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## Deforestation: Causes, Consequences and Possible Solutions

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### Abstract

Forests are vital terrestrial carbon sinks which play a crucial role in mitigating emissions of CO<sub>2</sub> and other greenhouse gases. They also furnish a wide range of ecosystem goods and services, including livelihood security, socio-economic development, ecosystem functioning, carbon cycling, biodiversity preservation, nutrient cycling, and climate regulation. However, forest degradation has been accelerated by factors such as huge and uncontrolled population growth, land-use changes for agriculture, industry, urbanization, and improper forest management. Shifting cultivation, a traditional land-use practice, is another significant driver of tropical forest degradation. The loss and degradation of forests activates a cascade of environmental changes, severely reducing essential provisioning services and impacting biodiversity locally and globally. The primary drivers of human-induced deforestation and large-scale habitat loss include unsustainable agricultural practices, industrial expansion, urbanization, and poor forest management. To educate people to the alarming effects of deforestation and habitat loss, a simple and practical solution lies in environmental education. Educating individuals about the importance of preserving natural forests and promoting reforestation and afforestation efforts where needed is essential. Implementation of environmental education serves as a powerful tool to counteract deliberate human actions and foster the protection and restoration of earth's natural ecosystems. This paper focuses on the causes of deforestation, its effects and possible solution to mitigate its effects on environment and how to replenish greenery on our earth.

**Keywords-** Biodiversity, Deforestation, Reforestation, Forest Degradation

### Introduction

Deforestation refers to the conversion of forests into other land uses through the clearing of trees or the prolonged reduction of tree canopy cover to below 10%. Often driven by human needs or commercial interests, deforestation significantly contributes to biodiversity loss and climate instability. As a result, deforestation stands as one of the most urgent environmental challenges facing the world today. Deforestation results from both natural and human-induced factors. Natural events such as hurricanes, forest fires and droughts can lead to the destruction of forests. However, the primary driver of deforestation is man-made activity. Deforestation has significant negative impacts on both human life and Environment. One of the primary effects of deforestation is the loss of biodiversity, as it destroys habitats for countless plant and animal species, resulting toward extinction. Additionally, deforestation contributes to soil erosion which can lead to landslides and the contamination of water sources. It is also a major cause of climate change. Forests serve as vital carbon sinks by absorbing large amounts of carbon dioxide and other greenhouse gases. When forests are cleared, the carbon stored in their biomass is thrown into the atmosphere, exacerbating global warming. This increase in greenhouse gases results in rising temperatures and disrupts environmental stability. Deforestation is particularly severe in tropical forests across South and Central America, Southeast Asia and Africa, where millions of hectares are lost annually. Primary forests home to the world's oldest and most extensive trees are among the worst affected. Primary forests play a crucial role in providing habitats for rare

and endangered species, making their destruction especially devastating for global biodiversity. Deforestation for farming and development is a significant reason for environment destruction. Within the last 100 years, the measure of land utilized for farming has nearly multiplied.<sup>1</sup>

Some deforestation statistics for 2024 is given below:

**Global deforestation:** The 2024 Forest Declaration Assessment reported that the world lost 6.37 million hectares of forest in 2023, which is 45% higher than the goal set by over 140 countries to eliminate deforestation by 2030.

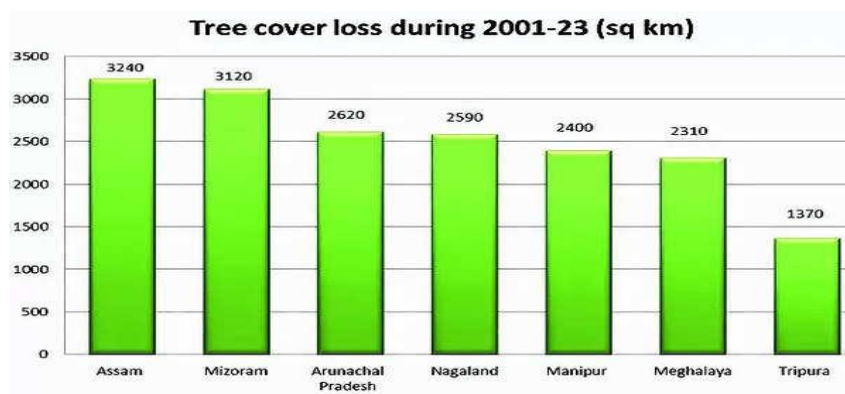
**Primary tropical forests:** Primary tropical forests lost 3.7 million hectares in 2023, which is 38% off track from efforts to protect them.

