

POLICY ISSUES AND DEVELOPMENT

Herath Madana Bandara

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CHAPTER 4

NATURAL RESOURCES AND DEVELOPMENT: TOWARDS SUSTAINABLE USE IN DEVELOPING COUNTRIES

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Introduction

Natural resources refer to elements of nature which under specific technological, economic and social conditions can be used to satisfy some human needs. This implies that a part of the natural environment will qualify as a resource only if it is useful to man and is accessible in terms of location, level of technology and economic realities. The mere presence of these components does not make them resources but, it is the utility conferred on them that qualifies them to be called resources. For a material to be regarded as a resource it must be understood to be a resource. Therefore, resources exist not only in a physical context but also, in a cultural context. As depicted by Zimmermann (1951) in his model of "Man, Culture and Environment", it is the interaction between human culture and the environment that gives rise to environmental resources. According to the model although, only a part of nature is perceived as resources but as culture develops, the proportion of nature perceived as resources increases as new resources are identified.

Natural resources are not only important in contributing to economic development but are also vital for poverty reduction by providing employment and livelihood and for their contribution to food security. In fact, in many countries exploitation of available natural resources have formed the basis of developmental efforts. Today, increasing demands for food, land, water and energy are introducing new pressures on natural systems and the benefits they provide to the people. In particular, globalization of world economies has increased the competition for resources and in many cases

conflicts within and between countries. These have been largely responsible for unsustainable exploitation of resources particularly in the developing world. The sustainability focus of development which has gained much root in the western world has long been neglected in most developing countries. It is only in recent times that some attention was directed to environmental aspects of national development in many countries of the developing world.

A key policy issue is thus, how to find the right balance between exploitation of natural resources and ensuring that long-term development goals are not compromised. In most cases however, inappropriate management of resources eventually compromise developmental goals as could be seen in some developing countries that are experiencing what has been termed the "natural resource curse". Situations in most developing countries are quite different from what exists in advanced economies where investments in sustainable agriculture, fishing and forestry, in lower carbon sources of energy, and in influencing the power of nature to adapt to and reduce the risks from natural hazards and a changing climate are creating the right conditions for long-term and resilient economic development.

Natural Resources and the Development Process

Availability of physical resources such as land, water, air, energy and minerals are important for providing people with the ingredients of material well-being. However, appropriate technology and social organization are required for transforming available physical resources and human labour into useful goods and services. Improving human well-being is the main objective of socio-economic development which is closely linked to environmental goods and services. On the other hand, level of well-being affects the ability of the human population to effectively manage their resources.

Development has been presented in the literature in four main ways. These are development as economic growth, as modernization, as distributive justice and as socio-economic transformation (Mabogunje, 1980). For a long time, development was equated with economic growth measured through Gross National Product (GNP) and Gross Domestic Product (GDP). However, development involves much more than economic growth it must result in reduction of poverty, unemployment and inequality

and must result in self reliance in the society. It implies conditions in which people in a society have adequate food and jobs (Seers, 1969; Hodder and Lee, 1974; Seers 1977). Closely linked to development as modernization, is the idea that, the developmental process eventually leads to democratization of the society (Huntington, 1991). As economic development progresses the society requires a sophisticated government to properly control and provide for the people (Inlgehart and Welzel, 2005; Ku, 2010).

Development is thus both man centred and multidimensional in nature and leads to a cumulative increase in the standard of living for an increasing proportion of people in the society. The improvement in standard of living is thus a combination of economic, social and political processes that results in enhancement of quality of life and opportunity to have access to basic necessities of life. Development transforms the economy, society and permit self actualization of human potentials (Mabogunje 1980; Hodder, 2000; Madu, 2007). In recent years the idea of sustainable development has emerged and added an environmental dimension to the concept of development. Sustainable development implies improving standard of living and quality of life, while also protecting and enhancing the natural environment (World Commission on Environment and Development, 1987).

