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EDITORIAL OPEN ACCESS

From Plastic Pollution to Climate Resilience: Integrating Sustainable Technologies, Policy Frameworks and Indigenous Ecological Knowledge for a Greener Future

Sonali Bhosale and Aparna Gunjal

Department of Environmental Science, Dr. D. Y. Patil, Arts, Commerce & Science College, Pimpri, Pune, Maharashtra
*Correspondence for materials should be addressed to SB (email: sonali.bhosale@dypvp.edu.in)

Abstract

Environmental issues such as climate change, global warming, and greenhouse gas emissions are intensifying at an alarming rate, posing significant threats to ecosystems and human well-being. These interconnected challenges demand urgent and comprehensive solutions rooted in sustainability. Conventional chemical-based approaches, although effective in the short term, often lead to long-term environmental degradation, soil infertility, and ecological imbalance. There is a need for environmentally friendly and sustainable methods that will address the environmental problems facing us today. The biological method, which combines technology and policies, is one of the most viable solutions to environmental problems. Moreover, the integration of Indigenous Ecological Knowledge (IEK) provides a holistic perspective by incorporating traditional practices that have evolved in harmony with nature over generations.

Keywords: Resilience; Integrating Sustainable Technologies; Policy Frameworks; Indigenous; Greener Future

Introduction

Waste production, especially plastics, food waste, e-waste, and kitchen waste, has become a worldwide issue. Plastic waste is specifically challenging because it is non-biodegradable and poses threats to the well-being of both land and marine ecosystems. It is crucial to minimize the consumption of plastic waste and explore sustainable solutions that will reduce harm to human life and biodiversity. Effective waste management should involve using waste to produce value-added products like compost and energy. Organic waste can be effectively managed through composting and anaerobic digestion, which produces biogas that can be used as a renewable energy source for cooking and other applications (Khalid *et al.*, 2011). These types of waste-to-energy systems help ensure environmental sustainability and efficiency in the use of resources. The indigenous system has always favored low-waste production and the use of biodegradable material like plant-based products, providing lessons on how to manage waste today (Berkes, 2012).

Sustainable Development Goals and Environmental Sustainability

The Sustainable Development Goals have laid out the path to resolve environmental issues with simultaneous development. Goals like Clean Water and Sanitation (Goal 6), Responsible Consumption and Production (Goal 12), Climate Action (Goal 13), and Life on Land (Goal 15) all relate to the idea of environmental sustainability. The fulfillment of these goals will require effective policies, innovative technology, and the involvement of communities as well. Environmental sustainability is further reinforced by ideas like green credit schemes, investment strategies, and climate-smart nutrition, among others. Achieving these goals requires the integration of policy measures, technological innovations, and community participation (Pawitar *et al.*, 2020).

Pollution, Climate Change, and Technological Interventions

Rapid industrialization and urbanization have been responsible for the pollution of the environment, which includes air, water, and greenhouse gases (Abbass *et al.*, 2022). The consequences of such pollutants have grave effects on

both the environment and human health (Najmaldin, 2024). Methods like bioremediation, phytoremediation, and nanotechnology help deal with pollution effectively. Bioremediation is a process that uses microbes for breaking down the pollutants. On the other hand, phytoremediation involves using plants to absorb pollutants from the soil and water (Vidali, 2001). Wastewater and industrial effluents require proper treatment before discharge into the environment. Integrating biological and technological approaches provides cost-effective and environmentally friendly solutions. Additionally, renewable energy adoption and carbon footprint reduction strategies are crucial in addressing climate change. Indigenous Ecological Knowledge contributes to climate resilience by promoting sustainable land use practices, water conservation, and ecosystem-based adaptation strategies, particularly in vulnerable regions (Gadgil *et al.*, 1993).

Environmental Health, Agriculture, and Food Security

Pollution of the environment has an effect on human health because of the presence of toxic substances in the air, occupational factors, and new pollutants. Thus, waste management and pollution control need to be sustainable to ensure human health protection. In agriculture, intensive use of chemicals has led to serious problems such as the degradation of soil properties and food safety issues. Biologically based fertilizers, including biofertilizers and organics used in agriculture, improve soil productivity without any negative impact on the environment (Altieri, 1995). Traditional agricultural methods, including polyculture and natural pest management, can also contribute to sustainability. Climate-smart agriculture is very important for ensuring food security.

Environmental Economics, Policy, and Social Dimensions

The concepts of environmental sustainability have strong connections with economic and policy aspects. Valuation of the services provided by nature, enforcement of environmental policies, and green investment are key features of environmental sustainability. Engagement of communities in conservation activities, assisted by NGOs and local administration, is crucial for effective environmental sustainability practices. Social factors like environmental justice, equity, and environmental awareness play important roles in creating effective environmental management practices. Cultural values and education greatly affect people's attitude towards nature and environmental management practices. Cultural and traditional knowledge can contribute to sustainability in environmental management and conservation.

Conclusion: Toward an Integrated and Resilient Future

The growing complexity of environmental challenges requires integrated solutions that combine scientific innovation, policy interventions, and traditional knowledge systems. Biological approaches to agriculture and waste management, supported by modern technologies, provide sustainable pathways for environmental conservation. The inclusion of Indigenous Ecological Knowledge enriches these approaches by offering time-tested practices rooted in ecological balance. Aligning these strategies with the Sustainable Development Goals will ensure long-term sustainability and resilience.

Ultimately, safeguarding the environment is essential for the well-being of present and future generations. A collective commitment to sustainable practices, technological innovation, and ecological stewardship is necessary to build a healthier and more sustainable future.

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