AN ANALYSIS OF ENVIRONMENTAL RESOURCES AND SUSTAINABILITY: PATHWAYS TO RESILIENCE AND DEVELOPMENT WITH SPECIAL REFERENCE TO SIKKIM

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ABSTRACT

The growing pressure of modernization, population expansion, and technological advancement have significantly increased the demand for environmental resources, posing serious challenges to environmental sustainability. This rising threat to the environmental resources to meet the demands of the society and also to preserve it for the generations to come is a serious concern. This thought has put across globally at the international level, national level and also at the local level. Environmental resources include – forests, water, soils, biodiversity and the clean air. The sustainable use of environmental resources means utilizing them in a manner that meets present needs without compromising the ability of future generations to meet theirs. The state like Sikkim which is unique due to its ecological fragility, steep slopes, climate change impacts and socio-economic development pressure.

By aligning forest conservation, organic farming, water resource management, and eco-tourism, the state has created a multi-pronged strategy for sustainable development. There have been ongoing challenges around climate change risk, enforcement, livelihoods and scaling remain. The sustainable use of environmental resources here is not only about conservation but also about equitable access, community benefits and ensuring ecological resilience in the face of change.

This paper aims to focus on "how are environmental resources being utilised and managed to ensure their sustainable use in the face of ecological fragility and socio- economic developmental pressure? It also analyse the laws and policies of India to promote sustainable use of biological resources? This paper also ponders upon the community- based traditional practices prevalent especially in the State of Sikkim to sustainable resource management? Sikkim can be a model state to all other Himalayan region globally for sustainable practices in Sikkim that helps in maintaining sustainability in eco-sensitive zone. Understanding these dynamics will help

in coining policies and legal framework for formulating stronger policies, use of traditional knowledge and community participation.

Keywords: environment, resources, protection and sustainability.

INTRODUCTION

Environmental resources constitute the ecological foundation upon which human life, economic systems, and cultural identities are built. Their sustainable use is central to achieving resilience and long-term development, particularly in ecologically diverse and climate-sensitive nations like India. This seminar paper presents a comprehensive analysis of environmental resources and their sustainable management within global, national, and regional contexts. It critically reviews existing literature, policy frameworks, landmark global agreements, and best practices from India including the Chipko Movement, forest governance evolution, and Sikkim's model of organic development. The paper also discusses critical challenges such as climate change, habitat fragmentation, resource overuse, and governance gaps. Finally, it proposes multilayered pathways to resilience—integrating policy coherence, technological innovation, community empowerment, traditional knowledge, environmental education, and green finance. The analysis establishes that sustainable resource governance is not only an ecological imperative but also a developmental necessity, especially for emerging economies.

Environmental resources—comprising forests, water bodies, soil, minerals, air, and biological diversity—are the fundamental assets that sustain human societies. They provide essential ecosystem services such as climate regulation, water purification, nutrient cycling, pollination, and food security. In economic terms, they constitute "natural capital," the stock upon which all other forms of capital formation depend. However, rapid industrialization, urban expansion, consumerism, and unsustainable agricultural practices have resulted in severe ecological degradation across the world.

Sustainability, as a concept, has evolved from conservation ethics to a multidisciplinary agenda that integrates ecological stability, economic development, and social equity. The increasing frequency of climate disasters, biodiversity loss, soil degradation, and resource scarcity has generated compelling evidence that unregulated development is incompatible with long-term human survival. Resilience—defined as the ability of systems to absorb disturbances and maintain functionality—has thus emerged as a key aspect of modern environmental

governance.

India, home to one of the world's richest biodiversity hotspots and diverse ecological landscapes, is uniquely positioned within this debate. As a megadiverse country, India hosts nearly 7–8% of the world's recorded species. At the same time, it faces acute environmental pressures due to population growth, poverty, industrial demands, and climate change. Balancing development with sustainability is therefore a national priority.

This paper aims to:

1. Examine the meaning and significance of environmental resources.
2. Evaluate global initiatives that have shaped environmental governance.
3. Analyze India's environmental policies and case studies.
4. Identify key ecological and governance challenges.
5. Propose pathways to sustainability and resilience in the Indian context.

