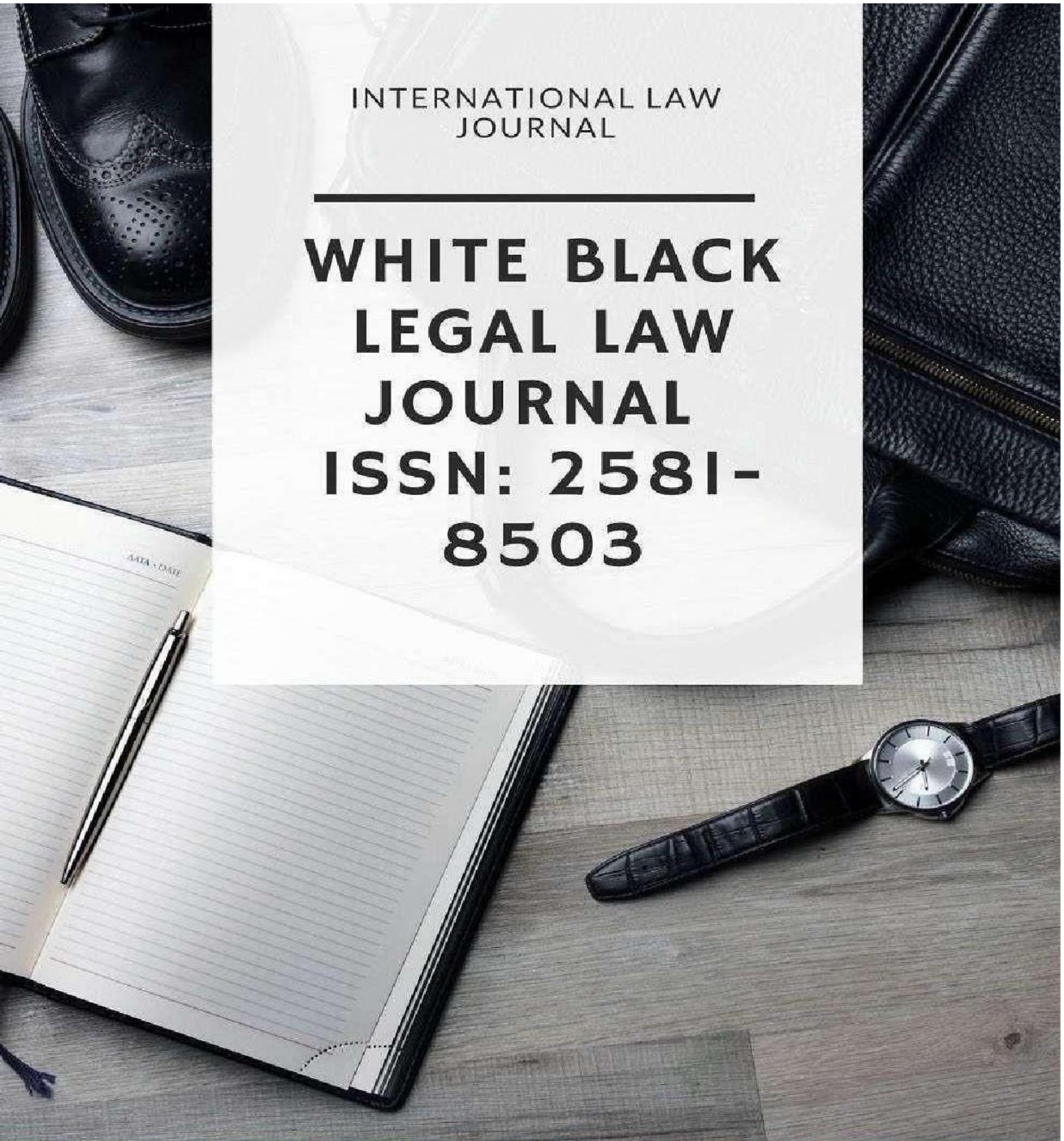




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CLIMATE CHANGE AND TRANSBOUNDARY RIVER GOVERNANCE IN SOUTH ASIA: REASSESSING THE PRINCIPLES OF EQUITABLE UTILIZATION AND SUSTAINABLE DEVELOPMENT UNDER INTERNATIONAL WATER LAW.