The actual role that natural resource endowment plays in the course of economic development has been a topic of extensive debates with different scholars supporting different lines of argument. There are those who view presence of a natural resource like petroleum as providing comparative advantage that could be developed to benefit the country. This was the conventional wisdom before the late 1980s when natural resources were viewed as positively related to development. On the other hand, there are those who argue that natural resource exploitation is characterised by decreasing returns on scale and with little linkage to other sectors of the economy. This line of argument point to the idea of the "resource curse" implying that, resource rich countries will have poor economic performance. They therefore propose that such countries would benefit better by diversifying their economies and reducing their dependence on exploitation of natural resources (Krugman, 1987; Rosser, 2006; Baghebo, 2012; Baghebo and Atima, 2013). However, others have opined that the

problem lies with overdependence on one source of external revenue rather than resource endowment. Therefore, this point of view call attention to the fact that some resource rich countries have succeeded by building on their comparative advantage to develop the sector and using it to develop other sectors (Blomstron and Kokko, 2003; Dooley et al., 2003).

The role that natural resources play in development therefore depends on the cultural, economic and political circumstances surrounding the exploitation and utilization of such resources. Certainly, natural resource endowment is not the only variable determining growth possibilities but, their availability may critically influence the pace and direction of development (Ogbonna, 1985). It is very clear that natural resources provide the base from which a large part of human basic needs are satisfied, but it is important to note that the mere presence of resources do not guarantee development. While it is true that resources have the capacity to enhance development, the geographical distribution of resources in the world does not provide the only explanation in the levels of development. However, if properly managed resources confer an important advantage at a crucial stage in the development process.

Meanwhile, a fundamental dilemma of material usage in the world is the conservation and management of natural resources in such a way that, economic and political progress is ensured. However, conservation has often been pushed to the rear in development while, economic needs have always come before all other interests. Human ability to modify the environment is fast increasing and this amplifies the need for both national and international political decisions to regulate and control human actions.

Issues and Challenges of Resource Use

Natural resources management issues are complex because of their close relationship to ecological cycles, the hydrological cycle, climate, animals, plants and geography. Man-environment relationship depends on how man uses his environment. This relationship is complex and dynamic. Some symptoms of the change in the man-environmental interface are the various forms of pollution resulting from poor management of soil, forest and water; uncontrolled urbanization, and destruction of existing life support systems. Human use of natural resources results in resource degradation,

resource decline and loss of biodiversity. Human quest to satisfy various needs often brings about some changes within the environment that may eventually not be beneficial to society. It is therefore necessary to identify and predict possible environmental changes and magnitude with a view to avoid or minimize possible adverse environmental damages. This is because if the present forms of resource use are left unchecked it may result in the eventual destruction of nature and consequently humanity itself. Ultimate survival of humanity therefore depends on the health and productivity of the natural environment.

Environmental concern in development has its origin in the experiences of the developed countries as a direct result of rapid industrial development and consequent pollution of air and water resources. Therefore, much emphasis has been on issues related to protection of environmental quality in the developed world. But for the developing countries the environmental issues is a question of conservation of the environment rather than protection (Wickramarachchi, 1991).

The major resources such as land, water, minerals, forests and climate have all undergone a process of rapid changes. For example, water was regarded as an inexhaustible resource in the past but, the experience of many areas facing water deficit situation today has led to more attention being focused on addressing the problem of water. Environmental issues related to irrigation water use never received adequate attention in the past. Emphasis was mostly limited to issues such as the prevention of salinity and pollution caused by agro-chemicals, malaria eradication and soil erosion control. The human facets and overall environmental protection were neglected. It is necessary to introduce comprehensive measures that will focus on protecting both the physical and social aspects of the environment (*ibid*). Farming practices are contributing to environmental pollution through the excessive use of chemicals and fertilizers. Some of these practices directly and indirectly cause damage to fish population and threaten water supplies for drinking and other uses down-streams. It is therefore important to appreciate the point that proper management policies require an understanding of how the traditional agricultural systems are being practiced. A better coordination between land and water resources management with strong and early involvement of farmers is vital.

