



INTERDISCIPLINARY DIALOGUES

Perspectives in Science, Humanities, and Society

Editors

Dr. Dayal Pyari
Dr. Sneha Sharma
Dr. Harish Kumar Yadav

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AND SOCIETY)**

by: Dr. Dayal Pyari, Dr. Sneha Sharma, Dr. Harish Kumar Yadav



ISBN: 978-93-48701-42-8

ISBN-10: 93-48701-42-8

DIP: 18.10.9348701428

DOI: 10.25215/9348701428

Price: ₹ 800/-

September, 2025



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SCRIBE & SCROLL PUBLISHING LTD.

Oshiwara Mhada Complex, 40/102, 1st Floor,
Sargam Society, New Link Rd, Andheri West, Mumbai,
Maharashtra 400102, India



Website: www.sspubs.publishing.org.in | **Email:** scribescrollpubs@gmail.com

Printed in India | Title ID: 9348701428

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Dedication

*This book is lovingly dedicated to our **teachers**, who illuminate the path of knowledge; to our **students**, whose curiosity drives innovation; to our **friends**, whose support nurtures creativity; and to our **parents**, whose guidance and blessings make every achievement possible.*

PREFACE

The contemporary world is marked by complexities that cannot be fully understood or addressed within the boundaries of a single discipline. The convergence of science, humanities, and society highlights the growing need for interdisciplinary approaches that foster holistic understanding, innovative problem-solving, and inclusive perspectives. This edited volume, *Interdisciplinary Dialogues (Perspectives in Science, Humanities, and Society)*, is a collective effort to bring together scholars, researchers, and practitioners who explore the intersections between diverse fields of knowledge.

The chapters in this book reflect the richness of interdisciplinary thinking, addressing issues such as ethical implications of scientific advancement, cultural dimensions of technology, sustainability, social justice, and the role of education in bridging disciplinary divides. By engaging multiple perspectives, the volume underscores the importance of dialogue in shaping new frameworks for research, pedagogy, and policy.

We believe that this book will serve as a valuable resource for academics, students, and professionals who seek to transcend conventional boundaries and cultivate a more integrative and critical outlook. It is our hope that these dialogues will not only broaden intellectual horizons but also contribute meaningfully to building a society that values collaboration, empathy, and shared responsibility in addressing global challenges.

Editors

Interdisciplinary Dialogues
(Perspectives in Science, Humanities, and Society)

ABOUT THE EDITORS



DR. DAYAL PYARI

A committed Professor with over twenty years of experience at leading *Dayalbagh Educational Institute, Dayalbagh Agra and Amity Institute of Education, Amity University, Noida, Up* teaching students from various social and cultural backgrounds, Possessing excellent administrative, verbal communication and written skills along with constructive and effective teaching methods that promote a stimulating learning environment, able to work in a managerial role or as part of team and having the proven ability to successfully work to tight schedules. She has published 95 research papers, 06 in Scopus and 03 in web sciences and five books. She is also senior member of International Association of Computer Science and Information Technology, Singapore, Associate Editors of International Journal of Applied Research, India, Reviewer Committee Member of IAOES, International Association of Engineers, Singapore and Life Membership of System Society of India, India. Research guidance as guided a number of M.Ed., M.Phil. Dissertation and Ph.D. in the area of interest.



DR. SNEHA SHARMA

Dr. Sneha Sharma is a dedicated academician and psychologist, currently serving as an HOD, Department of Psychology at S. S. Jain Subodh P.G. (Autonomous) College, Jaipur, Rajasthan. With over a decade of experience in teaching undergraduate and postgraduate students, and more than three years of professional counselling practice, she brings a rich blend of academic insight and practical expertise in the field of Psychology. She holds a B.A. (Hons) and M.A. in Psychology from the University of Rajasthan, Jaipur, and earned her Ph.D. from IIS (Deemed to be University), Jaipur. Further strengthening her qualifications, she also completed a Diploma in Guidance and Counselling from VMOU. Dr. Sharma has an impressive research portfolio, with numerous papers and articles published in esteemed national and international journals. Her active engagement in the academic community is reflected in her participation in over 50 workshops, faculty development programs, orientation and refresher courses, as well as national and international conferences. Her core research interests lie in Positive Psychology, Educational Psychology, and Clinical Psychology. In recognition of her excellence in education, she has been honoured with the prestigious "National Excellent Faculty Award 2024" by Saksham Society, a world record-holding NGO, and the "Glory of the Nation 2025 Award" from UTTHAN FOUNDATION, Delhi. Dr. Sneha Sharma remains deeply committed to the advancement of psychological science and education, inspiring learners and readers through her scholarly work and compassionate approach.