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ABSTRACT

The governance of transboundary river systems has become increasingly complex in the era of climate change. South Asia, home to some of the world's largest international river basins, faces growing challenges relating to water security, environmental sustainability, hydropower development, and interstate cooperation. The Indus, Ganges, and Brahmaputra River systems support nearly one-fourth of the global population and play a crucial role in regional economic development, agriculture, energy production, and ecosystem preservation. However, changing climatic conditions have significantly altered hydrological patterns, resulting in glacier retreat, extreme weather events, changing precipitation patterns, and increasing uncertainty regarding future water availability.

Existing treaty frameworks governing shared water resources in South Asia were negotiated during periods when climate change was not recognized as a major threat to water governance. Consequently, many of these agreements focus primarily on water allocation and utilization while providing limited guidance on environmental sustainability, climate adaptation, and integrated river basin management.

This article critically examines the adequacy of existing transboundary water governance mechanisms in South Asia through the lens of contemporary international water law. It analyses the principles of equitable and reasonable utilization, prevention of significant harm,

cooperation, environmental protection, and sustainable development. Particular emphasis is placed on the Indus Waters Treaty between India and Pakistan, the Ganges Water Sharing Treaty between India and Bangladesh, and India-Nepal water agreements.

The article argues that climate change has fundamentally transformed the legal and policy context within which these treaties operate. Traditional allocation-based frameworks are increasingly inadequate for addressing climate-induced challenges. The article concludes that effective transboundary water governance in South Asia requires adaptive treaty implementation, strengthened institutional cooperation, enhanced scientific collaboration, climate-resilient water management strategies, and integration of sustainable development principles into future governance arrangements.¹

Keywords: *Climate Change, International Water Law, Transboundary Rivers, Sustainable Development, South Asia, Indus Waters Treaty, Ganges Treaty.*

1. INTRODUCTION

Freshwater resources are among the most important natural resources for human survival and sustainable development. Water is essential for agriculture, industrial production, hydropower generation, ecosystem preservation, public health, and economic growth. As global populations continue to increase and climate change intensifies pressure on freshwater resources, the governance of shared watercourses has become a critical issue in international relations and international law.²

Transboundary river basins cover approximately half of the Earth's land surface and account for nearly sixty percent of global freshwater flows.³ These river systems frequently cross-national boundaries and are shared by multiple States, creating complex legal and political challenges relating to allocation, utilization, management, and environmental protection.

South Asia presents one of the most significant examples of transboundary water dependence in the world. The region contains several major international river systems, including the Indus, Ganges, and Brahmaputra basins. These river systems support hundreds of millions of people and form the foundation of agricultural productivity, food security, and economic development throughout the region.⁴

¹ U.N. Sustainable Development Goals, G.A. Res. 70/1, U.N. Doc. A/RES/70/1 (2015).

² Philippe Sands et al., *Principles of International Environmental Law* (4th ed. 2018).

³ United Nations Water, *Transboundary Waters Facts and Figures*.

⁴ Salman M.A. Salman & Kishor Uprety, *Conflict and Cooperation on South Asia's International Rivers* (2002).

Historically, disputes concerning shared rivers have often generated tensions among South Asian States. Water allocation, hydropower development, flood management, and irrigation projects have frequently become subjects of diplomatic disagreement. In response, States have adopted various treaty frameworks designed to regulate the use and management of shared water resources.

The Indus Waters Treaty of 1960, the Ganges Water Sharing Treaty of 1996, and the Mahakali Treaty of 1996 represent important examples of regional cooperation concerning transboundary rivers. These agreements have contributed significantly to regional stability and conflict prevention. Nevertheless, they were negotiated during periods when environmental concerns and climate change received comparatively limited attention within international law.⁵

The emergence of climate change has transformed the context in which these agreements operate. Scientific evidence indicates that rising temperatures are accelerating glacier retreat in the Himalayan region, altering river flow patterns, increasing the frequency of floods and droughts, and creating uncertainty regarding future water availability.⁶

These developments raise important legal questions. Are existing treaty frameworks capable of addressing climate-induced changes? Do contemporary principles of international water law provide sufficient guidance for adaptive governance? How can States reconcile developmental objectives with environmental sustainability?

This article seeks to address these questions by critically examining transboundary river governance in South Asia. It evaluates existing legal frameworks against contemporary principles of international water law and explores pathways for strengthening climate resilience and sustainable development within shared river basins.

