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Environmental Security and Regional Stability: Examining the Role of Transboundary Water Governance in International Relations

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ABSTRACT

This qualitative study examines the relationship between environmental security, transboundary water governance, and regional stability within the context of international relations, focusing on how shared water resources influence interstate cooperation, political tensions, and regional security. The study employed a qualitative comparative case-study research design based on secondary and documentary data. Data were purposively collected from peer-reviewed journal articles indexed in Web of Science and other relevant scholarly sources, along with institutional reports, policy documents, and credible documentary materials concerning transboundary water governance. The analysis comparatively examined four major river basins, namely the Indus River Basin, Nile River Basin, Mekong River Basin, and Danube River Basin, with attention to environmental-security pressures, governance arrangements, interstate relations, cooperation mechanisms, and regional stability outcomes. The qualitative findings indicate that environmental pressures, including water scarcity, climate variability, ecological degradation, population growth, and infrastructure development, do not inevitably lead to interstate conflict; rather, their security implications are shaped by institutional capacity, political trust, power asymmetries, information sharing, equitable resource management, and adaptive governance. The comparative findings further demonstrate that effective transboundary water governance can strengthen diplomatic engagement, facilitate cooperation, support peaceful dispute management, and contribute to regional stability, whereas weak or inflexible governance arrangements may intensify mistrust and geopolitical tensions. The study is significant because it integrates environmental security and transboundary water governance within an international-relations perspective and highlights the importance of cooperative, equitable, and climate-responsive governance for promoting environmental resilience and peaceful regional relations.

Introduction

Environmental security focuses on the interconnection between environmental pressures, human wellbeing and issues such as state capacity and stability. The difference with traditional security is the focus on military threats and territorial issues. Environmental

security focuses on the impact of deteriorating environment and the issues related to the shifts in climate and the inequities in access to natural resources. Water is unique, and of great concern, in environmental security as it provides the basis for numerous security issues. Fresh water scarcity creates numerous security issues, both within and between states. These issues extend beyond the realm of traditional security and threaten the basic existence of states. Moreover, although scarcity of natural resources in an environment does raise the threat of conflict, it has been shown that this is not an inevitable case. A great deal of the outcome has to do with the capacity of the state and the political will of the actors (Prniyazova, et al., 2025).

Transboundary freshwater resources make these environmental-security dynamics particularly salient because lakes, rivers and aquifers frequently flow across country borders. There are 153 countries with transboundary river and lake basins, and transboundary rivers account for approximately 60% of world freshwater flows (Koff & Maganda, 2016). Thus, what one country decides to do with regard to water infrastructure, extraction and pollution can impact a neighboring country. International relations have the potential to create unmanageable risks and manageable opportunities with regard to water resources. Where effective cooperative frameworks exist, shared water resources can serve as the focal point for cooperation and sustained interaction among states (Krzymowski, 2021).

The association between environmental security and regional stability is increasingly dependent on the quality of governance of shared resources. Certain environmental pressures can aggravate conflicts in the absence of adequate cooperative mechanisms for communication, negotiation, and monitoring, as well as mechanisms for equitable access and joint management of shared resources. In contrast, institutionalized cooperation can help constructively use the environmental vulnerability of a region. Water-related interactions in the Middle East, for example, have historically shown a preponderance of cooperation (Varady et al., 2023). This study further elaborates the need to analyze the governance of transboundary water resources as a means of providing environmental security and as a tool to improve regional stability.

Environmental Security

Environmental security deals with environmental conditions that affect human societies, and result in threats to livelihoods and resources, social well-being and political stability. Environmental security with regards water looks at the availability, quality, sustainability and equitable management of freshwater resources. With the increase in water demand and the growing depletion of freshwater resources, water becomes an ever-increasing source of insecurity. Environmental security demonstrates that conditions that undermine the economy and the potential to produce food can be security concerns. Therefore, there needs to be a consideration for interlinkages of ecological conditions and political, social and economic conditions, and their respective vulnerabilities (Dinar et al., 2019).

Water scarcity remains one of the most pressing environmental security threats. Freshwater resources are becoming increasingly insecure due to changing climate conditions, and rising world population, demand and pollution. These growing pressures are particularly challenging when water resources are shared between two or more countries. When two or more countries share a water resource, the absence of mutual cooperation creates uncertainty regarding water availability and can create perceived vulnerability, especially when the countries do not have equal political and/or economic capacity-Water cites inadequate cooperation on shared waters as a threat to international and social peace and stability because the actions of countries can influence other states (Schneider et al., 2025). Empirical research, however, advises against treating scarcity as an automatic cause of conflict because the quality of the institutions and political relationships determine whether environmental stress leads to confrontation or to cooperation (Hassan et al., 2021).

The connection between environmental security and effective governance of the state is therefore evident. The nature of the relationship between states determines whether the environmental challenges that confront them contribute to domestic political destabilization and international conflict, or whether the challenges promote the strengthening of governance. Transboundary water challenges between states often lead to confrontation, but research has shown that where the quality of institutions and the capacity of governance are high, environmental challenges can promote opportunities for greater cooperation among states, even in the absence of physical water resources (Hayat et al., 2025). This therefore supports the view that environmental stress often leads to political stability.

Transboundary Water Governance

Transboundary water governance is the inter-institutional, legal, political and cooperative mechanisms by which countries and other stakeholders collaboratively manage cross-border transboundary water resources. There are many instruments including water related treaties, basin organizations, joint commissions, information exchange, and integrated planning, and monitoring

systems; and mechanisms to resolve disputes and make decisions on the equitable and sustainable use of water. It is clear that governance has to move beyond unilateralism to cooperative, or institutionalized, frameworks. The UN presents aspects of effective operational transboundary cooperation as joint bodies, regular meetings, information exchange, and agreed management goals (Grünwald, 2018), showing the institutional character of governance.

