

**Proceedings of the International Workshop on  
Interdisciplinary Approach to Climate Change Education  
February 27–28, 2025  
Kochi, Kerala, India**

**Organized by  
INDO-DUTCH RESEARCH CENTER ON CLIMATE CHANGE LAW,  
RESEARCH AND EDUCATION  
In collaboration with  
Government Law College, Ernakulam  
Van Vollenhoven Institute for Law, Governance & Society,  
Leiden University, The Netherlands.**

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**Climate Change and Legal Education -Vol. 2  
Socio-Legal Issues & Local Adaptation**

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**Edited By**

**Dr Dayana MK and Dr. Rhea Roy Mammen**

# **Climate Change and Legal Education -Vol. 2**

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**Climate Change and Legal Education -Vol. 2**  
**Socio-Legal Issues & Local Adaptation**

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## **PREFACE**

The path between two worlds beckons us forward. On one side stands the withered tree of our extractive past—its branches bare, its roots drawing sustenance from depleted soil. On the other flourishes the tree of regenerative possibility, verdant with life, rooted in restored earth. The dirt track winding between them is more than a metaphor; it is the educational journey this volume seeks to chart.

Education has always been humanity's most powerful tool for transformation. Today, as we face the greatest challenge in human history, legal education must evolve beyond the transmission of precedents and procedures to become a catalyst for planetary healing. This second volume acknowledges that the lawyers, judges, policymakers, and advocates we train today will shape whether future generations inherit a barren landscape or a flourishing ecosystem.

Global frameworks for climate action exist—from the Paris Agreement to the emerging doctrine of ecocide, from indigenous legal traditions to cutting-edge Earth system law. Yet their potential remains largely untapped, their promise unfulfilled. The gap between international commitment and local implementation, between legal theory and lived reality, between what we know and what we do, represents one of the defining challenges of our time.

This educational imperative has found its most powerful expression in initiatives like the Indo-Dutch Research Centre on Climate Justice Law



and Education. Born from the collaborative vision of Government Law College, Ernakulam, and Leiden University, Netherlands, this partnership exemplifies the international cooperation essential for addressing planetary challenges. Through innovative certificate courses and transformative workshops on climate justice, they have created a model for legal education that transcends traditional boundaries—geographic, disciplinary, and conceptual.

The contributors to this volume understand that climate education is not merely about adding environmental modules to existing curricula. It requires a fundamental reconceptualization of what it means to practice law in the Anthropocene. It demands that we prepare legal minds to think systemically, act collaboratively, and advocate fearlessly for the rights of both present and future generations.

Each chapter in this collection represents a step along that winding path—from legal systems that treat nature as property to frameworks that recognise ecological personhood, from anthropocentric jurisprudence to Earth-centred law, and from national sovereignty to planetary stewardship. The journey is neither simple nor straightforward, but it is essential.

We stand at a pedagogical crossroads. We can continue training lawyers for a world that is rapidly disappearing—one where environmental degradation was an unfortunate externality rather than an existential threat. Or we can embrace the transformative potential of legal education to nurture advocates for the world that must emerge—one where law serves not just human justice but planetary flourishing.

The students who engage with these global frameworks today will inherit both the climate crisis and the responsibility for addressing it. May this volume equip them not just with knowledge, but with the wisdom to choose the path toward the flourishing tree, the courage to advocate for systemic transformation, and the vision to see law as a tool for planetary healing.

This volume was made possible through the groundbreaking work of the Indo-Dutch Research Centre on Climate Justice Law and Education, a collaborative initiative between Government Law College, Ernakulam, and Leiden University, Netherlands. Their certificate courses and workshops on climate justice have created a new paradigm for international legal education, demonstrating that the most pressing challenges of our time require the most innovative approaches to learning and scholarship.

We thank all contributors, participants, and supporters who have made this educational journey possible, and who continue to walk the path between worlds in service of climate justice.

The future is not predetermined. It lies along the path we choose to walk. May legal education light the way toward justice for all Earth's inhabitants.

Dr. Dayana M.K.,  
Associate Professor, and Coordinator of Indo-Dutch Research Centre,  
Government Law College, Ernakulam

JUSTICE SYAM KUMAR V.M.  
JUDGE  
HIGH COURT OF KERALA  
ERNAKULAM



Madhavam, 353/11  
Snehatheeram Colony  
Behind SNDP Hall  
South Chittoor, Ernakulam  
Kerala, PIN 682 027

05.08.2025

## INTRODUCTION

Our planet is reeling under the pressures of climate change. None of us are free from its devastating impacts. Efforts are on from across all sectors of society to tackle its challenges. The legal system, being a foundational pillar of governance, is tasked with playing a pivotal role in mitigating the impacts of climate change.

The importance that law affords to this topic is revealed from the observation of the Hon'ble Supreme Court of India in **M.K. Ranjithsinh and others v. Union of India** (2024) wherein it was declared that the "right to be free from the adverse effects of climate change" is integral to the fundamental rights enshrined under Articles 21 and 14 of the Indian Constitution, which guarantees right to equality and life.

The felt necessities of the times in which we live have compelled us to evolve localised and varied legal strategies to combat the effects of climate change. Over a period of time, the impacts of climate change have become more intense and diverse, making the role that the legal system plays in shaping, regulating, and responding to environmental change both challenging and complex.

Legal interventions to tackle climate change, though, have been remarkable, yet at times they tend to be localised and singular. It is beyond doubt that we can make further strides only by consolidating

these diverse experiences and adopting a comprehensive, global perspective on the legal trajectories undertaken. Such a holistic approach could reveal to us a broader legal landscape and assist us in charting a more coherent and effective path forward.

The book at hand is an effort in the said direction.

By engaging in region-specific and localised studies, the articles in this compilation examine the rapidly evolving legal dimensions of climate change, their intersections with environmental governance, human rights, trade, health, and migration. They analyse how legal frameworks at local, national, and international levels are responding to emerging climate-related challenges and suggest the future course. A brief overview of the articles in these volumes would reveal the varied topics that they cover, as well as their academic depth and critical relevance to climate change law.

In "Challenges to the Governance of Maritime Pollution in the Arctic and the Need for a Collaborative Approach" the environmental risks posed by increased maritime activity in the Arctic are addressed. It assesses existing frameworks such as UNCLOS and the Polar Code and argues for broader cooperation between Arctic and non-Arctic states. In the present digital age, the scope of online platforms in amplifying advocacy efforts and facilitating transnational engagement is examined in the article titled "Leveraging Social Media for Climate Advocacy", which outlines the role of digital networks in mobilizing climate action. In "The Private Sector and Climate Change", the author investigates corporate social responsibility within climate governance, examining the influence and limitations of voluntary compliance in private sector responses. Drawing on a coastal adaptation case study, "The Relevance of Dutch Coastal Management Strategies for Kochi's Adaptation to Sea Level Rise" considers how international practices may inform local strategies in Kerala. "The Role of International Legal Frameworks in

Addressing Climate Change" evaluates global cooperation mechanisms and highlights the institutional limitations alongside opportunities for improving legal responses. Tensions between climate policy and international economic regimes, particularly in the context of trade and investment disputes, are analysed and explored by the author under the title "Green Deals or Legal Battles?"

The perennial issue of how climate-induced health threats intersect with legal protections in a globalised context, is reviewed with much focus on the evolving role of human rights frameworks in the article "Climate Change, Health and Human Rights". The much needed socio-legal reading of how institutional decisions and public policy contribute to mitigation efforts are dealt with elaborately in the essay "The Role of Policy and Governance in Climate Change Mitigation". An often neglected though important area of indigenous knowledge and legal protections is examined in "G.I. Law, Climate Change, and Indigenous Rights" through a broader conversation on environmental governance in Northeast India. "Changing Food Safety Standards the Era of Climate Change under the SPS Agreement" investigates how agricultural and trade-related regulations adapt to environmental shifts under WTO provisions. In "Legal Approaches to Protecting Climate Migrants," the author outlines emerging legal challenges related to climate-induced displacement and identifies gaps in existing protection mechanisms.

Coming home, the article titled "Integration of Global Models into Local Scenario: Shielding Kerala from Climate Change Issues" focuses on adapting international climate strategies to local environmental and governance conditions. "Socio-Economic Impacts of Climate Change on the Indigenous Communities of Assam" documents the consequences of climate shifts on vulnerable populations, highlighting regional disparities and resilience challenges. "Governing Climate

induced Migration in South Asia" critically examines institutional responses to environmental migration in India and Bangladesh, emphasising governance gaps. "Climate Displacement in the Global South as a Defining Ecological Tipping Point" presents a legal argument calling for more urgent responses to displacement driven by climate factors. "Climate Change and Right to Health in India" raises the question of whether the Indian legal system requires specific statutory provisions to address the health effects of climate change. "The Evolution of Climate Change Legislation in India" traces the progression of India's environmental laws, mapping the shift from general protection frameworks to climate-specific regulation. "Brahmapuram Incident A Threat to Climate" recounts a local environmental incident that occurred closer to home and evaluates its implications for policy implementation and climate accountability. Climate Modeling in Land Management discusses the role of data-driven modeling in shaping ecologically sound land use policies and management systems and the article titled "Global Strategies, Kerala's Challenges" assesses how international climate and disaster resilience models can be recalibrated to address local risks and vulnerabilities. The closing contribution, "Climate Emergency and Human Rights," reflects on the legal relevance of human rights frameworks in responding to climate crises, with particular reference to the Indian context.

This collection thus offers a diverse set of perspectives grounded in legal analysis, regional inquiry, and policy reflection. The contributions made transcend local, national, and global scales, and together they illuminate how legal institutions, governance systems, and policy mechanisms are adapting to the complexities introduced by climate change. The strength of this compilation lies in its ability to be both region-specific and globally oriented, offering localised insights while engaging with multinational legal and policy frameworks.

The final takeaway of this book, I reckon, is the need for a collaborative, adaptive, and rights-based legal approach to effectively address the complex and multidimensional impacts of climate change.

I congratulate the authors and the Government Law College, Ernakulam and Leiden University for their efforts. This compilation is a phenomenal contribution to law and climate change studies in India. I am sure that it will be well received by the learned and the layman.

Justice Syam Kumar V.M.

## MESSAGE

Venu Rajamony

Former Ambassador of India to the Netherlands;

Chairman, Future Kerala Mission, Jain University, Kochi &

Professor of Diplomatic Practice, O.P. Jindal Global University, Sonapat

It is with great satisfaction and hope that I extend my heartfelt appreciation to the Indo-Dutch Centre on Climate Change Law Research and Education for the inspiring strides it has taken since its inception. As the person who had the honour of inaugurating this vital initiative, I have followed its evolution with both pride and keen interest.

Today, the climate crisis stands as the foremost existential and developmental challenge of our century. Its consequences are already being deeply felt across continents — from the retreating glaciers of the Alps to India's drought-stricken farmlands, from unprecedented floods in Europe to devastating heatwaves across South Asia. It is no longer an issue of future generations alone; it is a humanitarian, socio-economic, and legal emergency of today. Our response must be immediate, inclusive, and internationally coordinated.

India, with its vast coastline, agrarian economy, and vulnerable communities, is at high risk of bearing the brunt of rising sea levels, water scarcity, and extreme weather events. Europe too is facing increasingly severe climate disruptions, with implications for infrastructure, public health, and energy security. For the world at large, the failure to act decisively threatens to accelerate instability, deepen inequality, and erode the very ecological foundations on which our societies rest.



In this context, legal frameworks and scholarly cooperation across borders play a pivotal role. Climate change does not recognise the jurisdictional borders that define our policies; hence, our laws and research cannot remain confined to them either. Robust climate governance requires international solidarity, shared learning, and collaborative innovation. It is here that the Indo-Dutch Centre emerges as a beacon — a unique platform fostering dialogue between legal traditions, academic communities, and the lived realities of different regions.

The Netherlands has long been a pioneer in integrating law with environmental ethics. Its leadership in climate litigation — particularly the landmark *\*Urgenda\** ruling holding the state accountable to its climate obligations — has inspired movements far beyond Europe. By channeling Dutch experience into Indian legal education and research, the Centre exemplifies the power of purposeful partnership.

The Centre's initiatives — from the interdisciplinary *\*Certificate Course\** and transformative *\*International Workshop\** to the visionary *\*Faculty Development Programme\** — are not just academic milestones; they are catalysts for systemic change. By linking legal education with climate realities, the Centre is grooming a new generation of legal minds to think globally, act locally, and legislate ethically.

Moreover, the Centre's inclusive, student-focused approach ensures that climate law is not merely taught, but experienced and reimaged through the lenses of justice, empathy, and critical inquiry. Its focus on issues such as climate-induced displacement, indigenous rights, local governance, and corporate responsibility reflects an admirable recognition of the multifaceted nature of climate justice.

In doing so, the Centre is building what international jurist and Nobel laureate Amartya Sen once called the "infrastructure of justice" — not

only by sharpening legal tools, but by fortifying the moral convictions that give them purpose.

As António Guterres, Secretary-General of the United Nations rightly warned, “Climate change is moving faster than we are. We must catch up. We must rise to the challenge — together.”

The worsening impacts of climate change compel us not just to act — but to act together. International collaboration in climate law and research is not a matter of choice; it is an urgent necessity. The Indo-Dutch Centre's seamless blending of academic integrity, cross-border dialogue, and social relevance makes it a path-setter for similar global initiatives.

I congratulate the faculty coordinators, institutional partners, scholars, student leaders, and supporters of the Centre for their vision and tireless efforts. I remain confident that this platform will continue to grow in influence and impact — contributing to a future where law is not just a shield against climate injustice, but a transformative force for ecological and human dignity.

May the work of the Centre continue to inspire, inform, and transform — within classrooms, across borders, and for generations to come.



Venu Rajamony

July 29, 2025

## **MESSAGE FROM THE DIGNITARIES**

We are delighted to present the proceedings of the International Workshop on Interdisciplinary Approach to Climate Change Education, jointly organized by the Indo-Dutch Research Center on Climate Change Law, Research and Education, which is co-jointly honoured by the Higher Education Department, Government of Kerala under the aegis of Government Law College, Ernakulam, and the Van Vollenhoven Institute of The Netherlands.

This workshop stands as a remarkable confluence of thought leaders, scholars, practitioners, and students, dedicated to confronting one of the most pressing global challenges of our time — climate change. Through a unique interdisciplinary lens, the event has facilitated vital conversations on legal education, governance mechanisms, global frameworks, and local adaptation strategies essential to climate resilience.

We are particularly proud of the platform this initiative has provided for emerging researchers and young professionals to present their insights, case studies, and innovative solutions. The depth and diversity of the perspectives shared during the sessions underscore the urgency of integrated climate education within the broader legal and policy framework.

Our heartfelt gratitude extends to all the contributors, paper presenters, moderators, and participants who enriched this academic dialogue. We also acknowledge the tireless efforts of the faculty and student coordinators whose commitment brought this event to life.

We hope these volumes serve as a lasting academic resource and a catalyst for future collaborations on climate education and environmental law.

Let us continue to work together—across disciplines and across borders—to foster a sustainable and equitable future for all.

With warm regards,

Dr. Bindu M. Nambiar

Principal, Government Law College, Ernakulam

Dr. Adriaan Bedner

Professor, Van Vollenhoven Institute

Leiden University, The Netherlands

Dr. Dayana M. K.

Faculty Coordinator

Indo-Dutch Research Center

Dr. Rhea Roy Mammen

Project Coordinator, Indo-Dutch Research Center

Lecturer, Leiden University

## **THEME OF THE CONFERENCE**

### **Overview of the Event**

The International Workshop on Interdisciplinary Approach to Climate Change Education, held on February 27–28, 2025, at Government Law College, Ernakulam, brought together academics, legal experts, environmentalists, policy-makers, and students to engage in a rich exchange of ideas. Hosted collaboratively by the Indo-Dutch Research Center on Climate Change Law, Research and Education, the Van Vollenhoven Institute of Leiden University, and Government Law College, this workshop aimed to create a platform for exploring the intersection of law, governance, education, and climate change.

### **Goals and Key Themes**

The primary goal of the workshop was to foster a multidisciplinary approach to climate change education. Key themes included:

- Governance frameworks and legal responses to climate change
- Climate justice and human rights
- International cooperation and global environmental law
- Interdisciplinary teaching methods in legal education
- Local adaptation strategies and community engagement
- Climate-induced displacement, sustainability, and policy development

### **Significance of the Topic**

Climate change presents complex legal, social, and environmental challenges that transcend traditional disciplinary boundaries. As the world faces intensifying climate-related crises, the need for informed legal responses and climate-literate professionals is more urgent than

ever. This conference emphasized the critical role of interdisciplinary education in empowering future leaders and legal professionals to develop resilient, inclusive, and sustainable solutions. The dialogue and research showcased in this workshop contribute to evolving jurisprudence and academic discourse on climate change law and policy.

# I

## INTEGRATION OF GLOBAL MODELS INTO LOCAL SCENARIO: SHIELDING KERALA FROM CLIMATE CHANGE ISSUES

Niranjana Siby\*

### ABSTRACT

*Climate change poses an imminent threat to Kerala, a state highly vulnerable to floods, rising sea levels, extreme weather events, and ecosystem disruptions. Addressing these challenges requires a strategic blend of global best practices and locally tailored solutions. This paper, Integration of Global Models into Local Scenario: Shielding Kerala from Climate Change Issues, explores how Kerala can adapt and implement international climate mitigation and adaptation frameworks to strengthen its resilience against climate-induced calamities.*

*The study examines global climate governance models and nature-based solutions adopted by various nations like the Netherlands, Japan, Singapore etc. It analyses their relevance in the context of Kerala's unique geographical and socio-economic landscape. The paper further evaluates policy gaps, institutional preparedness, and legal mechanisms that can facilitate the effective localization of these models. Through a comparative*

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*approach, it identifies best practices that can be customized to enhance disaster management, climate-resilient infrastructure, and community-based adaptation strategies in Kerala.*

*By integrating global frameworks with Kerala's environmental policies and disaster management strategies, this research provides recommendations for a robust, interdisciplinary approach to climate change law. The findings aim to assist policymakers, legal practitioners, and environmentalists in crafting adaptive policies that shield Kerala from the adverse effects of climate change while ensuring sustainable development.*

**Keywords:** *Global Frameworks, Policy Integration, Climate Mitigation, Climate Adaptation*

## **1. INTRODUCTION**

With the intensification of the climate crisis, we have reached a crossroad in history, where the realities of climate change are no longer far-off warnings made by scientists; they have become imperative challenges facing populations globally. In Kerala, a State renowned with rich landscapes, peaceful backwaters, and throbbing culture, the effects of climate change become sharply felt. We have been experiencing unprecedented flooding that has torn through settlements, destroying homes and livelihoods, as well as landslides that have swallowed lives and interrupted social fabrics. The threat of sea-level rise casts a gloomy shadow on our coastal sanctuaries, a grim reminder that our pretty beaches



are being attacked. The immediate question we must contend with is: Are we ready to take on these challenges head-on, and if we are, how do we turn our readiness into resilience?

Kerala has, in the past, gone a long way in response efforts towards disasters, but our practice has been predominantly reactive—one that is defined by a reaction to tragedies—and not proactive—a plan to prevent them. The heart of resilience is not just in interventions after a disaster but in active measures that mobilize knowledge, policy-making, and local governance to effectively counter risks. This can be attained through a paradigm shift that encapsulates a systematic, inter-disciplinary climate education and governance framework. This should integrate climate science, law, policy, and participatory local governance to design holistic strategies that protect our communities.

The urgency for this interdisciplinary engagement cannot be overstated, as climate change is not confined to a singular realm of environmental discourse. Rather, it transcends multiple spheres including legal, economic, and social dimensions. Unfortunately, our existing educational structures often misalign with this reality. For instance, law students may delve into environmental statutes but frequently miss the underlying scientific principles that elucidate the very climate challenges we face. On the contrary, climate science students may scrutinize models and information without a proper grasp of the policy and legal contexts within which climate action is regulated. Policymakers, motivated to come up with climate plans, might ignore significant scientific knowledge necessary for well-informed decision-making. This gap not only degrades the effectiveness of climate response efforts but also limits our ability to build actual resilience.

This article, "*Integration of Global Models into Local Scenario: Shielding Kerala from Climate Change Issues*," assumes that the incorporation of inter-disciplinary knowledge—blending lessons from law, science, governance, and civic participation—is crucial to strengthening Kerala against the relentless wave of climate disturbances. We can effectively adapt successful, practical models created in other parts of the world and apply them to our specific context. Nations which take the leadership roles in combating global warming have clearly shown the potential of holistic templates that engender cooperation across wide-ranging groups of stakeholders. Analysis of such model practices informs us about elastic concepts that connect and resonate well within Kerala's sociocultural environments.

The prime challenge lies toward adopting such patterns. Kerala is distinguished by cultural diversity, intricate socio-economic dynamics, and different degrees of awareness and education on climate issues. Acquiring and transcending these challenges will not only make people and families more capable, but also promote a common ethos of climate awareness in society. This paper will guide through the possible ways forward, considering the nuances underlying the incorporation of best international practices into the Kerala environment.

Throughout the course of this discussion, the aim continues: to make known the utmost need for an interdisciplinary strategy for climate education and decision-making, map out working lessons from global good practices, specify the challenges which we have to overcome, and submit significant guidelines for making climate-resilient Kerala a reality. The time to move in this important program is now; climate resilience begins and ends with well-informed knowledge, shared policy-making,

and timely decision. It is only with this collective vision that we can hope to defend Kerala's tomorrow from the unabating uncertainties of climate change.

## **2. INTERDISCIPLINARY APPROACHES TO CLIMATE CHANGE EDUCATION**

Climate change education has evolved into a multidisciplinary field, emphasizing the integration of scientific, social, and political dimensions to foster comprehensive understanding and action. This literature review examines recent studies that highlight the importance of interdisciplinary approaches in climate change education, aligning with the objective of integrating global models into Kerala's local educational frameworks. Addressing climate change necessitates an interdisciplinary understanding that transcends traditional subject boundaries. Interdisciplinary courses combining ecology and anthropology to enhance students' comprehension of climate issues, demonstrating improved understanding and communication skills among participants are available.<sup>1</sup>

Traditional top-down educational methods have been critiqued for limiting student engagement in climate action. Science education has an obligation to help children and youth understand what is going on in their lives and what is going on with this crisis. Current approaches to climate change education are failing to help learners know what to do with the knowledge

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<sup>1</sup> Jennifer Sweeney Tookes and Lissa M Legee, 'Innovative Climate Pedagogy: Interdisciplinary Approaches to Teaching Climate Change' (2024) 18(1) *International Journal for the Scholarship of Teaching and Learning*, art 11 <<https://digitalcommons.georgiasouthern.edu/ij-sotl/vol18/iss1/11/>> accessed 01 March 2025.

and skills they develop in school.<sup>2</sup> Participatory and creative approaches that empower students, fostering action and advocacy are required.<sup>3</sup> By involving students in interactive and community-based projects, educators can bridge the gap between knowledge and action, promoting a sense of agency among learners.

Any proposal relating to climate change education must also concern itself with social structures. It is here that we can refer to socio-scientific issues, linking science, technology, and society from different perspectives including the social, ethical, economic, and political. In addition, climate change also encompasses technological knowledge, environmental problems (landslides, floods), and health issues (psychological and physical). Climate change education thus requires a context-based learning environment, where learning needs to include knowledge, skills, attitudes, and values.<sup>4</sup>

International frameworks and national policies play a crucial role in shaping climate change education. UNESCO's report on integrating

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<sup>2</sup> Anne Drewes, Jamie Henderson and Chrystalla Mouza, 'Professional Development Design Considerations in Climate Change Education: Teacher Enactment and Student Learning' (2017) 40 *International Journal of Science Education* 67 <<https://www.tandfonline.com/doi/full/10.1080/09500693.2017.1397798>> accessed 28 February 2025.

<sup>3</sup> David Rousell and Amy Cutter-Mackenzie-Knowles, 'A Systematic Review of Climate Change Education: Giving Children and Young People a "Voice" and a "Hand" in Redressing Climate Change' (2020) 18 *Children's Geographies* <<https://www.tandfonline.com/doi/full/10.1080/14733285.2019.1614532>> accessed 01 March 2025.

<sup>4</sup> María A Mejía-Cáceres, Marco Rieckmann and Maria Lúcia Folena Araújo, 'Political Discourses as a Resource for Climate Change Education: Promoting Critical Thinking by Closing the Gap between Science Education and Political Education' (2023) 15 *Sustainability* 6672 <<https://www.mdpi.com/2071-1050/15/8/6672>> accessed 02 March 2025.

climate change issues in education emphasizes the need for comprehensive strategies to make schools climate-ready. Additionally, the Global Partnership for Education's Climate-Smart Framework outlines actions such as integrating climate change into curricula and developing climate-resilient school infrastructure. These global initiatives provide valuable models for regions like Kerala to develop localized strategies that align with international best practices.

Implementing interdisciplinary climate education faces challenges, including curriculum rigidity, lack of trained educators, and inadequate policy support. However, these challenges present opportunities for collaboration between educational institutions, governments, and communities. Climate change education is embedded in key climate research topics such as adaptation and sustainability, and has the potential for interdisciplinary research and teaching agendas.<sup>5</sup> By leveraging these opportunities, regions can develop robust educational frameworks that address both global and local climate challenges.

### **3. LESSONS IN CLIMATE RESILIENCE: INSIGHTS FROM GLOBAL CASE STUDIES FOR KERALA**

With the effects of climate change becoming more severe worldwide, states such as Kerala are facing growing threats from flooding, sea-level rise, and volatile weather patterns. The State is marked by its verdant cover, monsoon-soaked terrain, and rich diversity of ecosystems, but it is also at the forefront of climate exposure. To overcome these challenges,

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<sup>5</sup> Valérie Muccione, Tyler Ewen and Seyedeh Azar Vaghefi, 'A Scoping Review on Climate Change Education' (2025) 4(1) *PLOS Climate* e0000356 <<https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000356>> accessed 03 March 2025.

Kerala must learn from international best practices. A close examination of effective case studies in the Netherlands, Japan, Bangladesh, and Singapore provides valuable lessons on interdisciplinary solutions and innovative approaches to climate resilience. Kerala can increase its ability to resist climatic challenges and promote sustainable development by implementing similar strategies.

### **3.1. The Netherlands: Innovative Flood Management Practices**

In the Netherlands, a nation famous for its complex water management system, the government has long struggled with the threat of flooding because much of its land is below sea level. Past disasters, including the disastrous North Sea Flood of 1953, spurred major investment in flood defences. Following a succession of floods in the 1990s, which highlighted the urgent need for adaptive measures, the Dutch government launched the "Room for the River" program in 2007. This integrated program was designed to improve flood protection, environmental quality, and the natural dynamics of the rivers that flow through the nation. Some of the main measures involved the reduction of floodplains by digging out sediment from riverbeds to expand their capacity to store and contain greater amounts of water.

Through the development of specific flood channels, the program created routes to channel excess water during peak flows, thus relieving pressure on the main river channels. In addition, structural changes were implemented in bridges and other barriers that obstructed the passage of water, so that rivers could flow more freely and effectively. Over 30 projects were finished under this program by 2018, which revolutionized the Dutch environment into a resistant and flexible ecosystem that not only

strengthened flood defences but also supported biodiversity and created leisure activities for the people. These Dutch actions provide a number of important lessons for Kerala.

The state can make the recovery of natural flood buffers like mangroves and wetlands a priority, which serve as efficient sponges to soak up excess water and reduce the effects of flooding. Studies have proven that well-preserved coastal ecosystems can drastically diminish the severity of flood occurrences. In addition, taking an integrated river basin management approach can contribute to sustainable flood mitigation by considering both upstream and downstream effects. Local communities must also be involved in planning; by making sure that solutions being proposed are context-based and backed by the public, planners can ensure more resilience and readiness.

### **3.2. Japan: A Model for Preparedness and Sustainability**

Likewise, Japan, being prone to earthquakes, tsunamis, and typhoons geographically, has established a strong disaster preparedness system spanning decades. Such a system is defined by the incorporation of education, infrastructure hardiness, and high-level technological integration. Education programs have been especially effective in instilling preparedness culture in the population. Regular disaster drills are undertaken by schools, which make the students aware of emergency procedures, and disaster preparedness training is integrated into the school curriculum. This goes a long way towards developing awareness from a young age so that subsequent generations can respond more effectively to emergencies. Infrastructure resilience is also a key aspect of Japan's disaster preparedness planning.

The country has strict building codes that compel buildings to be constructed using sophisticated engineering methods that can resist seismic and climatic forces. Furthermore, aged buildings are comprehensively evaluated and reinforced to ensure compliance with present safety regulations, considerably lowering the hazards triggered by earthquakes and floods. Technology has also been heavily invested in by Japan, most notably in creating sophisticated early warning systems. These systems use sensors and real-time information to issue timely warnings for earthquakes, tsunamis, and extreme weather conditions, backed by public education campaigns that educate citizens on how to effectively respond to these warnings. Kerala can learn several valuable lessons from Japan's all-encompassing disaster preparedness system.

For instance, by incorporating disaster preparedness in school lessons, Kerala is able to bring up a resilience culture from early childhood so that children learn with the knowledge and skills to face emergencies effectively. Moreover, refining and implementing building codes to confirm that infrastructure has the capacity to resist natural hazards will be central to future protection. Encouraging the use of robust materials and following new construction norms will further reinforce safety and sustainability. Lastly, investment in smart warning systems appropriate to the unique vulnerabilities of the region may supply vital lead time during disasters so that evacuations can be implemented and responses launched to unfolding danger.

### **3.3. Bangladesh: Community-Based Adaptations**

In Bangladesh, a country often plagued by flooding, novel community-based approaches to adaptation that emphasize local citizen participation



in enhancing resilience have become evident. Emphasizing that local communities are often the first responders during disasters, Bangladesh aims to empower these communities through a variety of initiatives. Training programs equip residents with essential skills in disaster response, first aid, and resource management, enabling them to act effectively during emergencies. Such education fosters self-reliance and strengthens community bonds, which are crucial during crises. Community participation is taken to the extent of local adaptation plan development so that interventions closely correspond to the local needs and expertise of the people.

For example, at the planning level, local knowledge can identify those areas most vulnerable to flooding, which can guide where infrastructural enhancements are located. New approaches to agriculture, such as floating farms, have been popular in Bangladesh as means to counter crop losses during floods. These floating agricultural systems enable farmers to keep growing crops even when land floods, thus ensuring food security. In addition, grassroots early warning systems have been developed that use local knowledge and communication networks to provide timely warnings on evolving risks. This allows communities to respond quickly when a hazard is eminent, drawing on their specialized knowledge of local conditions and environments.

The community-based initiatives in Bangladesh offer several useful lessons for Kerala as it attempts to strengthen its resilience to climate change and natural disasters. Decentralizing disaster management by empowering local self-governments, including panchayats, to spearhead disaster preparedness programs can go a long way in making these programs more effective. Local authorities are usually better informed

about the specific needs and challenges facing their areas, and this can result in quicker and more effective responses if they are entrusted with the authority and resources to act. Additionally, encouraging adaptive agricultural strategies like floating agriculture can contribute to the maintenance of livelihoods during flooding, making the farming community less exposed to climatic uncertainty.

Since Kerala has an agricultural foundation, supporting innovative practices compatible with indigenous traditions and the environment can build resilience and food security. Involving traditional knowledge and practice in formal disaster plans can provide stronger and more accepted solutions. Kerala can assist in building a multi-dimensional disaster resilience approach that considers the particularity of its geography and culture by respecting local expertise.

### **3.3. Singapore: Integrated Water Management and Climate-Resilient Urban Planning**

Singapore is another model case on how a city state with a small territory and limited natural freshwater resources developed a holistic strategy for integrated water management and climate-resilient urban planning. Being aware early of the interlinked nature of water security and urban resilience, Singapore took a multi-pronged approach to ensure water security while promoting urban resilience against climate change. The "Four National Taps" policy is a diversified policy that includes imported water, catchment water locally, desalinated water, and reclaimed water, also

called NEWater.<sup>6</sup> The diversified strategy ensures that Singapore is not dominated by any single source of water, improving total security. As part of its diversification in water sources, Singapore reserves about two-thirds of its total area as a catchment area to allow for efficient rainwater harvesting and recycling.

Sophisticated technologies enable seawater to be desalinated into drinking water, and wastewater is treated and reused for different purposes. Water management is not the sole concern; Singapore's urban planning also incorporates green infrastructure to counter the threats of climate change. These are green roofs, vertical gardens, and tree-lined roads, all of which help reduce the urban heat island effect and manage stormwater runoff efficiently. Advanced drainage systems that utilize bioswales, permeable pavements, and retention ponds have been implemented in order to effectively treat excess rain without overburdening cities. The holistic approach due to such integrated planning leads to a minimized urban flood even during monsoon spells.

Kerala can learn important lessons from the integrated strategy followed by Singapore regarding water management and urban planning. There is a need to transform water management methods to utilize better the state's heavy rainfall, especially in view of the periodic water scarcity suffered by most settlements. Spending money on rainwater harvesting systems, water recycling infrastructure, and city reservoirs might bring much relief during lean years.

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<sup>6</sup> Singapore Infopedia, *Centre for Liveable Cities, Singapore* (National Library Board, Singapore) <<https://www.nlb.gov.sg/main/article-detail?cmsuuid=71f07719-a200-4339-b20c-ec69e520776f>> accessed 3 March 2025.

Furthermore, climate-resilient urban planning is critical in a state dealing with increasing urbanization and unregulated building practices. Kerala needs to give high importance to incorporating green infrastructure within its cities, conserving wetlands and floodplains and minimizing urban heat and water management. Also, the installation of smart drainage systems using nature-based solutions can help effectively prevent urban flooding and promote overall resilience.

Finally, based on the case studies highlighted above, there is persuasive evidence that interdisciplinary solutions are central to managing the issues of climate change in an effective manner. Adapting to climate change requires science, policy, and law to work harmoniously together to arrive at effective solutions. While Kerala struggles with the urgent issues presented by climate change, solutions adopted by the Netherlands, Japan, Bangladesh, and Singapore can act as guiding beacons to improve resilience against climatic impacts.

To progress, Kerala needs to give prime importance to embracing people's participation, innovative approaches, and inter-disciplinary integration in order to develop a climate-resilient future in an accelerated changing environment.

The way forward for successful climate adaptation is to learn from these international models while adapting lessons to suit local conditions and imperatives in Kerala. As the state attempts to strengthen its defences against impending catastrophes, resilience stories from across the globe can motivate action and foster cooperation among all stakeholders. Doing so, Kerala can not only preserve its natural and cultural heritage but also

lead the way towards a prosperous, inclusive, and resilient future that is accepting of the challenges brought by an evolving climate.

#### **4. CHALLENGES: THE BARRIERS TO NAVIGATE**

Despite its commendable strides in environmental protection and disaster management, Kerala faces a number of persistent challenges that hinder its progress toward climate resilience. Nevertheless, these challenges also present valuable opportunities for innovation and reform that can lead to a more sustainable future.

One of the most significant challenges affecting Kerala's climate preparedness is the fragmentation of climate governance. The state's climate policies are often dispersed among various government departments, resulting in limited coordination. Environmental laws, disaster management plans, and urban development policies tend to operate in isolation rather than as part of a unified framework. This lack of coherence makes implementation ineffective, as overlapping responsibilities and insufficient communication can stall vital initiatives. By addressing this fragmentation, Kerala could enhance its climate governance and promote more cohesive actions that align with its overall sustainability goals.