2. PRINCIPLES OF INTERNATIONAL WATER LAW

The development of international water law has been shaped by treaty practice, customary international law, judicial decisions, and scholarly contributions. Contemporary water governance is guided by several fundamental principles that seek to balance sovereign rights, developmental needs, and environmental protection.

A. Principle of Equitable and Reasonable Utilization

The principle of equitable and reasonable utilization is widely regarded as the cornerstone of

⁵ Stephen C. McCaffrey, *The Law of International Watercourses* (3d ed. 2019).

⁶ IPCC, *Climate Change 2023: Synthesis Report* (2023).

modern international water law. It requires States sharing an international watercourse to utilize water resources in a manner that is equitable, reasonable, and sustainable.

Unlike absolute territorial sovereignty, which allows unrestricted utilization of resources within a state's territory, equitable utilization recognizes the interconnected nature of shared water systems and requires consideration of the interests of co-riparian States.

Article 5 of the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses provides that watercourse States shall utilize an international watercourse equitably and reasonably.⁷

Article 6 identifies several factors relevant to determining equitable utilization, including:

- Geographic and hydrological characteristics;
- Social and economic needs;
- Population dependence;
- Existing and potential uses;
- Availability of alternatives;
- Environmental considerations.

The principle does not require equal allocation of water but rather seeks a fair balance between competing interests.

B. Obligation Not to Cause Significant Harm

Closely related to equitable utilization is the obligation not to cause significant transboundary harm. Under this principle, States must exercise due diligence to prevent activities within their jurisdiction from causing significant adverse effects in other States.

The principle has been recognized in numerous international instruments and judicial decisions. It serves as an important limitation on the exercise of sovereign rights and promotes responsible resource management.

In the context of international rivers, the principle is particularly relevant to activities such as:

- Dam construction;
- Water diversion;
- Industrial pollution;
- Hydropower development;
- Large-scale irrigation projects.

⁷ Convention on the Law of the Non-Navigational Uses of International Watercourses, arts. 5–6, May 21, 1997, 36 I.L.M. 700.

The challenge lies in balancing developmental needs with obligations to prevent adverse impacts on co-riparian States.

C. Duty to Cooperate

Cooperation is a fundamental requirement of effective transboundary water governance. International watercourses cannot be managed effectively through unilateral action alone. Consequently, international law imposes a duty upon States to cooperate in good faith concerning the management and protection of shared water resources.

Cooperation may take various forms, including:

- Information exchange;
- Joint monitoring;
- Environmental impact assessment;
- Prior notification of planned measures;
- Institutional arrangements.

The duty to cooperate promotes transparency, trust, and peaceful dispute resolution.

D. Sustainable Development

The principle of sustainable development occupies a central position in contemporary environmental governance. Sustainable development seeks to reconcile economic development with environmental protection and social welfare.

The concept gained international prominence through the Brundtland Report and was subsequently incorporated into numerous international agreements.

Within the context of water governance, sustainable development requires:

- Efficient resource utilization;
- Environmental conservation;
- Protection of future generations;
- Climate resilience;
- Integrated planning.

The principle is particularly important in regions facing increasing environmental stress and resource scarcity.

E. Environmental Protection and Ecosystem Preservation

Modern international water law increasingly recognizes the importance of environmental protection and ecosystem preservation. Rivers are not merely economic resources; they are

complex ecological systems supporting biodiversity, fisheries, wetlands, and other environmental functions.

Consequently, contemporary governance frameworks emphasize:

- Environmental flow requirements;
- Pollution control;
- Biodiversity conservation;
- Ecosystem restoration;
- Precautionary approaches.

The integration of environmental considerations represents one of the most significant developments in international water law during recent decades.

3. CLIMATE CHANGE AND TRANSBOUNDARY WATERCOURSES

Climate change has emerged as one of the most significant challenges confronting international water governance in the twenty-first century. Scientific evidence demonstrates that global temperatures are rising at unprecedented rates, resulting in substantial changes in hydrological cycles, precipitation patterns, glacier dynamics, and river flows. These developments have profound implications for transboundary river systems, particularly in regions characterized by high population densities and dependence upon shared water resources.⁸

South Asia is considered one of the world's most climate-vulnerable regions. The Himalayan Mountain system, often referred to as the "Water Tower of Asia" or the "Third Pole," contains vast freshwater reserves that sustain major river systems including the Indus, Ganges, and Brahmaputra. These rivers provide water for agriculture, industry, hydropower generation, fisheries, and domestic consumption across several countries.⁹

The Intergovernmental Panel on Climate Change (IPCC) has warned that rising temperatures are accelerating glacier retreat throughout the Himalayan region. While increased glacial melting may temporarily enhance river flows, continued glacier loss is expected to reduce long-term water availability and increase seasonal variability.

