

# ***Vanishing Biodiversity: Global Threats to Flora and Fauna***

pp. 71-83, 2025, ISBN- 978-81-985978-7-8

*Editors:* M A Khalid, Sanjay Kumar, Esha Yadav, Pranay Punj Pankaj, Rakesh K. Kharwar

*Publisher:* M/S Academic Publishers & Distributors, Lucknow, India

DOI: <https://doi.org/10.5281/zenodo>.



---

## **DEFORESTATION AND ECOLOGICAL TIPPING POINTS: GLOBAL CONSEQUENCES IN THE AMAZON AND SOUTHEAST ASIAN FORESTS**

**Sarabjan Deori, Meghna Mech and Mayur Mausoom Phukan\***

Department of Forestry, School of Sciences, Nagaland University, Lumami - 798 627, Nagaland, India.

\*Corresponding author E-mail: [mayur\\_101@yahoo.com](mailto:mayur_101@yahoo.com), [mayurmausoom@gmail.com](mailto:mayurmausoom@gmail.com)

**(Received 11 August 2025, Revised 4 September 2025, Accepted 21 September 2025)**

---

**ABSTRACT :** Deforestation and forest degradation are among the most pressing environmental challenges, posing severe threats to global biodiversity and climate stability. This article reports recent research on the Amazon Rainforest and Southeast Asian forests, two of the world's most significant carbon sinks and biodiversity hotspots. Major drivers of deforestation include agricultural expansion, cattle ranching, palm oil cultivation, logging, infrastructure development and illegal land conversion. These activities result in substantial carbon emissions exceeding one billion tons of CO<sub>2</sub> annually in the Amazon alone. This has triggered severe biodiversity loss, habitat fragmentation, and disruption of ecosystem services. Southeast Asia's peatland degradation compounds these emissions through large-scale fires and methane release, contributing to regional haze pollution and climate change. The consequences extend beyond ecological damage, impacting indigenous communities through displacement, cultural erosion, and economic instability. Effective mitigation requires integrated approaches, including strengthened enforcement of land-use policies, sustainable agricultural practices like agroforestry, reforestation and community-based conservation. International collaborations and market-based mechanisms, such as Reducing Emissions from Deforestation and Forest Degradation (REDD+) are pivotal in curbing emissions and preserving forest ecosystems. This necessitates the burgeoning need for multidimensional, data-driven strategies to balance human development with the conservation and restoration of vital forest landscapes essential for biodiversity preservation and global climate regulation.

**Key words :** Deforestation, habitat destruction, Amazon Rainforest, Southeast Asian forests, biodiversity loss.

---

## **Introduction**

Forests and natural ecosystems are the backbone of global ecological stability. They regulate climate, purify air and water, maintain soil fertility, and harbor over 80% of terrestrial biodiversity. However, in the past two centuries, the Earth has experienced unprecedented habitat loss and deforestation rates, jeopardizing ecological and human health. Habitat destruction is generally referred to as the process through which natural ecosystems are no longer able to sustain the species that inhabit them, and this leads to the destruction or displacement of biodiversity (Bodo *et al*, 2021). Deforestation, which is one of the most extreme types of habitat destruction is the extensive removal of forest cover for purposes

other than forest use, like agricultural use, urbanization and logging (Singh *et al*, 2024). Globally, forests have shrunk from about 6 billion hectares in prehistoric times to around 4 billion hectares today, representing a loss of one-third of the planet's forest cover (Sinha, 2025). Alarming, from 2015 - 2020 alone, the world lost nearly 10 million hectares of forest annually, most of it concentrated in tropical regions such as the Amazon Basin, Southeast Asia, and Central Africa. These regions, paradoxically, are also global biodiversity hotspots and critical carbon sinks. The impact of habitat loss is far-reaching and multidimensional. The immediate effects, on the one hand, are extinction of species, genetic diversity loss, and breakdown of ecological processes like pollination and seed dispersal. On the other hand, the wider implications are speeding up climate change through the enhanced emission of carbon, interference with rainfall patterns, and desertification of previously fertile areas (Kumar *et al*, 2022). Case studies in the Amazon Rainforest and the forests of Southeast Asia illustrate how unsustainable anthropogenic activities when left unchecked, can drive ecosystems over tipping points and renders deleterious effects on the pristine ecological system. This chapter highlights evidence from recent studies and global reports to examine the causes, effects, and remedies linked to habitat loss and deforestation. In particular the article will

1. Examine the causes of habitat loss such as urbanization, agriculture, and logging.
2. Explore the impacts of deforestation on biodiversity, ecosystems and human societies.
3. Discuss the relationship between deforestation, desertification and land degradation.
4. Present case studies from the Amazon and Southeast Asia, highlighting regional drivers and consequences.
5. Evaluate conservation strategies and solutions to mitigate habitat destruction.

By effectively combining scientific data and case-study experience, this article presents a comprehensive perspective on one of the most pressing environmental challenges of the 21<sup>st</sup> century, exploring its causes, far-reaching impacts and viable strategies for sustainable mitigation.

