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FOOD SECURITY AND SAFETY IN NIGERIA: THE IMPACT OF ENVIRONMENTAL POLLUTION ON LIVESTOCK PRODUCTION SYSTEMS

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INTRODUCTION

Food security has been defined as access by all people at all times to the food required for them to lead a healthy and productive life (von Braun *et al.*, 1992). Its extreme opposite, food insecurity or famine is a catastrophic disruption of society as manifested in a cumulative failure of food production, distribution and consumption systems (Webb and von Braun, 1994). Famines are about death, and this is very obvious to the casual observer. However, in reality famine is actually more than death. To Apostle John, the author of *Revelations* in the Holy Bible, famine is an entity that is distinct from the *Weapons of Power given to the two horsemen of the Apocalypse*, namely War, Pestilence and Death (*Revelation 6: 8*).

Famine has three principal manifestations viz.: extreme, geographically concentrated shortfalls in food consumption that result in chronic loss of body weight and a rise in excess mortality; massive social disruption, including community dislocation and "abnormal behavior; and long-term resource depletion, including the degradation of productive material assets, of the natural resource base, and of human and animal capital (Webb and von Braun, 1994). Some common causes of food insecurity or famine are political and social instability, wars, natural disasters, *man-made* disruption of the eco-system resulting from abuse, over-use, neglect and even wanton, and at times willful destruction of his environment.

Physically, Nigeria lies within latitude 4°16' – 13° 52' N and longitudes 2 – 49° 32' E being 1100km on a North/South axis, 1300km on an East/West axis and encompassing a total land mass of 923,700km². According to Ita and Sado (1985), 124,878km² (13.52%) of the landmass is covered by the waters of the nation's major rivers, lakes, ponds and pools. These however, exclude the coastal regions of Nigeria, which extend from the Nigeria/Benin Republic border in the West to the Nigeria/Cameroon border in the East, a distance of 850km (Ibe, 1988). The vegetation zones in Nigeria are forest in the coastal and near coastal regions and various types of savanna elsewhere, except for Adamawa and Jos Highlands, where the vegetation is montane (Egborge, 1993).

The World Bank (1987) puts the population of Nigeria at 102 million and predicted a population growth to 163 million by the year 2000. Presently, unauthenticated newspaper reports put Nigeria's population at 118 million. Rapid population increase coupled with technological advances in agricultural and industrial practices, misuse and

abuse of many forms of these practices bring about the introduction of various substances into both aerial, terrestrial and notably, the aquatic ecosystems. Some side effects of a number of these advances, resulting in environmental pollution, are the alteration of the course of evolution and shift in the "balance of nature". These processes result from the fact that these environmental pollutants tend to simplify the community structure through the elimination of the more sensitive plant and animal species; cause changes in species relationship within the community; and alter nutrient cycles and subsequently affect the composition of the community. The net effect of these factors is a decrease in the diversity of the ecosystem, which results in a more unstable system. Such communities are subject to wide fluctuations in population, food security, socio-economic and political stability, and the very essential of life itself, be it for plants, animals and ultimately, man.

The five main variables that affect adequate food availability, access and appropriate food use are Resource, Production, Income, Consumption and Nutrition. Positive or negative variations in the framework and complexities of each of these variables will result in either food security or famine. A proper understanding of these relationships, especially as it affects livestock (including aquaculture) production is illustrated in Fig. 1. The most principal factor in the web of these variables is the resource. This includes natural resources – air, land and water ecosystems; physical resources, which will include micro- and macro-weather systems, natural and artificial lighting systems (sun, different types of light rays) etc; and last but not the least, the human, animal and plant resources. Any adverse effect on the web of interrelationships between these variables, positively or negatively, will shift the delicate balance existing in the course of nature, either for survival or otherwise. Within this Resource group, the use, abuse or neglect of the natural resource, an absolutely God-given resource, by man will be the focus of this discourse.

THE NATURAL RESOURCES AND THEIR ABUSE BY MAN

The Holy Bible tells us of the three resources available before creation to be Air, Land and Water. Fresh, unadulterated and unpolluted air in the atmosphere, just like blood, is a life giver and keeper. Air pollution is not only expressed as the pouring into the atmosphere of poisonous and obnoxious factory, automobile and sundry gases, it could also be reflected as the popular ozone layer depletion and the attendant porosity of the atmosphere to the dangerous rays from the sun, hitherto protected by the ozone layer, onto the earth surface. The net effect of the dangerous gases and irradiation to both plant and animal life is, at least for now, not quantifiable.