Climate change also contributes to more frequent and intense extreme weather events. South Asia has witnessed devastating floods, prolonged droughts, irregular monsoons, and changing

⁸ IPCC, *Climate Change 2023: Synthesis Report* (2023).

⁹ International Centre for Integrated Mountain Development (ICIMOD), *The Hindu Kush Himalaya Assessment* (2019).

precipitation patterns. These developments directly affect water security and create challenges for existing treaty frameworks that were designed under relatively stable climatic conditions.¹⁰ One of the most important legal implications of climate change is the increasing inadequacy of fixed allocation arrangements. Traditional water-sharing agreements often rely upon historical hydrological data and assumptions regarding river flows. However, climate-induced changes may render these assumptions unreliable, necessitating more flexible and adaptive governance mechanisms.

Furthermore, climate change intensifies competition among water users. Agriculture, urban development, energy production, and environmental conservation increasingly compete for limited water resources. This competition creates risks of interstate disputes and highlights the importance of cooperative governance frameworks.

International water law is gradually responding to these challenges through the development of adaptive governance principles emphasizing resilience, cooperation, environmental sustainability, and integrated water resources management. Nevertheless, implementation remains uneven across different regions and treaty regimes.¹¹

The South Asian experience illustrates both the strengths and limitations of existing transboundary water governance arrangements. While treaties have contributed significantly to regional stability, climate change necessitates a re-evaluation of legal and institutional mechanisms to ensure long-term sustainability and water security.

4. THE INDUS WATERS TREATY: A MODEL OF COOPERATION UNDER STRESS

The Indus Waters Treaty (IWT), signed on 19 September 1960 between India and Pakistan under the auspices of the World Bank, remains one of the most influential transboundary water agreements in international law.¹² Despite multiple wars and prolonged political tensions between the two States, the Treaty has survived for more than six decades and is frequently cited as a successful example of international water cooperation.

A. Historical Background

The origins of the Treaty can be traced to the partition of British India in 1947. The partition divided the Indus Basin between India and Pakistan without establishing a comprehensive

¹⁰ United Nations Environment Programme, *Freshwater Ecosystems and Climate Change* (2021).

¹¹ Berlin Rules on Water Resources, Int'l Law Ass'n (2004).

¹² Indus Waters Treaty, India-Pak., Sept. 19, 1960, 419 U.N.T.S. 125.

framework for managing shared water resources. As a result, significant irrigation infrastructure remained under Indian control while much of the irrigated agricultural land became part of Pakistan.¹³

Tensions emerged almost immediately. The temporary suspension of water supplies in 1948 highlighted the vulnerability of downstream users and underscored the need for a permanent agreement.

After nearly a decade of negotiations facilitated by the World Bank, India and Pakistan concluded the Indus Waters Treaty in 1960. The Treaty allocated the Eastern Rivers (Ravi, Beas, and Sutlej) to India and the Western Rivers (Indus, Jhelum, and Chenab) primarily to Pakistan.

This allocation-based approach represented a unique solution to a complex transboundary dispute.

B. Institutional Framework

The Treaty established the Permanent Indus Commission (PIC), consisting of one commissioner appointed by each State.

The Commission performs several important functions:

- Exchange of hydrological data;
- Inspection of projects;
- Technical consultations;
- Annual reporting;
- Resolution of routine issues.

The PIC represents one of the most enduring institutional mechanisms in international water governance and has continued to function despite political tensions.

C. Climate Change and the Indus Basin

The Indus Basin is highly dependent upon glacier and snowmelt originating in the Himalayas and the Karakoram ranges. Consequently, climate change poses a significant threat to the basin's long-term sustainability.

Scientific assessments indicate:

- Rising temperatures;
- Accelerated glacier retreat;

¹³ Daniel Haines, *Rivers Divided: Indus Basin Waters in the Making of India and Pakistan* (2017).

- Increased frequency of floods;
- Greater hydrological variability;
- Potential future reductions in water availability.