## **Causes of Habitat Loss**

Habitat loss is seldom the consequence of a single activity; instead, it arises due to the cumulative impacts of several human drivers working together (Sih *et al*, 2000). Globally, the three prevailing drivers of habitat loss are urbanization, agriculture and logging, responsible for majority of ecosystem degradation and deforestation (Scanes, 2017). These processes not only destroy natural habitats but also fragment ecosystems, disrupt species interactions, and speed up biodiversity loss (Lindenmayer and Fischer, 2013). Familiarity with the dynamics of these drivers is vital for the formulation of conservation plans and sustainable land-use practices (Swanston and Maria, 2012).

### **Urbanization**

Urbanization is a key driver of habitat destruction. Approximately, 68% of the world population will live in cities by the year 2050 (McKINNEY, 2002). This demographic shift necessitates the conversion of vast areas of land for housing, infrastructure, transportation,

and industrial development, resulting in the widespread clearance of forests, wetlands, and grasslands (Gomez, 2005). These ecosystems are often fragmented, reducing their connectivity and weakening the ability of species to migrate, forage and reproduce successfully (Adams, 1994). For instance, research in Port Harcourt and other African cities has indicated that previously dense forest around cities has given way to concrete housing areas and industrial areas, resulting in local biodiversity loss and poor air and water quality (Okorundu *et al*, 2022). Additionally, urban growth exerts indirect pressure on forests by raising the demand for building materials, timber, and fuel. With population explosion, dependence on fuelwood and charcoal for heat and cooking also advances deforestation at the local level, particularly in developing nations (Pandya and Didwania, 2021).

### **Agriculture**

Agriculture is the primary cause of global deforestation, responsible for almost 80 % of all forest cover loss (FAO, 2020). Two distinct but interrelated forms of agricultural - expansion subsistence farming and industrial agriculture contribute to habitat destruction.

- Subsistence farming, particularly slash-and-burn techniques, clears small patches of forest to grow food crops. Although ancient shifting cultivation permitted time for ecosystems to renew themselves, recent population pressures have reduced fallow periods, converting once-reliable systems to denuded lands.
- Industrial agriculture involves large-scale conversion of forests into monoculture plantations, such as soybeans in South America and oil palm in Southeast Asia. These monocultures not only destroy natural habitats but also reduce biodiversity by supporting only a limited number of species.

Livestock farming, particularly cattle ranching in Latin America, is a leading cause of Amazon deforestation. Vast tracts of primary rainforest are cleared annually to create pasturelands, directly contributing to biodiversity loss and greenhouse gas emissions.

### **Logging**

Logging both legal and illegal is yet another major driver of habitat destruction. Commercial logging targets high-value timber yielding trees such as mahogany and teak, while fuelwood collection caters to local energy demands (Agrawal *et al*, 2008). Although selective logging is less destructive than clear-cutting, it still degrades forest ecosystems by fragmenting habitats, opening canopies, and disturbing soil structures. Illegal logging is particularly devastating. Globally, illegal logging costs governments an estimated US\$ 5–20 billion annually in lost revenues, particularly in tropical timber-producing countries such as Brazil, Indonesia, Malaysia, and the Democratic Republic of Congo. (Margono *et al*, 2012). In parts of Southeast Asia, logging illegally has destroyed primary forests, and the habitats of such iconic species as orangutans and tigers (Miettinen *et al*, 2017). In the Brazilian Amazon as well, the situation is equally grim, with the government estimating that almost 80% of the logging is carried out illegally (De Lima *et al*, 2018). Ecological and socio-economic effects of forest logging are complex in nature. Direct habitat loss is the first effect where extensive logging of commercially important timber species, such as mahogany and teak, lowers biodiversity and forest structure.

**Table 1** : Causes of habitat loss and their impacts.

Causes	Primary Changes	Environmental Impacts	Societal Implications
Urbanization	Conversion of natural habitats into built environments	Habitat fragmentation, loss of corridors, pollution	Increased demand for timber, fuelwood and land
Agriculture	Large-scale forest clearance for crops and livestock	Biodiversity loss, soil degradation, monocultures	Global food supply, but long-term soil infertility
Logging	Removal of valuable timber, both legal and illegal	Forest fragmentation, erosion, invasive species spread	Economic profits short-term, loss of ecosystem services

Illegal logging is the second mechanism by which deforestation and forest degradation are driven, subverting sustainable forest management practices and compromising conservation policies (Reboredo, 2013). Thirdly, the construction of access roads for logging purposes provides previously undisturbed forest interiors to be exploited further, invaded by agriculture, and settlements expanded, thus enhancing habitat fragmentation (Kleinschroth and Healey, 2017). Illicit harvest of unique and valuable hardwoods, especially mahogany in the Amazon region of Brazil, is mostly prompted by demand from foreign markets in developed economies (Chimeli and Soares, 2017). There exists a strong nexus between global consumption patterns and local environmental degradation. Therefore, logging is not only a cause of loss of biodiversity, but also an essential aspect of the large issue of forest destruction globally.