This requires both financial and policy support to farmers and farmers' organizations.

In addition, community's rights and people participation in natural resource management are most often not recognized and accepted in most developing countries. Many at times laws in existence do not correspond with the actual circumstances on the ground due to a lack of participation from the people who are affected by such laws. Additionally, there is a lack of transparency, resulting in an overlapping of interest and benefits. Natural resource management remain a problem in many countries due to monopolization of natural resources through centralized laws and policies. In such cases exploitation of natural resources may provide opportunities for wanton looting of public wealth by the economic elite if it can seize control state power. As a result, natural resource extraction in developing countries is often associated with high levels of corruption, and ineffective governance (Smith, 2013).

The over exploitation of natural resources is not a new phenomenon. However, the pressure to develop and implement more dedicated public policy strategies on the sustainable use of these resources has been growing in the past few years, due to scarcity scares about some finite resources and increasing pressure on many others that are more renewable. The need for a robust natural resource policy is becoming increasingly evident in different regions with worries over availability and prices of food, water, energy and metals. The way in which natural resources have been used in many industrialized and developing nations in the past has made the potential adversities and dangers to natural resource systems clearer in recent years, and both international development organizations and governments in developing countries have begun to reassess their approaches to development. Growing awareness of the complex relationships between social and economic development and big-physical systems has led to demands for more effective methods of analyzing natural resources and the potential impacts of development policies on them.

The increasing awareness of, and growing demand for change in the way governments use natural resources have come at the same time that concepts and definitions of social and economic development are undergoing fundamental re-evaluation. The pursuit of "development" has

been one of the most important attempts to reorder social and physical conditions during this century. This ill-defined and ever changing concept underlies policies that have raised the living standards of millions of people in many countries; but the same time has worsened the conditions of millions of others. Manifestations of some of those adversities have led development planners and policy-makers to reconsider previous definitions of development, to re-examine the relationships between patterns of human behaviour and the dynamics of natural resource systems and to give greater attention to preserving and using more wisely the environment and natural resources on which human development - no matter how it is defined - ultimately depends.

The concerns expressed within the past few years over environmental degradation and destruction of natural resources in the pursuit of development (the benefits of which have accrued to only a small minority of the world's population), have led many to conclude that economic development and preservation of the natural environment are incompatible goals. But increasing evidence suggests that this conclusion may not be entirely accurate. A more accurate and increasingly acceptable conclusion is that some development policies are indeed detrimental to environmental quality and natural resources, but that others have created opportunities for large numbers of people to improve their standards of living in ways that are compatible with, complementary to, or capable of enhancing the natural resource base. The form development takes, and the way policies are designed and carried out, determine the effects on a country's natural resource systems.

Resource Management and Policy Issues

In many resource rich developing countries, exploitation of natural resources presents a relatively faster and easier means of amassing revenue than through domestic tax that can be used for socio-economic transformation. However, the goal of socio-economic transformation is most often compromised by poor natural resource management strategies. Therefore, while there are many examples of successful resource rich countries in the world, there are also countless cases of developing countries suffering from the natural "resource curse". It is therefore crucial that the

policy maker finds the correct balance between investments in natural resource based enterprises and making sure that long term development goals are not compromise (Mc'lead, 2013).

Thus, developing countries that wish to emerge from the "developing" status must introduce measures that will set the correct foundation for efficient and effective management of their natural resources. This could be achieved through the introduction of appropriate policies and conditions required for maintaining good, consistent and efficient environmental regulatory programs that would embrace both the value of existing natural resources and the need for rapid socio-economic development.

