

Deforestation and its Impacts on Climate Change

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Abstract

Forests cover more than a quarter of the land area in the world but are not uniformly distributed. They account for less than 5% of the land in many countries-such as Greenland, Egypt, Pakistan and Haiti-but cover more than 90% of the land in a few places such as Suriname and French Guiana. Forests are one the main natural factors that regulate and determine climate, weather patterns and amount of CO₂ of an area. With rapid industrialization and rapid urbanization there is a significant increase in deforestation and as a consequence rise in global mean surface temperatures. Rapid and unchecked cut down of forest cover has resulted in some of the worst disasters during the last decades.

Keywords: Deforestation • Forests • Climate • Natural hazards

Introduction

Deforestation is the loss of tree cover, usually as a result of forests being cleared for other land uses such as farming or ranching. Some limit the definition of deforestation to the permanent conversion of forests to another habitat. Climate change is one of the greatest concerns to mankind in recent times. Climate pattern of an area shapes the life style, livelihood and culture of an area. Majority of the world population experience the impacts of climate change on their socio ecological practices through variation in annual precipitation, temperature and sea-level over long-time span or through the increasing intensity and frequency of hydro meteorological hazards (Floods, storms, fires, cyclones, heat waves and droughts) and epidemics [1].

Apart from these climate related events there are other high impact phenomena of glacial melting and permafrost which may rise the global sea-levels by several meters, disintegration of the thermohaline circulation that in turn may cause considerable climate changes in the northern hemisphere and regional shift in the Asian Monsoon system and the El Niño Southern Oscillation phenomenon [2,3].

The impacts of climate change are devastating in developing countries due to lack of capacity in accordance with the changing climate. Rich countries effectively violate the human rights of thousands of the world's poorest people by excessive exploitation of natural resources. Continuous emission of greenhouse-gases from industrialized nations is resulting in hydro-meteorological events, sea-level rise and seasonal unpredictability. The consequences of uncertain seasonal variation are scarcity of water and food scarcity

(Failed harvests), rising sea level, destroyed homes and increasing health crises, which are affecting millions of peoples [4-7].

Strategies designed for mitigating climate change are focused on reducing the emissions of Greenhouse Gases (GHGs), particularly Carbon Dioxide (CO₂). One of the main causes of CO₂ emissions is deforestation. Forests act as natural filters for carbon dioxide absorption in the atmosphere. They store more carbon than they release and are termed as CO₂ sinks in their natural state. Approximately more than a quarter of the earth's land surface is covered forests which store more than three quarters of carbon in terrestrial setting [8-10].

Literature Review

Climate change and its impacts

The Intergovernmental Panel on Climate Change (IPCC), has forecasted an increase in the average temperature of the world within the range 1.4°C-5.8°C by 2100. Research carried out by four independent institutions analyzed that the decade (2000–2009) was the warmest on record. Since 1750 there has been an observed increase of 31% in the level of atmospheric carbon dioxide (CO₂). Fossil fuel consumption and deforestation at the present rate has resulted in an unprecedented increase of CO₂ in the atmosphere for the past 20,000 years (Climate Change 2001). Over the 20th century there has been an increase of about 0.6°C in the average surface temperature of the earth and the process had continued since 1861. Since the late 1950s there has been an increase in global temperature in the increases in the lowest 8 kilometers of the atmosphere and in surface temperature have been similar at 0.1°C

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per decade. Satellite data observation indicates a decrease of about 10% in the snow cover has occurred since the late 1960s, with a widespread retreat of mountain glaciers in non-polar regions. There has been an increase of about 0.1-0.2 meters increase in the global sea level as a consequence of climate change [11-13].

Various sectors together contribute over 60% of all Greenhouse Gas (GHG) emissions that include the energy supply sector, forestry and industry/manufacturing sectors [14].

Worldwide deforestation mainly contribute to forestry as trees cut down for land uses (Agriculture or construction) the soil loses its capacity to absorb carbon dioxide and if left to rot or burned, emit stored CO₂ in it [15].