DR. HARISH KUMAR YADAV

Dr. Harish Kumar Yadav is a dedicated Assistant Professor in the B.Ed. department at RCU Govt. PG. College Uttarkashi, Uttarakhand. He possesses a strong academic background with postgraduate degrees in Education, Economics, and Hindi. His expertise is further validated by UGC-NET qualification in Education. Dr. Yadav brings over ten years of valuable experience in Teacher Education to his role. He is a passionate researcher who has published extensively in national and international journals and books. Additionally, he has actively presented his research on inclusive education, special education, yoga education, and philosophy at national symposiums. This range of accomplishments demonstrates Dr. Yadav's commitment to fostering well-rounded educators and enriching the field of education.

CONTENTS

SR.NO.	CHAPTER NAME	PAGE NO.
1	PSYCHOLOGICAL INTERVENTIONS: A PRACTICAL MANUAL SLOW DEEP BREATHING EXERCISE: A PSYCHO-THERAPEUTIC INTERVENTION, APPLICATION, PRACTICE AND BENEFITS <i>Dr. G. K. Sellakumar</i>	1
2	TEACHING ACROSS BORDERS: GLOBAL PERSPECTIVES AND INTERDISCIPLINARY PEDAGOGIES IN HIGHER EDUCATION <i>Dr. Harish Kumar Yadav, Dr. Pranay Pandey</i>	10
3	CORPORATE SOCIAL RESPONSIBILITY IN THE LIGHT OF SUSTAINABLE DEVELOPMENT GOALS: AN INTROSPECTION <i>Dr. Srirupa Ray</i>	23
4	AWARENESS OF THE TRAINEE TEACHERS ABOUT ANCIENT INDIAN KNOWLEDGE SYSTEM <i>Dr. Adrija Chattopadhyay</i>	36
5	PANDEMICS AND POWER: HISTORICAL LESSONS IN SHAPING PUBLIC HEALTH, INEQUALITY, AND STATE CONTROL <i>Dr. Lekshmy.P.L</i>	47
6	CLIMATE CHANGE ANXIETY: A PSYCHOLOGICAL AND SOCIAL DISCOURSE <i>Chanthuru S</i>	55
7	CLIMATE CHANGE DISCOURSE: SCIENCE, ETHICS, AND SOCIAL NARRATIVES <i>Dr. Neelima Pandey</i>	61
8	AUGMENTED AND VIRTUAL REALITY TEACHING <i>Mr. Ramakrishnan A</i>	67

