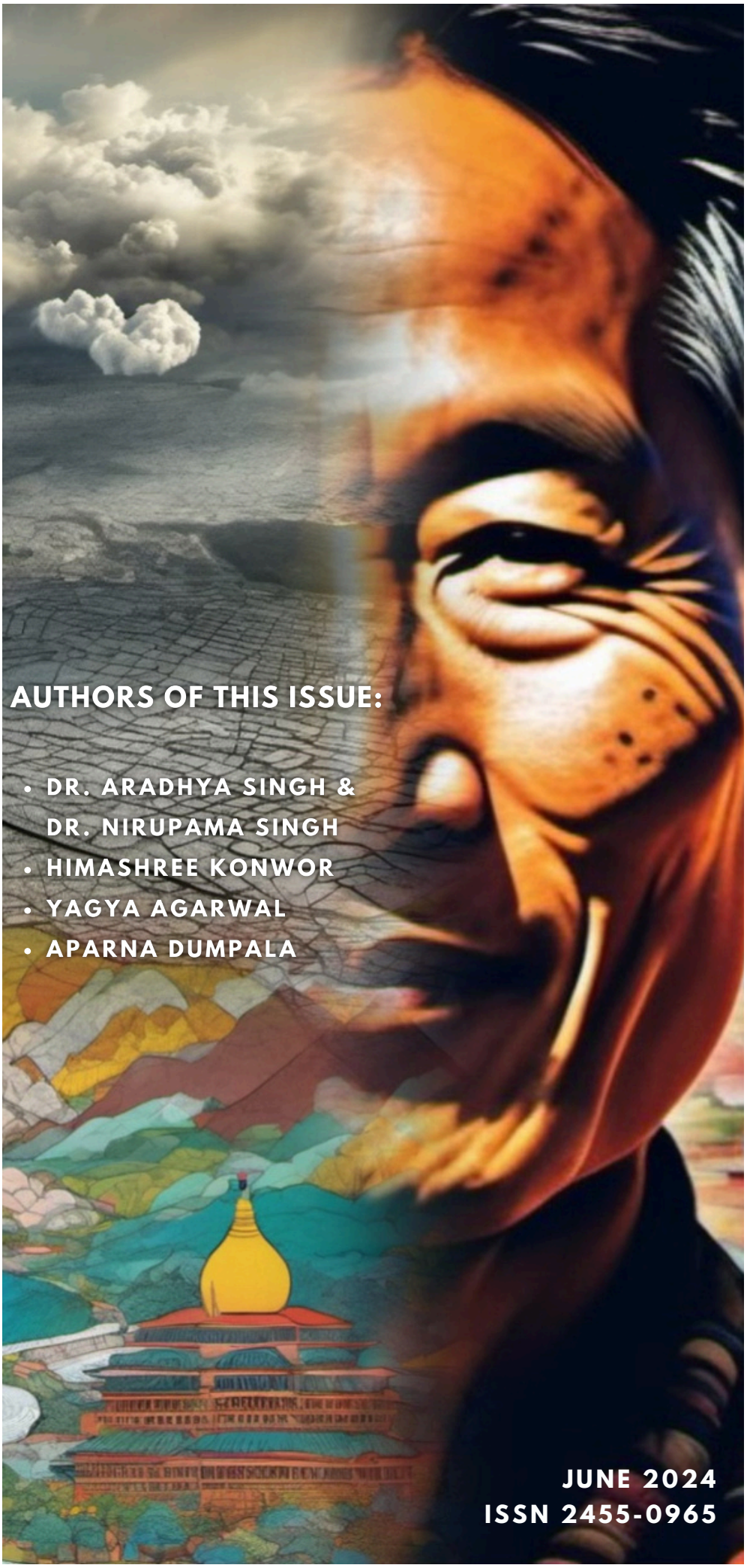
NATIONAL LAW UNIVERSITY AND JUDICIAL ACADEMY, ASSAM

LEX TERRA

CENTRE FOR ENVIRONMENTAL LAW, ADVOCACY AND RESEARCH



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ISSUE 44

JUNE 2024

ISSN 2455-0965

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EDITORIAL BOARD

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ISSN: 2455-0965

This issue shall be cited as:

[Author's name], [*Title of the Article*], [LT 44] [LEX TERRA], [Page(s) Cited][(2023)]
doi: http://nluassam.ac.in/celar.php.

ABOUT CELAR

The fundamental aim of the **Centre for Environmental Law, Advocacy, and Research (CELAR)**, National Law University and Judicial Academy, Assam, is to participate in advocacy and research on public interest environmental concerns. It endeavours to do so by holding workshops and seminars to educate and improve skills, convening conferences to encourage an exchange of ideas, conducting training programmes for capacity building in environmental law issues, undertaking legal research, and publishing newsletters and journals regularly.

The main objectives of CELAR can be elucidated as follows:

- Providing students with hands-on advocacy experience and direct exposure to the issues to inspire and educate them.
- Strengthen access to justice by conducting high-quality multi-disciplinary research on current environmental legal issues.
- Advocate for reforms in environmental law through scientifically sound legislative proposals.
- Organize training programmes for civil servants, law enforcement agencies, non-governmental organisations, and media professionals to improve their legal capacity on environmental laws and policy.
- Publish environmental law publications and bulletins on a regular basis.

Thus, to meet the last objective, ***'Lex Terra'*** is an initiative undertaken by CELAR. Through Lex Terra, we strive to provide a voice to various aspects of the environment, published quarterly, to create a community of environmentally conscious individuals from the legal and non-legal fraternity. Each issue of Lex Terra features important environmental news from across the world and from within the nation. This bulletin is meticulously compiled by CELAR members and is dedicated to enviro-legal enthusiasts around the country.

EDITORIAL NOTE

In this issue, we turn our attention to the Himalayas and the urgent call to action by environmentalist and innovator, Sonam Wangchuk. Wangchuk's powerful narrative is a testament to the pressing need for both local and global action to combat the environmental crises unfolding in these majestic mountains. His “Climate Fast,” a hunger strike aimed at drawing attention to the rapid melting of glaciers in Ladakh, encapsulated the desperation and hope of communities living on the frontline of climate change. These glaciers, often referred to as the “third pole” of our planet, are vital water sources for over a billion people across South Asia. As they retreat, the specter of water scarcity and ecological disruption looms large, not only for Ladakh but for the entire region dependent on these ice reserves.

Wangchuk's advocacy is deeply intertwined with his call for the implementation of the Sixth Schedule of the Indian Constitution in Ladakh. This provision, which grants legislative autonomy to tribal regions, is seen as a crucial step in empowering local communities to manage their land and resources sustainably. Without these protections, Ladakh faces the threat of unsustainable industrial development and loss of its unique cultural and ecological heritage.

The plight of Ladakh serves as a poignant reminder of the disproportionate impact of climate change on indigenous and rural communities. Wangchuk's message resonates beyond the borders of India, challenging the global community to rethink its relationship with nature and to adopt more sustainable lifestyles. His plea to "live simply so that we in the mountains may simply live" is a call to action for us all to reduce our carbon footprints and support policies that protect vulnerable ecosystems.

As we explore Wangchuk’s insights and the broader implications of his activism, let us reflect on our own responsibilities. In an interconnected world, the melting of glaciers in Ladakh is not just a local issue but a global one, demanding collective action and solidarity. Through the lens of Wangchuk’s experiences, we are reminded that the fight against climate change is as much about preserving the livelihoods and cultures of those most affected as it is about protecting our planet for future generations.

In this issue of *Lex Terra*, we delve deeper into the environmental, social, and political dimensions of Wangchuk's work and the broader struggle to save the Himalayas. We invite our readers to join us in this exploration and to consider the ways in which we can all contribute to a more sustainable and equitable future.

The *first* article discusses India's rich aquatic ecosystems, including wetlands like Deepor Beel in Assam, which are vital for biodiversity and human livelihoods. Designated as a Ramsar site in 2002, Deepor Beel supports diverse flora, fauna, and provides critical resources for local communities. However, it faces severe threats from urban encroachment, illegal waste dumping, and infrastructure projects like railways. The author discusses measures that can be implemented to protect and enhance the wetland by controlling pollution and promoting sustainable tourism.

In the *second* article, the author delves into the deep-rooted environmental protection principles in Indian religious texts and tribal traditions, highlighting their focus on ecological harmony and sustainable resource use. The changing climate and rapid environmental degradation pose significant threats to these ancient practices. To combat modern challenges, India has established frameworks like the National Green Tribunal (NGT) Act of 2010, which facilitates the swift resolution of environmental disputes and enforces penalties for violations. Additionally, the Seventh Schedule of the Indian Constitution mandates state-level water resource conservation, while the Sixth Schedule grants autonomy to District Councils in Northeast India, empowering them to manage natural resources and prevent over-exploitation. The article particularly focuses on Meghalaya, a state rich in tribal diversity, and how its communities, such as the Khasi, Garo, and Jaintia, integrate traditional and modern approaches to preserve their environment amidst contemporary challenges.