Land is a natural resource on which terrestrial animals and man, amphibious and even some aquatic plants and animals depend absolutely or partly for life. As the natural habitat, proper and improper use of land will directly have effects on the sustainability of life. Man in his quest for living (and experimenting in many cases), getting rid of both his liquid and solid wastes has turned this all-important natural resource into his ultimate killer.

Water is essential for all living organisms. In addition to being needed for all aspects of plant, human and animal life, it is also needed for aquaculture and also by the organisms it harbors. The bodies of water serve as the ultimate sink for most of the

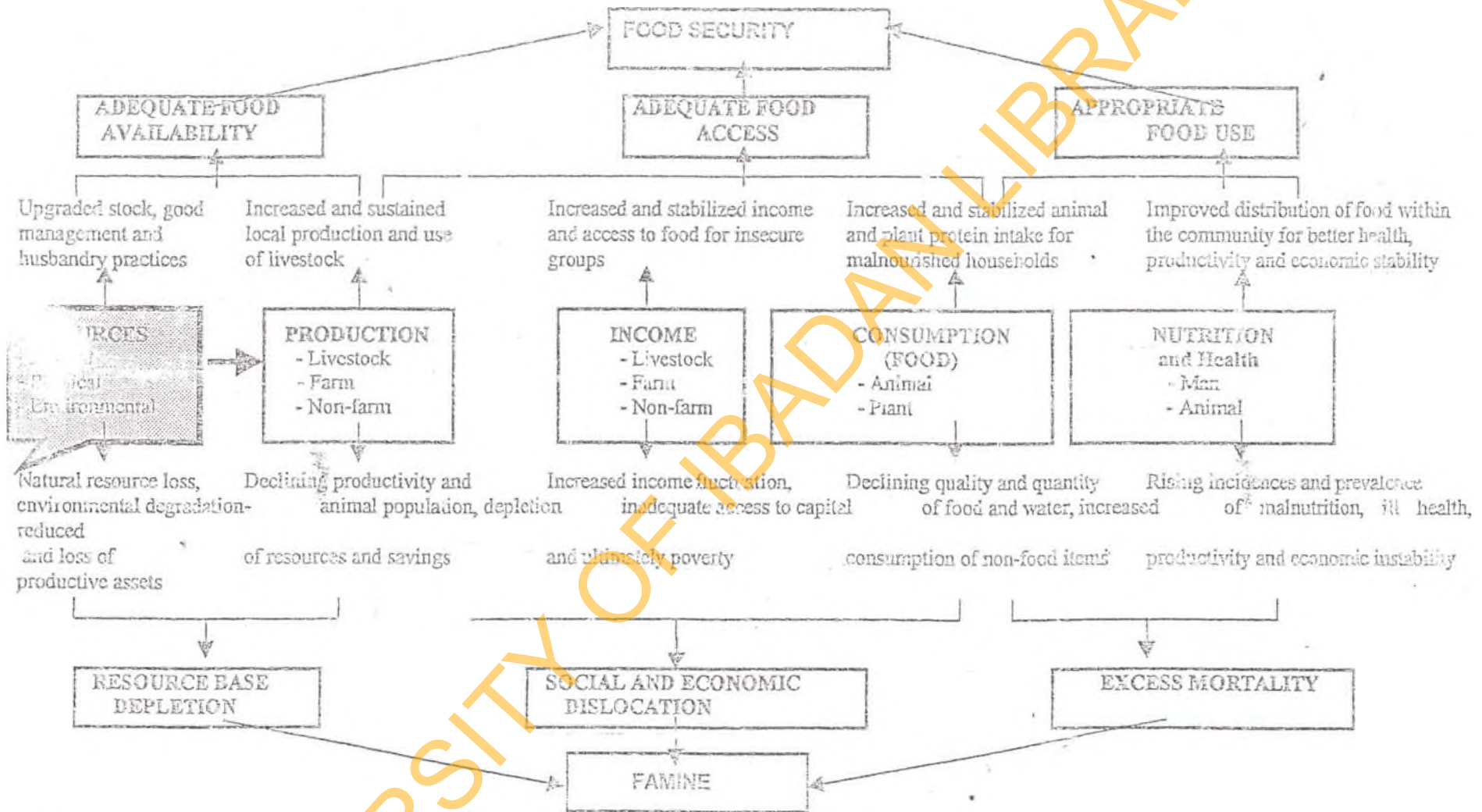


Fig. 1: A conceptual framework for understanding relationships between famine and food security.

