



Challenges and Preservation Efforts of Biodiversity in Northeast India

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Abstract: The biodiversity of Northeast India faces numerous threats, including deforestation, habitat loss, poaching, and human-wildlife conflict. To address these challenges, various conservation measures are proposed, such as regulated tree cutting, forest fire management, reforestation, and community participation. The study emphasizes the pivotal roles of both governmental and non-governmental organizations in biodiversity conservation efforts and underscores the importance of environmental education in raising awareness. Community participation is highlighted as crucial for the success of conservation strategies, emphasizing the necessity of grassroots involvement and collaboration. The abstract provides a concise overview of the study's focus on identifying threats to Northeast India's biodiversity and proposing conservation measures to safeguard its rich natural heritage.

Keywords: Biodiversity, Challenges, Environment, Culture, Development.

Introduction:

The northeastern region of India is not just a land of diverse cultures and rising sun, but also a treasure trove of biodiversity. Encompassing states like Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim, this area boasts a rich variety of life forms, spanning from within species to between species and entire ecosystems. Biodiversity, the essence of life on Earth, showcases the immense variability among living organisms. It is this diversity that sustains and enriches life, balancing the delicate interplay between humanity and nature for the greater good of all. However, the rapid degradation of natural habitats has led to a sharp decline in species numbers and genetic variations. Human activities have accelerated the process of extinction, posing a significant threat to the intricate web of life. Recognizing the urgency of the situation,

international and national conservation agencies have prioritized efforts to conserve biodiversity in the region. Despite these initiatives, the Northeast continues to face mounting pressure for development, underscoring the need for robust conservation strategies. Efforts to date require reinforcement, especially as the region grapples with the challenge of achieving a delicate balance between conservation and development. Northeast India presents a unique opportunity to showcase the harmonious coexistence of conservation and sustainable development, ensuring the security of livelihoods while safeguarding precious natural resources. The benefits of biodiversity are multifaceted, ranging from utilitarian advantages to ecological services, ethical considerations, and aesthetic value. However, various threats, including habitat destruction, overexploitation of resources, pollution, and climate change, continue to imperil this invaluable resource. To mitigate these threats, a concerted effort is required, encompassing measures such as ex-situ and in-situ conservation, community participation, addressing underlying causes of biodiversity loss, and improving biodiversity status through participatory planning and capacity building. By embracing these strategies, we can strive towards a future where biodiversity thrives, ensuring the well-being of both current and future generations. Northeast India, comprising Assam, Arunachal Pradesh, Nagaland, Meghalaya, Manipur, Mizoram, Tripura, and Sikkim, is home to a plethora of unique flora and fauna, many of which are found nowhere else. The region boasts diverse landscapes, cultures, and economies, each with its own distinct characteristics. Utilizing advanced technologies like satellite remote sensing, researchers have identified 19 different forest types in the Northeast. Recently, Mizoram introduced the New Land Use Policy (NLUP) to modernize farming practices and move away from traditional shifting cultivation methods. The Indian government has also implemented various programs aimed at conserving biodiversity through the establishment of protected areas. Efforts toward systematic biodiversity conservation are crucial, particularly in tropical regions like Northeast India. By leveraging comprehensive databases generated through biodiversity assessments, policymakers can prioritize conservation efforts in areas most susceptible to degradation. However, despite global and national efforts to identify biodiversity-rich areas, conservation plans for protected areas in Northeast India remain incomplete. It's crucial to implement appropriate measures for the preservation and management of biodiversity, particularly endemic species. Jain and Das (2022) emphasize the need for tailored conservation strategies to prevent the decline of unique species in the region. In essence, sustainable development initiatives in Northeast India must prioritize biodiversity conservation to prevent irreversible losses. By integrating conservation efforts into development plans and adopting effective preservation techniques, we can safeguard the region's rich natural heritage for future generations.

Objectives:

1. To discuss the threats of biodiversity in Northeast India
2. To give valuable suggestions for conserving biodiversity in Northeast India.

Methodology:

This study employs a multidisciplinary approach to assess the threats to biodiversity and propose conservation measures in Northeast India. The methodology involves a comprehensive review of existing literature, including academic papers, books, and research articles, to gather information on biodiversity, threats, and conservation efforts in the region. The study begins with an overview of the biodiversity in Northeast India, highlighting its significance, diversity, and unique ecological features. This section draws on existing research to provide a contextual understanding of the region's natural heritage. By adopting a multidisciplinary approach, the study aims to contribute to the growing body of knowledge on biodiversity conservation and inform policy and decision-making in the region.

Value of Biodiversity:

Biodiversity holds immense value across various dimensions, spanning from its practical utility to its cultural and ethical significance. Here's a breakdown of the different facets through which biodiversity is valued: **Direct Utilization Value:** This encompasses the tangible benefits derived from directly using biodiversity resources. These could include essentials like food, fiber, medicinal drugs, and fuel. Notably, even non-renewable resources like petroleum, natural gas, and coal originated from ancient biodiversity.