Another challenge lies in the rigidity of climate education. Currently, climate education in Kerala is often compartmentalized within science subjects, lacking an interdisciplinary approach that is essential for effective responses to climate challenges. Law students receive minimal exposure to climate governance, while engineering students rarely delve into the legal frameworks that guide sustainability measures. This gap in education hinders the development of a workforce equipped with the skills

and knowledge needed to address the complexities of climate change. By fostering interdisciplinary climate education that integrates legal studies, policy analysis, environmental science, and disaster management, Kerala can build a stronger foundation for future professionals who are well-prepared to tackle climate issues.

Additionally, rapid urbanization and unplanned development pose significant challenges to Kerala's environmental integrity. The state's cities have expanded quickly, often at the expense of critical ecosystems such as wetlands, forests, and coastal areas. Issues such as illegal constructions, inadequate drainage systems, and encroachments on natural habitats exacerbate the vulnerabilities associated with climate change. This unplanned urban growth not only increases the risk of flooding and other climate-related disasters but also diminishes the resilience of local communities. Addressing these urbanization challenges requires a comprehensive approach to sustainable city planning.

Limited community participation further complicates Kerala's efforts in climate resilience planning. Although policies exist at the state level to tackle these issues, grassroots involvement in their implementation remains minimal. Local bodies often struggle with a lack of knowledge and resources needed to execute effective adaptation measures. Community engagement is crucial, as it ensures that policies are tailored to the unique needs of local populations. Empowering local self-governments, such as panchayats and municipal bodies, can greatly enhance community involvement in climate adaptation initiatives.

Insufficient investment in green technologies is yet another obstacle that Kerala must overcome. While the state has initiated several renewable

energy projects, there is still a notable lack of funding for large-scale climate adaptation infrastructure. This includes essential components like flood-resistant urban planning, smart water management systems, and sustainable transport networks. Without adequate financial resources, Kerala may struggle to implement the innovative solutions necessary for building resilience to climate change.

## **5. TRATEGIC DIRECTIONS FOR SUSTAINABLE ACTION**

Amid these challenges, there are also major opportunities for change in Kerala. One such opportunity is building a complete climate governance structure. Having a State Climate Action Council that ensures coordination among government departments, local self-governments, and research institutions can lead to an integrated climate policy. This would harmonize activities in disaster management, environmental protection, and urban development to be better equipped to handle the intricacies of climate change.

A further potential area is the adoption of interdisciplinary climate studies. Higher education institutions in Kerala can adopt climate law and governance as a course of study that draws from legal academia, policy research, environmental science, and disaster management. Having students with various backgrounds work on climate-related projects can create innovative solutions that are multi-perspective.

In addition, encouraging sustainable urban development is a chance that Kerala can take. Learning from the best models such as Singapore's green urban design, Kerala can incorporate green areas into city planning, implement intelligent drainage systems, and impose rigorous building codes that consider climate threats. These measures can assist in

developing urban areas that are not only sustainable but also climate-resilient.

Building up community-based adaptation programs also offers a useful prospect for Kerala. Enabling local self-governments to be more actively engaged in climate adaptation involves giving disaster response training, promoting participatory land-use planning, and conducting decentralized water management programs. By building up local capacities, Kerala can establish a network of knowledgeable communities prepared to respond to climate issues.

Finally, climate-resilient infrastructure should be a top priority for investment in Kerala. Investing in eco-sensitive development measures like mangrove restoration, floodplain zoning, and wetland conservation can be a major push towards making the state more climate-resilient. Moreover, offering financial incentives to companies that implement green technology could encourage the private sector to engage in sustainability initiatives, an environment where they can innovate and grow.

## **6. CONCLUSION: THE WAY FORWARD**

Finally, Kerala is at a crossroads where it has to make a determined move towards climate resilience and sustainable development. The rising occurrence of floods, landslides, coastal erosion, and water scarcity calls for an interdisciplinary effort combining science, policy, law, and civil society participation.



By learning from international leaders such as the Netherlands, Japan, Bangladesh, and Singapore, Kerala can create climate policies that are innovative, inclusive, and effective. From nature-based flood management to smart city planning and decentralized climate governance, Kerala can become a model state for climate adaptation in India.

However, to achieve this, climate education must evolve to break disciplinary barriers. Universities should foster collaboration between legal experts, scientists, urban planners, and policymakers to generate comprehensive solutions. Furthermore, community participation must be strengthened. Local bodies and residents must be active stakeholders in climate planning, ensuring that adaptation strategies are inclusive and locally relevant.

Last but not least, Kerala requires more robust policies and investments in climate-resilient infrastructure, green technologies, and sustainable urban development. If action is taken today, Kerala can not only avoid climate risks but also be a leader in creating an environmentally secure and economically thriving future.

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## II

# **SOCIO-ECONOMIC IMPACTS OF CLIMATE CHANGE ON THE INDIGENOUS COMMUNITIES OF ASSAM**

**Shreya Doneriya\***

### **ABSTRACT**

*Climate Change poses severe socio-economic challenges to the indigenous communities of Assam, where large-scale renewable energy projects are being implemented. This study critically examines one such initiative by the Assam Government, i.e., the Assam Solar Project, a 1000 MW initiative in the Karbi Anglong district, Assam, and its violation of social sustainability as outlined in the Triple Bottom Line (TBL) model, which emphasizes economic, social and environmental balance. The project backed by the ADB, while aiming to boost renewable energy, threatens the livelihood and cultural heritage of approximately 9,000 indigenous villagers. Despite government claims of community support, independent assessments reveal widespread opposition, with concerns over land loss, displacement, and inadequate compensation. The flawed socio-economic assessment report of the government misrepresents indigenous perspectives; key issues include forest resettlement, destruction of agricultural land, and loss of communal resources,*

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*exacerbating economic vulnerabilities. While the project promises skill development and employment opportunities, the lack of clear implementation plan raises doubts about its effectiveness in addressing indigenous concerns. We also highlight the gaps in the current resettlement and compensation framework. To balance renewable energy development with indigenous rights, alternative approaches such as Building- Integrated Photovoltaics (BIPV) and Agrivoltaics are proposed, enabling sustainable land use without displacement. The research underscores the need for climate justice, advocating for inclusive development strategies that respect indigenous rights and promote social sustainability.*

**Keywords:** *Indigenous communities, Triple Bottom Line, Social Sustainability, Climate Justice, Renewable energy.*

## INTRODUCTION

Karbi Anglong, in Assam, is a district that finds its mention under the Sixth Schedule of the Constitution of India. Governed by the Karbi Anglong Autonomous Council (hereinafter referred as KAAC), the district includes several indigenous tribes like the Karbi and Dimasa, and is known for its huge forest cover and national parks.<sup>7</sup> The tribal communities have lived in this district for several decades and are now faced with the constant challenge of development and preservation of their diverse ethnicity. The recent governmental projects, in the name of infrastructural development

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<sup>7</sup> 'KAAC' <<https://karbianglong.co.in/>> accessed 4 March 2025.

and sustainable growth, pose a huge risk not only to the Indigenous tribes in specific but also to the environment in general. ‘The Assam Solar Project’ (hereinafter referred as ASP) is one such development initiative undertaken by the state government, which will be implemented shortly by the Assam Power Distribution Company Limited (hereinafter referred as APDCL).<sup>8</sup> This project aims to construct a Solar power grid in the Karbi Anglong, with an energy capacity of 1000 MW. The project was backed by the Asian Development Bank (hereinafter referred as ADB) last year, which will provide financial assistance of up to \$434.25 million.<sup>9</sup> The objective of this project is to meet the increasing energy demand in the state, and as per the Principal Energy Specialist of ADB, “this project will help Assam develop a renewable energy road map and increase its solar energy capacity to achieve its target of 3,000 MW by 2030.”

Moving on to the harsh side, the reality. In order to set up this solar grid, the project requires a land area of up to 18,000 bighas (2,400 hectares), of which 16,511 bighas is owned by the KAAC but the rest 1,489 bighas (198.5 hectares) is customarily owned by the Indigenous communities of the district including Karbis, Bodos, Dimasas and many more. The project leaves at stake around 1,277 Indigenous households and approximately 9,000 villagers in total. These communities will be permanently displaced

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<sup>8</sup> Singh B, ‘Construction of 1,000-Mw Solar Power Project in Karbi Anglong Will Begin Shortly: Assam CM Himanta Biswa Sarma’ *The Economic Times* (15 June 2024) <<https://economictimes.indiatimes.com/industry/renewables/construction-of-1000-mw-solar-power-project-in-karbi-anglong-will-begin-shortly-assam-cm-himanta-biswa-sarma/articleshow/111012450.cms?from=mdr>> accessed 4 March 2025.

<sup>9</sup> Bank AD, ‘ADB Approves Support to Establish Solar Facility in Assam, India’ (24 October 2024) <<https://www.adb.org/news/adb-approves-support-establish-solar-facility-assam-india>> accessed 4 March 2025.

from their ancestral lands by the Resettlement and Indigenous Peoples Plan (RIPP) separately devised under the project.

Throughout this paper, our primary focus will be on the social and economic problems that are bound to arise if this project is implemented. The government also undertook a socio-economic survey of 372 households i.e. 30% of the affected population, to understand broadly the challenges and issues of the indigenous community. But as discussed further, the findings of this report are controversial and fallacious, making false claims and under-representing the claims of the community. In doing so, we have relied on both qualitative and quantitative data which allowed us to form an in-depth understanding of the issue and its concerns.

Stressing on the idea of Social Sustainability and Climate Justice, our research highlights the importance of sustainable development and its three factors according to the Triple Bottom Line (TBL) model of sustainability. Our main task is to find out whether this project is truly sustainable in its approach, as it claims to be.

Finally, our research combines three disciplines, i.e., sociology, economics, and environment. As a result of climate change, countries often adopt projects like the ASP, which on their face, promise sustainable development with the expansion of renewable energy, but in reality, ignore other factors encompassing the idea of sustainability like the indigenous communities (the people) in our case. This also supports the idea of the Interdisciplinary Approach to Climate change laws, where in order to achieve a holistic understanding, we need to take a bird-eye view of the problem and understand that climate change doesn't happen in isolation.

The ignorance of this concept, could lead to devising projects like the ASP which destroy the environment, in the garb of making one.

## **7. LITERATURE REVIEW**

Our main literature for this research is the RIPP Report prepared by the APDCL for the ADB, which is accessible to the public at large. We have majorly relied on the quantitative data used in this report to reach our findings. The report contains a project description and its impact on the Indigenous communities via a socio-economic assessment, which surveyed 30% of the affected population, i.e., 372 households. The document assesses how the ASP, affects land acquisition, displacement and livelihood of the indigenous communities in Karbi Anglong. On the issue of land acquisition and displacement, RIPP highlights that, in total, 1,277 Indigenous households will be affected, with 38 residential structures and two religious sites facing demolition. A critical concern is the impact on agricultural livelihoods, as the primary source of income of the communities arise from agriculture (around 95%). The project also poses danger to plantation areas like rubber, chitranala, and bamboo, which collectively are spread over an area of 800 bighas, more than 50% of the concerned land area. RIPP additionally acknowledges that they had received Broad Community Support (BCS) from seven affected villages. It outlines a compensation mechanism under The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, which will provide the landless villagers with financial remuneration and employment opportunities.



The report weighs the pros and cons of the ASP, and highlights that there are more negative impacts of the project than positive. A major flaw that can be highlighted in this literature is its false claims of the Broad Community Support. On the ground level, the project has received criticism from the indigenous communities, where some also claim that they were threatened to give their consent for the project.<sup>10</sup> Also, the socio-economic survey only considered 30% of the total affected population, which is not even half of the population who will face the brunt of this project. Therefore, it can be stated that the report doesn't sufficiently include the concerns and viewpoints of the majority population, but only of a handful of them. It even classifies such important factors like Health and Welfare as 'not relevant' to the project, which is contestable. Even if 30% of the population were interviewed, their primary concerns were not highlighted in the report, which makes us conclude that the findings of RIPP cannot be entirely relied on. Throughout our research, this report will form the basis of our argument.

Our second vital source is the Initial Environmental Examination report (IEE) prepared by APDCL for ADB, which illustrates that the project will take a total time- period of 7 years (2024-2031) and categorizes the project under Project 'B' Category. The report specifies several risks of GHG emissions, soil erosion, and vegetation loss during the implementation period of ASP. Spilling of hazardous liquids and chemicals would remain a continuous risk of the project. With reduction in the green area,

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<sup>10</sup> 'India: ADB Must Stop Funding the "Assam Solar Project" Which Displaces Indigenous Tribes in Assam' <<https://iprights.org/index.php/en/all-news/india-adb-must-stop-funding-the-assam-solar-project-which-displaces-indigenous-tribes-in-assam#:~:text=The%20outsiders%20want%20the%20Solar,want%20the%20price%20of%20land.>> accessed 4 March 2025.

groundwater level will see a long-term reduction in its levels. As the area is highly seismic, there are considerable chances of forest fires as well. The study predicts cutting around 2,395 trees along with ground vegetation.

A major flaw in the IEE study is its assertion that “the project poses no major environmental risk that cannot be totally prevented or adequately mitigated.” Deforestation, loss of vegetation, and habitat loss are major environmental risks that the study ignores. The report falsely states that the risk of forest fires can be mitigated by removing vegetation near the area, and it fails to understand, that loss of vegetation is causing harm to the environment by not following the idea of Sustainable Development. The report wrongly justifies that the permanent loss of land of the indigenous communities can be compensated by giving them financial compensation as per RIPP, and it fails to acknowledge that the project will permanently deprive the indigenous communities of their ancestral lands and merely giving them financial compensation wouldn’t suffice the social and economic loss that these communities will incur.

Thirdly, we have relied on news reports and articles which made us aware of the contemporary situation at hand, and helped us in identifying the social and economic impacts arising from the project. They constituted our qualitative data, which defined and elaborated on the concepts of sustainable development, the TBL Model, land displacement, etc. All the sources are duly acknowledged in the research paper.

## **8. HOW THE PROJECT IGNORES THE CONCEPT OF SOCIAL SUSTAINABILITY**

### **3.1. The Idea of Sustainable Development**

The concept, though explicitly recognized under the Brundtland Report (1987)<sup>11</sup>, also finds its mention under Principle 1 of Stockholm Declaration<sup>12</sup>, which recognizes that one should use its resources in a manner, which efficiently meet the needs of the present as well as the future generations. This concept of Sustainable Development integrates Social, Economic and Environmental objectives, to ensure long-term viability. While industrialization and modernization are necessary for the economic progress of a country, they pose huge risks of deforestation, pollution, and displacement of indigenous communities. The challenge therefore is to balance and harmonize industrial growth within ecological limits. Therefore, the three factors that should be considered to ensure sustainable development are environmental sustainability, social justice and economic development. Often, we only focus on the economic development i.e. generation of profit and revenue if any project is implemented, and fail to consider its long-term social and environmental impacts.

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<sup>11</sup> ‘Brundtland Report | Sustainable Development & Global Environmental Issues | Britannica’ <<https://www.britannica.com/topic/Brundtland-Report>> accessed 4 March 2025.

<sup>12</sup> Nations U, ‘United Nations Conference on the Human Environment, Stockholm 1972’ (United Nations) <<https://www.un.org/en/conferences/environment/stockholm1972>> accessed 4 March 2025.

### 3.2. The TBL Model

These three factors of sustainability can be summarized by the Triple-Bottom- Line Model of Sustainability. This model is built on 3P's which constitute an important part of any development, and if these 3P's are met, we can say that sustainable development is achieved. The three P's are – Profit, Planet and People. Here, Profit represents Economic sustainability; People represent Social Sustainability; and Planet represents Environmental sustainability.<sup>13</sup> These three factors are inseparable when we talk about the idea of Sustainable Development, and at the interjunction of these three factors, is where true sustainable development lies.

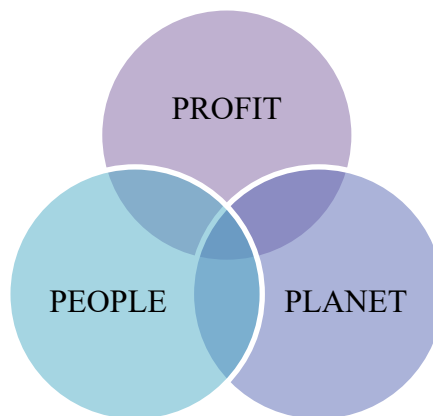


Figure 1: 3P's of the Triple Bottom Line Model

## 9. APPLICATION OF TBL TO ASP

If we apply the TBL model and try to find, whether the ASP is truly sustainable in its approach, the answer would be a big 'NO'. We will break

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<sup>13</sup> 'The Triple Bottom Line: What It Is & Why It's Important' (Business Insights Blog, 8 December 2020) <<https://online.hbs.edu/blog/post/what-is-the-triple-bottom-line>> accessed 4 March 2025.

down each one of its components to support this assertion, highlighting the social, economic, and environmental concerns of this project. As the primary focus of our research is on socio-economic impact, we will deal with these two parameters more elaboratively.

**4.1. People (Social Impacts)-** One primary issue with ASP is the land acquisition and displacement of tribal communities by the government which threatens their social security and hampers their quality of life. On careful examination of the project, it is clear that one of the P's of sustainability i.e. 'People' is completely ignored by the implementers, as people will face involuntary and forced displacement from their customarily held lands. Forced displacement is different from migration and doesn't involve any choice to the communities. It can also be understood as a "carefully planned move".<sup>14</sup> With Displacement and land acquisition, the principle of Intergenerational equity is sidelined, as the needs of both present and future generations are not taken into consideration by the government. Principle 4 of the Rio Declaration mentions this principle as "the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generation."<sup>15</sup> By ignoring this important aspect, the rights of tribal communities in the Karbi Anglong are compromised, infringing their Right to Life and Livelihood under Article 21 of the Constitution of

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<sup>14</sup> Verme P and Schuettler K, 'The Impact of Forced Displacement on Host Communities: A Review of the Empirical Literature in Economics' (2021) 150 Journal of Development Economics 102606  
<<https://www.sciencedirect.com/science/article/pii/S0304387820301814>> accessed 4 March 2025

<sup>15</sup> Unit B, 'Rio Declaration on Environment and Development' (13 November 2006)  
<<https://www.cbd.int/doc/ref/rio-declaration.shtml>> accessed 4 March 2025

India, which goes against the idea of Social Justice and their Fundamental Right to Life. Apart from Land acquisition, there are supposed to be temporary traffic disruptions during the construction of ASP, but the construction itself spans for a period of 7 years and the authorities should take this fact into consideration. Water availability in the area will also be hit, as RIPP illustrated, majority of the households (approx. 65%) use handpumps and 33% use wells as their source of drinking water.

As IEE predicts reduction in the level of groundwater, the major source of water for the indigenous communities will take a huge hit. This is problematic also for the people in general, as it demonstrates reduction in the total water levels of our planet. The project is most detrimental to those households which are below the poverty line (BPL). Although the number of these households is less, compared to the majority, but still their concerns cannot be completely ignored. Likewise, majority of the households have more than one source of income which illustrates that even if their primary source of income is lost (i.e. agriculture), they have other sources with them to sustain their livelihood. But there are also some houses, where people rely on agriculture as their only source of income. On a social level, ASP challenges social and religious cohesion, by endangering social infrastructures like schools, hospitals and churches. In total two churches will be demolished by ASP, and they've promised to resettle the same to a new place, but even for a shorter span of time, the cultural cohesion of the indigenous communities would be jeopardized. Therefore, the social impacts of the ASP can be summarized as:

¶ Land Acquisition

¶ Involuntary Resettlement

- ¶ Loss of Crops and Trees
- ¶ Loss of Livelihood
- ¶ Endangers Food Security
- ¶ Loss of access to ancestral land
- ¶ Loss of cultural assets
- ¶ Disruption of Social networks and relations
- ¶ Risk of traffic incidents

**4.2 Planet (Environmental Impacts)-** Moving on to the other P of Planet, it is eminently clear that the IEE study, clearly sidelines the major environmental impacts which this project will have. Loss of Vegetation, deforestation, soil erosion, loss of biodiversity and emission of greenhouse gases (GHG's), are some of the most adversarial outcomes of the project. Even though, the ASP aims to generate renewable energy as an environment protection measure to reduce dependence on fossil fuels, but at what cost? It's truly ironical that the Assam government claims of protecting the environment, at the cost of destroying it. One important principle of sustainability is the Precautionary principle<sup>16</sup>, which is built on the famous saying 'Prevention is the best cure'!. Instead of polluting and harming the environment first, and then finding solutions to protect it, we should consider these factors before as the damage to the environment that is caused is often irreversible in nature.

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<sup>16</sup> 'Precautionary Principle - an Overview | ScienceDirect Topics'  
<<https://www.sciencedirect.com/topics/earth-and-planetary-sciences/precautionary-principle>> accessed 4 March 2025.

**4.3 Profit (Economic Impacts)-** Finally, the project hinders Economic sustainability by hitting on the primary source of income of the Indigenous communities, i.e., agriculture. As all the households are rural settlements, ASP directly hits on their source of income and leaves them unemployed. Even though the project promises employment generation, and financial compensation to the communities, such promises cannot be entirely relied on and would only prove as a temporary solution to the long-term problem that will be faced by the indigenous communities. The long-term impacts of this compensation scheme are dubious and no concrete claims can be made for the same which leaves this question for further study. As per the IEE, approximately 66% of households will experience partial loss of livelihood, and the loss of commodities like bamboo and rubber plantations will affect their local income. The compensation guaranteed under the project is of Rs. 5 Lakh per family. The question lies, Is this one-time compensation enough to justify the permanent loss of land suffered by the Indigenous communities?

Through the table below, we have shown the primary crops which were grown by these communities and the revenue they generated per quintal.

**Table 1: Crops, Area Under Cultivation, Yield and Average Price,**

*Source: IOL and Census Survey, APDCL, Nov 23-Feb, 2024*



| <b>N a m e<br/>C r o p</b> | <b>N o .<br/>o f<br/>H H</b> | <b>%<br/>a g e t e d</b> | <b>C u l t i<br/>( B i g</b> | <b>T o t a l<br/>y i e l d<br/>q u i n t</b> | <b>A v e r a<br/>Y i e l d<br/>q u i n t</b> | <b>A v e r a<br/>M a r k e<br/>P r i c e<br/>q u i n t</b> |
|----------------------------|------------------------------|--------------------------|------------------------------|----------------------------------------------|----------------------------------------------|------------------------------------------------------------|
| Paddy                      | 89                           | 7.2                      | 56.8                         | 461.91                                       | 8.13                                         | 2420                                                       |
| Chilli                     | 25                           | 2.0                      | 8.5                          | 41.85                                        | 4.92                                         | 5000                                                       |
| Ginger                     | 20                           | 1.6                      | 9.9                          | 54.75                                        | 5.53                                         | 9000                                                       |
| Vegetables                 | 19                           | 1.5                      | 9.84                         | 51.4                                         | 5.22                                         | 3248                                                       |
| Brinjal                    | 13                           | 1.1                      | 1.44                         | 5.75                                         | 3.99                                         | 3400                                                       |

Based on this Table, it can be shown that almost 95% of the population cultivates rice/ paddy as their major crop, and it can be seen that the indigenous communities earned a decent amount to sustain their living by selling these crops. Agriculture, along with providing them economic security, also gave them food security. As their lands are now taken up, both these factors will be predominantly hit. It is also seen that some households used to lease their agricultural land, and receive annual rent per bigha of Rs. 700, 800 and 1000. With land deprivation, this income source would also take a hit. Remember when we talked about households having more than one source of income? Imagine if one of the affected household, had these sources of income i.e. selling crops and leasing their land. In such a scenario, it will lead to severe economic crises, leaving the household with no source of income. And as the success of compensation

and employment schemes cannot be ascertained, little did we know how many households will suffer severely on the economic front as a result of ASP. The project cannot claim to be 'economically sustainable' by following a twin approach of granting improved electricity and generating employment. Many more factors have to be taken into consideration, to devise a wholistic solution to the problem.

## **10. ALTERNATIVE REMEDIES**

We suggest a few solutions instead of displacing indigenous and tribal communities from their land. The two important factors which we have to keep in mind are: sustainable electricity generation for the communities and a solution which doesn't hamper their primary source of income i.e. agriculture.

### **1.1. BIPV (Building- Integrated Photovoltaics)**

Instead of clearing land to affix solar plants, this approach involves integrating solar panels into the components or parts of a household ex-roofs, windows etc.<sup>17</sup> This is highly used in urban areas, where people are switching towards solar energy. This method can be effectively implemented in the Karbi Anglong, as most of the houses have ceilings made of cement, which ensures smooth integration of solar panels on their rooftops. This will help the communities with their problem of energy supply, in a sustainable way. This model has been successful in countries

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<sup>17</sup> Canada NR, 'Building-Integrated Photovoltaics' (17 July 2018) <<https://natural-resources.canada.ca/energy-efficiency/building-integrated-photovoltaics>> accessed 4 March 2025.

like Canada<sup>18</sup> which protects the building not only from external environmental conditions, but also supports the idea of clean energy generation. With the help of the government, the indigenous communities will not face any displacement and it will also aid in meeting the renewable energy targets of the Assam government. Instead of houses, these solar panels could also be installed over other buildings like churches, schools and hospitals.<sup>19</sup>

## **1.2. Agrivoltaics (Solar Sharing)**

This approach seeks to achieve two targets at the same time i.e. food security and energy security. This model is used in China where solar panels are installed over agricultural lands, which leads to optimal use of the land. “This dual-layered system supports production of both food and electricity, thereby allowing income from both sources”.<sup>20</sup> This would prove to be the most efficient and viable option for the Indigenous communities of the Karbi district. This approach preserves not only their decade-long customary land rights, but also protects their primary source of income, along with the generation of clean and renewable energy which the people can utilize, to meet their daily energy demands. This model is getting wide acceptance in Asia and would also prove to be beneficial to

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<sup>18</sup> *Ibid* at 12.

<sup>19</sup> ‘Building the Future: Real-Life Success Stories of Mitrex BIPV Installations’ <<https://www.mitrex.com/blog/building-the-future-real-life-success-stories-of-mitrex-bipv-installations>> accessed 4 March 2025.

<sup>20</sup> Silan JG, Xu S and Apanada MJ, ‘Dual Harvest: Agrivoltaics Boost Food and Energy Production in Asia’ <<https://www.wri.org/insights/agrivoltaics-energy-food-production-asia>> accessed 4 March 2025.

the indigenous population. China has already incorporated 500+ agrivoltaics projects.<sup>21</sup>

### **1.3. Indigenous Skill Development and Employment Training Programmes**

The first two solutions, cannot work in isolation, until and unless clubbed with this final and most important solution. Instead of guaranteeing temporary employment to the indigenous population, the government should aim at training them with the necessary skill set, which can allow them to seek employment opportunities on their own, as per the current market demand. This will not only reduce the reliance of majority population from agriculture, but also is a viable long-term solution. If properly implemented, indigenous communities would see a major positive shift in their employment, and no longer would have to depend on traditional sources of income. Canada saw successful implementation of this method, by introducing such programmes. It is the choice of villagers if they still wish to carry on with their agricultural practices, but as a responsive government, it is our duty to enable them with the necessary tools and skill set, which can transform these communities into a long term asset.

## **2. CONCLUSION & RECOMMENDATIONS**

The ASP was introduced as a step towards a greener future, promising renewable energy. But unfortunately for the indigenous communities of Karbi Anglong, it represents something far more devastating leading them towards an uncertain future. While clean energy is crucial, it cannot come

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<sup>21</sup> *Ibid* at 15

at the cost of people's home, heritage and livelihood. The biggest flaw of the project lies in its disregard for people it affects the most. By displacing 9,000 villagers, who have lived on this land for generations, it does little by giving them financial compensation in exchange of replacing their deeply rooted way of life. The socio-economic survey used to justify the project barely scratched the surface of their struggles, failing to truly represent their voices. This is not to say that Assam doesn't need renewable energy, but the way this project is being carried out raises an important question- Can such development truly be called 'progress' if it comes at the cost of social and environmental injustice? There are better ways to achieve sustainability without displacing these communities. A fair and responsible approach to clean energy should consider both people and planet.

We suggest exploration of alternative methods like BIPV, where instead of taking away people's land, solar panels can be integrated into rooftops of houses, schools, hospitals etc. Another method is of Agrivoltaics, which allows farmers to continue growing crops while generating electricity. Assam can do the same, ensuring that both food security and energy security go hand in hand. Finally, as the people who are most affected should have the loudest voice in decision-making, the government must engage in transparent discussions with all affected households and not just a selected few. Furthermore, if land must be acquired, compensation shouldn't be just a one-time payment, Instead, Land-for-Land resettlement should be prioritized to ensure there is no major disruption in people's way of life. Any financial assistance should be long- term and sustainable, helping families rebuild their future instead of leaving them stranded once the money runs out.

Development that ignores people and destroys the environment, isn't progress but a step backwards. The future of Assam shouldn't be built on the ruins of its indigenous people's past, but should embrace innovation that uplifts everyone, ensuring that the promise of brighter future truly includes and benefits all.

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### III

## **GOVERNING CLIMATE INDUCED MIGRATION IN SOUTH ASIA; A CRITICAL EXAMINATION OF GOVERNING MECHANISMS FOR CLIMATE CHANGE MIGRATION IN INDIA AND BANGLADESH**

**Swasthik Narayanan\***

### **ABSTRACT**

*South Asia in the 21st century represents one of the major focal areas for climate change impacts on human lives. With its highly populated, low-lying coastal regions and substantially ecosystem dependent population, South Asia is predicted to have a large population at the risk of becoming climate refugees. According to recently released world bank reports, by 2050 more than 40 million people in south asia could be internally displaced due to slow-onset climate impacts. Other estimates maintain that a temperature increase of 2-3 degrees could result in 39-812 million south asians being at the risk of water stress. This peculiar condition of several interrelated extremes, regard also given to existing political fiasco, raises few questions where the issue of climate refugees and migration is studied. Questions regarding the sufficiency of the mechanisms in place and their preparedness to face the future, questions regarding their perception towards the issue of climate induced migration, questions on how much human rights protection are given heed in the*

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*process and finally what changes are necessary to better prepare for climate change impacts are, but some questions that are raised.*

*As such, the paper intends to investigate in detail, the politico-legal mechanisms enacted in India and Bangladesh, designed to deal with climate induced migration and their shortcomings with regard to distinctiveness of climate induced migration. It also examines the peculiar perception both these states have cultivated towards the issue of climate induced migration with special attention given to South Asian geopolitics. Finally suggestions directed at a better framework for climate change refugees and resultant migration suiting the particularly disorganized state of these societies are provided. The paper follows doctrinal methodology and makes use of primary and secondary sources. The study involves a systematic review of the materials to establish connections, drawing comparison and finalizing theories.*

**Keywords:** *South Asia, Climate change, migration, human rights, governance.*

## **1. INTRODUCTION**

Among the large heap of burning questions that 21st century faces, one acutely complex and perplexing question is the question regarding climate change governance. Its interdisciplinary nature coupled with peculiar percolative character fosters enquiries towards solutions from various disciplines while necessitating deconstruction of conventional mindsets regarding best possible pathways to such solutions. A related and equally complex question is regarding climate change induced displacement. From definitional issues to recognition related or legislation related issues,

the question of climate change induced migration is vastly contended. The paper argues that the contention is equally reflected in governing mechanisms for climate induced displacements. The Intergovernmental Panel on Climate Change(IPCC) in its 6th assessment report 2022 projects that more than one billion people globally could be exposed to coastal specific climate hazards by 2050, if translated that means millions of people being displaced due to climate change, even if forced or voluntary.<sup>22</sup> The International Organization on Migration(IOM) Global Data Institute brief on climate change and mobility 2022, likewise reports that over the past decade an estimated 21.6 million people annually were internally displaced by climate related hazards worldwide.<sup>23</sup> A further difficulty to this already existing confusion is the fact that worldover it is the least developing nations or global south in general that bears major brunt of climate change related hazards and the consequential displacement. High population, low lying coastal regions, high vulnerabilities to tropical cyclones are all some natural causes for their increased vulnerability.<sup>24</sup> However what's more important is the inadequate financial or technological capacities for relief or mitigation

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<sup>22</sup>IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

<sup>23</sup> IOM (*IOM Global Data Institute Thematic Brief #1: Evidence Summary on Climate Change and the Future of Human Mobility*, 9 November 2022) <<https://www.migrationdataportal.org/resource/iom-global-data-institute-brief-climate-change-and-mobility>> accessed 6 March 2025.

<sup>24</sup>Biermann F and Boas I, 'Protecting Climate Refugees: The Case for a Global Protocol' (2008) 50 *Environment: Science and Policy for Sustainable Development* 10.

mechanisms and a general absence of needed concern from governments in such states that results in segments of denizens who are landless, lacking basic necessities and forced to migrate, mostly having to face the worst kinds of exploitation. The academic literature on climate induced displacement is found to be largely varying and diverse. In defining such displacement, while some focus mainly on sudden onset climate hazards, consequential forced migration and Disaster Risk Reduction measures, others look at slow onset climate hazards and human rights perspectives that call for development of global norms on climate displacement that will prevent exploitation of such migrants or refugees.<sup>25</sup> Perspectives may also be classified into two extremes on the basis of the role of the environment in causing the migration; here the maximalists see climate change as the sole reason for migration while minimalists consider climate as of least relevance in these displacements. Most states have accepted the minimalist view of climate induced displacements. While benefits of such a view include points like the comparatively broader perspective it provides on climate displacement, they still largely ignore the comprehensive multi-layered nature of such displacements. Here we will be analyzing how South Asia frames perspectives on climate induced displacement and how they compare to the above discussed literature on climate induced displacement. The unique geopolitical standing, namely the very common border conflicts, resource sharing disputes, and their vulnerability to climate hazards are all reasons for looking specifically at South Asia. In that the governing mechanisms of India and Bangladesh will be the major focus whereby the findings seem to paint a whole new picture

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<sup>25</sup> Manuvie R, 'Governance of Climate Change Related Migration In Assam( India )' (thesis, 2018) 29.

of climate induced displacement covering it comprehensively. Primarily we find an absence of any flagship framework specifically for the protection and settlement of climate induced refugees and that both the nations follow a mixed perspective on climate induced displacement; having elements of both minimalism and maximalism. Further, and especially in the case of India, the states are found to use previously existing mechanisms meant for socio- economic related migration or sudden onset migration in cases of climate hazards to deal with the issue of climate induced displacement and contrary to many scholarly suggestions such mechanisms are found to be adequate. However the need for improvisation in the same cannot be ignored and a major challenge of an unconcerned government and sluggish administration is to be noted here. Lastly an analysis of final results shows us a broad picture where climate induced displacement is painted as multi-layered and requiring a similar multifarious and coherent approach.

## **2. LITERATURE ON CLIMATE INDUCED DISPLACEMENT**

### **2.1. Definitional Issues**

Starting with definitional issues in relation to climate induced displacement, there is no legal and universally accepted definition of climate induced migration. The major cause of such a gap is the multi-layered nature of the displacement which evades any narrow-minded approach to define climate induced displacement as a distinct occurrence as opposed to migration due to economic reasons. Most scholars by now have accepted the multi-layered nature and challenges involved in defining climate induced displacement although coming over to legal or policy landscapes such a gap enables the governments to continue with

their incremental mode of policy making.<sup>26</sup> An attempt made at the same by United Nations Environmental Programme (UNEP) in 1985 defined environmental refugees as:

*“...those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption that jeopardized their existence and/or seriously affected the quality of their life.”<sup>27</sup>*

The issue with the definition is that it looks at climate displacement in the early discussed parochial perspective where environmental disruption is the sole reason for migration. However, as we will see, climate induced displacement may happen from both extreme and gradual environmental events and the nature of displacement will vary depending on the pace and severity of the disasters. Further relevant factors are socio economic conditions of locality, availability of resources, capacity of local population, social networks etc.<sup>28</sup> This overlap of causes that makes a climate induced displacement look like economic migration, falling squarely within the classic migration definition, is exactly what makes governing such a climate change impact extremely complicated. Here definitional issues are also present when we discuss who is a migrant and who is a refugee. Various intergovernmental institutions are found to use both the terms almost synonymous to indicate the mobility induced by

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<sup>26</sup> Naser MM and others, ‘Climate Change, Migration and Human Rights in Bangladesh: Perspectives on Governance’ (2019) 60 Asia Pacific Viewpoint 176.