(Adapted with modification from Webb and von Braun, 1994).

substances, natural or otherwise, from both air and land. Man has made flowing and even stagnant waters a medium for getting rid of his wastes (both domestic and industrial), thus introducing obnoxious substances into them, which consequently pollute the water bodies. These wastes at high concentration adversely affect the physico-chemical properties of the water which consequently affect not only the biota in such water bodies, but man and animals that turn round to drink such polluted water, mostly as partly-treated or untreated, especially in the rural, semi-rural and some urban environments in developing and under-developed nations.

In the past when industrial activities were at low levels especially in Nigeria, many aquatic ecosystems remained largely unpolluted because pollution stress was low and easily accommodated by the natural self-purification process of the aquatic ecosystems (Sikoki and Kolo, 1993). However, as a result of increasing human and animal population and activities, increased demand in aquatic resources and industrial activities, the situation has since changed. The greatest pollution problem Nigeria has ever had, and still experiencing, is aquatic pollution. Oil spillage's top the list, followed by uncontrollable discharge of industrial wastes into water bodies, and not the least by unguarded use or outright abuse of chemical agricultural inputs such as fertilizers, herbicides and pesticides into the environment, with disastrous health and productivity implications to both land and aquatic biota. Some of these discharges pose serious problems and eco-disasters of varying types and magnitude to food security, human and animal health, and the economic and social stability of the nation at large.

Pollutants and Sources of Pollution.

From an ecological point of view, two basic types of pollutants are recognized. These are non-degradable and biodegradable pollutants (Sikoki and Kolo, 1993). The non-degradable pollutants include polythene bags and nylons (for "potable" water that is now a common sight in Nigeria etc.), plastic containers and wares, aluminum cans, mercurial salts, copper, cadmium, lead, cobalt, zinc, long-chain phenolic chemicals, DDT etc. These pollutants do not degrade or degrade only very slowly in the natural environment. Non-degradable substances are not only known to accumulate in the environment, where they are largely abandoned in heaps of wastes in many urban and peri-urban cities and even farms, some of them have been shown to be "biologically magnified" as they move in biogeochemical cycles along food chains (Odum, 1971; Kumar, 1980). The biodegradable pollutants include domestic sewage or municipal and industrial effluents such as organic matter, numerous microorganisms, bacteria and viruses, some of which rapidly decompose by natural processes and engineered systems. However, when some of these are allowed to pile up in very high concentrations in the environment, especially in inland water bodies, the rate of biodegradability will be overshadowed by the need for such water bodies for the use of man and animals, and bio-accumulation in food plants grown near or even with such water bodies. Such plants when consumed will serve as sources of poisoning to man and animals, disastrous health and productivity consequences.

EFFECTS ON LIVESTOCK PRODUCTION SYSTEMS

The aerial, terrestrial and aquatic resources placed at the disposal of man, especially in Nigeria, are very abundant. Many of these resources, which vary in composition, are renewable, but the continuous usefulness of the resilient but fragile ecosystem in which these resources are based is dependent upon responsible usage and maintenance. Irresponsible usage, overuse or neglect in some cases, cause varying degrees of ecological disasters, which adversely affect the livestock (including aquatic) production systems, either intensive, semi-intensive or free range.

Air Pollution

The damages that pollution of the aerial ecosystem causes to livestock are very enormous. Pollution of air by dangerous fumes and effluents from industries, automobile and sundry sources directly and indirectly affect livestock. If these fumes are not directly toxic, that is cause death by asphyxiation; they may cause severe irritation of the upper respiratory system, thereby initiating or complicating innocuous respiratory or other systemic diseases. Occurrences of acid rains have been reported in various parts of the country within the last 3 to 5 years (numerous newspaper reports).