### Deforestation and its Impacts

Deforestation is one of the most visible and destructive manifestations of habitat loss. It does not just mean cutting down trees, but also represents disintegration of ecological communities based on forests. Deforestation effects cascade beyond local levels, with ripple effects at regional and international levels. Deforestation is not only a cause but also an effect of global environmental change, affecting biodiversity, ecosystem processes, and climate governance (Shukla *et al*, 2025). Forests are home to the majority of terrestrial species, including plants, animals, and microorganisms. Tropical rainforests, in particular, represent biodiversity hotspots, with the Amazon alone supporting an estimated 10% of all known species. Deforestation leads to

- (i) *Species Extinction*: As habitats shrink, species loses access to food, breeding sites, and shelter. The International Union for Conservation of Nature (IUCN) has identified deforestation as a primary driver for the extinction of species such as the orangutan (*Pongo pygmaeus*) and Sumatran tiger (*Panthera tigris sumatrae*).
- (ii) *Habitat Fragmentation*: Fragmented forests tend to be remnant patches that are small and disconnected, hindered by inability to migrate or interbreed among species. This leads to inbreeding depression, reduced genetic diversity, and heightened disease and climate susceptibility.
- (iii) *Disruption of Ecological Networks*: Keystone species, which carry out essential functions like pollination, seed dispersal, and predation, are the first targets of

deforestation. They destabilize ecological networks, triggering cascades throughout ecosystems.

### **Climate Change and Carbon Emissions**

Forests act as major carbon sinks, absorbing nearly 2.6 billion tons of CO<sub>2</sub> annually (FAO, 2020). Deforestation transforms these sinks into carbon sources, releasing stored carbon through tree burning and decomposition.

- In the Amazon Rainforest, annual deforestation contributes approximately 1.1 billion tons of CO<sub>2</sub> emissions (Turetsky *et al*, 2014).
- In Southeast Asia, peatland drainage and burning are particularly harmful, as peat soils store massive amounts of carbon. Hence, these peat soils are burned and ignited, which releases CO<sub>2</sub> and methane in amounts much higher than normal forest fires (Cochrane, 2009).

Apart from greenhouse gas emissions, deforestation disrupts local and regional climate systems by reducing evapotranspiration, which lowers atmospheric moisture and leads to decreased rainfall. Changes in surface albedo cause greater heat absorption, raising local temperatures. These effects worsen drought conditions and increase the risk of wildfires, creating destructive feedback loops that further accelerate deforestation.

### **Impacts on Ecosystem Services**

Deforestation erodes critical ecosystem services that sustain human life

- *Water Regulation*: Trees facilitate groundwater recharge and maintain the hydrological cycle. Deforested areas experience reduced rainfall and water shortages.
- *Soil Fertility*: Removal of forest cover accelerates soil erosion and nutrient leaching, reducing long-term agricultural productivity.
- *Air Quality and Pollution Control*: Trees act as natural filters by removing pollutants such as carbon monoxide, nitrogen oxides, and particulate matter from the atmosphere. The loss of tree cover contributes to rising air pollution levels, which in turn increase the prevalence of respiratory illnesses among nearby communities. In tropical regions where slash-and-burn practices are common, smoke pollution further compounds health risks.
- *Medicinal Resources*: Forest biodiversity is a rich source of pharmaceutical resources, many of which have been used in modern medicine. Famous examples include quinine from cinchona trees, used to treat malaria, and cancer drugs derived from the Madagascar periwinkle. Large-scale destruction of habitats reduces the chance of discovering new medicinal plants and threatens traditional knowledge systems related to medicine, highlighting the urgent need to conserve forests for their medical and cultural value.

### **Socio-economic and Anthropogenic impacts**

Desertification and land degradation are not just ecological issues; they are closely linked to human activities and socio-economic systems. Anthropogenic pressures, such as

deforestation, overgrazing, unsustainable farming practices and infrastructure expansion, are the main causes of degradation around the world (Geist and Lambin, 2004). These processes lead to various socio-economic effects, including reduced agricultural productivity, poverty, food insecurity, and migration. The United Nations Convention to Combat Desertification (UNCCD, 2017) reports that nearly 3.2 billion people are affected by degraded land. Most of these people live in developing areas where their livelihoods rely heavily on natural resources.

The effects of deforestation are not limited to ecological dimensions; they directly affect human societies, particularly those living near forests (R. Kumar *et al.*, 2022).