<sup>27</sup> Hinnawi, E.E. (1985) Environmental refugees. Nairobi, Kenya: United Nations Environment Programme.

<sup>28</sup> Naser MM and others, ‘Climate Change, Migration and Human Rights in Bangladesh: Perspectives on Governance’ (2019) 60 Asia Pacific Viewpoint 179.

climate change making the subject more and more vague. However, recognition of victims of such climate change impacts, as diversely aggrieved as they are, is still necessary as solutions to a problem of someone losing their land to river erosion, thereby being landless may not be the same for an economic migrant looking for enhancing their income and quality of life. This then necessitates a comprehensive policy approach to climate induced displacement.<sup>29</sup>

## **2.2. Perception Among States**

Now coming over to legal and other measures that states adopt with regard to climate induced displacement, Scholars point out two major perspectives in existence, both originating in different conceptions of mobility by humans. First is the national security perspective originating in the security studies literature and second, neo classical economic migration perspectives originating in the classical migration studies.<sup>30</sup> Here the national security perspective works by a hyperbolic projection of future environmental refugees who will act as a security threat to the integrity of the state and so measures adopted would be to identify groups which are outsiders and enact legislation meant to regulate their movements along the international borders. Both India and Bangladesh using the Citizenship act to deal with the flow of migrants in their international border can be a representation of such a perspective. The same also reflects a geopolitical condition of the entire South Asia and we

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<sup>29</sup> Martin M, 'Climate-Influenced Migration in Bangladesh: The Need for a Policy Realignment' (2017) 35 Development Policy Review 0357.

<sup>30</sup> Manuvie R, 'Governance of Climate Change Related Migration In Assam (India)' (thesis, 2018) 32.

find similar approaches by states in dealing with irregular migrant flows between borders.

The Neo-Classical economic migration perspective by contrast underplays the factor of environment in production of refugees or migration. As such policies here mostly lean towards adopting welfare measures and adaptation laws for increasing resilience to climate change. As stated earlier, most states today agree with this perspective towards climate induced displacement as it is more accommodative of the broader nuances of climate induced displacement. India and Bangladesh in line with this argument follows this perspective for the most part. The Bangladesh Disaster management act 2012 and Indian Disaster management act 2005 are both representative of this approach. However in such an approach we find an increased contestation between various factors causing migration and results in lower relevance given to the environment as cause of displacement. Hence, we find that both the governments at various points take stands that recognize and promote international migration as a form of adaptation and strengthening the national economy while turning a blind eye to adaptation possibilities of large amounts of internal migration. Under the light of discussions till above we will now analyze the governing mechanisms in place of both India and Bangladesh.

### **3. BANGLADESH & CLIMATE INDUCED DISPLACEMENT**

Looking at Bangladesh, it is often ranked as one of the most climate vulnerable countries in the world. For instance, The Germanwatch Global Climate Risk Index 2018 placed Bangladesh in the 6th position in the list of countries most affected by climate change in the period 1997-2016.



<sup>31</sup>The state has been historically highly vulnerable owing to its geographical location in the delta of Ganges, Brahmaputra and Meghna Rivers. Additionally, the low-lying deltaic topography and dense population are all reasons for this vulnerability. The vast coastal areas to the south are frequently visited by extreme weather events and climatic hazards like cyclones, tidal surges and heavy rainfall. Among these the cyclones originating the Bay of Bengal is considered extremely deleterious as seen by the consequences of cyclone Aila in 2009 that caused loss of 330 lives.<sup>32</sup> These include both sudden onset and slow onset climatic hazards and are found to have highly adverse effects on human habitats, livelihood, health, access to water, food and housing. These adverse effects aggravate other existing socio-economic problems, leading to an entire cycle of displacements in search of a safer environment with alternative income, reliable livelihood and household security.

Governing mechanism wise, we find that Bangladesh has been manifesting its concerns regarding climate change impacts through various climate change related policies. Moreover a swift perusal of these policy or legislation documents reflects a evolutionary picture of such mitigatory or management plans that starts with a strict neoclassical economic migration point of view where migration is treated as a undesirable outcome of climate change and adaptive measures aimed at diversifying livelihood options are suggested and reaching a point where

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<sup>31</sup>Eckstein, D., Künzel, V. and Schäfer, L. (2017) Global climate risk index 2018: Who suffers most from extreme weather events? weather-related loss events in 2016 and 1997 to 2016. Bonn: Germanwatch Nord-Süd Initiative e.V.

<sup>32</sup> Martin M, 'Climate-Influenced Migration in Bangladesh: The Need for a Policy Realignment' (2017) 35 Development Policy Review 0357.

the plans acknowledges migration as a reasonable adaptation option, although still not acknowledging some very relevant aspects. The beginning of this evolution is found in the submission of the National Adaptation Programme of Action (NAPA) in 2005 as mandated by UNFCCC for least-developed countries, thereby recognizing that climate change will amplify the impacts of natural hazards.<sup>33</sup> The NAPA 2005 mainly focused on challenges like fresh water scarcity, coastal zone salinity, river bank erosion and incessant floods. The plan was made with the objective of achieving community adaptation to flood/tidal surge and sea level rise through the proposed programmes. Further it explicitly states that such programmes would halt affected communities from migrating to cities for jobs and livelihood. It considers such migration as causing ‘social problems’ to the cities. Overall, it treats migration as an unpleasant outcome of climate change and proposes programmes that can prevent this adverse outcome from being manifested. Subsequently we also saw the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008.<sup>34</sup> This document recognizes the large amounts of internal migration, especially from coastal areas, although it saw it as contributing to large amounts of unplanned urbanization that was posing a impending problem. Both the documents were revised in 2009. The relevance of the revision for NAPA was that the provisions on negative references to migration were deleted and for the BCCSAP there were major changes leading to recognizing migration as a possible adaptation mechanism. The 2009

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<sup>33</sup> Ministry Of Environment and Forest, “National Adaptation Programme of Action”(Government of The People’s Republic of Bangladesh 2005) <<https://unfccc.int/resource/docs/napa/ban01.pdf>> accessed February 28, 2025.

<sup>34</sup> Ministry Of Environment and Forest, “Bangladesh Climate Change Strategy and Action Plan” (Government of The People’s Republic of Bangladesh 2008).

BCCSAP updated the figures of displacement due to sea level change and salinity to 20 million and made a suggestion for resettlement of these ‘environmental refugees’.<sup>35</sup> The document goes to the extent of saying migration must be considered a valid option for the country; however this migration was confined to international migration while implicitly considering internal migration as exporting poverty to the urban areas. Some other policies related to development are also found in discussing the subject of climate induced displacement, namely the Sixth five year plan from 2011-2015 and vision 21 as part of the countries’ outline perspective plan.<sup>36</sup> Both the documents reflect the evolutionary features that updated BCCSAP inculcated, that is both of them seem to recognize and promote international migration while strongly opposing internal migration. Vision 21 especially while welcoming remittances from overseas, comments negatively on internal migration. In matters of disaster management policies too we see disaster management act largely overlooking internal migration and its contributions to coping with disaster events. What is important to note here also is that most internal migration happens from rural to urban areas in search for economic opportunities. The consequence then being swift urbanization with average annual rate of change from rural to urban at 2.4% in comparison to Asian average of 1.5% during 2010-2015.<sup>37</sup> Most of such short-term

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<sup>35</sup> Ministry Of Environment and Forest, “Bangladesh Climate Change Strategy and Action Plan” (Government of The People’s Republic of Bangladesh 2009).

<sup>36</sup> General Economics Division, “Outline Perspective Plan of Bangladesh 2010- 2021: Making Vision 21 a Reality” (Government of The People’s Republic Of Bangladesh 2010) .

<sup>37</sup> Martin M, ‘Climate-Influenced Migration in Bangladesh: The Need for a Policy Realignment’ (2017) 35 Development Policy Review 0357.

migrations happen from the need to adapt to the erratic climate that is now challenging. Such is very evident in the findings of a 1600 household survey conducted in northwestern Bangladesh according to which 19% of households\_migrated during lean farming season for the purpose of complementing their income.<sup>38</sup> Such migration from rural areas forms a significant factor in the growing manufacturing sector. The remittances sent by such migrants have helped reduce poverty and contribute to socio economic development of rural areas although, as we saw earlier, no recognition is given to the economic contributions of such internal migrants and their role in the growing economy is a subject totally absent in government discourses.

#### **4. INDIA & CLIMATE INDUCED DISPLACEMENT**

Coming over to India and how it governs climate change induced displacement, we find here a very different framework utilized in cases of climate related displacement, although the objectives are very similar to that existing in Bangladesh. What is *prima facie* noticeable in the Indian scenario in comparison to Bangladesh is a much less concern on the part of the state regarding climate change impacts on human lives. This means the governments still haven't recognized the role of climate change in aggravating natural hazards. Unlike most of its neighbours, India's participation in academic or policy debates on climate change induced displacement has been insignificant. This is also reflected in the general behaviour of the Indian government in refusing to discuss the matter of

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<sup>38</sup> Martin M, 'Climate-Influenced Migration in Bangladesh: The Need for a Policy Realignment' (2017) 35 Development Policy Review 0357.

climate change in any forums like UNFCCC, International Organization on Migration, United Nations High Commission for refugees etc .

This lack of concern however is despite the fact that every year millions of people are displaced due to climatic hazards in states like Bihar, Uttar Pradesh and Assam.

This stand of India too is a reminder of South Asian geopolitics whereby the history of conflicts and exploitation by foreigners have created a stubborn inclination towards international autonomy, reflected in how it considers climate change induced displacement to be a western construct. All throughout south asia this view is echoed in states desisting to ratify the refugee convention of 1951.

The Indian context of climate change induced displacements are found to be caused by hazards like floods, cyclones, sea level rise, drought and water scarcity. Regions like sundarbans in West Bengal are particularly susceptible to climate change related hazard like sea level rise owing to its location in the low-lying deltaic topography, Assam likewise is highly vulnerable to sudden onset floods from the shallow basin of Brahmaputra, Regions like Maharashtra and Karnataka face severe water shortages and all these contributes to climate change induced displacements in large number.

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) 2005 and Indira Awas Yojana (IAY) (renamed as Pradhan Mantri Awas Yojana) are two programmes existing in areas of mitigation and relief when looked from a climate change perspective. We find both the above given programmes providing a sufficient framework for climate induced displacement that does accommodate a broader definition of such

displacement. Looking at MGNREGA, we see the context and purpose of bringing this legislation in India was to provide employment for the population in rural areas and especially the agricultural farmers who are unemployed for certain times of every year.<sup>39</sup>

As the name suggests, the programme provides paid unskilled employment from the government to any adult from a rural area. As such any adult can demand 100 days of paid unskilled labour and such a demand must be met within 15 days. In cases of failure to meet the demand on part of the government, Unemployment allowance will have to be provided to the aggrieved. The objectives as we discussed earlier is the creation of a supplementary employment option for the vulnerable sections in rural areas. A major feature of the scheme is also the role Panchayati Raj Institutions(PRI) have in the promotion of the scheme. Under it the PRI's are to take up the responsibilities for registration of the workers, identification of the work etc. Overall MGNREGA has been considered a major milestone in the evolution towards right to livelihood and decentralization of governance frameworks. Several studies focusing on links between MGNREGA and Climate change found a good amount of potential in the act in reducing distress displacements related to climate change.<sup>40</sup> As noted earlier, one of the major forms of displacement induced by climate change is that of short distance temporary internal migration mostly in search of economic opportunities.

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<sup>39</sup> The National Rural Employment Guarantee Act 2005.

<sup>40</sup> Tiwari R, 'MGNREGA for Environmental Service Enhancement and Vulnerability Reduction: Rapid Appraisal in Chitradurga District, Karnataka' (2011) 46 Economic Political Weekly 39.

However, the working of the programme has not been so ideal as it is on paper. Core issue being generation of jobs under the scheme as being inadequate and has led to a general dissatisfaction amongst rural communities. Further this dissatisfaction is reflected in descending numbers of people demanding jobs. Further in areas like Assam, situated near the state border, the actual objective of the act seems to have been ignored for immediate goals like expressing the government's stand on issues like citizenship.<sup>41</sup> Thus here again the primary objectives of relief for the backward sections of rural areas or, as in present scenario relief for climate related displacement, does not find any priority in the state's consideration; highlighting the importance of the state acknowledging the relevance and complexity of climate induced displacements.

Looking at mitigatory policies, we see the National Flood Relief Policy, created in 1954 in the aftermath of devastating floods in Assam during the 1950's.<sup>42</sup> The policy aimed at adoption of various measures necessary for flood control and irrigation. With regard to Brahmaputra River, a source for the largest number of displacements in India annually and a location where flood relief policy should have worked effectively, even with all these institutional setup lack of structural development in the valley is found.<sup>43</sup>

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<sup>41</sup> Manuvie R, 'Governance of Climate Change Related Migration In Assam (India)' (thesis, 2018) 115.

<sup>42</sup> Government of India, National Flood Relief Policy 1954.

<sup>43</sup> National Disaster Management Authority, National Disaster Management Guidelines Management of Flood, 2008, <https://nidm.gov.in/pdf/guidelines/floods.pdf>, accessed 24th February 2025.

The small scale projects coming under program operationalization of MGNREGA also includes flood control activities. This makes the utility of act much more broad. However, a general decrease in expenditure for the act from 2015-16 have made this provision futile.<sup>44</sup> This is seen to be adding upon vulnerabilities during periods of floods.

Additionally, we may also mention the Pradhan Matri Awas Yojana, assisting landless population below poverty line families in seeking grants to construct affordable rural housing. <sup>45</sup>The scheme reserves 5% of total allocation per funding year as a contingency fund at the central level for various marginal groups. Among them, a reserve is also made for rehabilitation of BPL families affected by natural calamities. In various flood affected areas it is utilized as an effective scheme for rehabilitation of those affected by such floods.

And so to make a final remark on the Indian governance mechanisms for climate induced displacement we see that on paper various institutions with sufficient capability to mitigate and provide relief to climate change victims are very much present. Yet the deficit of implementation in the whole framework cannot be turned a blind eye. Although the Indian government doesn't agree to a concept of climate change induced migration, we see that through various mechanisms it has somewhat crafted a solution as seen in the wide applicability of MGNREGA. Yet the very fact of lack of concern is evident in decreasing expenditure in most

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<sup>44</sup> Sajwan R, 'Budget 2025-26: Rural Economy Does Not Get Much, Same Outlay for MGNREGA' Down to Earth (1 February 2025) <<https://www.downtoearth.org.in/economy/budget-2025-26-rural-economy-does-not-get-much-same-outlay-for-mgnrega>> accessed 25 March 2025.

<sup>45</sup> Government of India, Pradhan Mantri Awas Yojana (PMAY) <https://pmayg.nic.in> accessed 6 March 2025.



of these mechanisms and the low capacity of the state to structurally mitigate disasters. All this necessitates an acceptance of the distinctiveness of climate change induced displacement so that the governments can further refine these mechanisms to provide for a comprehensive solution for such displacement. The paper suggests such comprehensive solutions should consider all dimensions, namely migration being an adaptation possibility, livelihood diversity and economic development in rural areas providing alternatives to the short term migration so that burden on urban areas may be decreased and more concentration may be given on studying internal migration patterns and their effects on the economy. Moreover, India also has to deal with the irregular migrant flow from Bangladesh in a climate induced displacement perspective. It is to be seen as an essential first step for both India and Bangladesh.

## **5. CONCLUSION**

And so to conclude, Climate induced displacement constitutes one of the most burning and complex governmental questions in relation to climate change in the 21st century. From its definition related difficulties to difficulties in legislating on the matter, we find climate induced displacement to be a vastly contended one. This is visible in the academic literature on the subject that on one side attempts to distinguish it from other forms of migration under the justification of providing actual climate justice while on the other attempts at incorporating such displacement as part of classical migration types so as to broaden the scope of climate induced displacement. We further saw two major ways states perceive migration namely through the classical migration prism and the security studies prism. India and Bangladesh had elements of both. Further analysis was done on the governing framework in place in both the countries to

deal with the matter of climate induced displacement and a dominant inclination to developmental conception of climate induced migration was found although the realities of their economies showed a more comprehensive policy legal framework as necessary. This is specially the case in viewing migration as an adaptation method to climate change related hazards. Further there is an immediate need for a cold start to administrative apparatus dealing with migration and climate change related hazards in both nations as implementation was the biggest hurdle in the whole governing framework. In the case of India however there is still a long way to go in recognizing climate induced displacements and then refining already utilized mechanisms to the specific characteristics of such displacements. MGNREGA was found to be a really good instrument for this on paper, although its implementation wasn't very strong. Both the countries also need to address the issue of irregular migration happening between their borders beyond the political narratives and under the spotlight of climate change induced displacement. Finally viewing climate induced displacement in a broader perspective is suggested where fundamental right to movement, residence and other rights are considered within the question of climate induced displacement. The Indian constitutional provisions of article 19(1)d that talks about freedom of movement and Bangladesh constitutional provision of article 36 regarding the same may be of assistance in such an exercise. Further discussions are required as to whether the non-Refoulement principle should also be

applicable to hydro meteorological disasters.<sup>46</sup> All these also call for further research on the questions raised.

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<sup>46</sup> Ritumbra Manuvie,'GOVERNANCE OF CLIMATE CHANGE RELATED MIGRATIONS IN ASSAM(INDIA)'(PhD thesis, University of Edinburgh,2018)

## IV

# CLIMATE DISPLACEMENT IN THE GLOBAL SOUTH AS A DEFINING ECOLOGICAL TIPPING POINT; A PLEA FOR RADICAL ACTION

Vishnu K Reji\*

## ABSTRACT

*Despite the overwhelming scientific consensus on the severity and rapid pace of the climate crisis, global action remains troublingly elusive. This paper aims to analyze the uncanny paralysis that defines the contemporary responses and exploring the argument that it is not a mere failure of policy but a crisis of modernity and the deeper ideological and economic contradictions underlying modernity. The central thesis posits that our global economy's structural dependence on extractivism that prioritizes infinite growth and profit over ecological limits thereby creating a deadlock that prevents meaningful change. This inertia is explored through the phenomena of mass climate displacement and as the crisis disproportionately impacting vulnerable populations in the Global South. Using India as a critical case study, the paper also aims to examine the cascading effects of heatwaves and the significant gaps in international and domestic law to protect climate refugees. For climate change education, this paper can hopefully serve as an illuminating*

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*source. It moves the discussion beyond climate science into the interdisciplinary domains of political economy, law and social justice. By aiming to deconstruct concepts like ideological paralysis and examine the shortcomings of existing legal frameworks it can potentially provide educators and students with a critical exploration of understanding the systemic barriers to climate action. The importance of environmental jurisprudence and systemic thinking is also explored with the ultimate aim of equipping readers to understand and advocate for the radical structural transformations the paper posits is needed to address the crisis at its root.*

**Keywords:** Climate Displacement, Extractivism, Climate Justice, Environmental Jurisprudence, Systemic Change

## 1. INTRODUCTION

Climate change is the most defining transformational force of the 21st century and yet we remain collectively trapped in a state of paralysis and confusion. We find ourselves feeling inwardly undone by the anxiety of not knowing how to effectively respond so instead we circle around the drain while being held hostage to the whims of capital and extractivism. The urgency of the crisis is no longer a subject of debate; it is a reality backed by decades of scientific research and physical manifestations and yet meaningful action remains elusive. Climate change is not merely an environmental issue—it is a civilizational crisis that threatens human societies, economies and ecosystems in ways that surpass the scope of any previous historical challenge. As a complex phenomenon that operates on multiple scales, from the immediate largescale devastation of extreme weather events to the slower, creeping consequences of sea-level rise,

desertification, and biodiversity loss, it has far reaching consequences on the very fundamental human institutions of our modern age. Even the foundational ideal of the basic right of all human beings to a minimum sense of safety and protection, enshrined in our modern age, stands to disappear as the very ground gives way beneath our feet.<sup>47</sup>

The industrial, economic and social transformations commonly grouped under the term “globalization” have played a central role in exacerbating this crisis. While globalization has facilitated technological advancement, economic growth and international cooperation, it has also entrenched and accelerated the exploitative systems of production that it’s predicated upon that prioritize short-term gains over long-term sustainability. The fossil-fuel dependent economic model, which has driven development for centuries, continues unabated despite the well-documented consequences of such rampant extractivism.<sup>48</sup> The failure of international governance structures to enforce binding and effective climate action reflects a deeper contradiction in modern capitalism—an economic system predicated on infinite growth paradoxically operating within the constraints of a finite planet. The crisis is further exacerbated by a widespread collective psychological and political inertia. Despite overwhelming scientific evidence, the institutional responses are widely characterized by obfuscation and derealisation, treating climate change as a distant abstract problem—one that can be managed incrementally or by the next generation rather than being confronted with the immediate and radical

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<sup>47</sup> Alex McLaughlin, “Climate Resistance and the Far Future” *Social Theory and Practice* 50(2) (2024): 229-255.

<sup>48</sup> Carl Mitcham and Jessica Smith Rolston, “Energy Constraints” *Science and Engineering Ethics* 19 (2013): 313.

systemic changes it demands. This disconnect between knowledge and action has led to a paradox: while climate discourse has become increasingly alarmist, real-world policy measures remain superficial and fragmented. Governments and corporations make pledges and set targets, yet carbon emissions continue to rise, and ecological tipping points are being surpassed faster than anticipated.

In this paper, I aim to explore the structural deadlock that defines contemporary climate action. This deadlock is not merely a result of political inefficacy or corporate lobbying but is symptomatic of a deeper ideological and economic contradiction. Our institutions, built on principles of progress and expansion, struggle to accommodate the need for limits, restraint, and de-growth. Climate change thus becomes a crisis of modernity itself—a moment of reckoning for the fundamental assumptions that underpin our economic and political systems.

## **2. THESIS STATEMENT**

This paper seeks to analyze the uncanny paralysis that characterizes contemporary climate action. On one hand, scientific consensus overwhelmingly supports the need for urgent and radical intervention. Reports from our global institutions consistently highlight the catastrophic trajectory we are on. Conversely, the actual measures implemented by governments and international bodies remain inadequate and almost half-hearted. Policy targets shift as tipping points approach, and even the most ambitious climate agreements, such as the Paris Accord, fall short of enforcing meaningful systemic change. Rather than presenting a purely empirical study, this paper aims to be more of a theoretical exercise adopting an interdisciplinary lens to explore the climate crisis with a

broader scope. By weaving together theoretical perspectives with case studies, this paper seeks to highlight the urgency of systemic change while questioning the ideological and economic frameworks that continue to obstruct meaningful climate action.

### **3. CORE ARGUMENT**

#### **3.1 Extractivism and Climate Paralysis**

At the heart of the climate crisis lies the logic of our contemporary economic systems-systems that prioritize economic growth and profit maximization above ecological sustainability. Despite overwhelming scientific evidence pointing to the catastrophic consequences of continued fossil fuel dependence, the global economy largely remains structurally tied to extractivism.<sup>49</sup> The fossil fuel industry, backed by multinational corporations and state actors, has played a decisive role in climate denialism and delay tactics-which is a part of a wider phenomenon where ecological concerns remain ultimately subordinate to the flow of capital. The history of philosophy interpreted as revealing humanity's ceaseless struggle to reconcile its relentless ambition and enterprising spirit with nature's absolute sovereignty offers an effective framework for understanding climate change. As we move further from a natural way of life due to the increasing tension between our drive to dominate and the planet's indifferent limits, our sense of place in the world becomes

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<sup>49</sup> Bronwen Morgan and Declan Kuch, "The Socio-Legal Implications of the New Politics of Climate Change" *University of New South Wales Law Journal* 39(4) 2016: 1715-1740 .



increasingly elusive<sup>50</sup>. This tension has reached a mature stage under our contemporary global economic systems with its consequent atomization rendering individuals mere components of the extractivist machine, unwilling and unable to conceive of existence beyond the capital-human relationship.

The disparity between the Global North and Global South in climate responsibility and financing further highlights our current status quo's inherent contradictions. The major industrialized developed nations are historically responsible for the bulk of greenhouse gas emissions, yet the brunt of climate change's consequences—rising temperatures, extreme weather events, and displacement—is disproportionately borne by the third world.<sup>51</sup> Debates over climate financing, such as the Loss and Damage Fund proposed at COP meetings, reveal the persistent unwillingness of wealthy nations to compensate vulnerable countries adequately. Even when financial mechanisms are established, they remain severely underfunded or come with exploitative conditions. The developed countries reluctance to take genuine responsibility not only exacerbates global inequalities but also perpetuates a cycle where developing countries are forced into debt and dependency, further limiting its already fragile capacity to adapt to climate change<sup>52</sup>.

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<sup>50</sup> Heather B. Truelove and others, "Positive and Negative Spillover of Pro-environmental Behavior: An Integrative Review and Theoretical Framework" *Global Environmental Change* 29 (2014): 127.

<sup>51</sup> Sharon L. Harlan and others, "Climate Justice and Inequality" *Climate Change and Society: Sociological Perspectives* 5 (2015): 127-163.

<sup>52</sup> J. Timmons Roberts and Bradley C. Parks, "A Climate of Injustice: Global Inequality, North-South Politics, and Climate Policy" *International Environmental Agreements* 8(4) (2008): 409-412.

### 3.2 The Feeling of Paralysis

The paradox of climate change is that while it is universally acknowledged as an existential crisis, meaningful systemic action remains elusive.<sup>53</sup> This is described as a form of ideological paralysis, wherein society acknowledges a problem but remains unable to act decisively due to deep-rooted structural and psychological barriers.<sup>54</sup> This explains why climate agreements such as the Kyoto Protocol and the Paris Accord have failed to achieve consequential results. Targets are consistently revised, carbon budgets are exceeded and new deadlines are set, creating the illusion of progress while real emissions continue to rise. Donald Trump's presidency provides one of the most provocative examples of this fatalistic characteristic of the climate change phenomenon. His actions—such as withdrawing from the Paris Agreement, aggressively reviving the coal industry, and dismantling environmental regulations—along with the public support they garnered, reveal a deeper ideological commitment to extractivism. This mindset echoes Sarah Palin's infamous “drill, baby, drill” rhetoric, driven by a perverse psychological enjoyment—what Jacques Lacan terms “surplus jouissance”—in hastening destruction despite full awareness of its consequences. This extends beyond climate denialism into the broader structure of fossil capitalism, where even those who recognize the crisis find themselves unable to pull back from their complicity. The anthropocentric illusion of invulnerability and ‘otherness’ further reinforces this inertia, as modernity has conditioned us to see

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<sup>53</sup> Linda Steg, “Values, Norms, and Intrinsic Motivation to Act Proenvironmentally” *Annual Review of Environment and Resources* 41 (2016): 277-292.

<sup>54</sup> Robert J. Brulle and Kari Marie Norgaard, “Avoiding cultural trauma: climate change and social inertia” *Environmental Politics* 28(5) (2019): 886-908.

nature as an external, controllable entity rather than an integrated system upon which our survival depends.

Perhaps the greatest barrier to radical structural change is not technical feasibility but the psychosocial investment in the status quo. This addiction to extractivism mirrors compulsive behaviours and within this deeply entrenched pathology, even proven and pragmatic solutions such as nuclear energy and clean coal face resistance. Nuclear energy, despite being one of the most efficient low-carbon alternatives, remains politically controversial due to historical fears rather than scientific evidence. Even in the face of radical necessities, transitions like maximizing nuclear power utilization, supplemented by cleaner fossil fuel alternatives, offer viable and pragmatic pathways—yet structural and ideological barriers persist.

### **3.3 Climate Change and the Refugee Crisis: Global and Indian Perspectives**

Climate change is already driving mass displacement, particularly in the Global South. According to the UNHCR, weather-related disasters displaced 32.6 million people in 2022 alone, with projections indicating that climate-induced displacement could reach 1.2 billion by 2050 if current trends continue<sup>55</sup>. The most affected regions—Bangladesh, the Pacific Island nations and drought-stricken areas of Africa—face existential threats such as rising sea levels and desertification which would render entire regions uninhabitable. Concerningly, these populations are not granted formal refugee status under current international law, leaving

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<sup>55</sup> Internal Displacement Monitoring Centre, *Global Report on Internal Displacement 2023* (IDMC 2023)

them vulnerable to statelessness and exploitation. Closer home, India proves a worrying case study in climate-induced displacement. The country faces both extreme heatwaves and catastrophic flooding, making it one of the most climate-vulnerable nations.

In North India in recent years, extreme heatwaves have already led to thousands of deaths and have triggered large-scale migration. Urban centers, already struggling with infrastructural strain, are unable to accommodate the influx of displaced populations, leading to economic precarity and social tensions. Meanwhile the South Indian state of Kerala is characterized by regions with low lying terrain which are particularly vulnerable to rising sea levels. These densely populated regions face high impact events and land erosion leading to displacement and disruption of livelihoods. In addition, poor urban planning, deforestation, and unregulated construction in ecologically sensitive zones exacerbates such disasters. India previously lacked a legal framework to address such concerns and recognize internally displaced climate refugees leaving millions without efficient institutional support. Unlike conflict refugees, climate migrants were in a legal void but this could change with a landmark decision in 2024<sup>56</sup> by the Supreme Court recognizing a constitutional right against the adverse effects of climate change and the Rajasthan HC in 2024<sup>57</sup> oscolheld that the state's failure to implement heatwave preparedness measures violated Article 21 opening up a legal standing within Indian constitutional law to address climate displacement.

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<sup>56</sup> *M.K. Ranjitsinh and Others v Union of India and Others* (2024) 2024 INSC 280.

<sup>57</sup> *In Re: Save The Planet Earth And The Future Generations Of This Universe v Union of India* (2024) SCC OnLine Raj 1329 (Raj HC).

### 3.4 Catastrophe as the Only Wake-Up Call?

Perhaps the ecological tipping points that finally mobilize action might not be statistics and figures but existential disasters—disasters of such scale and intensity that they act as a forceful wakeup call across the globe providing no choice but to act.<sup>58</sup> The morbid irony is that a climate-induced collapse would first undermine the very economic structures that perpetuate extractivism and are utilized to combat its effects. Yet, rather than preemptively addressing this reality, there remains a collective willingness to “circle the drain” until collapse is undeniable. The assumption that the worst consequences will be borne by future generations fosters complacency, despite mounting evidence that climate-induced crises—ranging from pandemics to geopolitical instability—are already unfolding. Techno-optimism, which is the prevailing mobilizer of contemporary climate action, argues that banking on technological innovation can resolve the climate crisis on its own without necessitating systemic economic change. Proponents of the most ambitious technological plans such as geoengineering, carbon capture and cloud seeding claim that these interventions can allow for continued economic expansion while reducing environmental impact and buying time. However, the viability of these solutions remains uncertain while proving to be radical in its own right despite serving to sustain the current normalcy. Carbon capture technologies, for example, have not yet been proven effective at scale while geoengineering carries unpredictable risks that could exacerbate climate instability in addition to potentially

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<sup>58</sup> Lauren Feldman and P. Sol Hart, “Is there any hope? How climate change news imagery and text influence audience emotions and support for climate mitigation policies” *Risk Analysis* 38(3) (2018): 585–602.

impeding addressal of the fundamental causes of this problem which would only continue to persist.

Perhaps, far reaching and more pragmatic renewable solutions such as maximal adoption of nuclear energy, which still faces institutional and societal hurdles, could be undertaken at first, paired with transitional measures such as clean coal and carbon capture to provide a feasible supplement to facilitate such projects. However, without addressing the underlying ideological barriers that sustain extractivism, even the most elaborate technological solutions risk becoming band-aids on a systemic wound. The climate crisis is not just an environmental issue—it is a crisis of modernity itself. The ideological, economic, and psychological forces sustaining climate inaction must be confronted with radical choices and structural transformation.<sup>59</sup> The question is not whether change will come, but whether it will be proactive or forced upon us by collapse.

### **3.5 Renewables and the Race Against Time**

The global transition to renewable energy, which has accelerated significantly over the past two decades, is another prominent avenue of contemporary climate action with over 30% of electricity now being generated from renewable sources.<sup>60</sup> The total installed capacity for renewables has surpassed 4000 GW and most of this capacity was built since the year 2000.<sup>61</sup> Countries such as Uruguay, where approximately

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<sup>59</sup> William Davies, “Recovering the future: The reinvention of ‘social law’” *Juncture* 20(3) (2013): 216-222

<sup>60</sup> International Energy Agency, *Electricity 2024* (IEA 2024)  
<<https://www.ica.org/reports/electricity-2024>> accessed 20 May 2025.

<sup>61</sup> International Renewable Energy Agency, *Renewable Capacity Statistics 2024* (IRENA 2024)

90% of electricity comes from renewable sources, exemplify the potential of sustainable energy with this shift towards large-scale renewable integration being driven largely by wind and hydropower.<sup>62</sup> Meanwhile, China stands out as a notable global leader in adopting renewables, building nearly twice as much new wind and solar capacity as the rest of the world combined<sup>63</sup>, with India following closely too with the significant rise in consumer adoption of solar energy.<sup>64</sup> Beyond electricity generation, the rise of electric vehicles (EV's) is another major transformation of the global energy landscape. In China, the rapid adoption of cleaner personal transportation technologies is evident with how almost half of all new cars sales are New Energy Vehicles.<sup>65</sup> The market for EV's has expanded dramatically in recent years, fueled by both policy incentives and technological improvements. This shift away from fossil fuel-dependent transport is a crucial component in the broader movement towards decarbonization.

Nonetheless, solar and wind energy face fundamental challenges. The reliance on weather-dependent energy sources means that storage solutions and grid stability measures are essential to ensuring a reliable power supply leading to the key challenge of intermittency. Renewables each present their own set of particular problems, such as environmental

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<sup>62</sup> International Energy Agency, Uruguay 2023 - *Energy Policy Review* (Digital Report, 2023) <<https://www.iea.org/countries/uruguay>> accessed 20 May 2025.

<sup>63</sup> BloombergNEF, *Energy Transition Investment Trends 2024* (Online Report, 2024) <<https://about.bnef.com/energy-transition-investment/>> accessed 20 May 2025.

<sup>64</sup> Ministry of New and Renewable Energy, Government of India, 'Year wise Achievements' (*Ministry of New and Renewable Energy*, 20 May 2025) <<https://mnre.gov.in/en/year-wise-achievement/>> accessed 20 May 2025.