Land and Soil Resources

Land refers to the solid part of the earth surface and includes soils and other natural assets as well as buildings and other man-made fixtures. Land is the plain on which man interacts with his natural environment. As a resource, land serves as the base for the development of all other natural resources and it is needed to promote almost all sectors of the society (Mc'lead, 2013). In many parts of the developing world, rapidly increasing human population and the resultant need to increase food production and urban and industrial development often push small holder farmers into marginal lands. The uncontrolled expansion of human settlements in particular constitutes a serious challenge to sustainable land planning management (Tilakasiri, 1994). Increasing competition for land among the various sectors of the economy (Agriculture, industry, transport protection of water catchment areas, etc.), emphasises the need for comprehensive land-use and planning policies in developing countries. However, in Africa and many other developing countries multiple and often conflicting land-use policies have often hindered agricultural development, made factory location unprofitable and constrained wildlife conservation (M'clead, 2013).

In addition, in many areas of the developing world soils are generally thin and infertile. In such cases, soil erosion may result in complete loss of soil fertility, particularly when aggravated by poor management practices. Excessive erosion also results in siltation of water bodies often leading to eutrophication which is detrimental to fisheries and other aquatic resources

(People's Bank, 1975; Wickramarachchi, 1991). A significant challenge to land management in developing countries is finding a balance between agricultural modernization and maintenance of kinship and traditional ties of communal land ownership. Similarly, absence of adequate strategies for allocation of land for mineral exploitation, industrial and urban development is a potential source of conflict that may jeopardize economic development goals. Policy measures for addressing land resource problem include:

(a) Formulating comprehensive land-use policy based on extensive consultations with all relevant stake holders. A well conceived land-use policy should cover all land-uses and must embrace both the production and conservation components.

(b) Promoting better land management practices, which should involve using adaptive management techniques based on local conditions. However, this may entail replacing some agricultural practices like bush burning with practices like soil manuring.

(c) Developing management strategies for efficient harmonization of competing demands for land such as for farming, mining and for construction of residential and industrial buildings.

(d) Improving land administration competencies by engaging only qualified professionals in land management and through proper training and retraining of land administrators.

Water Resources

Water resources include surface water, sub-surface water and ground water. Clean and plentiful water provided the foundation for many prosperous communities today. Although, human population rely on clean water to survive, water pollution, overuse and climate change are pushing humanity towards a water crises. The result is that water is becoming increasingly scarce particularly in areas with limited rainfall. Although, irrigation is a common feature in the development of agrarian economies, new irrigation developments are becoming more expensive to provide and manage (People's Bank, 2009). Today, agriculture, industries, mining and inland fisheries all compete for water resources. People have managed to

keep many areas of the developing world agricultural, notwithstanding the fact that industrial development in particular requires large quantities. But, the recent trend is to view water in terms of its optimal use determined by economic measures (*ibid*).

Presently, agriculture accounts for about 70 per cent of the world freshwater withdrawals, while energy production in some parts of the world accounts for up to 45 per cent of all water withdrawals. It is estimated that food demand may increase up to 70 per cent by 2050, while, the world demand for energy may increase by up to 40 per cent (SIWI, 2012). Satisfying these demands, while also maintaining ecosystems, livelihoods, fisheries and biodiversity is a great challenge to humanity. A large proportion of global food production is based on unsustainable exploitation of groundwater that is increasingly being threatened by pollution from agro-chemicals.

Irrigation has facilitated the spread of cultivation to previously marginal lands to feed rapidly increasing human population but, reservoirs ensure that large areas of land are inundated and lost for ever. In addition, irrigation often requires continuous flow of water which is uneconomical. Percolation from poor quality canals and wasteful traditional farming practices also contribute to wastage of water. The situation is often compounded by water logging and increased alkalinity and acidity which eventually makes cultivable areas unproductive (Tilakasiri, 1991). These problems can only be addressed by effective management techniques for water and land resources. A key challenge which lies at the heart of efforts to developing appropriate water policy is finding a balance between water availability and quality. Policy measures required to address water resources issue include:

- (a) Creating suitable institutional and legal framework for comprehensive water resource management.
- (b) Building capacity and promoting public awareness for water resource management at all levels.
- (c) Setting up efficient monitoring systems for ground and surface water resource management.