In the *third* article, the author discusses the intersection of climate change and human rights violations, with a focus on the issue of climate refugees in India. Defining key terms like climate change, and human rights, the author explains how climate change events like droughts, floods, cyclones and landslides in India have led to large-scale displacement, violating the human rights of millions. The paper outlines the legal framework in India related to the protection of displaced persons, noting that while the Constitution guarantees fundamental rights and there are laws like the Disaster Management Act, there is no specific law protecting climate refugees. The author conclusively highlights how climate change is a major driver of internal displacement in India, violating human rights, and calls for an urgent policy response to address the humanitarian crisis faced by climate refugees.

In the *fourth* article of this issue the author explores how climate change poses significant economic challenges to the North Eastern States of India, comprising Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. Known for their rich biodiversity and cultural heritage, these states are highly vulnerable to climate impacts due to their unique geographical and socio-economic conditions. The author assesses how erratic weather patterns, extreme events like floods and droughts, and shifts in agricultural productivity severely affect key economic sectors such as agriculture, forestry, fisheries, and tourism. These disruptions exacerbate existing socio-economic issues, particularly affecting marginalized communities and increasing social inequalities. The paper underscores the importance of understanding these economic impacts to devise effective adaptation and mitigation strategies, thereby enhancing the resilience and sustainable development of the North Eastern States in the face of climate change.

Lex Terra Editorial Board

2023 - 2024

ENVIRONMENTAL SUSTAINABILITY IN MEGHALAYA: TRADITIONAL AND MODERN APPROACHES IN CONSERVATION OF WATER RESOURCES

- Dr. Aradhya Singh[*]
Dr. Nirupama Singh[**]

I. Introduction

The idea of environmental protection originated in Indian religious texts of the Vedas, Upanishads, Smritis, and Dharmashastras, which emphasized environmental harmony, and conservation and advocated for a respectful attitude toward the natural world. However, the biggest threat to the sustainability of all earthly species in this modern period of globalization is the changing climate and environmental degradation.[1] The ecological knowledge and behaviour of India's tribal people is primarily centered on sustainability, production, and the most efficient and well-balanced utilisation of the country's natural resources.

In the present scenario, the legislature enacted the National Green Tribunal Act (NGT) 2010 for the efficient and accelerated disposal of conflicts that involve the safeguarding and preservation of the environment and other natural resources. The significance that legal systems play in protecting the environment is shown by the NGT's imposition of fines on states for environmental infractions.[2]

Also, the Seventh Schedule of the Constitution of India under the Second List directs the State to promote practices of conservation of water resources in the concerned state which becomes helpful in planning, development, and management of water resources.[3] Additionally, District Councils are granted autonomy by the Sixth Schedule of the Indian Constitution, which limits state control over land use which is a way to prevent over-exploitation of the natural resources.

Northeast India i.e. the land of seven sisters comprises various ecological regions and tribal communities with distinctive languages, religions, and administrative setups. Meghalaya is one

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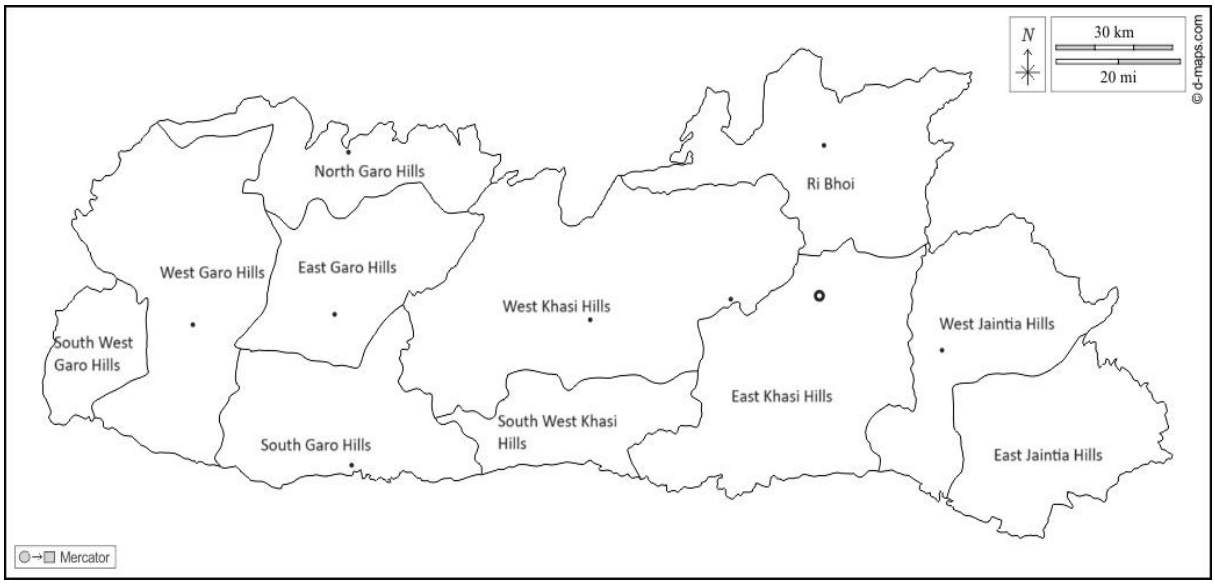
[1]Human Development Report 2006, UNDP, https://www.undp.org/publications/human-development-report-2006#:~:text=January%201%2C%202006&text=Water%20is%20a%20source%20of,a%20deepening%20global%20water%20crisis (last visited Feb. 15, 2024).
[2] Dr. Sujata Bhattacharyya, *Community and Environmental Protection- - In Search of the Lost Spring of Happiness of the North-Eastern Region*, 1, AIJACLA, 91, 91-106 (2021).
[3]*Id.*

of the tribal majority states in the north-eastern region housing three major tribal communities, Khasi, Garo, and Jaintia. However, the Schedule Tribes Khasi, Garo, Hajong, Pnar, Jaintia, War, Mikir, Lalung, Hmars, Rabhas, Boro, Hajongs, and Bhoi comprise a significant percentage of the sparsely inhabited mountains state.[4] A representative map of the state of Meghalaya is attached below:



Map 1 – Geographical distribution of tribes in Meghalaya.

Meghalaya experiences a typical monsoon climate and high rainfall during May till September wherein the annual rainfall measures around 2800 mm and reaches up to 12000 mm. Heavy rainfall in certain months causes extensive soil erosion therefore, this has become the prominent cause of forest degradation, and sediment disasters in streams and rivers. However, the remaining months experience erratic rainfall and the terrain makes it difficult to capture the surface water. Thus, natural springs are used for varied purposes like drinking water and agriculture. Therefore, the state is actively taking countermeasures for water conservation.

II. Traditional Methods For Water Conservation

As per the definition given under The Meghalaya Water Act, 2011 water includes— (a) surface water; and (b) all water that rises naturally on any private land or drains or falls naturally onto any private land, even if it does not visibly join any public stream; and (c) all groundwater.[5] In

[4] M.N. Karna, *Meghalaya, Sub-Regional Relations in Eastern South Asia: With Special focus on India's North-Eastern Region*, JOINT RESEARCH PROGRAM SERIES 133 (2005).
[5] The Meghalaya Water Act, 2011, https://megwaterresources.gov.in/pdf/Meghalaya_Water_Act_2011_draft.pdf (last visited February 23, 2024).

India, there are diverse traditional and indigenous techniques for harvesting and conserving water.[6] Some of them are as follows:

2.1 Bamboo Drip Irrigation

In Meghalaya, we see that bamboo is used for various purposes by indigenous people, especially in water conservation. Traditional methods of managing water are collectively administered and with locally available materials.[7] People continue to build bamboo tubes to carry water from springs to irrigate the fields. The people of southern Meghalaya have created intricate networks of bamboo tubes to transport water to fields of betel leaves situated in rock-strewn locations, in places that do not support the construction of channels. This whole system functions similarly to the contemporary drip irrigation method, supplying the plant's roots with precisely calibrated amounts of water. Bamboos are laid just above the properly spaced crop with small holes in the laterals so that the water can drip on the individual plant. The uniqueness of bamboo drip irrigation systems is their suitability to the local conditions, their economic feasibility, and easy implementation.[8]