<sup>65</sup> International Energy Agency, 'Global EV Outlook 2025' (*IEA*, 2025) <<https://www.iea.org/reports/global-ev-outlook-2025>> accessed 20 May 2025.

disruption, displacement of communities and consequent ecological consequences. For instance, algae growth in wind farm-associated water bodies has been cited as an unforeseen issue requiring further research and mitigation strategies.<sup>66</sup> Solar energy on the other hand, while increasingly affordable, raises concerns regarding the cost and environmental impact of solar panels. The materials used in their production, their relatively short lifespan and the difficulties associated with disposal contribute to the debate over their long-term sustainability.<sup>67</sup> Additionally, electric vehicles, despite their promise in reducing emissions, are not without drawbacks. Questions regarding their battery production, resource extraction for lithium and other materials and end-of-life battery disposal remain pressing concerns. The infrastructural demands of widespread EV adoption, including charging networks and grid capacity, also present significant challenges.<sup>68</sup>

Another critical question is whether the transition to clean energy is happening quickly enough to mitigate climate change effectively. Current estimates suggest that the world is on track for approximately 2.7 degrees Celsius of warming based on existing policies.<sup>69</sup> However, this estimate

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<sup>66</sup> Nathalie Niquil, 'Marine life: contrasting effects of offshore wind' (January 2022) <<https://www.polytechnique-insights.com/en/braincamps/energy/offshore-wind-drop-in-the-ocean-or-energy-tsunami/marine-life-contrasting-effects-of-offshore-wind/>> accessed 20 May 2025.

<sup>67</sup> IEA PVPS, *Life Cycle Assessment of Current Photovoltaic Module Recycling* (Report IEA-PVPS T12-13:2018, IEA-PVPS, 2018) ISBN 978-3-906042-69-5.

<sup>68</sup> Lakshmi R B, 'The Environmental Impact of Battery Production for Electric Vehicles' (*Earth.Org*, 11 January 2023) <<https://earth.org/environmental-impact-of-battery-production/>> accessed 20 May 2025

<sup>69</sup> Climate Action Tracker, 'The Climate Crisis Worsens: The Warming Outlook Stagnates' (November 2024) <<https://climateactiontracker.org/publications/the-climate-crisis-worsens-the-warming-outlook-stagnates/>> accessed 20 May 2025.



does not fully account for the increasing ambition of climate policies or the rapid scaling of new innovations. If nations commit to achieving net-zero emissions and employ all available strategies to accelerate the clean energy transition, there remains a possibility of limiting warming to below 2 degrees Celsius. Furthermore, if governments fulfill their 2030 targets and adhere to their legally binding long-term climate commitments, projections indicate that global temperature rise could be limited to around 2.1 degrees Celsius by the year 2100.<sup>70</sup>

While challenges remain, the momentum toward utilizing renewables for a cleaner energy future is palpable, with continued investment, technological advancements, and policy support determining the speed and effectiveness of this transition. Exemplifying such effective action in the public sphere is also critical to inspire further initiatives and to cultivate a proactive environment to counteract the social narcosis and predatory delay that perpetuate climate inaction.<sup>71</sup>

#### **4. CASE STUDIES: CLIMATE DISASTERS AND LEGAL/HUMANITARIAN CHALLENGES IN INDIA**

##### **4.1 North Indian Heatwaves and the Legal/Humanitarian Crisis**

Northwest India is a remarkable example of aggressive climate change effects most notably with its high particulate pollution and increasingly severe heatwaves. Rising temperatures, particularly in states such as

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<sup>70</sup> Climate Action Tracker, 'CAT Thermometer' (*Climate Action Tracker*, 14 November 2024) <<https://climateactiontracker.org/global/cat-thermometer/>> accessed 20 May 2025.

<sup>71</sup> Matthew T. Ballew and others, "Climate Change in the American Mind: Data, Tools, and Trends" *Environment: Science and Policy for Sustainable Development* 61(3) (2019): 4-18

Rajasthan, Punjab, Haryana, and Delhi, pose significant risks to both human health and economic stability. The India Meteorological Department (IMD)<sup>72</sup> and Intergovernmental Panel on Climate Change (IPCC)<sup>73</sup> have documented consistently sharp rises in heatwave frequency, with urban heat islands like Delhi and Ahmedabad proving the most intense examples of the crisis. Heatwaves in India have started reaching dangerous "wet-bulb" temperatures—where heat and humidity combine to make survival impossible without artificial cooling. A wet-bulb temperature of 35°C (95°F) is considered the upper threshold beyond which human bodies cannot regulate temperature, leading to heat stroke, organ failure, and death. Northwest India has already recorded wet-bulb temperatures of 31–32°C, with projections grimly indicating that by 2050, vast regions of Northwest India will be among the first to significantly cross the human survivability threshold<sup>74</sup>, with these extreme conditions triggering cascading effects and consequences. Mortality spikes keep being recorded with heatwave-related deaths increasing by 18.1% on average<sup>75</sup>, with Uttar Pradesh, Delhi, Bihar and Jaipur witnessing the most

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<sup>72</sup> India Meteorological Department, 'Climate Conditions in the Indian Region During 2024' (January 2025)  
<[https://internal.imd.gov.in/press\\_release/20250115\\_pr\\_3554.pdf](https://internal.imd.gov.in/press_release/20250115_pr_3554.pdf)> accessed 20 May 2025.

<sup>73</sup> Intergovernmental Panel on Climate Change, *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC 2023)

<sup>74</sup> Lucas R. Vargas Zeppetello and Adrian E. Raftery and David S. Battisti, 'Probabilistic projections of heat stress for the 21st century' (2022) (3) *Communications Earth & Environment* 183 <<https://doi.org/10.1038/s43247-022-00524-4>> accessed 20 May 2025.

<sup>75</sup> Amruta Nori-Sarma and others, 'The impact of heat waves on mortality in Northwest India' (2019) 176 *Environmental Research* 108546.

extreme heat days<sup>76</sup>. Meanwhile, outdoor laborers, including construction workers and farmers, are at the highest risk with occupational hazards. Many suffer heatstroke and dehydration-related fatalities due to a lack of cooling infrastructure and legal protections. In addition, water and food shortages due to events such as persistent droughts reduce agricultural productivity forcing migration and exacerbating tensions and even conflicts over resources.

The larger-scale future implications of conditions such as extreme heat, desertification, and water stress would trigger a mass displacement crisis across North India. A projected 45 million people could be forced to migrate internally by 2050 due to climate-related stressors.<sup>77</sup> The lack of legal recognition for climate refugees means these displaced populations face significant human rights challenges, including xenophobia, unemployment, and lack of housing and dignified shelter in urban centers. Without immediate policy interventions, India may face one of the largest climate-induced humanitarian crises of the century.

#### **4.2 Kerala Floods: Ignored Warnings**

Kerala's coastal and riverine geography makes it one of the most climate-vulnerable states in India. The state has witnessed intensifying floods, largely driven by a mix of anthropogenic environmental destruction, poor

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<sup>76</sup> Ashok Gadgil, 'Lost in the heat: The critical miscalculation in India's heatwave mortality data' (*Down To Earth*, 10 April 2025)

<<https://www.downtoearth.org.in/climate-change/lost-in-the-heat-the-critical-miscalculation-in-indias-heatwave-mortality-data>> accessed 20 May 2025.

<sup>77</sup> Abinash Mohanty and Shreya Wadhawan, 'Mapping India's Climate Vulnerability: A District Level Assessment' (Council on Energy, Environment and Water 2021)

<<https://www.ceew.in/sites/default/files/ceew-study-on-climate-change-vulnerability-index-and-district-level-risk-assessment.pdf>> accessed 20 May 2025.

urban planning and climate change-induced extreme weather events. The 2018 Kerala floods were one of the worst environmental disasters in India's recent history, with over 480 deaths and over 1.2 million people displaced. While extreme monsoon rainfall played a role, multiple studies indicate that unchecked deforestation, unregulated quarrying, and encroachments on wetlands exacerbated the disaster (MIDEQ, 2023). A key immediate contributing factor was poor dam management where sudden release of water from 35 major dams without coordination worsened flooding. Meanwhile, a significant underlying factor among many was the state's coastal erosion leading to nearly 63% of Kerala's coastline eroding and 500 hectares of land loss between 2002–2012, affecting over 79,000 people. Additionally, urban expansion in cities like Kochi and Thiruvananthapuram has led to encroachments and development in ecologically sensitive areas further exacerbating their susceptibility to flooding. In Kochi, unplanned urban sprawl and encroachments have compromised the city's canal systems, reducing their capacity and leading to increased flooding. Similarly, Thiruvananthapuram has experienced urban floods due to blocked or inadequate storm sewers and increased urbanization, with the city's growth pattern and expansion along major transportation corridors contributing to its flood vulnerability. These phenomena entail climate-induced migration in Kerala, with the state currently experiencing two forms of displacement: slow-onset displacement and sudden displacement. Slow-onset displacement due to rising sea levels are affecting low-lying regions like Kuttanad and Munroe Island. In areas of Kuttanad, over 6000 properties were abandoned in 2021 due to chronic flooding while Munroe Island has already lost 39% of its land area, leading to the abandonment of over 800

homes presenting a stark example of the first climate change migrants in the state. According to scientific estimates, by 2050, large portions of Kerala's Ernakulam, Kottayam, and Alappuzha districts stand to be below sea level due to rising sea levels, potentially displacing millions. Kerala's dense population and reliance on coastal economies mean that further inaction could result in one of India's potentially largest climate refugee crises.

These illustrative examples of escalating climate-induced displacement in North India and Kerala emphasizes the urgent need for robust legal and policy protections at both national and international levels. It has evolved into a human rights and legal crisis that demands immediate action; climate change is no longer just an environmental issue on paper but an existential crisis. However, history worryingly suggests that large-scale policy shifts often occur only in reaction to catastrophic events, rather than through proactive governance. In this sense, the worsening climate displacement crisis and its news visuals and imagery could act as a provocative and forceful catalyst which would finally compel governments to implement deep structural legal and policy reforms.<sup>78</sup> The rise in heat-related deaths, destroyed livelihoods and mass migration could finally push legal institutions to recognize climate refugees, strengthen humanitarian protections, and enforce climate accountability measures. A bluntly reactive approach to climate governance comes at an immense human cost, with evidence suggesting that ad hoc policy measures and interventions would prove to be inadequate in mobilizing effective action to address climate displacement or its many fatal effects such as further

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<sup>78</sup> Feldman, L n(9) 586

entrenchment of poverty cycles and violent resource conflicts.<sup>79</sup> Institutional aversion towards preventive legal and policy mechanisms only leads to chaotic and inadequate responses when the time comes, mirroring past historical failures in managing humanitarian crises.

### 4.3 The Current Legal and Policy Landscape

The current international refugee law is most concerningly characterized by its limitations in addressing climate displacement. The 1951 Refugee Convention<sup>80</sup>, which remains the principal legal instrument governing refugee protection, does not recognize those displaced solely due to climate change or environmental disasters as refugees. This omission leaves climate-displaced persons in a legal void, lacking rights and protections under international law. The absence of an explicit legal category for climate refugees means that affected individuals cannot seek asylum or access the same legal protections afforded to those said to be fleeing persecution. The problem is particularly severe in South Asia, where climate change is already exacerbating migration patterns due to rising sea levels, extreme heat, and natural disasters.<sup>81</sup> Countries like India, Bangladesh, and Pakistan, which collectively host some of the world's most vulnerable populations, have no legal mechanisms in place to recognize or support those displaced due to environmental factors. India's non-ratification of the 1951 Refugee Convention further complicates the

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<sup>79</sup> Marshall Burke and Solomon M. Hsiang and Edward Miguel, "Climate and Conflict" *Annual Review of Economics* 7 (2015): 577-617.

<sup>80</sup> Convention Relating to the Status of Refugees (adopted 28 July 1951, entered into force 22 April 1954) 189 UNTS 137 (Refugee Convention) art 33.

<sup>81</sup> Viviane Clement and others, 'Groundswell Part 2: Acting on Internal Climate Migration' (2021) *World Bank* <<https://openknowledge.worldbank.org/handle/10986/36248>> accessed 20 May 2025.

situation, as it lacks a formalized legal framework to categorize and assist displaced persons. While India has historically hosted various refugee communities, such as Tibetans and Sri Lankan Tamils, its approach has been ad-hoc, relying on executive discretion rather than wider legislative protections. This patchwork system results in inconsistencies, with some groups receiving limited government recognition while others standing to remain completely unrecognized. This inconsistency is even more pronounced in the case of climate migrants, who currently fall outside any concrete legal protection mechanism. There is an urgent need for regional cooperative agreements and policy development, given the transboundary nature of climate displacement in South Asia. Unlike conflict refugees, whose movements can oftentimes be more reliably anticipated based on geopolitical tensions, climate refugees are at greater risk of facing sudden displacement due to extreme weather events, flooding, and rising sea levels.<sup>82</sup> This unpredictability demands a more dynamic and coordinated legal framework. In this regard, India could play a crucial leadership role in developing a regional refugee instrument, modeled on frameworks like the OAU Convention<sup>83</sup> in Africa and the Cartagena Declaration<sup>84</sup> in Latin America. These instruments expand the definition of refugees by not only incorporating displacement caused by general violence and human rights

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<sup>82</sup> Internal Displacement Monitoring Centre, *Global Report on Internal Displacement 2024* (IDMC 2024) <<https://www.internal-displacement.org/global-report/grid2024/>> accessed 2 July 2024.

<sup>83</sup> Organization of African Unity Convention Governing the Specific Aspects of Refugee Problems in Africa (adopted 10 September 1969, entered into force 20 June 1974) 1001 UNTS 45.

<sup>84</sup> Cartagena Declaration on Refugees (adopted 22 November 1984) OAS/Ser.L/V/II.66/doc.10.

violations but also including cases of environmental disasters. A South Asian climate refugee framework could establish cooperative mechanisms for cross-border migration, ensuring that displaced individuals are not treated as illegal migrants but are instead provided humanitarian protections. The importance of proactive rather than reactive policies is paramount with governments in South Asia having no choice but to establish legal safeguards before large-scale displacement occurs in order to not let humanitarian crises escalate. The absence of such policies would lead to climate refugees, particularly from Bangladesh, Nepal, and vulnerable coastal regions of India, finding themselves in a legal limbo and statelessness thereby increasing various risks such as forced labor and human trafficking.

The role of the Indian judiciary in recognizing and addressing climate displacement is also essential. In a landmark 2024 judgment, the then-serving Chief Justice of India, D.Y. Chandrachud, ruled that the right to protection from the adverse effects of climate change is a fundamental constitutional right. The Court derived this right from Article 21 (Right to Life), Article 14 (Right to Equality), and Directive Principles such as Article 48A (Protection and Improvement of the Environment). This ruling signifies a major shift in environmental jurisprudence, as it explicitly acknowledges the disproportionate impact of climate change on vulnerable communities, including forest dwellers, indigenous groups, and populations residing in climate-sensitive zones.<sup>85</sup> This judgment opens new legal avenues for advocating climate justice and protection for

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<sup>85</sup> James D Ford, "Indigenous Health and Climate Change" *American journal of public health* 102(7) (2012): 1260-1266.



those displaced due to environmental factors by establishing a precedent for individuals and communities to seek legal remedies for climate-induced displacement, driving the state to take affirmative action in protecting affected populations with legislative action to operationalize these judicial pronouncements into enforceable policies. The judgment's broader implications extend to India's foreign policy and its position on climate justice at the international level. By legally recognizing the right against climate change's adverse effects, India could leverage this decision to push for the inclusion of climate refugees in international legal frameworks. Such a move could be used to encourage South Asian countries to adopt similar legal measures, creating a collective regional response in addition to strengthening India's position in global climate negotiations. However, the challenge remains that while courts can interpret rights expansively, the actual implementation of protections falls on the executive and legislative branches which require complementary laws and administrative mechanisms.

## **5. CONCLUSION**

Ultimately the climate crisis is not merely an environmental issue but a structural challenge that exposes the contradictions of our prevailing economic systems characterized by global inequality and legal inadequacies. Despite overwhelming scientific evidence and escalating climate disasters, meaningful action remains elusive. This paralysis is not due to a lack of knowledge or technological solutions but stems from entrenched ideological, economic, and political structures that prioritize

short-term profit over long-term sustainability. Climate change is, at its core, a crisis of modernity—one that demands a fundamental rethinking of economic models, legal frameworks, and governance structures. The case studies of North Indian heatwaves and Kerala floods highlight the disproportionate burden climate change places on vulnerable populations, particularly in the Global South.<sup>86</sup> In North India, rising temperatures threaten human survival, intensify water shortages, and force internal migration. Meanwhile, Kerala's worsening floods and coastal erosion demonstrate the interplay between climate-induced displacement and governance failures. Despite these clear warning signs, both national and international legal frameworks remain inadequate so far in addressing the growing crisis of climate refugees in a comprehensive and concrete manner.

A key barrier to action is the structural dependence on extractivism. The global economy remains locked into fossil-fuel dependency, with corporate and political actors delaying meaningful transitions. This results in a dangerous ideological deadlock-while climate action is recognized as urgent, the economic system resists any fundamental restructuring. This paradox, described as an ideological paralysis, manifests in half-measures, broken climate pledges, and the illusion of progress—all while carbon emissions continue to rise. The exemplary debate between enacting degrowth and banking on techno-optimism illustrates the complicated

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<sup>86</sup> Mahesh R. Gautam and Karletta Chief and William J. Smith Jr, "Climate change in arid lands and Native American socioeconomic vulnerability: The case of the Pyramid Lake Paiute Tribe" *Climate Change and Indigenous Peoples in the United States* (2013): 77-91.

nature of our various solutions which ultimately requires a pragmatic synthesis across the board which still entails a radical and large scale endeavor. The climate crisis is accelerating, and existing governance structures are failing to respond adequately. Without bold policy shifts, legal reforms, and structural economic changes, climate disasters will continue to intensify, leading to mass displacement, resource conflicts, and irreversible ecological damage. The choice is no longer between action and inaction but between proactive transformation or catastrophic collapse. The window for meaningful intervention is closing, and whether societies rise to the challenge or succumb to crisis will define the trajectory of the 21st century and beyond.

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V

**CLIMATE CHANGE AND RIGHT TO HEALTH IN  
INDIA: DOES INDIA NEED A LAW?**

**Miss Divya M J<sup>\*</sup>, Mr. Bineesh Kumar B S<sup>\*\*</sup>**

**ABSTRACT**

*According to the World Health Organization, climate change is the greatest threat to human health. In the resolution passed in October 2021, the UN Human Rights Council recognized the right to a sustainable, healthy, and clean environment as a human right. India, a signatory to various international frameworks on climate change, has added Article 48A and Article 51A (g) respectively. In addition to Articles 21 and 14, these Articles are important sources of information on the right to a clean environment and the right to be free from the adverse effects of climate change. In addition to constitutional validity, the Indian judiciary has played a significant role by prioritizing health as a key aspect under Article 21 of the Constitution when dealing with climate change issues. The adverse impacts on health due to climate change include: extreme weather events such as extreme temperatures, storms, floods, droughts, health impacts of sea level rise due to global warming, health impacts of food insecurity, diseases transmitted by pathogens, etc. Although the right*

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*to a healthy environment is one of the rights protected by the National Human Rights Commission (NHRC) under the law, it is important to note that there is no specific law in India to prevent and manage the impact of climate change on the right to health. This paper attempts to focus on the impact of climate change on human health and the need for a dedicated legislature to address these issues.*

Kerala in India has been experiencing seasonal flooding, especially during the monsoon season, since 2018. The series of disasters began with the tsunami in 2004, which killed nearly 200 people. Human efforts in the name of development are recklessly causing environmental degradation. Climate change has many adverse impacts, including crop failure, extreme heat, seasonal floods, and droughts, all of which directly or indirectly affect human health.<sup>87</sup>

**Key Words:** *Climate Change, Human Health, Right to a Healthy Environment, Indian Constitution, Environmental Degradation, Kerala Floods, Sustainable Development, Judicial Activism and Environment*

## **1. CLIMATE CHANGE AND HEALTH RISKS**

**Temperature Rise:** Humans are changing the Earth's natural greenhouse effect. The amount of carbon dioxide in our atmosphere increases as we burn fossil fuels like coal and oil. NASA says the amount of carbon dioxide and other greenhouse gases entering our atmosphere has

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<sup>87</sup> Ashwini Kulkarni, Chellappan Gnanaseelan: Assessment of Climate Change Over the Indian Region (Springer 2020).

increased. When these gases increase, the Earth's atmosphere traps more and more heat. As a result, the Earth warms.

**Ocean acidification:** All plants, from giant trees to microscopic marine phytoplankton, absorb carbon dioxide and release oxygen. Moreover, the ocean absorbs a significant amount of excess carbon dioxide in the air. Unfortunately, as carbon dioxide levels increase, ocean water is becoming more acidic. This is called ocean acidification. Many marine organisms, especially fish, may experience more acidic water, which can lead to human malnutrition, as fish are considered an important source of protein and other important vitamins, in addition to the scarcity of portable water<sup>88</sup>.

**Air Pollution:** In order to prevent and reduce air pollution, the National Green Tribunal banned diesel cars that are more than ten years old in Delhi. This approach led to a rise in pollution levels in other states. Since these ten-year-old diesel luxury cars were cheaper in Delhi, people from other states started buying used or fluorocarbon emitting machines as a way to show off their speed and prestige. Other major causes of air pollution are nitrogen oxides, ozone, carbon monoxide, carbon dioxide and sulphur dioxide, which are mostly emitted from the burning of fossil fuels, automobiles, factories, etc.

Nitrogen oxide and suspended particulate matter in the atmosphere affect our lungs, causing respiratory diseases such as asthma and bronchitis.

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<sup>88</sup> Navroz Dubash, *Handbook of Climate Change and India Development, Politics and Governance* (Taylor & Francis 2012).

Ground-level ozone reduces our immune system, making it easier for pathogenic foreign substances to attack.<sup>89</sup>

Carbon monoxide has a special affinity for Hb, which interferes with the transport of oxygen, impairs our concentration, slows our reactions, makes us confused and sleepy. SO<sub>2</sub> in the air causes respiratory diseases and respiratory ailments such as shortness of breath and wheezing. Air pollution can cause chronic respiratory diseases, lung cancer, heart disease, and even damage to the brain, nerves, liver, and kidneys.

**Frequent Natural Disasters;** Climate change will directly affect the weather and cause extreme weather events such as heatwaves, floods, landslides, and droughts. Floods and droughts disrupt agricultural production and lead to food shortages, economic imbalances, and loss of livelihoods. Wayanad and Idukki districts in Kerala are now experiencing frequent landslides. Heavy rains in 2024 caused a series of landslides in the villages of Mundakai and Chooralmala in Wayanad district, killing hundreds of people and livestock.

**Destruction of Health care sectors;** Severe weather and frequent disasters lead to the collapse of service sectors, especially the health sector. As a developing country, it is not economically viable to invest in rebuilding infrastructure after each disaster to bring it back to its pre-disaster state. This unexpected cost can stunt the development of these industries.

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<sup>89</sup> Daniel Bodansky, Jutta Brunnée, Lavanya Rajamani: *International Climate Change Law* (OUP Oxford 2017).

Water pollution and Disease transmission; During transmission, especially through water, infectious agents are likely to be attracted to it. Some of the substances that pollute water include agricultural chemicals, oil, synthetic detergents, sewage, and industrial waste. Aging, cancer, and arteriosclerosis are all linked to DNA damage, which is caused by high fluoride levels in water. There is no known cure for arsenic poisoning, which is caused by drinking water contaminated with arsenic. Twenty million people from West Bengal and Bangladesh are at risk from arsenic exposure, making it the largest mass poisoning in the world, although some estimates put the number as high as 36 million<sup>90</sup>.

Methemoglobinemia also known as blue baby syndrome, is a condition in which the blood's ability to carry oxygen is reduced, resulting in a lack of oxygen to various parts of the body. Adults are less likely to develop the condition than infants. The disease can be caused by consuming foods and water containing nitrates, exposure to nitrate-containing substances, or even genetics.

Minamata disease was first diagnosed in 1956. In Minamata, Japan, acetaldehyde was produced industrially using mercury. The organisms consumed toxic waste dumped into the surrounding waters. Following contamination of fish and other marine life, methylmercury poisoning eventually affected humans who ate the seafood.

Itai-itai, which causes bone weakness and kidney failure, is caused by cadmium poisoning. It gets its name from the severe joint and spine pain

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<sup>90</sup> Justin Gundlach, Michael Burger: *Climate Change, Public Health, and the Law* (Cambridge University Press 2018).

it produces. Cadmium dumped into rivers by mining companies and others has contaminated water sources used to irrigate rice fields<sup>91</sup>.

**Mental Trauma;** Unexpected exposure to deadly natural disasters can have a serious negative impact on a person's mental health, leading to depression, stress disorders, and other mental health problems. Disasters can cause the loss of loved ones, their property, and money.

**Malnutrition;** Extreme weather events caused by climate change are causing crop failures in some regions and surplus production in others. Ultimately, this can lead to increased demand, food shortages, unemployment, and poverty.

**Heat burns;** As the ozone layer is thinning due to climate change, heatstroke is a common problem in most Indian states. This harsh weather often affects people who work outdoors, leading to heatstroke and death. This can affect the mental health of employees, which can lead to reduced productivity<sup>92</sup>.

## **2. INTERNATIONAL LEGAL FRAMEWORK**

Ironically, the 1948 Universal Declaration of Human Rights, which is intended to protect individual human rights, does not address the right to a healthy environment. Although declarations exist, it is necessary to consider their legal nature in this context. The first international treaty to address the environment was the passage of the 1966 International

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<sup>91</sup> Lyall, Francis, *Climate Change and Space Law in International Law in the Era of Climate Change* (Edward Elgar 2012).

<sup>92</sup> Bridget Lewis, *Environmental Human Rights and Climate Change* (Springer Nature Singapore 2018).



Covenant on Economic, Social and Cultural Rights. Article 12 of the Covenant upheld “the right of everyone to the enjoyment of the highest attainable standard of physical and mental health.”

As a result of these forces, a number of international treaties have emerged that recognize the interrelationship of health and the environment. Later in 1972, the UN Conference on the Human Environment adopted the Stockholm Declaration and the Programme of Action for the Human Environment. Although it addresses both human health and environmental protection, it is still unclear whether this declaration is legally binding. Teaching children to support environmental protection is emphasized in Article 29 of the Convention on the Rights of the Child (CRC). The extent to which this convention can be applied is still a matter of debate<sup>93</sup>.

The 1992 United Nations Framework Convention on Climate Change sought to reduce greenhouse gas emissions to slow climate change, followed by the Kyoto Protocol in 1997 and the Paris Agreement in 2015. The most striking feature of the latter agreement is that its preamble contains explicit references to human rights, particularly the right to health.

In 2021, the United Nations Human Rights Council passed resolution 48/13, “recognizing the right to a safe, clean, healthy and sustainable environment as a fundamental human right for the enjoyment of human rights.” The resolution draws attention to how the effects of climate change and sustainable development are preventing current and future generations from enjoying their human rights, in particular the right to

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<sup>93</sup> John H. Knox, Ramin Pejan: *The Human Right to a Healthy Environment* (Cambridge University Press 2018).

life<sup>94</sup>. This recognition was further reaffirmed by General Assembly resolution 76/300.

According to General Comment 14 of the Committee on Economic, Social and Cultural Rights of 2000, "the right to health extends to the fundamental determinants of health, such as a healthy environment, and encompasses broader socio-economic factors that promote conditions in which people can lead healthy life."<sup>95</sup> In a statement issued in 2018, the Committee on Economic, Social and Cultural Rights highlighted the dangers posed by climate change, particularly the right to health. In 2016, the Office of the United Nations High Commissioner for Human Rights determined that the right to health is linked to climate change, its effects, the obligations of States and other considerations. The following year, the Human Rights Committee noted in its general comment 36 that "some of the most urgent and serious threats to the ability of present and future generations to enjoy the right to life are environmental degradation, climate change and unsustainable development." The Committee also stressed the State's obligation to protect life by providing essential goods such as adequate food, shelter, medical treatment and sanitation, all of which are essential for the full realization of the right to health. International law provides a solid foundation for addressing the impacts of climate change from the perspective of the right to health.

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<sup>94</sup> Alexander Thomas, Divya Alexander: *Climate Change and the Health Sector Healing the World* (Taylor & Francis Group 2023).

<sup>95</sup> Barry S. Levy, Jonathan A. Patz: *Climate Change and Public Health* ( Oxford University Press 2024).

It is important to note that while various international laws make vague attempts to address the right to health and environmental protection, there is no specific legislation in the international arena that directly addresses the right to health as it affects climate change.

### **3. COMPARATIVE ANALYSIS**

The UK's Climate Change Act 2008 was enacted to establish a legally binding carbon budgeting system that would aid in the shift to a low-carbon economy. They established a Committee on Climate Change to provide recommendations, track, and report on the status of goals. A 2019 amendment to the act aimed to achieve net-zero emissions of greenhouse gases, including methane, by 2050. There is also no specific reference to the "right to health" in the statute<sup>96</sup>.

In the USA, to control greenhouse gas emissions, the Clean Air Act was passed in 1963. In addition to this, the Climate Change Health Protection and Promotion Act is a proposed law that would incorporate strategic adaptation in the health sector to counteract health risks associated with climate change. Aside from this, the United States has several laws, like the Inflation Reduction Act, to safeguard and avoid climate change. In summary, there isn't a single comprehensive federal statute in the United States that specifically connects climate change to the right to health<sup>97</sup>.

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<sup>96</sup> United Nations Framework Convention on Climate Change. Part Two: Action taken by the Conference of the Parties at its sixteenth session. United Nations (2011) <<http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf> > accessed 25 February 2025.

### **3.1. The Constitution of India**

India, a signatory to various international frameworks on climate change, has inserted Article 48A and Article 51A(g) through the 42nd Constitutional Amendment Act, 1976. On closer inspection, we can see that the Indian Constitution has established a pair of accountability mechanisms for environmental protection. For example, Article 48A requires the state to protect and improve the environment, while Article 51A(g) requires citizens to contribute to environmental protection. The right to a clean environment and the right to be free from the adverse effects of climate change are found in these articles, as well as Articles 21 and 14<sup>98</sup>.

### **3.2. Indian Legislations**

**The Bharatiya Nyaya Sanhita, 2023:** Talking about criminal laws in India, there is the Indian Penal Code and the subsequent Indian Penal Code of 2023, which prescribe punishment under sections 279 and 280, respectively, for polluting water in a public spring or reservoir and causing the atmosphere to be injurious to health. The main provisions of the law include:

Section 279 – Fouling the water of a public spring or reservoir

Section 280 – Making the atmosphere noxious to health

**The Bharatiya Nagrik Suraksha Sanhita, 2023** contains provisions for a conditional order to remove a nuisance and the power of the magistrate

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<sup>98</sup> Rajamani, Lavanya. “The Cancun Climate Agreements: Reading the Text, Subtext and Tea Leaves.” (2011) *International & Comparative Law Quarterly* 60, 499.

to prohibit the repetition or continuation of a public nuisance. The crucial provisions of the Act are;

Section 152- Conditional order for removal of nuisance

Section 162- Magistrate may prohibit repetition or continuance of public nuisance<sup>99</sup>.

**Civil Procedure Code 1908** contains provisions relating to Public nuisances and other wrongful acts affecting the public<sup>100</sup>

Section 91 – Public nuisances and other wrongful acts affecting the public

**Central Motor Vehicles Rules, 1989-** Rules 112 to 116 include various provisions for controlling and preventing air pollution caused by the emission of toxic gases from vehicles. Rules 119 and 120 - for controlling and preventing noise pollution caused by the use of horns and exhaust gases from engines<sup>101</sup>.

Let us take a look at various environmental protection laws to know the legal position of the right to health caused by climate change.

### **3.3. The Water (Prevention and Control of Pollution) Act, 1974**

The Water (Control and Prevention of Pollution) Act, 1974 contains provisions prohibiting acts that cause water pollution. The Act prohibits the discharge of polluted water into a stream, well or land, and prohibits

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<sup>99</sup> The Bharatiya Nagrik Suraksha Sanhita, 2023, S 152,162.

<sup>100</sup> Civil Procedure Code 1908, India S 91.

<sup>101</sup> Central Motor Vehicles Rules, 1989, India.

people from obstructing the proper flow of water in a manner that leads to water pollution. The crucial provisions of the Act are;

Section 24(1)(a)- Prohibits the use of stream or well or land for disposal of polluting water.

Section 24(2)- Prohibits people from obstructing proper flow of water by any means, leading to water pollution

Section 25 -Restrictions on new outlets and new discharges

Section 47- Offences by Companies

Section 48- Offences by Government Departments<sup>102</sup>

### **3.4. The Air (Prevention and Control of Pollution) Act, 1981**

The main objectives of the Air (Prevention and Control of Pollution) Act, 1981 are to prevent, control and abate air pollution. The Act makes certain activities of government agencies and businesses that are likely to damage the environment punishable. The relevant provisions that serve the objectives of this Act are;

Section 19- Power of state governments to prohibit use of certain fuels, appliances, burning of certain fuels, and set emission standards for automobiles

Section 40- Offences by Companies

Section 41- Offences by Government Departments<sup>103</sup>

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<sup>102</sup> The Water (Prevention and Control of Pollution) Act, 1974, India.

<sup>103</sup> The Air (Prevention and Control of Pollution) Act, 1981, India.

### **3.5. Environmental Protection Act,1986**

The Environment (Protection) Act came into being as a result of the failure of the Water and Air Act to achieve its objectives. India passed the Environment Protection Act in 1986 to protect and improve the environment and related issues. The important provisions of this Act to be noted are;

Section 7- Person carrying on industrial operation, etc., not to allow emissions of any environmental pollutant above standards.

Section 8- Prohibition in handling any hazardous substance except following the procedure established.

Section 9- Responsibility for violation of emission standards due to accident or like, the person responsible and the person in charge will be liable<sup>104</sup>.

Apart from these Acts, several minor acts were introduced to protect and prevent the environment from degradation.

### **3.6. National Environmental Tribunal Act, 1995**

The National Environmental Tribunal Act of 1995 was primarily designed to create a specialized tribunal to efficiently and expeditiously resolve environmental damage cases, especially those caused by hazardous substances. The Act sought to provide relief and compensation for damages caused to people, property, and the environment by addressing

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<sup>104</sup> Environmental (Protection Act),1986, India.

the need for a specific legal framework to handle environmental disputes and ensure accountability for accidents<sup>105</sup>.

The Indian Forest Act, 1927, deals with the regulation of commercial activities other than environmental protection. Provisions for controlling deforestation are contained in the Forest (Conservation) Act, 1980. The Wildlife (Protection) Act, 1972. The Wildlife (Protection) Act was enacted for the protection of wild animals, birds, and plants<sup>106</sup>.

### **3.7. National Human Rights Commission**

The National Human Rights Commission of India was established under the Protection of Human Rights Act, 1993. The Act was enacted to provide for the constitution of the NHRC, State Human Rights Commissions, and Human Rights Courts for better protection of human rights. Although the NHRC recognizes the right to a healthy environment, there is no specific law in India to prevent and manage the impact of climate change on the right to health.

## **4. ROLE OF JUDICIARY**

Apart from Constitutional validity, the judiciary has played a significant role by prioritizing health as an important aspect under Article 21 of the Constitution while dealing with climate change issues. In **Rural Litigation and Entitlement Kendra V. State of U.P**<sup>107</sup>, the SC for the

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<sup>105</sup> National Environmental Tribunal Act, 1995, India.

<sup>106</sup> The Indian Forest Act, 1927, India.

<sup>107</sup> *Rural Litigation and Entitlement Kendra V. State of U.P* (1988) A.I.R SC 2187.



first time recognised Right to live in a healthy environment as a part of Article 21 in the Indian Constitution. Similarly, in **MC Mehta V. Kamalnath**<sup>108</sup>, the court has held the right to clean environment is an extension of right to life under Article 21 of the constitution, thereby re-affirming the importance of health. This case built a strong base for environmental protection efforts in India. This positive attitude of the judiciary by prioritising health over other aspects is reflected in several Supreme Court's decisions like banning of public smoking in **Murali S Deora V. Union of India**<sup>109</sup>, as it is violative of one's fundamental right under Article 21, etc. **M.K. Ranjitsinh & Ors. v. Union of India & Ors.**<sup>110</sup> the SC ruled that the right to a clean environment and protection from climate change is a fundamental right under Article 21 of the Constitution of India. In addition to this, the Supreme Court has developed several doctrines to protect and improve environmental protection.

