The Roles of Forest in Environment Modification

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Abstract

By the late 1990s the environmental problems included the greenhouse effect and global warming, the hole in the ozone layer, acid rain, and the destruction of tropical forests. But whilst the problems appear to be largely physical (environmental), the causes and solution lie more in people's attitude, values and expectation. It is expected that the environment should be all things to all people (It is to be life supporting, it is to be useful, and it is to be beautiful). Unfortunately the environment cannot meet all these needs at the same time. Cutting trees from large areas (deforestation) without adequate replanting has resulted to almost half of the world's tropical forest being cleared. Each year about 170,000 square kilometers of these forests are cut and equivalent portion is degraded. Within 30-50 years there may be little of these forests left, many of the remaining diverse, old-growth forests are being cleared and replaced with single species tree farms (plantations), greatly reducing wild life habitats and biodiversity. Eliminating or decimating wild species through destruction of habitats, commercial hunting, pest control and pollution. Each year thousands of wild life species become extinct, mostly because of human activities. If habitat destruction continues at present rates, as many as 1.5 million species could disappear over the next 25 years - drastic loss of vital earth capital, polluting renewable air, and water and soil so that they are unusable. This work therefore, x-rayed the benefits of forests to the environment, the concept of environmental sustainability and management of forests to enhance functional environment.

Keywords: *Greenhouse, Ozone, Deforestation, Environment, Biodiversity*

1.0 Introduction

According to Adeyogu (1981), forest is a tract of land covered by a plant association predominantly composed of trees and other woody vegetals.

The (human) environment has been variously defined as:

(i) The conditions, circumstances and influence under which an organization or system exists. It may be affected or described by physical, chemical and biological features, both natural and man-made. The environment is commonly used to refer to the circumstances in which man lives (Eziashi, 1997)

(ii) The sum of all natural resources, including the biosphere, which sustain life on earth (Eziashi, 1997).

(iii) All external conditions and factors living and non living (chemicals and energy), that affect an organism or other specified system during its lifetime (Miller, 1993, 1994).

(iv) The complex of physical, chemical and biotic factors that act upon an ecological community and ultimately determine its form and survival (Eziashi, 1997).

1.1 Concept of Sustainability

A leading focus within the environment debate since the 1990's has been the search for more sustainable ways of using the earth and its resources. This stems from the recognition that the future of the earth and its people is intimately tied up with our ability to maintain and preserve the life –support systems that nature provides. This therefore makes it our duty to ensure that:

- all uses of renewable resources are sustainable
- the diversity of life on earth in conserved
- damage to natural environment systems is minimized.

Forest vegetation plays indispensable roles in creating and preserving a stable and high quality environment. It modifies and moderates local climates, reduces soil erosion and regulates stream flow by forming a protective screen over the land. According to (NEST, 1991), forest vegetation influences local climate by reducing wind speed and temperature extremes and by increasing atmospheric humidity.By shedding the ground from the direct impact of rain-drops, offering obstruction to water moving on the ground, and holding the soil particles together with its roots, vegetation helps to reduce soil erosion. Forest vegetation also has a profound influence on water resources. It reduces the amount of rain water which runs down the slope and increases the amount which percolates deep down into the soil.

The result is that river flow is more regular: maximum flow during the rains is reduced while minimum flow during the dry season is enhanced (NEST, 1991).This all indicates that forest vegetation provides not only tangible products for our use and consumption but also performs vital environmental protection functions. Yet forest vegetation is a very fragile element of the environment. Loss of vegetation cover is directly related to desertification, accelerated soil erosion, declining soil productivity and loss of farmland, flooding and siltation of water bodies which are serious environmental problems in the country and al over the globe.

Forests and trees greatly contribute to maintaining the ecological balance. The integration of trees within agricultural schemes sustains crop production by improving soil fertility. Trees help to control water and wind erosion and they recycle vital nutrients, such as nitrogen back into the soil. Trees also grow where agricultural crops might fail, allowing production on marginal lands. As they grow, trees absorb and store carbon dioxide ($C0_2$). Deforestation especially by burning releases a great amount of stored $C0_2$ into the atmosphere, contributing to global warming.

2.0 Forest Ecosystems And Environment Modification

According to (FAO, 1991) in addition to their direct contribution to food supplies, trees provide habitats for animals, insects and plants that indirectly contribute to human nutrition. Mangrove forests, which cover only about 1600km^2, are essential to the life cycles of many of the world's major fish species. Shrimp, oysters, crabs and countless other edible species of aquatic animals also feed and bred in these forest ecosystems.

