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THE CULTURAL ASPECT OF TRANSBOUNDARY RIVERS - IN THE CASE OF THE LOWER JORDAN RIVER BASIN

THE Ph.D. DISSERTATION

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

1. **ANOVA**: Analysis of Variance
2. **BOD**: Biochemical Oxygen Demand
3. **CCIs**: Cultural and Creative Industries

4. **CES**: Cultural Ecosystem Services
5. **CI**: Confidence Interval
6. **DFCI**: Driver-Forces Coverage Index
7. **DF**: Driving Force
8. **DFs**: Driving Forces
9. **EROS**: Earth Resources Observation and Science Center
10. **EU**: European Union
11. **FoEME**: Friends of the Earth Middle East (EcoPeace)
12. **GIS**: Geographic Information Systems
13. **GS**: Google Scholar
14. **HC3**: Heteroskedasticity-consistent covariance estimator (type HC3)
15. **HSD**: Honestly Significant Difference (Tukey HSD)
16. **ICPDR**: International Commission for the Protection of the Danube River
17. **ICSD**: International Conference on Sustainable Development
18. **ICOMOS**: International Council on Monuments and Sites
19. **JRB**: Jordan River Basin
20. **LJRB**: Lower Jordan River Basin
21. **LULC**: Land Use/Land Cover
22. **MSSD**: Most Similar Systems Design
23. **NGOs**: Non-Governmental Organizations
24. **OCHA**: United Nations Office for the Coordination of Humanitarian Affairs
25. **OLS**: Ordinary Least Squares
26. **RBMPs**: River Basin Management Plans
27. **SD**: Standard Deviation
28. **SDGs**: Sustainable Development Goals
29. **SE**: Standard Error
30. **SolVES**: Social Values for Ecosystem Services
31. **TFDD**: Transboundary Freshwater Dispute Database
32. **UN**: United Nations
33. **UNECE**: United Nations Economic Commission for Europe
34. **UNESCO**: United Nations Educational, Scientific and Cultural Organization
35. **UNFCCC**: United Nations Framework Convention on Climate Change
36. **USGS**: United States Geological Survey
37. **WFD**: Water Framework Directive (EU)
38. **WoS**: Web of Science

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1. INTRODUCTION

1.1. Research Background and Context

1.1.1. Research Background

This dissertation considers rivers as socio-natural constructs instead of hydraulic conduits. Within the hydro social cycle, both water and society keep each other continuously co-produced through technologies, institutions, as well as daily practices, opposing dualisms that divide nature, culture, as well as politics (Linton and Budds, 2014). Power asymmetries also shape flows, access, as well as the meaning that gets attached to water under transboundary circumstances. The hydro-hegemony framework embeds these associations as basin-scale tactics of capture, integration, as well as resource containment (Zeitoun and Warner, 2006). International legal baselines frame shared rivers as common concerns: the 1997 UN Watercourses Convention centres equitable and reasonable utilization/participation, while the 1998 Aarhus Convention underwrites access to environmental information, public participation, and access to justice, principles increasingly invoked in river-basin planning.

Culturally, rivers are places where identity, remembrance, and a sense of belonging are crafted and recreated. The tripartite place-attachment paradigm (person-process-place) provides evidence-based constructs linking affect, cognition, and behaviour to stewardship and acceptance of policy (Scannell and Gifford, 2010). Simultaneous developments in cultural ecosystem services (CES) bring spiritual, heritage, and recreational values to the forefront that traditional techno-managerial paradigms are prone to underestimating.

1.1.2. Research Context

For thousands of years, the Jordan River has served as a significant cultural corridor: a landscape of pilgrimage interwoven with sacred sites, monastic communities, communal irrigation systems, ferries, and crossings. The Baptism Site, located on the eastern bank, known as “Bethany Beyond the Jordan” (Al-Maghtas), exemplifies this extended period of collective sacred geographies and ritual movement, with archaeological stratifications of churches, baptism areas, and hermitic residences evidencing ongoing reverence since the Byzantine period (Haddad et al., 2009).

In the early 20th century, the withdrawal of empires and the partitioning of mandates redefined the river from a means of connection to a legal boundary. British boundary delineation under the Mandate characterized the Jordan River as the divisive line separating Palestine (West Bank) from Transjordan (East Bank). This distinction was formalized through the arrangements outlined in Article 25 and the 1922 Trans-Jordan memorandum, which depicted the border as following the thalwegs of Wadi Araba, the Dead Sea, and the Yarmouk tributary. These actions established a contemporary state border traced along the river's trajectory, instilling administrative and security logics that replaced earlier integrative practices (Bunton, 2008).

After Nakba in 1948, the 1949 Armistice Agreements formalized ceasefire lines (the Green Line) that, centrally, essentially froze the river as a border between Israel and the Jordan-annexed West Bank. The Six-Day War (Naksa) in 1967 then altered territorial authority again, as the Jordan-occupied West Bank and Jordan Valley came to be controlled by Israel. The border then became something more than a legal demarcation, as restrictions on movement, settlement practice, and military-secured control altered access to the land, to the waters, to the cultural heritage (Ben-Dror, 2020). Hydro politics overlaid and reinforced this transformation. Large-scale infrastructure and diversions, Israel's National Water Carrier (1960s), the Jordanian King Abdullah Canal (from the late 1950s on the Yarmouk), and aborted headwater diversion schemes, reallocated flows away from the lower mainstem. These moves, together with return flows and pollution, reduced the lower Jordan to a fraction of its historical discharge and accelerated Dead Sea decline, recoding the river as a scarce, contested resource subject to state logics rather than a shared cultural landscape (Irshaid, 2021) .

The Israel-Jordan Treaty of Peace, agreed upon in 1994, brought this border closer to normality through the demarcation of specific areas, protocols regarding the distribution of water, as well as joint management (Annex II), and the establishment of a Joint Water Committee. It did, however, also consolidate the international boundary nature of the river, including controlled crossings and continued access and inaccessibility disparities (Kaufmann, 2021). Continued programs regarding rehabilitation, for example, EcoPeace/FoEME advocate strongly for the restoration of environmental flows, linking ecological recovery and targets regarding salinity to increased public access and heritage stewardship. This becomes an effort to reassert the integrative services of the river, within the bordered status allocated, rather than beyond (Sarig Gafny et al., 2010).

Today, the Lower Jordan River is noticeably deficient: long-term upstream diversion of the water and backflow mean that the mainstem retains only a fraction of its natural discharge, and the Dead Sea continues to sink at about 1 meter annually, worsening the salinity levels as well as the threat of sinkholes related to the basin wide overall change in the water balance, as outlined by extensive studies prepared by USGS/EROS and industry tracking. Nevertheless, the cultural significance of the valley remains strong, and both pilgrimage and heritage tourism continue to concentrate on the UNESCO-designated Baptism Site "Bethany Beyond the Jordan" (Al-Maghtas), resulting in a contemporary scenario that presents a paradox of considerable symbolic importance despite environmental degradation and closely regulated access (Katz, 2022).

Politically, the river continues to function as a transboundary boundary managed through bilateral agreements, where routine technical water coordination often continues even when broader normalization initiatives are paused or reversed due to domestic and regional pressures.

1.2. Statement of the Problem

Classic transboundary river analysis holds allocation regimes, infrastructure, and environmental conditions in high esteem. Cultural values, heritage/tourism access, and identity/attachment, however, potentially moderate compliance, stewardship, and conflict behaviours, as they do on border rivers such as the Lower Jordan River Basin (LJRB). Current practice lacks an interdisciplinary, multi-driver framework that (i) treats culture analytically on the same level as political, technological, economic, and environmental ones, (ii) links macro frames to empirical perspectives subject to border constraints and distorted ecological configurations, and (iii) yields operational insights amenable to restoration as well as access. Exclusion of the latter framework could misidentify change forces, underestimate rehabilitation values, and distributional access regime impacts.

1.3. Significance of the Thesis

Theoretically, this research reconceptualizes border-river transformation as a multi-driver cultural, political, and ecological process, instead of a hydrotechnical optimization issue. It does this through the integration of the hydro social cycle, which frames water and society as co-constitutive through infrastructures, institutions, and meanings, with hydro-hegemony, which formalizes the ways that asymmetric power structure allocation and the discourses of "cooperation" through the strategies of the capture, integration, and containment of resources (Linton and Budds, 2014).

Ontologically, culture ceased to be a residual category, instead, it acts as a catalyst affecting behaviour and compliance through place-attachment (the person-process-place model) and cultural ecosystem services (CES) (spiritual, heritage, recreational values) (Scannell and Gifford, 2010).

Intertwining these threads illuminates the processes wherein border regimes, environmental flows, and heritage meanings converge to jointly determine landscape change directions, an explanatory structure that conventional engineering-head accounts under-represent.

Methodologically, (i) the research proposes an inclusive, cross-driver analytical framework that is culturally oriented and operationalized through systematic mapping of structured evidence within the five driver domains to identify under-represented factor intersections, as best practice in systematic synthesis. (ii) a comparative structure to rationalize the Lower Jordan River Basin as a multi-layered border case, and (iii) a multi-community perception surveys that relate cultural constructs to measuring indicators (significance, heritage/tourism access, identity/attachment) and connects them to border constraints and ecological status as perceived. The perceptions' part utilizes established public involvement and social-valuation paradigms for eliciting place-based values and constraints. On the planning/biophysical side, the structure uses the environmental

flows studies as the ecological equivalent or complement to cultural and political indicators. Alongside these techniques, cross-walking subjective cultural values with institutional/legal foundations and environmental performance objectives becomes possible.

By connecting these objectives to empirically verified cultural and social-access patterns, the dissertation provides actionable guidance on the distribution of water, the building of access regimes, and the prioritization of investments that are legally rational, ecologically justifiable, and socially justified.

Practically, this dissertation offers a usable template for how basin authorities, and researchers can act in contested border rivers. It shows how to use the Driving Forces Coverage Index (DFCI) and cross-driver gap-mapping to select cases transparently and to generate a concrete pipeline of studies and policy briefs. It then translates the flows-access-meanings into planning levers by coupling environmental-flow and water-quality targets with very specific access measures such as serviced heritage sites, and safer crossings. Culturally, it proposes three operational workstreams: Significance, Heritage & Tourism, and Identity & Attachment. Finally, it standardises perception metrics and provides replication kits to compare results over time and across cases

1.4. Research Inquiry

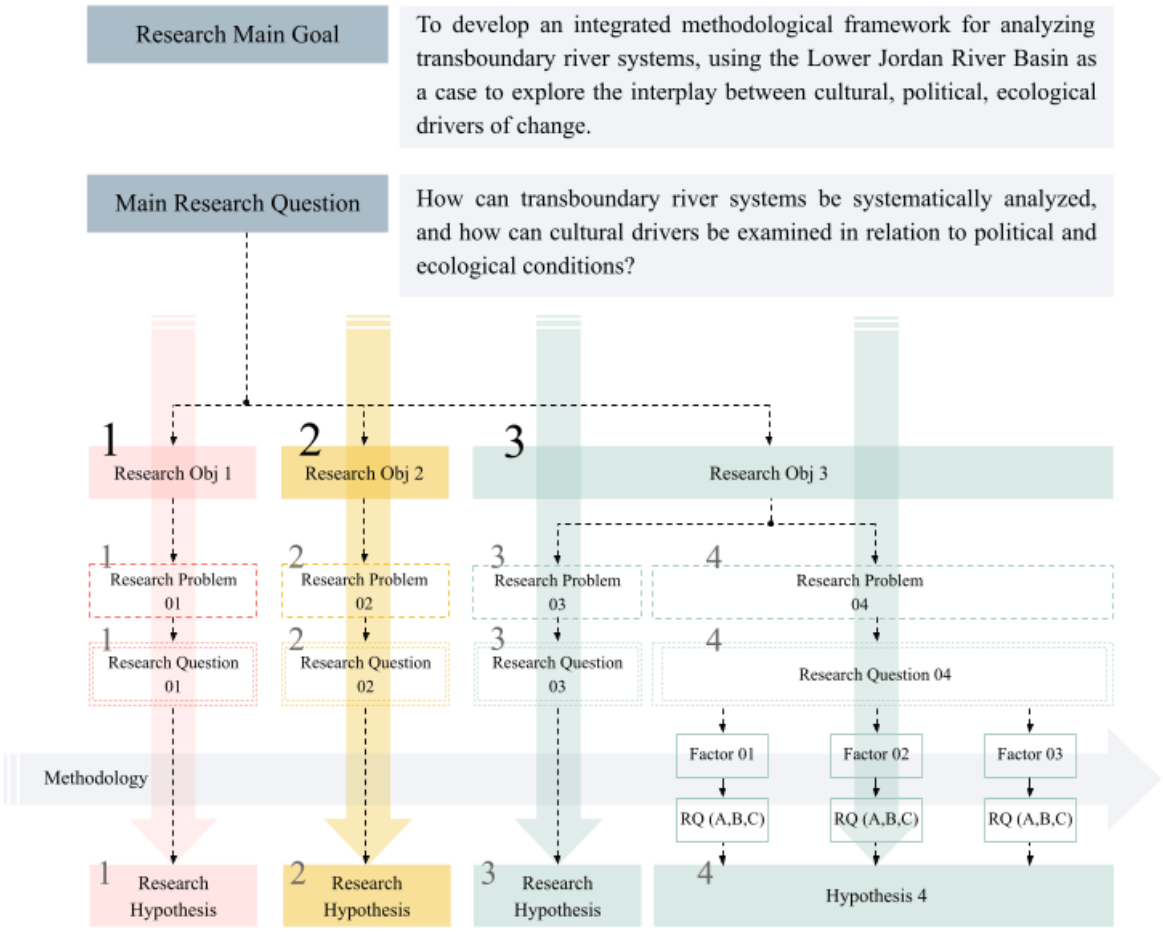


Figure 1: Main Framework of the Research (Source: Author)