SR.NO.	CHAPTER NAME	PAGE NO.
9	AI-MEDIATED LEARNING EQUITY: BRIDGING DIGITAL DIVIDES IN POST-PANDEMIC RURAL EDUCATION THROUGH CULTURALLY RESPONSIVE INTELLIGENT TUTORING SYSTEMS <i>Mr. Eshwar R</i>	77
10	HEALTH, WELLBEING, AND SOCIAL DETERMINANTS: AN INTERDISCIPLINARY LENS <i>Jatinder Pal Singh, Dr. Roopak Kumar</i>	93
11	NEUROSCIENCE, BEHAVIOUR, AND CULTURAL CONTEXTS <i>Jatinder Pal Singh, Dr. Roopak Kumar</i>	102
12	BRIDGING EPISTEMOLOGIES: INTEGRATING INDIGENOUS WISDOM AND SCIENTIFIC INQUIRY <i>Dr Yeshaswini V</i>	115
13	INTEGRATING SCIENTIFIC AND HUMANISTIC APPROACHES IN RESEARCH: TOWARDS A HOLISTIC PARADIGM <i>Dr. Payal Banerjee</i>	124
14	SOCIAL JUSTICE THROUGH INTERDISCIPLINARY RESEARCH: A TRANSFORMATIVE PARADIGM FOR EQUITY AND EMPOWERMENT <i>Dr. Payal Banerjee</i>	131
15	TECHNOLOGY, HUMANITY AND FUTURE OF WORK <i>Jaanvi, Dr. Roopak kumar</i>	139
16	QUALITY CONCERN THROUGH STEM EDUCATION IN INDIA <i>Subrat Kumar Panigrahy</i>	150
17	EXPLORING GENDER, SCIENCE, AND SOCIETY <i>Yogesh Kumar Sahu, Pradeep Kumar Patel</i>	162
18	NAVIGATING ENVIRONMENTAL CHALLENGES: INTEGRATING SCIENCE, CULTURE, AND POLICY FOR SUSTAINABLE FUTURES <i>Smrita Singh, Ashutosh Singh Chauhan</i>	184

SR.NO.	CHAPTER NAME	PAGE NO.
19	EVALUATING THE RECIPROCAL RELATIONSHIP OF SLEEP QUALITY, EATING HABITS, AND MENTAL HEALTH IN INDIAN YOUTH <i>Dr. Sneha Sharma, Ms. Anjali Loor</i>	191
20	ART, LITERATURE AND SCIENTIFIC IMAGINATION <i>Prof. Bhupendra Kumar Patel</i>	201
21	EXPLORING GENDER, SCIENCE AND SOCIETY <i>Dr. Triveni Patel</i>	219
22	INDIGENOUS KNOWLEDGE SYSTEM & MODERN SCIENCE <i>Dr. Chouleshwar Kumar Chandrakar</i>	232
23	SOCIAL JUSTICE THROUGH INTERDISCIPLINARY RESEARCH <i>Sakshi Patel</i>	246
24	जल संसाधन प्रबंधन डॉ. (श्रीमती) मंजुलता कश्यप	260
25	प्रवास/पलायन का मानवीय जीवन पर प्रभाव (मानसिक स्वास्थ्यगत/ आर्थिक/धार्मिक) एक समाजशास्त्रीय अध्ययन डॉ. (श्रीमती) वृंदा सेनगुप्ता	268
26	कला, साहित्य और वैज्ञानिक कल्पना डॉ. संध्या बिसेन	273
27	पर्यावरणीय चुनौतियों के समाधान हेतु राजनीतिक प्रयास डॉ. अर्चना चौहान	283

CHAPTER 18

NAVIGATING ENVIRONMENTAL CHALLENGES: INTEGRATING SCIENCE, CULTURE, AND POLICY FOR SUSTAINABLE FUTURES

Smrita Singh ¹, Ashutosh Singh Chauhan ²

ISBN: 978-93-48701-42-8 | DOI: 10.25215/9348701428.18

Abstract

Addressing contemporary environmental challenges requires an integrated understanding that bridges scientific evidence, cultural contexts, and policy frameworks. This chapter explores five interconnected themes: scientific understanding of environmental change, cultural perceptions and Indigenous knowledge systems, environmental policy frameworks and governance, the science–policy interface, and the socio-economic and ethical dimensions of environmental decision-making. Scientific data and modeling offer critical insights into climate change and biodiversity loss, while Indigenous knowledge systems provide context-specific, time-tested practices for sustainability. Governance structures at local to global scales attempt to balance ecological conservation with economic and social priorities. However, a gap remains between scientific evidence and policy implementation. Furthermore, ethical and equity-based perspectives are essential for just and inclusive environmental outcomes. The chapter argues that a transdisciplinary, participatory approach is vital to creating effective, resilient responses to planetary crises.