Energy supply, industry/manufacturing and forestry sectors collectively account for over 60% of all Greenhouse Gas (GHG) emissions. The forestry's contribution is basically through deforestation worldwide, as trees cut down to clear space for agriculture and other land uses can no longer absorb carbon dioxide and if left to rot or burned, emit CO₂ stored in trunks and leaves.

During the 20th century, more than 10 million people lost their lives as a result of natural catastrophes, with almost of them becoming victims of floods. Floods have been affecting communities ever since the history of mankind, followed by earthquakes, claiming 169000 lives. Between 1985 and 1999, all the natural hazards that occurred included 37% windstorms, 28% floods and 15% earthquakes. The remaining 20% included fires and landslides. Asia, the most populous continent, has been particularly hard hit. Statistical records reveal that between 1985 and 1999, Asia suffered about 77% of all casualties, 90% of all displaced (homelessness) and 45% of all recorded. With the onset of climate change and increasing intensity of natural hazards there is a greater need to adopt mitigation methods in accordance with the changing climate [16].

Deforestation-contributing factor of climate change

Deforestation is the loss/removal of tree cover, as a result of forests being cleared for other land uses such as farming or ranching. Some limit the definition of deforestation to the permanent conversion of forests to another habitat. Deforestation activities affect carbon flux in the soil, vegetation and atmosphere. Deforestation results in soil degradation, carbon emission as a result of plant decomposition left on forest floor, albedo effect and intensification of hydro-meteorological hazards [17].

Approximately 30% of the Earth's land mass is covered by forests. Forests influence the global climatic pattern through climate through physical, chemical and biological processes that regulates the hydrological cycle, temperature stability and atmospheric composition. There has been a significant decrease in primary forest area by 300 million ha since 1990. Between 2000 and 2010, around 13 million hectares of forest were converted to other uses or naturally lost, compared to 16 million hectares per year during the earlier decade. This results not only in degradation of biodiversity, but also adds 12%-15% to global warming by releasing CO₂ into the atmosphere and impeding further CO₂ storage. Forests cover ~42 million km² in tropical, temperate and boreal lands. Forests provide social, economic, ecological and aesthetic benefits to natural systems and people. They act as a hub for biodiversity, act as food supply, have

medicinal and economic value, help in hydrological cycle regulation, protect soil cover and serve as aesthetic and recreational sites. Additionally, forests influence climate through exchanges of water, carbon dioxide, energy and other chemical species with the atmosphere [18-19].

Forests store ~45% of terrestrial carbon and can sequester large amounts of carbon. Forests have low surface albedo and can mask the high albedo of snow and help in regulating surface temperatures of the earth. Forests play a key role in regulating the hydrologic cycle through evapotranspiration and can be used as an effective tool to mitigate climate change. Climate model simulations show that tropical forests maintain high rates of evapotranspiration, increase precipitation and results in a decrease in surface air temperature. Deforestation on the other hand increases surface temperature, excessive emission rates of carbon dioxide, soil degradation and increase in surface runoff resulting in flash floods. Removal of forest cover alters global and regional climate patterns and results in catastrophic rainfall spells followed by prolonged dry periods. During the last few decades increase in urbanization and change in land use have resulted in massive increase in the rate of deforestation causing a distortion of global climate patterns and increase in catastrophic hydro-meteorological events [20].

Deforestation and climate change in the South Asia

The Hindu Kush-Himalaya mountain system is the largest ice cover outside the polar region including more than 100000 km glacial cover and is termed as the Third Pole. It is one of the most complex and diverse mountain systems in the world. About 10 of Asia's largest rivers originate here. This mountain system stretches for 3500 km covering some of the world's driest and environments. It rises for about 8 km vertically through almost every life zone existing on Earth and lies at the geographical Centre of most dense concentration of humans. It is recognized as an extremely delicate environment that is particularly vulnerable to global warming. The region is highly vulnerable to frequent natural hazards and poses a constant threat to the communities living in the Himalayan region and downstream communities. Climate change is expected to intensify in frequency and magnitude of extreme weather events leading to disasters [21].

