

ENVIRONMENTAL CHALLENGES AND TECHNOLOGICAL ADVANCEMENT: A CASE FOR PROPER ENVIRONMENTAL MONITORING AND MANAGEMENT USING MODERN TECHNOLOGIES AND TECHNIQUES

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Abstract

Mankind is facing a number of environmental challenges now, most due to his own activities within the environment. Advances in technology largely contribute to the environmental problems, but some of them are used in solving the problems. The paper introduced the topic by defining environment and establishing its importance. The effects of population pressure and man's activities on the environment and biodiversity were discussed. Education, information and technology have been found to be very important in monitoring and management of the environment, and conservation of biodiversity. Recommendations are made as to how to check the processes of environmental degradation, and new technologies and techniques are presented for solving environmental problems.

Key Words: Environment, technology, population-pressure, biodiversity, conservation, techniques.

Introduction

The Environment

The environment consists of the Air, the Water, and the Land. Information about the environment is obtained from the atmosphere, the land, and the oceans. In other words, our environment, which comprises man and other life forms, is made up simply of the air, water and land.

Encarta 2004 defines environment as: the natural world, within which people, animals, and plants live. It goes on to say that "it is regarded by many as being at risk from harmful influences of industrial society"^[1]

What connects human beings world over, in our daily lives is the global environment. More and more are now realizing that what we do to the environment has far reaching ramifications. Statements about the environment based on unreliable information are of little use. Without facts we cannot understand the complex interrelationships between natural and human processes which shape our environment.

ENVIRONMENTAL CHALLENGES

Development

Development anywhere carries with it environmental consequences that could ultimately negate the goals of the development process. Past ignorant choices of man in the course of his economic operations have initiated some harmful effects on the environment. Baba, 1992 states: the negative impacts of man's activities on the environment now stands as grave dangers to human survival and well-being (like a boomerang that bounces back to hurt or destroy its thrower).^[2]

Physical development (infrastructures), industrialization, and agricultural practices are some of the ways man interacts with the environment and create problems in the environment.

Because agricultural development depends on the direct utilization of such physical components of the environment as soils, climate, flora, surface and ground water, etc. they constitute the most widespread channels of contact of man with the environment in his economic pursuits.

Population Growth and the Environment

The increasing human population is affecting the environment. Human activities on earth are increasing and in many dimensions, and most are environmentally unfriendly. Nigeria's ever growing population, currently put at about 122 million in the estimation of the National Population Commission (NPC, 1991 CENSUS), will hit 160 million by 2010, at a yearly rate of 2.98 per cent.^[3]

In Nigeria, the main causes of environmental resource degradation are high population growth rate with attendant population –pressure on the resources; use of agricultural practices that are environmentally unfriendly, and poverty (Onuigbo, 2002).^[4] It is a universally accepted fact that population growth affects agricultural production systems. When the population density increases beyond certain critical levels, fallow periods will decline, as there will be less land available for farming, the carrying capacity of land falls and production declines. Some of the poor agricultural management practices include the wide use of machineries and chemicals to clear farmlands and indiscriminate removal of vegetation.

Environmental Degradation

Concern for the impact of development on national and global environments has been growing as evidence accumulates of changes in weather patterns and increase in pollution levels and the sustainability of patterns of the use of natural resources is

questioned. The United Nations Conference on Environment and Development in Rio de Janeiro has drawn particular attention to two issues – global warming and declining biodiversity. There are many other issues, which relate to environmental degradation. These include access to clean water, rising levels of air pollution and its consequences (e.g. acid rain, ozone layer depletion), excessive pesticides, and the consequences of the persistence of residues which contaminate food chains, disposal of solid wastes (both domestic and industrial) especially those that are hazardous, soil erosion, and deforestation (CDL, 1993).^[5]

Most of these developments cannot be separated from the effects of high rates of population growth, which reduce the period over which adjustments can occur to changed patterns of land use, increased emissions and higher levels of consumption of products deleterious to the environment. The relationship between population growth and environmental degradation are not simple and can come in many forms. Poverty, as well as economic growth, can be responsible for some kinds of increased environmental degradation. Our intensive land use using inappropriate technologies can affect fresh water sources, and diminish indoor air quality through the burning of bio-mass.

