

A Doctrinal and Comparative Legal Analysis of The Indus Waters Treaty and Transboundary Water Conflicts in South Asia Under Climate Change

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ABSTRACT

Transboundary river governance in South Asia has historically been constructed upon rigid allocation-based legal frameworks grounded in assumptions of hydrological predictability and state-centric sovereignty. The accelerating impacts of climate change – manifested in glacial retreat in the Himalayan region, intensified monsoonal variability, and increased frequency of extreme hydrological events – have disrupted these foundational assumptions. This paper contends that existing treaty regimes, particularly the Indus Waters Treaty (1960), the Ganges Water Sharing Treaty (1996), and India-Nepal water agreements, are structurally ill-equipped to address the dynamic uncertainties introduced by climate change. Through a doctrinal and comparative legal analysis, this study evaluates the compatibility of these treaties with evolving principles of international water law, including equitable utilisation, the obligation not to cause significant harm, and sustainable development. Drawing upon international jurisprudence, including decisions of the International Court of Justice and arbitral tribunals, the paper advances the concept of “adaptive hydro-legal governance” as a necessary normative shift for South Asia.

INTRODUCTION

The governance of transboundary rivers constitutes one of the most intricate domains of international law, involving the intersection of sovereignty, environmental sustainability, and regional geopolitics. Unlike static territorial resources, rivers are fluid and dynamic, traversing multiple jurisdictions and supporting complex ecological and socio-economic systems. In South Asia, these challenges are compounded by colonial legacies, entrenched political rivalries, and growing environmental stress.

The Indus, Ganges, and Brahmaputra River systems collectively sustain nearly a quarter of the global population, making their governance a matter of both regional stability and global significance. Despite this, the legal frameworks governing these rivers remain anchored in mid-twentieth-century paradigms that prioritise allocation over adaptability.

The Indus Waters Treaty (IWT), concluded in 1960 under the auspices of the World Bank, is often cited as a paradigmatic example of successful conflict avoidance. However, its design reflects a hydrological and political context vastly different from the present. At the time of its negotiation, climate variability was not a central concern, and the assumption of relatively stable river flows underpinned its allocation-based structure.

Contemporary climate science challenges these assumptions. The Intergovernmental Panel on Climate Change (IPCC) has identified the Himalayan region as particularly vulnerable to climate change, with significant implications for glacier-fed river systems. Glacial retreat, altered precipitation patterns, and increased frequency of extreme events such as floods and droughts have introduced unprecedented variability into river flows.

This raises fundamental questions regarding the continued viability of existing treaty regimes. Fixed allocation frameworks, while effective under conditions of predictability, may become sources of conflict under conditions of scarcity and variability. The legal challenge, therefore, lies in reconciling the stability provided by treaties with the flexibility required to address changing environmental conditions.

LITERATURE REVIEW

Research Significance and Contemporary Relevance

The significance of the present study lies in its examination of the growing disconnect between traditional treaty-based water allocation mechanisms and contemporary climate realities. South Asia hosts some of the world's most densely populated river basins, with the Indus, Ganges, and Brahmaputra River systems supporting nearly two billion people. According to the Intergovernmental Panel on Climate Change (IPCC), the Himalayan region is experiencing accelerated glacier retreat, increasing hydrological variability, and more frequent extreme weather events, which directly threaten water security across the region.

The economic and geopolitical importance of these rivers extends beyond national boundaries. Agriculture, hydropower generation, food security, and ecosystem sustainability in India, Pakistan, Bangladesh, and Nepal are heavily dependent upon predictable river flows. Climate-induced uncertainty therefore

raises not only environmental concerns but also issues of regional peace, sustainable development, and international legal responsibility.

Although extensive scholarship exists on the Indus Waters Treaty and South Asian hydro-politics, limited research has critically examined how existing treaty regimes can be interpreted and reformed through the lens of contemporary international environmental law and climate adaptation principles. This study seeks to bridge that gap by evaluating the compatibility of existing water-sharing agreements with emerging norms of adaptive governance, environmental sustainability, and climate resilience.

The research is therefore significant for both academic discourse and policy formulation by proposing an adaptive hydro-legal governance framework that can strengthen regional cooperation and enhance the long-term sustainability of transboundary water governance in South Asia.

From Cooperation Narratives to Climate Critique

The academic discourse on transboundary water governance has undergone a significant transformation over the past decades. Early scholarship was largely optimistic, emphasising the role of legal frameworks in fostering cooperation and preventing conflict.

