

# Ganga River and Climate Change: A Sociological Perspective

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## Abstract

The Ganga River is not only a vital freshwater resource in India but also holds immense cultural, spiritual, and social significance. Climate change has had a profound impact on this river, influencing its flow, quality, and biodiversity. This paper examines the interplay between climate change and the Ganga River through a sociological lens, focusing on the social, economic, and cultural repercussions. By analyzing the river's role in the lives of millions, this study highlights the need for inclusive strategies to mitigate climate impacts on vulnerable populations dependent on the Ganga.

**Keywords:** Ganga River, Climate Change, Sociological Perspective, Environmental Degradation, Cultural Significance, Hydrological Impact, Community Resilience, Socio-economic Vulnerability, Policy Interventions, Sustainable Development, Uttarakhand, Livelihood Systems, Ecological Restoration, Water Resource Management, Marginalized Communities

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## Introduction

The Ganga River, flowing through northern India, supports over 400 million people. Revered as a sacred entity, the river is intricately tied to religious practices, agriculture, and urban water supply. However, climate change poses significant threats, such as glacial melt, altered precipitation patterns, and rising temperatures, which affect the river's flow and quality. Understanding these changes sociologically allows for insights into how communities perceive, adapt to, and are impacted by these environmental shifts.

## **Background**

The Ganga River, known as the Ganges in English, holds an unparalleled position in Indian society, being both a crucial natural resource and a cultural icon. Originating from the Gangotri Glacier in the Himalayas, the river spans over 2,500 kilometers across northern India and Bangladesh, ultimately draining into the Bay of Bengal. The river basin supports approximately 43% of India's population, making it one of the most densely populated river basins globally. Historically, the Ganga has been a cradle of civilization, fostering agricultural growth, trade, and cultural development. Whitehead, P. G., Sarkar, S., Jin, L., Futter, M. N., Caesar, J., Barbour, E., Butterfield, D., Sinha, R., Nicholls, R., Hutton, C., & Leckie, H. D. (2015). Dynamic modeling of the Ganga river system: impacts of future climate and socio-economic change on flows and nitrogen fluxes in India and Bangladesh. *Environmental Science: Processes & Impacts*, 17(6), 1082-1097. This study employs dynamic modeling to assess how future climate and socio-economic changes may affect the flow and nitrogen levels in the Ganga River system, providing insights into potential environmental and societal impacts. Singh, S., & Jain, C. K. (2018). Impact of climate change on the hydrological dynamics of River Ganga, India. *Environmental Monitoring and Assessment*, 190(5), 1-14. This paper evaluates the effects of climate change on the hydrology of the Ganga River, discussing implications for water quality, biodiversity, and hydropower potential, which are crucial for understanding societal impacts.

## **Cultural and Spiritual Importance**

The Ganga is deeply embedded in Indian culture and spirituality. Revered as a goddess in Hinduism, the river symbolizes purification and salvation. Millions of pilgrims gather annually along its banks to perform rituals and immerse themselves in its waters, believing it cleanses sins and aids in achieving moksha (liberation from the cycle of rebirth). This sacred status, while fostering deep respect, has also led to overuse and neglect, with little consideration for the environmental repercussions of human activities.

## **Economic and Social Dependence**

Economically, the Ganga River underpins various sectors such as agriculture, fisheries, and hydropower. Its fertile basin accounts for a significant portion of India's grain production, particularly rice and wheat. Urban centers along the river, including Varanasi, Patna, and Kolkata, rely heavily on its waters for drinking, sanitation, and industrial purposes. However, this dependence has led to significant stress on the river's ecosystem, compounded by inadequate waste management and industrial pollution. Sundaranand, S. (2011). Views on global warming. Swami Sundaranand shares observations on the environmental changes in the Ganga region, emphasizing the cultural and spiritual significance of the river and the societal implications of its degradation.