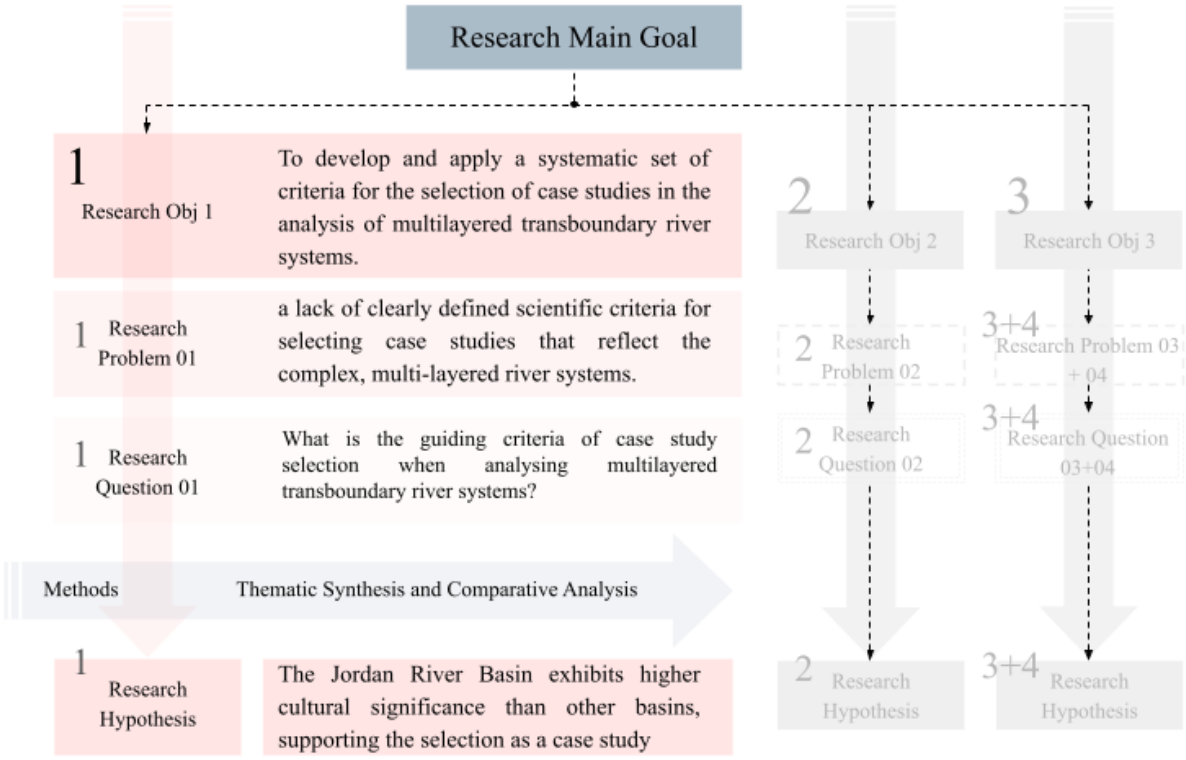


Figure 2: Stage 1 Framework (Source: Author)

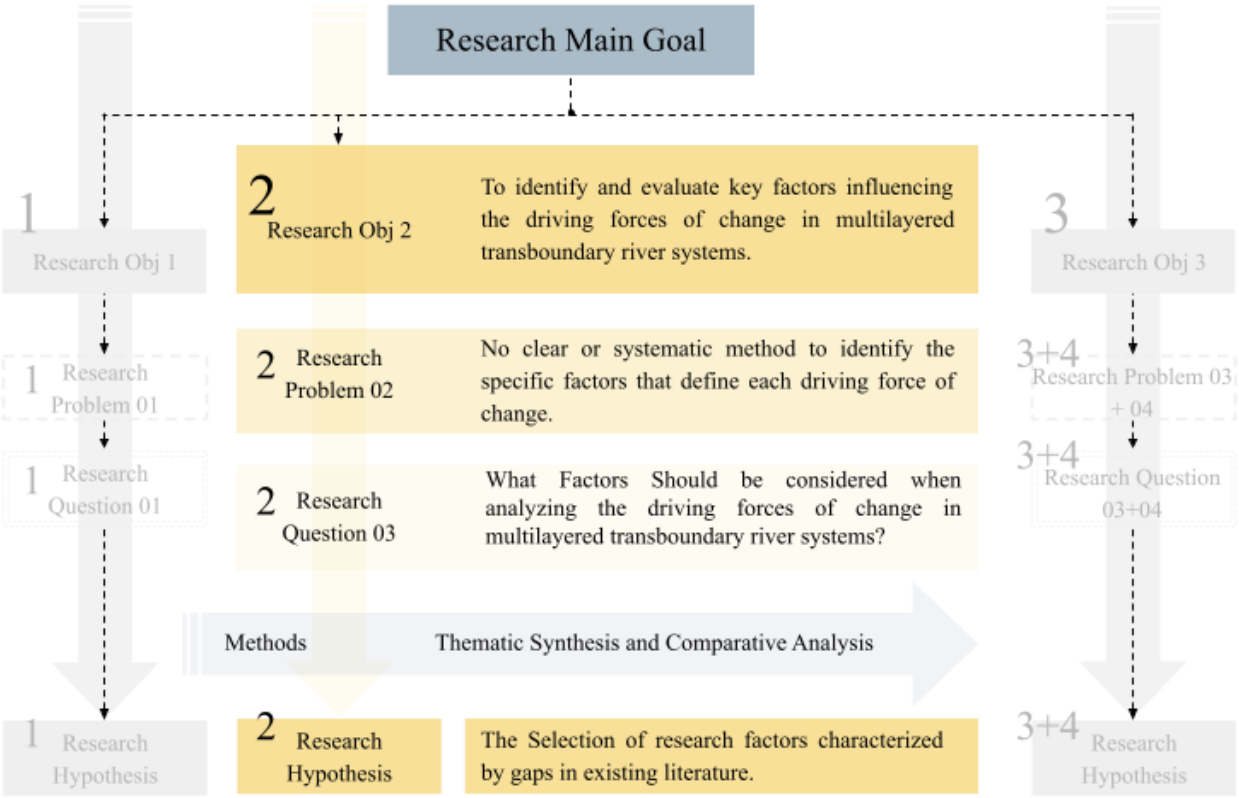


Figure 3: Stage 2 Framework (Source: Author)

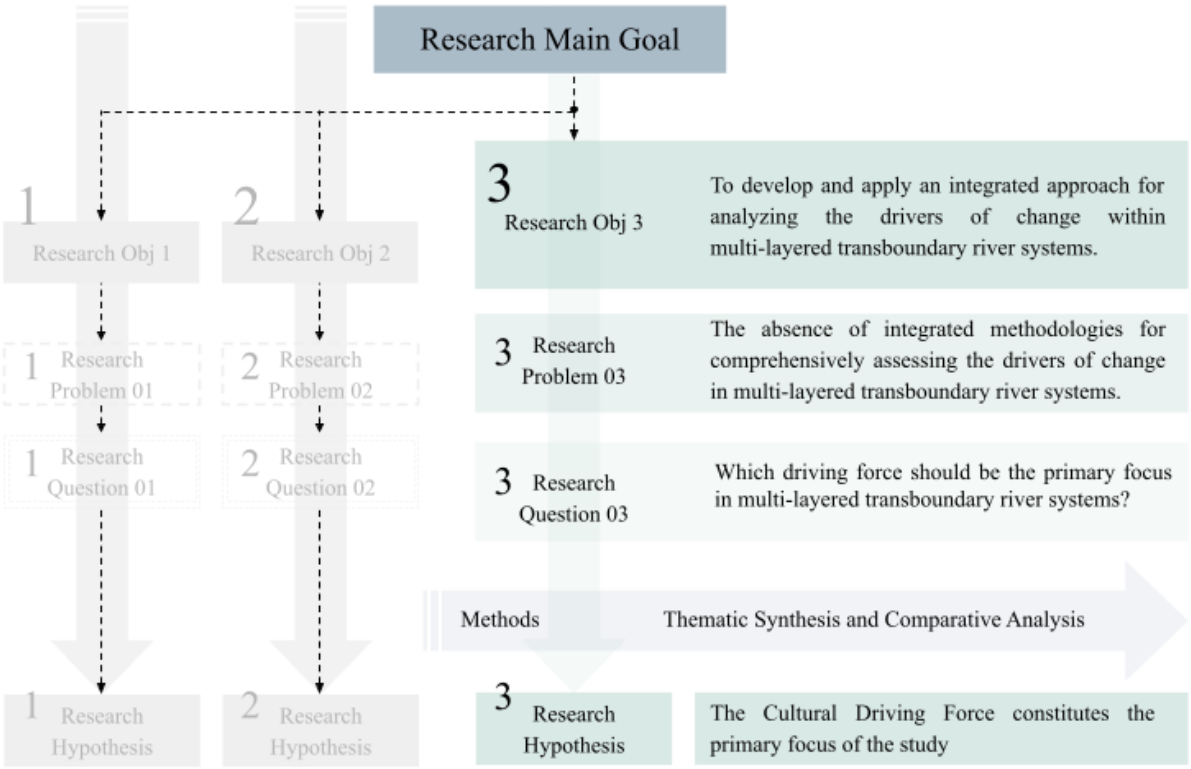


Figure 4: Stage 3 Framework (Source: Author)

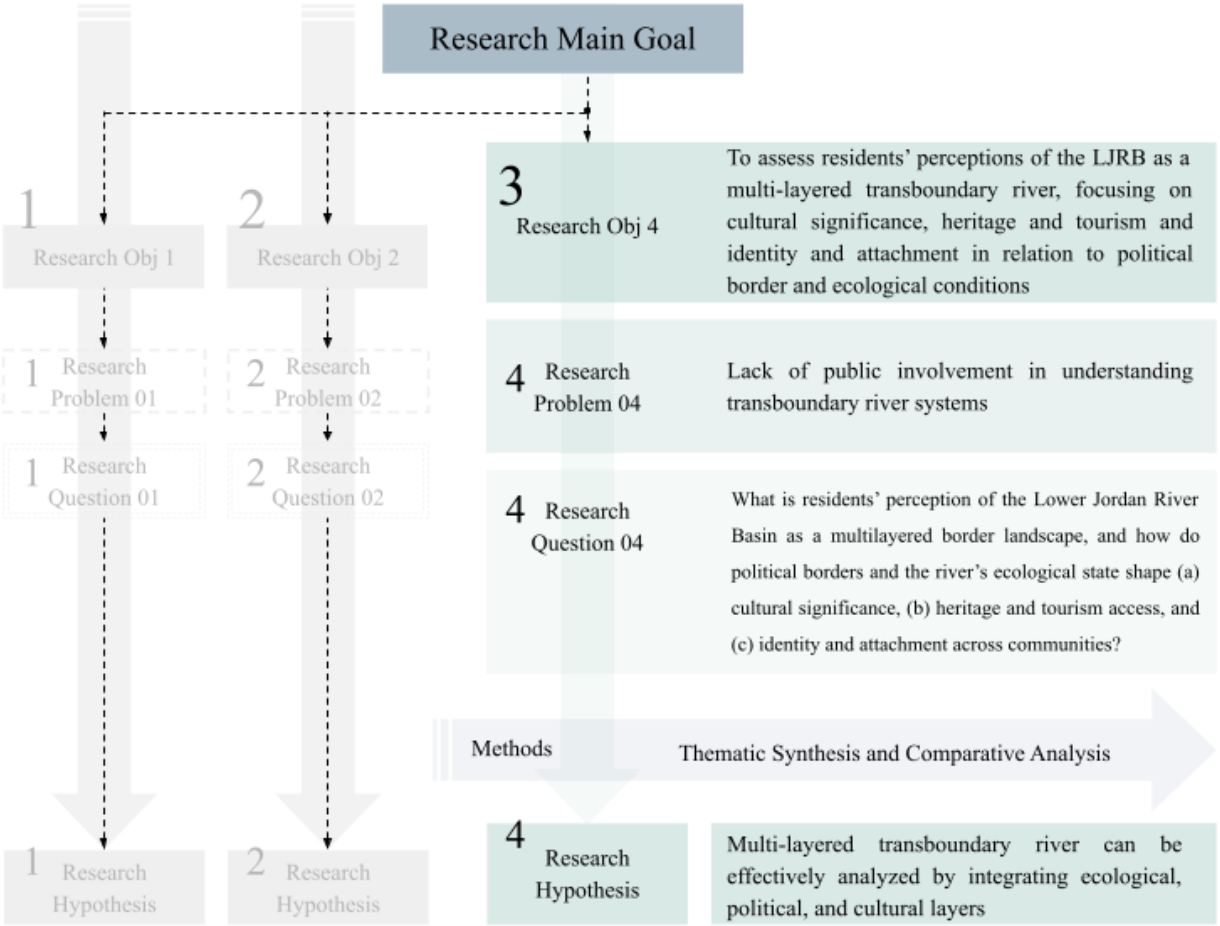


Figure 5: Stage 4 Framework (Source: Author)

1.5. Research Methodology

This dissertation utilizes a four-stage, mixed-methods design that links systematic synthesis to empirical research. An interdisciplinary evidence base is produced through a multi-database study with explicit search strings, inclusion/exclusion criteria, multilingual scope, and source evaluation.