There is an increasing recognition of transboundary water governance, especially for riparian areas with a high degree of hydrological connectivity. Water infrastructure, development and diversion by upstream states may alter water quality and quantity for downstream states. It is almost impossible to predict what downstream impacts will be from upstream developments, but the risks can be mitigated by establishing guidelines and rules and/or mechanisms for negotiating these prior to development. Conflicts concerning water resources have the potential to be addressed by using rules and/or institutions. To this effect, water related institutions have the potential to facilitate collaboration and reduce water related conflicts; however, the institutional development to address water sharing in cross-border areas has been slow and inequitable (Michel et al., 2021).

The success of transboundary water governance hinges on factors beyond the execution of treaties, for example inclusiveness and flexibility of the governance system, as well as the capacity of the institutions that implement the system. Current trends in water governance, management, and policies tend to encourage the integration of various sectors, improve the availability and use of science, and promote cooperation across all environmental and political borders. The UN Water Convention, for example, offers a legal framework at the international level for the sustainable use of transboundary water resources and the cooperation associated with it (Varady et al., 2023). In addition, international experience shows that cooperation on the management of transboundary water resources contributes to the achievement of food security, strengthens resilience to the effects of climate change, and provides other developmental benefits (Armitage et al., 2015).

This means that water governance and security are directly related, and water governance has the potential to change one of the biggest threats to security in a region, i.e. vulnerability associated with shared water resources, to cooperative interaction. Effective water governance arrangements can prevent conflicts from arising, or at least reduce them, through cooperation in the sharing of information, decision making, and resolving disputes. This is particularly critical in the context of climate change, since increased variability of water resources due to droughts and floods can increase existing water related stresses and tensions. Recently, it has been shown that effective transboundary water governance reduces the incidence of water related conflicts, and increases cooperation (Rivera-Torres et al., 2021).

Regional Stability

Regional stability is when countries in a geographic region manage political relations in a way that allows them to predict and avoid conflict that disrupts regional peace, stability, cooperation, and development. In the case of environmental security, regional stability is the management of shared resources with friendly political relations. The transboundary nature of water makes cross-border interactions between neighboring countries constant. Water related disputes and infrastructure development can influence the politics of neighboring countries in the long-term. Generally, the permanent nature of the interaction between neighboring countries allows countries to work out long-standing diplomatic relations that could improve the situation between states with conflicting interests (Hussain et al., 2025).

As with other transboundary resources, inequalities in sharing water can lead to mistrust and geopolitical tension, but this doesn't always lead to interstate war. Studies that assess long-term interactions across international water boundaries show that countries have more inclination toward cooperation than outright conflict. When interactions have leaned toward conflict, it has usually been associated with water infrastructure and the unilateral development of water resources by a country (Catano et al., 2020). This emphasizes that inadequate and unfriendly institutional governance is more likely to lead to regional instability than environmental scarcity.

Support for the management of transboundary waters can serve as a confidence building measure. There is a lot of value in maintaining diplomatic contacts, joint monitoring, and scientific cooperation, and negotiated resource sharing, even in the context of tense, or no, broader political contacts. The UN Water Program emphasizes that cooperation on water may lead to cooperation on other aspects on peace, resilience and sustainable development. Moreover, the 2024 report of UNESCO explains cooperation and inclusive water governance may lead to cooperation to increase resilience and peace, while uncooperative water governance may cause instability (Zulfqar, 2018).

Thus, the relationship between water governance and regional stability mainly relies on the capability of institutions to manage interdependence peacefully. If governance is effective, it can create rules, and reduce uncertainties. It may also give benefits to

relevant parties and create diplomatic channels, hence lower the likelihood that environmental issues may turn into broader regional tensions. However, if governance is ineffective, it may strengthen, or intensify, already existing disputes, as relevant parties may not have rules for consultation. Therefore, transboundary water governance is an important mechanism for making environmental security lead to regional stability.

International Relations

International relations create the larger political framework for environmental security and transboundary water governance. Ecological effects of state actions cross borders and challenge the assumption that nation states are able to pursue their interests in isolation. Transboundary water governance requires states to integrate interdependence into their relations with upstream and downstream neighbors and reconcile interdependence with their freedom to act. For such countries, the ecological effects of actions of upstream states are most pressing. As a result, water governance mandates reframe relations among such countries in the context of law, diplomacy, and negotiation. In the field of international relations, transboundary water governance embodies competition and cooperation at the same time. Institutional arrangements facilitate the peaceful management of contentious issues and agreement on cooperative arrangements.

Research on transboundary water politics shows cooperation depends on the region's structure of institutions, interests, and power as well as the broader political context (Gilpin, 2016). International legal instruments, including the UN Water Convention, represent examples of the international legal architecture concerned with the environmental dimension of international relations, promoting sustainable use, cooperation, and peace.The literature identifies that the relationship between environmental security, transboundary water governance, and regional stability is not linear or deterministic. Environmental issues create potential vulnerabilities, and governance structures define whether those vulnerabilities evolve to conflict, cooperation, or a stable situation (Kauppi et al., 2020).

Therefore, focusing on transboundary water governance in the framework of international relations enables an understanding of how environmentally scarce resources can act as a diplomatic bridge and be a catalyst for regional cooperation and integration, peace, and stability. This can also act as a bridge to understand the interactions that transboundary water governance has on regional stability in a context of growing environmental and geopolitical uncertainties (Devetak et al., 2017).

Research Objectives

- To examine the role of environmental security in promoting regional stability.
- To assess the role of transboundary water governance in strengthening cooperation and reducing tensions among states.
- To evaluate the influence of transboundary water governance on the relationship between environmental security and regional stability in international relations.

