve the efficiency and scope of operation of small-scale industrialists. Active consideration is given to environmental issues in these pursuits. Our Department of Geography's Environmental Resource Base Project has been designed to provide comprehensive information on the environmental resources necessary to facilitate regional planning. The university's Demographic Research and Training Unit has been conducting research into population problems and has in addition been training personnel in the vital area of demography and human ecology. It is in fact one of only two such centres in the whole of Africa. The Kainji Research Project has since 1965 been engaged in the study of the total range of knowledge offered by the creation of Lake Kainji in order to develop expertise in the ecological consideration for river-basin development. Similarly, the Termite Research Project and the Natural History Museum Unit are involved in studies relevant to human ecology in Nigeria. All these projects demonstrate the active involvement of various departments of this University in environmental studies.

The establishment of the Institute will provide a beginning from which we shall advance in our task to ensure that we as a nation cease to be "short-term pragmatists accustomed to dealing with the future only when it becomes the present".

We can no longer afford this. Posterity will not forgive our generation if we do not accept our responsibilities to the future now.

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