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"THE ROLE OF ADEQUATE AND RELIABLE DATA IN MANAGING NIGERIAN ENVIRONMENTAL DEGRADATION"

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1. INTRODUCTION

Environmental degradation has become an issue of growing concern throughout the country. The frequency as well as the magnitude of the environment related disasters threatening large populations living in diverse ecological zones show a dramatic rise everywhere in recent years. Where hazards of exogenous are concerned, such as drought, floods and landslides, natural factors such as climatic change or fluctuation may, at least in part, account for this increase; the consequences of human interactions on the environment also play an important role. Some of these consequences include:

(i) Land degradation resulting from unsustainable land-use practices, increases the disaster susceptibility of the land. Deforestation and other land-cover changes in the upper catchments of rivers, alter the hydrological regime. Reduction of the vegetation cover in dry lands due to over-grazing or harmful agricultural systems may cause dust storms that remove top soils and form sand dunes, which lead to desertification and increase exposure to drought hazard. Environmental degradation are not always quite natural but triggered off or aggravated by human activities.

(ii) Population growth has greatly increased the number of people living in environmental disaster prone areas. Not only has the population density increased in existing problem areas, but large groups have also settled in formerly unoccupied dangerous zones, such as along rivers in flood plains, on very steep unstable stapes and in marginal arid lands. Since land degradation and population growth are interrelated, more problems have evolved from uncontrollable settling of squatters and high density urban sprawl.

Recent advancement in science and technology continue to create hope and produce new techniques which help to collect up-to-date data for monitoring environmental degradation problems. These include the application of remote sensing in area of mapping, monitoring and predicting environmental degradation and hazards. In

fact, many dynamic geophysical processes occurring in remote locations are difficult to reach and survey. This restricts the monitoring of changes on the land by conventional means which may be too difficult and time consuming. Remote sensing offers an alternative, often more efficient and cost effective technique of data capture. Remote sensing refers to data collection concerning objects of the earth from a platform mounted with sensors above the earth surface.

2. AEROSPACE TECHNOLOGY FOR MANAGING ENVIRONMENTAL DEGRADATION AND NIGERIA'S PARTICIPATION IN GLOBAL MONITORING SYSTEMS.

The complexity of environmental degradation requires an integrated and global approach in the acquisition and the organization of appropriate data. Aerospace technology, especially satellite remote sensing, plays an important part in this regard. Monitoring of degradation processes is basic for early warning system (ID NDR: 1995). Thematic maps showing the configuration of the land are essential for hazard zoning with Geographic Information System (GIS) as a major tool. Thus, necessary timely action can be taken including, engineering works, physical planning; awareness raising, degradation scenarios and so on.

The diversity of aerospace technology nowadays is great and is still increasing. Each recording configuration has its merits. Orbiting satellites are excellent for purposes of monitoring, provided that their return period is adequate. They are important when reliable and speedy information is required on the spatial extent of disasters that have just occurred. Radar sensors may be required if cloud cover prevails over the area. Aerial photography can provide detailed information of smaller areas but for operational reasons may not become timely available. Thus the use of aerospace imagery to assess a disaster and to organize emergency operations is more timely and therefore most optimal. Another, even more important use of satellite imagery, is in the context of environmental degradation evaluation and assessment.

Monitoring on a global scale or covering large disaster-prone areas is among the most promising applications of aerospace technology in natural disaster reduction. The African Real Time monitoring and Information System (ARTMIS) operated by NASA and FAO for monitoring rainfall and

biomass deficiencies for the governments of affected countries including Nigeria, is an outstanding example. The proposal for a Global Emergency Observation and Warming (GLOWARM) by European Satellite Agency (ESA) and National Space Agency (NASA) participants of the International Space University in 1993 is another opportunity. It is conceived as a combination of remote sensing and satellite communications that would constitute a global system for disaster warning and degradation support management. Recently, UNEP has made an offer to Nigeria to supply remote sensing data from the UNEP-GRID through the Federal Ministry of Environment on regular basis. It is hoped that such data, when integrated into our existing GIS database, will assist us in generating appropriate strategies for proper monitoring and management of the dynamics of environmental degradation in Nigeria.

Global monitoring of flood is a rapidly expanding field. This is important in global change research and has a role in the reduction of flash-flood disasters. In direct connection to this is the monitoring of the atmosphere which is a fast growing field. It includes monitoring of temperature, euthrophism/pollution, cloud patterns, ozone content, etc. The Total Ozone Monitoring Satellite (TOMS) is a breakthrough in the area of Ultra Violet- 13 studies. Although our knowledge of the chemistry of the stratosphere has increased considerably through remote sensing observations, the advance in troposphere altitudes is still more limited. However, new approaches such a Global Ozone Monitoring Experiment (GOME) is promising. The Mission to Planet Earth (TMPE) – Earth Observation System (EOS) programme of NASA, is part of the US Global Change Research Programme. It includes the Earth (Observation System Data and Information System (EDSDIS) and the launch of the EOS satellite in 1998. It is hoped that Remote Sensing data from **Nigeria Sat-1** shall complement all above stated programmes.