Commercial Utilization Value: Many industries rely on biodiversity for their operations, ranging from paper and pulp production to silk, leather, and pearl industries. These sectors capitalize on biodiversity for their commercial outputs, driving economic activity and livelihoods. **Social and Cultural Value:** Biodiversity is deeply interwoven with social customs, religious practices, and cultural beliefs. Certain plants hold sacred status in various cultures, emphasizing the profound societal reverence towards biodiversity. **Ethical Significance:** The ethical dimension of biodiversity underscores the intrinsic value of all life forms and the moral imperative to preserve them. The ethos of "Live and let live" underscores the interconnectedness of all life forms, emphasizing the need for biodiversity conservation for the well-being of humanity. **Aesthetic Appreciation:** Biodiversity offers aesthetic delights that attract visitors worldwide, driving ecotourism. People invest significant resources to experience the beauty of wilderness areas, contributing to the global economy while reinforcing the aesthetic value of biodiversity. **Ecosystem Service Provision:** Biodiversity sustains critical ecosystem services essential for human well-being, including flood prevention, soil fertility maintenance, nutrient cycling, oxygen production, water regulation, carbon sequestration, and pollution mitigation. Recognizing and preserving these services are vital for ensuring environmental sustainability. **Option Values:** Biodiversity harbors untapped potential, with numerous biological resources yet to be fully explored. The concept of option value acknowledges the uncertainty of future discoveries and the importance of preserving biodiversity for potential future benefits, underscoring the prudence of conservation efforts.

Biodiversity in Northeast India:

India boasts remarkable biodiversity, with two of the world's 18 biodiversity hotspots nestled within its borders—the Western Ghats and the Eastern Himalayas. The country's diverse climatic conditions give rise to a vibrant spectrum of biodiversity, earning it a place among the world's mega biodiversity centers. The North East region of India, comprising eight states—Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, Sikkim, and Tripura—occupies 7.7% of India's landmass, yet sustains a population of approximately 40 million. This area stands out as a biodiversity haven, hosting 50% of India's flora, totaling around 8,000 species, with an impressive 31.58% (2526 species) being endemic. Characterized by a rich tapestry of ecological, social, and geographical landscapes, North East India showcases a diverse range of physiographic and eco climatic conditions. The region's topography encompasses a wide array of climatic, soil, and altitude gradients, fostering a plethora of ecological habitats. This diversity is exemplified by the presence of tropical and temperate forests, alpine meadows, and cold deserts.

Forest cover is a prominent feature of the region, with approximately 60% of each state's geographical area blanketed by forests. These forests exhibit a rich diversity in structure and composition, reflecting the unique blend of tropical and temperate forest types found in the region. This region is a sanctuary for endangered floral species, with around 800 out of 1,500 endangered species found within its borders. Encompassing approximately 167,000 square kilometers of forested land, the Northeast accounts for a staggering 7,500 species of angiosperms. Northeast India's botanical richness is further underscored by its representation of more than 200 out of the 315 families of angiosperms found in India, comprising nearly half of the country's total plant species diversity. The region is also a stronghold for bamboo diversity, boasting 63 out of the 136 bamboo species recorded in India, spread across an area of 30,500 square kilometers. Moreover, the Eastern Himalayan region, particularly the Northeast, is home to a significant portion of the Himalayan rhododendron species, with 70 out of 82 species recorded in the Himalayas found here.

Aside from their ecological significance, the flora of the Northeast region holds immense medicinal value. Arunachal Pradesh, Nagaland, Tripura, and Meghalaya are particularly rich in medicinal plants, with hundreds of species known for their therapeutic properties, offering potential treatments for various ailments.

Threats of Biodiversity in Northeast India:

The Northeast region of India, despite its rich biodiversity, faces a multitude of threats that jeopardize its delicate ecological balance and the survival of numerous habitats and species. These threats include:

Deforestation: Although the Northeast region boasts a significant forest cover, accounting for 64% of its total geographical area, rampant deforestation has led to a drastic reduction in forested lands, with the cover

dwindling to a mere 25%. This loss of habitat has dire consequences for the region's endangered and endemic wildlife species, pushing them towards extinction.

Encroachment of Forest Land: The encroachment of forest lands poses a grave threat to forest conservation efforts in the Northeast. This encroachment not only diminishes forest cover but also perpetually degrades forest resources, further endangering wildlife populations.

Jhum Cultivation: Traditional shifting cultivation, known as "Jhum," practiced by many tribal communities, has detrimental effects on the region's ecology and conservation efforts. While agriculture sustains livelihoods in the region, Jhum cultivation contributes to habitat loss and degradation, exacerbating the pressures on local ecosystems.