Climate change impacts in the Hindu Kush-Himalaya region and downstream areas, including the Indo-Gang- etic plains are particularly threatened by climate change. A large section of the population depends on climate sensitive livelihoods which increase their vulnerability to climate change. Poverty and lack of coping capacity increases the risk of adverse impacts of climate change in the Himalayas. The mountain dwellers heavily depend of forests to meet their fuel requirement. This has resulted in deforestation over large area at a rapid rate and further increasing the risk of flooding, landslides, rapid rate of glacier melting, depletion of fresh water sources and droughts in the region [22].

One of the most frequent and disastrous natural hazards that affect the South Asian countries, particularly the Himalayan region is floods. During the past two decades the region has suffered some of the worst flood disasters of human history. Deforestation has adversely affected the climate pattern and stability in South Asia in the recent years. Asia comprises of about 15% of the global forest area. The impacts of deforestation are far more adverse than in any other part of

the world. It is because of the influence of forest cover on the regional hydrological cycle, Asian monsoon pattern and circulation pattern that affect not only the region but has global impact [23-26].

Some of these adverse impacts would result in variation

Rainfall: There would be an expected decrease in the annual precipitation rate in the region as a result of deforestation. There would be prolonged dry spells followed but short periods of intense rains [27].

Temperature: Forest cover regulates the air and surface temperature by absorbing carbon dioxide, with a decrease in the forest cover there would a significant increase in the temperature of the region.

An increase of about 10°C is predicted for the region due to deforestation and reduced rate of evaporative cooling [28].

The study on the effects of deforestation on the summer monsoon system in Asia and concluded that deforestation results in weakening of the monsoon system in the upland areas due to high wind speeds and low water vapor content but increased intensity and intense rainfalls in areas downwind of deforestation [29].

Mangrove deforestation: Mangrove forests provide a barrier against tides and waves. With the increasing trend of deforestation along the coastal belts of the region creates an imbalance in the natural water chemistry and expose the coastal community to the direct impacts of tides and waves [30].

Teleconnections: These include the effects associated with deforestation or the secondary effects of deforestation. Rapid decrease of forest cover in the area will not only alter the Asian climate pattern but will influence the global meteorological circulation patterns as well leading to intense climatic disasters.

Deforestation and climate change in Pakistan

Pakistan has most of its forests located in its northern parts in the highlands of Khyber Pakhtukhwa, Gilgit-Baltistan and Azad Kashmir.

About 39 thousand hectares of forests are vanishing annually at an annual depletion rate of more than 1.5%. The increasing trend of deforestation has negative impacts on the production and protection of the forests and livelihoods of those living around the forests.

Due to illegal exploitation and poor implementation of legislation the forest cover is depleting at a devastation rate in the country. As a consequence of deforestation there is increasing risk of landslides, slope destabilization, floods, increase surface runoff and soil erosion. After the Kashmir earthquake an increased risk of landslides and debris flow was encountered due to exploitation of forests [31].

In 2010 Pakistan experienced the worst flood of its history. Scientists termed the unprecedented rate of monsoon rains as impacts of climate change in the region. During the catastrophic event deforestation again aggravated the situation.

Natural and anthropogenic conditions played a combined role in creating a disastrous situation. Soil degradation and deforestation resulted in increased surface runoff and soil erosion.

Discussion

Causes of deforestation

Fuel wood and timber: In Mansehra 90% of the respondents were using the forest wood for cooking. However 56% of the respondents were using forests for timber in the same villages. In Swat district, 96% of the respondents were using fuel wood for cooking purposes and 84% of the respondents used forests for their timber needs. Fuel wood is an important component of house hold economies. In Pakistan fuel wood covers about 53% of total annual domestic energy. This dependence on fuel wood is expected to remain high in Pakistan in the future, because the economy of our country is not so strong that shift the traditional fuel wood to modern fuels. It is estimated that the population growth and fuel wood consumption will increase by 3% per year. The high demand for domestic fuel wood is believed to be rapidly depleting the forests. Conducted a research study and stated that lack of alternate resources for fuel wood, timber and fodder are the main and first causes of deforestation in Dir Kohistan. According to them 83% of survey respondents the main cause of deforestation in Dir Kohistan is lack of alternate resources in which the main item is fuel wood. Global patterns of deforestation indicate that timber consumption and logging activities account for more than 70% of total deforestation. Fuel wood collection, charcoal production and to a lesser extent, livestock grazing in forests are the most important drivers of deforestation. Deforestation rates may increase because the population is growing and needs more land for food, fuel wood, timber or other forest products. Average house hold need for fire wood is 15.43 kg/day in summer and 31.94 kg/day in winter, while average timber needed for a house construction is 364 cft. It is also estimated that 30% of the population migrates to lower areas during winter season and 85% of the total needs of people met from the forests. Northern areas, the forest wood is intensively using for the construction of new and repair of existing houses as was informed by 73% of the respondents. Most of the houses in all of the villages are made of wood. Even if the house is made of mud/stones or brick yet timber is need for the construction [32].