Salman and Uprety's seminal work characterised the Indus Waters Treaty as a "remarkable example of sustained cooperation between adversarial states", highlighting its resilience even during periods of armed conflict between India and Pakistan. This perspective contributed to a broader narrative of the Treaty as a model for transboundary water governance.

However, subsequent scholarship has introduced a more critical perspective. McCaffrey argues that the principle of equitable utilisation, which underpins international water law, must be understood as inherently dynamic. According to this view, the legitimacy of water-sharing arrangements depends on their ability to adapt to changing environmental and socio-economic conditions.

Boyle and Redgwell further emphasise the integration of environmental considerations into international law, particularly through the concept of sustainable development. This shift reflects a broader transformation in legal thinking, from a focus on resource allocation to a recognition of ecological interdependence.

A particularly influential contribution to the literature is the concept of hydro-hegemony, developed by Zeitoun and Warner. This framework highlights the role of power asymmetries in shaping transboundary water relations, suggesting that legal outcomes are often determined by political and economic dominance rather than normative principles.

In the South Asian context, this is particularly relevant. India's upstream position in several major river systems gives it significant leverage over downstream states, raising questions about the equity of existing agreements.

More recent scholarship has increasingly focused on the implications of climate change for transboundary water governance. Brunnée and Toope argue that the legitimacy of international legal regimes depends on their capacity to

evolve in response to new challenges. This perspective underscores the need for adaptive legal frameworks capable of addressing the uncertainties introduced by climate change.

Despite these developments, there remains a notable gap in the literature. While the impact of climate change on water resources is widely acknowledged, there is limited doctrinal analysis examining how existing treaties can be reinterpreted or reformed within the framework of international law.

METHODS

The present study adopts a doctrinal and comparative legal research methodology. The research is primarily qualitative in nature and is based upon the systematic examination of primary and secondary legal sources relating to transboundary water governance and international environmental law.

Primary sources include the Indus Waters Treaty (1960), Ganges Water Sharing Treaty (1996), Mahakali Treaty (1996), relevant provisions of the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (1997), the Vienna Convention on the Law of Treaties (1969), and decisions of international courts and arbitral tribunals including Gabčíkovo–Nagymaros Project, Pulp Mills on the River Uruguay, Lake Lanoux Arbitration, and the Kishenganga Arbitration.

Secondary sources consist of peer-reviewed journal articles, books, policy reports, government publications, and reports published by international organisations including the IPCC, UNEP, and UNDP..

Data Analysis Process

The collected legal materials were analysed through a thematic and comparative framework comprising the following stages: The collected legal materials were analysed through a thematic and comparative framework comprising the following stages:

Stage 1: Identification of Core Legal Principles

The study identified key principles of international water law, namely equitable and reasonable utilisation, obligation not to cause significant harm, duty to cooperate, sustainable development, environmental protection, and climate adaptation.

Stage 2: Treaty Evaluation

Each treaty was examined against these principles to determine the extent to which its provisions accommodate changing hydrological and environmental conditions.

Stage 3: Comparative Assessment

The Indus Waters Treaty, Ganges Water Sharing Treaty, and India–Nepal water agreements were compared with respect to:

- Allocation mechanisms;
- Dispute resolution frameworks;

- Institutional arrangements;
- Environmental safeguards;
- Climate adaptation measures; and
- Compliance with international water law.

Stage 4: Jurisprudential Analysis

Relevant judicial and arbitral decisions were analysed to evaluate evolving interpretations of environmental obligations, sustainable development, and adaptive governance in international law.

Stage 5: Synthesis and Normative Evaluation

The findings obtained through doctrinal and comparative analysis were synthesised to identify structural deficiencies in existing treaty regimes and to develop the proposed framework of Adaptive Hydro-Legal Governance.

This analytical framework enhances the reliability, transparency, and academic rigour of the study while ensuring consistency with established methodologies in legal research.

RESULTS AND DISCUSSION

Normative Foundations of International Water Law

Equitable and Reasonable Utilisation

The principle of equitable and reasonable utilisation constitutes the cornerstone of international water law. Codified in Article 5 of the UN Watercourses Convention (1997), it requires states to utilise shared water resources in a manner that is fair and reasonable, taking into account a range of relevant factors.

These factors include geographical characteristics, hydrological conditions, population dependence, and existing uses. The principle does not mandate equal division but rather a balancing of competing interests. The International Court of Justice, in the Gabčíkovo–Nagymaros Project, affirmed the centrality of this principle:

Modern development of international law has strengthened the principle of equitable utilisation of shared water resources and requires its application in a manner consistent with environmental protection. This articulation highlights the evolving nature of the principle, particularly in relation to environmental considerations.