Man's Direct Contributions to Environmental Problems

A look at how man's activities contribute to some of the identified environmental problems:

CLIMATE CHANGE

The increasing human population is affecting the climate. Man's activities within the environment have led to problems such as Global warming, ozone layer depletion, loss of biodiversity, desertification, and climate change. From simulation, the more the population, the worse the environmental problems. Evidence suggests that production of carbon dioxide (carbon 2 oxide) and methane from human activities has already begun to change the climate, and that radical steps must be taken to halt any further change. Gases produced and used by man have been accumulating in the atmosphere causing ozone layer depletion and global warming. The fact that heat-trapping gases have accumulated in the atmosphere is well established. The increase has come about because human activities, especially the burning of coal and oil and destruction of forests, have released greater quantities of carbon dioxide into the atmosphere than have been removed

by diffusion into the oceans or by photosynthesis on land. A rapid and continuous warming will not only be disastrous to agriculture but also lead to wide spread of death of forest trees, uncertainty in water supplies and flooding of coastal areas. Such flooding was recently experienced in Nigeria in 2012.

DEFORESTATION

Green house effect or global warming is as a result of heat being trapped within the close-earth environment. It is a consequence of deforestation and other misuses of land and its resources. Forests are no longer spared; the rate of deforestation is alarming. In the tropics more than 16.8 million hectares are destroyed every year by agricultural expansion, ranching, logging and over exploitation for fuel wood. When forests disappear, so do the soil on which they stood, and the peoples and species that lived in them. Deforestation is responsible for between a quarter and a third of the CO₂ humanity has added to the atmosphere to date, increasing the risks of global warming.

Over 80 per cent of the planet's forests have been destroyed or degraded; a quarter of the world's mammal species are at risk of extinction, and biological diversity is disappearing at an alarming rate. More than half the world's coral reefs are threatened by human activities, and marine fisheries are being over-exploited to the point that their ability to quickly recover is in doubt (Toepfer, 2000).^[6]

PECULIAR ENVIRONMENTAL PROBLEMS

Some of the serious identified environmental problems are:

1. Deforestation
2. Ozone layer depletion
3. Desertification
4. Climate change
5. The generation of huge quantities of domestic wastes
6. Increasing quantities of gaseous effluents from transportation
7. Domestic heating and heating from industries
8. Chemical and solid wastes from industries
9. Poisonous gaseous emissions
10. Increasing sound (noise) from traffic, and electronics/loud speakers etc.

TECHNOLOGICAL ADVANCEMENT AND ITS CONSEQUENCES

The amazing technological and organizational skills of human beings now gives the impression that man can now subdue the

environment to his advantage. According to Erhlich, et al. (1970), “while the intelligent application of technology fosters human well being directly, a reducible but not removable burden of environmental disruption by the technology undermines well being.^[7] The negative burden includes the direct effects of technology's accidents on human life and health ...” (quoted in Baba, 1992). Technological advancement has led to the production of vehicles of all types, establishment of industries; oil prospecting and processing, space rockets, etc. All these introduce poisonous gases into the environment and they invariably affect human beings. Modern man is the cause of the systematic destruction of life on earth, by his increasing activities within the environment. Chlorofluorocarbons (CFCs) used in air conditioners, and as refrigerator coolants as well as aerosols propellants are known to be damaging the ozone layer which protects us from the sun's dangerous rays.