3. SPECIFIC EXAMPLES OF APPLICACATION OF LANDSAT, SLAR, SPOT AND OTHER DATA

The use of Landsat, Side Looking Airborne Radar (SLAR) and SPOT imageries in environmental studies all over the world has renewed and

strengthened rapid and reliable assessment, and improved the productive ability of the methods. For example, Abdulkadir (1993) found that through a conjunctive use of thematic map (TM) and aerial photographs, it was possible to monitor the conditions of Land-cover and detect calcareous, gypsiferous and saline soils using different bands and ratio images. Others have demonstrated, how remote sensing can be applied to assess changes in evaporation rates, evaporative power of the atmosphere, surface thermal features and thermal behaviour of different physiological units. The history of SLAR application in environmental monitoring in Nigeria dates back to the 1978 Land Use and Vegetation Cover Mapping sponsored by the FAO. Those maps formed the basis for the World Bank-assisted Environmental Management Project (EMP) in 1993 using Land Sat and SPOT Imageries as the Remote Sensing database with which the 1976 Land Use and Vegetation Maps were brought up to date. The outstanding results of this project formed the hardcopy and GIS digital environmental database of the Federal Ministry of Environment.

3.1. SOIL DEGRADATION ASSESSMENT

The application of Landsat imagery to soil degradation mapping was advocated by FAO (1978). It was found that mapping enhancement can be better achieved using 1:500,000 scale and optical enlargement especially in areas with less dense cover. Despite the limitations of Landsat in the area of poor relative poor resolution, insufficient overpass intervals and weather dependence, it is still recognized and used as a powerful and reputable tool in monitoring sediment deposition, especially in irrigated areas and stream channels as well as water reservoirs. In a more recent study of the impact of dam construction on Fadama cultivation in the downstream parts of Jakara Dam in Kano State, some authors have applied the use of SPOT and aerial photographs to assess changes in soil moisture status at pre-dam and post-dam periods. The study concludes that there was a serious fall in the soil moisture during the post-dam period resulting to a change in Land use (from Fadama to predominantly rain fed). Both SPOT and aerial photographs have proved to be useful tools complementing each other and providing a means of cross-checking data entry and reliability.

3.2 DROUGHT HAZARD ASSESSMENT

Large areas are affected by drought hazard notably in northern Nigeria, thus forecasting emergencies has become a vital issue. Monitoring

anomalies of cloud and rainfall patterns and the related vegetation cover changes caused by fluctuation of the seasonal displacement of the Intertropical Convergence Zone (ITCZ) over the years, using low-resolution satellite data is common practice nowadays. The combined capacities of covering large areas and short return period are ideal for this purpose. Early warnings are issued every three months. A complimentary approach is monitoring the desertification process over the years on the basis of sequential aerospace data. The changes in land-use/land-cover of Aeolian processes since the last 40 – 50 years can be analyzed this way if both aerial photograph and satellite images are used. Land classification geared towards susceptibility and drying out is a third important option for reducing drought, but should be linked to a study of the coping strategies of the local population. The ARTEMIS drought monitoring system of FAO, already mentioned and regional centers such as CILSS (Centre Intergovernmental pour la Lutte contre la Secheresse en Sohel) and IGADR (Inter Governmental Agency on Drought and Development) play an essential part in the research and use of aerospace technology.

3.3 FLOOD HAZARD ASSESSMENT

Distinction should be made of coastal flooding, plain folding and river floods since these types of emergencies require different approaches. The reduction of degradation/disasters due to coastal flooding, related to westerly storms is concentrated on early warnings based on monitoring eddies tracks using space-borne, air-borne and ground radar systems. Refuge structures/platforms have to be built in appropriate locations and awareness creation among the population is essential. In case of river floods, early warnings are usually based on the gauging stations upstream. Aerospace imagery serves to monitor the fluvial dynamics such as lateral sapping, etc and for flood hazard zoning and management. One should realize, however, that land classification focused on flood susceptibility in densely populated river plains does not necessarily result in effective land-use planning, because population pressure will cause farmers to settle in endangered areas. Nevertheless, such classification may be vital for planning infrastructure and urban extension.

CONCLUSION

Aerospace technology plays an important role in providing adequate and reliable data in managing Nigeria’s environmental degradation problems. The appropriate type/configuration varies with the degradational

type. It should be well selected and combined with other means of surveying and monitoring. From the examples put forward in this paper, it may be pointed out that world wide, remote sensing application in the mapping, assessment and monitoring as well as forecasting environmental degradation is modernizing, simplifying and easing the exercises which would otherwise be executed through conventional methods. Furthermore, recent pressure on environment arising from rapid population increase and competing uses, the need for improved mapping and monitoring systems become imperative.

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