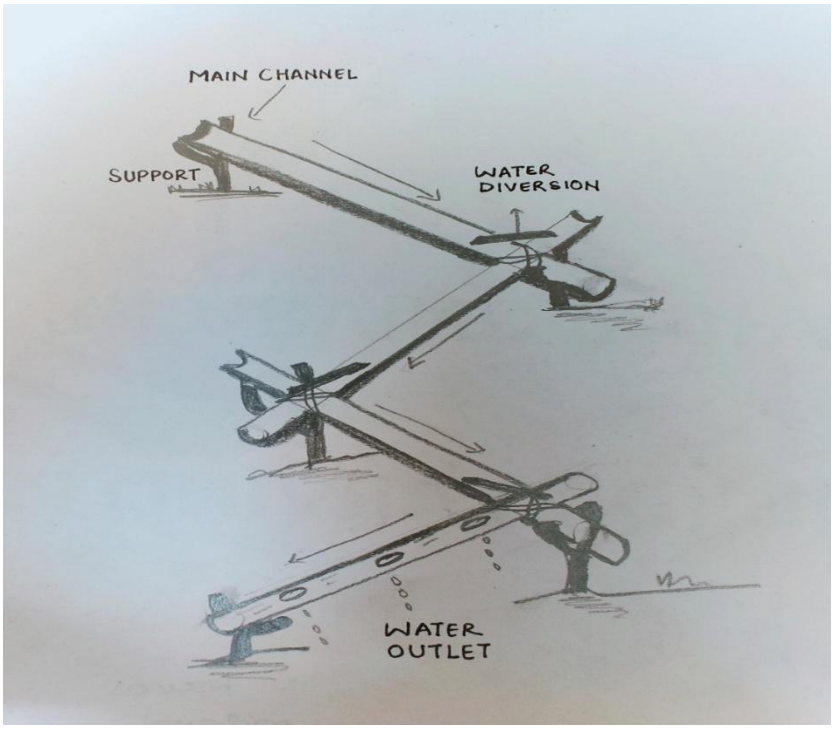


Image 1- Bamboo Drip Irrigation Technique in Meghalaya

[6] R.A. Singh & R C Gupta, *Traditional land, and Water management systems of North- East hill region*, IJTK,1(1) 32-39 (2002).
[7] *Id.*
[8] Anil Agarwal and Sunita Narain, *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems*, CSE, New Delhi (1999).

2.2 Protection of Aquifer

There is a devastating effect of environmental degradation on the hydrological cycle. Nature-based solutions are a way of strengthening the natural processes that aid water conservation. To store surface water, lakes are being protected and flood plains are being created for capturing runoff water.[9] In addition, various man-made interventions for recharging groundwater levels such as canals, infiltration basins, ponds, irrigation furrows, or injection wells are being used.[10] One of the most prominent water conservation techniques is 'aquifer storage and recovery' which involves the storage of available water through wells which can be used during dry spells.[11] It can be both naturally occurring and man-made.[12]

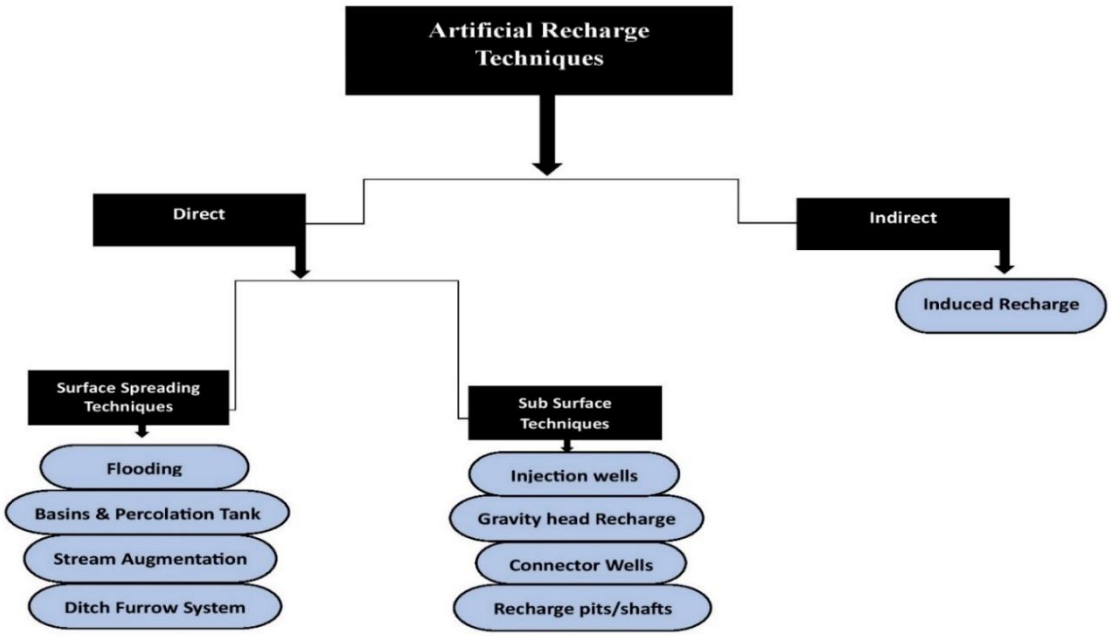


Table1- Artificial Recharge Techniques

[9] Amartya Kumar Bhattacharya, *Artificial Ground Water Recharge with A Special Reference to India*, 4(2) IJRRAS (2010).

[10] Angela Wipperman, *How Ancient Water Conservation Methods are Reviving in India*, GLOBAL CENTER ON ADAPTATION, (Feb. 11, 2024), https://gca.org/how-ancient-water-conservation-methods-are-reviving-in-india/.

[11] *Aquifer Storage and Recovery California Water Science Center*, USG https://www.usgs.gov/centers/california-water-science-center/science/aquifer-storage-and-recovery#:~:text=Aquifer%20storage%20and%20recovery%20(ASR,range%20from%20months%20to%20decades (last visited February 22, 2024).

[12] Dr. S. C. Dhiman, *Aquifer Systems of Meghalaya*, CGWB, https://www.cgwb.gov.in/old_website/AQM/Meghalaya.pdf (last visited February 22, 2024).

2.3 Rooftop Water Harvesting

The tank collection method is used in Rooftop harvesting for the conservation of rainwater. This water can be consumed directly, utilised for various purposes, or recharge groundwater employing basic filtering methods. Rainwater harvesting is one of the traditional and efficient methods for the conservation of water.[13] It is additionally regarded as one of the most promising methods for supplying groundwater amid increasing shortages and ever-accelerating water requirements in rural and urban regions. It is a sustainable form of water utilization without endangering future generations' survival.

Rooftop rainwater harvesting is commonly practiced for the preservation of water. Since drinking water is scarce in the state of Meghalaya, the state's government promotes rainwater harvesting therefore initiatives like the launched in various parts of the state to collect rainwater during heavy pours.[14] Rainwater harvesting is used to replenish groundwater either by deploying recharge wells or by altering natural conditions to increase infiltration.[15]

Image 2- Rooftop Water Harvesting Technique[16]

III. Modern Approaches: Measures Taken For Water Conservation

[13] NITYA JACOB, JALYATRA - A JOURNEY THROUGH INDIA'S WATER WISDOM, (CreateSpace Independent Publishing Platform, 2014).
[14] *Reviving and Restoring Defunct Water Harvesting Structures in Meghalaya*, https://ngobox.org/full-news_Reviving-and-restoring-defunct-water-harvesting-structures-in-Meghalaya-AROH-Foundation_22723 (last visited February 11, 2024).
[15] SPANDRE R., ARTIFICIAL GROUNDWATER RECHARGE in GROUNDWATER 3, (Luis Silveira and Eduardo J. Usunoff ed., 1998).
[16] Sourav Ranjan Mohapatra et al, *Review on Design of Rooftop Rainwater Harvesting in Gandhi Institute for Technology* (2002).

Local communities are being motivated to help resolve problems by employing modern technology and ideas, resulting in the formation of a body of professionals. Following are the efforts taken by the government at the Center and State, judiciary, as well as the judicial interventions.

3.1 Legislative Efforts by the Centre

There are several schedules and provisions provided in the Constitution for the advancement of the region.[17] The following initiatives on the part of the government play a prominent role in addressing the glaring issue of water scarcity. Some of the initiatives include the National Aquifer Mapping and Management Program, one of the major Central Sector schemes executed by the Central Ground Water Board (CGWB), which focuses on mapping aquifers, characterizing them, and developing Aquifers Management Plans. Mission Amrit Sarovar was also launched for the conservation, rejuvenation, and development of water bodies. The infamous Jal Shakti Abhiyaan, a pan-Indian Mission was also launched for strategizing the conservation of water bodies and was introduced in Meghalaya in 2019 for water-stressed areas.[18] The Central Water Commission (CWC) advances the promotion of studying various irrigation projects and focuses on improving water use efficiency and conservation practices, hence the initiatives highlight the impactful planning of the legislature of India.

3.2 The Efficient Water Resource Policy of the State Legislature

In 2011 the policy formulated in Meghalaya for the preservation of groundwater was a one-of-its-kind effort. Due to socio-political reasons the policy included within its ambit the acknowledgment of the serious threats to the water bodies and the methods for preserving the same. Meghalaya Water Bodies (Prevention and Conservation) Guidelines 2023[19] released for the Protection and Preservation of Water Bodies in the State by the Governor,[20] these guidelines prohibit the installation or construction of hoardings, billboards, signage, buildings, and other structures in waterbody setbacks, regulated zones, and nearby areas to protect strategic scenic

[17] Medha Patil & Aman Bahl, *Emerging Northeast India: Recent Socio-Environmental Developments,* 36 LEX TERRA, 15-21 (2018).