Forest Fires: Forest fires represent a significant threat to the Northeast's forests, causing extensive damage to vegetation and wildlife habitats. These fires, often sparked by Jhum cultivation practices or spreading from uncontrolled sources, impede forest regeneration and pose risks to surrounding areas, including major river catchment zones, exacerbating the impact on wildlife populations.

Habitat Loss: Deforestation and land conversion for various purposes result in habitat loss, leading to the extinction of many species unique to Northeast India. This trend, if unchecked, could contribute to mass extinctions driven by human activity.

Poaching of Wildlife: The region's abundant rare and endemic species make it a target for poachers. Wildlife trafficking across international borders with neighboring countries exacerbates this threat.

Smuggling: Illicit activities such as timber smuggling and trafficking of animal parts, including rhino horns and tiger skins, further degrade the region's forests and endanger its wildlife.

Overexploitation for Commercial Agriculture: Intensive commercial agriculture, including illegal extraction of forest products, not only disrupts biodiversity but also leads to pollution through the excessive use of chemicals.

Human-Wildlife Conflict: Disruption of wildlife migration routes often leads to conflicts between humans and animals, particularly in areas like the foothills of Assam and along the Brahmaputra riverbank.

Construction of Dams: Large-scale dam construction alters ecosystems and triggers controversy, as seen in protests against projects in states like Assam, Manipur, and Sikkim. **Migration:** Influx of immigrants from neighboring countries poses cultural and social challenges, threatening the identity and customs of indigenous communities.

Mining: Coal mining, particularly open-cast mining in Meghalaya and Assam, causes widespread destruction of natural habitats and pollution. Population Growth: Rapid population growth leads to increased pressure on resources, exacerbating deforestation, soil erosion, and climate change, further endangering species in the region. Industrialization and Urbanization: Urban expansion and industrial growth contribute to pollution and habitat destruction, accelerating the loss of biodiversity in Northeast India.

Efforts taken for Biodiversity Conservation:

Conservation embodies a holistic approach to the sustainable management of natural resources, aiming to enhance the quality of human life while safeguarding the integrity of the environment. It encompasses various practices such as preservation, maintenance, sustainable utilization, restoration, and enhancement of natural ecosystems. At its core, conservation entails the prudent utilization of our natural environment, preventing waste and degradation, and ensuring the preservation, improvement, and renewal of all resources. The World Conservation Strategy defines conservation as the careful management of human activities within the biosphere, aiming to maximize sustainable benefits for the present generation while preserving the capacity of future generations to meet their needs and aspirations. Recognizing the immense value of biodiversity, encompassing its commercial utility, ecological services, and social and aesthetic significance, underscores the critical importance of biodiversity conservation. To conserve biodiversity, including plant and animal species, various measures are employed. Conservation efforts typically involve two main approaches: in-situ conservation and ex-situ conservation. In-situ conservation focuses on protecting species and ecosystems within their natural habitats, ensuring their continued survival and ecological functioning. Ex-situ conservation involves the preservation of species outside their natural habitats, often through captive breeding programs, botanical gardens, or seed banks, as a safeguard against extinction and for future reintroduction efforts.

In-situ Conservation:

In-situ conservation revolves around the preservation of ecosystems and natural habitats, as well as the protection and revival of viable populations of species within their native environments. This approach is particularly effective as it ensures the maintenance of ecosystems and species within their natural settings, allowing them to thrive and evolve as they would naturally. In essence, in-situ conservation entails safeguarding wild species of flora and fauna in their original habitats, thereby focusing on preserving biological diversity in natural or near-natural conditions. The fundamental aim of in-situ conservation is to allocate specific portions of the Earth's surface for the protection and promotion of wildlife. This includes designating areas such as wildlife sanctuaries, national parks, biosphere reserves, and reserved forests, among others, where natural ecosystems and their inhabitants are granted legal protection from human interference and exploitation. By preserving these areas and their inhabitants, in-situ conservation helps maintain the intricate balance of ecological processes, safeguarding biodiversity for future generations while allowing ecosystems to flourish in their natural state.

Ex-situ conservation:

Ex-situ conservation involves preserving species outside of their natural habitats, within controlled environments such as botanical gardens for plants or zoological parks for animals. This approach entails expert management to propagate and sustain species under carefully monitored conditions. It is a refined conservation technique that relies on the cultivation of sample populations. Various methods are employed in ex-situ conservation, including gene banks, seed banks, zoos, botanical gardens, and culture collections. These facilities serve as repositories for genetic material and living specimens, allowing for the preservation and propagation of species that may be threatened in their natural habitats.