- *Indigenous Peoples:* Several indigenous groups rely on the forest for subsistence, medicine, and culture. Forest loss results in displacement of these groups, loss of identity, livelihoods, and land rights (Connell, 1978).
- *Human-Wildlife Conflict:* With the diminishing forests, wildlife like elephants, monkeys, and tigers move into agricultural lands and habitations in search of food. This leads to increased conflict, mostly causing economic damage as well as the death of wildlife.
- *Public Health:* Deforestation increases the risk of zoonotic diseases by bringing humans into closer contact with wildlife pathogens. For example, Ebola outbreaks in West and Central Africa have been linked to deforestation and bushmeat hunting, while HIV likely originated from cross-species transmission of simian viruses to humans. More generally, habitat destruction and wildlife trade raise the chances of new zoonotic diseases emerging, as highlighted by the COVID-19 pandemic (Keesing *et al*, 2010; Olivero *et al*, 2017).

## **Desertification and Land Degradation**

Deforestation and habitat destruction are strongly linked to desertification and land degradation. They are the most severe forms of ecological deterioration affecting millions of people worldwide (Bodo *et al*, 2021). While deforestation refers to the removal of tree cover, desertification is the process by which once fertile and productive lands become arid, barren, and incapable of sustaining vegetation and agriculture (Higginbottom and Symeonakis, 2014). The United Nations Convention to Combat Desertification (UNCCD) defines desertification as land degradation in arid, semi-arid and dry sub-humid areas caused by climatic variations and human activities (Schlesinger *et al*, 1990). Recent data highlight that approximately 24% of the Earth's land surface is undergoing degradation, affecting nearly 1.5 billion people worldwide (Gupta, 2019). In forest ecosystems, for instance, the Amazon and Southeast Asia, deforestation tends to initiate soil loss, nutrient loss and hydrologic disequilibrium, leading the ecosystem towards desertification-like conditions (Mukherjee *et al*, 2018). Land degradation does not occur only in arid or semi-arid areas. Rather, it involves a range of processes that decrease land's ecological and economic productivity.

- *Soil Erosion:* Soil erosion is a major consequence of deforestation and unsustainable land use. The removal of tree cover and conversion of forests to pastureland or agricultural land leaves soil exposed to erosion by wind and water. For instance, in the

Amazon Basin, rainforest cleared for cattle ranching loses up to 50 tons of topsoil per hectare each year, which greatly reduces soil fertility and increases sedimentation in rivers and streams. This erosion diminishes long-term land productivity and harms aquatic ecosystems downstream.

- *Nutrient Depletion*: Monoculture agriculture in the tropical forest hastens nutrient depletion. While natural forests recycle organic matter well, plantations leave the soils poor and dependent on chemical fertilizers.
- *Hydrological Changes*: Forest removal alters evapotranspiration and precipitation processes, generating more extended dry seasons and water deficiency. The procedure has been referred to as the “Savannization” of the Amazon, where previously humid forests transition towards savannah environments.

These processes all lowers land productivity, erode food security and enhance vulnerability to climate variability.

## **Case studies: Amazon Rainforest and Southeast Asian forest**

### **The Amazon Rainforest**

The Amazon Rainforest, covering approximately 5.5 million km<sup>2</sup> across nine South American nations (Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Guyana, Suriname and French Guiana) represents the single largest tropical forest ecosystem on Earth (Malhi *et al*, 2008). Brazil itself has around 60% of this vast forest landscape. The Amazon is referred to as the “lungs of the world” and has a significant contribution to carbon storage, hydrology, and conservation of biodiversity. It shelters almost 10 % of the world’s total known species, consisting of more than 40000 plant species, 2200 fish species, and emblematic animals like jaguars, harpy eagles and giant otters (Lovejoy and Nobre, 2019). The Amazon also contains approximately 100 billion tons of carbon in its biomass, which is one of the most vital natural carbon sinks on Earth (Phillips and Brien, 2017).

### **Drivers of Deforestation**

Deforestation in the Amazon is primarily driven by economic pressures and global commodity demands. Major drivers include

- (i) *Cattle Ranching*: Cattle ranching is the leading cause of deforestation in the Amazon, responsible for nearly 80% of forest loss (Barona *et al*, 2010). Vast areas of primary forest are cleared to create pasturelands that support Brazil’s expanding beef industry, much of which is linked to global export markets. This deforestation reduces biodiversity and releases large amounts of stored carbon into the atmosphere, contributing significantly to climate change (Barona *et al*, 2010).
- (ii) *Soybean Farming*: Brazil is the world’s largest producer of soybeans, and vast areas of forested land are converted into agricultural land to meet global livestock feed demand (Macedo *et al*, 2012).
- (iii) *Logging*: Both legal and illegal harvesting of valuable timbers, such as mahogany, rosewood and cedar, are major causes of forest degradation (De La Rosa Tincopa,

2009).

- (iv) *Infrastructure Development*: Construction of roads, hydroelectric dams, and mines opens up previously uncolonized areas to settlement and agricultural extension, which are further triggered by deforestation (Sonter *et al*, 2017).

### **Deforestation in the Amazon forests and its consequences**

Deforestation in the Amazon has detrimental consequences beyond the region, affecting local ecosystems and the global climate. It has led to biodiversity loss, water cycle disruption, increased carbon emissions, and additionally risks pushing the forest towards a tipping point that can trigger widespread forest collapse. If deforestation continues unchecked, it could result in irreversible damage, significantly contributing to global warming and threatening ecosystems and livelihoods worldwide. This renders Amazonian deforestation as one of the defining environmental crises of the 21<sup>st</sup> century.