Poverty and unemployment: 75% of survey respondents the second main cause of deforestation in Dir Kohistan is unemployment. The literacy rate of Dir Kohistan is low which results in the unemployment of local people. To fulfill their daily basic needs and requirements the unemployed and jobless people of the area use these forests as a source of income by illegal manners. Poverty and over population are believed to be the main causes of forest loss according to the international agencies such as FAO and intergovernmental bodies. Poverty; Population and Pollution (3Ps) are interlinked. As the population growth and poverty increases, the area is getting more polluted and the natural environment is degrading.

Policies and management: 63% of survey respondents, one of the causes of deforestation in Dir Kohistan is non judicial policies/ rules and ineffective management. During the survey, most of the local people in Dir Kohistan complained that only the stake holders get benefit from these forests and the share (60%) of total sale proceeded from the forests goes to them. To fulfill their requirements and basic needs the local people are unable to follow the rules of

local community and government. They get the benefits from the forests by illegal means. Deforestation result in northern areas is due to the ineffective forest management strategies and bad governance by the provincial forest department. The forestry extension service offered by the department is quite ineffective and doesn't address the real problems. It is decided that all forests in Dir Kohistan belong to the state. Before this, out of the total sale proceed only 15% was paid to the stake holders /right holders, which is now 60%. In 1975 the Forest Act 1927 was implemented and the forests were declared as protected forests. In district Swat 28% of the respondents used forests for qalang and 44% of the respondents got royalty from the forests in the past [33].

Medicinal plants and fodder: Only 20% of the respondents in Mansehra used forests for the collection of medicinal plants for household needs. There were 42% of the respondents who collecting fodder from the forests for their livestock. There were 50% of the respondents who were using forest lands as pastures. Similarly in district Swat, about 42% of the respondents were collecting medicinal plants from the forests for domestic use. In this village, 22% of the respondents told that they cut the trees from the forests and sell the wood to earn the cash income.

Black marketing: 53% of survey's respondents one of the main causes of deforestation in Dir Kohistan is black marketing of timber. The people complained that the staff of FDC, Sheringal is not honest in their duty and take bribes from the smugglers. Foresters take bribe from the villagers and outsiders are allowed to cut trees. Similarly the higher forest officials take heavy amount of money from the timber smugglers and allow them to cut the trees [34].

Daily livelihood activities causing deforestation

Daily life activities also play a key role in forest degradation. About 90% of the interviewees confirmed that the process of deforestation results directly and indirectly from livelihood activities of the local people. In this study different livelihood activities were noted and these are also highlighted to produce varied impacts. The frequency of deforestation respondents (43%) indicated that use of wood as fuel exists among the top factor resulting in deforestation. Chainsaws operation is also among the daily life activities resulting and causing deforestation. Deforestation is mostly caused by use of wood as fuel and agriculture though the impacts from the other activities are recognizable. Some interviewers suggested that chainsaw operation destroyed forests much more than other livelihood activities because it occurs deep in the core of the forests as compared with the other livelihood activities which are most often carried out on the fringes of the forests. Quite apart from that, the felling of trees by chainsaw operators is disputed to be carried out indiscriminately. As a result of this, they hardly consider if a tree is harvestable or not [35].

Conclusion

Forests provide a protection to the biodiversity and protects the soil cover and regulates hydrological cycle, atmospheric temperatures and help in militating against the impacts of climate change. With the increasing population and urbanization trend there is an increase in the rate of deforestation with has resulted in the disruption of natural atmospheric and climatic patterns and enhanced the devastating impacts of natural hazards.

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