¹ School of Biotechnology, IFTM University, Moradabad, U.P, India; Correspondent Author Mail Id: smrita1@gmail.com

² Air pollution and Stone conservation Laboratory, Archaeological Survey of India, Agra, U.P, India

Keywords: Environmental governance, Indigenous knowledge, Science–policy interface, Environmental justice, Climate change

Introduction

The 21st century is marked by escalating environmental crises—climate change, deforestation, biodiversity loss, pollution, and resource depletion—that threaten ecological stability and human well-being. While science has been instrumental in identifying these issues and projecting their impacts, resolving them requires more than technological fixes. Cultural values, ethical considerations, and political will significantly shape environmental outcomes.

This chapter provides a holistic examination of environmental challenges through five key lenses. First, it outlines the scientific basis for understanding environmental change and the role of data, modeling, and monitoring. Second, it highlights the importance of cultural perceptions and Indigenous knowledge systems in shaping sustainable practices. Third, it examines environmental policy frameworks and governance mechanisms at multiple scales. Fourth, it explores how to strengthen the science–policy interface to promote evidence-based decision-making. Finally, it addresses the socio-economic and ethical dimensions of environmental decisions, emphasizing equity, justice, and intergenerational responsibility.

Together, these dimensions reflect the complexity and urgency of building a sustainable future. Only by integrating knowledge across disciplines and involving diverse stakeholders can society effectively navigate today’s environmental challenges as follows:

1. Scientific Understanding of Environmental Change

Scientific understanding of environmental change is fundamental to identifying, predicting, and mitigating ecological degradation. Environmental science integrates disciplines such as climatology, ecology, geology, and atmospheric chemistry to examine complex systems and anthropogenic impacts. One of the most pressing concerns is climate change, driven primarily by increased greenhouse gas emissions, leading to global warming, altered precipitation patterns, and rising sea levels (IPCC, 2021). Biodiversity loss is another critical challenge, as ecosystems become fragmented and species face

extinction due to habitat destruction, invasive species, and pollution (Díaz et al., 2019).

Advanced monitoring technologies such as satellite remote sensing, GIS, and climate models have enhanced the ability to observe and predict environmental changes at global and local scales. These tools help identify trends and assess risks, enabling policymakers and communities to implement targeted interventions. Scientific data also underpin international agreements like the Paris Accord and inform sustainable development strategies (NASA, 2022). However, translating scientific evidence into action requires interdisciplinary collaboration and public engagement. Therefore, a robust understanding of environmental change through science is not only about analysis but also about guiding society toward informed and resilient environmental governance.

2. **Cultural Perceptions and Indigenous Knowledge Systems**

Cultural perceptions play a critical role in shaping human relationships with the environment. Different communities interpret and interact with nature based on their historical, spiritual, and social contexts. In many Indigenous cultures, nature is viewed not as a resource to exploit but as a living entity with which humans share a reciprocal relationship. This worldview fosters stewardship, conservation, and sustainable practices rooted in deep ecological awareness (Berkes, 2018).

Indigenous Knowledge Systems (IKS) represent cumulative bodies of knowledge passed down through generations, encompassing practices related to agriculture, forestry, water management, and biodiversity conservation. For instance, the fire management techniques of Aboriginal Australians and the agricultural terracing systems of the Andean peoples illustrate how traditional practices are often well-suited to local ecological conditions (Nakashima et al., 2012). These systems are increasingly recognized for their relevance in climate adaptation and biodiversity preservation. Studies have shown that regions managed by Indigenous peoples often have higher biodiversity and better ecological outcomes than adjacent protected areas (Garnett et al., 2018). However, such knowledge is frequently marginalized in policy and scientific discourse. Integrating Indigenous knowledge with scientific approaches can enhance environmental governance, promote

equity, and ensure that culturally embedded wisdom informs sustainable development.

3. Environmental Policy Frameworks and Governance

Environmental policy frameworks and governance structures are central to addressing complex and interconnected ecological challenges. These frameworks encompass the laws, regulations, institutional arrangements, and international agreements designed to protect natural resources and promote sustainable development. Effective governance requires coordination across local, national, and global levels, ensuring that policies are both scientifically informed and socially inclusive. Key international frameworks such as the Paris Agreement on climate change and the Convention on Biological Diversity (CBD) serve as foundational instruments for global environmental cooperation (UNEP, 2021).