The Polluter Pay Principle was evolved in **Indian Council for Enviro-legal action V. U.O.I**<sup>111</sup> making the polluters liable to compensate the victim as well as the money requires to restore the environment. Based on the concept of "Prevention is better than Cure" the SC of India has evolved the Precautionary Principle in the case **Vellore Citizens welfare Forum**

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<sup>108</sup> *MC Mehta V. Kamalnath* (1996) Supp. (10) S.C.R.12.

<sup>109</sup> *Murali S Deora V. Union of India* (2001) 8 SCC 765.

<sup>110</sup> *M.K. Ranjitsinh & Ors. v. Union of India & Ors* (2024) 3 S.C.R 1320.

<sup>111</sup> *Indian Council for Enviro-legal action V. U.O.I* (1995) AIR SC 2252.

**V. U.O.I** <sup>112</sup> Similarly Doctrine of Sustainable Development was first applied in the same case.

## **5. CONCLUSION**

Although the Indian Parliament has passed several laws, not a single law addresses the impact of climate change on human health. The above laws contain provisions that punish pollution and environmental degradation, but none address the legal status of the right to health, which is affected by climate change. Even developed countries are still pondering the need to legislate on climate change, recognizing the right to health.

## **11. SUGGESTIONS AND RECOMMENDATIONS**

An Indian climate change legislation that addresses key issues of climate change and the right to health, the main objectives of the law

1. Identifying climate-related health risks
2. Developing a national action plan - public awareness campaigns, financial assistance schemes
3. Training a health care provider
4. Prioritizing vulnerable groups - women, children, economically weaker sections
5. Collaborating with other agencies
6. A committee similar to the UK's Climate Change Committee may be formed to study the issues affecting human health due to climate change.

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<sup>112</sup> *Vellore Citizens welfare Forum V. U.O.I* (1996) SCR 241.

7. Complete ban on activities like burning plastic bags and releasing harmful gases

Strict penal provisions may be introduced for the discharge/emission of harmful substances into air, water, and land by amending the relevant laws accordingly.

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## VI

# THE EVOLUTION OF CLIMATE CHANGE LEGISLATION IN INDIA: FROM ENVIRONMENTAL PROTECTION TO CLIMATE ACTION

Meghna Singh\*

### ABSTRACT

*India's journey in establishing legal frameworks to address climate change has evolved significantly. This research investigates this progression, charting the course from traditional environmental protection laws to the creation of specific legislation and policies focused on climate action. The central argument is that while earlier environmental laws provided a foundation, the growing urgency of climate change demands more focused and proactive legal measures.*

*The study initially examines the pre-21st century period, concentrating on fundamental environmental legislation like the 1986 Environment (Protection) Act and its associated regulations. It analyzes how these initial laws, primarily designed for pollution control and environmental management, addressed climate change concerns, if at all, often implicitly. The limitations of this approach are highlighted, particularly the absence of specific provisions for mitigating greenhouse gas*

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*emissions, adaptation strategies, and dedicated institutional structures for climate action. It explores how existing environmental impact assessment (EIA) procedures considered climate change risks and vulnerabilities.*

*The research then explores the post-2000 era, a period marked by increased international pressure and growing domestic awareness of climate change. It analyzes key policy shifts, beginning with the 2008 National Action Plan on Climate Change (NAPCC). The NAPCC, with its eight national missions, represented a substantial move toward integrating climate considerations into various sectors. This study critically evaluates the NAPCC's implementation, examining the successes and shortcomings of individual missions and pinpointing areas where legal frameworks were strengthened or remained inadequate. Subsequent policy developments are also explored, including the creation of State Action Plans on Climate Change (SAPCCs) and their alignment with national objectives.*

*A key aspect of this research is the analysis of specific legislative developments that have directly or indirectly contributed to climate action. This includes examining revisions to existing laws, such as those related to promoting renewable energy, forest conservation, and water resource management, and how these changes have incorporated climate change considerations. The study also investigates the role of sectoral regulations, such as those governing the power sector, transportation, and industry, in driving climate mitigation and adaptation efforts. It assesses the effectiveness of these regulations in achieving their intended outcomes and identifies potential areas for improvement.*

*Furthermore, this research examines the role of the judiciary in shaping India's climate change legal landscape. It analyzes significant judicial pronouncements related to environmental protection and climate change, demonstrating how the courts have interpreted existing laws and influenced policy development. The increasing trend of climate litigation in India and its potential to hold governments and corporations accountable for their climate-related actions is explored. The challenges and opportunities associated with using litigation as a tool for promoting climate justice are also discussed.*

*The research concludes by evaluating the current state of climate change legislation in India, identifying both strengths and weaknesses. It contends that while considerable progress has been made, a more comprehensive and integrated legal framework is still needed. Recommendations are offered for strengthening existing laws, developing new legislation, and enhancing implementation mechanisms. The importance of aligning domestic legal frameworks with India's international commitments under the Paris Agreement and beyond is emphasized. Finally, the need for improved inter-agency coordination, stakeholder engagement, and capacity building to effectively address the complex challenges posed by climate change is highlighted. The crucial role of legal frameworks in facilitating India's transition to a low-carbon and climate-resilient future is underscored.*

**Keywords-** *Climate Change, Legal Frameworks, Environmental Protection, Environmental Management, Climate Justice, Capacity Building, Climate Resilient Future*

## **1. INTRODUCTION**

India, a nation experiencing rapid economic growth and facing diverse environmental challenges, has witnessed a gradual evolution in its climate change legislation. Initially framed within the broader context of environmental protection, the legal framework has increasingly shifted towards dedicated climate action, reflecting the growing global urgency and India's own vulnerabilities. This essay explores this evolution, tracing the trajectory from early environmental statutes to contemporary climate-centric policies, highlighting the key legislative milestones, challenges, and future directions. -

India's journey in climate change legislation mirrors its rapid development and increasing environmental awareness. Initially, the nation's legal approach was rooted in general environmental protection, addressing immediate concerns like pollution and resource management. However, as the global and domestic impacts of climate change became more pronounced, India's legal framework has progressively transformed, prioritizing dedicated climate action.

Early legislation, such as the Water and Air Pollution Acts, and the Environment Protection Act, laid the groundwork for future climate policies. While their primary focus wasn't climate change, they established regulatory mechanisms for industrial emissions and resource management, indirectly contributing to greenhouse gas reduction efforts. The National Forest Policy further acknowledged the role of forests as carbon sinks, emphasizing sustainable management.

The shift towards explicit climate action began with India's participation in international agreements like the UNFCCC and the Kyoto Protocol,



signaling its commitment to global efforts. The National Environment Policy recognized climate change as a critical challenge, advocating for its integration into development planning. The National Action Plan on Climate Change (NAPCC) marked a pivotal moment, outlining sector-specific missions for mitigation and adaptation, signifying a proactive policy approach.

Following the NAPCC, states developed tailored climate action plans, acknowledging the diverse regional impacts of climate change. The Energy Conservation Act, with its amendments, promoted energy efficiency and carbon trading schemes, reflecting a move towards market-based solutions. Regulations incentivizing renewable energy further reduced reliance on fossil fuels. Recent updates to the energy conservation act, and increased focus on disaster management show a continued evolution.

Despite this progress, significant challenges remain. Implementation and enforcement of climate laws are hindered by bureaucratic inefficiencies, resource constraints, and institutional weaknesses. Balancing economic development with climate commitments remains a critical issue, requiring the integration of sustainable practices across sectors. Effective inter-ministerial coordination, adequate financial resources, and increased public awareness are crucial for successful climate action.

India must strengthen institutional capacity, promote climate-resilient development, and enhance public participation. Improved data collection and monitoring, along with technology transfer and innovation, are essential for effective policy implementation. Strengthening national determined contributions (NDCs) in line with the Paris Agreement will be

crucial. By addressing these challenges and leveraging its strengths, India can solidify its leadership in global climate action.

## **2. EARLY FOUNDATIONS: ENVIRONMENTAL PROTECTION AS A PRECURSOR TO CLIMATE ACTION IN INDIA AND INTERNATIONAL LAW**

The trajectory of climate action, both in India and globally, is deeply rooted in the early foundations of environmental protection. Before the explicit recognition of climate change as a distinct policy issue, the legal and regulatory frameworks established to address general environmental concerns laid the groundwork for future climate-specific initiatives. This period, characterized by a focus on pollution control, resource conservation, and ecological balance, served as a crucial precursor to the more targeted climate legislation we see today.

### **2.1. International Landscape: The Seeds of Environmental Consciousness**

At the international level, the early foundations of environmental protection were established through landmark declarations and treaties. The Stockholm Declaration of 1972, adopted at the United Nations Conference on the Human Environment, marked a watershed moment. It recognized the fundamental right to a healthy environment and laid the groundwork for international environmental law<sup>113</sup>. While not explicitly addressing climate change, it fostered a global consciousness about the interconnectedness of environmental issues.

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<sup>113</sup> IPCC (Intergovernmental Panel on Climate Change) Sixth Assessment Report. (2023).

Following the Stockholm Declaration, various international agreements focused on specific environmental concerns.

The Vienna Convention for the Protection of the Ozone Layer (1985) and its Montreal Protocol (1987), for example, addressed the depletion of the ozone layer, a significant environmental problem linked to the release of certain industrial chemicals. This agreement serves as a powerful example of how international cooperation can lead to effective environmental regulation, and helped set a precedent for later international climate agreements<sup>114</sup>. Though ozone depletion is a separate issue from climate change, the scientific and political processes involved in addressing it provided a model for future climate action<sup>115</sup>.

The Convention on Biological Diversity (CBD, 1992), adopted alongside the UNFCCC, recognized the importance of biodiversity conservation and sustainable use of natural resources<sup>116</sup>.

Healthy ecosystems are vital for climate resilience and carbon sequestration, making biodiversity conservation an integral part of climate action. The CBD, therefore, contributed to establishing the understanding of the interconnectedness of environmental issues, a foundational principle for climate change mitigation and adaptation.

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<sup>114</sup> United Nations Environment Programme (UNEP). "Vienna Convention for the Protection of the Ozone Layer." [https://ozone.unep.org/sites/default/files/2019-12/The%20Ozone%20Treaties%20EN%20-%20WEB\\_final.pdf](https://ozone.unep.org/sites/default/files/2019-12/The%20Ozone%20Treaties%20EN%20-%20WEB_final.pdf).

<sup>115</sup> United Nations Environment Programme (UNEP). "Transboundary Air Pollution." <https://www.unep.org/explore-topics/air/about-air>.

<sup>116</sup> Convention on Biological Diversity (CBD), 1992.

## **2.2. Indian Context: Building the Framework for Environmental Governance**

In India, the early foundations of environmental protection were established through a series of legislative acts aimed at addressing immediate environmental concerns. These acts, while not explicitly designed to combat climate change, established a regulatory framework for pollution control and resource management, which indirectly contributed to reducing greenhouse gas emissions.

**The Water (Prevention and Control of Pollution) Act, 1974**, was one of the earliest pieces of environmental legislation in India. It aimed to control water pollution by establishing pollution control boards and setting standards for industrial discharges. While its primary focus was water quality, it helped regulate industrial activities that could contribute to greenhouse gas emissions through energy consumption and waste generation.

**The Air (Prevention and Control of Pollution) Act, 1981**, similarly focused on controlling air pollution, a significant source of greenhouse gases. It established air quality standards and empowered pollution control boards to regulate industrial emissions. This act helped establish a regulatory framework for controlling air pollution, which indirectly contributed to reducing emissions of pollutants that contribute to climate change.

**The Environment (Protection) Act, 1986**, was a landmark legislation that provided a comprehensive framework for environmental protection.

It empowered the government to take measures to protect and improve the environment, including setting standards for industrial emissions and

regulating hazardous substances. This act served as an umbrella legislation for various environmental issues, including those related to climate change. It also provided the legal basis for the government to issue notifications and rules on environmental matters, which could be used to address climate change.

**The National Forest Policy, 1988**, recognized the importance of forests in maintaining ecological balance and combating climate change. It emphasized afforestation and sustainable forest management, acknowledging the role of forests as carbon sinks. This policy contributed to establishing the understanding of the role of forests in climate change mitigation and adaptation.

### **3. THE CONVERGENCE OF ENVIRONMENTAL PROTECTION AND CLIMATE ACTION**

The early foundations of environmental protection, both internationally and in India, established a crucial precedent for environmental regulation and provided a foundation for future climate-specific policies. These early efforts fostered a global consciousness about the interconnectedness of environmental issues and established a regulatory framework for pollution control and resource management.

While the primary focus of these early initiatives was not climate change, they laid the groundwork for the development of more targeted climate legislation. They helped establish the understanding of the interconnectedness of environmental issues, the importance of

international cooperation, and the need for a comprehensive regulatory framework<sup>117</sup>.

The transition from general environmental protection to dedicated climate action is a testament to the evolving understanding of environmental challenges. The early foundations of environmental protection served as a crucial precursor to this transition, providing the necessary legal and regulatory framework for addressing the complex issue of climate change<sup>118</sup>.

The journey from general environmental protection to focused climate action reveals a crucial convergence: the understanding that these two domains are inextricably linked. Early environmental laws, while not explicitly targeting climate change, laid the essential groundwork for today's climate-centric policies<sup>119</sup>. This evolution underscores the growing recognition that environmental health and climate stability are mutually dependent.

Initially, environmental legislation addressed visible and immediate concerns like pollution and resource depletion. Acts like India's Air and Water Pollution Control Acts, and the broader Environment Protection Act, established regulatory frameworks and control mechanisms. Internationally, the Stockholm Declaration and the Vienna Convention

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<sup>117</sup>Nilsson, M., Griggs, D. & Visback, M. Map the interactions between Sustainable Development Goals. *Nature* 534, 320–322 (2016).

<sup>118</sup> United Nations Economic Commission for Europe (UNECE). "Convention on Long-Range Transboundary Air Pollution (LRTAP)." <https://unece.org/environmental-policy-1/air>.

<sup>119</sup>Thornton, T. F. & Combetti, C. Synergies and trade-offs between adaptation, mitigation and development. *Clim. Change* 140, 5–18 (2017).

fostered a sense of global environmental responsibility<sup>120</sup>. These early efforts, though not designed to combat climate change, indirectly contributed by regulating industrial emissions and promoting sustainable resource use.

The pivotal shift occurred as scientific understanding of climate change deepened. It became evident that long-term environmental health couldn't be achieved without addressing the systemic issue of greenhouse gas emissions. The convergence began as policies started to connect the dots between localized pollution and global climate patterns. For instance, the recognition of forests as carbon sinks in India's National Forest Policy demonstrated an evolving perspective, linking forest conservation with climate mitigation.

Internationally, the UNFCCC and the Kyoto Protocol marked a significant turning point, explicitly addressing climate change as a global concern. These agreements built upon the foundational principles established by earlier environmental treaties, demonstrating a shift from reactive pollution control to proactive climate management. The Convention on Biological Diversity further emphasized the critical role of healthy ecosystems in climate resilience, reinforcing the interconnectedness of environmental issues.

Today, the convergence is more pronounced than ever. Climate action is no longer viewed as a separate endeavor but as an integral part of environmental protection. Policies promoting renewable energy, sustainable land use, and circular economies reflect this integrated

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<sup>120</sup>IPCC Climate Change 2014: Synthesis Report (eds Core Writing Team, Pachauri, R. K. & Meyer L. A.) (IPCC, 2014).

approach. The realization that clean air, water, and soil are essential for both human well-being and climate stability has solidified the convergence.

The convergence of environmental protection and climate action is not merely a policy shift; it reflects a fundamental change in our understanding of the planet. It signifies a move towards a holistic approach to environmental governance, recognizing that a healthy environment is a prerequisite for a stable climate, and vice versa<sup>121</sup>. This integrated perspective is crucial for achieving long-term sustainability and ensuring a habitable planet for future generations.

In India, the evolution of climate legislation from national plans to state-level actions reflects a growing understanding of the diverse impacts and localized solutions needed to combat climate change. Initially, national frameworks like the National Action Plan on Climate Change (NAPCC) set the overarching direction, but the recognition of regional variations necessitated a more decentralized approach.

The NAPCC, launched in 2008, laid the foundation with its eight national missions, covering sectors like solar energy, energy efficiency, and sustainable agriculture. While comprehensive, its top-down structure highlighted the need for state-specific strategies. This led to the development of State Action Plans on Climate Change (SAPCCs), allowing states to tailor policies to their unique ecological and socioeconomic contexts.

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<sup>121</sup>Engström, R. E., Howells, M. & Destouni, G. Water impacts and water-climate goal conflicts of local energy choices – notes from a Swedish perspective. *Proc. IAHS* 376, 25–33 (2018).



The transition to state-level action empowered local governments to address climate vulnerabilities specific to their regions. Coastal states, for instance, focused on sea-level rise and cyclone mitigation, while Himalayan states prioritized glacial melt and ecosystem preservation. This decentralized approach fostered greater ownership and accountability, leading to more effective implementation.

Furthermore, existing legislation like the Energy Conservation Act was strengthened, with amendments promoting energy efficiency and carbon trading schemes. States actively implemented these provisions, incentivizing renewable energy adoption and promoting sustainable practices in industries. The emphasis on renewable energy, particularly solar and wind, gained momentum through state-level policies, attracting investments and creating local employment.

However, challenges persist. Inter-state coordination remains crucial for addressing transboundary issues like river basin management and air pollution. Capacity building at the state level is essential for effective policy implementation and enforcement<sup>122</sup>. Financial resources, often limited, need to be strategically allocated to support climate actions.

#### **4. STRENGTHENING CLIMATE LEGISLATION: FROM NATIONAL PLANS TO STATE ACTIONS**

India's climate legislation has undergone a significant transformation, evolving from centralized national plans to a more nuanced, state-driven approach. This shift was driven by the growing urgency of climate change

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<sup>122</sup> Lang, Winfried. "3 General International Law and Transboundary Air Pollution: Norms, Concepts, and Principles." *Oxford Journal of Legal Studies* 33, no. 1 (2013): 161-189. Oxford Academic.

and the realization that a one-size-fits-all national strategy couldn't adequately address India's diverse regional vulnerabilities.

Following the National Action Plan on Climate Change (NAPCC), states began developing their own State Action Plans on Climate Change (SAPCCs). This decentralized model allowed states to tailor strategies to their specific ecological and socioeconomic contexts. Recognizing that climate impacts vary significantly across India's diverse geography, this approach enabled more targeted and effective interventions. For example, coastal states prioritized sea-level rise and cyclone mitigation, while mountainous regions focused on glacial melt and ecosystem preservation.

Simultaneously, existing national legislation was strengthened to reinforce climate action. The Energy Conservation Act of 2001, along with its subsequent amendments, played a crucial role in promoting energy efficiency across various sectors, directly contributing to greenhouse gas emission reductions. The Act's scope was expanded to include carbon trading schemes, reflecting a move towards market-based mechanisms for climate mitigation.

The government also introduced regulations and incentives to promote the adoption of renewable energy sources, aiming to reduce dependence on fossil fuels. This included policies to encourage solar and wind power development, fostering a cleaner energy transition. The 2022 update to the Energy Conservation Act, which incorporated the trading of carbon credits, further emphasized India's commitment to climate action and signaled a significant step towards a carbon-neutral economy.

Furthermore, the increasing frequency and intensity of extreme weather events have necessitated a stronger focus on disaster management. This

has led to the development of enhanced disaster planning and mitigation strategies, integrating climate resilience into disaster risk reduction efforts.

In essence, India's climate legislation has transitioned from a top-down, national-centric approach to a more decentralized, state-driven model, complemented by strengthened national legislation and a growing emphasis on market-based mechanisms. This evolution reflects a deeper understanding of climate change's complexities and the need for tailored solutions to address regional vulnerabilities.

## **5. CHALLENGES AND FUTURE DIRECTIONS**

India's journey in strengthening climate legislation, while marked by significant progress, encounters a complex web of challenges that require immediate attention. Addressing these hurdles is crucial for realizing the nation's climate goals and fostering a sustainable future.

One of the foremost challenges is the implementation and enforcement of existing climate laws. Despite a robust legislative framework, bureaucratic hurdles, limited resources, and weak institutional capacity often impede effective implementation. Corruption and lack of accountability further exacerbate these issues, hindering the translation of policies into tangible action<sup>123</sup>.

Another critical challenge lies in balancing economic development with climate action. India's rapid economic growth necessitates a sustainable pathway that minimizes environmental impact. Finding this balance requires integrating climate considerations into all sectors, from

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<sup>123</sup>Policy Coherence of the Sustainable Development Goals (International Resource Panel, 2017).

infrastructure development to industrial practices. This necessitates a shift towards a low-carbon growth model, which demands significant investments in clean technologies and sustainable infrastructure.

Inter-ministerial coordination is also vital. Climate action cuts across various sectors, requiring seamless collaboration between ministries and departments. Siloed approaches can lead to fragmented policies and inefficient resource allocation. Streamlining coordination mechanisms and fostering a holistic approach are essential for effective climate governance.

Financial resources pose a significant hurdle. Mobilizing adequate funds for climate mitigation and adaptation is crucial, especially for a developing nation like India. This involves attracting domestic and international investments, leveraging public-private partnerships, and exploring innovative financing mechanisms

Public awareness and participation are indispensable for driving climate action. Engaging local communities, civil society organizations, and the private sector is crucial for ensuring that climate policies are socially equitable and culturally relevant<sup>124</sup>. Raising awareness about the impacts of climate change and promoting sustainable lifestyles are essential for fostering a collective sense of responsibility.

Furthermore, technological gaps need to be addressed. Access to advanced clean technologies and innovative solutions is crucial for transitioning to a low-carbon economy. Investing in research and development, promoting

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<sup>124</sup>Smith G, Hughes T (2020) Why participation and deliberation are vital to the COVID-19 response.

technology transfer, and fostering innovation are vital for bridging these gaps.

Data collection and monitoring are essential for informed decision-making. Enhancing data collection on greenhouse gas emissions, climate impacts, and adaptation measures is crucial for tracking progress and identifying areas for improvement.

Looking ahead, India's future directions must focus on strengthening institutional capacity for climate governance. This involves enhancing the skills and expertise of government officials, improving coordination mechanisms, and fostering a culture of accountability.

Promoting climate-resilient development and adaptation is crucial for minimizing the impacts of climate change. This involves integrating climate considerations into infrastructure planning, disaster management, and agricultural practices<sup>125</sup>.

Enhancing public participation and awareness is vital for driving behavioral change and fostering a sense of ownership. This involves leveraging educational campaigns, community engagement programs, and media outreach.

India must continue to strengthen its national determined contributions (NDCs) under the Paris Agreement, aligning its climate goals with global efforts. This requires a long-term vision and a commitment to continuous improvement.

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<sup>125</sup> Swisher, J.N.: 1998, Project Baselines and Additionality in the Clean Development Mechanism, Aspen, CO, The Global Aspen Forum.

## **6. CONCLUSION AND WAY FORWARD: INDIA'S PATH TO CLIMATE LEADERSHIP**

India's journey from foundational environmental protection to dedicated climate action reflects a growing understanding of the complex challenges posed by climate change. While early legislation established crucial regulatory frameworks, the evolution towards state-level action and strengthened national policies demonstrates a commitment to addressing these challenges. However, significant hurdles remain, demanding a concerted and multifaceted approach.

Recent data underscores the urgency. According to the 2023 World Air Quality Report, several Indian cities continue to rank among the most polluted globally, highlighting the persistent challenges in air quality management despite existing regulations. Furthermore, the 2023 IPCC Sixth Assessment Report emphasizes that India remains highly vulnerable to climate change impacts, including increased frequency of extreme weather events like cyclones and heat waves. Notably, in 2023, India experienced a series of severe heat waves, resulting in significant public health risks and agricultural losses<sup>126</sup>.

The core hurdles lie in the practicalities of implementation and enforcement. Despite robust legislative frameworks, bureaucratic inefficiencies, limited resources, and systemic corruption often impede the translation of policies into tangible action. For instance, reports from the Central Pollution Control Board (CPCB) indicate that compliance with emission standards in many industrial sectors remains inconsistent.

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<sup>126</sup>IPCC (Intergovernmental Panel on Climate Change) Sixth Assessment Report. (2023). IPCC.

Balancing economic growth with climate commitments remains a delicate act, requiring a fundamental shift towards sustainable development practices that minimize environmental impact. Inter-ministerial coordination, often fragmented, needs to be streamlined to ensure a cohesive and effective approach to climate governance.

The challenges of implementation and enforcement, balancing development with climate goals, and ensuring effective inter-ministerial coordination require immediate and sustained attention. Mobilizing financial resources, bridging technological gaps, and fostering public awareness are equally critical for achieving long-term sustainability.

India's trajectory in climate legislation, transitioning from foundational environmental protection to dedicated climate action, reflects a nation grappling with the dual imperatives of development and environmental stewardship. The journey, marked by the evolution from national plans to state-level actions, underscores a growing recognition of the diverse regional impacts of climate change and the need for tailored solutions. However, the path forward is fraught with challenges that demand immediate and sustained attention.

Financial constraints pose a significant obstacle. Mobilizing adequate resources for climate mitigation and adaptation is crucial, necessitating innovative financing mechanisms and strategic partnerships. Moreover, bridging technological gaps and ensuring equitable access to clean technologies are vital for accelerating the transition to a low-carbon economy. Public awareness and participation are equally essential,

requiring sustained efforts to educate and engage communities in climate action<sup>127</sup>.

Addressing these challenges demands a multifaceted approach. Strengthening institutional capacity, promoting climate-resilient development, and enhancing public engagement are paramount. Investing in data collection and monitoring systems will enable informed decision-making and track progress effectively<sup>128</sup>. Fostering technological innovation and facilitating technology transfer will accelerate the adoption of clean solutions.

India must also strengthen its international collaborations, aligning its national determined contributions (NDCs) with global climate goals. This involves demonstrating leadership in climate diplomacy and fostering partnerships to address trans boundary issues<sup>129</sup>. The transition to a low-carbon economy must be just, ensuring that vulnerable communities and workers in carbon-intensive industries are not left behind.

Ultimately, India's success in navigating the complexities of climate change will depend on its ability to forge a sustainable development pathway that prioritizes both economic growth and environmental integrity. By addressing the challenges head-on and implementing the

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<sup>127</sup>Whitmarsh L (2009) Behavioural responses to climate change. *J Environ Psychol* 29:13–23.

<sup>128</sup> Winjum, J.K., Brown, S. and Schlamadinger, B.: 1998, 'Forest harvests and wood products: sources and sinks of atmospheric carbon dioxide', *Forest Science* 44, 272–284.

<sup>129</sup>R.J. Park et al. Regional visibility statistics in the United States: natural and transboundary pollution influences, and implications for the regional haze rule *Atmos. Environ.* (2006).



necessary strategies, India can solidify its position as a global leader in climate action, paving the way for a resilient and prosperous future for all.

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## VII

### BRAHAMAPURAM INCIDENT

#### A THREAT TO CLIMATE

Santinove K J\*

#### ABSTRACT

*Climate change is a burning issue in day today world. Kerala “The god’s own country” know suffers from choking gases coming out of from burning of waste garbage’s at Brahmapuram waste management plant. As it affected the human being health issues, caused by air and water pollution nearby vicinity. Due to the corruption and mismanagement of the authorities and bureaucracy “The god’s own country” know became “The waste on country”. The Bhramapuram incident is a national disaster that affect the climate drastically. The Brahmapuram is a landfill that is a bone of contention in Kerala, where solid waste management, otherwise is systematic and decentralized. Kerala is a highly literally progressive state that laid out policies of decentralized waste management system to solve the municipal solid waste issue in state.*

*In March 2023, A massive fire broke out at Brahamapuram which turnout to be a major point of concern among the masses. The plant in Brahamapuram is polluting two rivers namely Kadambrayar and Chithrapuzha. Other than Kochi corporation, waste from other areas*

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*such as Kalamassery, Aluva, Angamaly and some other panchayats is dumped here. The plant area consists of 110 acres of land waste of six lakhs Tonnes. Almost 70-80% of this garbage is not segregated. This includes both biodegradable waste and non-degradable wastes. Several times fire break-out in Brahamapuram as first time in 2013. It took 6 hours to stop that fire. In 2019 second happened. In between 2018 to 2022 seven major fires happened. Posing a severe risk of a disaster that could happened any time. Kochi Corporation permits other panchayat and municipalities to dump waste in Brahamapuram, and the landfill could not take this overload. The management of plastic waste is also another issue and headache for the corporation. The unskilled Migrant labourers picking garbage from this landfill. The unskilled migrant labourers use beedi's and cigarette's which add to garbage woes. In a dangerous situation inventing possible fire break-out any time. According to estimates from planet earth an NGO ,4300 Tonnes unwanted unrecycled plastic is left in Brahamapuram, after recovery of unorganized labour. India is a developing nation supporting Paris Agreement that aiming sustainability and green protocol. Brahamapuram fire break-out is a national disaster which effects the health of the people as well as the wealth of the nation. The Brahamapuram fire highlighted the need for Proper waste management system in country. India is a highly populated country in the world. A proper decision making and policy formulation can overcome the challenges faced from solid waste management and by introducing proper allocation of funds and proper waste management plants are the need of the hour. Both central and state governments initiates policy and formulating policy for green protocol and environmental stability that*

*focused on every Indian citizen reminds that “Vasu Dheiva Kodambakkam” as “world is a family”. So, every citizen plays vital role in the waste management and environmental protection for the nation.*

**Keywords:** *Brahmapuram Fire, Solid Waste Management, Environmental Pollution, Public Health Crisis, Climate Change in Kerala*

## 1. INTRODUCTION

Climate change is a burning issue in day today world. Climate change is a international issue faced by the different nation in the world. In India especially Kerala “The God’s own country” know suffers from checking gases coming out of from burning of waste garbage at the Brahmapuram<sup>[130]</sup> Waste Management Plant situated in Kochi District. As it affected the human being health issues, caused by air and water pollution nearby Vinicity. Due to the highly corruption and mis- management of the authorities and bureaucracy. “The Gods own Country” know “The waste on country”. Yes, it is true that the waste management is big issue for the world. The Brahmapuram incident is a national disaster that affects our climate deictically. The Brahmapuram aim is a land till that is a bone of contention in Kerala, where solid waste management, otherwise is systematic and, decentralized. Kerala highly literally progressive state in India, that which paid out policies of decentralized waste management system to solve the Municipal solid waste issue in state. Inter disciplinary

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<sup>130</sup> Waste Management plant Kochi

prospective on climate change laws that means approaching the legal trape waste surrounding climate change by integrating knowledge and insights from various disciplinary beyond those laws, including social sciences political sciences, economics environmental science and engineering as to fully understand the complex impact and develop effectives solutions to address climate change issues on multiple levels. Here Must essentially consider the scientific economic social and political factors intertwined with legal regulations to create comprehensive climate change policies. Here Brahamapuram incident is highly connected with the interdisciplinary prospective on climate change law. That key aspects of an interdisciplinary approach to climate change law as follow

### **1.1. Economic Analysis**

Evaluating economic costs and benefits of different climate policies such as carbon precise or renewable energy incentives is for designing effective legal frame work.

### **1.2. Understanding the sciences**

A deep understanding of climate science is crucial to interpret legal implications of climate change including the impact of rising temperatures, extreme weather events and sea-level issues.

### **1.3. Social consideration**

Issuing how climate changes disproportionately impact vulnerable populations and I considering social justice issues within climate policy development.

#### **1.4. Political Feasibility**

Analyzing the political land stage and potential challenges to implements climate laws of different governance levels, from international assessments to local regulations.

#### **1.5. Policy design and implementation**

Designing practical legal mechanisms to achieve climate goals, including regulations market-based instruments, and adaption strategies.

As the benefits of an interdisciplinary approach as follows: -

##### **1. Holistic Understanding**

By considering multiple perspectives, it allows for a more comprehensive understanding of the complex issues surrounding climate change.

##### **2. Effective Policy Pollutions**

Integrating diverse knowledge can lead to more tailored and effective climate changes mitigation and adaption strategies.

##### **3. Collaboration and Communication**

Fosters collaboration between legal experts scientists economists and policy matter to facilitate better communication and decision making.

## **2. LITERATURE REVIEW**

As a summary of the existing researchers to topic “Brahamapuram incident a threat to climate”.



### **2.1.1. FIRE BREAK-OUT IN BRAHAMAPURAM**

In March 2023, A massive fire broke out at Brahamapuram which to amount to be a major point of concern among the massage. The plant in Brahamapuram is polluting 2 rivers namely Kadambrayar and Chithrapuzha. Other than Koch corporation, waste from other areas such as Kalamassery, Aluva, Angamaly and some other Panchayaths is dumped here. The plant area consists of 110 acres of land waste of 6,00,000 (six lakhs) tones. Almost 70-80% of this garbage is not segregated. This includes both biodegradable waste and non – degradable wastes. Several times fire breakout in Brahamapuram as first time in 2013. It took 6 hours to stop that fire. In 2019 second happened in between 2018 to 2022 7 major fires happened. Posing a severe risk of a disaster that could happen any time. Kochi corporation permits other Panchayat and Municipalities to dump waste in Brahamapuram, and the landfill could not take this over load. The Management of plastic waste is also another issue and headache for the corporation. The unskilled migrant labourers picking garbage from this and fill. The unskilled & migrant labourers use beedies and cigarettes which add to garbage waste. In a dangerous situation inventing possible fire break out anytime according to estimate from plant earth (plan@earth)<sup>[ 131]</sup> an NGO 4300 tonnes unwanted un-recycled plastic is left in the Brahamapuram, after recovery of unorganised labour. As before 70 acre of land then 110 acres because huge solid wastes. The Kerala has a limited land space filled with lakes, water bodies and rivers.

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<sup>131</sup> Non Government Organisation

Kochi corporation pursues other panchayats and Municipalities to dump waste in Brahamapuram, and the land could not take this overload. A lot of plastic that enters the land fill cannot be managed.

According to estimate from plan @ earth NGO 4300 tonnes unwanted un-recycle plastic is left in Brahamapuram, after recovery by unorganized labour. It is 4300 tons per month, and by end of the year, it is a mountain of non-recyclable plastic, which cannot be recovered just by picking it up. One aerosol can is all that it takes to explode and make the entire landfill burn. Spontaneous condition can happen any time.

According to Solid waste management rules 2016 from ministry of environment forest and climate change (MoEF) govt. of India, mixed waste in Brahamapuram was not acceptable. The rules say that only non-recyclable, non-biodegradable, non-combustible wastes should be allowed to come to the landfill, solid waste management rules 2016 guidelines include households event organizers, street vendors, gated communities restaurants and hotels to take responsibility for regulating waste of sources and handing it over to municipalities authorities.

Word tells about sustainability, perhaps a fraction of population can pursue this need for citizen to take ownership of trash they generate and segregate it so that it can be recycled or completed.

National Green Tribunal fine Kochi corporation for Brahamapuram landfill incidents with 100 crores however high court stayed the order.

According to Swachh Bharat<sup>[132]</sup> Report 2020 India loses over 1250 hectares of useful land every year to dispose of Municipal solid waste. National Green Tribunal Stated that more than 10,000 hectares of useful land are located up under 3159 legacy waste dump sites in the country.