Obligation Not to Cause Significant Harm

The obligation not to cause significant harm, codified in Article 7 of the UN Watercourses Convention, serves as a constraint on state conduct. It requires states to exercise due diligence in preventing activities that may cause transboundary harm.

In *Pulp Mills on the River Uruguay*, the ICJ clarified the scope of this obligation: A State is thus obliged to use all the means at its disposal in order to avoid activities which may cause significant damage to the environment of another State. This formulation emphasises the procedural nature of the obligation, focusing on due diligence rather than strict liability.

Duty to Cooperate

The duty to cooperate is a fundamental procedural principle in international water law. It encompasses obligations of prior notification, consultation, and information exchange. The *Lake Lanoux Arbitration* provides an early articulation of this principle: The upstream State has the duty to take into consideration the various interests involved and to show that it has made a genuine attempt to reconcile them.

Sustainable Development

The principle of sustainable development integrates environmental protection with economic development. In *Gabčíkovo–Nagymaros*, the ICJ recognised its significance: The need to reconcile economic development with protection of the environment is aptly expressed in the concept of sustainable development

Climate Change as a Structural Challenge to Treaty Law

Climate change introduces a level of uncertainty that fundamentally challenges the stability of treaty-based governance. Traditional treaties are premised on relatively predictable hydrological conditions, which no longer exist.

The Paris Agreement (2015) represents a global commitment to addressing climate change through mitigation and adaptation. While it does not specifically regulate transboundary watercourses, its emphasis on resilience and adaptive capacity has significant implications for water governance.

Moreover, the Vienna Convention on the Law of Treaties (1969) provides a legal basis for dynamic interpretation. Article 31 requires treaties to be interpreted in good faith in light of their object and purpose. This allows for the incorporation of evolving environmental norms into treaty interpretation.

Indus Waters Treaty: Stability versus Adaptability

The Indus Waters Treaty represents a unique approach to transboundary water governance, based on the partition of rivers rather than shared utilisation. While this approach has ensured stability, it raises significant challenges in the context of climate change.

Structural Rigidity

The Treaty allocates the western rivers to Pakistan and the eastern rivers to India, creating a rigid framework that does not account for variability in water flows. This rigidity may become increasingly problematic under conditions of climate-induced variability.

Jurisprudential Developments

The Kishenganga Arbitration represents a significant development in the interpretation of the Treaty. The tribunal recognised the need to maintain environmental flows:

The maintenance of minimum flow is necessary to protect downstream environmental interests and preserve the integrity of the river system. This decision reflects an emerging trend towards integrating environmental considerations into treaty interpretation

The Ganges Water Sharing Treaty: Flexibility without Enforcement

The Ganges Water Sharing Treaty of 1996 between India and Bangladesh represents a departure from the rigid partition model of the Indus Waters Treaty by adopting a formula-based allocation system. This system distributes water at the Farakka Barrage based on seasonal availability, thereby introducing a degree of flexibility into the governance framework.

However, this apparent flexibility is undermined by significant structural limitations. The Treaty lacks robust enforcement mechanisms and does not provide a comprehensive dispute resolution framework. Unlike the Indus Waters Treaty, which includes detailed provisions for neutral experts and arbitration, the Ganges Treaty relies heavily on diplomatic negotiation, thereby limiting its effectiveness in resolving disputes.

A key point of contention has been the reduced dry-season flow of the Ganges, which Bangladesh attributes to upstream diversions by India. This has significant implications for agriculture, fisheries, and ecological sustainability in downstream regions. The absence of binding enforcement provisions exacerbates these tensions, as compliance depends largely on political goodwill rather than legal obligation.

From a doctrinal perspective, the Treaty raises important questions regarding compliance with the principle of equitable utilisation. While the allocation formula appears equitable in design, its implementation does not adequately account for changing hydrological conditions, particularly those arising from climate change. The Treaty also lacks explicit provisions addressing environmental protection, thereby limiting its alignment with the principle of sustainable development.

Furthermore, the Treaty does not incorporate mechanisms for adaptive management. In the context of increasing variability in river flows, this omission represents a significant weakness. The Treaty's periodic review provisions are insufficient to address the dynamic challenges posed by climate change, as they do not mandate substantive revisions based on environmental changes.

India–Nepal Water Agreements: Asymmetry and Developmental Priorities

India–Nepal water agreements, including the Kosi Agreement (1954), the Gandak Agreement (1959), and the Mahakali Treaty (1996), provide a distinct perspective on transboundary water governance in South Asia. These agreements are characterised by a strong emphasis on infrastructure

development, including dams and irrigation systems, often prioritising economic benefits over environmental sustainability.