At the national level, governments implement environmental protection laws, such as emissions regulations, biodiversity conservation acts, and pollution control mechanisms. However, policy effectiveness is often hindered by weak enforcement, political inertia, and inadequate public participation. Strengthening environmental governance demands transparency, stakeholder engagement, and integration of Indigenous and local knowledge systems (Liverman, 2004). Moreover, adaptive governance—characterized by flexibility, learning, and responsiveness—is critical in the face of climate uncertainty and rapid ecological shifts. Collaborative efforts such as the Environmental Performance Index (EPI) also provide valuable data for assessing and improving policy outcomes globally (Wendling et al., 2020). Integrating environmental science with ethical, cultural, and socio-economic considerations ensures that policy responses are both equitable and resilient.

4. Science–Policy Interface: Bridging the Gap

The science–policy interface plays a crucial role in translating scientific knowledge into actionable environmental policy. While science provides the evidence base for understanding environmental challenges, policy determines how societies respond to them. However, the two often operate in separate spheres, resulting in delayed or inadequate responses to urgent issues like climate change, biodiversity loss, and pollution. Bridging this gap requires effective

communication, trust-building, and co-production of knowledge between scientists, policymakers, and stakeholders (van den Hove, 2007).

Mechanisms such as science advisory panels, boundary organizations, and policy briefs help facilitate this interface. For example, the Intergovernmental Panel on Climate Change (IPCC) exemplifies how scientific consensus can inform global policy frameworks like the Paris Agreement. Still, challenges remain, including political resistance, scientific uncertainty, and the underrepresentation of local and Indigenous knowledge (Sarkki et al., 2015). Effective science–policy integration also benefits from knowledge brokering and capacity-building initiatives that empower decision-makers to use scientific findings meaningfully (Gluckman, 2014). To improve this interface, it is essential to promote transparency, interdisciplinary collaboration, and participatory approaches. A stronger science policy interface enhances the legitimacy, relevance, and impact of environmental decisions, enabling more adaptive and inclusive governance.

5. Socio-Economic and Ethical Dimensions of Environmental Decisions

Environmental decisions are deeply intertwined with socio-economic and ethical considerations, as they impact not only ecosystems but also human livelihoods, health, and social equity. Poor and marginalized communities often bear the brunt of environmental degradation, such as air and water pollution, deforestation, and climate-induced displacement, despite contributing the least to these problems (Agyeman et al., 2003). This disparity raises critical issues of environmental justice, which calls for fair treatment and meaningful involvement of all people regardless of race, income, or geography in environmental policymaking.

Economic instruments such as carbon pricing, subsidies for green technology, and payment for ecosystem services aim to align environmental goals with market mechanisms. However, their design must consider social impacts to avoid reinforcing inequalities. Ethical frameworks, including intergenerational equity, stress the moral responsibility to preserve environmental resources for future generations (WCED, 1987). Moreover, decisions regarding conservation, development, and resource use often involve value-based trade-offs that cannot be resolved by science alone. Addressing these

dimensions requires inclusive, transparent processes that incorporate diverse cultural perspectives, ethical reasoning, and socio-economic realities. Integrating justice and ethics into environmental governance enhances both the legitimacy and sustainability of environmental decisions.

Conclusion

Environmental issues are no longer isolated ecological problems; they are deeply embedded in cultural, economic, political, and ethical dimensions of society. The chapter underscores that scientific insight is indispensable, but alone it is insufficient to drive meaningful change. Indigenous knowledge, participatory governance, ethical reasoning, and inclusive policies are equally critical in crafting durable solutions.

Bridging science and policy, respecting cultural diversity, and addressing social inequalities are fundamental to achieving environmental sustainability. A systems-thinking approach that combines empirical evidence with local wisdom and moral responsibility can enhance both the legitimacy and effectiveness of environmental actions. Moving forward, integrated and collaborative strategies must guide environmental governance to ensure a just and resilient future for all.

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