2. MEANING AND IMPORTANCE OF ENVIRONMENTAL RESOURCES

The biological resources have become a significant term with the purpose to conserve and sustain the with shared equity.[1]Biological Diversity was defined as the variability among living organisms from all resources including terrestrial marine and aquatic ecosystem and the ecological complex[2]At the most, biological resources mean the living, economically valuable components of biodiversity that provides benefits to humanity. Environmental resources are defined as all biotic (living) and abiotic (non-living) elements of the environment that support life and facilitate human development. These include:

- **Renewable resources** such as forests, water, biodiversity, and solar energy
- **Non-renewable resources** such as minerals, fossil fuels, and rare earth metals

[1] Convention on Biological Diversity, 1992.
[2] Article 2, United Nations Convention on Biological Diversity.

- **Ecosystem services** such as climate regulation, soil fertility, and pollination
- **Cultural and aesthetic resources** that shape community identities and traditional knowledge systems

The importance of environmental resources can be discussed under the following dimensions:

2.1 Ecological Importance

Ecologically, biological resources are not mere commodities but are interactive but are interactive, functional components of ecosystems. Biological resources are the living engines that drive all ecosystem services. Environmental resources maintain ecosystem balance and support the functioning of natural cycles. Forests act as carbon sinks, wetlands manage floodwaters, oceans regulate temperature, and biodiversity ensures ecosystem adaptability. Example-plants, insects, birds etc., There are so many advantages of these resources – ecosystems with a diversity of species performing similar roles such as- multiple species of nitrogen-fixing plants which are more resilient to disturbances like drought or pest outbreaks.

2.2 Economic Significance

Nearly 40% of India's population directly depends on environmental resources for livelihoods—agriculture, fisheries, forestry, animal husbandry, and eco-tourism. Natural capital forms the foundation of sectors such as energy, manufacturing, and food production. The economic significance of biological resources is closely related to the growth of economy. The value of biological resources extends from direct revenue and jobs to foundational life support service.[3] The U.S bioeconomy is a significant sector, with a direct economic impact of -$210 billion. The biological resources can bet he foundation for major innovative and sustainable industries, generating substantial wealth and employment.

2.3 Social and Cultural Value

Many communities, including tribal and indigenous populations, sustain their identities through cultural relationships with forests, rivers, and land. Traditional ecological knowledge often contributes to sustainable resource use. The social and cultural values of biological

[3] Karnik Aswini Explainer: What is Bioeconomy and Why is It Important? www.earth.org

resources, while intangible, are profound and increasingly recognized as crucial for their conversation. These values are most commonly discussed within the conceptual framework of Cultural Ecosystem Services CES). These benefits are central to human identity, spirituality, well-being and social cohesion.[4]

2.4 Ethical and Inter-Generational Responsibility

Sustainability emphasizes equity between present and future generations. Uncontrolled resource extraction threatens long-term human welfare and contributes to irreversible ecological losses.

3. INTERNATIONAL PERSPECTIVE ON ENVIRONMENTAL PROTECTION

Environmental protection has become one of the most important concerns of international law because environmental degradation transcends national boundaries. There are several concerns of environment such as climate change, biodiversity loss, deforestation, pollution in the air, water pollution etc which cannot be addressed by the individual state alone. Therefore, International environmental law has evolved through treaties, declarations, judicial decisions and customary principles that is established to balance economic development with ecological sustainability.[5] Environmental governance at the international level has evolved significantly over the last five decades. Three major developments shaped this evolution:

3.1 The Stockholm Conference (1972)

In 1972, the Conference on Human Environmental was held in Stockholm under the aegis of the United Nations. Thereafter, there was environmental management process which took place everywhere including India.[6] Often considered the turning point in global environmental consciousness, the Stockholm Conference placed environmental protection on the global political agenda. It led to the creation of the United Nations Environment Programme (UNEP).

[4] www.ecology and society.org Challenges to understanding and managing cultural ecosystem services in the global South vol.27 Issue3 Article23
[5] Virginie Barral" Sustainable Development in International Law: Nature and Operation of an Evolutive Legal Norm" European Journal of International Law, Volume 23, Issue2, May 2012 pg.377-400.
[6] Kailash Thakur Environmental Protection Law and Policy in India Deep and Deep Publications Pvt. Ltd. EDITION 2007 pg.118-119.