The Mahakali Treaty, in particular, represents an attempt to establish a more balanced framework, recognising the principle of equal entitlement to shared water resources. However, its implementation has been fraught with challenges, including disagreements over project design, benefit-sharing, and water allocation.

A critical issue in India–Nepal agreements is the asymmetry of power between the two states. India’s economic and political dominance has influenced the negotiation and implementation of these agreements, often resulting in outcomes perceived as inequitable by Nepal. This dynamic reflects the broader phenomenon of hydro-hegemony, where power asymmetries shape legal and institutional arrangements.

From a legal perspective, these agreements raise concerns regarding compliance with the principle of equitable utilisation. While the Mahakali Treaty formally recognises this principle, its operationalisation has been limited. The absence of effective dispute resolution mechanisms further undermines the enforceability of treaty provisions.

Environmental considerations are also insufficiently addressed. The focus on large-scale infrastructure projects has often overlooked ecological impacts, including displacement, sedimentation, and biodiversity loss. In the context of climate change, these issues are likely to become more pronounced, highlighting the need for more comprehensive environmental safeguards.

Comparative Doctrinal Analysis

A comparative analysis of the Indus Waters Treaty, the Ganges Water Sharing Treaty, and India–Nepal agreements reveals both commonalities and divergences in their legal structures and normative foundations.

Common Structural Limitations

All three frameworks share several key limitations:

- **Absence of Climate Adaptation Provisions:** None of the treaties explicitly address climate change or provide mechanisms for adapting to hydrological variability.
- **Limited Environmental Integration:** Environmental considerations are either absent or weakly incorporated, reflecting the historical context of their negotiation.
- **Institutional Rigidity:** The governance structures established by these treaties lack flexibility, making it difficult to respond to changing conditions.

Divergences in Legal Approach

Despite these commonalities, significant differences exist:

- The Indus Waters Treaty adopts a partition-based model, prioritising certainty over flexibility.

- The Ganges Treaty employs a conditional sharing mechanism, introducing some flexibility but lacking enforceability.
- India-Nepal agreements emphasise developmental cooperation, often at the expense of environmental sustainability.

Compatibility with International Water Law

When evaluated against the principles of international water law, these treaties exhibit varying degrees of compliance. The principle of equitable utilisation is partially reflected in all three frameworks but is often undermined by power asymmetries and rigid allocation mechanisms.

The obligation not to cause significant harm is not explicitly incorporated in most agreements, raising concerns regarding environmental protection. Similarly, the duty to cooperate is inconsistently implemented, particularly in relation to information sharing and dispute resolution.

Hydro-Hegemony and Regional Power Dynamics

The concept of hydro-hegemony provides a critical lens for understanding transboundary water governance in South Asia. Developed by Zeitoun and Warner, this framework emphasises the role of power asymmetries in shaping water-sharing arrangements.

In the South Asian context, India's upstream position and economic dominance enable it to exert significant influence over neighbouring states. This influence is reflected in the design and implementation of water agreements, often resulting in outcomes that favour upstream interests.

Hydro-hegemony operates through multiple mechanisms, including control over infrastructure, knowledge production, and diplomatic leverage. These mechanisms can reinforce existing inequalities and limit the effectiveness of legal frameworks.

The implications of hydro-hegemony are particularly significant in the context of climate change. As water scarcity increases, competition over resources is likely to intensify, potentially exacerbating existing power imbalances. This underscores the need for legal frameworks that prioritise equity and cooperation.

Climate Change and Treaty Reinterpretation

Climate change necessitates a re-evaluation of existing treaties through the lens of dynamic interpretation. The Vienna Convention on the Law of Treaties provides the legal basis for such reinterpretation.

Article 31 of the Convention requires treaties to be interpreted in good faith in light of their object and purpose. This allows for the incorporation of evolving norms, including those related to environmental protection and climate change.

The International Court of Justice has recognised the relevance of evolving norms in treaty interpretation. In *Gabčíkovo-Nagymaros*, the Court emphasised that:

- The development of international law has been marked by the emergence of new norms and standards, which must be taken into consideration.

- This principle supports the reinterpretation of existing water treaties to incorporate climate considerations.

Emerging Trends in International Environmental Jurisprudence and Their Relevance to South Asian Water Governance

The evolution of international environmental jurisprudence has significantly influenced the interpretation of transboundary water obligations. Contemporary international law increasingly recognises environmental protection not merely as a policy objective but as an integral component of state responsibility.

The International Court of Justice (ICJ) has progressively incorporated environmental principles into the interpretation of international obligations. In *Gabčíkovo–Nagymaros Project* (Hungary v Slovakia), the Court emphasised that environmental protection constitutes an essential consideration in the implementation of developmental projects affecting shared resources.