Mineral Resources

Mineral resources constitute an important material foundation for the development of human society. Though, minerals are finite and non-renewable in nature, they constitute vital raw materials for many basic industries. Mineral exploitation is important to development goals by contributing to employment generation, educational development, infrastructural development, revenue generation and through its link with other resources such as land, water and the environment (M'clead, 2013). Management of mineral resource therefore, needs to be closely integrated with the overall strategy of development; and exploitation of minerals is to be guided by long-term national goals and perspectives. Simultaneously, it is essential to keep in view the present and future needs and development of the country and strive to ensure indigenous availability of basic and strategic minerals to avoid disruption of core industrial production.

At early stages of economic growth, the solid mineral sector may serve as the major driver of economic activities due to the huge investments involved in mine development, demand for pre-production employment, the potentially huge revenues from mineral taxes and if properly managed the backward linkages to the other sectors of the economy. However, for hydrocarbons the highly capital-intensive nature of the industry does not result in many linkages at the early stages of its development. Yet, the long period of time required for development provides enough time for the preparation of other sectors, like human resources and support to the sub-sector by local suppliers in readiness for the commercial stage. On the other hand, the large revenue potential may cause distortions in expenditure management, non-transparent agreements and macroeconomic instability. In addition, the linkage between oilfield operations with the environment is problematic, particularly in terms of local capacity to effectively monitor the operations of large, complex sites (M'clead, 2013).

National Policy for the strategic planning and exploitation of the mineral resources must acknowledge the importance of the mineral raw materials that contribute to progress and development, ensure a high living standard and create a competitive national and regional economy and new job opportunities. The policy must also ensure that the minerals are

produced and distributed to the society in conformity with the constitutional principle of sustainable development.

It must also be stable and transparent; it must be able to be adjusted depending on the social and economic conditions or with a view of protecting the natural environment. Moreover, it must also be in harmony with the other National Policies, mitigating the conflicts that hinder the growth of the National Economy. Such a policy and all its different aspects of implementation can only be the outcome of a wide dialogue, information and public consultation at national, regional and local levels. Policy measures required for addressing these issues include:

- (a) Formulation of a clear mining policy to ensure transparency and ensure public knowledge of mining laws and the country's goals for the sector;
- (b) Developing a comprehensive legal framework that contains provisions for community issues as well as national concerns, reconciles environmental and conservation demands and development goals
- (c) Creation of a natural resource fund management facility such as sovereign wealth funds, heritage funds and so on. This will help in determining how much to save and how much to consume immediately, considering pressures to meet development goals.
- (d) In terms of addressing environmental and conservation issues major efforts should be directed towards enhancing local capacity to monitor and pre-empt damage. Local capacity building and cooperation with countries with better experience are very essential for managing environmental problems associated with hydrocarbon exploitation.

Forestry and Wildlife

Forests are highly valuable areas protecting biodiversity. Forest includes natural forest cover as well as plantations established by the society. Forest as a renewable resource requires close monitoring because of its potential impact on the livelihoods of local communities, domestic energy use and its link with biodiversity protection (M'cleod, 2013). It is

not only providing timber and other economically valuable substances but also facilitate maintenance of fertility of tropical soils. Tropical forests are the highest productive ecosystems of the world. Some tropical forests are estimated to produce more than 3200 grams of biomass per cubic meter per year. More than 80 percent of the nutrients in tropical ecosystems are held in the trees and there is a well developed mechanism related to recycle of nutrients. Clearance of forests is a complete destruction of this recycling system and the nutrients. In the tropics the rate of soil erosion from forest areas maybe accelerated by a factor of between 2 to 2000 depending on the type of disturbance (Wickramarachchi, 1991).

In the tropics millions of hectares of forest land are lost to land and water development projects annually. This affects the hydrological cycle and with serious consequences for human life. Tropical rain forests are the most diverse and productive ecosystems of the world. They account for more than 25,000 flowering plants in the world. Species diversity in the topics provides opportunities for many economic activities. All the species of plants and animals in the world are interdependent. Since the human specie shares the environment with other species extinction of one could have serious consequences for man himself (*ibid*).