Problem Statement

Water scarcity and the uncontrolled development of water resources by different countries are creating increasing challenges in managing and sharing water. Previous studies have shown that shared water resources can sometimes contribute to tensions and disputes between countries. However, recent research suggests that transboundary water relations are more often based on cooperation than conflict. Effective governance institutions can help countries communicate, manage shared resources, resolve disagreements, and reduce the risk of conflict. Therefore, strong water governance can play an important role in promoting cooperation and supporting peaceful relations between countries. The International Water Law acts as a governance mechanism facilitating cooperation. There is, however, a critical research gap concerning the role trans-boundary water governance has in linking environmental security with regional stability in global relations. The focus in the existing literature has mainly been on water conflict and cooperation or water governance at the basin level. Far less attention has been given to their joint implications on environmental security and regional stability.

On the other hand, recent studies show persistent shortcomings in integrated governance, climate-smart policies, equitable water sharing, institutional capacity and data exchange in transboundary river basins (Schneider et al., 2025). Furthermore, research on transboundary water quality has shown that the relationship between environmental pressures and water conflicts, or water cooperation, is poorly understood, therefore limiting our understanding of the potential role of governance in preventing the emergence of environmental problems in the realm of international relations (2025). This calls for a more integrated approach that looks at environmental security, transboundary water governance and regional stability. This approach should examine if improved

governance of transboundary water resources could decrease environmental vulnerabilities and increase transboundary cooperation to improve regional relations (Link et al., 2016).

Significance of the Study

This study is significant because it provides a comprehensive understanding of how transboundary water governance can contribute to environmental security and regional stability within international relations. The study highlights the importance of cooperative water management in addressing shared environmental challenges, reducing tensions among neighbouring states, strengthening diplomatic relations, and promoting sustainable use of transboundary water resources. It provides useful insights for policymakers, governments, international organizations, and regional institutions seeking to develop effective mechanisms for water-sharing, conflict prevention, information exchange, and joint environmental management. The study also contributes to the academic literature by connecting environmental security, transboundary water governance, and regional stability within an integrated framework, thereby providing a basis for future research on environmental cooperation, hydropolitics, and regional peace.

Literature Review

Environmental Security and the Changing Nature of Security

The study of environmental security has moved beyond the traditional state-centered view of security. It now takes into account ecological impacts, resource dependence, and human vulnerability, as well as various political institutions. Hough (2014) stated that environmental problems should not be conceptualized as the direct causes of conflicts. He also stated that the security implications of environmental problems are shaped by history and by political and institutional conditions. Barnett (2010) looked at the case of the Mekong River and identified that environmental security consists of integrated concerns of water, food and energy security as well as the degradation of ecosystems, development and climate change. More recently, Antwi-Boateng and Detraz (2009), stated that environmental scarcity should be viewed as a conflict amplifier rather than an independent cause of conflicts, and that the quality of governance is a determining factor of the outcome.

Recently, several scholars have conceptualized environmental security as more of a governance problem than a resource problem. Climate change, rising population and changing consumption patterns contribute to increased stress on freshwater systems. How states and institutions respond to these changes determines the security implications. Elliott (2015), in their review of water security studies conducted between 2010 and 2024, identified that climate change, hydro-hegemony, environmental peacebuilding, and river basin organizations, shape the field of water security studies. Through their analysis, they concluded that the interplay of environmental and political pressures determines the level of insecurity in water resources.

Governance of Shared Freshwater Resources

Transboundary water governance is an important area of research because water systems, whether on the surface or below the earth's surface, often span more than one nation. As a result, a single country's efforts to manage water resources may be inadequate. O'Donnell (2018) critiqued the tendency to classify transboundary water relations as strictly either conflict or cooperation. Their work indicated that conflict and cooperation can manifest in water relations simultaneously and that the nature of international water relations is political and involves other aspects of the international relations of states. Zeitoun et al. illustrated that one of the principal reasons states negotiate water arrangements (either cooperatively or competitively) is the degree of influence that exists in the relationship. They argued that the presence of a formal water agreement does not necessarily mean that the arrangement is equitable or that one state is dominating the other.

More contemporary research has supported the case that adequate institutions are critical for managing shared-water relations. Parsons et al. (2020) relied on the Transboundary Freshwater Diplomacy Database, and showed that historically states have been more cooperative than conflictual with regard to sharing of waters. It has been shown that more conflicts regarding water quantity and the construction of unilateral water infrastructure have occurred since 2000 (Schipanski et al., 2023). Turgul et al. found that there are institutions that can facilitate cooperation and minimize water conflicts. However, in recent years, the pace of creating and adopting such institutions has slowed. This indicates that governance arrangements need to be effective not only in their presence but also in their implementation and commitment Recent research has broadened the discussion within the field of water governance, toward sustainability, equity and adaptability (Albrecht et al., 2017).

Transboundary Water Governance and Environmental Security

There is a relationship between the governance of transboundary waters and environmental security. When pressure on the environment extends across borders, this relationship takes on added importance. Grumbine (2018) shows that in the case of the Mekong Basin, the environmental security challenges cannot be disentangled from governance. The challenges of water, food, energy, and development are intertwined with the challenges of ecosystems and security. Grumbine argues that governance reforms have to be inclusive and deliberative in order to sufficiently manage shared environmental pressures.

Empirical evidence gives added support to the role of governance in the case of water challenges under conditions of climate change. A recent global study on water conflict and cooperation for the period up to 2026, suggests that where there is adequate governance in a transboundary basin, challenges posed by climate change will not translate to water conflicts between countries. The study, however, cautions that this will depend on the extent of the governance network and the relations it incorporates. This is in line with the finding of the comparative study by (Palazzo et al., 2024), which argues that in cases where governance is poor, the environment challenges posed by climate change are more likely to be translates to situations of security.