- (i) *Biodiversity Loss*: Endangered species such as jaguars, pink river dolphins, and unique endemic flora face severe population decline due to habitat fragmentation (Júnior *et al*, 2021).
- (ii) *Carbon Emissions*: Approximately 1.1 billion tons of CO<sub>2</sub> are released every year through forest loss and burning, which goes against climate change abatement (Silva *et al*, 2020).
- (iii) *Rainfall Disruption*: The Amazon produces its own rain by evapotranspiration, and forest degradation decreases rainfall over South America, endangering agriculture and water security (Sampaio *et al*, 2007).
- (iv) *Indigenous Peoples*: More than 400 indigenous societies depend on Amazonian ecosystems. Deforestation not only destroys their subsistence livelihoods but also undermines cultural and spiritual practices (Hecht *et al*, 2024).

### **Southeast Asian forests**

Southeast Asia's tropical forests (extending across Indonesia, Malaysia, Myanmar, Thailand, Cambodia, Laos and the Philippines), are among the world's most biologically diverse regions, home to endangered species such as orangutans, Sumatran tigers, hornbills, and Asian elephants (Sodhi *et al*, 2010). These forests also play a cardinal role in global climate regulation, with Indonesia and Malaysia's peatlands storing over 60 billion tons of carbon (Turner, 2010). However, the region faces severe deforestation driven mainly by global commodity demand and weak governance.

The primary drivers of deforestation include

- (i) *Palm Oil Plantations*: Southeast Asia produces over 85% of the world's palm oil, mostly in Indonesia and Malaysia, causing massive forest clearance and habitat loss (Vijay *et al*, 2016).
- (ii) *Logging*: Both legal and illegal logging target valuable hardwoods, fragmenting forests and exacerbating degradation (Nemani *et al*, 2003).



(iii) *Peatland Burning*: Draining and burning peatlands release large amounts of CO<sub>2</sub> and CH<sub>4</sub>, contributing to climate change and transboundary haze affecting human health (Page *et al*, 2011).

(iv) *Shifting Cultivation and Mining*: Unsustainable slash-and-burn farming, gold and coal mining degrade forests, soils, and water resources (Fox *et al*, 2009).

The impacts include drastic biodiversity loss (orangutan populations have declined over 50%), significant greenhouse gas emissions from peat fires, regional haze pollution causing respiratory ailments and threats to indigenous livelihoods

### Deforestation in Southeast Asia and its consequences

The ecological and social consequences of deforestation in Southeast Asia are profound, affecting biodiversity, climate, public health and livelihoods.

- *Biodiversity Loss*: Orangutans in Sumatra and Borneo have lost over 50% of their populations over the past six decades as a result of habitat fragmentation (Ancrenaz *et al*, 2016).
- *Carbon Emissions*: Peatland fires emit a significant quantum of greenhouse gases, with CO<sub>2</sub> and CH<sub>4</sub> both being released into the atmosphere (Gaveau *et al*, 2014).
- *Regional Haze Pollution*: Fires generate seasonal haze impacting Malaysia, Singapore, and Thailand, which lead to respiratory diseases and significant economic losses through health crises and decreased productivity (Marlier *et al*, 2015).
- *Indigenous Communities*: Forest-dependent communities lose access to traditional resources, undermining food security, livelihoods, and cultural continuity (Colchester *et al*, 2011).

The outlook for Southeast Asia's forests is highly concerning. If deforestation continues at current rates, most primary forests could disappear within this century (Sodhi *et al*, 2010; Kumar *et al*, 2025). This would cause severe ecological damage, including species extinctions,

**Table 2** : Comparative analysis of Amazon and Southeast Asian forests.

Parameter	Amazon Rainforest (South America)	Southeast Asian Forests
Geographic Area	~5.5 million km <sup>2</sup> across 9 countries (Brazil dominant)	Indonesia, Malaysia, Myanmar, Thailand, etc.
Key Biodiversity	Jaguars, harpy eagles, giant otters, diverse endemic plants	Orangutans, Sumatran tigers, Asian elephants, hornbills
Main Drivers of Deforestation	Cattle ranching (80%), soybean farming, logging, infrastructure	Palm oil plantations, peatland burning, logging, mining
Carbon Emissions	~1.1 billion tons CO <sub>2</sub> annually	Major emissions from peat fires (CO <sub>2</sub> + CH <sub>4</sub> )
Human Impacts	Indigenous displacement, loss of traditional livelihoods	Loss of indigenous rights, haze pollution, rural poverty
Global Concern	Risk of tipping point to savannah ecosystem	Risk of complete loss of primary forests within a century

disruption of water cycles and intensified climate change. Economically, it would harm agriculture, ecotourism and water security, all dependent on intact ecosystems. Continued peatland burning would further aggravate climate instability and public health crises, making forest conservation an urgent global priority.