Similarly, in *Pulp Mills on the River Uruguay*, the ICJ recognised environmental impact assessment (EIA) as an obligation under customary international law where proposed activities may have adverse transboundary effects.

The Court observed: “It may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context.”

In addition, arbitral jurisprudence has increasingly recognised ecological considerations within water governance frameworks. The *Kishenganga Arbitration* marked a significant departure from rigid developmental priorities by affirming the necessity of maintaining minimum environmental flows.

Climate Security and Transboundary Water Conflicts

Climate change has increasingly been conceptualised as a “threat multiplier” capable of exacerbating existing political and socio-economic tensions.

The Himalayan region, often referred to as the “Third Pole”, contains one of the largest concentrations of glaciers outside the Arctic and Antarctic. Initially, glacial melting may increase river flows and intensify flooding. However, long-term glacier depletion is expected to reduce dry-season flows significantly, thereby intensifying competition over water resources.

The relationship between water scarcity and conflict remains contested within academic discourse. Nevertheless, climate-induced variability undeniably increases pressure on existing treaty regimes.

Statements suggesting the potential suspension or modification of the *Indus Waters Treaty* illustrate how environmental issues may become intertwined with national security concerns.

Ecosystem-Based Governance and the Rights of Rivers

Recent developments in comparative constitutional and environmental law have introduced innovative approaches to water governance, including the recognition of legal rights for rivers and ecosystems.

These developments possess important implications for transboundary governance. Traditional treaty frameworks primarily conceptualise rivers as divisible economic resources. Ecosystem-based governance, by contrast, recognises rivers as interconnected ecological systems requiring holistic management.

Procedural Environmental Rights and Public Participation

Another significant development in international environmental governance is the increasing recognition of procedural environmental rights, including access to information, public participation, and access to justice.

These principles are reflected in the Rio Declaration on Environment and Development (1992), particularly Principle 10. South Asian water treaties have historically been negotiated through highly centralised diplomatic processes with limited public participation.

The Need for Regional Hydro-Diplomacy

The increasing complexity of climate-induced water challenges necessitates stronger forms of regional hydro-diplomacy.

A regional framework for South Asian water governance could facilitate:

- Coordinated climate adaptation strategies,
- Integrated basin management,
- Scientific cooperation,
- Disaster risk reduction,
- Environmental monitoring.

Despite these challenges, climate change may create incentives for greater cooperation. Shared environmental vulnerability could encourage states to adopt more collaborative approaches to water governance.

Toward Adaptive Hydro-Legal Governance

In light of the limitations of existing frameworks, this paper proposes a shift towards adaptive hydro-legal governance. This approach is characterised by flexibility, cooperation, and environmental integration.

Legal Reforms

- Inclusion of climate adaptation clauses in treaties
- Periodic review mechanisms linked to environmental indicators
- Explicit incorporation of environmental principles

Institutional Reforms

- Strengthening of river basin organisations
- Enhanced dispute resolution mechanisms
- Greater transparency and data sharing

Normative Reforms

- Shift from sovereignty-based to ecosystem-based governance
- Recognition of water as a shared resource
- Integration of climate resilience into legal frameworks

Extended Judicial Extract

The ICJ in *Gabčíkovo–Nagymaros* observed:

The Court considers that the need to reconcile economic development with protection of the environment is aptly expressed in the concept of sustainable development. The development of international law in this field has been marked by the emergence of new norms and standards, which must be taken into consideration, and such new standards given proper weight.

CONCLUSIONS AND RECOMMENDATIONS

Transboundary water governance in South Asia stands at a critical juncture. The existing treaty frameworks, while historically significant, are increasingly inadequate in addressing the challenges posed by climate change.

This paper has demonstrated that the Indus Waters Treaty, the Ganges Water Sharing Treaty, and India–Nepal agreements share common structural limitations, including rigidity, lack of environmental integration, and absence of climate adaptation mechanisms. These limitations are compounded by power asymmetries, which influence the design and implementation of agreements.

The concept of adaptive hydro-legal governance provides a pathway for reform, emphasising flexibility, cooperation, and sustainability. By aligning treaty frameworks with evolving principles of international law, South Asian states can develop more resilient and equitable approaches to water governance.

FURTHER STUDY

This study still has limitations, so further research on A Doctrinal and Comparative Legal Analysis of The Indus Waters Treaty and Transboundary Water Conflicts in South Asia Under Climate Change is needed to refine this study and enhance the insights of readers and the authors.

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