These developments were not anticipated when the Treaty was negotiated. As a result, the Treaty contains no explicit provisions concerning:

- Climate adaptation;
- Environmental sustainability;
- Ecosystem protection;
- Groundwater management;
- Disaster risk reduction.

This omission has generated growing concern among scholars and policymakers regarding the Treaty's capacity to address contemporary challenges.

D. Hydropower Development and Emerging Disputes

India's increasing demand for renewable energy has encouraged the development of hydropower projects on the Western Rivers. Although the Treaty permits certain forms of run-of-river hydroelectric development, disagreements frequently arise concerning project design and operation.

The most prominent disputes involve:

1. Kishanganga Hydroelectric Project

The Kishanganga Project involves the diversion of water from the Kishanganga (Neelum) River for hydropower generation. Pakistan challenged the project before a Court of Arbitration established under the Treaty.¹⁴

In its Final Award, the Court recognized India's right to undertake the project while requiring maintenance of minimum environmental flows.

The decision is particularly significant because it introduced environmental considerations into the interpretation of the Treaty.

2. Ratle Hydroelectric Project

The Ratle Project on the Chenab River has generated further disagreements regarding spillway design, pondage capacity, and operational flexibility.

Pakistan argues that certain design features may affect downstream water availability, while India maintains that the project fully complies with Treaty requirements.

¹⁴ Kishenganga Arbitration (Pak. v. India), PCA Case No. 2011-01.

These disputes illustrate the increasing complexity of balancing water allocation, environmental protection, and energy development.

E. India's 2023 and 2025 Notices for Treaty Modification

One of the most significant recent developments concerns India's notices seeking review and modification of the Treaty. India has argued that contemporary circumstances—including climate change, demographic pressures, technological developments, and procedural concerns regarding dispute resolution—necessitate reconsideration of certain aspects of the Treaty's implementation.

India has particularly emphasized concerns regarding parallel proceedings involving Neutral Experts and Courts of Arbitration. According to India's position, the Treaty requires modernization to ensure efficiency and effectiveness in dispute resolution.

These developments raise important questions under international treaty law concerning treaty adaptation, interpretation, modification, and the principle of fundamental change of circumstances (*rebus sic stantibus*).¹⁵

The future trajectory of the Treaty may therefore depend upon the ability of both States to reconcile traditional allocation arrangements with contemporary environmental and developmental realities.

5. THE GANGES WATER SHARING TREATY: COOPERATION, CHALLENGES, AND CLIMATE RESILIENCE

The Ganges River is one of the most significant transboundary river systems in South Asia. Originating in the Himalayas and flowing through India and Bangladesh before entering the Bay of Bengal, the river sustains millions of people and supports agriculture, fisheries, transportation, industry, and ecosystem services.¹⁶

Historically, disputes between India and Bangladesh concerning the Ganges River centered on the operation of the Farakka Barrage, constructed by India primarily to improve the navigability of the Kolkata Port. Bangladesh expressed concerns that upstream diversion of water during the dry season adversely affected downstream river flows, agriculture, fisheries, and environmental conditions.¹⁷

Following decades of negotiations and interim arrangements, India and Bangladesh concluded

¹⁵ Vienna Convention on the Law of Treaties arts. 39, 62, May 23, 1969, 1155 U.N.T.S. 331.

¹⁶ Treaty Between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on Sharing of the Ganga/Ganges Waters at Farakka, Dec. 12, 1996.

¹⁷ Salman M.A. Salman & Kishor Uprety, *Conflict and Cooperation on South Asia's International Rivers* (2002).

the Ganges Water Sharing Treaty on 12 December 1996. The Treaty established a formula for sharing dry-season flows measured at Farakka and represented a major achievement in regional water diplomacy.

A. Key Features of the Treaty

The Treaty provides a framework for allocating water during the critical dry season while promoting cooperation between the two States. Important features include:

- Allocation of dry-season flows based on predetermined formulas;
- Joint monitoring of river flows;
- Information exchange;
- Consultation mechanisms for dispute resolution.

Unlike the Indus Waters Treaty, which allocates entire rivers, the Ganges Treaty focuses primarily on seasonal flow sharing.

The Treaty contributed significantly to reducing tensions and enhancing bilateral cooperation. It demonstrated that negotiated solutions are possible even in politically sensitive contexts involving scarce water resources.