### Conservation Strategies

A plethora of solutions ranging from policy to community mobilization, technological innovation and restoration ecology have been formulated across the world to retard, stop and even reverse deforestation. But effective implementation of these measures is contingent upon good governance, global cooperation and interlinking socio-economic growth with environmental conservation.

### Regulatory Frameworks

- *REDD<sup>+</sup> (Reducing Emissions from Deforestation and Forest Degradation)*: A UN initiative that incentivizes developing countries to reduce forest loss by providing financial compensation. REDD<sup>+</sup> also promotes conservation, sustainable management, and enhancement of forest carbon stocks.
- *Paris Agreement (2015)*: A legally binding treaty that includes commitments to halt deforestation as a part of global climate mitigation efforts (UNFCCC, 2015).
- *Convention on Biological Diversity (CBD)*: Encourages nations to conserve ecosystems and integrate biodiversity concerns into national planning (CBD, 2020).
- *Brazil's Forest Code*: Requires Amazonian landowners to preserve 80 % of forest cover on their properties (OECD & FAO, 2023).
- *Indonesia's Palm Oil Moratorium*: Suspends new licenses for palm oil plantations to limit deforestation (FAO & UNEP, 2020).
- *India's Compensatory Afforestation Fund Act (2016)*: Ensures that land diverted for non-forest use is offset through afforestation initiatives elsewhere (Government of India, 2016).

### Conclusion

Habitat destruction and deforestation critically threatens biodiversity and climate regulation, and in this regard the Amazon and Southeast Asian forests are no exception. Anthropogenic pressure (agriculture, logging, infrastructure, land conversions etc.), triggers habitat fragmentation, GHGs emissions and disrupts ecosystems. The consequences of this destruction are far-reaching. There are steep declines in species populations, disruptions in hydrological and climatic patterns, and increased risks of zoonotic disease outbreaks. Indigenous and forest-dependent communities (often recognized as environmental stewards), face displacement, cultural erosion, and economic marginalization. On a global scale, deforestation accelerates climate instability, intensifies food insecurity and contributes to transboundary pollution, showing the interconnected and multifaceted nature of this crisis. Addressing these challenges needs coordinated strategies from grassroot to top levels. Priority actions include strengthening land-use governance and enforcing laws against illegal logging and land grabbing. Expanding

agroforestry, sustainable farming, and large-scale restoration can support ecosystem recovery. Initiatives such as REDD<sup>+</sup> offer financial incentives, but must include indigenous rights and community-led conservation. Protecting forests is essential for climate stability, biodiversity, and human health. Sustainable policies balancing development and ecology are key to preserving these vital ecosystems for future generations.

## References

- Adams L W (1994) Urban wildlife habitats: a landscape perspective. *Choice Reviews Online* **32**(04), 32–2109. <https://doi.org/10.5860/choice.32-2109>
- Agrawal A, Chhatre A and Hardin R (2008) Changing governance of the world's forests. *Science* **320**(5882), 1460–1462. <https://doi.org/10.1126/science.1155369>
- Barona E, Ramankutty N, Hyman G and Coomes O T (2010) The role of pasture and soybean in deforestation of the Brazilian Amazon. *Environ. Res. Lett.* **5**(2), 024002. <https://doi.org/10.1088/1748-9326/5/2/024002>
- Bodo T, Gimah B G and Seomoni K J (2021) Deforestation and habitat loss: human causes, consequences and possible solutions. *J. Geographical Res.* **4**(2), 22–30. <https://doi.org/10.30564/jgr.v4i2.3059>
- Chimeli A B and Soares R R (2017) The Use of Violence in Illegal Markets: Evidence from Mahogany Trade in the Brazilian Amazon. *Amer. Econ. J. Appl. Economics* **9**(4), 30–57. <https://doi.org/10.1257/app.20160055>
- Cochrane M A (2009) Tropical fire ecology: climate change, land use, and ecosystem dynamics. *Choice Reviews Online* **47**(03), 47–1397. <https://doi.org/10.5860/choice.47-1397>
- Connell J H (1978) Diversity in tropical rain forests and coral reefs. *Science* **199**(4335), 1302–1310. <https://doi.org/10.1126/science.199.4335.1302>
- De La Rosa Tincopa C (2009) *Environmental governance and implications of small-scale logging: the case of the indigenous groups in the Ampiyacu Basin in the northeastern Peruvian Amazon*. <https://repositories.lib.utexas.edu/handle/2152/ETD-UT-2009-08-326>
- De Lima L S, Merry F, Soares-Filho B, Rodrigues H O, Damaceno C D S and Bauch M A (2018) Illegal logging as a disincentive to the establishment of a sustainable forest sector in the Amazon. *PLoS ONE* **13**(12), e0207855. <https://doi.org/10.1371/journal.pone.0207855>
- Geist H J and Lambin E F (2004) Dynamic causal patterns of desertification. *BioScience* **54**(9), 817. [https://doi.org/10.1641/0006-3568\(2004\)054](https://doi.org/10.1641/0006-3568(2004)054)
- Gomez B (2005) Degradation of Vegetation and Agricultural Productivity due to Natural Disasters and Land Use Strategies to Mitigate Their Impacts on Agriculture, Rangelands and Forestry. In : *Springer eBooks* (pp. 259–276). [https://doi.org/10.1007/3-540-28307-2\\_15](https://doi.org/10.1007/3-540-28307-2_15)
- Gupta G S (2019) Land degradation and challenges of food security. *Rev. Europ. Stud.* **11**(1), 63. <https://doi.org/10.5539/res.v11n1p63>
- Hecht S, Schmink M, Abers R N, Assad E, Bebbington D H, Brondizio E, De Assis Costa F, Calisto A M D, Fearnside P, Garrett R, Heilpern S, Mcgrath D, De LT Oliveira G, Pereira H and Pinedo-Vazquez M (2024) Amazonia in motion: Changing politics, development strategies, peoples, landscapes and livelihoods. *Acta Amazonica* **54**(spe1). <https://doi.org/10.1590/1809-4392202203060>
- Higginbottom T and Symeonakis E (2014) Assessing Land degradation and Desertification using Vegetation Index Data: Current frameworks and future directions. *Remote Sensing* **6**(10), 9552–9575. <https://doi.org/10.3390/rs6109552>
- Júnior D P L, De Oliveira Dantas E S, De Souza R, De Souza M H, Ramos L H D, Sehn M, Siqueira V S, De Oliveira M M and Silva A M A (2021) Burning Season: challenges to conserve biodiversity and the critical points of a planet threatened by the danger called global warming. *Int. J. Environ. Clim. Change* 60–90. <https://doi.org/10.9734/ijecc/2021/v11i530409>