Transboundary Water Governance and Regional Stability

Regional security is closely connected to shared environmental resources, especially rivers and water systems that cross national borders. Because neighboring countries depend on the same water sources, their security and development interests are often linked. Research by Turgul et al. (2024) suggests that countries have generally chosen cooperation rather than conflict when dealing with shared water resources. Their findings indicate that water-related institutions and agreements help countries communicate, manage disputes, and work together even when disagreements over water distribution or infrastructure exist. Likewise, Hayat et al., (2022) explain that water interdependence can influence relations between countries in different ways. Water resources may be used as a source of cooperation through joint projects and energy production, while at the same time affecting negotiations and bargaining between neighboring states. Overall, effective management of shared water resources can contribute to regional stability, cooperation, and peaceful relation

The relations in South Asia illustrate this argument most clearly. Megens et al., (2025) points out that climate change, especially its growing variability and increasing water insecurity, along with changing regional politics, can potentially affect the security and stability of South Asia in a negative manner. Above all, the study pointed to the governance of transboundary water resources as a positive climate-stability nexus.

Environmental Security and Regional Stability

The literature identifies several pathways that relate environmental security to regional stability including, for example, resource competition and migration, as well as interstate tensions. Political and institutional conditions shape when environmental challenges cross the environmental security divide. Environmental scarcity is often shown to deepen existing political and institutional weaknesses, rather than generate conflict by itself.

Current and emerging literature focuses more on the role of effective institutions in facilitating cooperative environmental governance as one of the principal mechanisms stabilizing the region. For instance, Butts (2007) highlight environmental peacebuilding, water governance, and their corresponding research agenda as some of the newer areas in the field. Other more recent literature on cross-border governance deals with similar concerns including the political nature of cooperation, including failures in cooperation. It is more often the case that effective institutions that address environmental insecurities, inequalities, and injustices, and enable communication across states are more likely to promote regional stability. There is a closer correlation between environmental security and regional stability, where there are cooperative, transparent, and effective institutions in place across the region that manage risks (Russell, 2009).

Research Gap

While much of the existing literature covers transboundary water conflict, cooperation, and environmental governance, there are important gaps in explaining how transboundary water governance integrates environmental security and regional stability in international relations. Important gaps remain in integrated governance, climate-smart policies, equitable water sharing, and institutional and cross-border data-sharing capacities, particularly in geopolitically-contested areas. Galgano, (2016) also show how, in water research, increasing attention is focused on institutions and other governance gaps, power and justice, and environmental peacebuilding, among other areas. They, however, also show that gaps remain in water research on how

transboundary commitments are turned into effective governance and cooperation. Furthermore, research shows that how environmental deterioration, and more specifically water-quality-related problems, affects interstate conflicts and cooperation is largely unchartered territory (2025). Water-related research, development, and policy funding and the geographical distribution of research support also emphasize the gaps, with a disproportionate focus on the Global North and neglect of the Global South (Jager, 2016). Thus, the present study attempts to close this important gap in international relations theory by linking transboundary water governance and environmental security to regional stability.

Methodology

Research Design

This study used a qualitative research design focused on secondary document analysis to examine the relationship between environmental security, transboundary water governance and regional stability in international relations. Qualitative research was appropriate because the study aims to interpret political and environmental perspectives and institutional frameworks contained in existing documentary sources, rather than measuring relationships statistically. Document analysis is a qualitative method to review pre-existing materials to form interpretations related to the research question. The use of secondary qualitative data is also appropriate when the research covers a broad geographic and political scope and could not be collected through primary data sources.

Data Sources and Collection

The study completely depended on secondary data collected from scholarly and publicly available documents. Scholarly data was primarily identified through the Web of Science, and other published materials were identified using relevant search engines. Relevant published data included journal articles and newspaper articles. Peer-reviewed journal articles were selected based on their relevance to environmental security, transboundary water governance, regional stability, water conflicts and cooperation, and international relations. In addition to the scholarly publications, policy, and institutional documents were reviewed, as well as other publicly available documents, to capture political discourse and developments concerning transboundary water issues. Newspapers are significant sources of evidence for qualitative research, as they can contain reports that capture political and public discourse on issues of concern. The documentary materials were purposively selected, rather than drawn through statistical sampling.

Documents were included if they contained important information related to the objectives of the study and contributed to addressing issues relating to transboundary water management; environmental challenges; cooperation and disputes; governance and diplomacy; or regional security. In the process of selecting documents, their relevance to the study, and the reputation and authority of their authors were considered. This process is founded on the principles of qualitative document analysis, according to which researchers evaluate the relevance of the documents to the study rather than their number.

Data Analysis

Documents were analyzed using a qualitative thematic document analysis. To get acquainted with the content of the document's, repeated readings were done on the documents. Based on the objectives of the study, textual segments of the documents were identified and coded. Related codes were later grouped into themes. The themes were formed based on the research questions and objectives, and they include transboundary water governance, interstate cooperation, environmental security, international relations, and regional stability. Water related tensions and conflicts were given specific attention. Qualitative document analysis usually entails coding and categorization of documents, and comparison of findings. The analysis made use of source triangulation by comparing evidence from scholarly sources to evidence reported in newspapers and institutional and policy sources. Strengthening the interpretation in this way requires examining if similar issues have been reported in different source categories and not relying on a single source. The study took an interpretivist approach to analyzing the data and focused on political contexts within which transboundary water governance and environmental security issues were addressed. Such an approach is consistent with qualitative media and document research. The objective is to evaluate the significance and explore the meaning and discourse within the context of the documentary evidence. It is not to analyze the frequency of words or phrases.