A change after Brahamapuram, Kerala has a solid waste management policy which emphasizes decentralized waste treatment. The policy emphasizes on reduction, recipe recycling and recovery a zero waste state phase by phases. Paravur Plan@earth a NGO Kochi bend nonprofit working on waste managements and other environment issues, brought a new model in waste segregating. Under the derution of Dr. K Vasulis / A S officer in 2016 – 2017 in charge of Suchitwa Mission<sup>133</sup> in Kerala as executive Director introduced Several steps to initiate tackle waste Management invited proposals from all over Kerala. In 2016 of a swearing in ceremony of Cabinet members followed the green protocol as the first time that minimizing waste generation ever prioritized as a government scanning in ceremony. Not only in Kerala that model adopted by Himachal Pradesh.

After Brahamapuram incident a card system introduced in waste collection just like LPG whenever garbage picked up by Haritha Karma Sena (Green Volunteers as women volunteers) they marked collected further on SMS alert goes to people's reminder. So that they can know collectors will be coming to pick up garbage its systematic increase introduced after Brahamapuram incident.

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<sup>132</sup> Government program (clean India Mission)

<sup>133</sup> Kerala Government Clean Programme

2 strong solutions from the model selected from the directions.

1. Garbage collection fee collected from house holder (Rs. 50/-) user fee and shop holders (100/-) user fee.
2. Recycles who pay for recycling, vasulri the its officer

Vasulri the IAS Officer included this model as a plan that needs to be followed in every panchayath of Kerala. It's a successful Master plan for the Kerala State waste Management in Kerala. Haritha Kerala Mission was intitaded in state. Every corporation has a waste management plan but its not completely scientific. The user fee collected of Rs. 50/- from shop holders and Rs. 100/- from them as user fee. Collected by Haritha Karma Sena (Womens Green Volunteers) that userfee Same model followed by plan @ earth in paravur Municipality the Success model as the collected money used to give income to women's who working in Harith Karma Sena who collected waste.

After Brahamapuram incident introducing Haritha Karma Sena (Green Voluntares (women's) a lot of changes brought to the state. That waste as solid waste management. Began segregation process. As bio-degradable and non-biodegradable waste began segregate by house holders and shop holders. The model taken from plan@earth is nonprofitueshing for waste management is a successful in the state. That why implemented in the whole panchayath in the state also municipalities there is Harith Karma Sena (Women's Green Voluntaries)

### **3. CORE AGREEMENT**

#### **3.1 Brahamapuram incident created Air and water pollution.**

Also environmental pollution. That Brahamapuram incident is a threat for climate Brahamapuram fire breakout contributor to climate change. Air pollutions like Co<sub>2</sub>, methane and black carbon not only degrade air quality but also contribute to global warming. These pollutants trap heat in the atmosphere, exacerbating climate change due to the incident.

#### **3.2 Health and Environmental Consequence**

As per Article 21 a citizen must get fire and free Air and unpolluted pure water to drink a right of the citizen. Here incident happened created Health issues for the residents as respiratory diseases and issues, cardiovascular diseases, choking etc. and environmental damages as eg. (Acid rain, smog) which can worsen with m temperatures due to climate changes. As the climate change progresses, it may worsen both air and water quality in certain region due to more pregnant wild fires, heat waves and that create poor health outcomes and further environmental degradation.

#### **3.3 Legislative measures for pollution control**

Government as both central and state government regulations made after the disaster that happened national in Brahamapuram incident. As to control the climate change by controlling air, water and environmental pollution and introduce a better and proper waste management plant system and reducing green house gas emissions.

### **3.4 Effectiveness of Policies in Pollution Control**

Effectiveness policies are not just almost making laws, but also their implementation and enforcement, policies may be ineffective of their such insufficient monitoring or penalties for non – compliance. A key appeal of policy effectiveness is alimity to trade pollution levels and esure that law followed. That for policies need to be flexilde and adaptable for the Brahamapuram Plant.

### **3.5 Challenges in Policy implementation**

As per Brahamapuram incident is a disaster happened in Nationally. So it affect the financial back bone of the Nation inversely also created high alert in Nation. So effective policy making needs to balance environmental needs with economic considerations

### **3.6 Climate Justice**

Courts are increasingly being asked to rule on cases involving air pollution, water pollution solid waste management and its connection to climate change. Judicial thinking can hold governments and corporations accountable for environmental damages and self-precedents for stricter standards. Forcing governments to take action on proper waste management, judicial orders can issue as a vital check when legislative or executive branches are show to act, legal battles jurrading climate change often focus on how vulnerable populations, Judicial approaches can demand greater equity in pollution control environmental protection and municipal solid waste management.

## **4 CASE STUDIES & BEST PRACTICES**

### **1. Union Carbide Corporation is VOI 1990 AIR 273**

It's a landmark case in India that addresses the 1984 Bhopal gas leak tragedy. The court applied the principle of strict and absolute liability, the "Polluter pays" and led to the creation of new environmental laws.

### **2. M.C. Mehta is VOI AIR 1987 SC 965**

A landmark Supreme Court of India case that established the principle of absolute liability for hazardous industries. The case called Olan Gas Leak<sup>[134]</sup> case or Shriram Industries case. The Court introduced "doctrine of absolute liability for corporations engaged in hazardous industries. This doctrine makes a significant departure from the traditional principles of tort law, making industries absolutely liable for any harm caused without exceptions or defenses.

### **3. Subash Kumar is state of Bihar (1991 AIR 420)**

The Supreme Court of India held that the right to clean environment is a part of the right to life under Article 21 of the constitution. The petitioner filed a writ petition alleging that the discharge of a slurry from Tata Iron and Steel Co. into Bokaro River polluting water affecting his livelihood and the health of residents. The court held that the right to life includes the right to enjoy pollution-free water and air.

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<sup>134</sup> MC Mehta and Anr vs. Shri Ram Foods and Fertilizers Industries and others

**4. Vellore citizen welfare from is VOI AIR 1996 JC 2715.**

In the case petitioner filed petition by the Vellore citizens welfare forms against significant pollution caused by tannery in Tamil Nadu, which were discharging untreated waste into agricultural lands waterways, and the polar river, impacting the local populations access to clean water. The court strongly emphasized the “precautionary Principle” ad polluter principle into decision, stating that industries must take productive measures to product environmental damage and beheld accountable for harm they cause. All tanneries mandated to install proper effluent treatment plants and implanted strict pollution control measures.

**5. Almitra Patel Vs. VOI 1999**

The first case to extensively deal with solid waste management. The supreme court ordered the formation of a committee to look into all affects of urban soft waste management.

**6. Paryavaran Suraksha Vs.VOI (2017) 5 SCC.326**

The National Green Tribunal monitors liquid waste management based on this case.

**7. Lokesh Kuamr Khusana Vs. State of Up**

The court directed that District magistrates should take leadership on waste Management at the grass roof levels.

**8. Waste management legislation**

- The solid waste Management Bill, 2016
- The municipal solid wastes (Management and Handling) Rules 2000



❖ **Other waste Management Case laws.**

1. M/s Harsh international Vs VOI
2. RiM Dhariwal 100% Eou Vs VOI loss
3. A. Mahendran Vs.M. Dwarakanath
4. P.R. Chemicaly Vs. VOI & Anr's
5. Dharanpal Satyapal Ltd. Ie. VOI fors.
6. Rashi Poly Rack Through its proprietor Vs. Jharkand state pollution control.

## **5 BEST PRACTICES**

Every citizen of the Nation play's a vital role for managing the waste Management. As it began from the family of the citizen. First important as waste separation as important fact that the citizen's to relies.

For the next generation as our future generation that conducting school level and college level faminass clauses about the environmental and waste management (solid) as biodegradable and non bio degradable and non bio degradable crates Management.

Conducting Seminar for the public provide the valuable information for the public about waste segregation and how to manage plastic crates and hazardous wastes live medical wastes etc. That waste management mucous is a channel that the connected with common citizen and governments that proper information and proper management can control the waste management in nationally. Its very

difficult that India is highly populated country that practice a systematic and proper waste management.

## **6 CONSLUSION AND RECOMMENDATION**

In the loss of Brahamapuram incident a national disaster happen due to corruption and management happened by authority and bureau crazy. The God's own country that became "The waste on country" Nation noticed too disaster that effect the health and wealth Nation, Air, water and environmental pollution affected the state also raise of temperature and affect the climate change because of this incident. That common men's as the citizens of the nation who suffers from the incident as Brahamapuram incidents. That the state has absolute liability as per the article 21 of the Indian constitution provides the citizen free air and water not modules should be provided by state for the citizen, But Brahamapuram incident affect the health and wealth of national as the incident challenge the Article 21. Yes the Brahamapuram incident is National disaster affected the common men who residing rear the Brahamapuram plant.

After the incident central and state government both taken several policies and decision making formulated that favorers for environmental protection air, and water pollution that rear to waste dumping plants. Brahamapuram is a waste management plants with 110 acres of land hill. Proper solid waste management reader and proper allocation frond as from central and state government provided under the law, As the Brahamapuram incident happened that that for Lawrence Joseph had chronic obstructive pulmonary disease (OPD) died in Kochi after inhaling toxic from the Brahamapuram waste plant

fine in March 2023. The National Green Tribunal (NGT) citizen Kerala and relevant authorities for “after failure” and violations solid waste management rules.

Yes, the state feed a proper waste management practices at the land file that way proper waste management possible especially is MSW Municipal solid waste, providing seminars at school level, college level and for citizen about the waste management and waste segregation is must for the protection for information environment cur and water many people experienced breathing difficulties, headaches, dizziness, eye’s discomfort and itching. On the Brahamapuram incident happiness that the local administration advised residents to stay indoors and wear N-95 makes a the residents went outside on that time.

India is a developing nation supporting party agreement that aiming sustain ability and green protocol. Brahamapuram fire break out is a national disaster which effects the health of the people as well as the wealth of the nation. The Brahamapuram fire highlighted the need for proper waste management system in country. India a highly populated country in the world. In the modern era waste management is biggest headache for the world. The waste should be segregated under biodegradable and non-biodegradable wastes and proper Management of waste should be follow up. A proper management and decision making in proper way helps to formulate policies can overcome the challenges faced from solid waste management and by introducing proper allocation of funds by both central and state governments provided for a proper waste Management plants are need of the hour. Both central and state governments initiates policy and

formulating policy for green protocol and environmental stability that focused on every Indian citizen remains that Vasu Dheiva Kodenbakkam<sup>135</sup> as “world is a family” So every citizen plays a vital role in the waste Management and environmental protection for the nation

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<https://planatearth.org>

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<sup>135</sup> The World is one family

## VIII

### CLIMATE MODELING IN LAND MANAGEMENT: A SYNERGY FOR ECOLOGICAL ROBUSTNESS

Mary Sania Nash\*

#### ***Abstract***

*The world is under a threat to spontaneous climate change with wide spread Impact on humanity and environment. This research paper hunts us through multifaceted dimensions of these issues and employ climate models for the purpose of improving our understanding and predictability of climate behaviours on land. Climate Modeling is a compounded scientific endeavour that requires an interdisciplinary approach, amalgamating expertise from computer science, Physics, Mathematics, Atmospheric Science, Ecology and Oceanography. This paper explores how alliance across these disciplines enhances the exactness, efficiency and applicability of climate models for the purpose of land management. These models use complex mathematical equations to simulate the changes occurring in the land surface. The use of computer programs and data analysis for creating compounded replications of Earth's climate system by writing codes for finding the interconnection between various land components based on ecological factors. In climate Models we use 3-D grid that divides Earth into cubes and each cube shows specific area from atmosphere to land and helps to identify land use changes and land*

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*cover changes and how these changes influence the atmospheric processes. This research also highlights the use of applications of climate modeling in different scenarios. Assimilating climate models with land management models can provide information on the potential impacts on biodiversity, other resources. The common climate models used in land management are Global climate models, regional Climate models, land surface models. These models are complicated and involves limitations and uncertainties and a factor that leads to the*

*model uncertainty is “internal variability “, which refers to the natural fluctuations in the Earth’s Climate system and this has to be dealt with caution and care. A case study is done to evaluate climate modeling to predict the future impacts of climate change and analyzing how the changes in temperature and precipitation patterns could affect land. The outcome of this research is that we get to know the warning signs in the nature. Degrading activities like deforestation, large scale conversion of forest land into cultivable lands, tremendous use of plastics, lack of waste management practices leads to global warming, Arctic Amplification. This paper concludes with the various strategies that include transitioning to ecological friendly practices like reforestation and sustainable land management practices can contribute to carbon sequestration diminishing climate change by absorbing atmospheric carbon dioxide, following the 3rs (reduce, reuse, recycle), transitioning to renewable source of energy, improving energy efficiency and sustainable land management.*

**Keywords:** *Climate model, 3D grid model, land management, Global climate models, Internal variability, 3rs (reduce, reuse, recycle), Global warming, Arctic Amplification.*

## 1. INTRODUCTION

An interdisciplinary approach to climate change education is significant as it allows for a comprehensive understanding of complicated issues by incorporating knowledge from various disciplines like economics, social science, science, etc. Helping the students to get hold of the miscellaneous consequences and develop a holistic approach to tackle climate change in a more effective manner. Incorporating knowledge from various disciplines helps the students to know the interconnection with each other and promotes critical and innovative thinking on climate change. Since my research paper mainly emphasizes the concept of climate modeling, we focus more on its interdisciplinary approach. Land management is a crucial subject that should be focused on at wider levels. In this research we employ the climate models to dig into more on increasing the effectiveness of land management<sup>136</sup>. The core reason for adopting such an approach to climate modeling and land management centers on the acknowledgement that climate systems and land-use practices are elaborately linked through complex interactions among atmospheric, ecological and sociological factors. There are a lot of policies governing climate change, and these policies address the

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<sup>136</sup> Schipper, E.L.F., Dubash, N.K.&Mulugetta, Y., “Climate change research and search for solutions: rethinking interdisciplinarity”. (2021) 168 climate change <<https://doi.org/10.1007/s10584-021-03237>> accessed 18 October 2021.

environmental factors which provide the evidence needed to promote sustainable development and ecological conservation. During the ancient times there were limitations in using the climate models, as we were living in a less computerized world, so accurate data on variations occurring in the atmosphere and, as a result how it impacts land and things pertaining to it, was very difficult to determine<sup>137</sup>.

With the advent of fully equipped climate models, things have become easier. By integrating data from various disciplines, there is a scope for more accuracy and reliable data. This approach helps in decision-making for understanding the aids in evaluating various strategies required for balanced land management. Climate change impacts different regions and communities; therefore, following this approach helps in achieving global sustainability goals. Assessment of climate-related disasters like wildfires, floods, droughts require the assistance of scientists, scholars, engineers who will provide us with a mature friendly approach and methods to tackle this more effectively. Increasing global warming and arctic amplification are the biggest threats nature is facing; therefore, proper waste management, especially the plastic waste, reduced use of coals, treatment of industrial effluents, etc., has to properly implemented. An interdisciplinary approach to this

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<sup>137</sup> National Academies of Sciences, Engineering, and Medicine, "Planning Freight-Efficient Land Uses: Methodology, Strategies, and Tools". (2022) Washington, DC: The National Academic Press 324.



helps to build strategies that provide nature-friendly solutions<sup>138</sup>.

The research students would get an idea by means of effective utilization of climate models, one can achieve better land management and development of land resources, and these resources can be used for the management of agriculture, water resources, forestry and other resources pertaining to land. By noting the land cover changes and changes in the biodiversity and ecosystem, evaluating deforestation, afforestation and consequences on weather events and its impact on land is examined here. By means of equations (mathematical equations), data analysis of 3D grid which divides Earth in the form cubes in, use of various land models like global climate models, regional climate models, land surface models etc., are the various methods adopted in effectively using the climate models. Let's make this world a better place to live in by responsible and optimistic approaches to climate change.

## **2. LITERATURE REVIEW**

### **2.1 Review of The Existing Literature**

The world is facing the impact of climate change and its harsh consequences on humanity and environment. Climate change is a crucial topic that needs to be discussed in the present scenario. Existing research approaches to climate change learning involve experimental, empirical, quantitative and qualitative approaches. The main goal

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<sup>138</sup> Wang F, Harindintwali J.D, Wei K, et.al., "Climate change: Strategies for mitigation and adaptation". (2023) 1(1) The innovation Geoscience <<https://doi.org/10.597171/j.xinn.geo.2023.100015>>.

behind this is to reach this concept to the masses and make them understand the strategies required to preserve this planet. An interdisciplinary approach is followed by combining knowledge from various spheres like science, mathematics, economics, social sciences, ecology, technology, etc., to address climate change.<sup>139</sup> This approach is significant as it gives a holistic understanding of climate change.

The use of innovative technologies led to the development of high-resolution climate models to enhance climate change education and engagement. The current scenario of climate modeling within land management focuses on using computer simulated models to understand the land use changes (afforestation, deforestation, reforestation, agricultural practices, urbanisation) and their consequences on biodiversity, soil fertility, weather patterns, etc. The conversion of forest into cultivable lands impacts temperature changes and precipitation patterns that would be an adverse effect on the climate. Soil and Water Assessment Tool (SWAT) mainly used in modeling water balance and agricultural consequences on the climate.<sup>140</sup> InVEST (Integrated Valuation of Ecosystem and Tradeoff) helps in examining the ecological services like carbon sequestration and water resources related to land use and land cover changes. Incorporating Global climate models into land management can assess waste management practices, water resource

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<sup>139</sup> Reid A, "Climate change education and research: Possibilities and potentials versus problems and perils?" (2019) 25(6)<[https:// doi.org/10.1080/1350462](https://doi.org/10.1080/1350462)> accessed 24 September 2019.

<sup>140</sup> Samuel S. Guug, Shaibu Abdul Ganiyu, Raymond A Kasei, "Application of SWAT hydrological model for assessing water availability at the Sherigu catchment of Ghana and Southern Burkina Faso". (2020) 3 Hydro Research <<https://doi.org/10.1016/j.hydres.2020.10.002>> 13 October 2020.

management, agriculture planning, etc. Employing regional climate models can be used to analyze weather patterns in local areas. It can also check the land use practices that have an adverse impact on climate change and take remedial measures to mitigate such adverse practices.<sup>141</sup>

## **2.2.Current Academic Approaches to Interdisciplinary Learning**

The current academic approaches to interdisciplinary learning include collaboration between various disciplines, practical based learning, use of innovative digitalized tools, theme and project-oriented approach. In the area of climate change, the current approach followed by the scientist is the use of innovative digitalized tools like climate models to study the interactions in the atmospheric components and their impact on ecosystem<sup>142</sup>. Artificial intelligence and personalized tools can enhance the data generated more effectively. Combination of qualitative and quantitative models for understanding changes in the ecosystem and socio-economic impacts. Research universities must collaborate together to formulate strategies to synthesize land use and extensive planning, for example, drainage planning, and it shall also encourage students to use their skills and be part of these strategies enthusiastically.<sup>143</sup>

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<sup>141</sup> Joshua H Goldstein, Giorgio Caldarone, Thomas Kao Duarte, Driss Ennaanay, Neil Hannahs, Guillermo Mendoza, Stephen Polasky, Stacie Wolny and Gretchen C. Daily, "Integrating ecosystem-service tradeoffs into land use decisions". (2012) 109(19) PNAS <[https:// doi.org/10.1073/pnas.1201040109](https://doi.org/10.1073/pnas.1201040109)> April 23 2012.

<sup>142</sup> School of Education, American University, "Interdisciplinary Education: An Overview". <<https://soeonline.American.edu>> October 6 2023.

<sup>143</sup> Eva Kinnebrew, Elizabeth Shoffner, Aldo Farah Perez, Megan Mills-Novoa, Katherine Siegal, "Approaches to interdisciplinary mixed methods research in land-change and environmental management". (2020) Conservation Biology <<https://doi.org/10.1111/cobi.13642>>30 December 2020.

### **2.3 Identification Of Gaps Between Legal and Non-Legal Aspects**

When addressing climate change through an interdisciplinary approach, gaps exist in integrating legal aspects with non-legal aspects like economics, science, social sciences etc., especially in fields like climate change consequences, and bridging the gap between them might lead to ineffective conclusions. In climate modeling there are computer simulations and data analysis for land management but overlooks the role of legal frameworks on land use decisions. This can result in going against the regulations that govern the land management practices. Effective land management requires interlinkage between different disciplines such as ecology, social sciences, law, technology, economics, etc. For example, for the purpose of management of a dam reservoir, there are certain aspects to be checked in, such as the use of innovative technologies for generating electricity, physics can be applied hydrostatic pressure, buoyancy, fluid dynamics, economics can be applied for controlled irrigation practices, law can be applied in regulating the operation of dam based on safety standards set by the law and policymakers.

Certain agencies like US Bureau of Land Management failed to incorporate computer science into their strategies due to inefficient data collection. This shows the ineffective handling of technology<sup>144</sup>. Landowners and government face unreliability in costly climate

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<sup>144</sup> Sarah K Carter, Travis S Haby, Jennifer K Meineke, Alison C Foster, Laine E Mccall, Leigh D Epsy, Megan A Gilbert, Jeffrey E Herrick, Karen L Prentice, "Prioritizing science efforts to inform decision making on public lands". (2023) 21(10) *Frontiers in Ecology and the Environment* <<https://doi.org/10.1002/fee.2672>> accessed September 5 2023.

strategies and challenge the outmoded legal doctrines not designed for current climate challenges<sup>145</sup>. The modernization of land use regulations, the promotion of interdisciplinary collaborations, the development of innovative technologies (high resolution climate models) based on standardized protocols, the encouragement community-based participation for spreading awareness on climate change, introduction of climate-based education in schools and universities- all these strategies will be of great aid to overcome these gaps<sup>146</sup>.

### **3. CORE ARGUMENTS**

#### **3.1 Overview**

A climate model is a computer simulation of Earth's Climate system. It uses a number of mathematical equations and it gives a demonstration that how energy and matter move through atmosphere, ocean, land and ice<sup>147</sup>. We follow an interdisciplinary approach in this concept for an effective land management.

#### **3.2. Mathematical Equations in Climate Modeling**

Mathematics plays a very important role in climate modeling by providing fundamental equations that are necessary for controlling the Earth's climate system. Differential equations play a pivotal role in

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<sup>145</sup> Mark Nevitt, "The Legal Crisis Within the Climate Crisis". (2024) 76 Stanford Law Review 77.

<sup>146</sup>

<sup>147</sup> Yingshou Lyou, Hong Chen, Zhe Cheng, Yuetong He, Xi Zheng, "Identifying the impacts of land use landscape pattern and climate changes on streamflow from past to future". (2023) 345 journal of Environmental Management <<https://doi.org/10.1016/j.jenvman.2023.118910>> accessed November 1 2023.

climate modeling as they mathematically indicate vital processes governing the Earth's climate system. These equations describe how various elements like atmosphere, oceans, land surface and ice interact and develop over time. The following table give us a glance on the role of mathematical equations in climate modeling in land management.

Table 1.

| Model name                            | Equations                                                                                                                                            | Description                                                                                                                   |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1. Land surface models <sup>148</sup> |                                                                                                                                                      | It affects the interlinkage between land surface (soil, vegetation) and atmosphere and measure the transfer of energy, water. |
| i. Surface water balance              | $P - E = R + \Delta SW$<br>P is precipitation<br>E is evapotranspiration<br>R is runoff<br>$\Delta SW$ is change in water storage (surface and soil) | Shows the interactions of processes in soil moisture, energy fluxes with atmosphere.                                          |

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<sup>148</sup> Romi Bala, Hemant Pandey, "Mathematics of Climate Modeling: Challenges and perspectives". (2020) 11(3) Turkish journal of computer and mathematics education <10.61841/turcomat.v11i3.14657> accessed December 2020.

|                                                     |                                                                                                                                                                                                                                                                                                                          |                                                                                                                                          |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| ii. Surface energy balance                          | $R_n = G + H + LE$<br>$R_n$ is net radiation<br>$G$ is ground heat flux<br>$H$ is sensible heat flux<br>$LE$ is latent heat flux                                                                                                                                                                                         | Through exchange of energy in the Earth's surface, it can be used to forecast land use changes, soil moisture and its impact on climate. |
| 2. Global Average Temperature Models <sup>149</sup> | $R \frac{dT}{dt} = Q(1 - \alpha) - \sigma T^4$<br>$R$ is Earth's average heat capacity<br>$T$ is Earth's average temperature<br>$t$ is time in years<br>$Q$ is the annual mean incoming solar radiation per square metre of the Earth's surface<br>$\alpha$ is planetary albedo<br>$\sigma$ is Stefan Boltzmann constant | It calculates the amount of heat absorbed by the land surface and how much it radiates back.                                             |

<sup>149</sup> James Walsh, "Climate Modeling in Differential Equations". (2015) 36(4) UMAP <[jawalsh@oberlin.edu](mailto:jawalsh@oberlin.edu)>.

|                                               |                                                                                                                                                                                                                                           |                                                                  |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 3. Reaction diffusion equation <sup>150</sup> | $\frac{\partial u}{\partial t} = D \nabla^2 u + R(u)$ $u$ is concentration of combustible material<br><br>$D$ is the thermal diffusivity.<br><br>$\nabla^2$ is laplacian operator<br><br>$R(u)$ is a reaction term for combustion process | Fire spread in environment can be modeled using these equations. |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|

### 3.3. Data Analysis in Climate Models and Its Applications in Land Management

In the domain of land management, data analysis is important for understanding and forecasting land-use changes and their ecological impacts. These models can evaluate ancient and future frameworks to estimate potential impacts of human activities and natural processes on the environment.

One of the significant models based on computer simulations and data analysis is Global climate models. There are various components in Earth, like land, atmosphere and oceans, and studying their interactions

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<sup>150</sup> Raimond Burger, Elvis Gavilan, Daniel Inzunza, Pep Mulet, Luis Miguel Villada,” Exploring a Convection- Diffusion- Reaction Model of the propagation of forest fires: Computation of risk maps for heterogeneous environment”. (2020) 8(10) MDPI< <https://doi.org/10.3390/math8101674>> accessed October 1 2022.



with elements like carbon dioxide, water vapour, heat, Earth's rotation requires the need for computer simulated codes (climate models)<sup>151</sup>. Here these models are employed to study the elements on the land surface like soil, vegetation processes, carbon storage and their interactions with factors like carbon dioxide, water vapour, heat, pressure, density which can help the scientist to forecast the changes in land uses like reforestation, deforestation, agriculture and its consequences on the Earth's climate.

Global Climate models divide Earth into a 3D grid with interconnected cubes that represent specific components (land, atmosphere and oceans). Magnitude of the cubes is approximately 100 Km<sup>3</sup> i.e. 24 miles cube with 2.8 miles each cube. The magnitude of grid relies on the power of the computer that can be used to solve the equations. Smaller grid resolutions demand substantial computational power. Doubling the resolution can increase computational requirements by up to tenfold. This necessitates the use of supercomputers for storage of complex data.

There are two types of processes within the climate model: simulated and parameterized. Simulated processes simulate the interactions of various components on the land surface based on fundamental laws in physics and are larger than the grid. Parameterized process is smaller than the grid and depicts how the parameterization of the land components influence atmosphere. Grid functions based on the calculation of components through mathematical and physical equations. Testing of models can be done by a method called hind

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<sup>151</sup> U.S DEPARTMENT OF AGRICULTURE, "Basics of Global Climate Models" (USDA Climate Hubs). <<https://www.climatehubs.usda.gov>> accessed April 30 2024.

casting in which past conditions is used to model actual conditions and its solution are compared with observed conditions to increase model accuracy<sup>152</sup>.

### **3.3.1 Applications in Land Management**

Since these high-resolution models calculate land cover changes, it shows greater insights on the following:

¶Forest Management: Forestry professionals utilize GCM outputs to assess how climate change may alter forest ecosystems. It predicts the consequences of the loss of forest on global and regional climate as well depicts the positive effects like cooling in case of afforestation<sup>153</sup>. Estimation of increased temperatures and changes in precipitation can impact decisions on species rate, pest control, and fire prevention strategies. For example, locates the dry areas in which the fire is likely to spread with the help of fire climate feedback and vegetative climate feedback mechanisms guided by models.

¶Agricultural Expansion: These models aid in minimizing land use to balance food availability and ecological viability. It helps the farmers to know the temperature changes and precipitation patterns and plant the crops accordingly. It also guides land use changes like agroforestry, crop diversification, etc<sup>154</sup>.

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<sup>152</sup> NOAA, "Climate Models". <<https://www.climate.gov>>.

<sup>153</sup> Rodney J Keenan, "Climate change impacts and adaptation in forest management: a review". (2015) 72 <<https://doi.org/10.1007/s13595-014-0446-5>> accessed March 2015.

<sup>154</sup> Dennis Timlin, Kristen Paff, Eunjin Han, "The role of crop simulation modeling in assessing potential climate change impacts". (2024) 7(1) Agrosystems, Geosciences & Environment <<https://doi.org/10.1002/agg2.20453>> accessed January 3 2024.

¶Conservation and Biodiversity: Conservationists use GCMs to predict how climate change may affect habitats and species distributions. These models identify the areas with increased temperature and change in rainfall patterns that may ruin forests and other habitats. These models aid the Conservationists with habitat restoration. It checks the reasons for possible extinction in the future and takes steps to mitigate it. It aids carbon cycle feedback mechanisms by checking the amount of carbon dioxide present in the atmosphere and how it is likely to affect the habitat.

¶Urban Planning: Evaluates how the expansion of towns and cities affects the temperature and weather patterns. Aids to increase eco-friendly infrastructure and green spaces for a better Earth.

¶Water Resource Management: Forecast the changes in river flow patterns and take necessary steps for effective flood control and reservoir management. Accurate predictions of future hydrological cycles are crucial for managing water supplies. GCMs inform water resource managers about potential changes in rainfall patterns, river flows, and groundwater recharge rates. This knowledge aids in planning for water storage and flood control<sup>155</sup>.

An Interdisciplinary approach to climate modeling in land management is significant as climate system is affected by multiple factors which require a combination of knowledge of different disciplines. We follow a participatory and integrated approach in employing climate

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<sup>155</sup> Mustapha Besbes, Jamel Chahed, “Predictability of water resources with global climate models. Case of Northern Tunisia” (2023) 355(S1) *Comptes Rendus Geoscience* <10.5802/cregeos.219> accessed June 2023.

models in land management. Community based learning aids in connecting to real world issues.

#### **4. CASE STUDY**

Brahmapuram Municipal Solid Waste Treatment Plant (BMSWTP) is located near Kadambayar river, Kochi. On March 2, 2023, around 3:30 PM, a massive fire broke out at the 110-acre Brahmapuram landfill site, located approximately 17 kilometers from Kochi city. The fire swiftly spread around the surrounding areas releasing toxic dense fumes. As a result, the residents of that area developed chronic respiratory diseases such as Asthma, eye irritation, dizziness even went to up to developing throat cancer. It took almost 12 to 13 days to completely extinguish the fire.

##### **4.1 Causes**

Several factors that contributed to the severity of this incident are as follows:

4.1.1. Waste Accumulation: Kochi municipal corporation dumps the waste gathered from the locality at Bhramapuram waste plant. It contains both bio degradable and non-biodegradable waste. Anoxic putrefaction of waste releases methane gas and other toxic fumes that increase the risk of combustion. Non-Biodegradable waste such as plastic harms ecosystems and human health in many ways like toxins released from them on combustion such as Dioxins, Polychlorinated biphenyls (PCB), Benzo pyrene (BAP), Polyaromatic hydrocarbons, Bisphenols and phthalates, Mercury, furans cause cancer and have a serious impact on environment. The report submitted by National Institute for Interdisciplinary Science and Technology (NIIST) in 2020 revealed that dioxin levels in the air at

bhramapuram waste site were 3.2 picogram which exceeded the site measurements<sup>156</sup>.

4.1.2. Spark: There are suspicious rumours like the fire incident was caused by a spark from the machine. Elements like corruption and other illegal aspects ignited the spark debate. Refused Derived fuel that was stored for energy projects increased fire risk.

Improper waste management: Waste plant should be set up with the idea of proper waste management. The main concern in this issue is ineffective disposal i.e. not making a division between biodegradable and non-Biodegradable waste as a result when the waste ignites it releases toxic fumes enormously. The animals feeding on the waste might get exposed to skin diseases that will spread among humans contagiously<sup>157</sup>.

## 4.2 Impacts

4.2.1. Air Pollution: <sup>158</sup>Fire caused the emission of six major pollutants such as carbon dioxide, carbon monoxide, nitric oxide, methane, Hydrofluorocarbons, sulphur hexafluoride and these greenhouse gases have a treacherous impact on the atmosphere leading to climate change.

4.2.2. Water Pollution: About 60,000 litres of water from kadambaryar river per minute was used to put off the fire. This might lead to high

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<sup>156</sup> Haritha John, "Bhramapuram fire: An environmental disaster that was waiting to hit Kochi", *The News Minute* (Kochi, March 14 2023) [www.thenewsminute.com](http://www.thenewsminute.com).

<sup>157</sup> Anna Jose "2023 Bhramapuram Fire: Two years on, what has changed?" *The New India Express* (Kochi March 1<sup>st</sup> 2025) [www.newindiaexpress.com](http://www.newindiaexpress.com).

<sup>158</sup> Madhuraj Palat Kannankai, "Air quality impacts of landfill fires: A case study from the Bhramapuram Municipal Solid Waste Treatment Plant in Kochi, India". (2024) *Sci Total Environ* <10.1016/j.scitotenv.2024.170289> accessed March 15 2024.

leachate contamination causing the release of more toxins in the river that might harm the marine system badly. It also elevated the microplastic levels in water.

4.2.3. Soil degradation: <sup>159</sup>Around 209 million kg of waste has been burnt, resulting in 12 to 13 million residue and ash. The ash contains toxins that contaminated soil and groundwater. Certain chemicals, like persistent organic pollutants can remain in the soil for a long period of time and affect the soil microbes and plants grown in the soil.

4.2.4. Health Impact: The greenhouse gases if inhaled, lead to serious health consequences like Asthma, cancer, dizziness etc. According to the reports, a 70-year-old man died in the local hospital as a result of inhaling the toxic hair.

### **4.3. Effective Solution Through the Application of Climate Models**

Incorporating Global climate models and Land surface models offers an understanding of different factors on this incident and helps in developing effective land management. Their integration provides insights into how climate variables influence land conditions, which in turn affects the possibility of fire incidents.

4.3.1. Prediction of atmospheric events: Global climate models can be used to understand the interactions among various atmospheric conditions such as temperature, wind, pressure, precipitation. Based on these factors the municipal corporations can forecast the fire risk and take

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<sup>159</sup> Chythenyen Devika Kulasekaran, “How plastics caused fire & affected air, water, soil, life in Bhramapuram”, *Down To Earth* (March 28<sup>th</sup> 2023) .

remedial measures effectively.

4.3.2. Land surface processes: land surface models simulate the processes occurring on the land such as vegetation growth and change, mass wasting, deposition, soil moisture content, carbon storage. By detecting these processes land surface models can be used to find dump sites that are prone to increased risk of fire<sup>160</sup>.

4.3.3. Integrating Global average temperature models: Fire spread in dumpsites can be measured using reaction diffusion equations. These equations demonstrate how the fire disseminates through a medium by combining combustion reactions and heat transfer.

4.3.4. Proper waste management: There are various strategies involved in making these models effective in proper waste management;

- I Collection of past information on similar fire incidents, waste disposal data.
- II Land surface models can be employed to check how the chemical decomposition affects the soil microbes, fertility etc.
- III Helps in following certain land management practices like waste segregation, recycling of waste etc. Global climate models aid in planning waste collection routes and transportation with its high-resolution codes.