As demands for wood, timber, water, grazing and recreation and so on are increasing more rapidly, forest management has also become an important issue. As a renewable resource, much benefit can be derived from proper management of forests. Forest resources are managed under the method of practical forestry. This must involve several services as protection from fire, overgrazing, and theft. It must also ensure enough growing space for every tree and abundant reproduction. The amount of wood taken from a healthy forest and the amount grown should be nearly as equal. The problem of balance between conservation and agricultural development arises in all the main ecological regions of the world. This calls for the introduction of proper forest management policies.

Modern agriculture poses the greatest threat to wildlife. In addition, large tracts of wildlife habitat are being destroyed or modified for human settlement development and industrial development and natural resources exploitation. Quality of wildlife is determined by both the abundance and

the diversity of native plants and animals. Particularly in the lowlands, majority of habitats have been greatly modified and impoverished as a result of human activities (Wickramarachchi, 1991).

Measures for promoting sustainable forestry and wildlife management include:

- (a) Improving legal and political framework for conservation management. Very comprehensive policies must be developed for the management of biodiversity resources. These should cover both zoological and habitat problems while also addressing the issue of harvesting and marketing of forest resources.
- (b) There is the need for comprehensive surveys and evaluation of forest and wildlife resources. This is necessary for providing adequate data for planning and development of appropriate management and conservation policies.
- (c) Capacity building for forest and wildlife conservation is very essential. This should however be combined with building the right political attitude among the generality of the population, to ensure success of conservation policies. This would be easily achieved through the provision of basic education on forestry and wildlife for the generality of the citizenry.
- (d) Appropriate policies must be developed to ensure biological conservation of buffer zones to ensure that local communities carry out their livelihood activities without threatening protected areas. Introduction of appropriate economic incentives for local communities will help control encroachment of protected areas (Adapted from Usman and Adefalu, 2010).

Climate Resources and Climate Change Policies

Climate is a coin with two sides, can be hazardous and its variables when wisely harnessed and utilized can also be of immense benefit to man. The benevolent aspects of climate which include rain, sunshine, cloud and wind makes it a vital resource nature has offered mankind on the planet earth.

Rainfall is the determinant factor of agriculture as its year to year variability has been responsible for fluctuations in yields and total production mostly in the tropics where agriculture is rain fed. Besides, rain constitutes the major source of water to rivers which can be dam to supply water to generate hydroelectric power and irrigation. Cloud produces all forms of precipitation and at the same time regulates the amount of insolation received on the earth surface.

Another importance of resource of climate is sunshine (solar radiation). It is an important aspect in photosynthetic process and hence crop production. Solar energy is an exhaustible and clean source of energy can be annexed and converted to usable form. Such energy has been used to drive engines. For instance a small solar car was built by friends of the Earth in Hong Kong. Similarly the first test- fly of a solar impulse 2 plane which uses only solar energy landed on the island of Oahu, Hawaii in December 2009. Solar energy is being turned into useful electrical energy mostly in the tropics where its surplus.

The application of energy resource of wind is seen in various forms. Example is the development of the windmill. This mill is used to pump water from a deep well e.g. in Kano, Nigeria. Wind turbine is used to generate electricity for a single home or building or can be connected to electricity grid for more wide spread electricity distribution.

Climate change impacts all these climatic resources mostly through global warming. For instance rapid evaporation of water consequent of earth warming causes drought in some areas and excessive rain which often results into flood in another areas. Climate change is a global problem that requires a global solution. An important step towards having effective legally binding emission cuts is the Kyoto Protocol conference that took place in Japan in 1997. The agreement reached by nations of the world sets binding obligation on industrialized countries to reduce emissions of GHGS 6-8% below the 1990 levels between the years 2008-2012, the first emission budget period. However, many industrialised countries were reluctant to fulfil commitments under the protocol.

