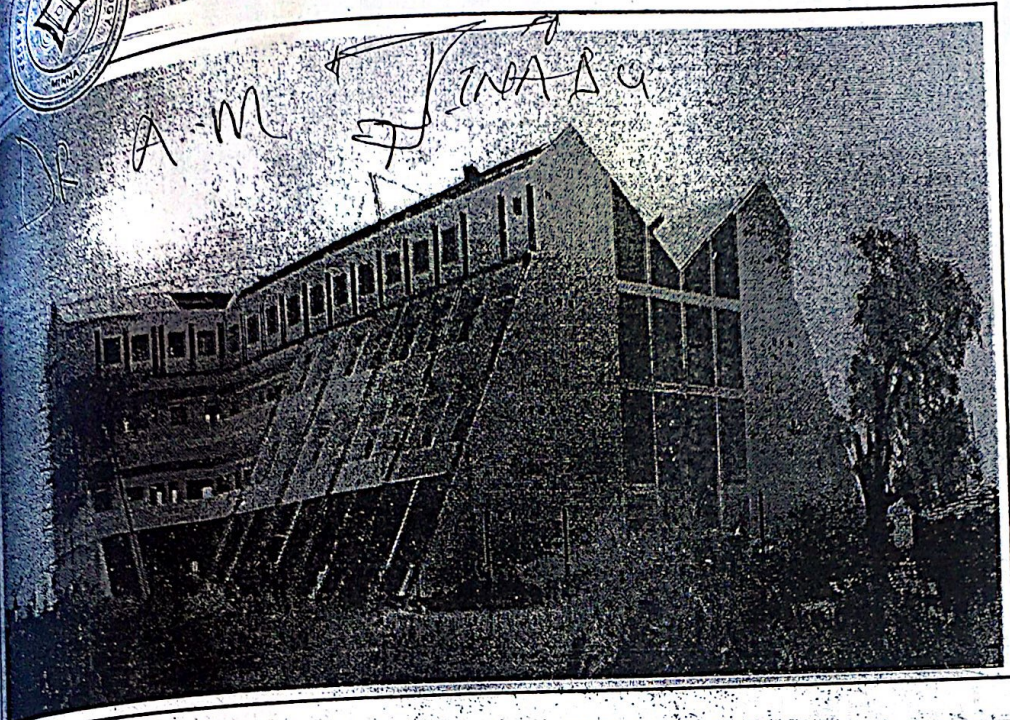


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ENVIRONMENTAL MANAGEMENT AND PRESERVATION FOR DISASTER RISK REDUCTION IN HUMAN SETTLEMENTS: A Review Of Issues And Strategies

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ABSTRACT

The interaction between man and the environment is an inevitable natural occurrence which has generated both positive and negative outcomes in different parts of the world. In most cases, especially when environmental resources are exploited without caution, the interactions have generated problems which increase the vulnerability of human settlements and endanger the lives of the residents. Amongst others, environmental abuse and poor management/preservation are recognized as major causes of natural and man-made disasters. Hence, the preservation of the environment through good management practices is seen as a means of disaster risk reduction in our towns and cities. This paper reviews some environmental problems/hazards that increase vulnerability and induce disasters in human settlements. Amongst others, global warming, environmental pollution, deforestation, land degradation, coastal area development and flood plain encroachments, poor and haphazard developments are recognized as causal factors of disasters. The paper noted that the impacts of disasters resulting from these problems include loss of biodiversity, loss of lives and livelihoods, social disorder, loss of investment and revenue, infrastructure damage and political instability amongst others. It therefore recommended some environmental management and preservation measures such as environmental assessment and monitoring, risk assessment and vulnerability mapping land use zoning, environmental education, pollution control, flood plain/coastal area protection, afforestation and desertification control, as well as environmental education to reduce disaster risks and to mitigate disaster impact in human settlements.