**Indonesia:** Deforestation in Indonesia increased by 57% in 2023, failing to meet the national goals by 82%.

**Brazil:** The new government in Brazil has demonstrated a stronger dedication to sustainability, which resulted in deforestation statistics dropping 22% in Earth's largest rainforest.

**India:** In 2024, India has reported 13,651 VIIRS fire alerts, which is low compared to previous years.

In India, 75% of country's tree cover loss in 22 years happened in North-east. The northeast region experienced substantial tree cover loss from 2001-2023, greatly surpassing the country's total depletion. Assam, Mizoram, Arunachal Pradesh, Nagaland, Manipur, Meghalaya and Tripura were most impacted according to the data of the Global Forest Watch (GFW), raising concern among environmental activists. The northeast region has lost 17,650 sq km of tree cover during the above said periods which are around 12 times the size of Delhi and almost half the size of Kerala. (Figure-1)



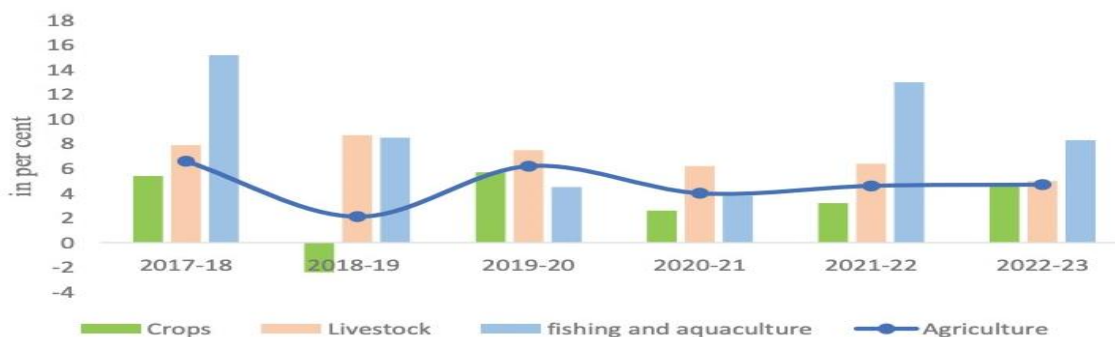
**Figure- 1:** Tree-cover loss of 7 north-east states during 2001-23 in square kilometer in India.

**Source:** Times of India

Forest degradation and forest fragmentation are responsible for deforestation. Forest degradation is a progressive process that negatively affects the structural and functional characteristics of a forest. Unlike sudden events such as earthquakes, forest degradation typically occurs over an extended period and may take years to become visibly apparent. This process is primarily driven by human activities, which are shaped by various macroeconomic, technological, demographic, institutional, and political factors. With the passage of time, these influences collectively and significantly contribute to the deterioration of forests, undermining their ecological integrity and functions<sup>2</sup>. Forest fragmentation is indeed a significant ecological issue, leading to a variety of adverse outcomes for biodiversity and ecosystem services. As forests become fragmented, the remaining patches of forest become smaller and more isolated, making it harder for species to find food, mates, or migrates. It can also lead to a loss of habitat for many plant and animal species, some of which may be unable to survive in smaller, isolated patches<sup>3</sup>.