1. Stage 1 employs a comparative screening rubric, level of securitization, cultural/heritage salience, hydro-ecological change, and evidentiary depth within the framework of a Most-Similar-Systems Design to justify the Lower Jordan River Basin (LJRB) as the core sector.
2. Stage 2 undertakes structured evidence mapping based on five drivers (political, technological, economic, environmental, cultural) to line up the 200 sources within a driver factor matrix that reveals recurring and under-represented intersections as part of driving cultural factors (identity and attachment, heritage and tourism, cultural significance).
3. Stage 3 establishes a consolidating cross-driver platform that conjoins legal and governmental standards to hydro social and hydro-hegemony perceptions, as well as cultural-perception constructs, turning them into functioning indicators that indicate the path of landscape change as well as ecological levels.
4. Stage 4 undertakes multi-community surveys that evaluate cultural value, heritage, and accessibility to tourism, sense of identity and attachment, observed condition of ecology, border-related constraints, and employs respective parametric/non-parametric tests, effect sizes, as well as tests of robustness.

1.6. Thesis Framework and Structure

This dissertation is structured into six core chapters, followed by the reference, appendices, as well as acknowledgment, making up a complete work that holistically engages landscape change within the Lower Jordan River Basin (LJRB) as a complex border landscape.

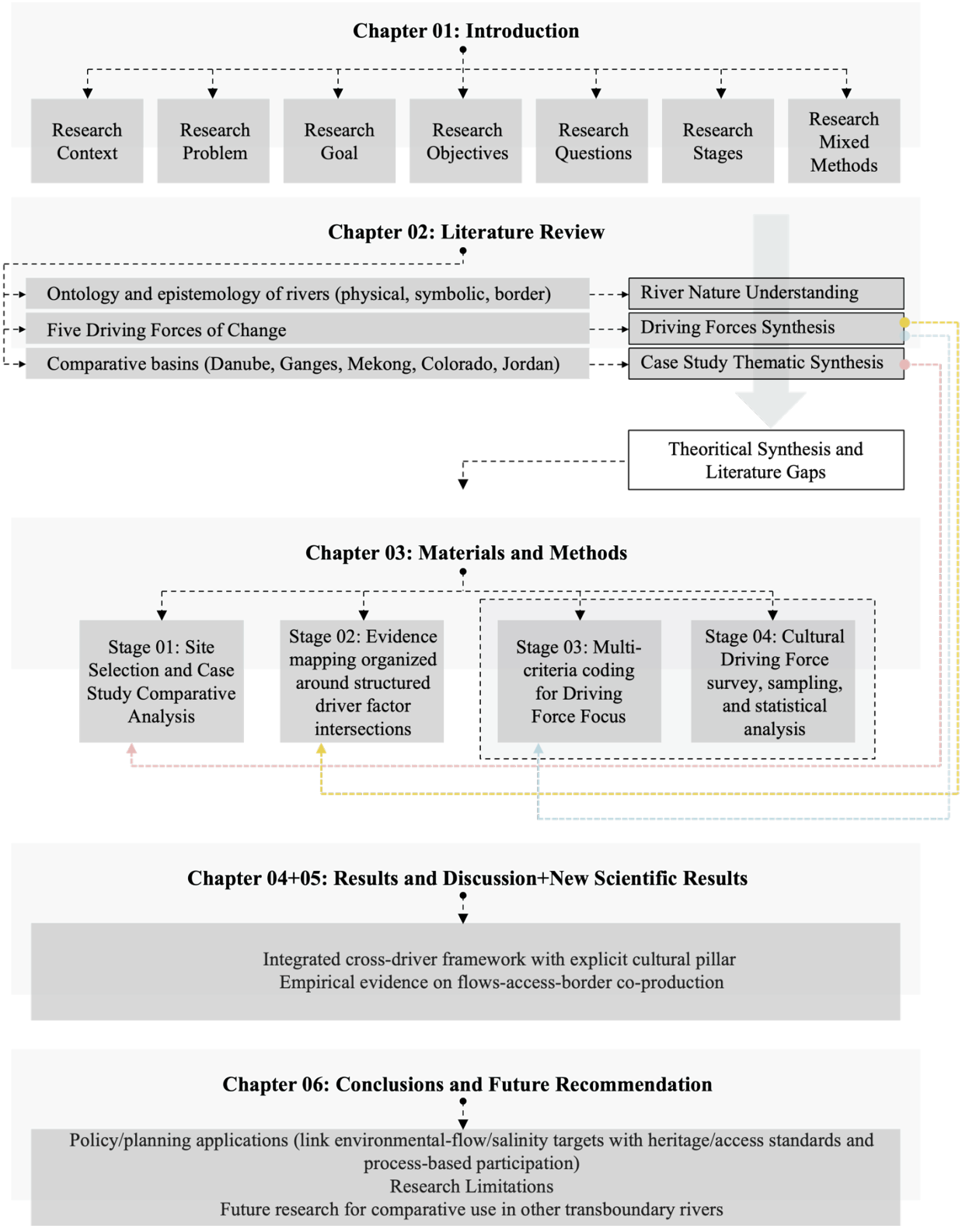


Figure 6: Thesis Chapter Structure (Source: Author)

2. LITERATURE REVIEW

This literature review has two main purposes. First, it situates transboundary rivers as multilayered socio-ecological systems shaped by political, economic, technological, natural, and cultural drivers. Second, and more specifically, it builds the conceptual basis for three cultural constructs: cultural significance, cultural heritage and tourism, and cultural identity and attachment. The following sections, therefore, privilege bodies of literature that discuss cultural landscapes, place identity and belonging in border regions, cultural ecosystem services and heritage tourism, and identity-mediated relations to riverine environments.

2.1. Ontology and Epistemology of River Systems

Ontology and epistemology profoundly influence scholarship and practice with river systems. Ontology defines a river by its flowing water and sediment, as well as the narratives, regulations, and rituals associated with it; conversely, epistemology demonstrates how assertions regarding the river gain credibility, face contention, and may ultimately be overlooked (Moon and Blackman, 2014). In river studies, ontological perspectives range from the positivist view that rivers are stable, quantifiable channels governed by physical laws to relational, constructivist interpretations that regard a river as a dynamic assemblage of ecological, social, and symbolic relationships (Linton and Wynn, 2010). Hydrology, ecology, anthropology, geography, and political science each provide distinct yet inadequate perspectives. A hydrological model can indicate the locations of peak flood risk, but it fails to account for how kin groups, religions, and historical narratives are intertwined with the same water flow (Boelens, 2015; Orlove and Caton, 2010).

2.1.1. Rivers as Physical Systems

The prevailing scientific perspective on rivers persists in influencing research across hydrology, geomorphology, and ecology. From this perspective, a river functions as a physical mechanism propelled by gravity, transporting water, sediment, and organisms along an inclined pathway. Falkenmark and Rockström, (2006) refined this perspective with their blue-green-water model, which integrates surface streamflow with subsurface soil moisture in the assessment of the global water budget. Pahl-Wostl *et al.*, (2007) contended that every river integrates natural hydrology with human decisions, rendering it ineffective to assume that water research and social policy operate in isolation.

Agricultural reform, dam construction, and modified canals have altered fish behaviours and floodplain routes in the Amazon, Mekong, and Rhine (Petts and Gurnell, 2005). Nevertheless, numerous conventional water studies overlook local histories, political agreements, and cultural norms. These factors influence public perception of events in the channel and the rationale behind managerial responses (Sneddon and Fox, 2006). This oversight leads to a limited, utilitarian

perspective of rivers as simply resources for economic activities, agriculture, energy production, and transportation.

Placing the Jordan River Basin into this global framework reveals that physical modifications alone cannot account for the river's complex function. The political tensions and cultural affiliations characterizing the region introduce complexities not present in solely biophysical assessments (Zeitoun and Mirumachi, 2008). Thus, the study of physical river systems must be augmented with socio-political analysis to comprehensively understand the basin's difficulties and opportunities.

2.1.2. Rivers as Symbolic Entities

Apart from physical nature, rivers are also imperative cultural and symbolic landscapes. Research is progressively recognizing rivers as more than mere natural watercourses; they are arteries of civilization comprising historic conflicts, geopolitical fears, and community identities. This symbolic function shapes environmental attitudes and governance practices. For example, Verbrugge *et al.*, (2019) conducted an interactive mapping study of five European rivers in Denmark, Germany, the Netherlands, Switzerland, and Spain. It illustrates how individual and shared experiences, cultural meanings, and social dynamics intersect to shape robust senses of place within river landscapes. These place-based identities influence how communities relate to environmental change and management and can foster active stewardship when integrated into planning processes. The findings emphasize that symbolic and emotional attachments to river spaces are not peripheral but integral to sustainable and inclusive river governance. Similarly, Llausàs and Nogué, (2012) followed sense-of-place indicators over time and space, demonstrating that while visible landscape markers can be altered or destroyed, deeper, often intangible cultural attachments persist. The inference of the study is that river management policies that disregard symbolic and cultural dimensions compromise long-term conservation goals.

While these European studies provide insightful lenses, their relevance to the Lower Jordan River Basin lies in highlighting the interplay between physical access, political restriction, and cultural belonging, urgent realities in the Jordan context. The basin's contested borders and multi-ethnic demographics create a complex mosaic of meanings and attachments, which shape the ways different groups engage with the river. Identifying these symbolic dimensions is critical to creating culturally aware and politically perceptive management strategies that fit the Jordan River Basin's specific geopolitical context.

2.1.3. Rivers as Border Landscapes

The classical political geography situates rivers as "natural frontiers," designating clear boundaries for states (Prescott, 2014). But physicality serves to veil complex socio-political processes, rendering river boundaries flexible, dynamic, and frequently disputable ones (Zeitoun and

Mirumachi, 2008). Hydro-political research places rivers as arenas where the politics of power, resource control, and sovereignty are continuously negotiated, typically in the face of competing and unequal interests (Delli Priscoli and Wolf, 2009; Wolf, 1999).

Central to this discourse is hydro-hegemony, a condition where a dominant riparian state exercises disproportionate control over shared water resources through economic, technical, or military means, which illustrates how influential riparian states project control over transboundary water resources through economic, political, and military power, often determining downstream states' access and ability to govern (Zeitoun and Warner, 2006). While this framework commendably emphasizes power asymmetries within transboundary water conflicts, its operational utility differs across geopolitical situations, at times diminishing localized social dynamics and institutional complexities.

Border theory takes this one step further in complicating river conceptions by dissolving the fixed and impenetrable line theory of boundaries, emphasizing their performativity and social construction (Newman and Paasi, 1998). Rivers are the very essence of this fluidity, being "liminal spaces" where sovereignties, power relations, and identities converge, get transformed, and are ever-negotiated (Schofield, 2002). This case of borders intersects with hydro-political asymmetries of power in shaping the way territorial power is exercised, contested, or evaded through political rhetoric and social practices (Zeitoun and Warner, 2006). Rivers are therefore not just geographical demarcates or rigid political boundaries but socio-ecological systems highly invested in cultural meanings and identity, with ramifications for governance and conflict management (Swain, 2004). River border landscapes encompass necessary social elements such as community identity, cultural affiliation, and symbolic meaning that typically are not given adequate consideration within purely political or hydrological frameworks (Bakker, 2007; Verbrugge et al., 2019).

The way that locals approach the river and their engagement with cross-border cooperation or conflict relies on such social affiliations, requiring interdisciplinary methods in the management of transboundary waters. The Danube and Rhine River basins are exemplary cases of institutional success in promoting cooperation through transnational river basin institutions (Kostic, 2007), though balancing heterogeneous stakeholders' interests and environmental sustainability remains challenging. Conversely, rivers like the Nile reveal the persisting tensions induced by unbalanced power relations and competing water entitlements, illustrating hydro-hegemony's real-world relevance and the task of generating a mutually equitable resource allocation (Zeitoun and Warner, 2006). This conceptual framing informs the research questions and approach by emphasizing the necessity to consider rivers not only as physical and political boundaries but as socio-ecological systems where cultural identity, political authority, and environmental processes overlap, particularly in complex transboundary contexts.

2.1.4. Cultural Landscapes and Place Identity in Border Regions

The concept of cultural landscapes, initially proposed by Carl Sauer, has subsequently developed to encompass the reciprocal interaction between human civilizations and their settings, wherein place acquires cultural, symbolic, and political value. Cultural landscapes are increasingly perceived as interrelated, complex systems in modern human geography, formed by both tangible behaviours and intangible cultural discourses (Antrop, 2018). This is especially pronounced in border regions, where landscapes serve as arenas for environmental change as well as identity construction, conflict, and negotiation.