3.2 Brundtland Report (1987)

A significant development in International environmental law was the emergence of the concept of sustainable development. The Brundtland Commission report, officially titled *"*Our Common Future," this report introduced the widely accepted definition of sustainable development: "*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*[7]

It emphasized:

- Integrated development
- Poverty alleviation
- Environmental stewardship

3.3 Rio Earth Summit (1992) and Agenda 21

The Rio-Earth Summit of 1992 further strengthened international environmental protection by adopting the Rio Declaration and Agenda 21. The Declaration introduced several principles on protecting environment, such as precautionary principles, the polluter pays principles and the principle of common but differentiated responsibilities (CBDR). Rio established global conventions on biodiversity, climate change, and desertification. Agenda 21 offered a blueprint for sustainable development for all nations. The principle of CBDR recognized that the developed states bear greater responsibilities in protecting environment because they are more responsible for its degradation and also, they are financially sound.[8]

3.4 Kyoto Protocol (1997) and Climate Justice

The Kyoto Protocol, adopted on 11 December 1997 under the United Nations Frameworks Convention on Climate Change (UNFCCC), represents a landmark development in International environmental law. It was the first legally binding international agreement that imposed quantified greenhouse gas emission reduction targets on developed countries. [9]The

[7] World Commission on Environment and Development, Our Common Future (Oxford University Press, 1987).
[8] United Nations, Rio Declaration on Environment and Development, U.N. Doc./A/CONF.151/26(Vol.i0,1992.
[9] Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted on 11 December1992, 1771 U.T.N. T.S. 107(entered into force 21 March 1994.

Kyoto Protocol established legally binding emission reduction obligations for developed countries, For the first time, countries were legally bound to reduce greenhouse gas emissions. It addressed climate justice by differentiating responsibilities of developed and developing nations.

3.5 Paris Agreement (2015)

The Paris Agreement adopted a more inclusive approach requiring all parties to undertake nationally determined contributions. Recent academic studies argue that the Paris Agreement reflects a dynamic model of differentiation, balancing fairness with progressively increasing environmental commitments.[10] A landmark achievement where nations agreed to limit global temperature rise to 1.5–2°C. It shifted focus to:

- Nationally Determined Contributions (NDCs)
- Renewable energy transitions
- Climate adaptation and resilience

The International perspective on environmental protection reflects an evolving legal order based on cooperation, shared responsibility, and sustainable development. Future development will rely upon stronger implementation mechanisms, enhanced international solidarity, and a greater commitment to intergenerational equity. These frameworks highlight that environmental protection is not just a national concern—it is a global imperative requiring collective action.

4. ENVIRONMENTAL RESOURCES AND DEVELOPMENT IN INDIA

India's economic development has historically been dependent upon the utilization of its abundant environmental resources, including forests, water bodies, minerals , biodiversity, and fertile agricultural land. With the growth of industrialization, urbanization and population growth have intensified pressure on these resources leading to various environmental problems.[11]The environmental India's developmental trajectory is closely tied to its

[10] Joyeeta Gupta and Susanne Schmeier, "Future Proofing the Principle of No Significant Harm" (20210International Environmental Agreements: Politics, Law Economics.
[11] Subhash Kumar v. State of Bihar, (1991)1 SCC 598.

environmental resources. Agriculture, forestry, fisheries, and mining have historically been the backbone of the Indian economy.

4.1 National Policy Frameworks

India's national policy framework for environmental sustainability seeks to integrate economic growth with ecological conservation. The framework also reflects India's commitment to international environmental obligations, sustainable development Goals, and develomentwhile protecting future generation.[12]The Government of India has developed a comprehensive policy framework that integrates environmental, economic and social dimensions of sustainability. There are several national initiatives attempt to integrate environmental protection with development. These policies provide the road maps for environmental governance and sustainable resource management.[13]

4.1.1 National Environment Policy (2006)

The National Environment Policy was first formulated in 2006, by Government of India, Ministry of Environment and Forest. The National Environmental Policy seeks to extend the coverage, and fill in gaps that still exist, in light of present knowledge and accumulated experience. It doesnot displace, but builds on the earlier policies.[14] The National Environment Policy seeks to integrate environmental concerns into development planning. Its objectives include and provide a framework for environmental protection, emphasizing:

- Conservation of critical ecological resources
- Intra-generational and inter-generational equity
- Public participation

The policy emphasizes sustainable use of natural resources and public participation in environmental decision- making. In order to gain sustainable development, there shall be integrated development process to be introduced involving all stakeholders. The National contains a framework that arched across sectors and therefore, environmental policy should be

[12] Vellore Citizens welfare Forum v. Union of India, (1996) 5 SCC647
[13] Ministry of Environment, Forest and Climate Change, Annual Report (latest edition)
[14] http://utkaluniversity.ac.in

in mainstream while planning development of nation. All the ministries of government must inculcate it in respective sectorial plans and implementation.[15]

4.1.2 National Biodiversity Action Plan (2008)

The National Action Plan on Climate Change is a significant policy initiative aimed at addressing climate change while promoting sustainable development. It consists of various policy mission. This plan aims to conserve biodiversity, promote sustainable utilization, and ensure equitable sharing of biological resources. The National Action Plan on Climate Change is a significant policy initiative aimed at addressing climate change while promoting sustainable development. It consists of eight national missions:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Water Mission
- National Mission for Sustainable Agriculture
- National Mission for Green India
- National Mission for sustaining the Himalayan Ecosystem
- National Mission on Strategic Knowledge for Climate Change
- National Mission on Sustainable Habitat

These missions focus on reducing emissions, conserving resources, and building climate resilience. policy is intended to focus on environmental protection in all developmental activities. The main objective of this Act is to conserve environment al resources to secure livelihoods and wellbeing of all. The human being should be at the centre of concerns for sustainable development and they deserve to have healthy and productive life in harmony with nature. A resources can be best utilized with scientific innovation and capacity building of

[15] Shereen Samant "Assessing The Impact of Environmental Policy 2006: A Critical Examination" pg.5 Vol. 5 Issue 5 September-October 2023.

biodiversity.[16]

4.1.3 National Action Plan on Climate Change (NAPCC)

The mission-based approach includes:

- National Solar Mission
- National Mission for Sustainable Agriculture
- National Water Mission
- Green India Mission

4.2 Role of Forests and Biodiversity

India's forests cover approximately 21% of its geographical area. The National Biodiversity Action Plan seeks to conserve biological diversity and ensure sustainable use of biological resources. It promotes ecosystem conservation, protection of endangered species, and community participation in biodiversity management. They:

- Support tribal livelihoods
- Provide raw materials
- Buffer climate impacts
- Protect watersheds

4.3 Economic Development vs. Environmental Conservation

Economic development and environmental conservation portrayed as competing objectives. Economic development. Economic development focuses on increasing production, income, employment, and overall standards of living, while environmental conservation aims at protecting natural resources ecosystems, and biodiversity for present and future generations. The challenges before the law-makers is to balance these two goals to ensure sustainable

[16] Dr. Sudha Garg "Biodiversity Conservation : An Integrated Action Plan is the Need of Hour" International Journal of Trend in Research and Development , pg 390.4(3) May-June 2017.

development. While industrial growth has contributed to GDP, it has also:

- Increased pollution
- Caused deforestation
- Degraded natural habitats

India faces the challenge of ensuring development without compromising ecological integrity. There has always been a deep relationship between economic development and environmental conservation. While the pre-industrial age has seen peaceful interactions with nature, it is actually, industrialization Revolution that has made the conservation of environment crucial focal point as a result of excessive use of natural resources and damage caused to the environment.[17]

5. BEST PRACTICE CASE STUDIES IN INDIA

5.1 Chipko Movement (1970s, Uttarakhand)

The Chipko movement is o e of the initiative taken by the public in the Himalayan region in 1970s against the rampant deforestation and the degradation of vital natural resources. There has been a growing concern for the environmental conservation and its protection from degradation which has mobilised local communities- Led by rural communities, especially women, this movement protected forests from commercial logging by physically embracing trees by women to prevent it from being cut down. This has reflected human's deep connection with the ecology, and it is known as The Chipko Movement.[18] It influenced:

- Forest conservation policies
- Recognition of community rights
- Women's leadership in environmental activism

[17] Anas K. T. and P. Natarajamurthy "Exploration of the Nexus between Economic Development and Environment Sustainability from Theory to Price: A Review SOUTH Asian Journal of Social Studies and Economics Volume 22 Issue 9, pg. 33-43, 2025: Articles no. SAJSEE. 142385ISSN:2581-821X.