## **Environmental Challenges**

In recent decades, the Ganga has faced severe ecological degradation. Rapid urbanization,

industrialization, and agricultural expansion have introduced pollutants, including untreated sewage, heavy metals, and chemical effluents. The deteriorating water quality has threatened aquatic life and human health, with rising incidences of waterborne diseases.

### **Climate Change and the Ganga**

Climate change has emerged as a critical factor aggravating the challenges faced by the Ganga River. Rising temperatures have accelerated the melting of Himalayan glaciers, the river's primary source, leading to unpredictable flow patterns. Increased variability in monsoon rains has caused alternating cycles of floods and droughts, impacting agriculture and settlements along the riverbanks. International Water Management Institute (IWMI). (2015). Ganges women to bear the brunt of climate change. Narrating how climate change disproportionately affects women and vulnerable groups in the Ganges basin, emphasizing the need for gender-sensitive adaptation strategies. These climatic shifts pose a significant threat to the millions of people dependent on the Ganga for their livelihoods and spiritual practices. This background establishes the interconnectedness of the Ganga River with Indian society, underscoring the necessity of viewing its challenges through a sociological lens. It highlights the urgent need for sustainable strategies to address the compounded impacts of human activities and climate change on this iconic river system.

### **The Sociological Significance of the Ganga River**

#### *1. Cultural and Religious Dimensions*

The Ganga is central to Hindu rituals, including purification rites, cremations, and pilgrimages. The perception of the river as "Mother Ganga" influences societal behavior and its resistance to recognizing the environmental crisis.

#### *2. Economic Importance*

The river supports agriculture, fisheries, and industries. Livelihoods of millions are at risk due to diminishing water quality and quantity caused by climate change.

#### *3. Social Inequality*

Vulnerable groups, including marginalized communities and women, are disproportionately affected by the river's degradation. These communities lack resources to adapt, exacerbating existing inequalities.

### **Impacts of Climate Change on the Ganga River**

#### *1. Glacial Melt and Reduced Flow*

Himalayan glaciers, the source of the Ganga, are retreating due to rising temperatures. Seasonal variability in flow disrupts agricultural cycles and water availability.

## *2. Floods and Droughts*

Increased intensity of floods affects urban and rural settlements, leading to displacement. Drought conditions exacerbate water scarcity, impacting farming communities.

## *3. Water Pollution*

Rising temperatures lead to eutrophication and loss of aquatic biodiversity. Industrial waste, untreated sewage, and reduced dilution capacity worsen water quality.

## *4. Health Implications*

Polluted waters increase the incidence of waterborne diseases, disproportionately affecting poorer communities. The psychological burden of displacement and loss of livelihoods exacerbates mental health issues.

# **Adaptation and Mitigation Strategies**

## *1. Community-Based Approaches*

Empowering local communities to manage water resources sustainably. Involving women and marginalized groups in decision-making processes.

## *2. Policy Interventions*

Strengthening regulations to control industrial discharge and urban sewage. Implementing climate-resilient agricultural practices to reduce dependence on river water.

## *3. Cultural Engagement*

Leveraging the cultural reverence for the Ganga to promote awareness and conservation. Organizing mass campaigns and pilgrimages focused on ecological restoration.

## *4. Technological Innovations*

Deploying advanced wastewater treatment technologies. Monitoring river health using satellite imagery and artificial intelligence.

# **Research Methodology**

This study on the sociological implications of climate change on the Ganga River employs a qualitative research methodology. The approach is designed to explore the lived experiences, perceptions, and adaptive strategies of communities dependent on the river, as well as to examine broader sociocultural and institutional dynamics.

## **1. Research Design**

This study adopts an exploratory and descriptive research design to: Understand the

sociological significance of the Ganga River. Assess the impacts of climate change on its flow, quality, and ecosystem. Examine how affected communities adapt to these changes and the role of institutional responses.

## **2. Methods of Data Collection**

### **a. Primary Data**

#### **Interviews:**

Semi-structured interviews were conducted with key stakeholders, including: River-dependent communities (farmers, fishers, and boat operators). Religious leaders and practitioners conducting rituals along the river. Policy-makers, environmental activists, and NGOs involved in conservation and climate adaptation efforts.