In transboundary environments, landscapes facilitate the convergence of political boundaries and cultural continuity. Borders often create artificial divisions between ecological and cultural systems; nonetheless, individuals in these areas frequently share histories, rituals, and perceptions of place. Place identity, originating from environmental psychology and humanistic geography, delineates how individuals and communities develop their self-conception in relation to spatial contexts (Lewicka, 2011). Identity is particularly complex in border regions, where communities fluctuate between national allegiance and local affiliation, influenced by overlapping sovereignties and transnational cultural exchanges.

Recent empirical investigations emphasize that border landscapes function as mnemonic devices, encapsulating both conflictual and integrative narratives. These findings support the assertion that landscapes in border areas are semiotic entities, continually re-signified by state policies, everyday practices, and transboundary interactions. (Verbrugge et al., 2019).

A second crucial element is place-identity in border landscapes. Identity is not solely inherited but is continuously enacted through symbolic indicators, territorial behaviours, and geographical narratives. Cultural landscapes serve as venues for the enactment of belonging, whether through pilgrimage, festivals, or communal memory. For example, the Ganges River, considered sacred in Hinduism, is a cultural landscape where spiritual belonging, identity, community connections, and cultural events are ritually enacted (Sati, 2021). Ethnographic studies illustrate that these events serve as platforms for cultural exchange, familial gatherings, and collective memory practices, typically fostering a sense of community that contrasts with the rigid territoriality of the modern nation-state. These performances not only evoke historical linkages but also reconstruct transborder identities in the present. Contemporary landscape projects, including river restoration initiatives, integrate natural processes with local symbolic significance and community involvement (Verbrugge et al., 2019). Collectively, these processes demonstrate that cultural landscapes at borders serve as dynamic arenas for identity negotiation, inscribing memory and significance onto the world (Hubner and Dirksmeier, 2023).

Institutional control of borderland cultural landscapes frequently lacks the mechanisms to encapsulate the intricacies of hybrid place identities. Traditional arrangements prioritize geographical sovereignty, undermining emotional and symbolic connections to land (Brunet-Jailly, 2013).

Contemporary research converges in acknowledging that the cultural landscapes of border regions are both materially and symbolically produced. These are areas where natural currents converge with cultural practices and where the state's territorial frameworks interact with the dynamic, emotional landscapes of local identity. Understanding necessitates an examination of land use and administration, as well as the narratives, performances, and power dynamics that shape place identity throughout time.

2.1.5. Driving Forces of Landscape Transformation

When discussing a transformation in the landscape, there must be a driving force that precipitates this change. The driving forces of landscape studies are the interrelated social, political, economic, technological, environmental, and cultural forces that dynamically fall into contact to shape landscapes through time across regions (Bürgi et al., 2005). Driving forces work in complex, often non-linear ways, interacting across spatial and temporal scales to influence land use, ecosystem processes, and human-environment interaction. These forces generally comprise exogenic pressures, including climate change and geopolitical conflict, and endogenous processes, such as governance systems, technological developments, and cultural practices affecting decision-making and transformations of landscapes (Yesuph and Dagnew, 2019). This paradigm asserts that a landscape suffers the impact of a multiple set of interdependent variables, which require a broad-based analytical procedure in formulating management options grounded on the cumulative risks protected within socio-ecological systems. These dynamics are particularly observed in the Jordan River Basin, as the interfacing of sovereignty claims and hydro-hegemony serves to shape the landscape.

This section provides a comprehensive introduction to the fundamental driving forces influencing landscapes, encompassing theories, terminology, and interrelations.

- Multilayered Landscape

A composite where political, economic, technological, environmental, and cultural forces converge, interact, and occasionally conflict, resulting in complex and sometimes unanticipated changes in the landscape (Antrop, 2018; Verbrugge et al., 2019). As outlined in *The Routledge Companion to Landscape Studies*, landscape is not a static entity but a dynamic field of inquiry that integrates diverse epistemologies and methodologies, encouraging critical reflection on identity, power, and participatory transformation across scales (Howard et al., 2013). The multilayered perspective encourages the rejection of reductionism in favour of a comprehensive

understanding that encompasses the socio-ecological intricacies of landscape transformation. In transboundary river basins, political territoriality, economic development objectives, infrastructural advancement, climate variability, and culturally infused place identities interact to create distinct yet cohesive patterns of change.

- Political Drivers: Territorial Sovereignty, Conflict, and Policy

Political divisions continue to be significant catalysts for landscape alterations, particularly in conflict zones or regions adjacent to national borders. The declaration of territorial boundaries, geopolitical competition, and conflicts directly influence settlement patterns, agricultural resource distribution, and ecological conditions (Zeitoun and Mirumachi, 2008). In addition to the standard concept of hydro-hegemony, which explains how dominant riparian states exert disproportionate control over transboundary water resources (Zeitoun and Warner, 2006), it is increasingly acknowledged that the prevailing collective action approach to climate policy neglects local social processes, governance experimentation, and resistance. Empirical research increasingly indicates that states frequently behave independently of free-rider concerns and that domestic distributive conflicts and internal political institutions are better predictors of climate policy trajectories than the expectations of global cooperation models (Aklin and Mildenberger, 2020). This perspective, informed by the Foucauldian theory of governmentality, conceptualizes power as decentred rather than as domination, contested daily through practices and discourses that influence resource utilization and identity construction (Joseph, 2010).

- Economic Drivers: Development, agriculture, and water commodification

Economic processes, including intensive agriculture, urbanization, and emerging water markets, necessarily affect landscapes by altering land cover, hydrological regimes, and biodiversity. For Rangpur City, Bangladesh, the land-use changes during the period 1989-2014, examined via GIS as well as remote sensing technologies, exhibit the large-scale conversion of wetlands, bare lands, and vegetated regions to urban settings. Such land-use conversion indicates the broader pattern of unbridled growth based on demographic growth and financial imperatives, as well as weak regulatory mechanisms (Islam and Sarker, 2016). Groundwater commercialization is the classic example of the trade-off between short-term economics versus long-term sustainability (Foster et al., 2013). Debates continue about the degree to which market-based approaches can ensure fair allocation of supplies or intensify existing inequities, mostly in contexts of water scarcity as well as increased political concern about financial costs. Development-based policies favour investments in infrastructure in order to speed changes in the landscape, which can compromise cultural as well as ecological resilience (Pot, 2023).

- Technological Drivers: Infrastructure, Dams, and Water Governance Tools

Technological innovation, for example, the construction of dams, irrigation, or high-tech water management, alters crucial natural processes as well as human relationships with rivers (Wang and He, 2022). Technologies manage hydrological regimes as well as ecological relationships, while providing new potential for governance based on evidence-informed decision-making (Brauman, 2015). Technological interventions lack ontological neutrality, in that they instantiate specific ontologies of risk governance as well as resource management that can embed socio-environmental injustices without society's stakeholders being involved (Chinedu Alex Ezeigweneme et al., 2024). The political economy of adopting technology must receive critical consideration, in particular, whose knowledge is most valuable as well as the implications of this for the marginalized people.

- Environmental Drivers: Climate Change and Ecological Degradation

Natural processes, specifically anthropogenically driven climate change, have a profound impact on landscape dynamics by shifting the pattern of precipitation, elevating the occurrence of drought, and increasing the risk of floods (Bolan et al., 2024). Such systemic processes remain linked to human activities via intricate mechanisms of feedback, commonly exacerbating ecological degradation problems like soil erosion, deforestation, and loss of biodiversity. Recent academic studies amplifies the variable vulnerability of the socio-ecological system to climatic risks, consequently emphasizing the need for the synchronization of climatic forecasts via landscape governance arrangements responsive to localized socio-political realities (Malakar et al., 2023).

- Cultural Drivers: Identity, Heritage, and Symbolic Landscapes

Cultural drivers significantly impact landscape development by imparting meaning, history, and emotion, hence impacting environmental management and the potential for conflict (Lv et al., 2025). Semiotic theories of landscapes demonstrate how practices and narratives imbue landscapes with symbolic significance, facilitating conservation through the meanings generated but simultaneously provoking opposing land claims (Lindström et al., 2011). Critical and postcolonial geography approaches challenge conventional notions of territory by emphasizing hybrid identities and conflicting interpretations of landscapes, particularly in borderland areas where national and local allegiances intersect (De Jong et al., 2021). The integration of these concepts into landscape management plans may promote more culturally sensitive and inclusive approaches. While individual agents in landscape trajectories possess varying degrees of agency, their aggregate actions yield emergent properties that transcend isolated analytical frameworks. Investments in technological infrastructure led to a reconfiguration of power dynamics in politics; economic development alters cultural identities; and climate change intensifies resource conflicts in the political sphere. The intertwined aspects necessitate a methodologically multiscale and integrative

strategy that amalgamates qualitative and quantitative datasets, incorporates participatory governance structures, and embraces an interdisciplinary perspective.

2.2. Thematic Synthesis of Driving Forces in Existing Literature

Drawing on a synthesised literature, this section identifies and evaluates the factors of each driving force that shape transboundary river landscapes.

2.2.1. Political Driving Forces of Landscape

The political driving force is analysed through four sub-factors: water management policies, territorial jurisdictional boundaries, international relations, and public participation, deductively derived from the analytical scope, objectives, and guiding research questions.

- Political Ontologies and Theoretical Development

The political ontology of rivers views them not merely as geopolitical entities but as contentious arenas of governance, where sovereignty, identity, and knowledge converge (Yates et al., 2017). The delineates Foucault's theoretical framework of governmentality, wherein state authority over rivers is exercised through regulatory norms, infrastructural initiatives, and forms of public engagement, collectively constituting significant political endeavours (Joseph, 2010).

Hydro politics, a fundamental concept in this domain, situates rivers within the context of interstate negotiation, collaboration, and conflict (Al-Muqdadi, 2022). The hydro-hegemony framework examines how dominant riparian nations leverage material and ideational resources to establish river governance that serves their interests. This has been further supported by critics who recognize the constraints of linear, state-centric governance and promote a polycentric governance model that integrates several scales and stakeholders to streamline decision-making (Lubell and Morrison, 2021). Contemporary transboundary water governance is shaped by interdisciplinary assemblages of spatial politics, diverse legal frameworks, and institutional resilience (Varady et al., 2023). Legal frameworks like the UN Watercourses Convention (1997) and the UNECE Water Convention (1992) establish normative standards for equitable and sustainable governance; however, the discrepancies between these frameworks and their inconsistent regional application undermine their effectiveness (Tonina, 2025).

The guiding research questions are:

- How do water management policies influence the governance and equitable distribution of transboundary river resources?
- What is the role of jurisdictional and institutional boundaries in shaping river management and cooperation across regions?
- How do international political relations and stakeholder participation affect decision-making processes in transboundary water governance?

(1) Water Management Policies

Water management policies are systematic approaches employed at international and state levels to regulate the design, utilization, and conservation of river systems. These policies are situated within legal frameworks and institutional mandates, outlining fundamental principles like the equitable utilization field (Mcintyre, 2015), and management strategies like basin-wide monitoring (Zhang et al., 2022). Comparative analysis reveals the existence of an implementation gap. The Cooperative Framework Agreement in the Nile Basin is politically contentious, hence restricting its enforceability (Ibrahim, 2011). The governance of the Mekong has faced criticism due to donor-driven agendas and inadequate enforcement measures (Cogels, 2025).

(2) Territorial jurisdictional boundaries

The overlap between hydrological dynamics and administrative jurisdictions forms an important disjunction undermining effectiveness in governance. Research points to two key features of the disjunction: vertical aspects (municipal, regional, and national) and horizontal aspects, transborder riparian zones (Rahayu et al., 2024). The European Union's Water Framework Directive (WFD) is often used as an example of integrated basin management (Voulvoulis et al., 2017), but its success depends on available political will, local knowledge, and administrative coordination that do not always abound in non-EU contexts.

(3) International Relations

Hydro political theory highlights how interstate relationships play a key role in affecting riverine ecosystems (Al-Muqdadi, 2022). The exercise of power, diplomatic exchange, and geopolitical issues often dictate treaty negotiation outlines, water resource allocations, and conflict resolution mechanisms. Examples of cooperative built-in resilience in difficult contexts include the Indus Waters Treaty and Albufeira Agreement, whereas examples from the Jordan and Tigris-Euphrates basins demonstrate how existing sovereignty conflicts and past resentments hinder consensus (Khalid, 2020). Little attention has been paid to date to how these treaties can adapt to contemporary challenges like climate change, demographic challenges, and transborder activism.

(4) Public Participation

Public participation is often considered a necessary component of authentic environmental governance; yet, in the Jordan River Basin, its implementation is considerably restricted. Despite the centrality accorded to participatory rights within international treaties, including the Aarhus Convention of 1998 (Osae et al., 2024), basin decision-making traditionally has been characterized primarily through state-led negotiations and externally driven policies, thus marginalizing riparian activists and limiting their formal inclusion (Kaufmann, 2021). A working example is the failed Johnston Plan of the 1950s, along with the following mutual water-sharing treaty, each undertaken at the governmental level without involving riparian people or civil society groups (Phillips et al.,

2007). More recent schemes such as the Red Sea–Dead Sea Conveyance initiative have been criticized for prioritizing economic and political interests over the interests of the local population, as well as Palestinian farmers and Jordan Valley communities (Klimasauskaite and Tal, 2023).
Exclusionary practices undermine environmental justice and democratic legitimacy, making the inclusiveness and effectiveness of participation a central criterion for assessing governance in the Jordan River Basin and its prospects for conflict resolution and long-term sustainability.
These political patterns shape who can physically access the Lower Jordan, under what restrictions, and with which expectations of belonging. In Stage 4, these dynamics are captured indirectly through survey items on perceived political impact, mobility constraints, and their links to emotional attachment.