[18] Shiwani Pandey, Devender Singh, Kamlesh ChandraJoshi, Ankit Ghildiyal "Chipko Movement at 50: Reflections on Environmental and Social Change" Journal of Mountain P-ISSN:0974-3030,E-ISSN:2582-5011Vol. 2o(2), 2025pg. 225-235.

5.2 Sikkim – India's First Organic State

Sikkim, a small northeastern Himalayan state of India, occupies a strategic ecological position within the Eastern Himalayas, a globally recognised biodiversity hotspot. Despite its geographical constraints, Sikkim has gained national and international recognition for progressive environmental policies, including becoming the world's first fully organic state, enforcing early bans on plastic and non-biodegradable materials, and promoting community-led conservation initiatives. These measures reflect an integrated approach to ecological protection, socio-economic development, and cultural preservation.

However, Sikkim's environmental achievements coexist with significant vulnerabilities. Climate change impacts such as glacial retreat, erratic rainfall, landslides, floods, and biodiversity loss pose serious risks to livelihoods and infrastructure. Rapid urbanisation, tourism growth, and hydropower development further strain natural resources. Against this backdrop, the central question addressed in this paper is how environmental resources in Sikkim are being managed to promote sustainability, resilience, and equitable development

Sikkim's complete transition to the world's first 100% organic state is a landmark contribution in sustainable development. By complete phasing out synthetic fertilizers and pesticides, the state seriously put forward the fragile Himalayan ecosystems, restores soil health, and protects biodiversity while acting as a global blueprint for agro-ecological policies.[19]Key initiative aimed at the following:

- Restored soil fertility
- Reduced chemical pollution
- Enhanced biodiversity
- Promoted eco-tourism
- Strengthened local livelihoods

The Sikkim's stringent policies on forest conservation, effective waste management and recycling programmes have reduced the environmental impact and boosted local economies.

[19] www.futurepolicy.org

There are ample opportunities in promoting sustainable development and enhancing climate resilience by this method. Sikkim's commitment towards conserving natural resources through sustainable development and securing bright future for the generations to come balancing complete harmony between sustainable development and economic growth. This is an exemplary to the world.[20]This has made the social and economic transformation in the state. By organic farming, the local farmers of this area have attracted not only domestic market but international market as well. The products from Sikkim have unique identity as they are known for their purity.

5.3 MGNREGA and Ecological Restoration

MGNREGA works for environment and ecology as a useful tool. It helps in conserving water and involved in other environmental services which in the long run helps in climate change mitigation and carbon sequestration as well. The Mahatma Gandhi National Rural Employment Guarantee Act has been instrumental in:

- Water conservation
- Land rejuvenation
- Afforestation
- Climate adaptation

5.4 Community Forest Rights (CFR)

Community forest rights (CFR) empower indigenous and local populations to govern, manage, and sustainability utilize customary forest lands. Over the past years, community forestry has emerged as a key strategy of conservation as well as a promotion of local livelihoods. It has been almost 3.56 million hectares forest under community forests i.e. 61% of total forest area of Nepal.[21]In India, the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 FRA an important piece of law which helps to transform lives and livelihoods of hundreds of people who are dependent on forests. Under the Forest Rights Act,

[20] Sarmistha Sarma, komal Prity "A case study on Sikkim Sustainability Initiatives and Economic Implications Indian Journal of Sustainable Development vol. 11 Issue 1 pg.12025

[21] Ranjana Budhathoki "A Case study on Assessment of Sustainability of Hari siddhi Community Forest of Sindhupal Chowk District

indigenous communities manage forest resources. This improves:

- Conservation outcomes
- Sustainable livelihoods
- Participatory governance

6. MAJOR CHALLENGES TO SUSTAINABILITY IN INDIA

Sustainability development seeks to balance present developmental needs without compromising the ability of future generations to meet their own needs. Despite various initiative and legislative interventions, India continue to grapple with numerous sustainability challenges as discussed below:

6.1 Deforestation and Habitat Fragmentation

Deforestation and habitat fragmentation constitute significant threats to environmental sustainability in India. Deforestation refers to the large-scale removal of forests for agricultural expansion, urban development, mining, infrastructure projects and industrial activities. India is home to diverse ecosystems that supports. Due to developmental pressures, infrastructure expansion, and mining.