Keywords: *Environment, Management, Preservation, Disaster, Risk and Settlement*

Introduction

The global environment is a reservoir of natural resources as well as a life supporting system. All economic and development activities of man are dependent on the available environmental resources. Thus, the exploitation of natural resources remains a basic necessity and an important activity which is central to the existence and survival of human beings in all settlements.

The inevitable exploitation and use of environmental resources have severe consequences for the sustenance of human settlement environment, most especially where the resources are harvested without caution. The issue is that, intensive and unsustainable exploitation of the environment lead to biodiversity loss; impede the natural processes of the ecosystem, degrade the natural environment, render it vulnerable to natural hazards and increase the potentials for disaster occurrence. Today, environmental degradation due to excessive resources exploitation, abuse and poor planning/management are recognized as major causes of natural and man-induced disasters.

As the state of the global environment deteriorates, the world has witnessed an increase in disaster occurrence. According to Olokesusi (2006), the world witnessed 3,561 major disaster events ranging from floods to storms, earth quakes, volcanic eruptions and health epidemics between 1994 and year 2003. Regional distribution of disaster events as revealed in the OFDA/CRED International Disaster database shows that the Asian continent recorded the highest figure of 2,164 events (1,217 for East Asia/Pacific and 947 for South Asia), Sub-Saharan Africa recorded 1,225 events while Latin America and Caribbean experienced 819 disaster events. The year 2004 statistics of the International Federation of Red Cross and Red Crescent, indicated that disasters, including floods, famine, earth quakes and hurricanes, affected almost 146 million people worldwide and

that 250,000 people died in disasters in 2004, including the 225,000 casualties in the Asian tsunami (Olokesusi, 2006).

Whenever and wherever they occur, disasters have serious negative socio-economic effects on the people and economy of nations. Global estimates of human casualties is put at 60,000 people per year while in economic terms, the real losses due to disasters have risen from US \$75.5 billion in the 1960s, to \$213.9 billion in the 1980s and to \$659.9 billion in the 1990s (UNDP, 2004 as quoted in DFID, 2005). The general assessment of the macro-economic impact of disasters revealed that they cause low productivity, loss of tax revenue and eventual poverty. On the aggregate disasters result in development failure and can slow down the achievement of the millennium development goal.

The social and economic miseries caused by disasters in human settlements have aroused global concern for disaster mitigation and risk reduction. Consequently, the World Conference on disaster Risk Reduction was held between 18th and 22nd January 2005 in Kobe Japan and the Hyogo Framework for Action adopted at the conference offers the blue print for the reduction of disaster losses by year 2015.

Environmental preservation and/or management is recognized as an important daily activity required for disaster mitigation and sustainable settlement development. Section II, chapters 9 - 22 of Agenda 21 on Environment and Development recognizes the importance and the need for conservation and proper management of the environment as means of reducing environmental stress and disaster. In line with this requirement, this paper considers the different dimensions of environmental problems and the related disasters in human settlement. It identified some environmental management/preservation measures and concludes with recommendations on how to reduce disasters in our settlements.

Environmental Problems\Hazards and Vulnerability of Human Settlements

Human settlements around the world face a lot of environmental problems which constitute hazards and which make our towns and cities vulnerable to disasters. These problems are ecological in nature and they are caused by both natural and human factors. Amongst others, human factors are said to result in most of the world's environmental problems. Historical facts has it the man began to alter the earth's environment thousands of years ago, first with the use of simple tools for hunting and gathering, and later with more complex tools. Today, evidence of human environmental intervention abounds in all parts of the world. According to UNDP (1993) the original vegetation has almost disappeared around the Mediterranean Sea and in England, 90% of the forest has vanished. The Brazil's Atlantic forest which once covered a million square kilometers is now only 7% of its original size. In Nigeria, FEPA (1992) observed that virtually all vegetation has been affected by human activities and deforestation was estimated at 350,000 hectares per annum. The 1990 report of the World Bank estimated the long term losses from deforestation in Nigeria at around US \$750 million per annum.