[18] Observance of Water Heritage Fortnight as part of Jal Shakti Abhiyan, https://meghalaya.gov.in/sites/default/files/press_release/Catch_the_rain_Campaign_2023.pdf (last visited February 22, 2024).

[19] Notification No. FORlCC/29/2019/1140, https://meghalaya.gov.in/sites/default/files/documents/FOR_CC_29_2019_1140_A.pdf (last visited February 25, 2024).

[20] Meghalaya Water Policy for Groundwater Conservation, TOI, https://timesofindia.indiatimes.com/city/guwahati/meghalaya-water-policy-for-groundwater-conservation/articleshow/7688760.cms (last visited February 10, 2024).

views from nearby roads, highways, and other views. These are published as guiding principles for the State of Meghalaya's intergenerational equity and sustainable development about the conservation, preservation, and protection of water bodies.

3.3 Judicial Interventions

Enforcing environmental rights under Articles 32 and 226 of the Constitution has been made possible in large part by Public Interest Litigation (PIL) and judicial activism.[21] The state administration has developed comprehensive policies to preserve and protect the water bodies existing in the state, and this step was done in response to many directives given by the Meghalaya High Court. Any encroachment near water bodies was prohibited by law. It also restricts the expansion of already-existing industries and the creation of additional ones near bodies of water. Disposing of potentially hazardous substances, solid and biomedical waste, and untreated waste and effluents from cities, municipalities, and villages into water bodies will be unlawful.

In one case, the High Court of Meghalaya[22] held that "In the absence of any other employment opportunities, the natural beauty of the state should not be destroyed." The decision of the court emphasised the difficulties of encouraging tourism, development of infrastructure, and urbanisation while preserving the environmental splendour of the area. The High Court of Meghalaya state was hearing a PIL concerning the state of cleanliness of Umiam Lake which revealed the detrimental impacts of unrestricted construction and commercialization on the lake and the surrounding water bodies. The court emphasised that economic progress should not come at the expense of damaging a region's natural prosperity, and so struck a balance between environmental protection and economic development.

***3.4** The pro-active Involvement of the Civil Society*

A developing worldwide water issue poses a threat to human growth in the early twenty-first century. In earlier times, usually, water was usually conserved by the rulers, communities, or nobles since the preservation of water provided spiritual and religious merit. Rulers usually built large water tanks, wells, and artificial lakes but the task of maintaining these was given to zamindar or village headmen and these establishments were common property of the

[21] Ayesha Dias, *Judicial Activism in the Development and Enforcement of Environmental Law: Some Comparative Insights from the Indian Experience*, 6(2) JLEL, 243, (1994).
[22] *In Re: Cleanliness of Umiam Lake versus State of Meghalaya (2023) SCC OnLine Megh 259.*

villagers who contributed for their upkeep and maintenance.[23] Villagers could predict the amount of rainfall and appoint people to manage the water. Men were usually given the responsibility to maintain village tanks and clean the channels before the rains, and the bundhs were also strengthened by them.[24] In contemporary times, the social sector activities have brought about drastic changes like improved availability of water supply to the people at large. They have also developed the infrastructure of the human settlements by constructing water tanks in school buildings, community halls, processing units, etc. This infrastructure has uplifted both the rural and urban communities. Afforestation of water catchment areas is taken up around Nokrek and Balapakram National Parks. Also, an environmental awareness campaign is being conducted at various places by the Eco-Development Society that is organised by the Meghalaya Forest Department[25] Meghalaya Basin Management Authority (MBMA), a non-profit organisation incorporated under the Planning Department of the Government of Meghalaya indulges in the implementation of specific development projects that are focused on improving natural resource management, and livelihood development.

IV. Conclusion

Water is a natural resource that preserves our ecosystems and supports life; therefore, its preservation becomes fundamental for the existence of human beings on Earth. Water is only renewable when it is managed appropriately. The tribal communities manage their resources using regionally present organic materials such as wood, bamboo, leaves, stones, etc. Bamboo is primarily utilised for constructing spikes, hooks, fences, and ducts for the transportation of water along the hilly terrain. Currently, there is a decline in the use of these eco-friendly ways of conservation and preservation because they are uneconomical, labour-intensive, and fragile. The solution for preservation now lies in the union of modern artificial knowledge with traditionally used methods and techniques. Traditional knowledge must be embraced in addition to the creative methods by building conservation structures, putting effective irrigation systems into place, maintaining current springs, and benching and terracing hillside areas with the help of the public. The indigenous knowledge system passed down through the centuries must be considered a solution for making sustainable use of the current environment.

[23] Ramaswamy Sakthivadivel*, The Groundwater Recharge Movement in India*, IWMI (2007).
[24] *Supra* note 10.
[25] Eco-Development Society, https://megforest.gov.in/boardsauth_ecosociety.html (last visited February 25, 2024).

ECOLOGICAL DEGRADATION OF DEEPOR BEEL: SHEDDING TEARS OF THE ONLY RAMSAR SITE OF ASSAM

-Himashree Konwor*

''How sad to think that nature speaks and mankind doesn't listen.''

-Victor Hugo

I. INTRODUCTION

Environment is the most precious thing in this entire world. The state of Assam is the heart of the entire North-East India region and holds a hidden gem of biodiversity and natural beauty. Deepor Beel, which is an important freshwater lake in Assam, is not just a stunning landscape but also a vital ecosystem that owns a variety of flora and fauna. Sadly, this wetland has been fighting for its existence against the threats it faces from human activities, pollution, encroachment, and uncontrolled urbanization. Proper actions shall be taken to preserve the Deepor Beel from deterioration. This article tries to analyse the problems encountered and the actions taken by Governmental and Non-Governmental organizations to protect the wetland.

1.1 Understanding Deepor Beel

'Deepor Beel' is an Assamese name that comes from the Sanskrit word 'Dipa' meaning elephant and the Assamese word 'Beel' meaning wetland or large aquatic body, which means Lake of Elephant. Because of its rich wetland biodiversity, it was listed as a Ramsar site in November 2002 under the Ramsar Convention on Wetlands, 1971. Deepor Beel is the only Ramsar site located in Assam. It is also designed as a 'Wetland of International Importance' under the same convention. The Beel is situated 18 kilometers southwest of Guwahati city in Assam. The region is 40 square kilometers, including 4.14 square kilometers designated as a Wildlife Sanctuary by the Assam Government in 1989.[1] The maximum depth of the wetland is 4 m, whereas the average depth is 1m. Deepor Beel exemplifies the wetlands in the Burma Monsoon Forest biogeographic area.[2] Deepor Beel is a permanent freshwater lake that has rich

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[1] ASSAM INFO, HTTP://WWW.ASSAMINFO.COM/TOURIST-PLACES/37/DIPOR-BIL-OR-DEEPOR-BEEL.HTM (LAST VISITED FEB. 22, 2024).

[2] MK Saikia, PK Saikia & R Bhatta, *Managament Perspectives For Avian Population Conservation And Enrichment In Deepor Beel Ramsar Site*, *North-East India*, 3(2) JOURNAL OF GLOBAL BIOSCIENCES 428, 428-451 (2014).

ecological significance. It is encircled by nearly fourteen villages and several educational and other institutions. It provides a livelihood to the villagers, who are directly dependent on the freshwater fish of the Beel.

1.2 Flora and Fauna of Deepor Beel

Deepor Beel is also enriched with diverse flora and fauna. The Beel is popularly known for birds and it accommodates a huge number of residential birds. In addition to this, it also welcomes an abundance of migratory birds every year, especially in the months of winter. It has 220 species of birds, of which 70 species are migratory.[3] Some endangered species of birds can also be found in this Beel. Among the species that may be seen in this area are the white-eyed pochard, the greylag geese, the Baer's pochard, the gadwall, and a dabbling duck, amongst others. Apart from birds, the Beel also contains several other aquatic species. It has more than 50 indigenous species of fish, 20 salamanders, 12 reptiles, 18 ophidians, 6 turtles, etc. It also holds various aquatic plants like floating water orchids, dwarf hair grass, water nymphs, Nymphaea rubra, nile cabbages, water lentils, wild celery, water thyme, water spinach, etc.

II. DISRUPTION TO THE ECOSYSTEM OF DEEPOR BEEL

Deepor Beel has a very unique and rich biodiversity. Unfortunately, the ecosystem of this Beel is in a hazardous situation because of several environmental challenges. The ecological degradation of this Beel has become a major concern for environmentalists. In recent years, Beel has shrunk by at least 35%. Originally, the wetland had about 6,000 hectares of area, but now it officially has 4,014 hectares of area. The reduction in wetland area is one of the primary reasons for the deterioration of its ecosystem.

Water pollution is also affecting the environment of Deepor Beel. The quality of the water of the wetland is worsening, and it is becoming a significant threat to the Beel. It is generally agreed that the primary cause of water pollution is the presence of pollutants such as fertilizers, pesticides, suspended solids, biomedical wastes, industrial water waste, and non-point sources, amongst others. These toxic elements are harming the overall health of aquatic communities in wetland systems. Overgrowth of algae and suspended soil Turbidity inhibits transparency and photosynthesis in the deeper levels of the water column, reducing algae and

[3] *Supra,* note 1.

water hyacinth production and increasing fish productivity.[4] Connections of the small rivers like Khandajan, Kalmoni and Basistha to the Beel are also being disrupted. Apart from this, Mora Bharalu which is a 13.5 km abandoned river carries a huge amount of untreated sewage to Deepor Beel. This untreated sewage is posing a risk to the lives of aquatic species.