2.1 Atmospheric Role of Forests

Rainforests play the important role of looking up atmospheric carbon in their vegetation via

photosynthesis. The vegetation and soils of the world's forest contain about 125 percent of the carbon found in the atmosphere, when forests are burned, degraded or cleared, the opposite effect occurs, large amounts of carbon are released into the atmosphere as carbon dioxide along with other green house gases (nitrous oxide, methane and other nitrogen oxides). The burning of forests releases about 22 percent of anthropogenic emissions of carbon dioxide (Rhett, 2010). The build up of carbon dioxide and other gases in the atmosphere is known as the 'greenhouse effect'. The accumulation of these gases is believed to have altered the earth's radioactive balance, meaning more of the sun's heat is absorbed and trapped inside the earth's atmosphere, producing global warming. Greenhouse gases like carbon dioxide are transparent to incoming shortwave solar radiation. Greenhouse gases are opaque to long-wave radiation and therefore, heat is trapped in the atmosphere. As greenhouse gases build up, this capacity is released and more heat is trapped in the atmosphere.

The largest atmospheric contributor to the greenhouse effect is carbon dioxide gas emissions, about 77 percent of which comes from the combustion of fossil fuels and 22 percent of which is attributed to deforestation. The final 1 percent comes primarily from energy-costly production activities like the manufacture of concrete, steel and aluminum. The pre-industrial atmosphere concentration of carbon dioxide was 290ppm, though today levels have risen to 375ppm, a 30 percent increase.

Table 1: *Atmospheric Role of Forest*

Global Carbon Emissions	**Breakdown Gigators**	**Global Carbon**	**Reservoirs**
		Carbon Reservoir	Size (Gigators)
Global Emissions	8.7-91		
Fossil fuels	6.9 – 7.0	Atmosphere	750
And use change (deforestation):	1.8-2.0	Forest	610
Other:	0.1	Surface oceans	1,580
Global absorption:	8.7-9.1	Deep oceans	38,100
Remains in atmosphere	4.5	Fossil fuels	5,000
Absorbed by oceans:	2.3	Coal	4,000
Absorbed by vegetation	1.9 – 2.3	Oil	500
		Natural gas	500

Source: IPCC, 2000

2.2 The Effect of Forests on the environment, the climate and humanity

Forest cover is one of many factors which affect climate at the global level as well as regionally and locally. Also forests provide habitat for wildlife and they affect the volume and timing of water flow out of the forested area as well as rates of soil formation or erosion. Forests are one of the numbers of important elements in the global cycling of carbon, oxygen and other gases of importance which influences the composition of the earth's atmosphere (FAO, 2005).

Many environmental and ecological 'services' are derived from forests. In most cases, the forest ecosystem is one element in a complex interaction in which factors such as geographical location, size of the forested area, geology, human and animal activities all play a role. Different interpretation of the significant of forests in issues such as global climate change, flows of water in rivers, or soil erosion are other related to the complexity of measuring the role of forests ecosystems in the phenomenon in question.The global climate varies with changes in the polar ice caps, in surface and subsurface temperatures of the oceans, by absorption, reflection and

transmission of energy in the form of light and heat from the surface of the earth, since nearly two thirds of the surface of the globe is covered by oceans and the polar ice caps, these, rather than forests and other land features, are the significant physical features of the glove affecting climate.

2.3 The effect of Forests on Rainfalls

According to Reynolds, and Thompson, 1988, forest cover affects the absorption, reflection and transmission of light and heat from the surface of the earth, and of water from the forest canopy due to processes of evaporation and transpiration. On a global scale, only very large areas of forest appear to have a noticeable effect on climate and rainfall, although smaller areas of forest do have some effects on local microclimates.

Reynolds and Thompson, 1988, further stated that historically, it was believed that the presence of forests attracted rain or were instrumental in increasing rainfall. Over the last forty-five years, it has become possible to trace the movements of water vapour and atmospheric gases to develop a clearer idea of the role played by forest in moderating or regulating rainfall. In temperature regions and tropical regions such as South East Asia, the main source f water vapour in the atmosphere is from evaporation at the surface of oceans. In the Amazon Basin, however nearly 50% of water vapour in the atmosphere in the region of Manaus and belem appears to be 'recycled' from the forest.

2.4 The Impact of Forest on Water Storage and Hydrology

Rain falling on forested land is intercepted by the foliage of the canopy. Some of the rainwater that penetrates to the land surface flows into rivers, lakes and oceans Some water penetrates the soil before resurfacing to join the surface flow, while some water become part of underground reserves of water or aquifers (IPCC, 2000).Forest cover plays a role in regulating hydrology (cycles of water flow). Since variables such as density of foliage, temperature, the humus (or decomposed vegetation) layer on the forest floor permeability of soils, slope and geology, all affect the flow of water, it is not possible to state categorically that forest increase or decrease water flow. It would be accurate to say, however, that forests cover does mitigate the effects of events such as tropical rainstorms or rapid snowmelt, reducing the likelihood of downstream flooding and extending the time during which water flows can recharge underground reserves

According to (IPCC, 2000), "water cycling is another major environmental service of forests. One of the expected impacts that would result from a significant expansion of the extent of deforestation in Amazonia and other parts of Brazil would be a reduction in rainfall, especially during the dry season (IPCC, 2000). Similar effects have been calculated for the effects of forests on rainfall in the Indian subcontinent (IPCC. 2000) and tropical forest protection has been shown to generate drought mitigation and flood mitigation benefits in Indonesia. The tropical forest and indeed any forest cover produces litter that protects the soil beneath from rainfall impact and filters out the fire particles that may clog the larger pores. Infiltration rates are therefore usually high under forest cover where the forest floor later is well developed. Where it is disturbed by logging or removed by fire, protection may be decreased sufficiently to lead to overland flow. It can be argued however, that the microclimate (high humidity, light wind, maintaining of low moisture fluxes) prevents the forest soils from drying (especially during the West African Hamattan). The soil does not even harden, so that its permeability is maintained preserving its infiltration capacity. Finally, the

presence of a certain amount of humus in the top soil assures a soil structure favourable to infiltration (Reynolds and Thompson, 1988).