The different dimensions of human interference in the environment have caused and are still causing serious environmental problems\hazards which make our settlements vulnerable and liable to natural and man-induced disasters. Some of the environmental problems\hazards that threaten human settlements and the related disasters are discussed below.

- (1) **Global Warming:** - Global warming is an environmental problem which the world grapples with in the modern times. It results from the accumulation of carbon dioxide in the earth's atmosphere due to deforestation, combustion of fossil fuels in heavy industries and other economic activities of man e.g transportation. Global warming leads to atmospheric and ocean temperature rise. One major effect of global warming is the gradual climatic change, resulting into melting of ice at the Polar Regions and the consequent rise in sea level. The UNDP (1993) has observed that, depending on the degree of global warming, the sea will rise by 30 centimeter to 2 meters by the year 2075, jeopardizing coastal settlements and marine ecosystem. Global warming is thus a major environmental hazard which exacerbates super hurricanes through ocean warming and cause serious flooding disaster as the case in New Orleans in USA in 2005.

(2) Environmental Pollution: - Environmental pollution is a form of climatic hazard affecting human settlement worldwide. It takes the form of air, fresh water and marine pollution noticeable in all parts of the world. Air pollution results mainly from the greenhouse gas effects in heavily industrialized areas and emission of carbons from vehicular exhaust pipes. These human activities emit pollutants such as sulphur dioxide, nitrogen oxides, particulates, carbon monoxide, and lead into the air and render it harmful. Air pollution results in ozone layer depletion when chlorofluorocarbons (CFCs) are released into the atmosphere. Ozone layer depletion occurs mostly in the Polar Regions and it first became noticeable in the 1970s and the early 1980s when the Antarctic 'Ozone Hole' was discovered. Ozone depletion is one of the serious environmental hazards that expose human beings to health disasters. It increases in skin cancer, cataracts and reduces immune system functioning. Fresh water and marine pollution result in spread of pathogens and chemicals to the environment and affect humans, animals and marine life.

(3) Deforestation and Desertification: - Deforestation and desertification are related environmental hazards affecting human settlements. Studies have shown that habitat degradation due to rapid population growth, expansion of settled or industrialized areas, unregulated logging, overgrazing, land clearing for farming purposes, forest clearing, intensive fuelwood harvest, draining of wetlands and destruction of healthlands and coral reefs is a serious threat to humanity. The trend is such that, the tropical forests are being destroyed at a rate of 0.8 - 2.0 per cent per annum and the rate of species extinction is now estimated at between 1,000 and 10,000 times greater than in the recent past (John Sale, 2008). Deforestation results in loss of forestry resources, flooding and carbon emissions. According to UNEP, as quoted in Michael Flesman (2008), between 20 - 25% of all annual carbon dioxide emissions (more than is caused by the world's entire transportation sector) are caused by forest clearing. Deforestation also engenders severe climate conditions such as low or uncertain rainfall and higher temperatures a situation which leads to desertification. The negative effects of desertification include the reduction of land productivity and eventual drought and famine disasters.

(4) Landslide: - This is the mass movement of land under pressure and it is a major environmental hazard that makes human settlements vulnerable to disasters. Landslide problem is brought about by occupation and development of precarious areas such as steep slopes, softer soils and cliff tops. According to UNDP (1993), an estimated 60% of the developing world's poor live in areas vulnerable to environmental change, such as hillsides. Thus the building of settlements at the base of steep slopes or on the mouths of streams from mountain valleys is a major cause of landslide disasters.