Another great concern regarding Deepor Beel is the dumping site near the Beel. The Boragaon dumping yard lies in the eastern corner of the wetland. It has been functioning since 2005 under the control of the Guwahati Municipal Development Authority. The contaminated waste from this dumping site is affecting the entire habitat of Deepor Beel. Because of consuming trash from the dumping site, birds and other species are losing their lives every year.

The 2001 North-Eastern Frontier Railway route at Deepor Beel's southern edge concerns the wetland. The railway road has fragmented the Beel into two parts. Water flow blockage is the result of this railway road, which disturbs the entire ecosystem of the wetland. It also interferes with the calm environment of the Beel. The biggest tragedy is that because of this railway line, elephants, birds and other species are suffering the loss of their lives.

One more significant threat to the wetland is the unplanned urbanization around the Beel. In recent decades, Beel has lost a huge amount of its water-spread area. If the construction continues, it could give rise to flash floods in the area shortly. The growing educational, commercial and residential activities have raised a great concern for the ecosystem of the Beel.

Deepor Beel has been battling for its survival due to all these sad realities. The number of migratory birds is degrading every year. Some recent research shows us the unsatisfactory picture of the wetland. A study conducted by an NGO named 7WEAVES in its second edition of the Deepor Beel Winter Birding Festival (WBF) found that about 11,000 migratory water birds of 155 species came to Deepor Beel in January this year.[5] This number is very low as compared to last year.

III. GREEN WATCHDOG TO PRESERVE THE WETLAND

[4] Nibedita Kapil & Krishna G. Bhattacharyya, *Spatial, Temporal and Depth Profiles of Trace Metals in an Urban Wetland System: A Case Study with Respect to the Deepor Beel,Ramsar Site,* 2(1) CCSE, 51 (2013).
[5] Sandeep Sharma, *Assam: Deepor Beel in crisis, bird numbers plummet in latest count*, NORTHEAST NOW (Feb. 22, 2024, 9:24 PM) https://nenow.in/north-east-news/assam/assam-deepor-beel-in-crisis-bird-numbers-plummet-in-latest-count.html.

Deepor Beel has great biological importance for the entire North-East region of India. It is one of the largest aquatic bodies and attracts a great number of migratory flyways, especially in winter.[6] Initiatives have been taken to preserve the wetland on international and national stages. Residents and other non-governmental organizations are also playing a remarkable role in the conservation of the Beel.

3.1 Constitutional Measures

The Constitution of India provides a mechanism to safeguard environmental resources. By the Constitution 42nd Amendment Act, 197, Article 48A has been added to Part IV of the Constitution to preserve environmental resources. Under this provision, the constitution directs the state to endeavor to protect and improve the environment and to safeguard the forest and wildlife of the country.[7]

Another Directive Principle provided under the constitution is to foster respect for international law and treaty obligations in the dealings of organized people with one another.[8] Under this provision, the state has the responsibility to respect international treaties and conventions. The state is obliged to respect the Ramsar Convention of 1971 to preserve and protect the wetlands. Deepor Beel was added as a 1207 Ramsar site in the year 2002. Deepor Beel has also been selected as one of the Important Bird Area (IBA) sites by Birdlife International because of its unique identity and richness of avian fauna.

The Indian Constitution also mandates that its residents exhibit compassion for all living things and preserve and enhance the country's natural environment, which includes its forests, lakes, rivers, and animals.[9]

3.2 Initiatives Taken by the Government and other Non-Governmental Organizations

The State Government of Assam is playing its role in a very significant way to conserve and restore Deepor Beel. It has been consistently trying to fulfil the international and national obligations of saving the ecology of the Beel. The state government is concerned enough to develop Guwahati City without hampering the biodiversity of the wetland. The state government declared 4.14 sq km of the wetland a wildlife sanctuary in the year 1989. It was

[6] RAMSAR SITE INFORMATION SERVICE, https://rsis.ramsar.org/ris/1207 (last visited Feb. 23, 2024).
[7] INDIA CONST. art. 48A.
[8] INDIA CONST. art. 51.
[9] INDIA CONST. art. 51A.

the very first step that has been taken by the government of Assam to protect the bird habitat of the Beel.

The Pollution Control Board of Assam also has the responsibility to control pollution of the Beel. It releases its action plan for rejuvenation, protection and management of the Beel as per the directions given by the National Green Tribunal. The primary aim of the Board is to control industrial pollution and water management around the Beel.

The Assam Science, Technology, and Environment Council, under the Government of Assam, is also leading efforts to conserve the wetland. It focuses on the regeneration of the wetland. The Council has completed the regeneration of about one-kilometer-long area with about 50 meters of width on the outside of the core area of Deepor Beel. [10] The council also works for the development of alternative drinking water facilities for the villagers. A tree plantation drive is also being carried out by the council with the help of the local communities.

Assam Chief Minister Himanta Biswa Sarma is also sensitive enough to take action against the ecological degradation of Deepor Beel. In the last year, he has spearheaded efforts to raise the lake's water level to 1.5m. This strategic measure aims to restore Deepor Beel's natural habitat and support its diverse flora and fauna. [11] Recently, he has also launched Eco-Tourism plans for the Beel. It is a beautification plan that shall be carried out by the Government of Assam.

The role of other non-governmental Organizations and residents cannot be ignored in the preservation of the environment of Deepor Beel. The Institute for Science and Technological Research (INSTER) started its first campaign for the conservation of Deepor Beel in the year 1989 by reaching out to the Government of Assam, the Government of India and other Mass media to look into the matter of ecological deterioration of the wetland.

Aranyak is another important organization that has been fighting for the existence of Deepor Beel since 1990. It has been raising its voice against several activities that harm the wetland. It has launched capacity building in the villages around the Beel. Early Bird, a grass-roots environmental organization is also taking initiatives to protect the wetland. It is running

[10] ASSAM SCIENCE TECHNOLOGY ENVIRONMENT COUNCIL, https://astec.assam.gov.in/portlet-sub-innerpage/development-and-management-of-deepor-beel (last visited on Feb. 24, 2024).
[11] THE STORY MUG, https://thestorymug.com/assam-cm-spearheads-efforts-to-protect-deepor-beel/ (last visited on Feb. 24, 2024).

an awareness program on sustainable ways of living by collaborating with the communities living on the southern fringe of the wetland.

Deepor Beel Ramsar Site Conservation Community is an informal non-profit education research group of Gauhati University, Assam, which is tremendously making an effort to conserve the Beel. This group is working to influence the legislative and administrative branches of the central and state governments to conserve the wetland.

IV. JUDICIAL STANCE ON CONSERVATION OF THE ONLY RAMSAR SITE OF ASSAM

The role of the judiciary in preserving the environment has always been applauded. The responsive efforts of the judiciary focus on the conservation and protection of the ecological diversity of the wetlands. The judiciary is also concerned about the degraded ecosystem of the Deepor Beel. The Gauhati High Court, the guardian body of the judiciary in the state, has been sensitive to maintaining the environment of the wetland.

The Gauhati High Court, while hearing a public interest litigation filed by Pramod Kalita along with other environmentalists [12] , has shown its deep concern for the wetland. The government has been instructed by the court to acknowledge the PIL and to take the necessary steps to preserve the Beel. The petitioner claimed that the current municipal garbage disposal projects near the wetland violated the Solid Garbage Management Rules and Wetland (Conservation and Management) Act, 2016. They claimed that the installation of a second railway track near the Beel was done without following a thorough wildlife management plan[13]

The Division Bench of the Gauhati High Court, including Chief Justice Sandeep Mehta and Justice Suman Shyam, has provided recommendations to the state government about the preservation, improvement, and beautification of the Beel. The court has recommended constructing a promenade, cycling track and walking track on the entire outer edge of the wetland. It will welcome the possibility of organizing various sports and other events at the national and international level. The court has also suggested the state government set up the facilities for promoting tourism alongside the promenade.

[12] Pramod Kalita & others v. Union of India & others (PIL/18/2023).
[13] Mukut Das, *Gauhati HC poser to Centre, state on two Deepor Beel pleas*, THE TIMES OF INDIA (Feb. 24, 2024, 10:13 PM), https://timesofindia.indiatimes.com/city/guwahati/hc-poser-to-centre-state-on-two-deepor-beel-pleas/articleshow/98746693.cms.