Trustworthiness and Ethical Considerations

Documents were assessed for credibility, relevance, consistency and context before they were included in the analysis. Peer-reviewed journals published in Web of Science were the primary source of academic documents. Other academic sources included newspaper articles and institutional documents. Participants in this study were the documents and scholarly works. Emphasis was

placed on quotes and scholarly works in acknowledging and interpreting previous scholarly works. This study leveraged the academic integrity of documentation in scholarly work and journalism by accurately representing documents and scholarly works, highlighting scholarly works and properly acknowledging the original works. Document the scholarly focus of using secondary data and placed special emphasis on the quality of the source and its context, as well as the ethical use of publicly available data.

Comparative Qualitative Data Analysis

A comparative qualitative analysis was performed to understand how various forms of transboundary water governance impact environmental security and regional stability in selected international river basins. This analysis does not treat all transboundary water disputes the same, but rather compares cases based on the nature of governance, strength of institutions, politics, environment, cooperation, and regional stability. This approach is warranted as previous studies show that river basins vary considerably. Some have developed relatively strong joint institutions, while others remain divided and governed by bilateral tensions and asymmetric power relationships. For example, compared 12 major transboundary river basins, and showed that governance is conditioned by the type of agreement (i.e., allocation versus limited-purpose agreements, and joint management). Other recent studies also compare the Nile, Colorado, Mekong, and Senegal basins on collaboration, benefit sharing and adaptive governance.

Table 1: Comparative Analytical Framework

This study compares five analytical dimensions: governance structures, environmental security pressures, interstate cooperation, conflict management mechanisms, and regional stability. These dimensions are derived from the research questions and are consistently applied to the case studies. The goal was not to rank countries as successful or unsuccessful, but to analyze different political and institutional contexts to understand how different results are achieved. This is essential because the literature suggests that there is no universal model of transboundary water governance; effectiveness of institutions is influenced by political, social, economic and ecological situations as well as geography.

Analytical Dimension	What Was Examined	Comparative Purpose
Governance structure	Treaties, river commissions, agreements and joint institutions	To determine the strength and scope of institutional cooperation
Environmental security	Water scarcity, climate stress, pollution, floods and ecosystem pressures	To identify major environmental threats
Interstate relations	Trust, diplomatic tensions, power asymmetry and negotiation	To understand the political context of water governance
Cooperation mechanisms	Information sharing, joint monitoring, negotiation and dispute resolution	To assess how governance manages shared problems
Regional stability	Conflict reduction, diplomatic cooperation and long-term resilience	To assess wider security implications

Table 1 provides a comparative analytical framework to assess the relations between environmental security, transboundary water governance, and regional stability for the selected river basins. The analysis incorporated five key dimensions, namely: governance structure, environmental security, interstate relations, cooperation mechanisms, and regional stability. The study examined governance structures by reviewing treaties, agreements, river commissions, and other joint institutions that help countries manage shared water resources. Environmental security factors included water scarcity, water stress, climate change, pollution, flooding, and the condition of ecosystems. Interstate relations were assessed through political trust, diplomatic interactions, power dynamics, and negotiation processes between countries. The analysis also considered cooperation mechanisms such as information sharing, data exchange, joint monitoring activities, and approaches used to resolve disputes. Regional stability was evaluated through the level of diplomatic cooperation, peaceful relations, reduced conflict, and the ability of countries to respond effectively to environmental challenges. This framework made it possible to compare the Indus, Nile, Mekong, and Danube river basins and understand how differences in political and governance arrangements affect environmental security and regional stability.

Comparison of the Indus, Nile, Mekong and Danube Cases

The Indus River Basin is an important case for understanding the connection between water governance, political tensions, and regional stability, particularly because of the long-standing tensions between India and Pakistan. Water management in the basin is strongly linked to the Indus Waters Treaty, which has provided a framework for managing shared water resources. However, in recent years, the treaty has faced growing pressure due to climate change, changing socioeconomic conditions, and geopolitical tensions. The 2026 assessment suggests that the treaty itself has not been the main source of conflict but has increasingly become part of broader political disagreements. Therefore, the Indus case provides a useful example of how water governance institutions can continue to support resource management even when relations between neighboring countries are strained.

The Nile River Basin governance is complex, as there are multiple states with different needs and priorities within the same basin. The Nile case study is a good example to demonstrate the obstacles to creating a basin-wide governance framework to address competing historical rights, development needs and equitable water allocation. The main sources of the obstacles to Nile governance are cited as insufficient will to engage and resolve conflict, and transform systems to improve the adaptive capacity of institutions and mechanisms.

Governance obstacles to managing the Mekong river basin are similar to those of the Nile, and are a result of intensive, large scale hydropower development and the transformation of riverine ecosystems. The Mekong illustrates how governance cannot be exclusively focused on water allocation and how changes in the flow of a river can impact fisheries, agriculture, livelihoods, and the ecological system across several countries. Other comparative studies, therefore, underscore the need for integrated governance, the participation of stakeholders, benefit sharing, and adaptable institutions. The Mekong shows how environmental security is broader than the tensions concerning the distribution of international water and includes the protection of interconnected social and ecological systems.

The Danube River Basin, on the other hand, presents an advanced model of transboundary cooperation. The governance framework focuses on the legal field, environmental management, and institutional cooperation of the riparian states. Therefore, the Danube illustrates how the management of transboundary water resources can contribute to regional cooperation and contribute to improve peace and security. Comparative research identifies the Danube among the basins with governance structures that contribute to cooperation and peace.