**Causes of Deforestation:**

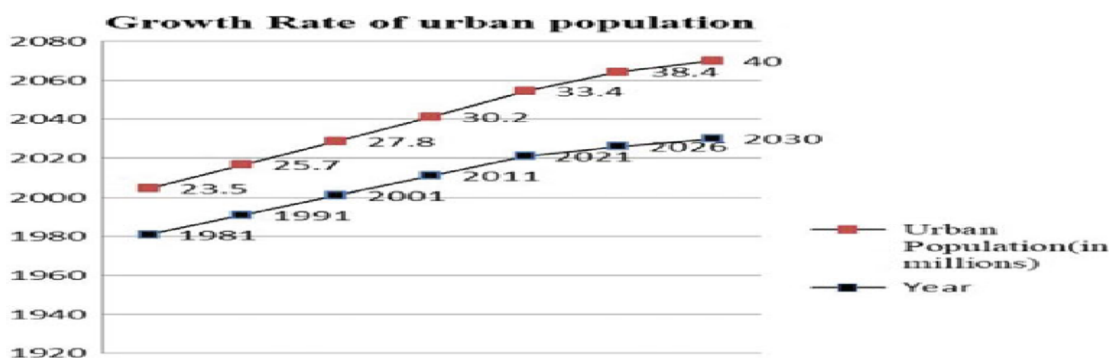
- Expansion of agricultural land: Agricultural practices such as subsistence farming and commercial farming accounts for more than 70% of deforestation. Subsistence farming is the only way for millions of people to sustain their families. Farmers in these areas typically clear small plots of land by cutting down trees and burning them but this practice is usually unsustainable, as they are forced to clear a larger land surface when soil becomes infertile. Commercial agriculture involves large scale production of cash crops like soy and palm oil. For palm oil plantation in south-east Asia and central Africa and soybean cultivation in South America, a large area of tropical rain forests has been cleared.
- Livestock and grazing: Livestock grazing is done for meat production where farmers clear vast areas of land to create grazing pastures for their livestock. Overgrazing often leads to repeated clearing and deforestation. Due to global demand for meat, large amount of feed crops like soy are grown to feed livestock. This increase in demand puts tremendous pressure particularly in Amazon rain forest.



**Figure- 2:** Growth of Agriculture and allied sectors

**Source:** National Statistical office (NSO) M/O Statistics and PI

- Logging and wood harvesting: These practices are more common in North America and Russia which is responsible for deforestation. Forest provides timber products for furniture, paper and construction. Unsustainable logging practices destroy millions of hectares of forested land every year. Nearly half of the country’s forests have been cleared in Indonesia due to unsustainable logging practices.
- Urbanization and expansion of cities: As urbanization increases, they require more resources to sustain their population, increasing demand for products like beef and agricultural goods. More land for housing and settlement is needed for expansion of cities. For example due to urban expansion Brazil has lost more than 16 million hectares of forested land in past 20 years.



**Figure- 3:** Growth rate of urban population in India in millions (**Source:** Bharne<sup>6</sup>)

- Human population growth: As population is growing, the need for housing and infrastructure is also increasing, which is a major contributing factor for deforestation.
- Increased need for resources: Forests provide an irreplaceable range of ecosystem services, including carbon sequestration, habitat provision, soil health maintenance, and air quality preservation. Despite their shrinking areas, human activities, growing populations, and increasing demand continue to place immense pressure on forests. Taking these essential services for granted creates ecological imbalances and perpetuates an unsustainable approach to interacting with and relying on nature. Recognizing and preserving the value of forests is crucial to maintaining environmental stability and ensuring the well-being of future generations.
- Slash and Burn techniques: This technique is also known as shifting cultivation. This process involves cutting down trees and vegetation in a particular area, leaving them to dry for many weeks and then setting fire to the debris. The removal of trees and vegetation exposes soil to erosion leading to soil depletion and reduced agricultural productivity over time. It destroys natural habitats and leading to the displacement of animal species. Burning vegetation release a huge amount of carbon dioxide and other greenhouse gases into the atmosphere causing global warming.