- Kleinschroth F and Healey J R (2017) Impacts of logging roads on tropical forests. *Biotropica* **49**(5), 620–635. <https://doi.org/10.1111/btp.12462>
- Kumar R, Kumar A and Saikia P (2022) Deforestation and forests degradation impacts on the environment. In: *Water science and technology library* (pp. 19–46). [https://doi.org/10.1007/978-3-030-95542-7\\_2](https://doi.org/10.1007/978-3-030-95542-7_2)
- Kumar S, Raj A D, Kalambukattu J G and Chatterjee U (2022) Climate change impact on land degradation and soil erosion in hilly and mountainous landscape: sustainability issues and adaptation strategies. In : *Springer climate* (pp. 119–155). [https://doi.org/10.1007/978-3-031-15501-7\\_5](https://doi.org/10.1007/978-3-031-15501-7_5)
- Lindenmayer D B and Fischer J (2013) *Habitat fragmentation and landscape change: An Ecological and Conservation Synthesis*. Island Press.
- Lovejoy T E and Nobre C (2019) Amazon tipping point: Last chance for action. *Sci. Adv.* **5**(12), eaba2949.
- Macedo M N, DeFries R S, Morton D C, Stickler C M, Galford G L and Shimabukuro Y E (2012) Decoupling of deforestation and soy production in the southern Amazon during the late 2000s. *Proc. Nat. Acad. Sci.* **109**(4), 1341–1346. <https://doi.org/10.1073/pnas.1111374109>
- Malhi Y, Roberts J T, Betts R A, Killeen T J, Li W and Nobre C A (2008) Climate change, deforestation and the fate of the Amazon. *Science* **319**(5860), 169–172.
- Margono B A, Turubanova S, Zhuravleva I, Potapov P, Tyukavina A, Baccini A, Goetz S and Hansen M C (2012) Mapping and monitoring deforestation and forest degradation in Sumatra (Indonesia) using Landsat time series data sets from 1990 to 2010. *Environ. Res. Lett.* **7**(3), 034010. <https://doi.org/10.1088/1748-9326/7/3/034010>
- McKINNEY M L (2002) Urbanization, biodiversity and Conservation. *BioScience* **52**(10), 883. [https://doi.org/10.1641/0006-3568\(2002\)052](https://doi.org/10.1641/0006-3568(2002)052)
- Mukherjee J, Mridha N, Mondal S, Chakraborty D and Kumar A (2018) Identifying suitable soil health indicators under variable climate scenarios: a ready reckoner for soil management. In : *Springer eBooks* (pp. 205–227). [https://doi.org/10.1007/978-981-13-1861-0\\_8](https://doi.org/10.1007/978-981-13-1861-0_8)
- Nemani R R, Keeling C D, Hashimoto H, Jolly W M, Piper S C, Tucker C J, Myneni R B and Running S W (2003) Climate-Driven Increases in Global Terrestrial Net Primary Production from 1982 to 1999. *Science* **300**(5625), 1560–1563. <https://doi.org/10.1126/science.1082750>
- Okorundu J, Umar N A, Ulor C O, Onwuagba C G, Diagi B E, Ajiere S I and Nwaogu C (2022) Anthropogenic Activities as Primary Drivers of Environmental Pollution and Loss of Biodiversity A Review. *Int. J. Trend Sci. Res. Dev.* **6**, 621–643.
- Pandya M and Didwania K (2021) Existential repercussions of development: Deforestation caused by haphazard urbanisation and rapid industrialisation. *Int. J.* **1**, 1372–1397.
- Phillips O L and Brien R J W (2017) Carbon uptake by mature Amazon forests has mitigated Amazon nations' carbon emissions. *Carbon Balance and Management* **12**(1). <https://doi.org/10.1186/s13021-016-0069-2>
- Reboredo F (2013) Socio-economic, environmental and governance impacts of illegal logging. *Environment Systems & Decisions* **33**(2), 295–304. <https://doi.org/10.1007/s10669-013-9444-7>
- Sampaio G, Nobre C, Costa M H, Satyamurty P, Soares Filho B S and Cardoso M (2007) Regional climate change over eastern Amazonia caused by pasture and soybean cropland expansion. *Geophysical Res. Lett.* **34**(17). <https://doi.org/10.1029/2007gl030612>
- Scanes C G (2017) Human activity and habitat loss: destruction, fragmentation and degradation. In : *Elsevier eBooks* (pp. 451–482). <https://doi.org/10.1016/b978-0-12-805247-1.00026-5>
- Schlesinger W H, Reynolds J F, Cunningham G L, Huenneke L F, Jarrell W M, Virginia R A and Whitford W G (1990) Biological feedbacks in global desertification. *Science* **247**(4946), 1043–1048. <https://doi.org/10.1126/science.247.4946.1043>