4.1 National Green Tribunal

The National Green Tribunal has also taken the initiative to rescue the ecosystem of Deepor Beel. NGT in the year 2018 has constituted a committee to find out the movements of elephants to the Beel. It is a six-member committee headed by Assam's chief secretary and consisting of senior railway and forest officials. It aimed to construct an underpass to allow the unhampered movement of elephants and other animals, etc. [14]

The Tribunal expressed its discontentment while disposing of a petition filed by Environment Rohit Chaudhury for ensuring control over sewage flow into the wetland. The Tribunal, while hearing the petition, gave directions to declare 'Deepor Beel' as an 'Eco-Sensitive Zone'. It has also directed that the aquatic body of the wetland should be made free from all the toxic waste and at least the main area of the Beel reinstated to its original condition. In connection with this, a report shall be submitted by the state in its affidavit.[15]

Following the direction of the Union Environment Ministry, have taken the necessary steps to build a consolidated solid waste management facility. Accordingly, the dumping of solid waste in Deepor Beel has ceased since 2021.

CONCLUSION

Deepor Beel holds a unique, incredible biodiversity and unique ecological richness that our planet harbours. It provides a home to numerous species of birds and animals. The wetland also supports the local communities in earning their livelihood. However, threats such as water pollution, unplanned waste management systems, excessive urbanization, etc. are posing a danger to the fragile wetland. Both the general public and the government must recognize the importance of this natural treasure. The ecosystem of the Beel needs proper sustainable management practices so that its future existence can be ensured. No government plan to conserve the environment shall succeed without public cooperation. The common people residing near the Beel should have a positive attitude towards the long-term preservation of the unique ecosystem. Safeguarding Deepor Beel will not only ensure the conservation of a

[14] Utpal Parashar, *Green watchdog dissatisfied at efforts to save Deepor Beel wetlands in Assam*, HINDUSTAN TIMES (Feb. 23, 2024, 10:24 AM), https://www.hindustantimes.com/india-news/green-watchdog-dissatisfied-at-efforts-to-save-deepor-beel-wetlands-in-assam-101651592257854.html.
[15] Divya Bahn, *NGT directs Assam government to declare 'Deepor Beel' as an eco-sensitive zone*, THE NEW INDIAN EXPRESS (Feb. 23, 2024, 2:43 PM,) https://www.newindianexpress.com/nation/2019/Aug/22/ngt-directs-assam-government-to-declare-deepor-beel-as-an-eco-sensitive-zone-2022734.html.

beautiful landscape but also uphold the protection and restoration of the environment for future generations.

HUMAN RIGHTS AND CLIMATE CHANGE: THE UNTOLD MISERY OF REFUGEES

-Yagya Agarwal*

I. INTRODUCTION

Across the globe, climate change has been identified as one of the major causes of displacement and those who have been moved are frequently the most sensitive to its impacts[1]. It is essential to understand the fundamental terms and concepts involved before going into the intricate relationship between climate change and human rights. We must grasp what we mean by climate change and what human rights entail.

1. Climate change is defined as a shift in climate that is caused by human activity and modifies the composition of the ecosystem, in addition to natural climate variability observed over comparable time periods[2].

2. Human rights are the basic rights and freedoms that every person is entitled to, regardless of race, gender, nationality, religion, or other status. These rights include civil and political rights like freedom of speech, as well as economic, social, and cultural rights like the right to education and healthcare[3].

The intersection of these two concepts highlights the challenges faced by displaced persons who are impacted by climate change.

II. HOW CLIMATE CHANGE VIOLATING HUMAN RIGHTS

Climate change has widespread ramifications, including political, economic, social, technological, and environmental, but in these all, we often tend to ignore the most significant aspect i.e., the violations of human rights of persons who are affected by the changing climate. India is a country that has been particularly susceptible to the effects of climate change, with numerous regions experiencing severe weather events including floods, droughts, and heat waves. Among them, droughts pose a major concern in India, particularly in the country's

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[1] *Climate Change Link to Displacement of Most Vulnerable Is Clear: UNHCR*, UN NEWS, (Apr. 26, 2021) https://news.un.org/en/story/2021/04/1090432.

[2] The United Nations Framework Convention on Climate Change, 1994, art. 1(2).

[3] Universal Declaration of Human Rights, art. 2.

western regions. The droughts of 2015 and 2016 affected over 330 million people in India and resulted in the displacement of over 6 million[4].

Floods and landslides are some of the most common climate-related disasters in India. In August 2018, the state of Kerala in southern India experienced its worst floods in almost a century, affecting over 5 million people and leading to the displacement of over 1 million[5]. In 2019, Cyclone Fani hit the eastern coast of India, affecting over 14 million people, and causing the displacement of over 1.2 million[6].

According to the Internal Displacement Monitoring Centre (IDMC) report "Global Report on Internal Displacement 2021, in 2020 alone, India had the highest number of people displaced due to climate-related disasters in the world, with over 9 million people forced to leave their homes[7]. A report released by the Centre for Science and Environment has revealed that India has faced extreme weather events on almost 90 percent of days in the first nine months of 2022[8].

The recent natural calamity that occurred in Joshimath, Uttarakhand in 2023 is a stark reminder of the impact of climate change on human rights. It has been reported that the subsidence in Joshimath is expected to have a significant impact on around 35% of the families residing there. Hundreds of families have been evacuated to shelters due to concerns for their safety, and it remains uncertain whether they will be able to return to their homes, as the government has deemed the area unsafe for habitation[9].

In India, most of the climate refugees are internal refugees who move within the country, but there are also instances of cross-border displacement, particularly in the case of people living

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[4] *Govt says 33 crore people suffering from drought*, LIVE MINT (Apr. 20, 2016) www.livemint.com/Politics/ZVHDdIwnXz6Xm7vxAUV2aO/Govt-says-33-crore-people-suffering-from-drought.html.

[5] *Kerala Floods Led to Most Casualties Among Extreme Global Events in 2018: Climate Report,* THE INDIAN EXPRESS (Dec. 1, 2018), https://indianexpress.com/article/india/kerala-floods-led-to-most-casualties-among-extreme-global-events-in-2018-climate-report-5473610/.

[6] United Nations International Children's Emergency Fund, Cyclone Fani Situation Report 2, (May 12, 2019), https://www.unicef.org/media/82111/file/India-Cyclone-Fani-SitRep-12-May-2019.pdf.

[7] Internal Displacement Monitoring Centre, Report of Global Report on Internal Displacement for 2020 (May, 2021)

[8] Sirur Simrin, *Nearly 90% of Jan-Sept Days Saw Extreme Weather Events in Some Part of India, Says New Report,* THE PRINT (Nov. 2, 2022) https://theprint.in/environment/nearly-90-of-jan-sept-days-saw-extreme-weather-events-in-some-part-of-india-says-new-report/1192785/.

[9] Sayantani Biswas, *Joshimath 'unsafe for living', 60 families evacuated, 90 in the waiting*, LIVE MINT, (Jan. 8, 2023), https://www.livemint.com/news/india/uttarakhand-joshimath-unsafe-for-living-60-families-evacuated-90-in-the-waiting-latestupdates-11673179293743.html (Last visited 10 February, 2023)

in border areas. A wide variety of human rights, including the rights to life, development, food, water, sanitation, and health, are significantly impacted by climate change. These rights are indivisible and linked, and climate change makes them more vulnerable.

The ability of climate change to cause extreme weather events, such as storms, droughts, and heatwaves, which can result in loss of life and property, to occur puts the right to life at danger. Disasters brought on by climate change disproportionately afflict weaker populations, frequently resulting in fatalities and economic losses. The right to development is compromised by climate change's negative effects on social, economic, and cultural advancement. Disasters brought on by climate change drain funds away from development priorities like health and education, which keeps poverty and inequality alive. Food insecurity results from climate change's disruption of agricultural productivity, which jeopardizes the right to food. Societies that depend primarily on agriculture for survival and are prone to harvest failures are particularly affected. Climate change-induced water shortage threatens the right to water and sanitation, heightening competition for this vital resource. As they are entrusted with carrying water and have special demands that are not met, women and girls frequently shoulder the bulk of the responsibility. The hazards to the right to health are growing because of climate change. The most vulnerable people are most likely to be negatively impacted by factors including air pollution, vector-borne illnesses, and rising temperatures, which can all contribute to a decline in physical and mental health.

III. NAVIGATING THE SEA OF LEGAL FRAMEWORK

Given the increasing number of people being displaced due to climate change events such as floods, cyclones, droughts, and landslides, it is pertinent to understand the legal framework in place in India for providing protection and assistance to such individuals.

It is worth noting that India is a signatory to the Universal Declaration of Human Rights. The first law that comes to mind for the protection of such displaced persons is the Indian Constitution, which guarantees several fundamental rights, including the right to life and personal liberty under Article 21. In Subhash Kumar v. State of Bihar[10], the Supreme Court of India held that the right to a clean environment is a fundamental right under Article 21 of the Constitution, and this ruling could be applied to all individuals, including climate refugees. These rights are applicable to all individuals, including displaced persons, and may provide

[10] AIR 1991 SC 420.

some level of protection against human rights violations caused by climate change-related displacement.