**Figure- 4:** The aftermath of slash and burn farming in central Amazon.

(Source: Laurence<sup>7</sup>)

- Expansion of manufacturing and industrial sites: The expansion of manufacturing and industrial sites is a major driver of deforestation globally. Industrialization has significantly increased the demand for resources such as wood, minerals, and other raw materials, leading to extensive forest clearing. Additionally, biomass power generation- an energy source reliant on organic materials from forests is a significant contributor to deforestation when these materials are sourced unsustainably. This escalating demand for resources has not only resulted in the destruction of forest ecosystems but also led to the loss of critical natural habitats, further endangering biodiversity.
- Intensive crop cultivation: Intensive crop cultivation involves the cultivation of crops on a large scale, with high inputs of fertilizers, pesticides, and other chemical additives. This method is commonly employed to cultivate crops such as soybeans and palm oil, which are in high demand for use in livestock feed and various other industries. The rising global demand for meat has further increased the need for these crops, driving farmers to clear vast areas of forest to establish soy and palm plantations. This large-scale deforestation not only results in the loss of forested lands but also diminishes the essential ecological services they provide, such as carbon sequestration and habitat preservation. While current agricultural productivity meets market demands, it comes at a significant environmental cost, including deforestation, soil degradation, and biodiversity loss.

- Over-exploitation of Natural Resources: Over-exploitation of natural resources is major cause leading to deforestation. This occurs when humans extract more resources than the environment can replenish naturally, leading to the depletion of natural resources such as minerals, fossil fuels and timber. Activities that contribute to this type of deforestation include mining, logging and oil and gas extraction.

### Consequences of Deforestation:

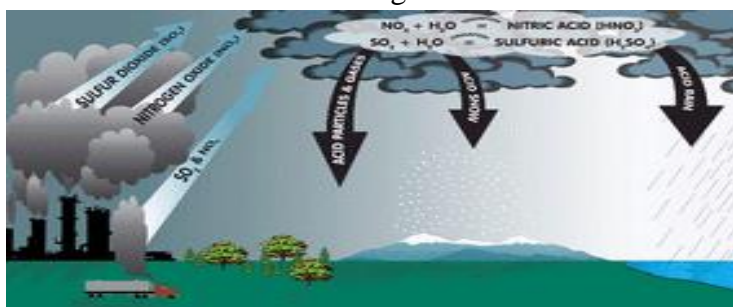
- Habitat loss:** When an organism's natural habitat, such as rain-forests or wetlands, is altered to the point where it can no longer support the species. It is of three types-
  - Habitat destruction:** This is the most intense form of habitat loss, where the habitat is completely exterminated. Examples include deforestation for urban development, agriculture draining wetlands, and converting natural landscapes into industrial areas. It often results in the endless loss of biodiversity.



**Figure-5:** Jungle burned for agricultural in southern Mexico (Lacanja, Chiapas)

(Source: Fliker.com<sup>8</sup>)

- Habitat degradation:** In this type, the habitat remains physically intact but its quality declines, making it less appropriate for the species that depend on it. Pollution, climate change, invasive species and unsustainable resource extraction can lead to degradation.



**Figure-6:** Acid rain causing Habitat degradation

(Source: NYS Department of Environmental Conservation)

- Habitat fragmentation:** This occurs when huge, continuous habitats are divided into tiny, isolated patches due to activities like construction of roads, logging, or urban expansion. Fragmentation disturbs migration, procreation, and feeding patterns, making it harder for species to survive.
- Climate change:** Deforestation is a significant contributor to climate change. Trees play a vital role in absorbing and trapping excess carbon dioxide (CO<sub>2</sub>) from the atmosphere daily which helps mitigate its harmful effects on humans and the environment. However, when trees are cut down, the stored CO<sub>2</sub> is released back into the atmosphere, exacerbating global warming. Unfortunately, many trees are felled to make way for agricultural activities. Studies show that food and agriculture contribute approximately 24% of global greenhouse gas emissions, while deforestation alone accounts for an estimated 10–15% of all anthropogenic CO<sub>2</sub> emissions<sup>4</sup>. Global climate change is driven by greenhouse gases such as methane and carbon dioxide,

which trap heat in Earth's atmosphere. Trees play a crucial role in sustaining life by releasing oxygen and water into the atmosphere, while also absorbing excess carbon dioxide. This natural process helps maintain a balance essential for human survival. However deforestation is disrupting this balance. The continuous cutting down of trees not only releases stored carbon back into the atmosphere but also reduces the number of valuable carbon sinks. This contributes to the accumulation of greenhouse gases, exacerbating global warming. The effects of climate change are far-reaching, altering the survival of wildlife, plants, and humans through drastic weather changes and increasing the frequency and intensity of natural disasters. Moreover, deforestation is leading to extensive habitat loss, further endangering Earth's ecosystems<sup>5</sup>.