(5) Coastal Development and Flood Plain Encroachment: - Development spread to the coastal areas and river flood plains is a major aspect of human manipulation of watersheds and drainage basins. There is an increasing trend in the location of settlements in low lying coastal areas. Between 1980 and 2003, coastal population grew by 33 million. Today, one-third of the world's population is estimated to be living within 100 kilometer of ocean while 13 of the 18 largest cities of the world are by the sea (Glen Barry, 2005). This development trend has resulted in the destruction of the wetlands and general depletion of the coastal ecosystem. For instance, Louisiana in the United States is estimated to have lost 5000 square kilometers of wetlands (equivalent of 65 km² of hurricane absorbing wetlands) over the past seven decades. The implication is that, wetlands near rivers and coastline could no longer perform their functions of absorbing and storing flood water as well as slowing down ocean storm surges. The consequence is the increases in hurricane episodes and flood disasters all over the world in the recent times. Besides, development activities, such as farming pools in many low-lying tropical coastlines of Southeast Asia and South America, are observed to have increased the level of local hazards through coastal erosion and loss of coastal defense provided by mangrove stand in the recent times.

(6) Poor Physical Development and Creation of Slums: - The high rate of urbanization, most especially in the developing world is a major factor of poor and haphazard physical development which leads to the creation of slums. Generally, the poor residents erect and live in substandard buildings built of planks, zinc and other inflammable materials thus making their settlements vulnerable to fire disasters. In most cases the poor residents of peripheral slums who have little or no access to productive land are pushed to marginal areas for agricultural and other economic activities, thereby degrading the general environment. Outside the slum environment, poor planning and development encroachments in commercial areas subject our markets to incessant fire disasters.

Socio-Economic and Physical Impacts of Disasters

Natural disasters can have significant and multi dimensional impacts on the economy of a nation. Generally, disasters result in loss of biodiversity, loss of lives and livelihoods, forced migration, social disorder, loss of investment and revenue, infrastructure damage and political instability amongst others. With respect to the direct impacts on human population, disasters bring about displacements, injuries and deaths. In 1999, for instance, flash floods and landslides in the Caracas and on the northern coast of Venezuela killed 30,000 people and affected 483,000 others (De Sherbinin *et al.*, 2007). In Guatemala, mudslides and landslides triggered by hurricane Stan buried the entire village of Panabed, killing over 30,000 people while mudslide disaster in Philippines on the 17th of February, 2006 buried 8,000 people in the mud. Likewise in Jakarta, Indonesia one of the worst floods of the year, reaching 3 meters in height, killed 20 persons and displaced over 200, 000 people in February, 2007. In Nigeria, statistics on disaster impact provided by the Nigerian Red Cross Society indicated that almost 280,000 Nigerians were affected by various kinds of disasters in 2001, while in 2003, more than 185, 000 people were displaced due to disasters with about 3, 638 injuries and 1, 099 deaths (see Orebiyi, 2002 and Olokesusi, 2006). The EM-DAT statistics for selected disasters summarized in table 1 also indicated that between year 2000 and 2007, 386,965 persons were affected, 34,303 were rendered homeless while 654 people were killed.

In economic terms, the direct costs of disasters include those incurred from damage to properties and physical infrastructure including the costs of relief, rehabilitation and reconstruction while the indirect costs emanate from productivity and investment loss resulting in debt burden and poverty. Global estimate of disaster costs shows that between 1990 and 2000, natural disaster resulted in damages constituting 2-15% of an exposed country's annual GDP (World Bank 2004 cited in DFID, 2005) while between 1997 and 2001 alone, damage per large disaster amounted to over 5% of the GDP of low-income countries (IMF, 2003). In Bangladesh, the estimated value of damage by major floods in 1987, 1988 and 1995 were US\$ 451, 3775 and \$ 530 million respectively (UNESCAP, 1998 cited in DFID, 2005).

The economic losses due to disaster events is also huge in Africa. In Nigeria, Adefolalu (2000) noted that over N50 billion worth of infrastructure (houses, schools, roads etc.) were destroyed in several flooding and erosion episodes across the country in 1999. Between 2000 and 2007, the EM-ADT statistics for selected flood and fire disasters also sum up to US \$9,425,000.00 (see table 1). The situation in Zimbabwe is such that, severe drought between 1991 and 1992 resulted in the reduction of the country's real GDP by 9% and fiscal balance deficit increased from 6 – 12% in the same period (DFID, 2005).