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<sup>160</sup> Liu, Huang, Wang, S., Zhang, Xu, and Chen, "ML4Fire-XGBv1.0: Improving North American wildlife prediction by integrating a machine – learning fire model in land surface model". (2024) GMD <<https://doi.org/10.5194/gmd-2024-151>> accessed August 30 2024.

For mitigation of these similar incidents the Kerala government has undertaken policies and frameworks like decentralized waste management practices that have been adopted by the municipalities with stricter regulations and more protocols. Promoting bioremediation and bio mining practices like the setting up of biogas can prevent fire hazards. Spreading awareness among the public regarding the importance of waste management and the health risks associated with this is the local institution's duty. But these are prone to challenges like lack of infrastructure for waste collection, segregation, transportation due to financial constraints, difficulty in implementing policies, short term political strategies etc. Leads to environmental harm<sup>161</sup>. By employing these high-resolution climate models, the existing gaps can be rectified to an extent.

## **5. CONCLUSION**

This paper examines different strategies of climate modeling in land management, like the use of mathematical equations, global climate models, land surface models for modeling the Earth's surface and its impact on land use and land cover changes and applications in implementing these models more effectively. Climate models contain limitations, and one factor that caused this is internal variability, which means natural fluctuations in Earth's climate system. This variability arises from interactions occurring in land surface, atmosphere, oceans leading to differences between spotted and modeled data. It impacts crop yield and forest health forecasting. Data limitations are also faced by

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<sup>161</sup> Vincenc Mendez and Joseph E Llebot, "Hydrobolic reaction:diffusion equations for a forest fire model". (1997) E56 Phy.Rev  
<<https://doi.org/10.1103/PhysRevE.56.6557>> accessed December 1 1997.



climate models due to use of least quality data equipment. Sometimes physical equations cannot be employed for finding the estimates of future greenhouse emissions and it will be based on assumptions by socioeconomic factors which can be incorrect. To overcome these limitations, scientist magnify the quality and resolution of land use data so that data storage capacity and its accuracy can be increased. The advent of supercomputers proved to be great in increasing the resolution of land use data as they integrate thousands of processors admitting them to process billions of calculations in each second<sup>162</sup>.

By doing the case study we get to know that the nature is in the state of a ventilator. Deforestation, conversion of forest land into farm land, burning plastic are the contributors to greenhouse gas emissions and its impacts are more treacherous that one can never imagine. This leads to global warming which in turn leads to artic amplification. Earth's artic region is heating up twice the rate of global average temperature which would lead to melting of sea ice and absorption of solar radiation resulting in global warming. Melting permafrost releases methane gas (greenhouse gas) can cause more heating up and rise of sea levels. The consequence is the depletion of the ozone layer, which is the prime protector against ultraviolet rays of the sun<sup>163</sup>. Effective waste management practices like 3rs (reduce, reuse, recycle) has to be implemented with respect to plastic waste so that the aforesaid consequences can be stopped.

Initiation of climate change education in universities is significant as it

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<sup>162</sup> "Uncertainty 101: Understanding and Managing Climate Models" (ClimateWest, September 27 2022) <https://climatewest.ca>.

<sup>163</sup> Kara Anderson, "How supercomputers are improving climate modeling" (Leaf by Greenly) <<https://greenly.earth>> February 29 2024.

educates the students and equips them with skills necessary to combat challenges pertaining to climate change. Moulding the future leaders to make informed decisions and strategies on sustainable land management practices that is needed to reduce carbon sequestration by absorbing carbon dioxide in the atmosphere. Students must actively participate at all levels in spreading awareness for transformation to renewable source of energy. Future research opportunities in interdisciplinary approach to climate change education include developing pedagogical approaches, incorporating high innovative technologies like supercomputers that aids the researchers to analyze vast amounts of data providing more understanding on land use practices and simulating temperature and rainfall pattern changes. By addressing these research areas, the interdisciplinary approach to climate modeling provides insights on sustainable land management practices.

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## IX

### **GLOBAL STRATEGIES, KERALA'S CHALLENGES: ADAPTING CLIMATE AND DISASTER MODELS FOR LOCAL RESILIENCE**

**Greeshma C Thomas \***

#### ***Abstract***

*Kerala has faced a series of climate-related disasters in recent years, including severe floods, deadly landslides, and rising heat levels. These events have caused serious disruptions to daily life and raised concerns about how prepared the state is to deal with changing weather patterns. This paper looks at how Kerala can learn from other countries that have found effective ways to manage similar problems. Examples include Japan's clear rules on where it is safe to build, Nepal's local disaster training programs, Singapore's use of greenery in cities to lower temperatures, and the Philippines' early warning systems. Each of these approaches offers lessons that Kerala can shape to fit its own environment and communities. In addition to practical changes, the paper highlights the need for better public education, stronger local leadership, and updated laws that reflect today's climate realities. It also points out that schools and colleges should teach climate topics in a way that connects*

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*science, law, and real-life situations. While Kerala has made progress in some areas, it still needs to bring together its knowledge, people, and policies in a more connected and consistent way. If it does so, it can become a leading example of how local action, inspired by global ideas, can make a real difference in the face of climate change.*

*By focusing on practical solutions and people-centered planning, this paper aims to encourage long-term thinking rather than quick fixes. Kerala's strength lies in its educated public, strong local governance, and deep connection to the environment. These are valuable tools that, if used wisely, can help the state build lasting resilience in a world where climate threats are becoming more frequent and less predictable.*

**Keywords**

*Climate Adaptation Strategies, Local Resilience, Comparative Disaster Models, Environmental Governance, Climate Education Reform*

## **1. INTRODUCTION**

Kerala, often celebrated as "God's Own Country", is a land shaped by its topography and nourished by its rivers, forests, and coastal plains. Yet beneath this ecological abundance lies a growing vulnerability. In recent years, the state has experienced a string of environmental crisis - unprecedented floods, deadly landslides, prolonged heatwaves, and unpredictable rainfall patterns - that have disrupted everyday life and exposed the fragility of its natural and built environments. The floods of 2018 and 2019 marked a turning point in Kerala's relationship with climate. These were not isolated weather events but signs of a deeper

ecological imbalance: intensified monsoons, deforestation, unscientific construction, and inadequate infrastructure created a perfect storm. Entire communities were displaced, and the recovery process revealed gaps in disaster preparedness, coordination, and long-term planning. Similar stories emerge from landslide-prone districts like Idukki and Wayanad, where natural disasters are no longer occasional but increasingly seasonal. Meanwhile, urban centres like Kochi and Thiruvananthapuram are struggling with soaring temperatures, congested cityscapes, and the urban heat island effect, all of which worsen public health and widen socio-economic inequalities.

At the heart of these challenges lies the tension between rapid development and ecological sensitivity. Kerala is undergoing accelerated urbanisation, yet its terrain is marked by delicate ecosystems - from the Western Ghats to the Vembanad backwaters. Infrastructure growth, if not guided by environmental planning, can further erode the state's resilience. The added layer of climate change - global in cause, but deeply local in impact - demands urgent policy recalibration. Kerala can no longer rely on reactive disaster response. It needs anticipatory, science-backed, and community-driven strategies.

This paper aims to explore how Kerala can adapt existing global climate resilience models to its local context. It does not advocate for wholesale replication, but rather, for meaningful adaptation - one that respects the state's ecological specificity and socio-political fabric. Drawing on case studies from Japan, Singapore, Nepal, and the Philippines, the discussion examines approaches to flood management, landslide risk reduction, heat mitigation, and public education. These models are not perfect blueprints but starting points that offer practical lessons. The paper also examines the

role of interdisciplinary education and local governance in enhancing disaster resilience. The involvement of local communities, not just as beneficiaries but as active participants in planning and implementation, is essential.

## **2. LITERATURE REVIEW**

### **2.1 Climate Education and Resilience**

Climate education has evolved from a purely scientific discourse to an interdisciplinary field that bridges environmental studies, public policy, and law. Scholars now emphasize the value of experiential learning and place-based curricula, especially in regions highly susceptible to environmental shocks. UNESCO's roadmap for Education for Sustainable Development (ESD) notes that informed, climate-literate citizens are central to climate adaptation efforts.<sup>164</sup> Kerala, with its well-established education system, is positioned to lead in this regard but practical integration remains limited.

In the state's academic curriculum, climate change is mentioned, but often in abstract terms. Institutions like the Kerala State Disaster Management Authority (KSDMA) conduct awareness campaigns, yet these are not fully embedded in formal education. A stronger institutional bridge is needed between scientific research, classroom learning, and practical resilience training. As Mukherjee & Mukherjee point out, Indian climate education often fails to capture the nuances of local vulnerability, which makes

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<sup>164</sup> UNESCO, *Education for Sustainable Development: A Roadmap* (UNESCO 2020) <https://unesdoc.unesco.org/ark:/48223/pf0000374802> accessed 3 March 2025.

policy implementation less effective.<sup>165</sup> Kerala needs localised content, especially modules that address its own monsoon patterns, flood histories, and agricultural risks.

## **2.2 Interdisciplinary Approaches: Law, Science, and Community**

The complexity of climate risks requires a response that is not siloed. A review of contemporary scholarship reveals growing support for interdisciplinary education where environmental law is taught alongside ecological science and public administration. Boyer and Roth argue that climate education must break traditional academic boundaries if it is to influence real-world decision-making.<sup>166</sup> This approach is particularly important in law schools, which often focus on international treaties while ignoring local implementation challenges.

Kerala has made strides in environmental law education, with some universities integrating disaster law and climate governance into their curriculum. However, collaboration between faculties, law, geography, urban planning, and public health remains limited. Real progress will come when students and scholars work across disciplines to produce research and solutions tailored to Kerala's distinct needs.

Furthermore, international models highlight the value of community-integrated learning. For example, in Nepal's disaster education programs, villagers are taught to identify landslide triggers and develop evacuation

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<sup>165</sup> Sacchidananda Mukherjee and Chiranjib Mukherjee, *Climate Change Adaptation and Local Governance in India: Institutional Challenges and Opportunities* (Springer 2020).

<sup>166</sup> Ernest T Boyer and Wolff-Michael Roth, *Sustainable Education: Re-Visioning Learning and Change* (Green Books 2011).

protocols.<sup>167</sup> In Kerala, similar efforts are underway through initiatives like the Haritha Keralam Mission, but these lack a strong legal and institutional foundation. A comprehensive curriculum that includes local case studies, legal rights during disasters, and hands-on planning exercises can empower communities to take ownership of their safety.

### **2.3 Gaps in Current Legal and Educational Frameworks**

Despite Kerala's reputation for social development, its legal and educational frameworks are yet to fully align with climate realities. While national laws like the Environment (Protection) Act and the Disaster Management Act provide broad guidelines, their enforcement is often uneven at the state and local levels. Academic legal curricula continue to prioritise compliance over innovation, leaving little room for discussion on emerging issues like climate migration, ecological reparations, or adaptive land-use planning.

There is also a notable absence of Kerala-specific case studies in legal education. The 2018 floods, for instance, were a critical moment in the state's environmental history, yet they are rarely analyzed through legal lenses. Students and policymakers alike would benefit from detailed legal research on dam mismanagement, land encroachment, and the role of panchayats in disaster response.

In short, the literature points to a dual gap: first, in the integration of climate resilience into formal education, and second, in the localisation of

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<sup>167</sup> Government of Nepal, Community-Based Landslide Risk Reduction and Management Guidelines (Ministry of Home Affairs 2019).



legal discourse. Bridging these gaps will require policy innovation, interdisciplinary collaboration, and active community participation.

### **3. CORE ARGUMENT - K E R A L A 'ENVIRONMENTAL CHALLENGES AND LOCAL RESPONSES**

Kerala's geographical diversity ranging from the highlands of the Western Ghats to low-lying coastal plains makes it particularly sensitive to climate-related hazards. Over the past decade, these vulnerabilities have been starkly exposed, especially during the catastrophic floods of 2018, recurrent landslides in Wayanad and Idukki, and escalating heatwaves affecting both urban and rural districts. This section argues that Kerala's environmental crisis is not isolated phenomena but symptoms of broader ecological stress, urban mismanagement, and inadequate adaptation mechanisms. While the scientific consensus on climate change is well established, what remains less developed is a coherent, state-specific strategy that marries global insight with regional realities.

#### **3.1 The 2018 Floods: A Watershed Moment**

The floods that struck Kerala in August 2018 were described by the Indian government as a "Level 3 Calamity" the most severe in the disaster classification system. Over 483 people died, and more than 1.4 million were displaced.<sup>168</sup> The disaster was triggered by extreme rainfall, nearly

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<sup>168</sup> Government of Kerala, Kerala State Disaster Management Authority: Post-Disaster Needs Assessment Report (Revenue and Disaster Management Department 2018) <https://sdma.kerala.gov.in/> accessed 1 March 2025.

double the seasonal average in some districts and worsened by uncoordinated dam releases, encroachment into floodplains, and deforestation. The Kerala Post-Disaster Needs Assessment (PDNA) revealed that much of the damage was avoidable had river basins been managed more sustainably and early warning systems functioned optimally.<sup>169</sup>

The floods disrupted not just infrastructure but governance. Local bodies were overwhelmed; communication between district officials, dam authorities, and the disaster management authority broke down. In areas like Mundakkai and Chooralmala, rescue operations were delayed due to poor logistical planning and lack of local participation. This exposed a central problem: disaster response in Kerala remains top-down and slow to adapt to ground realities.

Ecologically, the floods devastated wetlands, river ecosystems, and agricultural zones. Siltation, contamination from septic tanks and industrial waste, and the spread of invasive plant species have made recovery long and uneven.<sup>170</sup> The event revealed a need to move beyond reactive measures to proactive climate adaptation.

### **3.2 Landslides in Wayanad: Warnings Unheeded**

Landslides are not new to Kerala's hill districts, but their frequency and intensity have risen alarmingly. In July 2024, a massive landslide in Mundakkai (Wayanad) claimed over 250 lives. The disaster was not

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<sup>169</sup> United Nations Development Programme, Post-Disaster Needs Assessment: Kerala Floods 2018 (UNDP 2019).

<sup>170</sup> Government of Kerala, Kerala Post-Disaster Needs Assessment: Floods and Landslides – August 2018 (Published by the Kerala State Disaster Management Authority under the Revenue and Disaster Management Department 2018).

without precedent or warning. The Geological Survey of India (GSI) had installed a Landslide Early Warning System (LEWS) ten days before the event, but it failed to issue timely alerts due to calibration issues. Residents received only general rainfall warnings, not location-specific alerts that could have triggered evacuation.

The disaster became a political flashpoint, with accusations of mismanagement and communication failures between state and central agencies. But the issue runs deeper. Kerala lacks a legal mandate for localised hazard zoning, unlike Japan, where construction in high-risk landslide zones is either prohibited or strictly regulated. In Wayanad, land-use patterns continue to ignore slope stability. Quarrying, road expansion, and tourism infrastructure have all contributed to weakening the terrain.

The state's environmental planning remains fragmented, with various departments - revenue, environment, local self-government, working in silos. What is required is an integrated disaster risk governance model that aligns science, law, and local participation.

### **3.3 Rising Heat and Urban Stress**

Though Kerala has traditionally enjoyed a moderate climate, recent summers have brought uncharacteristic heatwaves, with temperatures soaring above 40°C in places like Palakkad and Thrissur. The Indian Meteorological Department reports that average temperatures in the state have risen by up to 1.2°C over the past 50 years.<sup>171</sup> The Urban Heat Island (UHI) effect is particularly severe in rapidly growing cities like Kochi and

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<sup>171</sup> India Meteorological Department, Climate Change and Temperature Trends in Kerala: A 50-Year Analysis (IMD 2020).

Thiruvananthapuram, where concrete infrastructure and vehicular emissions have intensified local warming.

The public health implications are serious. There has been a recorded 30% increase in heatstroke cases in 2023 alone, especially among daily wage labourers, the elderly, and outdoor workers.<sup>172</sup> Incidences of sunburn, respiratory distress, and dehydration-related illnesses are also rising. Yet, Kerala's urban planning laws still do not mandate heat-resilient architecture or green zoning in new construction.

Water scarcity is another fallout. Erratic monsoons and over-reliance on borewells have led to declining groundwater levels in districts like Kasargod and Alappuzha. Climate-induced water stress is no longer a distant concern but a lived reality, particularly for agricultural households and remote communities.

### **3.4 Institutional Gaps and Governance Bottlenecks**

Kerala has multiple bodies working on climate resilience like the KSDMA, Haritha Keralam Mission, local self-governments, and state environment departments. However, their efforts are often uncoordinated. Policies remain largely advisory rather than enforceable. For instance, while there are guidelines for dam management and land zoning, compliance is weak, and there are no statutory penalties for violations.

Moreover, while local governments have a constitutional mandate under the 73rd and 74th Amendments to implement environmental programs, they are rarely empowered with the resources or expertise to do so. Disaster preparedness drills are sporadic, and community training is still

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<sup>172</sup> Ibid

limited to NGOs and ad-hoc campaigns. A stronger, legally binding disaster governance framework is required, one that clearly defines accountability and mandates climate resilience into planning approvals and land development processes.

#### **4. CASE STUDIES AND BEST PRACTICES**

While Kerala's challenges are unique in their cultural and geographical contexts, similar climate and disaster vulnerabilities have been addressed in various parts of the world through targeted, adaptive strategies. This section reviews select global models that Kerala can draw inspiration from not as templates to replicate, but as flexible frameworks adaptable to local realities.

##### **4.1 Japan's Landslide Hazard Zoning**

Japan, with its mountainous terrain and seismic activity, has long been vulnerable to landslides. In response, the Japanese government implemented the Landslide Disaster Prevention Law, under which areas prone to landslides are mapped and classified into risk zones.<sup>173</sup> These include "Yellow Zones," where caution is required, and "Red Zones," where construction is either prohibited or strictly controlled. Development in these areas requires special engineering reinforcements, and relocation is sometimes mandated.

For Kerala, particularly in districts like Idukki, Wayanad, and Kottayam, this approach offers critical insights. Though the Geological Survey of India has hazard maps, they are rarely linked to binding legal restrictions.

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<sup>173</sup> Government of Japan, Landslide Disaster Prevention Law and Hazard Zoning Policies (Ministry of Land, Infrastructure, Transport and Tourism (MLITT) 2001).

By integrating remote sensing, GIS technology, and historical rainfall patterns, Kerala can institutionalise a zoning system that informs planning permissions, public awareness, and insurance regulation. Most importantly, hazard zones must have legal enforceability - something that remains a gap in current frameworks.

#### **4.2 Nepal's Community-Based Landslide Management**

Nepal faces frequent landslides during the monsoon, especially in its hilly regions. To tackle this, the Ministry of Home Affairs launched a Community-Based Landslide Risk Reduction and Management Programme, which trains local volunteers in monitoring slopes, identifying early signs of instability, and executing evacuation drills. The model rests on community ownership, with training tailored to local knowledge systems and terrain familiarity.

Kerala, with its robust panchayat system and active civil society, is well-positioned to adopt a similar approach. Instead of relying solely on centralised early warning systems, the state can train local task forces comprising residents, students, and health workers to monitor vulnerable slopes. Tribal communities, often most affected by landslides, can be integrated into planning processes, ensuring culturally sensitive and sustainable interventions. Such an approach also builds trust and ensures quicker mobilisation during emergencies.

#### **4.3 Project NOAH – Philippines**

The Nationwide Operational Assessment of Hazards (Project NOAH), launched in the Philippines in 2012, combined real-time data from weather satellites, river gauges, and mobile apps to provide localised flood and

landslide warnings.<sup>174</sup> Although government support ended in 2017, the project was institutionalised within the University of the Philippines, where it continues as a research and public safety tool.

Kerala can adapt this model by creating a permanent, interdisciplinary disaster research hub within an academic institution like the Kerala University of Fisheries and Ocean Studies (KUFOS) or the Indian Institute of Science Education and Research (IISER) in Thiruvananthapuram. This hub could integrate AI, machine learning, and hydrological data to enhance the accuracy of alerts. Moreover, a mobile app tailored for Kerala's diverse linguistic population could deliver real-time alerts and safety instructions, bridging the last-mile gap.

#### **4.4 Urban Heat Solutions from Singapore**

Singapore, despite its dense urbanisation, has become a global leader in urban greening. The city-state enforces legal mandates for rooftop gardens, vertical forests, and public green spaces in new developments.<sup>175</sup> Iconic initiatives like the Gardens by the Bay and the Park Connector Network demonstrate how ecology can be woven into urban infrastructure. Vertical greenery also serves as passive cooling, reducing building-level energy consumption.

Kerala's cities are rapidly urbanising, but the absence of green infrastructure policies worsens the Urban Heat Island (UHI) effect. Municipal building codes should mandate rooftop greenery and permeable pavements. City corporations can also launch tree audit programs,

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<sup>174</sup> University of the Philippines, 'Project NOAH' <https://noah.up.edu.ph/> accessed 10 March 2025.

<sup>175</sup> Kenneth Yeang, *Ecodesign: A Manual for Ecological Design* (Wiley 2008).

identifying heat-prone neighbourhoods and prioritising tree planting. Lessons from Singapore's public-private partnerships could guide local governments in mobilising CSR funds for greening public infrastructure.

#### **4.5 Tokyo's Water-Based Cooling Techniques**

To counter heat stress, Tokyo has implemented a variety of water-based cooling strategies. These include mist-spraying systems on streets, permeable pavements, and the restoration of urban waterways.<sup>176</sup> The Tokyo Metropolitan Government has also built rainwater-retention parks, which serve both cooling and flood mitigation functions.

With Kerala's extensive network of canals, backwaters, and ponds especially in cities like Alappuzha and Kochi, this model offers tremendous potential. Local governments can retrofit public spaces with misting stations in markets and bus stops. Additionally, integrating urban water retention systems with Smart City plans can provide dual benefits of flood control and temperature regulation. Reviving traditional water bodies through community programs can also support both cooling and cultural preservation.

### **5. CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion**

Kerala's climate journey is entering a defining phase. The state, long admired for its lush ecology and high human development indicators, now stands exposed to the worsening impacts of global warming. The floods of 2018, landslides in Wayanad, prolonged heatwaves, and erratic

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<sup>176</sup> Tokyo Metropolitan Government, Urban Heat Island Mitigation Report (Bureau of Environment, Tokyo Metropolitan Government 2021).



monsoons are no longer occasional disasters: they are becoming recurring features of Kerala's environmental landscape. These events highlight more than nature's volatility; they expose critical weaknesses in policy design, urban planning, and local governance.

This paper has argued that climate adaptation in Kerala must go beyond incremental reforms. The challenges the state faces are systemic, rooted in outdated land use laws, weak institutional coordination, and over-dependence on reactive disaster relief. Adaptation must be proactive, locally embedded, and science-informed. While the global South has often had to work within resource constraints, Kerala has one advantage: a literate, aware population and an active local governance system.

The case studies explored from Japan's hazard zoning to Singapore's vertical greening, and from Nepal's community-based disaster planning to the Philippines' data-driven early warning systems - show that effective adaptation is not limited by geography or wealth. What matters is political will, legal clarity, and public participation. Kerala need not mimic these models exactly; it must adapt them to its own topography, economy, and socio-political dynamics. That is where real resilience lies - in choosing what works, localising it meaningfully, and enforcing it firmly.

Moving forward, Kerala's climate resilience must be guided by the principle of "Decentralised Adaptability" a framework that empowers local bodies to act quickly and wisely, supported by state and scientific institutions. Education, especially interdisciplinary learning that integrates law, climate science, and planning, must form the backbone of future preparedness. Ultimately, a resilient Kerala is not just one that survives its next disaster, but one that plans so well, it prevents it.

## 5.2 Recommendations

To convert these insights into action, the following targeted recommendations are proposed for policy-makers, local governments, educational institutions, and civil society:

### *5.2.1. Institutionalise Hazard Zoning and Land-Use Reform*

- i. Legally enforce hazard zoning in landslide-prone districts by adapting Japan's red/yellow zone model. This should include clear construction bans or special permit requirements in ecologically sensitive areas.
- ii. Use remote sensing and GIS mapping to update existing land records and inform panchayats and municipalities of climate-risk zones.
- iii. Integrate climate risk mapping into the Kerala Town and Country Planning Act and ensure all building permits factor in topographical vulnerability.

### *5.2.2. Build Community-Based Early Warning Capacity*

- i. Develop ward-level disaster task forces, trained in early warning interpretation and evacuation protocols.
- ii. Collaborate with academic institutions to replicate Project NOAH-style platforms for hyper-local weather forecasts and alerts.
- iii. Establish a decentralised training hub in each district, managed by the KSDMA, for skill-building in disaster response and environmental monitoring.

### *5.2.3. Green Urban Development through Policy*

- i. Make green roofs and vertical gardens mandatory in new commercial and public buildings in major cities.

- ii. Incentivise private builders through tax benefits for complying with greening guidelines.
- iii. Integrate urban tree cover audits into Smart City Mission metrics and allocate funds for shaded pedestrian pathways and Miyawaki forests in urban areas.

#### *5.2.4. Expand Heat and Water Resilience Strategies*

- i. Install public misting stations and cooling corridors in high-density zones, particularly near hospitals, markets, and transport hubs.
- ii. Encourage permeable pavement use in city infrastructure upgrades to manage both heat and flood risk.
- iii. Restore and integrate traditional water bodies into city planning, especially in heat-vulnerable wards of Kochi, Thrissur, and Palakkad.

#### *5.2.5. Reform Environmental Legal Education*

- i. Encourage universities to adopt interdisciplinary modules that include Kerala-specific environmental case studies.
- ii. Add dedicated courses on disaster law, local governance, and climate litigation in law colleges, with field exposure.
- iii. Develop legal literacy programs for panchayat leaders on disaster risk obligations, planning laws, and liability frameworks.

These recommendations are not exhaustive, but they form a foundation. What Kerala needs now is not just to respond, but to lead. By integrating science, law, and community action, the state can chart a path that is locally resilient, legally sound, and globally relevant.

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## X

# INTERDISCIPLINARY APPROACH ON CLIMATE CHANGE AND MIGRATION

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### Abstract

*Climate change is increasingly recognized not only as an environmental phenomenon but also as a profound driver of human mobility and social transformation. Climate-induced migration—resulting from sea level rise, desertification, and extreme weather—raises complex challenges that no single discipline can fully address. This paper argues for an interdisciplinary approach to climate change education, particularly in integrating environmental science, international law, human rights, and migration studies within the curriculum. Through a mixed-methods study involving qualitative content analysis and a review of international curricula, the research explores how interdisciplinary frameworks can foster deeper understanding, ethical reasoning, and policy-relevant thinking. This paper emphasizes that without incorporating legal and socio-political dimensions, climate education remains incomplete. It proposes curriculum integration models that bridge theory with action, equipping learners to navigate and influence the multifaceted reality of climate-induced displacement. The relevance of this study to climate*

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*change education lies in its potential to reform curricula, empower future policymakers, and address the human dimension of ecological crises.\**

**Keywords:** *climate change education, interdisciplinary curriculum, environmental migration, climate justice, international law*

## 1. INTRODUCTION

Climate change is more than a crisis of emissions and rising temperatures—it is a global phenomenon with deeply social, legal, and political implications. Among the most urgent of these is the growing incidence of climate-induced migration. Whether through rising sea levels submerging coastal communities, desertification threatening agriculture, or extreme weather events displacing entire populations, environmental degradation is increasingly compelling human movement. Traditional disciplinary frameworks in education have struggled to address this complexity in a coherent way. Students learn about climate systems in geography, legal protections in civics, and migration in sociology, but rarely are these taught as interlinked phenomena. This fragmented approach fails to equip learners with the interdisciplinary insight required to understand and respond to one of the most pressing challenges of our time.

This research paper argues that climate change education must adopt an interdisciplinary framework, especially when addressing the intersection of climate change and migration. The central thesis is that effective climate literacy should integrate scientific, legal, sociological, and ethical dimensions—offering students not only knowledge but the tools to act as informed global citizens. Educational institutions must move beyond

siloed curriculum structures and develop cross-disciplinary models that reflect the real-world complexity of environmental migration.

The urgency of this integration lies in the global legal vacuum surrounding climate migrants. As of now, individuals displaced by climate change do not qualify for protection under the 1951 Refugee Convention. This legal invisibility, coupled with the scale of expected displacement (estimated to reach 216 million by 2050), demands a generation of professionals, scholars, and citizens who can think holistically across policy domains. An interdisciplinary education model can help future leaders navigate these uncharted legal and ethical territories.

To structure the investigation, this paper is organized into five key sections. The first section introduces the topic and core argument. The second presents a literature review on climate change education, interdisciplinary pedagogy, and legal frameworks. The third section develops the core argument for curriculum reform, highlighting the necessity and benefits of an interdisciplinary approach. The fourth examines global and national case studies that demonstrate successful curriculum integration, drawing attention to institutional frameworks, pedagogical innovations, and practical challenges. The final section summarizes findings and provides concrete recommendations for policymakers, universities, and educators.

Methodologically, this research adopts a qualitative content analysis of existing curricula in climate-vulnerable regions—such as Bangladesh, the Philippines, and the Pacific Islands—combined with a review of legal literature and educational policy documents. It also draws from semi-



structured interviews with educators and legal scholars to evaluate perceptions of interdisciplinary teaching in climate education.

In line with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 on quality education and SDG 13 on climate action, this research aligns with global calls for transformative learning that is inclusive, participatory, and action-oriented. The goal is not merely to advocate for climate literacy, but to push for a climate justice literacy—one that recognizes the human rights dimensions of climate impacts and the need for institutional responses that are equitable and legally sound.

The interdisciplinary approach proposed in this paper is not an academic abstraction; it is a necessary evolution in how we prepare society to face the climate crisis. By centering environmental migration within climate education, this paper underscores the critical role of education in not only understanding but shaping the future.<sup>12</sup>

## **2. LITERATURE REVIEW**

Climate change education has historically been rooted in environmental science and geography, with a strong emphasis on climatology, ecological impacts, and mitigation technologies. While scientifically grounded, such approaches often overlook the human and legal dimensions of the crisis. Scholars such as Monroe and Oxarart (2017) have called for a shift toward 'climate action education' that encompasses ethics, equity, and decision-making.

Interdisciplinary education has emerged as a response to the inadequacies of single-discipline learning. According to Jacobs (1989), interdisciplinary learning enhances critical thinking, creativity, and real-world problem solving—skills essential in confronting global challenges such as climate-

induced migration. Recent work by UNESCO (2021) also supports the adoption of integrated pedagogies in teaching complex issues.

Legal studies have begun to engage with climate migration, though primarily in the context of gaps in international refugee law. Scholars like McAdam (2012) argue for the expansion of international frameworks to include climate-displaced individuals. However, legal education remains largely separate from environmental curricula, limiting students' holistic understanding of displacement and justice.

Furthermore, a review of educational policies from climate-vulnerable countries (e.g., Bangladesh, Vanuatu) reveals a disconnect between climate science and social policy education. Curricula rarely incorporate climate migration or its legal implications, suggesting a need for systemic reform.

In summary, the literature reveals substantial gaps in both disciplinary education and legal curriculum. While interdisciplinary models are advocated in theory, their practical implementation in climate change and migration education remains inconsistent and underdeveloped.<sup>3456</sup>

### **3. CORE ARGUMENT**

This section presents the central thesis: climate change education must be fundamentally interdisciplinary, particularly when addressing environmental migration. An effective curriculum should bridge the domains of science, law, social studies, and ethics to prepare students for complex global realities.

Interdisciplinary learning facilitates a more comprehensive understanding of climate change and displacement. While science explains causality—

rising sea levels or increased drought—law and ethics explore responsibility, protection, and governance. For instance, understanding that climate migrants lack legal recognition requires both legal theory and human rights perspectives, which in turn influence ethical debate and policy response.

Pedagogically, this integration can be achieved through case-based learning, thematic units, and cross-disciplinary projects. For example, a module on 'Climate and Conflict' could include analysis of the Syrian drought's role in mass migration, legal frameworks for asylum, and mitigation strategies. Active learning tools like simulations, debates, and community engagement can deepen understanding and foster civic responsibility.

The educational justification lies in building 'climate justice literacy'—a framework combining knowledge of environmental systems, legal mechanisms, and social inequity. This approach promotes empathy, critical thinking, and systems-level thinking. It also aligns with global educational goals (e.g., UNESCO's ESD framework and SDGs).

Ultimately, interdisciplinary climate education is essential not only for raising awareness but for cultivating leaders capable of addressing climate change in its full complexity.

#### **4. CASE STUDIES & BEST PRACTICES**

Several countries and institutions offer valuable lessons in interdisciplinary climate education. In the Pacific Islands, governments have partnered with UNESCO to implement climate resilience curricula integrating traditional knowledge, environmental science, and disaster

law. These curricula are tailored to island realities, emphasizing both adaptation and migration literacy.

In Europe, the 'Education for Climate Justice' project combines environmental science with human rights law, civic education, and storytelling to empower secondary school students. Similarly, in Kenya and the Philippines, NGOs have worked with local schools to introduce community-based climate-migration modules using participatory research and local legal advocacy.

Universities have also developed interdisciplinary programs, such as the MSc in Climate Change and International Development at the University of East Anglia, which combines climate science, policy, and law. However, challenges persist—particularly in resource-constrained contexts—where curricula remain fragmented and educators lack interdisciplinary training.

Best practices include: policy alignment between education and climate ministries; interdisciplinary teacher training; participatory curriculum development; and integration of local knowledge with scientific literacy. These strategies support systemic reform and offer scalable models for other regions.

## **5. CONCLUSION & RECOMMENDATIONS**

This research has highlighted the urgent need for interdisciplinary approaches in climate change education, especially as it relates to environmental migration. Current educational models are insufficiently equipped to address the legal, social, and scientific complexities of climate-induced displacement.

The central argument—that curriculum reform must integrate climate science, law, and justice—has been supported by literature and case studies from across the globe. Interdisciplinary education empowers learners to think critically, understand systemic causes, and participate in meaningful climate action.

Key recommendations include: (1) integrating interdisciplinary content into national climate education frameworks; (2) training educators across disciplines to collaborate; (3) developing learning modules that address real-world migration issues; and (4) promoting international cooperation in curriculum development.

Future research should focus on evaluating the outcomes of interdisciplinary climate education initiatives and exploring digital platforms as tools for global learning exchange. Ultimately, reforming education is not only about knowledge—it is about justice, capacity, and survival in a changing climate.<sup>177</sup>

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<sup>177</sup> UNHCR, \*The 1951 Refugee Convention\* (UNHCR 2011) <<https://www.unhcr.org/1951-refugee-convention.html>>.

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<sup>6</sup> McAdam J, \*Climate Change, Forced Migration, and International Law\* (Oxford University Press 2012).

<sup>1</sup> UNHCR, \*The 1951 Refugee Convention\* (UNHCR 2011) <<https://www.unhcr.org/1951-refugee-convention.html>>.