Copenhagen conference was held in December, 2009 to assess the progress of Kyoto Protocol, to plan for future and design an agenda for the

world to take up in fighting the problems of climate change after 2012. A 13 paragraph political accord termed "Copenhagen Accord" was agreed but without legal commitments. The Accord recognizes the following;

- (1) The scientific case for keeping temperature rise below 20°C but does not contain commitments for reduced emissions that would be necessary to achieve that aim.
- (2) A pledge of USD 30 billion to the developing world over the next 3 years, rising to USD 100 billion per year by 2020 to help poor countries adapt to climate change
- (3) The dropping of the earlier proposals that would have aimed to limit temperature rises to 1.5°C and CO₂ emission by 80% by 2050
- (4) Agreement that would set up deal to reduce deforestation in return for cash from developed countries (Adapted from Ologunorisa, 2010).

Climate Change Impact on Natural Resource Policy Development

As a system, climate is made up of five components namely; the atmosphere (world of air), hydrosphere (world of water), lithosphere (world of rock and soil), biosphere (world of living things) and the cryosphere (the world of ice). All earth resources reside within the components of this system which is highly responsive to climate change. Thus, natural resources can be examined outside the components of climate system and any policy formulation on this subject matter must give due attention to the processes operating within the climate system. For instance, climate change constitutes a major threat to the global natural resources mostly through global warming and hence to the well-being of citizens in every country of the world. These interacting processes have the potential to undermine development, investments and recent gains in poverty alleviation, food and water, security and human health, particularly in the most vulnerable developing countries. Though, the poorest countries historically have been least responsible for climate change and ecosystem degradation, they face the most severe consequences of its effects (ranging from altered rainfall, reduced crop yields and increased weather-related disasters, to rising sea levels and exacerbated diseases).

Climate Impact on Land-use and Land Use Policy

Inefficient land use planning obviously aggravates the future climate impact and also worsens resilience against natural hazards of climate change. For instance, unsustainable farming practices alone have been identified by the International Institute for Sustainable Development (IISD) (2013) as the factor responsible for approximately 20% of global emissions of carbon dioxide each year. However, farming done in sustainable ways constitute a sink for the same gas, reduce soil erosion, build up soil fertility and structure among other things. Spatial shift in cropping patterns occur to compensate for the shift of agricultural boundaries. Increase in rainfall regime in all eco-zones of Nigeria for instance has resulted in abnormal dry periods during the rainy season even in the coastal areas (Adeyemi, 2000; Olanrewaju, 2006 and Bello, 2010).

To build community resilience to climate change, involves developing a framework that links climate change with disaster management and land use planning. Gurran et al (2008) highlight the need for mitigation as well as adaptation strategies in a land use planning context to deal with climate change. The mitigation measures includes stricter environmental studies, energy and waste efficiency, modifying building codes and changes in urban form to reduce dependencies on motor vehicles through planning. Some of the adaptation measures to coastal hazards include forbidding new permanent developments within areas of risk, reinforcing barrier devices to protect property and re-establishing foreshore vegetation. Land use planning can play a vital role in reducing both current and future community risks associated with climate change. Policy framework on climate change and land use management should be the responsibility of all levels of government.

Climate Change Impact on Wildlife Resources and Wildlife Policy

One of the challenges facing the wildlife sector is the direct impact of climate change on the physiology of individual species, changes in abiotic factors, changed opportunities for reproduction and recruitments and altered interaction among species. The indirect effects of climate change manifest on the damages done to the habitats of the wildlife. Habitat requirements for various species of wildlife is very critical for their wellbeing and hence their

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survival. The most important of the threats of climate change on wildlife are global warming and extreme climatic events such as flood, drought and storms.