**3. Loss of Biodiversity:** Deforestation destroys habitats and reduces the number of species that live in forests. It can also lead to extinction for some species. The forest acts as a vast support system, a web of interconnected life. Trees provide shade and cooler temperatures, offering protection to animals and smaller plants that might not survive the harshness of direct sunlight. In addition to their protective role, trees nourish animals with their fruits and supply the food and shelter essential for their survival. The ecosystem functions as a delicate web of interdependence, where survival hinges on the connections between species. For example, the extinction of a particular herbivore species could disrupt populations of carnivores that rely on them for food. Every component of an ecosystem is interconnected, and the loss of even a single species can have wide-reaching impacts on others. Deforestation, particularly when coupled with bush burning, poses a severe threat to plants and animals, potentially leading to the complete eradication of certain species(9).

**4. Soil erosion:** Deforestation significantly reduces soil quality. Forest soils are typically rich in organic matter and highly resistant to erosion, adverse weather, and extreme climatic events. However, when forests are cleared, the soil becomes exposed and increasingly fragile, making it more vulnerable to natural disasters like landslides and floods. Deforestation also contributes to severe erosion problems. Eroded soils can lead to catastrophic mudslides, with large quantities of sediment washing into nearby streams and rivers. This not only clogs waterways but also causes extensive damage to hydroelectric structures and irrigation systems. In certain areas, soil erosion due to deforestation disrupts agriculture and affects the reliability of electric power infrastructure. As deforestation causes soil to erode and wash away, farmers are often forced to move to new lands, further clearing forests in search of fertile soil for agriculture. This cycle leaves previously deforested areas barren and highly susceptible to flooding, especially in coastal regions.

**5. Rainfall patterns:** Forests influence rainfall patterns. Deforestation can lead to drier, hotter climates in tropical regions.

**6. Water quality:** Deforestation can disrupt the water cycle. Deforestation increases soil erosion, resulting in higher soil, sediment, and turbidity levels in the water, increasing the need for drinking water treatment. As more and more trees get cut down, evaporation levels are disrupted, drying up the moisture in the air and throwing off the balance of the water cycle. A continual cycle of dry air, low humidity, and decreased precipitation will inevitably lead to a drought-prone, desert-like climate.

**7. Human-Wildlife conflict:** Many animals are forced out of their natural habitats by hunters and other intruders into forested areas. In their desperate attempts to escape or find safer shelter, some of these animals venture into human-populated areas. This often leads to fatal encounters, involving dangerous wildlife such as tigers, lions, and venomous snakes. When conflicts between humans and displaced forest animals escalate beyond tolerable levels, farmers and local residents frequently resort to killing the animals to protect themselves and their livelihoods. This response further exacerbates the already critical decline in wildlife populations.

**Possible solutions for deforestation:**

- Cyclic agriculture is the way to the problem for livestock grazing. This method involves rotation of crops in a particular area and maintains soil fertility.
- To minimize the effects of logging and wood harvesting, efforts are being made to stop illegal logging, protect forested areas, reform trade agreements and educate local communities.
- It is important to embrace sustainable living and support organizations that actively work to fight deforestation.
- To tackle global deforestation it is essential that all countries, governments and private organizations take action not only on a local level but also with respect to its resource imports, ensuring that all products acquired are sustainably sourced(10).

**Conclusion:** Deforestation and habitat loss are not merely about losing a few plants and animals; the survival of humanity itself is intricately linked to these issues. Deforestation accelerates the degradation of our already endangered planet, making it increasingly hostile for plants, animals, and humans to thrive. The demand for more land to support agricultural activities and human expansion continues to deplete forested areas across the globe. This relentless loss not only disrupts ecosystems but also jeopardizes essential ecological functions that sustain life on Earth. To combat this crisis, environmental education plays a pivotal role. By raising awareness and promoting the protection of natural forests, as well as encouraging afforestation where needed, we can work toward reversing the damage caused by deliberate human actions.

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