B. Climate Change and the Ganges Basin

Climate change presents substantial challenges to the implementation of the Treaty. The Ganges Basin is highly dependent upon Himalayan snowmelt, monsoon rainfall, and seasonal hydrological cycles.

Scientific studies indicate that climate change may alter:

- Timing of river flows;
- Monsoon intensity;
- Frequency of floods;
- Occurrence of droughts;
- Groundwater recharge patterns.

These changes create uncertainty regarding future water availability and may complicate the implementation of fixed allocation arrangements.

One of the principal limitations of the Treaty is its reliance upon historical hydrological assumptions. Climate-induced variability may require more flexible and adaptive management approaches capable of responding to changing environmental conditions.

C. Environmental Considerations

Environmental sustainability has become an increasingly important component of transboundary river governance. Reduced river flows can adversely affect:

- Wetlands;
- Fisheries;
- Biodiversity;
- Delta ecosystems;
- Livelihoods of local communities.

Contemporary international water law emphasizes environmental flow requirements designed to preserve ecological integrity.

Future cooperation between India and Bangladesh may therefore benefit from integrating ecosystem protection, climate adaptation, and sustainable development considerations into Treaty implementation.

D. Prospects for Future Cooperation

The experience of the Ganges Water Sharing Treaty demonstrates the importance of cooperation and dialogue in managing shared water resources.

Future reforms may include:

- Real-time hydrological data sharing;
- Joint climate adaptation programs;
- Basin-wide environmental assessments;
- Collaborative scientific research;
- Enhanced institutional mechanisms.

Such measures would strengthen resilience while promoting long-term water security and sustainable development throughout the basin.

6. INDIA–NEPAL WATER AGREEMENTS: TOWARDS INTEGRATED BASIN MANAGEMENT

India and Nepal share several important transboundary river systems originating in the Himalayan region. These rivers possess significant potential for irrigation, hydropower generation, flood control, and regional development. Consequently, water cooperation has occupied a central place in bilateral relations between the two countries.¹⁸

¹⁸ Surya P. Subedi, *Dynamics of Foreign Policy and Law: A Study of Indo-Nepal Relations* (2005).

Several agreements have been concluded over the past decades to facilitate cooperative management of shared water resources.

A. The Koshi Agreement (1954)

The Koshi River has historically been associated with severe flooding and river course changes, resulting in significant socio-economic impacts in both India and Nepal. To address these challenges, the two countries concluded the Koshi Agreement in 1954.

The Agreement sought to:

- Control flooding;
- Facilitate irrigation;
- Promote regional development;
- Construct and manage the Koshi Barrage.

While the Agreement generated substantial benefits, it has also attracted criticism concerning issues of sovereignty, benefit sharing, and local participation.

B. The Gandak Agreement (1959)

The Gandak Agreement was concluded to facilitate irrigation and water resource development within the Gandak Basin.

The Agreement provides for:

- Construction of irrigation infrastructure;
- Water diversion projects;
- Cooperative management mechanisms.

Although the Agreement contributed to agricultural development, debates concerning equitable distribution of benefits have persisted.

C. The Mahakali Treaty (1996)

The Mahakali Treaty represents one of the most significant water agreements between India and Nepal. Signed in 1996, the Treaty adopts a more integrated approach to river basin management and recognizes principles of mutual benefit and equal entitlement.

The Treaty addresses:

- Hydropower generation;
- Irrigation;
- Water allocation;
- Integrated development of the Mahakali River.

Compared with earlier agreements, the Mahakali Treaty reflects a more modern approach to transboundary water governance.

D. Climate Change and Shared Himalayan Rivers

Climate change poses significant challenges to India-Nepal water cooperation. Himalayan river systems are particularly vulnerable to:

- Glacier retreat;
- Glacial lake outburst floods (GLOFs);
- Extreme rainfall events;
- Altered river flow patterns;
- Landslides and sedimentation.

Scientific evidence indicates that many Himalayan glaciers are retreating at accelerated rates, threatening long-term water availability and increasing disaster risks.¹⁹

Because both countries depend upon these rivers for economic development and environmental sustainability, climate adaptation has become a critical governance priority.

E. Opportunities for Enhanced Cooperation

Future cooperation between India and Nepal should focus on integrated basin management and climate resilience.