2.2.2. Economic Driving Force of Landscape

The economic drivers represent the processes that link agricultural and industrial development, tourism growth, and land-use trade-offs to access to water and riverine landscapes, creating both beneficiaries and those who are disadvantaged.

- Economic Ontologies and Theoretical Development

Economic ontologies of rivers conceptualize them not merely as natural resources but as arenas of accumulation, production, and distribution. Accordingly, the dynamic movement of water is tied intricately to processes of capital investment, labour, and commodification (Rickard and Ludwig, 2024). Political economy insights highlight that capital-based projects, such as irrigation systems, hydropower plants, and tourism resorts, shape the distribution of benefits and environmental impacts across different geographical and social landscapes (Tickner et al., 2017).
Ecological modernization theory explains changes in river systems as ways of reconciling economic progress with environmental conservation, highlighting the roles of technological efficiency and innovation. As opposed to this, political ecology analyses inherent structural inequities common with river system-based economies, which describe how dominant interests, global economic institutions, and international markets gain at the expense of poor communities, which often bear the brunt of environmental degradation and displacement (Jänicke, 2008). Furthermore, dependency theory frames transboundary river economies into asymmetric global configurations, which argue that the production of water-intensive agricultural products, industrial growth, and ecotourism largely serve international markets at the expense of local subsistence needs (Ahumada and Torres, 2024).
While government policies generally tend toward prioritizing hydro-agriculture, hydro-energy, or hydro-tourism as economic development pathways, such portrayals tend to ignore related distributive trade-offs, most notably economic gains that largely accumulate among economic and

political elites but at the expense of marginalized riparian communities with limited access (Wang et al., 2013).

The economic driving force relevant to transboundary river basin catchments can be distilled into five different functional sub-factors: (1) dependency on agricultural activities, (2) development of industry and tourism, (3) utilization of lands and consequential economic trade-offs, (4) development strategies and policies, and (5) economic status and access inequities. The guiding research questions are:

- How do different economic sectors (e.g., agriculture, industry, and tourism) depend on and impact the river landscape and resources?
- What are the economic trade-offs, distribution impact, and benefits associated with current water allocation and land use in transboundary river basins?
- How do regional and national development strategies influence the economic use and transformation of riverine landscapes?

(1) Agricultural dependence

Irrigation is, in several river basins, a considerable fraction of usable water at some points, even exceeding the threshold of sustainable abstraction (Vallino et al., 2020). For the Jordan River Basin, the spread of irrigation in Israel (Occupied Palestine), Jordan, and Syria has seen reduced downstream discharge and environmental deterioration (Sarig Gafny et al., 2010). Similarly, along the Indus Basin, large-scale irrigation programs support agricultural productivity but are followed by setbacks such as salinization, waterlogging, and non-equitable access by small-scale farmers (Quereshi and Sarwar, 2009). The evidence reveals that agricultural dependency not only shapes land use but also causes systemic stress on the water supply distribution and river basin resilience.

(2) Industrial and Tourism Development

Industrial processes, such as energy generation, mining, and manufacturing, often compete with agricultural activities for the same scarce water resources while also adding pollutants to the ecosystem (Liu, 2024). The tourism sector, particularly those that are based on ecotourism and heritage tourism along rivers, draws on these water resources as valuable economic and cultural assets, realizing economic returns but typically limiting residents' access (Arif et al., 2022). The case of tourism along the Dead Sea is one example of such tension: massive mineral extraction and resort development result in local economic growth but also create environmental emergencies, such as sink formation and shoreline erosion (Sevil and Gutiérrez, 2023).

(3) Land Use and Economic Trade-offs

Economic choices around transboundary river basins always involve trade-offs across differing land uses, specifically agriculture, industry, conservation, and urbanization, each of which holds specific economic benefits and environmental impacts. In the Mekong River case, the development

of hydropower dams as drivers for regional growth simultaneously reduces downstream fisheries and agricultural yields, thus jeopardizing food security for millions of people (Green and Baird, 2020; Yoshida et al., 2020). Similarly, the dilemma of balancing irrigation expansion and hydropower production in the Nile Basin has become a politically charged and economically contested issue (Azizi and Leandro, 2025).

(4) Development Strategies and Policies

National and regional development strategies significantly impact the economic governance of transboundary river systems. These strategies commonly prioritize large-scale economic projects, such as dams, canals, and industrial centres, among others, as measures of progress and national power (Mirzaei-Nodoushan et al., 2021). The Jordan Valley provides a relevant example, which introduces divergent national approaches based on state-centric agricultural modernization and regional water allocations (Zülküf, 1992). These examples illustrate that riverine environments are subject to dominant economic development paradigms extending beyond local needs and that place primary emphasis by nation-states and economic organizations on water allocation priorities.

(5) Economic Inequality and Access

Essentially linked to different economic activities is the vital problem of unequal access to water resources and the resulting benefits created from river development. Access to water is affected not only by geographic location along the river but is also shaped by socioeconomic status, ethnicity, and political influence (Gondo et al., 2020; Langnel et al., 2025). In the Jordan River Basin, Palestinian farmers face serious challenges due to strict water access policies, while rich stakeholders practice large-scale irrigation schemes and tourism developments (Muratoglu and Wassar, 2024).

The review reveals that recent scholarship on transboundary river economies focuses largely on agricultural dependency and industrial development, yet distributive concerns related to inequality and access are significantly absent. Since these distributive concerns are fundamental to justice, sustainability, and legitimate governance, the identified gap in the literature justifies the inclusion of economic inequality and access in this research, with particular attention to the Jordan River Basin and other riverine contexts marked by structural exclusion and long-standing access inequities.

These distributive dynamics inform the cultural focus on economic benefit, tourism exposure, and perceived fairness, which are analysed alongside cultural attachment to understand how material inequalities intersect with cultural meanings.

2.2.3. Technological Driving Force of Landscape

Technological drivers have effects on ecological and social systems with the alteration of hydrological processes, redistribution of resources, and impacts on geographical land use

arrangements (Xu and Shu, 2023). A review of theoretical research not only provides an explanation of how technology reshapes landscapes but also describes the processes that enhance governance, equity, and cooperation for river basins.

- Technological Ontologies and Theoretical Development

Modern technological ontologies of rivers increasingly treat them not only as natural economic resources but also as arenas for technological engagement, infrastructure innovation, and innovation diffusion. Here, rivers come to be conceptualized as ecological-technological hybridity in which innovation in water management, irrigation use, and wastewater treatment is shaped by human design and technical engineering (Dorondel and Gatejel, 2025).

Socio-technical system theory adds depth by noting that technologies are inextricably linked with those institutional, cultural, and governance regimes that surround them. Which, in other words, justifies the interrelation and connection that combines human (society, regulation, users) with technical parts (infrastructure, water use, ecosystems) (Shrimpton and Balta-Ozkan, 2024). Ecological modernization theory believes that technological progress can reconcile environmental sustainability with economic growth by promoting greater efficiency in the use of water and integration of renewable sources of energy, as well as precision irrigation practices (Jänicke, 2008).

Socio-technical theory emphasizes how without institutional support, stakeholder participation, and cultural approval for such technologies, solutions would either fail or bear unintended impacts, while ecological modernization theory emphasizes such interventions' transformative potential when properly administered. As a result, studying river basins within such frameworks in parallel provides an integrated view of how technology, society, and governance interact ultimately in determining hydrological, ecological, and socio-economic outcomes.

However, technology-access theories focus in general on the fact that variations in capacity along with innovation diffusion entrench inequalities in river basins, thereby affecting transboundary cooperation as sustainability outcomes (Ahumada and Torres, 2024).

The following research questions guided the selection of technological factors:

- How have technological advancements in water management and agriculture influenced land use and environmental conditions in river basins?
- What is the role of infrastructure (e.g., dams, irrigation systems, wastewater treatment) in shaping the ecological and hydrological dynamics of rivers?
- How do technological disparities and access affect regional cooperation and sustainability in transboundary river systems?

These above theoretical views are found in their empirical demonstrations in four related technology sub-factors:

(1) Hydraulic & Water Management Infrastructure

Infrastructure applications like dams, canals, and irrigation networks form an integral component of technological interventions in river basins for regulating hydrological dynamics, encouraging agricultural development, and ensuring urban and industrial supplies of water, thus radically modifying both landscape morphology and ecological systems (Chakraborty, 2021). Interventions at a large scale show the possibility for water-management infrastructures in modifying patterns for sediment transportation, altering floodplain features, and changing ecological systems (Abdellatif et al., 2025; Al-Taani et al., 2025). In the Jordan Valley, early canalization initiatives started during the British Mandate for Palestine but were later increased under Jordanian rule; it is nonetheless in Israeli occupation following 1967, when most extensive developments occurred (Talozi et al., 2025). At the same time, ecological modernization theory foregrounds the promise of such interventions in relation to agricultural productivity, water use efficiency, and technological innovation (Jänicke, 2008).

(2) Wastewater and Water Treatment System

Water and wastewater treatment systems are a key technology area that facilitates both ecological integrity and socio-political stability across transboundary river basins (Dombrowsky et al., 2010). Effective wastewater treatment reduces nutrient loading, toxic chemicals, and pathogen levels, hence supporting freshwater biodiversity and public health (Preisner et al., 2021). Conversely, inadequacy or absence of treatment facilities contributes to further environmental degradation through processes involving eutrophication, bioaccumulation of poisons, and interception of ecological services, with serious consequences regarding food security, livelihoods, and conflict processes (Wang et al., 2019). In the Ganges, reduced industrial waste lowered BOD, coliforms, and nitrates, showing the key role of wastewater control and the need for ongoing plant upgrades and strict regulation (Dutta et al., 2020). In the Mekong, monitoring and modelling show that upgrading municipal and industrial treatment is crucial to cut pollutant loads and protect fisheries and human uses (Mutea et al., 2021). By contrast, places without adequate or modern facilities often face severe water-quality deterioration that disproportionately harms poorer downstream users, reinforcing inequality (Preisner et al., 2021).

Political ecological criticism emphasizes that treatment infrastructures often become unevenly allocated within spaces that privilege centres of industry, urban oligarchies, or upstream interests at the expense of rural and vulnerable groups (Jänicke, 2008). In the Jordan River Basin, wastewater treatment stands as a model of both a technological and a political force driving transformations in the landscape. With a limited supply of freshwater sources, Jordan, Israel (Occupied Palestine), and the Palestinian Territories have increasingly come to rely on treated wastewater for irrigation use, especially in the Jordan Valley, where waste reuse has become an

integral component of irrigation systems (Craddock et al., 2021). Jordan has expanded reuse for agriculture but faces economic and ascending constraints at plant and distribution levels (Carr et al., 2011). Whereas Israel's technologically advanced facilities accommodate large-scale use of high-grade-treated effluent, those in Palestine and Jordan often do not keep pace due to financial, technical, and political constraints, leading to effluent or inadequately treated sewage dumping into streams within the Jordan River catchments (Craddock et al., 2021).

(3) Technological Access and Capacity

Transboundary river basin technological change is not exogenous or neutral: it is brokered by uneven state capacity, unequal finance, and socially differentiated access to information and infrastructure (Boelens et al., 2016). Traditional diffusion logics (information, incentives, risk) imperfectly account for which water technology adopters are (Ruzzante et al., 2021). In highly political basins, permit regimes, import barriers, and donor conditionality generate path-dependent gaps in capacity that favour some riparian and communities over others (Selby, 2013). In the Lower Jordan River Basin (LJRB), Israel's unified utilities, tariffs, and R&D system facilitated fast scaling of desalination and nearly-total treatment effluent reuse for irrigation (85–90%), physically increasing the nation's "manufactured water" and insulating agriculture from climatic variability (Reznik et al., 2017). Circumstances reducing both absorptive capability and the continued functionality of advanced systems even when projects are externally supported (Mahmoud et al., 2022). Jordan comes between these extremes: institutionally unified and policy-oriented with respect to reuse but fiscally strained due to population pressures and fast urbanization (Carr et al., 2011).

Urbanization increases demand and investment, often preferring the security of municipal supply at the peri-urban and rural level (McDonald et al., 2014). Worldwide assessments regularly correlate population growth from urbanization with infrastructural pressures and uneven provision of the service, a pattern evident in cities all around the Middle East, which depend on limited water resources (McDonald et al., 2011).

The systematic reviews and latest multi-region studies indicate that lower formal education and lower household incomes lower adoption chances for capital-intensive monitoring or irrigation technologies, constrains of governance, and gender gaps for information and input access lower women's uptake unless initiatives are specifically aimed at them (Ruzzante et al., 2021).

Transboundary basins must frame their own capacity development as institutional and population targeting (credit, training, O&M finance, gender-responsive extension, and peri-urban service equity), rather than mere procurement. Otherwise, high-value resources reinforce hydro-hegemonic positions and widen inter-community gaps between quality, reliability, and resilience (Zeitoun and Warner, 2006).