Very recently, precisely on Thursday, 12 July 2001, an aquaculturist client rushed to our Veterinary Pathology Department in a frenzy mood. He reported a mortality of about 60% of his experimental homestead *Clarias* and *Heterobranchus* breeding stock within 4-6 hours after a moderately heavy rain overnight. Upon investigation, we detected darkened water and heavy deposit of soot at the bottom of the aquaria. Some leaves of adjoining vegetation were covered with thick soot resulting from fumes of smoke from the burning of tar being used by a construction team patching leaking roofs of a conference center within the University of Ibadan. Many of the surviving fish showed signs of severe respiratory stress and uncoordinated movements. Gross postmortem examination of the dead fish showed intensely reddish gills, blanched skin and pale conjunctiva. On histological examination, there were slight ballooning degeneration of gill epithelial cells, focal hemorrhages in the gill submucosa and cerebral cortical meninges, and few focal areas of centrilobular hepatic necrosis. Chemical analysis carried out on the water revealed slight acidity (pH 6.2). Our findings are consistent with acute anoxia, which may be related to "acid rain" and carbon monoxide poisoning. What a colossal loss (economic, research and time), resulting from "simple (?) environmental pollution!!

Many domestic livestock species in communities around the Ewékoro Cement Factory in Ogun State have been reported to suffer varying degrees of respiratory diseases (Alagbe, personal communication) and one big time commercial poultry farm had to fold up, in the late 1980s because of the frequent high incidences of respiratory diseases in their flock (Dr. V.O. Taiwo, personal experience). Another very recent example is the dislocation of a community in Delta State by salt rain (Anchor Newspaper, 12 July 2001; page 3) from aerial pollution with mist from a salt manufacturing company in the locality. Many people in the community were reported sick; a lot of domestic livestock owned by

the residents were reportedly dead, apart from habitat dislocation of others, which will affect their health and productivity.

Misuse of the Land Resource

The productive management of domestic and semi-wild livestock is based on the land resource. Direct and indirect abuse or overuse of the land resource affects grazing and food supply sources to these animals. Some of these effects are outlined below:

Dumping of Refuse, Human and Industrial Wastes

In Nigeria, the environmental impact of improper dumping of wastes (human and industrial) on livestock production systems cannot be easily or justifiably quantified. A few of the common examples that have been documented are:

- (i) Ikem (1996) found high levels of chemical oxygen demand (COD), dissolved and suspended solids, ammonia, iron, nickel, chromium, manganese, cadmium and pH in soils, adjacent streams and wells around waste dump sites in two locations in Ibadan (Orita Aperin) and Lagos (Oworonsoki). Many of such waste dumps are common sights in our towns and cities. Water bodies around these sites become repositories of these dangerous substances, which ultimately find their ways into the systems of animals and man, resulting into poisonings and attendant morbidity, reduced productivity and mortality. The magnitude of the economy of therapeutic intervention cannot also be quantified.
- (ii) the consistent finding in our postmortem laboratory at the Department of Veterinary Pathology, University of Ibadan, of different sizes and compositions of polythene wrappers, jute bags, plastic wares and other sundry solid materials in the gastrointestinal tract of free-range or semi-intensively reared ruminants swine and even poultry. On one occasion, 18kg dry weight of a combination of jute bag, nylon and other solids were recovered from the rumen of an adult cow which died from ruminal impaction-aided respiratory distress and peripheral circulatory failure. Items such as bar soap, common salt, and other dangerous items, including stones and sticks (!) picked from waste dumps have been recovered from the stomachs of other domestic animals. It is a common site to find various types of livestock (cattle, sheep, goats, poultry, etc) especially those on free range or semi-intensive management, scavenging on rubbish heaps, even within our cities. The implication of this on their health, productivity and economics has not been quantified, but could be disastrous!
- (iii) indiscriminate and improper disposal of wastes from petrochemical substances such as diesel spills from trailers, spent lubricating oils and from automobile mechanic workshops spread across most urban and rural communities has led to the percolation into the ground of such wastes. In at least one widely publicized incidence at Orogun area of Ibadan in 1993, water from wells dug in some parts of this area were reported to have kerosene-like taste, and that some considerable quantity of "kerosene" were recovered from such wells. Upon close observation and investigation, it was discovered that the areas were at lower altitude and are not far from the Trailer Park at Ojoo, a place that is notoriously polluted by waste automobile oils and lubricants. Cattle and other ruminants, which are known to lack gustatory discrimination,