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## XI

### CLIMATE EMERGENCY AND HUMAN RIGHTS- A SOCIO LEGAL RELEVANCE WITH SPECIAL REFERENCE TO INDIA

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#### Abstract

Climate change refers to the fluctuation in temperature, precipitation, wind and other elements of the *earth's climate system over time*. This phenomenon is labelled as global warming. The Intergovernmental Panel on Climate Change (IPCC) refers to climate change as a statistically significant variation in either the mean state of the climate or in its variability presenting for an extended period. As the earth's average temperature increases over time it causes climate change. Article 1 of the UN Framework Convention on Climate Change presents a different definition: 'Activity of the climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over the comparable time periods. The argument over who or what is to blame for global warming has become one of the most urgent and hotly debated environmental issues of the 21st century. Most scientists do agree however that global warming is occurring and that along with other factors

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*including natural changes in the climate, human activity is accelerating it. The Working group II Contribution to the IPCC Fourth Assessment Report 2007 has noted that Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate change particularly as temperature increases. Warming of water has affected the changes in marine and freshwater ecosystems. It is very likely that there will be an increased incidence of heat waves in most land areas that can cause algal blooms in water resources and endanger the quality of water.*

*However due to the status of developing nation, India is not designated as Annexure Party by the UNFCCC and is thus not bound by the Kyoto Protocol to reduce its emission to 1990 levels. The Ozone Depleting Substances (Regulation and Control) Rules, 2000 (ODS) were notified under the Environmental Protection Act, 1987. There is vast range of waste management legislations in India that are not very climate friendly.*

*The starting point of the linkage between human rights and climate change is that climate change will undermine the realisation of a range of internationally protected human rights such as right to life, right to food, right to water, right to shelter, property, livelihood and culture with migration and resettlement. The Human right approach to climate change places human right principles in the centre of international climate change policy in order to save the present and future generations. The report of OHCHR describes the implication of climate change for a wide range of the Human rights but at the same time also states that while climate change has obvious implication for the enjoyment of human right, it is less obvious whether and to what extent such efforts can be qualified as a human right violation in the strict sense.*



*In India, due to the depletion of natural resources caused by climate change fundamental rights are violated, which has been held by the Honourable Supreme Court in **Subhash Kumar v. State of Bihar** (1992) that realisation of rights can be achieved only through a safe environment. Hence the right to a free and pollution free environment is a fundamental right of every individual.*

*Climate change raises questions on our definitions of responsibility and accountability to the rest of the human race. The issue is more philosophical and political in many ways. In deciding what action to take, we should be guided by answers to these questions:*

- 1. What is intergenerational equity in climate change?*
- 2. How does the change in climate affect the existence of living being?*
- 3. How can human rights and fundamental rights be protected in the arena of destruction of our environment?*
- 4. What is my responsibility in protecting the environment by safeguarding climate change?*

**Key words:** *Climate change, Environment, Human rights, Fundamental rights, Judiciary*

## **INTRODUCTION**

Climate is weather condition of a place or area, conditions of temperature, rainfall, wind etc. The saying goes ‘Climate is what you expect, weather is what you get’. Climatologists generally consider 30 years as the time needed to assess the climate of a place. The factors that influence global

climate are the amount of solar energy the earth receives, the condition of the atmosphere, the shape and rotation of the earth and the current and other process of the ocean. A part of the radiation from the sun that falls on the earth is absorbed by the earth and some of it is reflected into the atmosphere. This enables the plants, animals and people to live safely. Naturally occurring gases known as greenhouse gases help to capture the sun's energy, keeping the earth warm enough to sustain life. As the earth's average temperature increases over time it causes climate change. This phenomenon is known as climate change.

Climate change refers to the fluctuation in temperature, precipitation, wind and other elements of the earth's climate system over time. This phenomenon is labelled as global warming. The Intergovernmental panel on Climate Change (IPCC) refers climate change as a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period.<sup>178</sup>

### **EFFECTS OF CLIMATE CHANGE**

Most natural ecosystems are somewhat climate dependent and have exhibited many changes. The Working group II contribution to the IPCC Fourth Assessment Report 2007 has noted that observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases. Warming of water has affected changes in marine and freshwater ecosystems. In high latitude oceans, there have been shifts in

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<sup>178</sup> Contribution of Working Group 1 to the Third Assessment Report of the Intergovernmental Panel on Climate Change (2001): The Scientific Basis, Cambridge University Press, 2001

ranges and changes in algae, plankton and fish abundance. It is very likely that there will be an increase in incidence of heat waves in most land areas that can cause algal blooms in water resources and endanger the quality of water.<sup>179</sup>

Climate change also poses risk to the biological diversity. The IPCC Report predicts that 20 -30% of the plant and animal species assessed by it so far as likely to be at increased risk of extinction, if increase in global average temperature exceeds 1.5 to 2.5 degree Celsius. Low elevation coastal zones are at a greater risk of climate change. This poses a large risk to human population as these areas account for 10 % of the world's population.<sup>180</sup>

## **RESEARCH OBJECTIVES**

1. To examine the legal framework in International instruments for the protection of human rights and the impact of climate change
2. To examine the legal framework in India for dealing with climate law and safeguarding environment, thereby ensuring human rights
3. To examine the role of judiciary in protecting the right of individuals in climate change
4. The role of government is safeguarding the environment by decreasing the factors affecting the climate change

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<sup>179</sup> Contribution of Working group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Climate Change (2004); Climate Change Impacts, Adaptation and Vulnerability, Summary of Policy makers , Cambridge University Press, 2004

<sup>180</sup> Srabani Roy, 'Climate Change: Coastal Mega Cities in for a Bumby Ride', Inter Press Service, Wednesday 28<sup>th</sup> March 2007

5. To evaluate the effectiveness of laws and regulations in protecting the right of individuals from the factors that affect the climate change, through an interdisciplinary approach.

### **RESEARCH QUESTION**

The research question mainly focus on the impact of climate change in the environment and human beings and the steps to be taken for the protection of fundamental and human right guaranteed under Art 21 and Art 14 of the Indian Constitution.

### **RESEARCH METHODOLOGY**

The research methodology adopted is analytical and descriptive method with the help of primary resources from books, articles, case studies and journals and secondary sources from internet source.

### **RESEARCH HYPOTHESES**

The human right is affected due to the deterioration of the environment through climate change and legislative frame work has to be redrafted for safeguarding the rights guaranteed in the Constitution.

### **OVERVIEW OF INTERNATIONAL LEGAL INSTRUMENTS RELATING TO CLIMATE CHANGE ADAPTATION**

The main international legal instruments for climate change adaptation is UN Framework Convention on Climate Change (UNFCCC). Mitigation has been defined as ‘a human intervention to reduce the sources or enhances the sinks of greenhouse gases.’<sup>181</sup> The UNFCCC has defined

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<sup>181</sup> Available at [http://unfccc.int/essential\\_background/glossary/items/3666.php](http://unfccc.int/essential_background/glossary/items/3666.php) accessed on 16/2/2025

adaptation as “Adjustment in natural or human systems in response to equal or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities’. The UNFCCC is the main international legal tool for combating climate change. It stated the objective is the stabilization of greenhouse gases concentration in the atmosphere at a level that would prevent dangerous anthropogenic human induced interference with the climate system. Despite some gaps in binding measures, the UNFCCC remains an important international body because it provides for a forum for diplomatic negotiations.

Another important legal instrument relating to Climate Change adaptation and adaptive social protection is the ILO Social Protection Floors Recommendation, 2012 and absorbing the residual impact of climate change not buffered by adoption measures. The application of the relevant ILO Convention and the efforts to extend coverage through a global social protection floor will make a significant contribution to adaptation.<sup>5182</sup>

Social Protection is important to climate change adaptation for at least four reasons. Firstly, it can reduce vulnerability to impact such as rising food prices or unemployment which exacerbate vulnerability to climate change even further. Secondly, social protection can enhance the adoptive society of the vulnerable. Thirdly, social problem measures will be critical for addressing the residual impacts of other climate change adaptation

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<sup>182</sup> Mark Harsdrorff, et.al, *Towards an ILO Approach in Climate Change Adaptation* (2011) 52-53

measures.<sup>6183</sup> Fourthly, historical experience have demonstrated the importance of social protection to absorb their shocks and at the same time act as ‘automatic stabilizers’ of the economy leading to the faster recovery. In the context of climate change this means that impacts of climate events on people and their income will be buffered by social protection.

According to fifth Assessment Report of the Inter-Governmental Panel on Climate Change (IPCC) human influence has been detected in warming of the atmosphere and the ocean as it changes the global water cycle in reduction in snow and ice, and changes in the climate extremes and that it is extremely likely that human influence has been the dominant cause of the observed warming since 20<sup>th</sup> century.<sup>7184</sup>

### **EFFECTS OF CLIMATE CHANGE IN INDIA**

Green House effect – A green house has higher temperature inside than outside though the interior receives less radiation – it is called greenhouse effect. During this process these gases in the atmosphere is called greenhouse gases obstruct the escape of heat from the earth into space while allowing the radiation from the sun to the earth. This process is called greenhouse effect due to which earth becomes warmer. The National Environmental Policy, 2006 states that India’s GHG emission in 1994 were 1228-million-ton CO<sub>2</sub> equivalent which is below 3 % of global GHG emissions.

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<sup>183</sup> ILO, Climate Change and Employment Challenges and Opportunities in the Carribean (2014) 13

<sup>184</sup> ‘Climate Change 2013: The Physical Science Basis’, Published by the IPCC as part of Fifth Assessment Report available in [http://www.ipcc.ch/pdf/assessmentreport/ar5/wgl/WG1AR5\\_SPM\\_FINAL.pdf](http://www.ipcc.ch/pdf/assessmentreport/ar5/wgl/WG1AR5_SPM_FINAL.pdf). Accessed on 16/2/2025

Global warming- Global warming is an increase in the earth's temperature due to the use of fossil fuels and other industrial processes leading to the buildup of greenhouse gases in the atmosphere. Air pollution traps more heat in the atmosphere rendering the earth warm. This effect is called global warming. The problem arises when the amount of greenhouse gases exceeds certain limit. The average surface temperature is about 15 degrees Celsius. This is about 33% higher than it would be in the absence of the greenhouse effect.

Human activities during the last few decades of industrialization and population growth have polluted the atmosphere to the extent that it has begun to seriously affect the climate. Concurrently, deforestation also releases carbon trapped in the tissues of the trees. At the same time, loss of trees reduces the earth's capacity to absorb carbon dioxide through photosynthesis.

Effects of global warming include Climate effects, Rise in sea level, Impact on forests, effects on human settlements and society, effects on health etc. Global warming also results in depletion in ozone layer. Ozone depletion is a chemical that destroys the ozone in the stratosphere and most of them are chemically stable compounds containing chlorine and bromine and also include other depleting substances like chlorofluorocarbons, halons and tetrachloride.

The depletion in ozone layer allows more UV B radiation reaching the earth's surface. It has been estimated that 5% loss of ozone results in 10% increase in UV B radiation which create health problems in human beings, UV radiation causing damage in microscopic life, damages nucleic acid in the living organisms, inhibits photosynthesis in plants and phytoplankton

etc. The United Nations Environmental Policy took up the issue of ozone depletion in 1976 and adopted a simple but effective approach. The report attracted international efforts among the people and the government and UNEP provided the framework for harnessing this interest to promote international action. This process led to the Vienna Convention for the protection of Ozone Layer in 1985 and the Montreal Protocol on Substances that deplete the Ozone layer in 1987. The UN Conference on Environment and Development (UNCED) established the principles of reducing greenhouse gas emission at the earth summit held at Rio De Janeiro, Brazil in 1992.

Nuclear accident and Nuclear Holocausts – Nuclear energy was researched and developed by man as an alternative source of clean and cheap energy compared to fossil fuels. Leakage of radioactive substances from nuclear plants always has disastrous impact on human society, although nuclear power plants are designed in a way that is no leakage of radioactive materials from them. India has 14 nuclear power reactors. The Atomic Energy Regulatory Board (AERB) ordered the closure of India's first nuclear plant in the state of Rajasthan. The reactor that put India on the nuclear world map developed series of defects starting with *turbane blade failures*.

## **INDIAN LEGISLATIONS AND CLIMATE CHANGE**

The UN Framework Convention on Climate Change (UNFCCC) in its Art 1 defines climate change as a change of climate which is attributed directly or indirectly to human activities that alters the composition of the global atmosphere and which in addition to natural climate variability observed over comparable time periods. Climate change is perceived among the



greatest health risks of the 21<sup>st</sup> century. It affects social and environmental detriments of health like clean air, safe drinking water, sufficient food and secure shelter. Climate change may have various impact but most commonly observed negative effects on human health are seen as rise in illness and deaths. High temperature is known to increase the ground level ozone and other climate altering pollutants other than CO<sub>2</sub> which further exacerbate cardio respiratory and allergic diseases and sometimes cancer.

However, due to the status of Developing nation, India is not designated as Annexure 1 Party by the UNFCCC and is thus not bound by Kyoto Protocol to reduce its emission to pre1990 levels. The Ozone Depleting Substances (Regulation and Control) Rules, 2000 (ODS) were notified under Environmental Protection Act 1986. Import of ODS and its export to certain countries is totally prohibited. The rules implement the Montreal Protocol on Substance that deplete the Ozone Layer which was adopted in 16.9.1987. Although the Convention is conscious of the potential climatic effects of emissions it does not include CO<sub>2</sub> emission in its list of regulated substance and these fall within the purview of Kyoto Protocol.<sup>185</sup> Consumption under ODS Rules is defined as the amount of that substance produced in India in addition to the amount imported, less the amount exported.<sup>186</sup> There is an array of waste management legislations in India that is not very climate friendly.

Bio medical Waste (Management and Handling) Rules 1988 – Under this rules Incinerator is suggested to various biomedical waste products which

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<sup>185</sup> Ozone Depleting Substances (Regulation and Control ) Rules India 2000, Rule 2 (d)

<sup>186</sup> solid waste include item contaminated with blood and body fluids including cotton, drainage, soiled plaster casts, bedding and other material contaminated with blood as per Set1 of the Act.

include human anatomical waste, animal waste, microbiology and biotechnology waste, discarded medicines and cytotoxic drugs and solid waste.<sup>10187</sup>

The Municipal Solid Waste (Management and Handling) Rules, 2000 prescribes incinerator of municipal solid waste for specific purposes.<sup>11</sup>

The Environment (Protection) Third Amendment Rules, 2005 deem incinerator as environmentally acceptable method of disposing drill waste, providing that a proposal is submitted to the pollution control board for disposal.

Incinerator is severally restricted under the provisions of the Stockholm Persistent Organic Pollutants (POPS) treaty. It aims to phase out a number of POPS in particular the dirty dozen, many of which emanate from incinerators and the practice of incineration runs contrary to Kyoto Protocol

In *Environment Monitoring Forum v State of Kerala*<sup>188</sup> Ombudsman of Local Self Government had the opportunity to consider the matter and ruled that practice of incineration by the rules are inappropriate.

In *CIT v Tej Singh*<sup>189</sup> cited that rules produce an excuses legum. There is a necessary or invincible disability to perform the mandatory part of the law or the forbear the prohibitory Municipal (Solid Waste Management and Handling) Rules, 2000.

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<sup>187</sup> Municipal Solid Waste (Management and Handling) Rules 2000 Sch 2

<sup>188</sup> (2004) 1 KLJ (NOC) 10

<sup>189</sup> AIR 1999 SC 352 at 356

Schedule 2 of the rules specify that biodegradable waste is to be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wasters. In the case of *Almitra H Patel and another v UOI*<sup>190</sup> the court directed Central Government to identify landfill sites in New Delhi and develop appropriate sites for compost plants for the purpose of managing municipal waste. Montreal Protocol on Substances that Deplete the ozone layer, 26 ILM 1550 (1987).

### **CLIMATE CHANGE PROBLEM AND APPEAL TO HUMAN RIGHTS**

The starting point to the linkage between human rights and climate change is that climate change will undermine the realisation of a range of internationally protected human right such as right to life, right to food, water, shelter, property, livelihood and culture with migration and resettlement with the rise of the concern regarding climate change at international level, the justice issue raised due to the nature of climate change drew direct line between the wealth and life style of some and the suffering of others.<sup>191</sup>

The human right approach to climate change places the human right principles in the centre of international climate change policy making in order to save the present and future generations.<sup>192</sup> Focusing on the rights of those who are already vulnerable and marginalized due to poverty and

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<sup>190</sup> AIR 2000 SCW 924

<sup>191</sup> Stephen Humphreys, 'Competing Claims – Human Rights and Climate harms', in Stephen Humphreys (edn), *Human rights and Climate Change* (2010) at p.38

<sup>192</sup> Kate Rawarth, 'Climate Wrongs and Human Rights: Putting people at the heart of climate change policy', Oxfain International Briefing Page available at <http://www.oxfam.org/sites/www.oxfam.org/files/bp117-climate-wrongs-human-rights-summary-0809.pdf> accessed on 4/2/2025

discrimination a human right approach to climate change can be a useful tool to complement international efforts at tackling the adverse effect of climate change. The Human right approach to climate change places the human right principles in the centre of international climate change policy making in order to save present and future generations. It is found that people who are socially, economically, culturally, politically or otherwise marginalized are especially vulnerable to climate change and also to some adaptation and mitigation processes. Climate change involve large number of actors including governments, businesses, civil society organizations and individual citizens. Each of these actors have a role to play in addressing climate change whether through reducing emissions, investing in renewable energy or advocating for climate change. From this angle, governments have a responsibility to respect, protect and fulfil the human rights while individuals and civil society have a role to play in holding governments accountable to human right violations. It is often claimed and appealed that by recognizing the human rights dimension s of climate change<sup>193</sup> policy makers can better understand the impact of climate change on people's lives and design policies and measures that protect and promote human rights in the face of changing climate.

The debate relating to the linkage between human rights and climate change can be sketched to the established literature relating to environmental protection and human rights<sup>194</sup> and the growing recognition in the resolution and reports of international bodies as well as soft and hard law relating to human right and environment. To live in a quality and

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<sup>193</sup> Sofia Gruskin and Madhuray Roy, 'Climate Change and Human Rights: Roles. Responsibilities and Actions' 23 Human Rights Defender 14(2014)

<sup>194</sup> A.Boyle, 'Human Rights and Environment, Where Next? 23(3) Environmental Journal of International Law (2012) 613,642

healthy environment is a fundamental and basic human rights. There are two features of climate change make it distinctive from other crisis relating to environment to which the international community has yet confronted, First, due to raise in global temperature there are numerous impacts including increase in droughts, land degradation, intensity of floods, decrease in availability of potable water and food security.<sup>195</sup> Second, distribution of climate change is uneven.

There are some conceptual as well as analytical questions present while linking human rights and climate change. How to place the pervasive phenomenon of climate change with its aggregated causes and diffuse effects within the normative framework of human rights regime is a challenge. While conceptualizing the connection between human rights and climate change one of the aspects is to focus on the number of rights that will be impacted adversely by climate change including the right to life, food, health, shelter, and self-determination. IPCC Fourth assessment report reveals that the warming of the climate system is unequivocal and accelerating. The report of OHCHR describes the implication of the climate change in a wide range of human rights but at the same time also states that while climate change has obvious implication for the enjoyment of the human right, it is less obvious whether and to what extent, such efforts can be qualified as a human right violation in the strict sense.<sup>196</sup> In September 2011, the Human Rights Council adopted its resolution on

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<sup>195</sup> World Bank, World Development Report, 2010. Development and Climate Change, Washington D.C Chapter 2,11 available at <http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1226014527953/WDR10-Full-text.pdf> accessed on 6/2/2025

<sup>196</sup> United Nations Office of the HC for Human Rights (OHCHR) Report on the relationship between Climate Change and Human Rights, UN .Doc A/HRC/10/61 (Jan 15,2009)

‘human rights and climate change’ resolution 18/22. The resolution affirmed that the obligations, standards and principles have the potential to inform and strengthen international and national policy making in the area of climate change, promoting policy coherence, legitimacy and sustainable outcomes.<sup>197</sup>

## **CLIMATE CHANGE AND FUNDAMENTAL HUMAN RIGHTS**

Climate change has particularly serious implication for the realisation of individual and collective rights of inhabitants of low-lying small island developing state. These may result in number of short- and long-term harms, including increased rates of mortality and disease, damage to basic infrastructure, contamination of fresh water supplies, loss of traditional livelihoods and sources of income, temporary and permanent displacement. These climate change related impacts have adverse consequences for arrangement of internationally recognised human rights such as right to life, food, health, shelter and potable water with other human rights and at risk due to the impact of climate change.

Right to life – is inseparably linked to the human rights which is protected by various national and international human right treaties (Art 6 ICCPR, 1966; Art 4 of American Convention on Human Rights, 1969; Art 2 of European Convention on Human Rights, 1959; Art 4 of African Charter of Human and People’s Rights, 1981). The Human Rights Committee stated that a failure by state institutions to take action to prevent, mitigate and remedy life threatening harms from climate change constitute a violation of right to life. A number of effects of climate change will pose

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<sup>197</sup> UNHR Council Res.18/22 in UNHR Council, Report of the Human Rights Council in Eleventh Session, UN DOC A/HRC/RES/18/22 (Oct 17, 2011)

direct and indirect threats to human life as reflected in the OHCHR 2009 report on climate change and human rights. Global warming causes sea level to rise, both because water expands as it warms and because water from melting glaciers flow into the ocean.<sup>198</sup>

Right to adequate food – The right to adequate food as an element of the right to an adequate standard of living recognised by ICESCR. The ICESCR has maintained that right to food is fundamental to the inherent dignity of a human person and indispensable for the fulfilment of other human rights enshrined in International Bill of Rights.<sup>199</sup>

Climate impacts and possibly climate response measures may impend both availability and accessibility to food. Increase in extreme weather events, including drought and floods will also negatively affect crop production.<sup>200</sup> If agricultural production in the low-income developing countries of Asia and Africa is adversely affected by climate change, the livelihood of large number of rural poor will be put at risk and their vulnerability to food insecurity increased.<sup>201</sup>

The right to health- The ICESCR recognises the right to highest attainable standard of physical and mental health and ICESCR recognises this right crucial for the enjoyment of other human rights. The right to health is widely protected in other international and national treaties and under

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<sup>198</sup> John H.Knox, 'Linking human rights and climate change at the UN', 33 *Harvard Environmental Law Review* (2009) 477-498, p.480

<sup>199</sup> In India it is explicitly recognised by SC in *PUCL v. UOI* (1997) 1 SCC 301

<sup>200</sup> IPCC Climate Change Report 2007

<sup>201</sup> Climate Change and Food Security: A Framework document, Food and Agriculture Organization of UN Rome, 2008 available at <http://www.fao.org/forestry/15538-079b31d45081fe9c3dbe6ff34de4807e4.pdf> accessed on 4/2/2025

national Constitution.<sup>202</sup> All these are considered the basic detriments of health which in the assessment of WHO, climate change will place at risk.<sup>203</sup> Climate change is likely to have significant health impacts including malnutrition, the number of people suffering from death, disease and injury from heatwaves, flood, storms and drought and cardio respiratory morbidity and mortality associated with ground level ozone.

Right to water – The right to water<sup>204</sup> is an essential condition for human existence. It is not a self-standing right, but is documented as inextricably associated with other human rights such as right to adequate standard of living, the right to highest attainable standard of health and the right to adequate housing and adequate food. Climate change is projected to seriously affect the availability of water. The rise in temperature will result in the disappearance of numerous Himalayan glaciers threatening water shortages for a quarter of China's population and hundred and millions of Indians. The United Nations General 2030 Agenda for Sustainable Development adopted by the United Nations General Assembly in September 2015 consists of 17 Sustainable Development Goals. One of the key goals under this agenda is SDG6, which aims to ensure universal access to clean water and sanitation and sustainable management of water resources.

Right to shelter – Under this right to shelter individuals should have access to safe, habitable and affordable housing free from discrimination.

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<sup>202</sup> Consumer Education and Research Centre v. Union of India (1995)3SCC42

<sup>203</sup> WHO, Protecting health from climate change (2008) 6, available at [http://www.who.int/world-health-day/toolkit/report\\_web.pdf](http://www.who.int/world-health-day/toolkit/report_web.pdf) accessed on 4/2/2025

<sup>204</sup> ICESCR, General Comment No 15: The Right to water E/c.12/2002/11 (2003) available at <http://www.unhchr.ch/tbs/doc/.nsf/0/a5458d1d1bbd713fc1256cc400389e94> accessed on 2/2/2025



Governments are generally tasked with ensuring the realization of this right and are expected to take appropriate measures to address homelessness,<sup>205</sup> provide social planning programs and prevent forced evictions. The right to shelter is an essential element in promoting social justice and equality as it contributes to the overall wellbeing and security of individuals and communities. Climate change impact can damage housing infrastructure particularly in areas prone to extreme weather events. People are forced to leave their homes and seek shelter elsewhere due to the destruction of their dwelling.<sup>206</sup> This raises concern of those who are being displaced.

Climate change is degrading ecosystems and natural resources<sup>207</sup> leading to a loss of biodiversity and ecosystem services. The right to healthy environment is recognized as a human right and governments have a responsibility to protect and conserve the environment for the present and future generations. Stockholm Declaration adopted in 1972 recognised that humans have the fundamental right to an environment of a quality that permits a life of dignity and wellbeing. Subsequently, in the UN Conference on Environment and Development (UNCED) held in Rio De Janeiro in 1992, Principle 1 of the Rio Declaration on Environment and Development also recognized the right to a healthy environment as a fundamental human right. In 2021, the Human Rights Council adopted

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<sup>205</sup> Jonathan M.Mann, Lawrence Gostin, et.al (eds), “Health and Human Rights”, 1 Health and Human Rights 6 (1994)

<sup>206</sup> Roger Zetter and Camilo Boano, ‘Planned Evacuations and the Right to Shelter during Displacement’, 41 Stud Transnational Legal Policy 165 (2010)

<sup>207</sup> Fabian Schupett, Introduction: Justice, Climate Change and the Distribution of Natural resources’, 22 Res Publica 3 (2016)

another resolution recognizing the right to safe, clean, healthy and sustainable environment as a human right.

### **ACCESSING CLIMATE LEGAL REGIME AND HUMAN RIGHTS**

Over the past four decades, it has been increasingly clear that there is a close connection between human rights and environmental protection. In fact, the two are fundamentally interdependent: a healthy environment is essential for people to fully enjoy their rights. But this relationship is not clearly acknowledged under the International Climate Change Regime. Paris Agreement acknowledges that climate change is a common concern of human kind and parties would when taking action to address climate change, respect, promote and consider their respective obligations on human rights. But whether such acknowledgement is emphatic enough is a matter of concern because the term human rights find space only once in the entire document and secondly the term is used ancillary and corollary to right to health and other rights. On the parameters of acknowledging climate change as a human right issue, the United Nations Framework Convention on Climate Change 1992 (UNFCCC) and the Kyoto Protocol do not come out strong because altogether there is no mention of human rights anywhere in the international multilateral climate change agreements.

The impact of climate change is raising concerns about the effectiveness and adaptability of social and legal systems. It calls for a comprehensive and strategic approach to utilize the rule of law in addressing the causes and consequences of climate change.<sup>208</sup> Despite the presence of various

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<sup>208</sup> Cinnamon Carlarne, Climate change, Human rights and the Rule of law, 25 UCLA Journal of International law and foreign affairs 11 (2020)

legal and administrative institutions tasked with implementing both voluntary and binding environmental regulations, there have been difficulties in achieving collaboration and action among stakeholders which is crucial in tackling urgent climate change challenges.<sup>209</sup> The safe climate is vital to the right to a healthy environment and is of absolute necessity to human life and wellbeing.<sup>210</sup>

Climate change in itself is the outcome of the failure of international environmental law or domestic laws but this does not mean the end of either the international environmental law framework or the efforts to combat the climate change. Ensuring the fundamental right to life is the converging point in safe guarding the human rights.

### **CONTEXTUALISING CLIMATE CHANGE LITIGATION IN INDIA**

All the human rights in special context to Indian Jurisprudence seem to flow from the right to Life as a principal doctrine. Art 21 of the Indian Constitution states that No person shall be deprived of his life and personal liberty except according to the procedure established by law. The apex court in India has widened the definition of Art 21 by incorporating the right to clean environment.<sup>211</sup>

Although India's per capita carbondioxide emission are very low and its historical emissions were insignificant its current annual GHG emission are the third highest in the world. In 2008, the Government of India,

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<sup>209</sup> Daniel Bodansky, *The art and craft of International Environmental Law* (Harvard University Press) 2010

<sup>210</sup> David R. Boyd Special Rapporteur on the issue of Human rights obligation relating to the enjoyment of safe, clean, healthy and sustainable environment) Reported on Human rights Obligation relating to the enjoyment of safe, clean, healthy and sustainable environment, U.N Doc. A/74/161

<sup>211</sup> In *Subhash Kumar v State of Bihar* (AIR 1991 SC 420) Supreme Court interpreted Art 21 right to life provision as encompassing the right to clean environment.

released the National Action Plan on Climate Change (NAPCC) which endorsed a co benefit approach- An approach that promotes India's development objectives while on addressing climate change effectively. The NAPCC led to the emergence of National Climate Policy, making and institution building in India. Several Laws also address different aspect of climate change in particular causes and impacts and thus provide potential hooks to the climate litigation. But there is no comprehensive legislation to climate change in India.

The Indian Judiciary particularly the Supreme Court, High Court and National Green Tribunal has played an active role in the Indian Environmental Governance over the past three decades. It has nurtured PIL as an instrument to increase access to the judicial system, and several cases of environmental and social science have been brought to judicial attention without meeting onerous procedural requirements. The judiciary has also interpreted constitutional and statutory rights to provide response to the deteriorating environmental conditions and readily referred to international legal instruments to support its decisions. Therefore it is not surprising that climate concerns are finding their way to Indian courts even in the absence of climate law.

In *Om Dutt Singh v State of Uttar Pradesh*<sup>212</sup> the applicants challenged the construction of a massive irrigation project. One of the ground they raised was that submergence of large tracts of forest land would lead to methane emissions. The NGT did not address this issue in its final order. It rejected the challenge primarily because shutting down the project at such a later stage would have meant a loss of large amount of public

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<sup>212</sup> Application No 521/2014, National Green Tribunal

money. In *Sukhdev Vihar Residents Welfare Association v. Union of India*<sup>2137</sup> NGT had to consider whether a waste to energy plant should be permitted to be operated in a densely populated area. The tribunal noted that the project was a clean development mechanism project and was therefore required to meet international standards including the emission of GHG emissions. In *Society for Protection of Environment and Biodiversity v. Union of India*<sup>214</sup> the NGT found portions of government notification exempting the construction industry from an environmental regulating approval process to be illegal. The tribunal held that exemptions was inter alia in derogation to India's Commitment under the Paris Agreement and the Rio Declaration.

In *Gaurav Bansal v Union of India*<sup>215</sup> the applicant sought orders from the NGT directing the Central and State Government to show the steps taken by them to implement NAPCC. In its final order the tribunal did not directly rule in its jurisdiction over the implementation of NAPCC but held that in future, specific cases regarding violation of NAPCC, its consequences and its impact should be filed before it. In *Hanuman Laxman Arozkar v. Union of India*<sup>216</sup> court discussed the environmental rule of law that should under the environmental governance in the country and in particular the interpretation of statutory process in question. In *Manu Anand v. State of Kerala*<sup>217</sup> while directing the government to formulate policy on the use of agricultural land for mining operations the

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<sup>213</sup> M.A No 19 of 2014, National Green Tribunal

<sup>214</sup> Application No 677 of 2016, National Green Tribunal.

<sup>215</sup> Application No 498/2014 in National Green Tribunal

<sup>216</sup> (2019) 15 SCC 401

<sup>217</sup> (1996) 2 KLT 197

Kerala High Court stated that the Kyoto Protocol reminds the nation to strive for the policies and measures to minimize adverse effect on climate change and to promote sustainable forms of agriculture in the light of climate change conditions.

In *State of Maharashtra v Suraj pal*<sup>218</sup> while dealing with the poaching of endangered wild animals court held that carbon sequestration is extremely important from the viewpoint of reducing carbon footprint of a nation and is considered as a major contribution towards lowering down global warming brought about by green house or carbon dioxide emitting gas.

In *Abhimanyu Rathor v State of Himachal Pradesh*<sup>219</sup> Himachal Pradesh High court held that we have already cause d immense damage to the environment and ecology resulting in global warming. Every Citizen has a right to breathe fresh air and access to potable water. The National Green Tribunal in *Court in its Own Motion v State of HP*<sup>220</sup> cautioned against the dangers of global warming and held that global warming is a consequence of the large quantity of CO<sub>2</sub> released into the atmosphere by industries, power stations and motor vehicles.

In *M.K.Ranjisinh and others v Union of India*<sup>221</sup> the Supreme Court has recognised a much felt but less articulated right against the adverse effect of climate change as a distinct fundamental right of the Constitution. It is yet to be articulated that the people have a right against the adverse effects

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<sup>218</sup> (2015) 1 Bom CR (Criminal) 576

<sup>219</sup> AIR 2014 HP High Court 5202

<sup>220</sup> 2014 SCC Online NGT 1

<sup>221</sup> (2024) 3 SCR 1320

of climate change. This is perhaps because the right and the right to clean environment are two sides of the same coin. As the havoc caused by climate change increases year by year, it becomes necessary to articulate this as a distinct right. It is recognised under Art 14 and 21 of the Indian Constitution. The judgement came in connection with the survival of endangered Great Indian Bustard Species. Linking the right against climate change to Art 14 and 21 Chief Justice said that right to life and equality could not be fully raised without a clean and stable environment. The court highlighted the interconnection between climate change and various human rights including right to health, indigenous people, gender equality and right to development. The Judgement noted that the right to healthy environment safe from the ill effect climate change is a fundamental human right. The court underscored the important role solar power would play in arresting the ills of climate change.

## **CONCLUSION AND SUGGESTIONS**

The human right based approach was intended to palliate the lack of protective structure of the UNFCCC which does not really have human beings and their interest at the centre of the argument though admittedly the aim was to solve the issue of climate change for the man kind in the long run. Under the approach, action plans, policies and programs are designed based on a system of rights and corresponding obligation under the international law. Art 21 of the Indian Constitution recognises the right to life and personal liberty while Art 14 indicates that all persons shall have equality before law and equal protection of law. These articles are the important source of right to clean environment and the right against the adverse effect of climate change.

Climate change is a pressing human right issue and must be seen as one. It affects one's right to life, food, clean drinking water, housing, livelihood and many other important rights. While people in poverty are responsible for just a fraction of global emission, they will bear the burn of climate change and have the least capacity to protect themselves. United Nations General Assembly recognised the right to clean and healthy environment as a human right in 2022.

India ranks seventh in the list of countries most vulnerable to climate change.<sup>222</sup> As per World Air Quality Report India was borne to 11 to 15 most populated cities in Central and South Asia in 2021. It says that more than 80% of the India's population live in districts that are vulnerable to disasters of extreme nature. At the premises, human rights body of the country, the NHRC has the statutory responsibility to protect among others the right to a healthy environment. Supreme Court of India in *M.C. Mehta v Union of India* and in number of cases has held that right to clean and healthy environment is covered under the right to life stated in Art 21 of the Indian Constitution. While there is wide spread agreement on the importance of integrating human rights into policy measures, the practical implementation of human rights in a meaningful, legal manner present significant challenges. Bridging the substantial gap in understanding is paramount, as the perspective of climate change differ greatly. The consensus to mitigate climate change challenges is clear but the solution is non convergent. There exist a dichotomy of climate issues and environmental issues whereas both are the side of the same coin ie, unsustainable development. Resolving this dichotomy is crucial, and the

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<sup>222</sup> <https://www.deccanherald.com/opinion/main-article/a-rights-based-approachto-climate-change-115481.html> accessed on 15/2/2025



right to life emerges as a potential guiding principle for achieving a balanced approach to climate action. By acknowledging the interconnectedness of climate change, human rights and fundamental rights to life, efforts can be focused on addressing the need of climate vulnerable population. This approach ensures that climate action is not only environmentally sound but also equitable and just promoting the wellbeing of the present and future generations. The recognition that climate change infringes the basic fundamental and human right necessitates urgent action to mitigate its impact and protect human wellbeing. Through concerted efforts and collective action, we can strive to achieve a more sustainable, equitable and resilient work for all, by guaranteeing the basic right enshrined in Art 21 of the Indian Constitution.

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