#### **Focus Group Discussions (FGDs):**

FGDs were held with local community members in regions highly dependent on the Ganga, such as Haridwar, Varanasi, and rural areas of Uttarakhand. These discussions aimed to capture collective experiences and community-level perspectives on climate-induced changes and socio-economic impacts.

#### **Field Observations:**

Ethnographic observations were conducted along key locations of the Ganga to document cultural rituals, water usage practices, and visible ecological changes like pollution levels or reduced water flow.

### **b. Secondary Data**

Document Analysis: Government reports, research papers, and climate impact studies on the Ganga were analyzed. Specific documents reviewed include: Reports by the Central Pollution Control Board (CPCB) and the National Mission for Clean Ganga (NMCG). Studies on glacial retreat and hydrology of the Ganga basin. Socioeconomic data on communities along the river from census reports.

#### **Media Analysis:**

Articles, news reports, and documentaries were examined to understand public discourse and perceptions about the Ganga and climate change.

## **3. Sampling Techniques**

Purposive Sampling: Participants were selected based on their proximity to the river, dependence on its resources, or active involvement in related policies and conservation efforts.

**Sample Size:** 30 individual interviews.

5 focus group discussions (8–10 participants each). Observations in 2 major cities (Haridwar, Rishikesh) and 2 rural regions along the Ganga.

#### **4. Data Analysis**

##### **Thematic Analysis:**

Data collected from interviews, FGDs, and observations were analyzed thematically to identify recurring patterns and insights. Key themes included: Cultural and religious perceptions of the river. Socioeconomic impacts of climate change. Community adaptation strategies.

##### **Triangulation:**

Cross-validation was conducted by comparing data from different sources (interviews, secondary documents, and field observations) to ensure accuracy and reliability.

#### **5. Ethical Considerations**

**Informed Consent:** All participants were briefed about the purpose of the study and gave informed consent before participation.

*Confidentiality:* Anonymity of participants and sensitivity toward cultural and religious sentiments were strictly maintained. *Environmental Responsibility:* Efforts were made to minimize environmental disturbance during field observations and data collection activities.

#### **6. Limitations of the Study**

**Geographical Scope:** While the focus is on key locations along the Ganga, the vast size of the river basin may limit comprehensive coverage.

*Subjectivity:* Qualitative data relies on subjective interpretations, which may vary among researchers. By employing this methodology, the study aims to provide an in-depth sociological understanding of how climate change impacts the Ganga River and the communities that depend on it, highlighting avenues for sustainable adaptation and policy interventions.

#### **The Ganga river's dual significance—sociological and ecological—in the context of Uttarakhand.**

The Ganga River, known as the Bhagirathi in its early course in Uttarakhand, is a vital natural and cultural asset for the state. As one of the most sacred rivers in the world, its origins at Gaumukh glacier in the Gangotri region symbolize purity and spiritual connection for millions. Uttarakhand, often referred to as Devbhoomi (Land of Gods), is not only a critical ecological zone but also a hub for religious and cultural activities centered around the Ganga. Nicholas Institute for Environmental Policy Solutions. (2011). Freshwater, Climate Change and Adaptation in the Ganges River Basin. Evaluating the impact of changing water availability on agriculture, ecosystems, and energy sectors in the Ganges basin, offering insights into the socio-economic

challenges posed by climate change. This section explores the river's dual significance—sociological and ecological—in the context of Uttarakhand. Whitehead, P. G., Jin, L., Sarkar, S., Futter, M. N., Caesar, J., & Sinha, R. (2015). Assessing the impacts of climate change and socio-economic changes on flow and phosphorus flux in the Ganga river system. *Environmental Science: Processes & Impacts*, 17(6), 1098-1110. This study examines how climate and socio-economic changes influence river flow and phosphorus levels, with implications for water quality management and societal health.