have been reported to consume crude petroleum and kerosene from spilled pools on the ground and those floating on ponds and streams with disastrous consequences (Toofanian *et al.*, 1979; Barber and Cousin, 1997). Since most of our ruminant stock is in the hands of smallholder and pastoralist nomads, whose main type of husbandry system is extensive, these animals which freely roam about are exposed to danger of consuming such polluted water.

Soil Erosion and Drought

Uncontrolled tree felling and subsequent deforestation, roads and dams construction and other sundry activities, lay bare large expanses of land. These result in undue exposure of soil to direct sunlight, erosion and ultimately desertification, drought and famine. Drought and famine does not only compromise crop cultivation; they take a heavy toll on livestock, resulting from reduced forage and fodder availability, competition between man and animals for available grains, increased cost of livestock feeds and other feed inputs. All these lead to reduction in or loss of production, high prevalence of diseases, animal mortality and loss of productive assets.

Drought situations in many parts of northern Nigeria cause the annual and at times continuous mobility through nomadism and transhumance by Fulanis and Shuwa herdsmen who practice the inefficient traditional (free range) method of husbandry (Ikede, 1989) and who produce up to 80% of our animal protein (Obot, 1993) in this country. Such transhumance has exposed predominantly trypanosusceptible Zebu cattle to the tsetse and trypanosomiasis plague, resulting in deaths, reduced productivity and high costs of treatments (Ikede and Taiwo, 1985; Ikede *et al.*, 1987). Consequent upon their movement into the largely agrarian southern parts of the country (to as far as the coastal regions), deadly clashes have been (and are still being) reported between the resident communities and the nomadic Fulanis when the latter graze their stock on food crops. Some communities even go to the extent of using poisonous chemicals on their crops or vegetation with resultant mortalities of cattle that were grazed on such crops or vegetation. Ethnic tension, communal clashes and avoidable human and animal mortalities have always accompanied this. The absence of adequate numbers and maintenance of grazing reserves in Nigeria (Falobi, 1998) has compounded this problem and may continue indefinitely, if adequate measures are not taken by the government.

Indiscriminate Use, Abuse or Overuse of Chemical Farm Inputs

(i) Fertilizers, herbicides and pesticides have been generally abused in our agricultural systems to the effect that soil quality has been compromised, bio-accumulation in plants and farm produce, improper dumping or handling and the consumption of chemically-preserved stored foods (mostly grains) serve as poisonings for both animals (Fadina *et al.*, 1999) and man. Heavy fertilization with nitrogenous compounds and the use of certain herbicidal compounds have been reported to marked increase nitrite and nitrate contents of plants, respectively (Radeleff, 1970). These two chemical substances have been shown to cause varying degrees of tissue hypoxia, and may lead to death in relatively high concentrations. In many parts of the north where agricultural practice is

associated with consistent use of fertilizers and herbicides, produce from such practice, containing bio-accumulated residues of chemicals can be potentially dangerous to consumers (both man and animals)

- (ii) The drainage of such dangerous chemical farm inputs such as DDT, nicotine, Karate®, gamma-BHC, gammalin-20, dieldrin etc. into water bodies (including wells) and the eventual consumption of such polluted water leads to toxicity in man and animals. Such pollutants, when they build up to considerable concentrations in surface waters and lagoons become dangerous to fish (Taiwo *et al.* in press), and probably to man or animals that in turn consume such fish.

Water Pollution

Although our waters and their resources are abundant and are renewable; their continuous usefulness is dependent on the responsible usage of these resilient but fragile ecosystems taking into cognizance man's activities that are deleterious to water quality. In different (if not most) parts of Nigeria, it is common knowledge that rivers and streams are used as disposal sites for refuse, human sewage, wash waters from kitchens and wastes from abattoirs and industries. Streams and rivers running through areas of significant human influence such as farms, cities and industrial estates are prone to pollution, especially where environmental protection regulations are not in existence or not strictly enforced (Fagade *et al.*, 1993). Livestock and aquatic resources in such areas have been decimated (Ajayi and Adeleye, 1977; Ajayi and Osibanjo, 1981; Egborge, 1991), and considerable parts of such streams with signs of organic pollutants had no fish in them (Fagade *et al.* 1993). The Lagos lagoon is a living example of the largest water refuse dump in the country!