(4) Agricultural and Irrigation Technologies

The historical record shows how irrigation development has supported the growth of intensive agriculture but also disrupted hydrological regimes, often leading to further scarcity and environmental decline (Levidow et al., 2014). New irrigation technologies, such as drip irrigation, sprinklers, and precision agriculture equipment, align with the theory of ecological modernization as proposed solutions for increasing water use efficiency and integrating agricultural production with the environment (Jänicke, 2008). Yet, political ecology criticism attentions against the adoption of such technologies as a means for reinforcing entrenched inequalities since access would tend to favour larger and wealthier farmers and politically influential groups (Boelens et al., 2016). In the Jordan Valley, Israel (Occupied Palestine) has been pioneering the use of wide-scale drip irrigation and advanced monitoring systems, which have resulted in water loss reductions and increased agricultural productivity (Tal, 2016). In contrast, West Bank Palestinians often face challenges such as a lack of financial means, weak institutional support, and limited infrastructural access to adopt similar systems, creating large productivity gaps between agriculture (Selby, 2013). Jordan has aimed at facilitating the use of more water-efficient irrigation methods by donor-supported initiatives, but the continued setbacks include especially high costs of implementation and fragmented water governance institutions (Saidan et al., 2020).

In the Indus, for instance, large canal irrigation schemes once supported agricultural development but engendered widespread waterlogging and salinity problems, exemplifying the environmental risk of maladapted irrigation technology (Qureshi et al., 2008). In the Mekong, hydropower development and flow regulation for efficiency purposes generated economic benefits but altered downstream hydrology and fisheries, increasing tensions between riparian states (Ziv et al., 2012). In the Jordan Valley, political and demographic stratification meet: Jordan has scaled up wastewater reuse for irrigation but farm-level adoption reflects financial capability for on-farm systems; Israel's (Occupied Palestine) irrigation is highly technological and widespread as the level of adoption by the occupied Palestinian population in the West Bank and Gaza Strip is held back by binding budgetary and administrative and political limits despite need reported by agriculture diagnostics and reviews of reuse (Carr et al., 2011; Craddock et al., 2021). Community perception and household structure determine acceptance of water-saving measures (e.g., greywater or wastewater treatment for irrigation), and a study from Jordanian and Palestinian communities demonstrated a relationship between attitude toward reuse and between attitude and reported practice by age, education level, and socio-economic standing (Al-Mashaqbeh et al., 2012).

The technological inequalities are not measured technically but appear as perceived access to water, infrastructure, and reuse, which condition place attachment and cultural significance.

2.2.4. Natural Driving Force of Landscape

Natural drivers constitute the underlying environmental base from which riverine landscapes evolve. In border regions like the Jordan River Basin (JRB), variables like climatic variability, geology and soil conditions, topographic effects, shifts in vegetation and land cover, hydrological interactions with groundwater, and anthropogenic interferences accrue and interact with each other through nonlinear and path-dependent processes spanning from seasonal through multi-decadal timescales. These six interrelated sub-factors are highlighted in this analysis: (1) Climate Diversity and Precipitation, (2) Geology, Morphology, and Soil, (3) Topography and Flow, (4) Vegetation and Land Use and Land Cover (LULC), (5) Hydrology and Groundwater, and (6) Human Interventions.

- Natural Ontologies and Theoretical Development

The philosophy of "nature" of river basins has transitioned from deterministic, single-driver accounts to resilience theory-based and socio-ecological systems thinking frameworks. These frameworks highlight the capacity of coupled systems to absorb disruptions and reorganize while maintaining identity and function (Folke, 2006). The stability landscape metaphor helps to explain how climatic or anthropogenic pressures may force a system past threshold into low-performing ecological attractors that are characterized by low ecological performance (Garza-Díaz and Sandoval-Solis, 2022). Hydrological sciences also embraced non-stationarity as a principle because climatic and hydrological inputs are no longer predictable or stable and therefore require interpretative frameworks that afford a prominence of variability, of feedback, and of uncertainty (Twinomuhangi et al., 2025).

The guiding research questions are:

- How has the landscape changed over time, and what are the main natural drivers and impacts of these changes?
- What are the impacts of climate change and human interventions on river landscape dynamics?
- What are the potential long-term consequences of these changes for the stability and resilience of riverine systems?

(1) Climate Diversity and Precipitation

Runoff generation, flood pulses, sediment transport, and groundwater recharge are controlled by precipitation through amount, intensity, and seasonality. Analogues of JRB shifts towards more flashy rainfall events and modified intra-annual distributions continue hydrologic "flashiness," longer recession limbs, and lessened baseflow even where annual totals vary moderately (Tramblay et al., 2020). Regional-scale changes in the Eastern Mediterranean/Middle East face more frequent droughts and more intense heat-rainfall extremes and rising scarcity and erosion

risks (Lelieveld et al., 2012). Notably, climate hardly ever acts as an individual driver: at East African headwaters, the combined effect of climate variability and land-use shift produced higher reductions of runoff and recharge compared by individual drivers (Mango et al., 2011). Satellite-derived water-balance assessments (2003-2021) indicate increasing evapotranspiration and urban/cropland water use with marked accelerations consistent with climatic pulses increasing demand-side stresses in the JRB (Comair et al., 2023).

(2) Geology, Morphology, and Soil

Lithology and soil science determine how climate effect is translated: karstic/faulted limestones characteristic of the JRB form preferred subsurface conduits and locally heterogeneous recharge and yield highly nonlinear spring and baseflow responses to pulses of rainfall (Hartmann et al., 2013). Thin erosion-prone soils of drylands are rapidly damaged from overgrazing/cultivation, which lessens infiltration and induces rill–gully networks. Under karst conditions, epi-karst pores and fractures hasten export of sediment and magnify responsiveness to high-intensity precipitation (Xiong et al., 2024). Under long-term canal irrigation of irrigated fine-textured soils, salinization and waterlogging are generated, and hydraulic properties are modified and degradation spreads through salinity plumes. In the lower Yarmouk and Jordan rivers, the behaviour of salinity reflects composites of natural saline groundwater and agricultural drainage, with saline contributions and diversions appreciably affecting water quality (Farber et al., 2005, 2004).

(3) Topography and Flow

Steep headwaters promote incision and bed material conveyance, wide lowland floodplains promote overbank storage, bar and island creation, and habitat variety. Human changes to the magnitude and timing of flows disrupt these balances: sediment-starvation reaches incise and the number of floodplains diminishes (Syvitski et al., 2009). Downstream ramifications can be severe at major scales: upstream damming of the Mekong and other deltas has lowered sediment delivery, pushing channel incision and progressive delta shore retreat, a prototypical water-sediment decoupling cascade.

The result is morphological simplification, fewer side channels, truncated floodplains, and diminished habitat heterogeneity, synthesizing JRB balance findings in (Comair et al., 2023).

(4) Vegetation and Land Use and Land Cover (LULC)

Root systems improve soil permeability, encourage infiltration, decelerate surface runoff, and stabilize banks, while canopies adjust energy balance through shading and evapotranspiration. Global syntheses reaffirm that riparian condition has a strong regulation of stream ecological integrity and water quality and that good riparian buffers are at the heart of ecosystem service maintenance (Dala-Corte et al., 2020). Evidence from other dry basins shows how closely tied vegetation is to flow regimes: at the Tarim River in northwest China, ecological water allocations

have elevated groundwater and expanded vegetation cover and initiated riparian forest recovery, with a clear demonstration of how special flows can recover vegetation-groundwater links (Fu et al., 2021). In the Jordan River Basin, a high-resolution vegetation map derived from 640 ground plots and a Sentinel-2 satellite image shows fragmentation and ecological stress patterns moderated both by the pressures of aridity and land use (Taifour et al., 2022).

(5) Hydrology and Groundwater

Aquifers maintain baseflows, buffer temperature and flow variation, and shield rivers from multi-year droughts. But once groundwater abstraction outpaces natural recharge, this buffering breaks down: hydraulic gradients are reversed, surface-groundwater exchange declines, and the danger of salinization escalates. Worldwide, from an approximate 1.7 billion inhabitants residing within zones of high groundwater use or groundwater dependent ecosystems stress (Gleeson et al., 2012). Comparable ecosystem level degradation has reduced stream aquifer connectivity, contributing to diminished riparian recruitment and lower drought tolerance (Williams et al., 2022).

The water system in Jordan is undergoing an acute security crisis as the pressures of climate change converge with rapid demographic shifts. Coupled systems modelling indicates that without substantial policy reforms, there will be drastic reductions in freshwater security (Yoon et al., 2021). In the lower Jordan, the discharge of saline groundwater and return flows from irrigation represent major contributors to the river's solute load, emphasizing strong yet impaired connections between groundwater and surface water (Holtzman et al., 2005). Concurrently, the prevalence of groundwater-dependent agriculture and excessive extraction in Jordan’s desert areas exacerbate sustainability issues, thereby reinforcing a trajectory towards increasingly compromised hydrologic states (Al Naber and Molle, 2017).

(6) Human Intervention

Functions of dams, water diversion, inter-basin transfer, groundwater pumping, agricultural extension of irrigated areas, conflicts and wars, and land cover alteration are all part of redrawing natural variability parameter settings (Muratoglu and Wassar, 2024). In the Jordan River Basin (JRB), a century of hydraulic interference and water diversion has created a rapid retreat of the Dead Sea, consequently initiating widespread sinkhole formation and geomorphic hazards through the dissolution of underlying salt deposits as less saline groundwater replaces hypersaline coastal waters (Shalev et al., 2006). Beyond the JRB, as one example among many, sediment-starved deltas such as the Mekong demonstrate the acceleration of shoreline erosion through upstream retention of sediment as relative sea levels continue their rise, thus illustrating the compounding impacts of anthropogenic manipulation and climate-associated stresses in limiting ecological resilience (Syvitski et al., 2009).

Increasing precipitation variability, fragile karst alluvial landforms, widespread regulation of river flow, riparian vegetation loss, and continued groundwater over-abstraction individually and together are leading to lowered hydrological and ecological connectivity, simplification of river form, and a shrinking resilience envelope of the basin.

As a result of the lack of such compatibility of activities with nature through the preservation of environmental flows that uphold vegetation and groundwater links, restriction of unsustainable abstraction of water to prevent degradation of baseflow buffers, and adjustment of land use practices according to geology and soil constraints, riverine landscapes can become trapped in costly and difficult or impossible to reverse degradation.

These natural drivers frame the environmental backdrop against which residents interpret degradation, restoration, and the cultural value of the river, all of which are reflected in the cultural perceptions of ecological identity and conservation.

2.2.5. Cultural Driving Force of Landscape

Cultural influences fundamentally outline how riverine landscapes are imagined, used, controlled, and transformed over subsequent generations. Rivers are cultural landscapes, "combined works of nature and of man," where meaning, memory, and tradition build up over time through ritual, subsistence use, mobility, and knowledge transmission. An understanding of such multi-faceted meaning shifts the paradigm for assessment from mere provisioning to encompass spiritual, aesthetic, educational, recreational advantages, and public opinions, which encourage stewardship yet are frequently undervalued by virtue of their unmanageable measurability compared with hydrological or economic terms. Current guidelines ground these values in two basic frameworks: the World Heritage system, which preserves cultural standards and stewardship roles for landscapes, and the cultural ecosystem services, which defines boundaries over non-material advantages and associations with well-being, identification, and citizenship. Together, these frameworks articulate why communities exposed to identical hydrological regimes will differ in their priorities and narratives regarding permissible interventions.

- Cultural Ontologies and Theoretical Development

A cultural ontology conceives of rivers as socio-natural beings whose identities are formed by process over time instead of regarding them as inert resources. Critical water studies map how technocratic abstractions of our time have eclipsed relational understandings of water, while recent law evolutions, such as river personhood recognition, place back Indigenous ontologies and incorporate care and guardianship ethics in institutionalized arrangements. Place-cantered scholarship and environmental psychology provide the micro-foundations for these broader changes: the triadic model of place attachment (person-process-place) delineates how cognitive, affective, and behavioural elements bond communities to river and how such bonds scale to

stewardship, conflict, or compliance. Traditional human geography accounts regarding space and place remain central to how river-related experience is temporalized by memory and feeling of belonging form river-related values and entitlement claims (Scannell and Gifford, 2010).

The cultural driving factor is carefully separated into six sub-factors: (1) Cultural Significance, (2) Historical Context, (3) Cultural Heritage & Tourism, (4) Identity & Attachment, (5) Cultural Infrastructure, and (6) Socio-economy. All such structuring is guided by questions:

- How have historical trajectories shaped the cultural significance and meanings attached to the river?
- How do communities perceive, use, and value the river as a cultural landscape in terms of identity and emotional attachment?
- How do cultural heritage, tourism, and cultural infrastructures around the river influence conservation, access, and everyday practices?
- How do culture-related economic activities (heritage tourism, crafts, cultural and creative industries) affect livelihoods and the distribution of benefits in riverine communities?

(1) Cultural Significance

Cultural significance in river landscapes is recognized as a collective of historic, spiritual, aesthetic, social, and epistemological significance through which societies assess and derive benefit from places, with resultant quantifiable effects upon stewardship, legitimacy, and conflict. Cultural ecosystem services overviews indicate that these intangible benefits systematically affect well-being and collective effort (Romanazzi et al., 2023), although they are frequently underappreciated in decision-making as a side effect of their troublesome measurability, underscoring methodological distinctness in planning (Chan et al., 2012). These overviews all highlight that cultural significance, such as identity, spirituality, place attachment, education, and entertainment, form foundational constituents by which individuals make river-related interventions acceptable to themselves, and exclusion of these equates to compliance and conflict issues (Gould et al., 2019).