- Shukla G K A M, Kizha A R, Panwar P and Chakravarty S (2025) *Forest Degradation and Management: An Indian Perspective*. Springer Nature.
- Sih A, Jonsson B G and Luikart G (2000) Habitat loss: ecological, evolutionary and genetic consequences. *Trends Ecol. Evol.* **15**(4), 132–134. [https://doi.org/10.1016/s0169-5347\(99\)01799-1](https://doi.org/10.1016/s0169-5347(99)01799-1)
- Silva C V J, Aragão L E O C, Young P J, Espirito-Santo F, Berenguer E, Anderson L O, Brasil I, Pontes-Lopes A, Ferreira J, Withey K, França F, Graça P M L A, Kirsten L, Xaud H, Salimon C, Scaranello M A, Castro B, Seixas M, Farias R and Barlow J (2020) Estimating the multi-decadal carbon deficit of burned Amazonian forests. *Environ. Res. Lett.* **15**(11), 114023. <https://doi.org/10.1088/1748-9326/abb62c>
- Singh D, Johnston B, Gerbode C, Kerr S, Paltseva J, Gordon D R, Holst E, Kleisner K, Akin-Olçum G and Funk J (2024) Advancing Effective and Equitable Crediting for Natural Climate Solutions: An Introduction. *SSRN Elect. J.* <https://doi.org/10.2139/ssrn.4976807>
- Singh S and Singh Y (2024) 9 Forest Resources. *Advances in Geospatial Technologies for Natural Resource Management* 213.
- Sinha A (2025) Forest, forestry, and state of forests. In : *Forest, forestry and state of forests* (pp. 3–21). [https://doi.org/10.1007/978-981-97-8289-5\\_1](https://doi.org/10.1007/978-981-97-8289-5_1)
- Sodhi N S, Koh L P, Clements R, Wanger T C, Hill J K, Hamer K C, Clough Y, Tscharntke T, Posa M R C and Lee T M (2010) Conserving Southeast Asian forest biodiversity in human-modified landscapes. *Biological Conservation* **143**(10), 2375–2384. <https://doi.org/10.1016/j.biocon.2009.12.029>
- Sonter L J, Herrera D, Barrett D J, Galford G L, Moran C J and Soares-Filho B S (2017) Mining drives extensive deforestation in the Brazilian Amazon. *Nature Communications* **8**(1). <https://doi.org/10.1038/s41467-017-00557-w>
- Swanston C and Maria E J (2012) *Forest adaptation resources: Climate change tools and approaches for land managers*. <https://doi.org/10.2737/nrs-gtr-87>
- Turetsky M R, Benscoter B, Page S, Rein G, Van Der Werf G R and Watts A (2014) Global vulnerability of peatlands to fire and carbon loss. *Nature Geoscience* **8**(1), 11–14. <https://doi.org/10.1038/ngeo2325>
- Turner M G (2010) Disturbance and landscape dynamics in a changing world. *Ecology* **91**(10), 2833–2849. <https://doi.org/10.1890/10-0097.1>
- Vijay V, Pimm S L, Jenkins C N and Smith S J (2016) The impacts of oil palm on recent deforestation and biodiversity loss. *PLoS ONE* **11**(7), e0159668. <https://doi.org/10.1371/journal.pone.0159668>