Table 1: Selected Disaster Cases and Their Impacts on Affected Communities in Nigeria

Date of events	Disaster type	Location	Impact (loses)
4 th Oct. 2007	Flood	Lagos and Ibadan	17 Killed
14 th Aug-21 st Oct. 2007	Flood	Plateau, Yobe, Ogun, Adamawa, Borno, Bauchi, Nasarawa, Sokoto, Kebbi	68 Killed, 50,000 affected
1 st Oct. 2007	Flood	Gusau (Zamfara)	40 Killed, 1000 affected
15-17 th July, 2006	Flood	Edo State	2000 affected
3 Aug- 11 Oct. 2006	Flood	Zamfara State	10,000 homeless

7 th Aug- 16 th Sept. 2005	Flood Flash flood	Jigawa, Bauchi, Taraba, Yobe State	60 killed, 4 injured, 3000 homeless, 147,000 US \$ damage
6 th Feb. 2005	Flood	Lagos	1000 affected
21- 23 Aug. 04	Flood Flash Flood	Yarwa-Gana, Burundi Bega, Bolari, Tudun-wada, Jekadafari, Yalenguruza (Gombe)	25 Killed, 3000 affected
8- 12 Aug 04	Flood	Loko, Dumne, Dikwa (Adamawa State)	65 Killed, 600 Injured, 10,000 affected
8-10 th Aug. 2004	Flood	Ughelli (Delta State)	15,000 affected
22-25 th June 2004	Flood Valley Flood	Dankida, Arki, Damatsa, Almu, Sau-rakin (Jigama State)	4 Killed, 300 affected
17-18 th June 2004	Flood	Lagos	100 affected
5 th Sept.-28 Oct 2003	Flood	Kaduna, Kano, Niger and Jigawa States	16 Killed, 210,000 affected, 2,570,000 US \$ damage
April 2002	Flood	Lagos, Bariga, Bode Joseph	200 homeless
27 th Aug- 4 Sept. 01	Flood Flash Flood	Jigawa, Kano States	200 Killed, 84,065 affected, 3000 US \$ damage
22 nd July 2001	Flood	Talata mafara (Zamfara State)	50 injured, 3,802 homeless
May, 2001	Flood	Oke- Ogun, Idimissa, olle-oje, Ogbonmo, Oke- Idigbon, Ijebu-owo, Oke-Ajama Illone, Iyere, (Ondo State)	200 Ohomeless
23 Sept. 2000	Flood	Kebbi State	1000 homeless
20-21 Sept. 2000	Flood	Lagos	500 affected, 4,805,000 US \$ damage
15 Aug 2000	Flood	Zamfara State	750 homeless, 1,900,000 US \$ damage
14 Aug 2000	Flood	Cross- River	4 Killed, 1000 homeless
June 2000	Flood	Sokoto	250 homeless
26 th , March 2007	Fire	Kaduna State	93 Killed, 100 injured
6 th Jan. 05	Fire	Port-Harcout	10,000 homeless
9-10 th March 2004	Fire	Oko baba (Lagos)	16 Injured, 5000 homeless
5 th March, 2001	Fire	Bwal-bwag Gindiri (Plateaus State)	30 Killed, 10 injured
20 Dec. 2000	Landslide	Atakumosa (Osun State)	15 Killed
23, Sept. 2000	Landslides	Amakor (Anambra State)	17 Killed, 300 homeless

Source: Compiled From EM-DAT: The OFDA/CRED International Disaster Database,

2008.

The statistics above reveals that the combined direct and indirect negative effects of disasters are quite debilitating, most especially, on low income countries that lack the technical and financial capabilities to cope with disaster events. Disaster occurrence in these countries is currently eroding the gains of development efforts and is threatening the survival of man in our settlements. In order to reduce disaster risks and to sustain development gains, there is the need to pursue pragmatic and proactive environmental management measures to mitigate the impact of disasters in our settlements.