A second thread running through environmental psychology and human geography provides explanations of why these meanings "stick." Place attachment's triadic framework outlines person, process, and place dimensions that predict pro-environmental intentions and reactions to landscape change, and a synoptic review platforms construct strength across method and context (Lewicka, 2011). Strong attachment in riverscapes both strengthens stewardship and raises resistance when interventions threaten cherished narratives or access.

Contemporary value theory makes clear the normative framework of significance. In addition to essential (in nature's interest) and instrumental (for human purposes) values, relational values, care, responsibility, connection, and place obligation (duty located in place) summarize ethical

responsibilities that individuals harbour towards rivers. Empirical and theoretical research posits these values as separate and frequently decisive to cooperation among worldviews such that culturally "thick" explanations can firm up governance despite breakdowns in cost-benefit logic (Gould et al., 2019; Himes and Muraca, 2018).

Ever since the year 2000, methodological advances have transformed the field from simple narrative accounts to evidence in preparation for decision-making. Public-participation GIS and participatory mapping effectively obtain "place values" and culturally important sites, systematic reviews have identified best practices in sampling, scaling, and bias reduction (Brown and Fagerholm, 2015). The Social Values for Ecosystem Services (SolVES) framework translates participatory data into spatial indicators, linking them to environmental variables, thereby making them suitable for transferability and scenario development (Sherrouse et al., 2014). Coupled with deliberative valuation (framed methodologies that develop preference by reasoned argument), these tools make cultural significance explainable alongside hydrological and economic measures (Kenter et al., 2016).

Meaning is contextually situated over time and dynamic under climatic stress. Systematic reviews from heritage research document intensifying threats through floods, heatwaves, conflagrations, and humidity shifts to sites and practices, verifying that consideration and adaptation of risks must encompass intangible traditions connected to riverine settings along with built heritage (Orr et al., 2021). This positions of "loss and damage" on a larger canvas involving loss of meaning, access, and ritual transmission as critical meaning dimensions frequently overlooked by traditional asset-counting metrics.

Institutional experiments also demonstrate the influence of recognition of significance on results. Socio-legal analyses of river personhood, for example, Te Awa Tupua/Whanganui, argue that if law focuses on culturally defined interests and appoints guardians, governance and accountability objectives shift toward culturally grounded well-being alongside ecosystem health (O'Donnell and Talbot-Jones, 2018)While designs vary and debates endure, these cases represent evidence for one such mechanism by which cultural significance is translated into policy and practice.

(2) Historical Context

Settlement and pilgrimage trajectories, canalization and industrialization, colonization and displacement, treaty and restoration making, echo through recent cultural practice and legitimacy assertions about rivers. Climate hazard scholarship reveals that it now passes through this history and jeopardizes both intangible resources (festival customs, knowledge about fishery environments and stocks, ritual practices) and physical heritage (bridges, shrine sites, mills) and thus requires assessments that include both non-material loss and fabric decay (Sesana et al., 2021).

Correspondingly, river research integrates how infrastructures and flows coproduce social values and cultural relationships such that historical decisions about water use (diversions, dams, drainage) have indelible cultural footprints that endure into the contemporary (Anderson et al., 2019). Latest evaluations of World Heritage documentation support this integrated conceptualization of "water systems + cultural practice," asserting conservation objectives and planning cannot disregard historical uses and meanings as integral components of the functioning river system, rather than as supplementary ones (Dai and Hein, 2023).

(3) Cultural Heritage and Tourism

The heritage and tourism studies converges on a conditional statement: tourism can finance conservation and diversify livelihood opportunities, but net effects rely on governance quality, stakeholder engagement, benefit-sharing, standards of authenticity, and visitors' pressure. A cross-country macro study links tourism development to progress on multiple sustainable development goals (SDG)s, suggesting intermediary beyond income (infrastructure, employment quality, innovations), but warns benefits are not automatic (Elgin and Elveren, 2024).

At the regional/local level, econometric proof indicates that heritage endowments can increase incomes and property prices, reflecting a tourism-mediated developmental channel (Bertacchini et al., 2024; Kostakis and Lolos, 2024).

Systematic reviews give distributional texture: heritage tourism may support well-being and local development if designs retain cultural continuity and keep money in local hands. If not, leakage and commodification destroy meaning and livelihood (Brooks et al., 2023).

Methodologically, choice-experiment and meta-analytical research now consider integrated "heritage bundles" that bundle landscape context with built heritage such that finer trade-offs between them can be analysed in river valleys (Gómez-Zapata et al., 2025).

(4) Identity and Attachment

Identity and place attachment explain why communities evaluate the same river (and landscape) distinctively and react differently to landscape change. Meta-analyses and large-sample surveys demonstrate robust positive associations between place attachment (and environmental identity) and pro-environmental acts (e.g., compliance and volunteerism), whose effect sizes are moderated by context and measurement choices (Daryanto and Song, 2021).

Elementary syntheses from environmental psychology and human geography serve as the analytic template for using these relationships in questionnaire applications (person-process-place, identity/dependence). The template enables one to test assumptions relating to differences in attachment to stewardship or conflict between groups (Scannell and Gifford, 2010).

Current empirical models explain mechanisms: Attachment moderate relationships between attitudes and on-/off-site behaviours and is itself informed by commitment and identity

development among river-adjacent communities (Yoon et al., 2024). For river-basin planning, this implication is practical: neglecting identity/attachment deprives legitimacy, quantifying it provides leverage for co-management and conflict avoidance.

(5) Cultural Infrastructure

Culture infrastructure, museum heritage sites, archives, interpretation centres, festivals, cultural routes, and online platforms determine who may access, curate, and reinterpret river heritage and how such meanings travel across boundaries. Museum studies from recent decades reflect growing convergence with sustainability and sustainable development goals (SDG) agendas, yet recurrent chasms between aspiration and delivery; promoted evaluation toolkits now track programming, partnerships, environmental stewardship, and community outcomes (Cerquetti et al., 2024). Peer-reviewed syntheses tracking the development of digital cultural heritage along one axis point to involvement, standards, and reuse as levers that democratize narrative authority and have specific relevance for transboundary river histories and multilingual publics (Lian and Xie, 2024).

(6) Socio-economy

Culture is also an engine for economic development through cultural and creative industries (CCIs), heritage economies, and tourism spillovers with big though varied effects at various territorial levels and subdomains. European evidence connects creative workforces and industries to creativity and regional economic performances and emphasizes human capital and urban networks as major channels (Sleuwaegen and Boiardi, 2014).

Studies demonstrate that cultural and creative industries (CCIs) engender regional development (jobs, business start-ups, regeneration of cities) and manifest distributional risks, precarity, and unequal returns such that specific policy crafting is called for (Kalfas et al., 2024).

For culture-related development, meta-analytical and econometric research mirrors favourable economic yields associated with cultural heritage, usually routed via tourism demand. Furthermore, these efforts encourage valuation models encompassing intangible aspects to prevent insufficient funding for cultural resources (Kostakis and Lolos, 2024).

For river basin regions, the crux is double: culture-driven economies (crafting, guiding, festivities, conservation jobs, creative sectors) will diversify rural economies and render them more robust, yet realizing inclusive benefits depends on engagement, value capture locally, and monitoring through tracking both market and non-market value creation.

Research confirms culture co-creating riverscapes by crafting what is valued in societies, how they remember, and what future they will uphold, but cultural dimensions are systematically underweighted in planning and evaluation compared to biophysical or financial ones. New tools fill this gap: UNESCO's Culture 2030 Indicators translates facilities, programmatic participation, and governance links to sustainable development goals (SDG)s into measures, Europe's digital

heritage plans and data spaces provide wider access and reuse, climate-heritage guidance under UNESCO and UNFCCC mainstreams adaptation measures for tangible and intangible assets. With these evolutions as building blocks, a thesis can include survey-attachment measures, cultural ecosystem services (CES) compatible indicators, cultural-infrastructure mappings, and cultural and creative industries (CCI) employment value-added statistics to measure how historical trajectories and landscape change redefine cultural importance, and how cultural tourism treats local economies under other governance arrangements.

In this thematic synthesis, I showed how five interlocking drivers-political, economic, technological, natural, and cultural-co-produce change in transboundary river landscapes. Politically, governance is structured by international norms but filtered through unequal power among riparian, hydro-hegemony explains how stronger states shape treaties, allocations, and on-the-ground outcomes, leaving participation comparatively underdeveloped in both practice and scholarship. Economically, rivers function as arenas of accumulation and trade-offs: irrigation, hydropower, industry, and tourism generate benefits while redistributing environmental burdens, so decisions about land and water use hinge on distributional choices, not just efficiency.

Technologically, dams, canals, irrigation, and wastewater systems are socio-technical artifacts: their effects depend on institutions, financing, and access, which can either mitigate or entrench inequities aligning with ecological-modernization aims only where governance capacity and inclusion are present. Natural drivers, climate variability, geomorphology, vegetation dynamics, groundwater, surface water coupling, set shifting boundary conditions that interact non-linearly with human interventions, producing thresholds and path dependence that complicate restoration and planning. Culturally, rivers are lived places whose meanings (identity, attachment, heritage) shape compliance, stewardship, and conflict, robust frameworks (hydro social cycle, place-attachment theory) and participatory mapping methods now allow these “intangible” values to be analysed alongside biophysical indicators, strengthening legitimacy and design of basin governance.

2.3. Comparative Review of Transboundary River Basins

This subchapter introduces five cases: Danube, Ganges, Mekong, Colorado, and Jordan using the Driving Forces Framework. These cases (Figure 7) have been selected based on five analytical rationales: Each is a transboundary system marked by several and/or common governing arrangements, all have experienced political or territory-based conflicts over water governance, each basin has cultural and symbolic value in the region, sometimes transnationally or internationally, there is an interdisciplinary research base in each basin, these cases as a group reflect different geographical salience (regional effect, number of riparian’s, hydro-ecological setting). These choices chime with established comparative water-governance scholarship based

on conceiving basins as social-ecological constructs, rather than just hydro-systems (Linton and Budds, 2014).

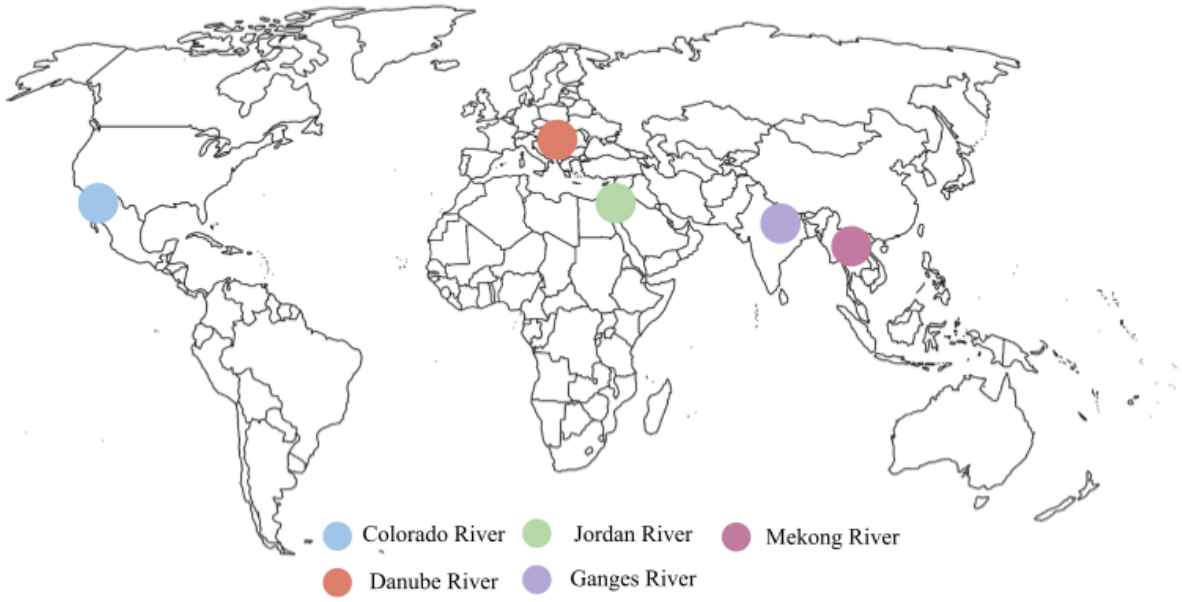


Figure 7: Selected Rivers Location on the World Map (Source: Author)

The basins are regarded as empirical sites in which the Driving Forces find expression, operating through distinct configurations. Instead, the analysis demonstrates this materiality through an exploration of how these drivers operate with dominance and offer counterbalance in governance, infrastructures, cultural interpretations, economies, and ecologies of each basin.

(1) Danube River

Figure 8: Danube River Location in Europe and Riparian States ((Schlattmann et al., 2022))

The Danube is a leading example of political and institutional integration in a massive transboundary context. The International Commission for the Protection of the Danube River

(ICPDR) manages the implementation of the EU Water Framework Directive (WFD) amongst riparian states through periodic River Basin Management Plans (RBMPs), collaborative monitoring procedures, and mutually linked flood-risk planning. This arrangement promotes standardization of laws across many states while also tracking developments and successive shortfalls, with nutrient and hydro morphological issues. Even while riverfront urbanism and heritage culture are hugely visible, they are more taken as development and brand ability instruments than integrated as prime water-governance principles, such a trend is in line with more general criticisms concerning scale adequation in multilevel-governance arrangements (Nachtnebel, 2000).