The hydrological processes in question include precipitation, evaporation and runoff interception splits precipitation into that delivered t the land surfaces and that caught on the forest canopy and returned to the atmosphere by evaporation. Water delivered to the land surface may run off directly, as overland flow into streams to drain by way of rivers and lakes back into the sea, or infiltrate the soil. This latter pathway has been considered the most important pathway for the sustenance of man (Reynold and Thompson, 1988)) from the soil, vegetation is supplied; the surplus drawing further down to springs maintains the stead flow of rivers. Plants return much of the soil water through transpiration to the atmosphere. Some water also evaporates directly from the soil and from the surfaces of lakes and rivers. It is known that part of the water that infiltrates the soil moves laterally through the upper horizons until it reaches a stream channel and does not become part of the ground water reservoir. This portion of subsurface flow is known as interflow or through flow and, together with overland flow, constitutes what is generally referred to as surface run-off or more properly, as directed run-off or quick-flow. In practice interflow and overland flow cannot be accurately separated, but severally methods of hydrograph separation are available for isolating their sum from base flow (Reynolds, and Thompson, 1988).

2.5 The Role of Forests in Carbon Sequestration Process

During photosynthesis, plants absorb carbon dioxide and convert it to carbon dioxide and convert it to carbon (stored as plants tissue) and oxygen. Forests therefore have an important ecological function in fixing and sorting carbon from the atmosphere. Increasing concentrations of carbon dioxide in the atmosphere appears to be one of the factors leading to observed changes in the global climate, so that there is growing interest in the role of forests as a possible factor in mitigating climate change (Matthew, et al., 2000).

"Each year, as forests grow and increase their biomass, they absorb carbon from the atmosphere and store it in plant tissue. The process is known as carbon sequestration. Despite constant exchanges of carbon between forest biomass soils and the atmosphere, a large amount is always present in leaves and woody tissue, roots and soil nutrients. This quantity of carbon is known as the carbon store. Carbon sequestration and storage slow the rate at which carbon dioxide accumulates in the atmosphere and mitigate global warming. Forests sequester and store more carbon than any other terrestrial ecosystem and constitute an important natural defense against climate" "More than any other kind of vegetation, forests capture vast amounts of atmospheric carbon dioxide and store it in live and dead woody tissues (especially in stems and roots) and in forest floor and soil organic matter. But different forests types and development stages accumulate atmospheric carbon in different ways. In general, growth rates are greatest when forests are young, whereas the total store of biomass is greatest in older forest". And, boreal forests are especially rich in soil carbon, while tropical forests probably store more in their vegetation (http://www/serc.si.edu/forest ecology/forest ecology production.htm2011)

In 1992, the Thailand Development Research Institute (IDRI) published estimates of carbon uptake in different forest types after forest conversion. The estimates are based n research carried out in 1989 when the Royal Forestry Department had reported a total of 6,970km^2 of land reforested. The report does not break down the carbon uptake by hectare, by forest type, but repots the following aggregate figures.

Forest Type	Carbon Uptake (million tone)
Tropical evergreen forest	0.177
Mixed – deciduous forest	0.062
Dry Dipterocarp Forestry	0.095
Pine forest	0.004
Mangrove Forest	0.02
Total	0.362

Source http://www.info.tdri.or.th/library/quarterly/tables/m922t2.htm

3.0 Conclusion

According to (Greenfacts, 2011), the 2005 Forest Resources Assessment as the most comprehensive assessment of forests to date, in terms of both content and number of contributors It tells us that forests cover 30% of the land area of planet earth and range form undisturbed primary forests to forests managed and used for a variety of purposes.

The assessment also tells us that deforestation continues at an alarmingly high rate, but that the net loss of forest area is slowing down thanks t forest panting, landscape restoration and natural expansion of forest on abandoned land. Forest are increasingly being conserved and managed for multiple uses and values. . They play a crucial role in climate change mitigation and in the conservation of biodiversity as well as of soil and water resources. If managed sustainably, forests also contribute significantly to local and national economies and to the well-being of current and future generations.

The assessment of progress towards sustainable forest management depends on the context, the scale and the perspective applied. At the global level, the world's forest resources appear to be in relatively good shape. However, at regional and sub-regional level, this picture changes dramatically revealing considerable differences, with alarming trends in several tropical sub-regions. Considerable efforts will be needed to address remaining negative trends in order to progress towards sustainable forest management in all countries and regions.

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