Environmental Management and Preservation Measures for Disaster Risk Reduction

It is evidenced from the conclusions of several studies that disasters are mostly caused by ecological problems induced by man rather than natural events. Such environmental problems as location of human settlements in risk zones (e.g. on low-lying coastlines, flood plains and hill sides), intensive exploitation and unsustainable use of environmental resources, poor land use and management practices etc degrade the environment, increase the risk potentials and make our settlements vulnerable to disaster attack. Since most environmental problems result from human interaction with the environment, the only sustainable way to reduce disaster risks is through proper environmental preservation and management.

Environmental management implies a combination of functions that are integrated and administered as part of the process of planning and controlling economic development. It is a continuous process of finding solutions to environmental problems. Appropriate management is achieved when resources are used efficiently and/or conserved. Some environmental management\conservation measures necessary for risks reduction and disaster impact mitigation include the following.

Environmental Management Measures

A. These are measures for monitoring and control of development activities to forestall negative impacts on the environment.

1. Preparation of an Environmental Overview (EO).

According to UNDP (1993), environmental overview is an assessment tool which provides basic information and assessment of the environment, at the country and the project level and it forms the basis for the environmental management strategy of a nation. The EO gives a brief description of the natural environment of the country (or project area) and provides environmental baseline data on: -

- (i) Climatic elements such as precipitation, seasonal characteristics, rainfall, climate, temperature, existence of seismic faults, susceptibility to other natural disaster.
- (ii) Demographic data; - population size, growth, and distribution.
- (iii) Land ecosystems - plains, mountains, valleys, areas experiencing soil erosion and desertification.
- (iv) Water ecosystems - main water bodies, international basins and underground waters.
- (v) Biological diversity and renewable resources - main biological species and opportunities for use and conservation.

The baseline data contained in the EO provides ample data environmental monitoring and decision making.

2. Environmental Monitoring and Decision Making: -

Effective environmental management requires the setting up of monitoring systems to provide information for decision making. Monitoring units of disaster management organizations and related agencies should be set to monitor the environment through field data and analysis of real time data from satellite imageries.

3. Risk Assessment and Hazard Mapping:-

Assessment of environmental hazards is done to identify risk zones. Risk assessment is done through the Vulnerability and Capability Analysis (VCA) which is a diagnostic tool for understanding environmental problems and their root causes. The risk/hazard areas are mapped to show the frequency/probability of hazard occurrences of various magnitudes and duration. The hazard map provides a guide for development decision making and general environmental monitoring.

4. Environmental Assessments for Project Development: -

Environmental assessments include a variety of analyses seeking to build in environmental consideration in project execution and development decision making. Environmental Impact Assessment (EIA) is an analytical process which provides decision makers with a prediction of possible consequences of a project so that mitigation measures are instituted or that the design may be altered if necessary. It is similar to Strategic Environmental Assessment (SEA) which is a tool for the integration of environmental considerations into policies, planning and programmes at the earliest stages of decision making. These methodologies and tools should be developed for proper assessments of development impacts.

5. Environmental Legislation and Zoning: -

The use of legal control and land use zoning are important environmental management instruments. These instruments enable the government to regulate human activities that impact the environment. Thus, legislations and land use zones should specify what activities are permissible and forbidden in certain areas as well as the management responsibilities of individuals, groups and organizations whose activities impact negatively on the environment. Thus, environmental laws and effective land use zoning plans should be implemented.

6. Environmental Awareness Education and Citizen Participation: -
The use of formal and non-formal education sectors to promote environmental awareness and to create environmental friendly culture is an important management measure. The success of environmental management efforts relies heavily on institutional capacity and community participation in the management process. Thus proper education on environmental risks, hazards and vulnerability factors are necessary at the community level for people have a better knowledge of their local environment and to have interest in its management. Effective awareness and participation should include capacity building at the community level and this could be facilitated through the formation of disaster preparedness committees.