Two main rivers (Ona and Ogunpa) and very many subsidiary streams drain Ibadan City with an estimated population of over 5 million people and several large, medium and small-scale industries. Fagade *et al.* (1993) in a three-year study reported significantly, but seasonally varied increases in water temperature, transparency, pH, total ionic contents, total alkalinity, ammonia nitrogen concentration, heavy metals, coliform bacteria counts and progressive decreases in aquatic biota in some monitored rivers and streams within and around Ibadan City. Ademoroti (1983) observed that the untreated wastes being discharged from the industries and residential areas in the city into these rivers and streams contained high levels of heavy metals. The rapid and continuous rural-urban migration into Ibadan and other metropolitan cities has led to increased population growth, number of automobiles, industrial activities and progressive deterioration of the environment. Coupled with difficulties in waste management resulting from unwholesome government policies, very rapidly deteriorating societal hygienic practices and habits have helped to compound the problem of environmental pollution and its danger to life of man and animals.

Oil and gas exploration in the coastal and inland riverine areas of Nigeria has and is still causing phenomenal land and water pollution with a very high degree and colossal waste in crop, animal and aquatic resources, if not man. Gaffar (1993) reported that between 1976 and 1980, over 56 million gallons of oil was spilled into the Nigerian environment as a result of deliberate dumping, accidental spills, pipeline leakages, leakages at drilling rigs or disposal of used oil. Nowadays, there is hardly a week when

one or more incidence of oil spillage and pollution is not reported (in newspapers) either through accidents or by sabotage by pipeline vandals along the pipelines, which criss-cross the length and breadth of this country. The impact of such pollution has largely been underestimated or not adequate quantified, especially on our vast aquatic resources. Oil prospecting and extraction have caused livestock, fish and other marine life genocide due to pollution by oil spillage's and shock wave destruction from dynamites and explosive charges used in seismic activities (Kerr and Edwards, 1991; Ibeakuzie and Bereiweriso, 1993). Many hectares of coastal lands and polluted areas have suffered severe erosion, oil sludge encroachment and colossal loss of flora and fauna. Potable water, apart from the apparent dislocation of their traditional occupation -- fishing, has continued to be an enigma to human and animal populace in such areas. As a result of these hardships, there have been deadly uprisings by restive youths, economic sabotage and threats of secession.

CONCLUSION AND SUGGESTIONS

Animals and especially man, rely essentially on the resources of nature for survival. Their food, water, drugs, clothing, shelter, energy requirement, and many other factors required for living are derived from nature. Natural resources as a whole, whether renewable or not, have suffered catastrophic exploration, exploitation and waston destruction, notably by man, particularly in the 20th century. The essence of renewable natural resources management is to balance the rate of their use against that of their formation or production in order to maintain stability and ensure sustained yield within the framework of ecological realities and balanced ecosystem from which the resources are derived. In this regard, the following recommendation and suggestions are proffered:

- Urgent need to set up effective national food safety and quality control systems to monitor, from time to time, the food and foodstuff being made available to man and his animals (*expand NAFDAC's mandate or set up other bodies ???*)
- Enact and make effective relevant legislative instruments and appropriate funding of agencies for enforcement of standards
- Immediate arrest and control of the causes of the fast deteriorating aerial, terrestrial and aquatic resources by instituting EIA studies by experts in various working groups
- Mass education on dangers of indiscriminate use and disposal of chemicals, proper waste management, and community and personal hygiene
- Biodiversity studies, inventory of livestock resources, setting up of gene banks, and genetic improvement of our livestock species

Since man has no other planet to run to yet, the continued survival of man and his animals will depend on his *ability to maintain a balanced ecosystem and sustainable resources* to the benefit of both present and future generations ... Man

did not *create* his environment and should not destroy it, lest he be destroyed along with it !!

Thank you for listening.

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