Table 2: Comparative Table of Governance and Security Outcomes

Case	Governance Character	Main Environmental Challenge	Political Relationship	Observed Governance Outcome
Indus	Treaty-based bilateral governance	Water stress, climate variability, infrastructure and hydropower	Highly sensitive India–Pakistan relations	Water institution provides a mechanism for continued management, but wider geopolitical tensions constrain cooperation
Nile	Multilateral and developing basin governance	Water allocation, dam development and climate pressure	Strong upstream–downstream disagreement	Negotiation continues, but limited consensus constrains comprehensive cooperation
Mekong	Regional institutional and cooperative governance	Hydropower, ecological degradation and changing river flows	Cooperation mixed with development competition	Institutional cooperation exists, but geopolitical and development pressures limit effectiveness
Danube	Strong multilateral institutional governance	Pollution, flooding, ecosystem protection	Relatively cooperative interstate relations	Institutional coordination supports environmental management and regional stability

Table 2 shows qualitative comparisons of Indus, Nile, Mekong, and Danube River basins based on the criteria of governance structures, environmental challenges, political relations, and observed governance outcomes. The Indus Basin reflects treaty-based bilateral governance, and while the mechanisms of water management are in place, India-Pakistan geopolitical tensions restrict water cooperation. The Nile Basin has multilateral governance tendencies, but is restricted by upstream and downstream

disagreements, hence the stalemate in completing the framework agreement. The Mekong Basin reflects multilateral cooperation in regional institutions, hydro-power development, and ecological pressures, but competes with geopolitical considerations and governance. The Danube reflects stronger multilateral cooperation, and environmental management, which in turn contributes to regional stability. Other factors (i.e. geopolitical tensions) restrict the effectiveness of transboundary water governance, and can negatively impact stability in the region.

Cross-Case Comparison of Governance Effectiveness

The comparison shows that while the development of transboundary water governance institutions is crucial, it is not sufficient to achieve effective transboundary water governance. The case of the Indus shows that formal agreements can withstand protracted geopolitical tensions. However, the case of the Nile shows that protracted geopolitical tensions and poor agreement can result in lengthy processes and a lack of institutional development, resulting in little cooperation, especially if the parties do not agree on the distribution of water and how it should be developed. The case of the Mekong shows that transboundary water management is closely connected to other issues of regional governance, especially hydropower development and ecological security. Effective regional management of the Mekong relies on the management of other transboundary rivers in the region. The Danube illustrates the value of flexible institutions to integrate a wide array of environmental management. All the cases provide evidence on the role of politics and institutions in the design of integrated water resources management (IWRM).

Table 3: Cross-Case Comparison of Governance and Regional Stability Factors

Comparative Factor	Indus	Nile	Mekong	Danube
Formal institutions	High	Moderate	Moderate–High	High
Basin-wide coordination	Limited	Developing	Partial	Strong
Political trust	Low	Low–Moderate	Moderate	Relatively High
Power asymmetry	Significant	Significant	Significant	Comparatively manageable
Environmental pressures	High	High	High	Moderate–High
Cooperation potential	Constrained but persistent	Contested	Moderate	High
Regional stability contribution	Moderate	Limited/contested	Moderate	Strong

Table 3 makes cross-case comparisons of the main governance, political, environmental, and security factors of the four river basins. The research indicates that in addition to varying degrees of formal institutional frameworks, the Indus and Danube river basins' governance outcomes differ due to variations in political trust, basin-wide coordination, and interstate relations. The Indus has developed formal institutions, but lacks basin-wide coordination, and political trust, and has great power asymmetries. As a result, while cooperation is constrained, it is persistent and leads to a moderate level of stability in the region. The Nile has great environmental stresses and power asymmetries, and moderate formal institutions and political trust. This has resulted in contested cooperation and limited outcomes for stability in the region. The Mekong has moderate formal institutions and political trust, but is developing basin-wide coordination. This results in moderate cooperation and stability in the region. Compared to the other three river basins, the Danube has developed basin-wide coordination and political trust and has moderate power asymmetries. As a result, cooperation is strong and this leads to greater stability in the region. The findings from the comparison show that to have greater regional stability, there needs to be more than developed formal institutions; political trust, cooperation, and coordination to address stresses are also important.