Priority areas include:

- Joint scientific research;
- Flood forecasting systems;
- Climate adaptation planning;
- Hydropower cooperation;
- Disaster risk reduction;
- Environmental conservation.

Integrated governance approaches can facilitate sustainable utilization while ensuring that benefits are shared equitably among stakeholders.

The India-Nepal experience demonstrates that transboundary water cooperation must evolve beyond simple allocation arrangements and embrace broader objectives relating to sustainability, climate resilience, and regional development.

¹⁹ ICIMOD, *The Hindu Kush Himalaya Assessment* (2019).

7. SUSTAINABLE DEVELOPMENT AND THE FUTURE OF TRANSBOUNDARY WATER GOVERNANCE

The concept of sustainable development has become a central principle of contemporary international law and environmental governance. Since the publication of the Brundtland Report in 1987 and the adoption of the Rio Declaration in 1992, sustainable development has increasingly influenced the interpretation and implementation of international agreements concerning natural resources and environmental protection.²⁰

Sustainable development requires balancing economic growth, environmental protection, and social welfare. Within the context of transboundary river governance, this principle seeks to ensure that water resources are utilized efficiently and equitably while preserving ecological integrity for present and future generations.²¹

South Asia faces unique challenges in achieving sustainable water governance. Rapid population growth, urbanization, industrialization, and climate change have intensified pressure on shared water resources. Simultaneously, increasing demand for food, energy, and infrastructure has created competing claims over water utilization.

The Sustainable Development Goals (SDGs), particularly Goal 6 (Clean Water and Sanitation), Goal 7 (Affordable and Clean Energy), Goal 13 (Climate Action), Goal 16 (Peace, Justice and Strong Institutions), and Goal 17 (Partnerships for the Goals), provide an important framework for addressing these challenges.²²

Effective transboundary water governance contributes directly to achieving these objectives by promoting cooperation, reducing conflict, supporting renewable energy development, and enhancing climate resilience.

A. Water-Energy Nexus

One of the most important contemporary issues in river governance is the relationship between water and energy resources. Hydropower projects depend upon reliable river flows, while water management infrastructure often requires substantial energy inputs.

The Indus, Ganges, and Himalayan River systems possess significant hydropower potential. Consequently, water governance decisions increasingly influence regional energy security and sustainable development strategies.

However, hydropower development can generate disputes concerning:

²⁰ Report of the World Commission on Environment and Development, *Our Common Future* (1987).

²¹ Rio Declaration on Environment and Development, Principle 4, U.N. Doc. A/CONF.151/26 (1992).

²² Transforming Our World: The 2030 Agenda for Sustainable Development, G.A. Res. 70/1 (2015).

- Water allocation;
- Environmental impacts;
- Downstream flows;
- Community displacement;
- Ecosystem degradation.

Sustainable governance therefore requires balancing energy development objectives with environmental protection and interstate cooperation.

B. Integrated Water Resources Management

Integrated Water Resources Management (IWRM) has emerged as a preferred framework for sustainable water governance. IWRM emphasizes coordinated development and management of water, land, and related resources to maximize social and economic welfare without compromising environmental sustainability.²³

The approach encourages:

- Basin-wide planning;
- Stakeholder participation;
- Ecosystem protection;
- Climate adaptation;
- Intersectoral coordination.

Several international organizations have recommended adoption of IWRM principles within South Asian River basins.

8. COMPARATIVE PERSPECTIVES FROM INTERNATIONAL RIVER BASINS

Comparative analysis provides valuable insights into alternative approaches to transboundary water governance. Several international river basin regimes have adopted innovative institutional and legal mechanisms that may inform future reforms in South Asia.

A. The Mekong River Basin

The Mekong River Agreement of 1995 established a framework for cooperation among Cambodia, Laos, Thailand, and Vietnam.²⁴

²³ Global Water Partnership, *Integrated Water Resources Management Framework* (2000).

²⁴ Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, Apr. 5, 1995.

The Agreement emphasizes:

- Joint basin planning;
- Environmental protection;
- Information sharing;
- Sustainable development;
- Cooperative decision-making.

Unlike many traditional water-sharing agreements, the Mekong framework adopts an integrated river basin approach that recognizes ecological interdependence.

B. The Danube River Protection Convention

The Danube River Basin represents one of the most sophisticated examples of transboundary environmental governance.²⁵

The Convention establishes mechanisms for:

- Pollution control;
- Ecosystem restoration;
- Joint monitoring;
- Scientific cooperation;
- Climate adaptation.