Despite the lack of specific law protecting persons affected by climate change, India has enacted numerous rules and regulations that give some protection to displaced people who have been relocated. Laws such as the National Disaster Management Act of 2005 govern how natural catastrophes are handled, including the provision of help and rehabilitation to those affected. To respond to disasters, the Act also requires the development of a National Disaster Response Force[11] and a State Disaster Response Force[12].

The National Action Plan on Climate Change, established in 2008, is another document that includes the development of adaptation and mitigation strategies. The strategy recognizes the need to protect vulnerable populations, particularly displaced people, and includes programs to strengthen vulnerable communities' resilience to the effects of climate change.

IV. PAVING A PATH FOR SUSTAINABLE TOMORROW

All these sections demonstrate that India's legal system lacks a specialized framework for dealing with human rights violations caused by climate change. Indian legislation must be broad and thorough to safeguard those whose human rights have been violated because of climate change. Following are a few suggestions that can be deployed for tackling the issues of climate change displacement.

I. **Creating a National Policy on Climate Refugees:** India should develop a comprehensive national policy. Climate refugees should be given special status under this policy, allowing them access to essential services. It must include clear safeguards for human rights, including the rights to life, dignity, housing, food, and water both before and after relocation, as well as the right to health. For climate refugees, it is important to guarantee equal access to social services, healthcare, and education. Guidelines for community engagement, data collecting, and resettlement and rehabilitation must be ethical and sustainable. Management of cross-border displacement necessitates cooperation with international organizations and neighbouring nations.

[11] The National Disaster Management Act, 2005, §12.
[12] The National Disaster Management Act, 2005, §14.

II. **Preserving Traditional knowledge:** Optimising resource management for agriculture and forestry depends on preserving and making sustainable use of the traditional knowledge that local communities and indigenous peoples possess. This requires appreciating the worth of indigenous knowledge and incorporating it into contemporary conservation techniques. Giving indigenous peoples and other local populations land rights is also a crucial step in preserving trees and improving carbon storage.

III. **Strengthening Mitigating efforts**: People should come first in efforts to combat and adapt to climate change, with an emphasis on gender sensitivity and the Défense of the rights of vulnerable groups including women, children, indigenous communities, and those who are poor. To make sure that climate efforts benefit people who face the greatest risks, these programs should be led by extensive impact analyses.

IV. **Improving Access to technology:** To successfully address the problems caused by climate change, fair and equal access to technology must be ensured. To do this, intellectual property rules may need to be lowered and knowledge transfer may need to be facilitated. A larger range of stakeholders, such as poor countries and marginalised groups, may have easier access to breakthrough technology with the lowering of intellectual property norms. By doing this, we can foster international cooperation in the fight against climate change and speed up the adoption of technologies that are favourable to the environment, ultimately paving the way for a more sustainable and just future for all.

V. **Enhanced financial cooperation:** Greater cooperation based on the values of equality and fairness to guarantee appropriate finance and research into adaption strategies to aid the most vulnerable individuals, organizations, and nations as well as the poorest section of society;

V. CONCLUSION

Landslides, floods, and droughts have harmed millions of people in India, which is particularly vulnerable to the effects of climate change on human rights. Uprooted climate refugees face a range of challenges, including the loss of their homes and possessions, difficulty accessing essentials, and marginalization and hostility in their new communities, all of which compound food insecurity. Even if present laws and regulations provide some protection, India must take other steps, such as adopting a national strategy for climate refugees, increasing disaster risk reduction initiatives, enhancing access to justice, and supporting sustainable development

practices. The Indian court can safeguard persons who are relocated owing to climate change by integrating climate change-related displacement in the present legal framework for disaster management.

ASSESSING THE ECONOMIC IMPACTS OF CLIMATE CHANGE ON THE NORTH EASTERN STATES OF INDIA: CHALLENGES, VULNERABILITIES, AND ADAPTATION STRATEGIES

-Aparna Dumpala*

I. INTRODUCTION

Climate change poses significant challenges to the economies of regions across the globe, and the North Eastern States of India are particularly vulnerable to its impacts. This paper assesses the economic ramifications of climate change on the North Eastern States, exploring the challenges they face, their vulnerabilities, and potential adaptation strategies. The North Eastern States of India, comprising Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, are characterized by rich biodiversity, diverse ecosystems, and unique cultural heritage. However, they are also highly susceptible to the impacts of climate change due to their geographical location, topographical features, and socio-economic vulnerabilities. Climate change manifests in various forms in this region, including erratic weather patterns, extreme events such as floods and droughts, and shifts in agricultural productivity.

The economic sectors of the North Eastern states, including agriculture, forestry, fisheries, and tourism, are profoundly affected by climate variability and change. These impacts exacerbate existing socio-economic challenges, including poverty, food insecurity, and inadequate infrastructure. Moreover, climate-induced disruptions often disproportionately affect marginalized communities, exacerbating social inequalities. Understanding the economic implications of climate change on the North Eastern states is crucial for devising effective adaptation and mitigation strategies.

Climate change is a serious threat to socio-economic development globally and in India. It is a worldwide peculiarity, brought about by human exercise, and is a developing test for mankind and a tolerable turn of events. Rather than strength, which is how much

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geophysical, natural, and financial frameworks bounce back, recover, or recuperate from the adverse consequences of environmental change, weakness to environmental change is how much these frameworks are helpless to, and unfit to adapt to, the unfavorable effects of environmental change.

Indians are particularly inclined towards the impacts of environmental change in view of their high dependence on the climate for food and livelihood. Therefore, improving our knowledge of how climate variability will behave in the future is essential for both mitigating disasters and creating adaptation plans. In this regard, determining India's level of climate change vulnerability is crucial to developing adaptation plans, particularly for the regions and industries with the highest levels of risk. The frequency of crime, unrest, and violence, as well as the worker's physical and mental performance, energy demand, and agricultural production, have all been found to be impacted by temperature.[1]

II. AGRICULTURAL SECTOR VULNERABILITY

The distinct geographical and biological features of the northeastern regions of India make the agriculture sector especially susceptible to the effects of climate change. Rainfall patterns are predicted to shift as a result of climate change, increasing precipitation variability and unpredictability. This may lead to floods or droughts, which might both have disastrous impacts on the area's agricultural output. Crop productivity and growth may be impacted by rising temperatures. Elevated temperatures have the potential to hasten evaporation rates, resulting in the depletion of soil moisture and decreased crop productivity, especially for plants susceptible to heat stress.[2] It can also influence the distribution and abundance of pests and diseases, leading to new pest outbreaks or shifts in the timing and intensity of existing ones. This can pose significant challenges to crop management and reduce yields[3].

[1] L. Chandy, *Economic Development in an Era of Climate Change*, CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE (2023).
[2] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, *THE IMPACT OF DISASTERS AND CRISES ON AGRICULTURE AND FOOD SECURITY: 2021* (2021).
[3] B.C. Barah, *Strategies for Agricultural Development in the North-East India: Challenges and Emerging Opportunities*, 62 INDIAN J. AGRIC. ECON. 1 (2007).

The northeastern states of India depend heavily on glaciers and snowmelt for water supply. Glacial retreat due to rising temperatures can disrupt water availability for irrigation, affecting crop production, especially during the dry season. Expanded force and recurrence of outrageous climate occasions, for example, weighty precipitation can set off avalanches and soil disintegration, prompting the loss of arable land and harm to harvests and the foundations[4]. It additionally influences biodiversity in the locale, including the deficiency of local plant and creature species that are significant for keeping up with environmental administrations, for example, fertilization, bug control, and soil ripeness. Weakness to environmental change in the horticultural area can worsen existing financial difficulties in the northeastern states, including neediness, food uncertainty, and provincial vocations reliant upon farming.[5]

III. WATER RESOURCES MANAGEMENT

The North East districts of India are known for their plentiful water assets, including streams, lakes, and wetlands. Nonetheless, environmental change is supposed to essentially affect water accessibility, quality, and dispersion in the locale, with suggestions for different areas, for example, hydropower generation, water systems, and drinking water supply. Environmental change is probably going to adjust precipitation designs in the North East, prompting expanded fluctuations and changes in the timing and force of precipitation. While certain areas might encounter heavier precipitation and expanded flooding, others might confront more delayed droughts and dry spells. The Himalayan glacial melt that contributes to the waterways in this area also has an impact. Nonetheless, increasing temperatures related to environmental change are speeding up glacial retreat, influencing the timing and volume of water streams. At first, this could prompt an expanded stream as ice sheets liquefy, followed by a decreased stream as glacial mass lessens over the long haul.

[4] L. Priscilla, P. R. Sharma, & P. Kar, *Economic Impact of Crop Diversification in North-East India: Evidence From Household-Level Survey*. SOCIAL SCIENCE RESEARCH NETWORK (2021).
[5] A. Roy, D. Kolady, NU Singh, D Chakraborty, SM Feroze & Anjoo Yumnam, *Impact of climate change on agriculture in north-east India: A case study in Meghalaya*, PHARMA INNOVATION, 282-286 (2022).