## **Sociological Importance of the Ganga in Uttarakhand**

### **1. Religious and Cultural Significance**

The Ganga is considered the holiest river in Hinduism, and Uttarakhand is home to important pilgrimage sites such as Gangotri, Haridwar, and Rishikesh. Pilgrims from across India and the world visit these locations to participate in rituals, such as the Ganga Aarti and immersion of ashes, believing it leads to spiritual purification. The Char Dham Yatra, which includes Gangotri, significantly contributes to the state's cultural and economic vitality.

### **2. Tourism and Economy**

The Ganga supports a thriving religious tourism industry, providing employment to thousands of people in Uttarakhand. Activities such as rafting in Rishikesh and eco-tourism based on the river attract domestic and international tourists, boosting the local economy.

### **3. Livelihood and Social Identity**

The river sustains communities dependent on agriculture and fishing, particularly in rural areas. The Ganga is integral to the cultural identity of Uttarakhand's residents, reinforcing traditional practices and community cohesion.

### **4. Social Challenges and Inequalities**

Unequal access to clean water from the Ganga exacerbates social and economic inequalities, particularly for marginalized communities in remote areas. Displacement caused by hydropower projects and flood risks disproportionately affects vulnerable populations. Wageningen University. (2010). *Water Resources of the Ganga Basin under a Changing Climate*. This study hypothesizes how climate change may affect water resources in the Ganga basin, with discussions on potential socio-economic consequences and adaptation strategies.

## **Ecological Importance of the Ganga in Uttarakhand**

### **1. Source of Freshwater**

The Ganga originates from the Himalayan glaciers, supplying freshwater to ecosystems and millions of people downstream. It plays a critical role in replenishing groundwater and sustaining riverine biodiversity.

## **2. Biodiversity and Ecosystem Services**

The upper reaches of the Ganga in Uttarakhand support unique Himalayan flora and fauna, including fish species and migratory birds. The river's ecosystem services, such as soil fertility, water purification, and flood regulation, are essential for agricultural and ecological sustainability.

## **3. Climate Regulation**

The glaciers feeding the Ganga act as natural water reservoirs, regulating flow and maintaining ecological balance. Forests along the river, including parts of the Rajaji National Park and Corbett National Park, help mitigate climate change impacts by absorbing carbon dioxide. Phys.org. (2021). Effects of climate change and anthropogenic activities on the Ganga basin. This article discusses how human activities and climate change are impacting the Ganga basin, with a focus on environmental and societal consequences.

## **4. Threats and Conservation Challenges**

Glacial retreat due to climate change poses a significant threat to the river's flow, directly impacting biodiversity and dependent communities. Hydropower projects in Uttarakhand have altered the river's natural course, disrupting habitats and increasing landslide risks. Pollution from religious activities, untreated sewage, and tourism is degrading water quality, harming aquatic life and ecosystems. World Bank. (2015). Implications of climate change for water resources development in the Ganges basin. This report provides a basin-wide assessment of potential climate change impacts on the hydrology and water resources of the Ganges system, discussing implications for regional development and societal well-being.

## **The Contributions of Pushkar Singh Dhami**

Pushkar Singh Dhami, the Chief Minister of Uttarakhand since July 2021, has played a pivotal role in steering the state's development and governance. As the youngest chief minister of Uttarakhand, Dhami's leadership reflects a focus on youth-centric policies, sustainable development, and administrative efficiency. Below are some of his significant contributions:

### **Disaster Management and Infrastructure Development**

**Efforts in Disaster Preparedness:** Dhami's tenure has seen an emphasis on improving disaster management systems, particularly given Uttarakhand's vulnerability to floods, landslides, and earthquakes. **Reconstruction of Kedarnath and Char Dham Infrastructure:** He has overseen ongoing projects aimed at enhancing infrastructure for pilgrims while maintaining environmental sustainability.

### **Environmental Conservation**

**Sustainable Development:** Under his leadership, policies balancing ecological preservation with



development have been promoted, including afforestation drives and waste management projects. Climate Resilience: Dhami has emphasized the importance of renewable energy and reducing the state's carbon footprint, especially given the region's dependence on natural resources.