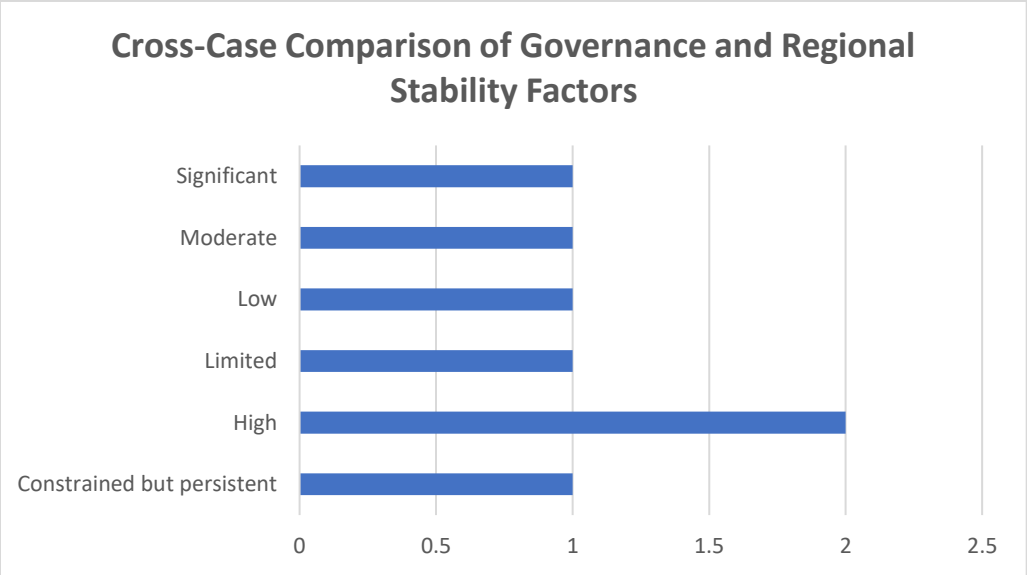


Fig 1: Cross-Case Comparison of Governance and Regional Stability Factors

Environmental Security Comparison

Considering environmental-security, the cases illustrate different pathways by which environmental factors cross over into the security domain. In the Indus case, water security is linked with agricultural security, climate change vulnerability, and the India-Pakistan relationship. In the Nile case, water security is inter-related with national development and inter-state negotiation. In the Mekong case, environmental security is inter-related with fisheries, food systems, ecosystems, hydropower and livelihoods. In the Danube case, environmental security is more related with coordinated environmental protection and pollution management, flooding and sustainable use of resources. This comparison shows that environmental security is relative, and the same water related pressure can produce different political effects relating to inter-state relationship and the state's capacity for governance. The research shows that water disputes are the consequences of inter-linked geographical, political, social, economic and ecological factors and processes, and the inter-institutional frameworks, instead of the simple presence of water scarcity.

Water Governance and Interstate Cooperation

There are, of course, limits to the capacity of governance institutions to keep communicating during disagreements. The case of the Indus shows that mechanisms to keep diplomatic and technical engagement channels open exist and can be institutionalized. The cases of the Mekong and Danube show the significance of joint institutions for information exchange, coordination, and dispute resolution. Recent studies show that among other joint institutions and river-basin organizations, river-basin organizations are among the most effective mechanisms for the prevention, resolution and peaceful settlement of transboundary water disputes, but their effectiveness remains politically determined.

Institutional cooperation has its limits when there is disagreement about fundamental questions of rights and the distribution of benefits and costs of development. The case of the Nile points to limits of cooperation and offers lessons for the analysis of other basins. The case of the Nile shows that the existence of an institution should not be confused with effective governance. The case of the Nile illustrates the need to include a broader range of sectoral actors, policy makers and decision-makers to enhance effective cooperation in information exchange and dispute resolution and to adapt mechanisms to changing environmental and institutional conditions.

Comparative Relationship with Regional Stability

The final stage of the analysis looked at how differences in water governance affect stability in other regions. The cases study suggests that effective governance creates a pathway for preventing environmental conflicts from escalating into larger political

issues. The presence of institutionalized avenues for negotiation and joint commission for water quality and quantity monitoring, data exchange, and resolution of water disputes helps keep water-related issues within the management of diplomatic channels. Water-related issues can become elements of geopolitical competition when trust and governance are fragmented. Comparative research in recent years has examined stability in the various river basins (e.g. Mekong, Zambezi, Rhine, Danube, Jordan, Inguri and Nile) and identified various degrees of contribution of the river basins to the region's stability, and how institutional and geopolitical conditions explain the variances.

Table 4: Relationship Between Governance Conditions, Environmental Security, International Relations, and Regional Stability

Governance Condition	Environmental-Security Effect	International-Relations Effect	Regional-Stability Outcome
Strong joint institutions	Better management of environmental pressures	Regular diplomatic engagement	Greater stability
Effective information sharing	Reduced uncertainty	Greater transparency	Lower risk of escalation
Equitable resource arrangements	Reduced perceptions of insecurity	Greater political legitimacy	Stronger cooperation
Adaptive governance	Better response to climate and ecological change	Continued institutional relevance	Greater resilience
Weak institutional coordination	Increased environmental vulnerability	Mistrust and unilateral action	Greater instability
High political tension	Environmental issues become securitized	Water becomes a geopolitical bargaining instrument	Higher risk of regional tension

Relationships between governance conditions, environmental security, international relations and regional stability are qualitatively illustrated in Table 4. The case studies mostly support the hypothesis that efficient and effective joint institutions can provide a mechanism for diplomatic engagement that can improve management of environmental problems and increase regional stability. The case studies confirmed the hypothesis that facilitation of effective and equitable information and communication exchange can contribute to risk reduction and increase stability. Effective and equitable control of shared resources can help build and strengthen trust, improve political legitimacy, and promote and foster cooperation. Therefore, adaptive and transformative governance can increase regional resilience to climate change and supporting the role of institutions in responding to environmental changes. Weak institutional integration can increase environmental insecurity, reduce trust among countries, and limit opportunities for cooperation, which may negatively affect regional stability. Environmental challenges are often influenced by political interests, and when these issues become politicized, tensions between countries can grow. In regions where governance systems are weak, problems related to shared natural resources and climate change may become more difficult to manage, creating a greater risk of instability. The findings from the case studies show that transboundary water governance can support both environmental security and regional stability when it is fair, flexible, and capable of responding to changing conditions.

Discussion

This qualitative comparative analysis finds that environmental security, transboundary water governance, and regional stability mutually influence one another in international relations. By analyzing the Indus, Nile, Mekong, and Danube river basins, it shows water scarcity, climate and ecological variability, and other stresses do not necessarily create interstate conflict. It is the governance arrangements, political trust, power relations, and the willingness of states to adjust that determine the security consequences. This aligns with Turgul et al (2024) who also argued that cooperation for shared water resources is greater than conflicts and stated that the right set of institutions can foster cooperation and ease the management of water disputes. Therefore, it can be said that when existing governance structures and arrangements are inadequate to manage the competing interests, environmental pressures increase concerns of regional security.

The research also shows that transboundary water governance is a key response to environmental-security challenges. However, while having formal institutions may appear to be essential, it is political trust, adjustment, and the willingness of states to carry out previously agreed arrangements that influence the success of cooperative efforts. This aligns with previous studies that transboundary water governance needs to be tailored to the political, economic, social and environmental conditions of river basins, and should not rely on a single framework.