6.2 Pollution (Air, Water, Soil)

India faces severe pollution levels resulting from industrial emissions, vehicular traffic, waste mismanagement, and agricultural chemicals.

6.3 Climate Change Impacts

Manifested through:

- Erratic rainfall
- Loss of agricultural productivity
- Increased droughts and floods

- Glacial melting in the Himalayas

6.4 Overexploitation of Resources

Excessive groundwater extraction, overfishing, monoculture farming, and sand mining threaten long-term sustainability.

6.5 Weak Governance and Law Enforcement

Environmental laws exist but often suffer from:

- Poor implementation
- Bureaucratic delays
- Lack of interdepartmental coordination

7. PATHWAYS TO SUSTAINABILITY AND RESILIENCE

7.1 Policy Integration

Environmental, social, and economic policies must align instead of operating in silos. Climate adaptation and biodiversity conservation should be integrated into all development plans.

7.2 Technological Innovation

Digital tools can transform environmental governance:

- GIS mapping
- Remote sensing
- AI for biodiversity monitoring
- Early warning systems for disasters

7.3 Community Empowerment

Community empowerment plays a crucial role in promoting sustainability and resilience in the

face of environmental, social and economic challenges. Empowered communities actively participate in decision-making processes, resource management, and local governance, thereby contributing to sustainable development outcomes. Local communities must be at the centre of environmental decision-making. Decentralized governance strengthens ownership and accountability. In India, community- based initiatives in areas such as forest conservation, water management, disaster preparedness, and climate adaptation have demonstrated the potential of local participation in achieving resilience. The relationship between community empowerment, sustainability and resilience highlighting the legal and policy frameworks at the early stage.[22]

7.4 Environmental Education and Awareness

Strengthening environmental literacy from schools to universities fosters responsible citizenship and behavioural change.

7.5 Blending Traditional Knowledge with Modern Science

Indigenous practices such as shifting cultivation, sacred groves, and water harvesting must be preserved and complemented with scientific approaches.

7.6 Green Finance and Sustainable Markets

Green finance has emerged as a vital instrument for promoting sustainable development by directing financial resources toward environmentally responsible projects and businesses. It encompasses financial products and services such as green bonds, sustainable investments, climate funds, and environmentally focused lending that support activities aimed at reducing carbon emissions, conserving natural resources and enhancing environmental resilience.[23]

Green finance acts as a catalyst for the development of sustainable markets by mobilizing capital toward renewable energy, sustainable infrastructure, clean transportation, and climate adaptation projects. Incentivizing sustainable agriculture, renewable energy, waste management, and conservation through:

[22] United Nations Development Programme, Empowered lives, Resilience nations :Community based Approaches to Sustainable Development(UNDP, NewYork, 2021)12.
[23] United Nations Environment Program, (UNEP Nairobi, 2017)

- Carbon markets
- Green bonds
- Eco-labelling
- Public-private partnerships

8. CONCLUSION

Environmental resources are central to the survival, progress, and development of societies. Sustainable management of these resources ensures ecological integrity, economic resilience, and social well-being. As India advances toward becoming a global economic power, it must embrace sustainability as a developmental priority. Case studies such as the Chipko Movement and Sikkim's organic transformation demonstrate that ecologically responsible development is possible and achievable.

A resilient future depends on our ability to integrate traditional wisdom, scientific innovation, policy coherence, and community participation. The pathways discussed in this paper offer a comprehensive roadmap for India to achieve sustainable development while safeguarding environmental resources for future generations. Collaboration among government agencies, private enterprises, civil society organizations, and local communities is essential for addressing sustainability challenges effectively.

India has taken several initiatives to promote green finance, including the issuance of green bonds, sustainable banking guidelines, and policies encouraging renewable energy investments. It encompasses financial products and services such as green bonds, sustainable investments, climate funds and environmentally focussed lending that support activities aimed at reducing carbon emissions, conserving natural resources, and enhancing environmental resilience.

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