ATMOSPHERIC EMISSIONS

The origin of emissions can be natural or man-made and from either diffuse or point source. The main sources of atmospheric emission are: industry, landfill sites, transport, intensive farming with chemicals, etc. The key pollutants are:

- ✓ Sulphur dioxide (SO₂)
- ✓ Oxide of Nitrogen (NO_x)
- ✓ Lead
- ✓ Ozone (O₃)
- ✓ Carbon monoxide
- ✓ Particulate matter
- ✓ Benzene

A large percentage of certain emissions e.g. NO_x are generated by transport (Smith, et. al., 1997).^[8]

DEVELOPMENTS AND THE ENVIRONMENT

Recent years have witnessed rising concern about whether environmental constraints will limit development and whether development will cause serious environmental damage, impairing the quality of life of this and future generations. The most immediate environmental problems facing developing countries are unsafe water, inadequate sanitation, soil depletion, indoor smoke from cooking fire and outdoor smoke from coal burning (W.D.R., 1992).^[9] Even in recent times in Nigeria, smoke or fume from generators has killed a reasonable number of people in different households.

Developing countries need to have access to less-polluting technologies and to learn from the successes and failures of industrialized countries environmental policies. Some of the potential problems facing developing countries, such as global warming and ozone layer depletion, in particular, stem from high consumption levels in rich countries; thus, the burden of finding

and implementing solutions should be on the rich countries of the world.

APPLICATIONS OF TECHNOLOGY IN MONITORING AND SOLVING ENVIRONMENTAL PROBLEMS

Remote Sensing

is one of the technological advancements that have been very useful to man in monitoring the environment. Remote sensing is defined as 'the science of acquiring and interpreting information about the earth's from measurements made without physical contact.' Remote sensing has made tremendous impact on man's quest to understand his environment and the impact of his activities on the environment.

Satellite imagery is ideally suited to monitoring changes in our environment. Only satellite data can keep up with the rapid changes to our environment. There are a number of satellite borne instruments which sample gases within the Troposphere of the Earth's atmosphere (0 – 10 km). Available information acquired for this report focused on these instruments' ability to measure Green House Gases (GHG), including CO, CO₂, CFCs, NO₂, and CH₄. Some of these also have relevance to acid precipitation (Smith, et. al., 1997).^[8]

VEHICLE EMISSIONS

A variety of enabling technologies have been developed to detect harmful vehicle emissions. These technologies include Conductive polymers, fiber optic and infrared sensors. In order to make the best of these technologies, sensor(s) must be configured such that they can distinguish specific pollutants (Hcx, Co, and Nox), and be bundled with related field components and processing. Emission sensing may be done from vehicle or from the roadside.

ENVIRONMENT SENSORS

Environment sensor technologies monitor Local Climate (temperature, humidity, precipitation, wind, pollution) and road surface status (dry, wet, ice, snow). Environment sensors measure air temperature and relative humidity as well as wind speed and direction. Other atmospheric sensors may include precipitation sensors as well as visibility sensors. More modern sensors include infrared cameras to assess road surface conditions.

CONCLUSION

World wide, environment resource base (land, water and air) are being damaged by increasing human population and their insatiable demands. In developed countries, environmental degradation results from excessive demand for resources, waste production and cumulative effects of these activities. About 20 percent of the planet's people lack access to safe drinking water and 50 percent lack adequate sanitation. Weather events worldwide are becoming more frequently extreme. Land fertility is declining. Land degradation is increasing. The rapid growth of urbanization is causing massive air pollution. Nitrogen pollution is compromising terrestrial and aquatic ecosystems, as well as contributing to global warming. Over 80 percent of the planet's forests have been destroyed or degraded; a quarter of the world's mammal species are at serious risk of extinction, and biological diversity is disappearing at an alarming rate. More than half the world's coral reefs are threatened by human activities, and marine fisheries are being over-exploited to the point that their ability to quickly recover is in doubt. Technological advancements have contributed immensely to environmental problems around the world. Examples are nuclear disasters, pollutions, emissions, etc. from the new technologies.

RECOMMENDATIONS

Mankind must do everything possible to stem the rate of environmental degradation. Modern technologies such as remote sensing should be applied more vigorously in solving environmental problems. We should be more

serious with the campaign against human activities destroying the environment and biodiversity. Our population growth rate must be checked. The impacts of new technologies on the environment should be moderated.

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