Water governance in the Indus River Basin demonstrates how climate change, variability and irrational human behavior can exacerbate water disputes, although diplomatic relations may be stable. Traditionally, although India-Pakistan relations may be hostile, Pakistan and India have been able to negotiate and collaborate on matters related to water through the framework of treaty-based agreements. Nonetheless, Williams, (2018) point out other challenges, including unpredictable climate, rising water stress, and evolving geopolitical, diplomatic and infrastructure challenges. Overall, although diplomatic relations may be stable, the changing climate and unpredictable variability may create challenges for the Indus System and other river basins around the world. What happens on the Indus System may have profound implications elsewhere. Long-term environmental security in the Indus System would require more than the establishment and continuation of existing institutions (Gunder).

The Nile River Basin shows more political contestation with water allocation and dam development. Upstream and downstream interests are mixed with the different national priorities of development. It shows that perceptions of fairness and asymmetrical power play a role in environmental insecurity in addition to the availability of water. When countries have differing perceptions of their water rights and development needs, environmental concerns can become inter-linked with national security and sovereignty. Therefore, maintaining negotiation and promoting better cooperation in the basin will help break the cycle of environmental concerns intensifying mistrust and political tensions (Al-Muqdadi, 2025).

The Mekong River Basin shows cooperation and competition occur simultaneously. There are multiple regional institutions and mechanisms for cooperation which facilitate dialogue and coordination; however, there are challenges with hydropower development and other large-scale infrastructure, ecological degradation and changing the flow of rivers. These challenges mingle with competing national priorities (Wafa et al., 2025).

These findings back up the claim that governance doesn't eliminate contestation. Instead, peaceful management of contestation is more realistic. This is in line with the broader body of research which shows water relations across international borders tend to contain both contentious and cooperative aspects, rather than fall along a simple conflict-or-cooperation continuum.

The Danube River Basin provides a more adequate example of using effective regional cooperation to address common challenges and achieve multiple coordinated objectives. Through the coordinated exchange of information and robust environmental management, the majority of the contradictions regarding environmental challenges in the Danube River Basin have been resolved. One of the advantages of the Danube River Basin is that a certain level of regional stability can exist alongside environmental pressures. This is possible due to the effective regional mechanisms that some of the states employ to respond to the pressures (Cassidy-Neumiller et al., 2024).

One of the major cross-case findings refers to the role of trust and the exchange of information. States that have higher trust in each other tend to exchange information, participate in joint monitoring, and solve disputes through negotiations and construct cooperative arrangements. There are exceptions to this tendency. For example, if states interpret certain environmental or infrastructural changes as posing threats, there may be little trust to support the exchange of information. In all cases, the absence of information can aggravate a given situation and support an escalation of the conflict. Reliable information helps reduce uncertainty and has the potential to support positive interpretations. Therefore, according to the findings, transparency should be considered an essential aspect of water governance (Albrecht et al., 2018).

Finally, the comparison highlights the role of power balance, equity, and adaptive governance. Given the imbalances that exist among states, certain mechanisms and considerations may be useful for accommodating the needs of the most vulnerable states. Also, an infrastructure project that is vital to the development interest of one state may be viewed by another state as a direct threat to its water security and wellbeing. Impartial resource arrangements and appropriate benefit-sharing mechanisms improve legitimacy and lead to greater cooperation. Adaptive governance is increasingly important because of climate change. Historical patterns of water availability may not remain stable, and governance institutions must be able to respond to changing water availability, floods, droughts, and other changing environmental conditions.

Conclusion

This study explores the relations between environmental security, transboundary water governance, and regional stability within the field of international relations. Using a qualitative comparative approach, it examines the Indus, Nile, Mekong, and Danube river basins to understand how environmental challenges influence relations between countries. The study focuses on issues such as water scarcity, changes in water availability, environmental degradation, population growth, and the expansion of transport and infrastructure networks. It investigates whether these pressures increase the likelihood of interstate tensions and conflict or encourage cooperation and collective resource management among neighboring Stability and security concerns related to these environmental stresses are significantly influenced by governance and institutions, interstate collaboration and trust, and the capacity of states to adjust to environmental changes. The comparison shows that positive and cooperative governance structures create an atmosphere of trust and facilitate the management of disputes and joint environmental management. In doing so, they decrease the possibility of water related pressure and concerns evolving into broader regional issues of instability.

The study reveals that in the case of the Indus and Nile basins, geo-political tensions and competing development interests, as well as environmental stresses, create obstacles for cooperation. The study further shows that without positive and cooperative governance structures, the potential of transboundary water challenges to create instability prevails. The study therefore shows that, in addition to formal water-sharing agreements, transforming transboundary water challenges from potential sources of insecurity into cooperation and environmental resilience requires a focus on adaptive institutions, continued diplomacy, cooperation and trust, as well as the integration of climate-resilient structures and active water management.

Future Implications

Future policies and research should give greater attention to strengthening cooperation among countries that share water resources. As climate change, population growth, environmental degradation, and water scarcity continue to place pressure on shared river systems, effective collaboration will become increasingly important. Governments and regional institutions should develop stronger systems for joint monitoring, information sharing, and coordinated decision-making. Efforts should also focus on ensuring fair water allocation, improving the management of climate-related risks, and promoting peaceful solutions to water-related disputes. These measures can help support environmental security, strengthen regional cooperation, and contribute to long-term stability. The study recommends that future research consider additional river basins and utilize mixed methods and longitudinal approaches to study how environmental changes and the evolution of the geopolitical landscape shape regional stability and cooperation over time. Research should focus on how transboundary water challenges and cooperative initiatives encourage regional cooperation and sustainable international relations and help strengthen the environment resilience of the region.

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