Environmental sustainability occupies a central role within the Danube governance framework.

C. The Senegal River Basin Organization

The Senegal River Basin Organization (OMVS) is frequently cited as a model of cooperative river management.

Key features include:

- Joint ownership of infrastructure;
- Shared benefits;
- Integrated development planning;
- Collective decision-making.

The Senegal experience demonstrates that cooperative management can generate benefits exceeding those achievable through unilateral action.

²⁵ Convention on Cooperation for the Protection and Sustainable Use of the River Danube, June 29, 1994.

D. Lessons for South Asia

Comparative experience suggests several lessons for South Asian River governance:

- Strengthening basin-wide institutions;
- Enhancing environmental cooperation;
- Expanding scientific collaboration;
- Improving data-sharing mechanisms;
- Integrating climate adaptation into treaty implementation.

These lessons may contribute to more resilient and sustainable governance arrangements.

9. RECOMMENDATIONS FOR STRENGTHENING TRANSBOUNDARY WATER GOVERNANCE

The analysis conducted in this article demonstrates that existing treaty frameworks have contributed significantly to regional stability but require modernization to address contemporary challenges.

Several reforms should be considered.

A. Climate Adaptation Mechanisms

Future treaty implementation should incorporate explicit climate adaptation measures, including:

- Joint climate assessments;
- Glacier monitoring programs;
- Drought management strategies;
- Flood forecasting systems;
- Emergency response mechanisms.

B. Enhanced Data Sharing

Timely and accurate information is essential for effective water governance.

States should establish:

- Real-time hydrological monitoring systems;
- Shared databases;
- Satellite-based observation programs;
- Joint scientific research initiatives.

Improved transparency can strengthen trust and facilitate cooperative decision-making.

C. Environmental Protection Measures

Future governance frameworks should incorporate:

- Environmental impact assessments;
- Minimum environmental flow requirements;
- Biodiversity conservation measures;
- Ecosystem restoration programs.

Environmental sustainability should become a core objective of treaty implementation.

D. Institutional Strengthening

Existing institutions such as the Permanent Indus Commission should be strengthened through:

- Expanded technical expertise;
- Climate specialists;
- Environmental scientists;
- Independent advisory mechanisms.

Enhanced institutional capacity will improve responsiveness to emerging challenges.

E. Dispute Resolution Reform

Dispute resolution mechanisms should be clarified and modernized to ensure efficiency, predictability, and legal certainty.

Greater emphasis should be placed upon:

- Preventive diplomacy;
- Technical consultations;
- Mediation;
- Scientific review mechanisms.

Such reforms may reduce the likelihood of prolonged disputes.

10.CONCLUSION

Climate change has fundamentally transformed the governance of transboundary rivers throughout South Asia. The Indus, Ganges, and Himalayan River systems remain indispensable for regional water security, agricultural productivity, energy generation, and sustainable development. However, these river systems are increasingly affected by glacier retreat, altered precipitation patterns, floods, droughts, and environmental degradation.

The analysis undertaken in this article demonstrates that existing treaty frameworks—including

the Indus Waters Treaty, the Ganges Water Sharing Treaty, and India-Nepal water agreements—have contributed significantly to regional cooperation and conflict prevention. Their durability reflects the value of legal frameworks in managing shared natural resources. Nevertheless, these agreements were negotiated during periods when climate change and environmental sustainability occupied a comparatively limited place within international law. Consequently, they often lack the mechanisms necessary to address contemporary challenges. Modern international water law increasingly emphasizes equitable and reasonable utilization, prevention of significant harm, cooperation, environmental protection, and sustainable development. These principles provide an important foundation for adapting existing governance frameworks to changing environmental conditions.

The future of transboundary water governance in South Asia depends upon the ability of States to embrace adaptive management, strengthen institutional cooperation, integrate climate resilience into treaty implementation, and promote sustainable utilization of shared water resources.

Effective cooperation is not merely a legal obligation; it is an essential requirement for ensuring regional stability, environmental sustainability, and human well-being in an era of unprecedented climatic uncertainty. The experience of South Asia demonstrates that while treaties remain indispensable instruments of cooperation, their continued effectiveness depends upon their capacity to evolve in response to changing circumstances and emerging challenges.

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