International Efforts for Biodiversity Conservation:

Biodiversity is recognized as a global imperative, crucial for the well-being of humanity and the health of the planet. In 1948, the International Union for Conservation of Nature and Natural Resources (IUCN) was established, headquartered in Switzerland, marking a significant step towards international cooperation in biodiversity conservation. The need for coordinated efforts to protect endangered species led to the formation of the Convention on International Trade in Endangered Species (CITES) in July 1975. This treaty aimed to regulate the international trade of wild flora and fauna to prevent their exploitation and decline. In 1980, the World Conservation Strategy was devised, laying out a framework for preserving biodiversity on a global scale. This strategy emphasized the importance of conservation, sustainable resource use, and equitable sharing of benefits derived from genetic resources. The landmark Rio Earth Summit in 1992 saw the signing of the Biodiversity Convention Treaty, officially known as the Convention on Biological Diversity (CBD). This treaty represented the first comprehensive global agreement addressing all aspects of biological diversity, including genetic resources, species diversity, and ecosystem health. The objectives of the CBD, outlined in 2011, encompassed the conservation of biodiversity, sustainable utilization of its components, and fair sharing of benefits arising from the utilization of genetic resources. By addressing these key pillars, the CBD aimed to promote the responsible stewardship of Earth's natural resources for the benefit of present and future generations.

Indian Efforts for Biodiversity Conservation:

India has demonstrated a strong commitment to biodiversity conservation through the implementation of various laws and establishment of dedicated institutions. The formation of the Ministry of Environment and Forests (MOEF) in 1985 underscored the government's focus on monitoring, enforcing, and promoting environmental conservation efforts. Additionally, a comprehensive legal framework, including the Indian Forest Act 1972, the Wildlife Protection Act 1980, the Environment Protection Act 1986, and the Biodiversity Act 2002, has been enacted to protect biodiversity across the country. India's engagement in international agreements such as the Convention on International Trade in Endangered Species (CITES) since 1976 and the Convention on Biological

Diversity (CBD) since 1992 further highlights its commitment to global conservation efforts. The establishment of protected areas, Biosphere Reserves, Sanctuaries, National Parks, and Botanical Gardens, including those in the Northeastern region, further demonstrates India's dedication to preserving its rich biodiversity.

To effectively conserve biodiversity in the Northeast, several recommendations have been put forth:

1. Regulated Cutting of Trees: Implementing methods like clear cutting, selective cutting, and shelter wood cutting to mitigate the impact of deforestation.
2. Forest Fire Control: Utilizing modern firefighting techniques and trained personnel to prevent and manage forest fires.
3. Reforestation and Afforestation: Implementing well-planned programs to replant and establish forests in deforested areas.
4. Limiting Forest Clearance: Restricting forest clearance for agriculture and habitation and promoting green belt development around urban areas.
5. Forest Protection: Implementing measures to protect forests from grazing and diseases through chemical sprays or disease-resistant strains.
6. Sustainable Utilization of Forest Products: Ensuring efficient utilization of forest resources and minimizing waste.
7. Forest Management: Adopting comprehensive forest management practices, including surveying, categorizing, and sustainably using forest resources.
8. Government Intervention: Formulating specific legislation and policies tailored to the unique biodiversity conservation needs of the Northeast.
9. Environmental Education: Promoting environmental awareness and education to instill a sense of responsibility towards conservation.
10. NGO Involvement: Encouraging the active participation of non-governmental organizations in conservation efforts, leveraging their expertise and grassroots connections.
11. Community Participation: Involving local communities in planning, management, and monitoring of conservation programs to ensure their success and sustainability.

Conclusion:

The study highlights the prominent threats facing the rich biodiversity of Northeast India, which include deforestation, encroachment on forest land, jhum cultivation, forest fires, habitat loss, wildlife poaching, smuggling, overexploitation for commercial agriculture, human-wildlife conflict, dam construction, migration, mining, population growth, industrialization, and urbanization. These findings align with prior research conducted by Rawat & Agarwal (2015) and Hazarika (2021), who also identified similar threats to biodiversity in the region. Rawat & Agarwal (2015) emphasized habitat loss, population growth, and resource depletion as principal threats, while Hazarika (2021) highlighted deforestation, encroachment on forest land, jhum cultivation, forest fires, poaching, overexploitation for agriculture, and disruption of migration routes. The study proposes various conservation measures for preserving biodiversity in Northeast India, including regulated tree cutting, forest fire management, reforestation, monitoring forest clearance, sustainable use of forest resources, and effective forest management practices. Additionally, the study underscores the pivotal roles of both the government and non-governmental organizations (NGOs) in biodiversity conservation efforts. Furthermore, it emphasizes the importance of environmental education in raising awareness among diverse segments of society about the significance of biodiversity conservation. Lastly, the study emphasizes the necessity of community participation in ensuring the success of biodiversity conservation strategies, emphasizing the importance of grassroots involvement and collaboration.

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