7. Development of Early Warning System: -
The development and use of early warning system is part of environmental management. Advanced warning about the potential effects of risks or hazards allows the community to prepare itself and institute some measures to avert or reduce the impact of disasters. This will increase the level of community preparedness and resilience. The different environmental information gathered could therefore be used to predict both the slow-onset and rapid-onset disasters. An appropriate method of announcing or disseminating warning information at the community level should be developed.

B. Environmental Preservation Measures

These are measures meant to preserve the natural environment and to reverse the negative effects of harm caused to the environment.

1. Protection of the Atmosphere: -

The earth's atmosphere could be protected by reducing air pollution through the establishment of regulations to control air pollution i.e setting up emission standards or limits. The essence of pollution control is to encourage efficient energy use, curb pollution from traffic emissions and industry in urban areas and to halt or reduce the rate of ozone layer depletion. Other management measures like car care\maintenance and the use of mass transit vehicles will go a long way in conserving fuel use, reducing combustion and air pollution in our cities. All these will slow down the rate of global warming and reduce the potentials of natural hazards.

2. Afforestation and Control of Deforestation: -

It is known that the forest is the most efficient storehouse of greenhouse gas and according to the Un-sponsored Intergovernmental Panel on Climate Change (IPCC), the total amount of carbon stored by forest is about 1000 billion tones or about 166 years worth of current global carbon emissions (Michael Fleshman, 2008). Afforestation could be promoted through agroforestry (combining agriculture and forestry on the same plot), social or community forestry (where local people plant trees outside regular forested areas), tree planting as windbreaks, silvopasture (integrating trees and livestock raising on the same plot), establishment of tree crop plantations and integrated land use (raising trees, crops, and livestock on one plot). On the other hand, strategies for control or prevention of deforestation include logging control, development of solar energy and biomass fuels, establishment and management of large scale wood fuel plantations to meet community needs for wood as well as the promotion of the design and use of improved wood stoves.

3. Protection of the Coastal Environment and River Flood Plains:-

The prevention of development in unstable coastal areas and flood plains is an important coastal conservation measure. In this case, protection measures will include the establishment of marine protected areas (e.g. coastal buffering), mangrove regeneration, creation of artificial reefs to rehabilitate degraded areas and the removal of physical development structures from the river basins. The overall coastal management plan should include watershed mapping, management, and protection. Policy initiatives that support ecological restoration and sustainability in the coastal areas should be instituted.

Sustainable Agricultural Practices and Prevention of Soil Degradation: -
Good agricultural practices such as crop diversification, mulching and land allowing ensure soil protection and allow land to regenerate. Strategies for reducing or reversing soil degradation include soil improvement through the replenishing of nutrients, terracing and tree planting to reduce erosion. All these protect the land and prevent the occurrence of droughts.

Conclusion and Recommendation

The causal relationship that exists between man and his environment is well established in the literature. The mounting environmental pressure created by man's exploitation and use of natural resources is no doubt creating environmental stress which, in turn, threatens the survival of man in his abode. The problem of biodiversity loss and the consequent environmental degradation has negative effects on all aspects of human wellbeing, including food security and vulnerability to natural disasters. The increasing frequency of disasters is an indication of the severity of ecological problems created by man. The resulting disasters have not only resulted in human injuries, deaths, infrastructure and settlement destruction, it has imposed heavy economic burden and threaten development efforts as well. The emerging scenario portends great danger and calls for proactive management and preservation of the environment to remove or reduce the risk of disasters in our settlements.

Pragmatic environmental preservation and management calls for adequate institutional frameworks; funding and political will to implement the disaster risk reduction measures suggested in this paper. An important requirement of the environmental management process advocated here, is the formulation of a national environmental policy and strategies for reducing environmental risks/hazards so as to improve the resilience of people and human settlements to disaster events.

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