**Conclusive Argument:** Pushkar Singh Dhami's leadership is characterized by a focus on youth, sustainable development, and religious tourism. While his tenure has faced challenges like natural disasters and post-pandemic recovery, his policies aim to address these issues while fostering growth and preserving Uttarakhand's unique cultural and ecological heritage. His contributions lay the groundwork for a more resilient and prosperous Uttarakhand.

### **The Road Ahead: Pushkar Singh Dhami's Vision for Uttarakhand**

As Uttarakhand faces unique challenges and opportunities, the road ahead under Pushkar Singh Dhami's leadership must focus on balancing economic growth, environmental sustainability, and social equity. Here are the key areas for future development:

#### **Enhancing Disaster Resilience**

**Climate Change Adaptation:** Strengthening early warning systems, disaster response mechanisms, and community awareness campaigns is critical in a state prone to natural disasters.

**Eco-Sensitive Infrastructure:** Promoting sustainable infrastructure development in disaster-prone areas to minimize environmental degradation and human displacement.

#### **Environmental Sustainability**

**Renewable Energy Expansion:** Increasing the capacity for solar, wind, and hydroelectric power while mitigating ecological impacts.

**Forest Conservation:** Implementing afforestation programs and community-led forest management to preserve biodiversity.

**Conclusive Argument:** The road ahead for Pushkar Singh Dhami and his administration lies in fostering inclusive development while addressing the dual challenges of climate change and economic growth. By focusing on disaster resilience, sustainable tourism, digital transformation, and equitable policies, Dhami's leadership has the potential to shape Uttarakhand into a model state that harmonizes tradition with modernity, growth with sustainability, and equity with prosperity.

The Ganga River, as a lifeline for millions, embodies profound sociological, ecological, and cultural significance, particularly in the context of Uttarakhand. However, the growing challenges of climate change have placed this vital river system at significant risk. Through a sociological lens, the interplay of climate change with socio-economic structures, cultural practices, and

policy interventions reveals complex dynamics that necessitate urgent attention. Climate change exacerbates existing vulnerabilities in the Ganga basin by altering hydrological patterns, increasing the frequency of extreme weather events, and disrupting agricultural and livelihood systems. These impacts disproportionately affect marginalized communities, including women, indigenous groups, and economically disadvantaged populations. International Water Management Institute (IWMI). (2015). *A Framework to Understand Gender and Structural Vulnerability to Climate Change in the Ganges River Basin*. The paper presents a framework for understanding vulnerability to climate change in the Ganges River Basin, focusing on gender and structural inequalities that exacerbate societal impacts. At the same time, the cultural and spiritual sanctity of the river is threatened, as environmental degradation compromises its symbolic and ritualistic importance.

## **Conclusion**

The Ganga River is more than a water resource; it is a lifeline with profound sociological implications. Climate change exacerbates vulnerabilities among communities reliant on the river, threatening livelihoods, traditions, and health. Addressing these challenges requires a multidisciplinary approach that integrates sociological insights with environmental and policy measures. By fostering collective responsibility and inclusive solutions, the sacred and life-sustaining Ganga can be preserved for future generations. The role of governance and policy-making becomes critical in this context. While initiatives like the Namami Gange Program and climate adaptation strategies aim to address these challenges, their effectiveness depends on robust implementation and community participation. Sustainable solutions must integrate sociological insights, fostering a holistic approach that combines ecological restoration with socio-economic resilience. In conclusion, the future of the Ganga River amidst climate change lies in adopting inclusive, community-driven, and scientifically informed strategies. By addressing socio-economic inequities, empowering local communities, and emphasizing ecological conservation, stakeholders can ensure that the Ganga continues to sustain life, culture, and spirituality in the region. This research underscores the urgent need for interdisciplinary approaches to safeguard the river's vitality, recognizing it as both an ecological entity and a cornerstone of societal well-being.

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