Furthermore, increased competition for water resources between hydropower generation, irrigation, and other sectors could exacerbate water scarcity issues[6]. Changes in precipitation patterns and altered river flows can also impact the availability and quality of drinking water in the region. Increased flooding can lead to contamination of water sources with pollutants and sediments, affecting water quality and posing risks to public health. Conversely, prolonged dry spells and reduced river flows can lead to water shortages, particularly in urban areas, exacerbating water stress and necessitating the implementation of water management strategies and infrastructure improvements.

IV. BIODIVERSITY AND ECOTOURISM

Climate change poses significant threats to ecotourism in Nagaland, Manipur, and Mizoram, known for their biodiversity[7]. Habitat loss, species migration, and biodiversity decline reduce the region's appeal to ecotourists. Climate-induced changes disrupt ecosystems and diminish wildlife viewing opportunities. Climate change can also trigger shifts in the distribution and migration patterns of wildlife species as they adapt to changing environmental conditions. While some species may expand their range into new areas, others may decline or face local extinctions. Consequently, tourist arrivals and revenue for local communities decline, impacting livelihoods. Conservation efforts are crucial to mitigate these impacts and promote sustainable ecotourism. Collaboration among stakeholders is essential to address challenges posed by climate change and ensure the long-term viability of ecotourism in the region.

V. INFRASTRUCTURE AND URBAN RESILIENCE

[6] Akshit Sangomla, *Climate Crisis in North East India: What Is Behind Water Scarcity in the Region*, DOWN TO EARTH, (May 27, 2024), https://www.downtoearth.org.in/news/climate-change/climate-crisis-in-north-east-india-what-is-behind-water-scarcity-in-the-region-78910.

[7] THE WORLD BANK, https://www.worldbank.org/en/news/feature/2013/06/19/india-climate-change-impacts, (last visited March 31, 2023).

Urban centers in the North East region of India are vulnerable to various climate-related hazards, including floods, landslides, and cyclones, which pose significant risks to infrastructure, public safety, and economic stability. Urban areas in the North East are prone to flooding due to heavy rainfall, poor drainage systems, and deforestation in surrounding areas. Floods can damage roads, bridges, buildings, and other infrastructure, disrupt essential services such as water supply and electricity, and pose risks to public health and safety. The economic costs of flood damage include repair and reconstruction of infrastructure, loss of property and livelihoods, increased healthcare expenses, and loss of revenue due to business disruptions. Steep terrain and intense rainfall make urban centers in the Northeast susceptible to landslides, which can damage roads, buildings, and utility infrastructure, disrupt transportation networks, and lead to loss of life and injuries. Landslides also pose challenges for emergency response and rescue operations, increasing the economic costs associated with disaster recovery and rehabilitation efforts.

While cyclones are less frequent in the Northeast compared to coastal regions, they can still occur and cause significant damage to urban infrastructure and communities[8]. Strong winds, heavy rainfall, and storm surges associated with cyclones can lead to structural damage, flooding, power outages, and the displacement of populations. The economic costs of cyclone damage include rebuilding homes and public infrastructure, restoring utility services, and providing humanitarian assistance to affected communities.

VI. INDIGENOUS COMMUNITIES AND TRADITIONAL KNOWLEDGE

Indigenous communities in Tripura, Sikkim, and Arunachal Pradesh are utilizing their traditional knowledge and adaptive strategies to respond to the challenges posed by climate change. These strategies may include diversification of livelihoods, adoption of resilient crop varieties, agroforestry practices, community-based natural resource management, traditional water harvesting techniques, and indigenous early warning systems for weather-related hazards. By drawing upon their traditional knowledge and cultural resilience, these communities are able to adapt to changing environmental

[8] NITI AAYOG, https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf, (last visited Oct. 22, 2020).

conditions and mitigate the impacts of climate change on their livelihoods and well-being[9].

Recognizing the importance of traditional knowledge and adaptive strategies, efforts are being made to integrate indigenous perspectives into climate change adaptation and resilience-building initiatives. Collaborative projects between indigenous communities, government agencies, NGOs, and researchers are facilitating the documentation, validation, and dissemination of traditional knowledge, as well as supporting community-led initiatives for sustainable resource management, capacity-building, and policy advocacy. By strengthening the resilience of indigenous communities and honoring their traditional knowledge systems, these initiatives contribute to more holistic and effective responses to climate change in the region.

VII. IMPACT ON FISHERIES

Climate change is drastically affecting the fisheries economy in northeastern India, where abundant rivers, lakes, and freshwater bodies support diverse aquatic life. Rising temperatures are altering water temperatures, impacting fish distribution and behavior, especially for cold-water species. Changes in precipitation patterns cause fluctuations in water levels and flow, disrupting fish habitats and migration routes. Moreover, increased carbon dioxide levels lead to ocean acidification, harming plankton and essential habitats like wetlands and coral reefs. Extreme weather events like cyclones damage fishing infrastructure, vessels, and aquaculture, disrupting livelihoods. As fish populations move to new areas, traditional fishing grounds are affected, requiring adjustments in practices. These climate impacts worsen poverty and vulnerability in coastal and riverine communities heavily reliant on fishing for income and food security[10].

[9] Arunav Goswami, *Northeast India's Climate Conundrum: Navigating the Impacts on Ecosystems and Communities*, NEZINE (May 27, 2024), https://www.nezine.com/info/a25CRTV2UzJISnF4bkRPRi84ZmV2QT09/northeast-india%60s-climate-conundrum:--navigating-the-impacts-on-ecosystems-and-communities.html.

[10] B.C. Borah*, Impact of climate change-induced challenges on fisheries in the North Eastern Region of India and the way ahead*, 24(3) AQUATIC ECOSYSTEM HEALTH & MANAGEMENT 94, 94–102 (2021).

VIII. CONCLUSION AND SUGGESTIONS

Addressing these vulnerabilities requires a combination of adaptation and mitigation measures, including the development and promotion of climate-resilient crop varieties, improved water management practices, soil conservation measures, early warning systems for extreme weather events, and policies that support diversified livelihood options for rural communities [11] . Collaboration between governments, local communities, researchers, and civil society organizations is essential to effectively address the challenges posed by climate change in the agricultural sector of the northeastern states of India.

8.1 Policy Responses and Adaptation Strategies

Here's an evaluation of existing climate change policies and adaptation initiatives, along with recommendations for enhancing adaptive capacity and promoting sustainable economic development:

8.1.1 Existing Policies and Programs

a) National Action Plan on Climate Change (NAPCC): The National Action Plan on Climate Change is a document that describes a number of national climate change missions and projects. The North East's unique vulnerabilities and adaptation requirements, however, might not have been properly taken into consideration when the NAPCC projects were implemented there.
b) State Action Plans on Climate Change (SAPCCs): To address the effects of climate change at the state level, a few states in the Northeast have created State Action Plans on Climate Change. The effectiveness of these plans, which include adaptation, mitigation, and capacity-building strategies, may differ depending on how they are implemented and how resources are allocated.
c) Government Initiatives: Governments in the North East have launched programs and projects to address climate change impacts, such as afforestation schemes, water resource management projects, and disaster risk reduction initiatives.

[11] J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, *Climate Change Impacts in the United States*, 52 THE THIRD NATIONAL CLIMATE ASSESSMENT, 150-174 (2014).

However, coordination between different sectors and stakeholders may be lacking, leading to fragmented implementation.

8.1.2 Gaps and Barriers

a) Limited Data and Research: One of the main challenges in developing evidence-based policies and adaptation plans for the North East is the scarcity of comprehensive data and research on the implications of climate change.
b) Weak Institutional Capacity: Planning, carrying out, and overseeing climate change programs may be hampered by a lack of institutional capacity and technical know-how at the state and local levels.
c) Inadequate Funding and Resources: Limited financial support and resources for adapting to climate change are a major obstacle to implementation, especially in states with limited resources.
d) Inadequate Community Engagement: Limited participation of local communities in decision-making processes and a lack of awareness about climate change exacerbate vulnerabilities and hinder the effectiveness of adaptation measures.

8.1.3 Recommendations for Enhancement

a) Integrated Approach: Adopt an integrated approach to climate change adaptation that considers cross-sectoral linkages and synergies between different initiatives, such as agriculture, water management, disaster risk reduction, and biodiversity conservation.
b) Capacity Building: Building institutional capacity at the state and regional levels through knowledge-sharing platforms, training programs, and technical assistance can help to promote evidence-based decision-making and the execution of climate change efforts.
c) Community Participation: Foster greater community engagement and participation in climate change adaptation efforts through awareness-raising campaigns, capacity-building workshops, and an inclusion of indigenous knowledge and practices in adaptation strategies.
d) Enhanced Funding Mechanisms: Mobilize additional funding and resources for climate change adaptation projects through public-private partnerships, international cooperation, and innovative financing mechanisms such as climate funds and green bonds.

e) Research and Data Collection: Funding research and data collection initiatives will help the North East better understand the effects, vulnerabilities, and alternatives for adaptation to climate change. This will help with focused interventions and well-informed decision-making.

Achieving these objectives and guaranteeing a future for the North East that is more climate-resilient will require effective collaboration between governments, civil society organizations, academics, and local communities.