The critical impacts of climatic factors in the tropics is loss of moisture that has led to the extinction of some plant species. Example of this as noted by Brennan (2008) in Monteverde cloud forest in Costa Rica which recorded the extinction of a species called the golden toad (*Bufo Perilene*). Similarly the decline and near absolute lethal limits of boreal forest sites in Alaska has been reported by Brennan (2008), and loss of sea ice has threatened the ice dependent specie such as polar bear. Rodger (2007) express his fear that any measure taken at reducing the GHGS emission now may be too late to prevent some plants and animals species from going into extinction. Rodger's fear notwithstanding, actions to reduce the emission of GHGs should be put in place.

Climate Impact on Water Resources and Water Policy

A delicate equilibrium exists between precipitation and evaporation in the hydrologic cycle and when this balance is upset the earth is faced with the problem of either too much or too little water with their attendant woes. Climate change is having a significant impact on the sustainability of water supplies that will linger into the future. The negative impact of climate on water is felt everywhere around the globe. Increase in temperature consequent of global warming increases evaporation rate and the capacity of the air to hold water thus affecting the amount of precipitation and hence water supply in an area.

The climate change impacts on water vary over space and time. For instance in the temperate and polar regions, global warming will cause precipitation to fall as rain instead of snow. In the tropics the combination of the global warming through anthropogenic activities and the natural warming caused by the overhead sun makes the water in this area most vulnerable to climate change impacts. Thus in the tropics rising temperature results in decrease in flow which has reduced the supply of water for irrigation and reduce electricity power supply thus increasing electricity demand for air conditioning and refrigeration.

Climate change endangers coastal resources such as marine organisms. For instance rising air temperature can warm up the sea, stream and lake temperature beyond the tolerance range of the aquatic lives. Extreme events such as flood will generate high stream flow that can damage spawning nests, wash away fish incubating eggs and flushes young fishes from river. Heavy rainfall washes pollutants into rivers thereby affecting water quality negative. Similarly sea level rise introduces saltwater into the freshwater areas polluting the water and rendering it useable or expensive to use. From the foregoing the water of the world is in distress of climate change and there is the need to protect this vital natural resource.

Climate Impact on Mineral Resources and Mineral Extraction Policy

Mineral resources are vital to economic growth and development of any nation. The impact of climate on it is indirect. For instance, heavy down pour can result in flood episode. This has the potential of damaging some of the physical structures used in mining processes. According to the HRD, Government of Orissa mining district of India (2004) cited in Hota (2007) the interior mining districts are experiencing severe floods in recent years.

On the other hand, mineral extraction impacts climate directly through rising atmospheric Green House Gases (GHGs) and temperature which affect the local climate. However, the pooling together of such effects from other mining districts of the world results in global climate change. Indirectly, mineral extraction affects climate through forest degradation and deforestation thus reduction on the natural capacity of forests to absorb carbon dioxide and hence rise in temperature. Again, the surface albedo (reflection coefficient) of bare ground is higher than the vegetated area. This also has a lot of implications on the energy budget of the earth.

Considering the importance of mineral resources to the national economy and the repercussions of their extraction on climate at both local and global scale, it becomes necessary to formulate policy that guides extraction of such resources in sustainable ways.

Conclusion

Apart from contributing to economic development, exploitation of natural resources such as land, water, minerals and forests are also important for poverty reduction by providing employment and livelihood and for their contribution to food security. Presently, in many developing countries exploitation of available natural resources constitutes the main source of revenue for financing developmental projects. However, a major challenge in natural resources management in the developing world is the absence of adequate policies and political will to enforce existing regulations. Inappropriate management of resources has most often compromised developmental goals as could be seen in the situation of some countries that are experiencing what has been termed the "natural resource curse".

Development oriented natural resource management must be based on policies and actions that meet the widest range of interests. That is, policies that promotes even development, reduces inequality and promotes socio-economic wellbeing of the generality of the citizenry. Suitable legal procedures must be developed within individual countries, for the establishment of transparency and accountability to tackle the problem of endemic corruption in many countries. In addition, income from resource exploitation should be invested in developing other sectors of the economy. This will help in the diversification of the economy into value-adding activities while reducing dependence on resource extraction.

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