(2) Ganges River

The Ganges combines deep religious cultural prominence with extensive environmental strain. Conventional writing on the Ganga/Yamuna belt demonstrates the intertwining of ritual life and identity with the river's symbolism while pollution and extraction damage the environment. Though programs dating back to the Ganga Action Plan have been in place for decades, basin-wide achievement of water-quality objectives has been patchy, with recent evaluation emphasizing untreated sewages and industrial effluents in rapidly developing urban-industrial sections where capacity to treat has been unable to keep abreast (Haberman, 2006) (Figure 9).

Figure 9: Ganges River Rituals vs. Pollution (Source: https://www.dreamstime.com/hindu-religious-ritual-bathing-holy-ganges-river-ancient-ghats-showing-colorful-traditional-clothing-varanasi-image251855090)

(3) Mekong River

In the Mekong, geopolitical and technological forces intertwine closely. Expedited hydropower development, particularly upstream, has redrawn seasonal flows, sedimentation, fishery, and livelihoods. The Mekong River Commission offers deliberation and information but weak enforcement power, limiting basin-wide cooperation and allowing for unilateral behaviour. Complementary economic plans based on regional electricity trade fortify the course of dam

construction, frequently pushing aside place-based cultural assertions in national infrastructure narratives (Grumbine and Xu, 2011).

Figure 10: Traditional fishing in the Mekong delta (Source: https://dialogue.earth/en/climate/vanishing-mekong-shifting-tropical-storms-threaten-a-great-river-delta/)

(4) Colorado River

The Colorado River has been governed for decades with an engineered set of laws (the "Law of the River") sustaining large agricultural and urban economies but is being redefined with climate-enhanced scarcity. Streamflow from 2000-2014 showed an average of 19% variability from the 1906-1999 mean, with warmer temperatures adjudged an underlying driver of reduced runoff, findings underlying current shortage management and interstate allocations. Precise federal accounting tracks diversions, return flows, and consumptive use with Tribal water rights, long overlooked in implementation, emerging as more prominent players in future planning and equity (Udall and Overpeck, 2017).

Figure 11: Colorado River Irrigation Canal and Drought (Source: https://www.sdcwa.org/your-water/imported-water-supplies/colorado-river/)

(5) Jordan River

The Jordan River has all five forces concentrated in a conspicuously unique manner. Institutionally and politically, management is compartmentalized and all too commonly securitized, with empirical pumping schedules over a half-century attesting to asymmetric abstraction and allocation schedules between Palestinian and Israeli users, which hard-wires differential access into routine management (Sarig Gafny et al., 2010). Technologically, diversions, dams, and wastewater treatment facilities have redrawn flows, particularly in the Lower Jordan, where environmental-flow assessments detail restoration volumes and operational routes necessary to restore ecological function (Zeitoun et al., 2009). Economically, extreme scarcity drives efficiency and reuse agendas: recent World Bank sector documents detail non-revenue water reduction, energy-efficiency targets, and expanded treated-wastewater reuse to stabilize utilities and service, situating Jordan as a test bed for cost-reform under chronic deficit conditions. Culturally, the river's world sacred designation is codified through the UNESCO World Heritage designation of Al-Maghtas (Bethany Beyond the Jordan), the world-renowned baptismal site of Jesus, emphasizing the river valley's unique religious heritage and significance in regional identification and pilgrimage economies (Jawabreh et al., 2022). Environmentally, several scientific and policy syntheses all point to a scenario of intense flow reduction and ecological deterioration in the Lower Jordan, placing numerical value on how current flows in principal reaches are but a fraction of the natural state and establishing numerical objectives for restoration (Peppard, 2013).

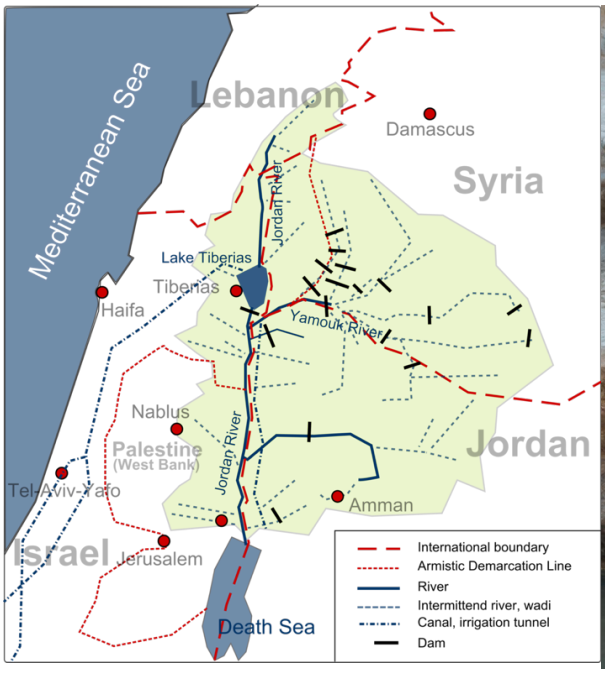


Figure 12: Jordan River Hydrology (Left) (Source: https://www.geo.fu-berlin.de/en/v/iwrm/Implementation/water_governance/riverbasinmanagement/Conflicts-of-transboundary-cooperations/example_jordan_river/index.html)

Figure 13: The Baptisim Site (Right) (Source: https://www.mosaiccityhotel.com/baptismsite.html)

In combination, the five basins imply four cross-case propositions. First, basin organizations' enforcement power determines how much technologies reshape landscapes: with credible rule harmonization and monitoring. For example, the EU's Water Framework Directive over the Danube's International Commission for the Protection of the Danube River (ICPDR), big infrastructures are coordinated and externalities more actively internalized, with weak enforcement, for example, the Mekong River, hydropower has proceeded with greater ecological and distributive costs (ICPDR RBMP Update 2015). Second, institutional translation of cultural salience influences outcomes: in the Ganges and Jordan, the sacred or heritage value determines narrative, but absent integrated mandates, finance, and enforcement, water-quality and eco-nomic indicators do not improve Third, environmental shocks reopen institutional settlements: due to warming-induced decline in flows on the Colorado, long-term allocation compacts have been undermined, increasing equity claims, particularly Tribal water rights, during renegotiation, Fourth, basin cross-driver synergies are eclipsed by securitization: in the Jordan, security and territory logics have excluded culture restoration and environmental rehabilitation even with technical roadmaps existing.

2.4. Literature Gaps and Analytical Justification for a Cultural Focus

A critical review of the Lower Jordan River Basin (LJRB) contends that no individual framework encapsulates the basin's securitized politics, socio-technical interventions, and culturally infused sense of place; a hybrid toolkit is necessary instead. Power-sensitive approaches, power-atonement instruments like hydro-hegemony and the Transboundary Water Interaction framework, are still irreplaceable in diagnosing dominant riparian’s shaping of allocations, infrastructures, and even the modalities of "cooperation". For the Jordan case, these frameworks reveal how seemingly technical decisions (diversions, treatment, reuse) reflect and generate asymmetries, why formal agreements normalize differential access, and why state-centric hydro politics alone has excess granularity. The hydro social cycle corrects course here by considering water and society as co-produced in the basin, so that canals, desalination, and wastewater plants are deciphered not as neutral remedies but as products embedded in institutions and social significations. Border theory also finesses the analytical solution for the Lower Jordan River Basin (LJRB) further by demonstrating how boundaries are performed and reproduced through performances and narratives, critical in a context in which permits, border crossings, and differential mobility regulate who gets proximate, uses, or attends to the river. Together, these viewpoints clarify why technologically "optimal" solutions deadlock in practice when they intersect with lived border regimes and uneven power (Zeitoun and Warner, 2006).

Normative and procedural frameworks provide mutually supportive benchmarks but also reflect a disconnect between principle and practice. The UN Watercourses Convention enshrines equitable

and reasonable utilization as a foundation stone, while the Aarhus Convention enshrines public information, participation, and justice, both provide criteria with which to evaluate the procedural legitimacy of basin decisions. Applying to the Lower Jordan River Basin (LJRB), these comparisons tend to suggest consultative modalities without enforceability have little chance of rebalancing access or restoring environmental flows, and rights to participate must be reflected in practice (who is consulted, how feedback influences decisions), as well as principle, in short, must bear fruit in how decisions are taken.

The most enduring analytical omission is with reference to cultural drivers. In transboundary research, culture more commonly appears as a contextual or ancillary variable, with political, natural, and technological drivers receiving overriding analytical salience. But current knowledge on cultural ecosystem services and environmental psychology offers operational frameworks, place attachment (person-process-place), relational values (care, responsibility, belonging), which are predictors of stewardship, rule following, and conflict response, and are assessable with validated tools. In securitized borderlands like the Lower Jordan River Basin (LJRB), identities, histories, and emotional attachment dictate the acceptability of reuse, willingness to co-govern heritage sites, and response to restoration or restriction policies. Accordingly, an efficiency-exclusive or infrastructure-dominant explanation misses an overriding mechanism. Cultural value influences behavioural take-up and governing legitimacy. Although the strengths of the existing knowledge (sophisticated power diagnostics, strong procedural norms, mature hydro social theory) are significant, they are counterbalanced by an enduring under-specification of culture as an assessable driver with material influence (Scannell and Gifford, 2010).

This dissertation determines effective components and fills existing gaps. It adapts the notion of hydro-hegemony to structure the study of asymmetrical relationships and interaction dynamics. It superimposes hydro social and border theories to study technologies and access as socio-natural processes performed territorially, while also incorporating constructs of place attachment and cultural ecosystem services to allow operationalization of identity, significance, belonging, and access across different demographic segments. Finally, it proposes a Cultural Driving Forces framework that (i) distinguishes Cultural Significance, Heritage & Tourism, and Identity & Attachment as basic components, (ii) links these components with behaviour-based outcomes like stewardship, compliance, and willingness to stay or leave, and (iii) integrates procedural benchmarks and power differences as shaping factors. The resulting hybrid offers a more realistic description of the Lower Jordan River Basin (LJRB)'s multi-faceted reality and develops transferable indicators usable in other contested border basins in which material infrastructures, institutions, and meanings are jointly constructed.

2.5. Literature Review Summary

The research focuses on a relational understanding of rivers. As they are more than hydrologic channels, they are socio-natural systems co-produced institutionally, technologically, culturally, and through exercises of power. The hydro social cycle offers the overarching theoretical framework for this co-production, while hydro-hegemony clarifies how asymmetric riparian power constructs allocation, "cooperation," and the daily materiality of infrastructures/access. Correspondingly, international norms offer baseline procedures for equitable and reasonable use under the UN Watercourses Convention and access to information, public participation, and justice under the Aarhus Convention. Crucially, cultural aspects are now something that can be measured rather than only described: the place-attachment framework (person-process-place) bridges identity and belonging to stewardship and policy acceptance (Linton and Budds, 2014).

Four limitations are shared across the corpus. First, cultural drives remain under-specified relative to political, natural, and technological drives. Second, rights to participation are more principled than practiced: consultation regimes devoid of enforcement do little to redress access imbalance or revive environmental flows where securitization dominates. Third, power is heavily theorized yet under-operationalized across multi-methods linking basin politics to household-level perception practice beyond borders. Fourth, gaps persist around measurement and transferability, and notably absence of longitudinal, cross-scalar datasets that integrate infrastructure, ecology, institutions, culture, and so EU exemplars cannot be assumed transportable where monitoring and enforceability is deficient. These gaps underpin an integrated, power-sensitive and culture-forward framework for the Lower Jordan River Basin (LJRB) that measures significance, heritage and tourism access, and identity and attachment as much as political, ecological, technological indicators (Scannell and Gifford, 2010).

This dissertation proposes a set of Cultural Driving Forces distinguishing the Cultural Significance, Heritage and Tourism, and Identity and Attachment forces, and situates it within a frame that is responsive to questions of power, hydro social considerations, and border issues. It utilizes accepted constructs of place attachment to operationalize culture and spatializes values through public participation methodologies, thereby situating cultural measures alongside ecological measures and policy indicators. It finally situates normative commitments to participation and equity through assessable procedural indicators that relate to international instruments and basin-planning practice, clearly distinguishing both the existence and non-existence of such commitments within the Lower Jordan River Basin.

3. MATERIALS AND METHODS

This chapter is structured as an interrelated set of stages that offer the foundation for the research. It begins by providing a systematic analysis of how the literature review is conducted, including the search strategy, inclusion and exclusion criteria, and the evaluation of sources. This is followed by 4 stages of analysis. Stage 1, which analyses the delineation of the site selection and case study selection criteria, providing the grounds for the geographical and thematic importance of the study area, and then stage 2, which focuses on the selection process for the factors which relate to each driving force as explained in the literature review chapter, with an explanation for the specific cultural, political, technological, economic, and environmental driving forces for consideration. Stage 3 elaborates the narrowed-down selection of cultural focus, and finally, stage 4 provides a cultural analysis of the selected case study, which is given to frame the empirical dimension of the study.

3.1. Literature Review Methodological Criteria

3.1.1. Search Strategy

The methodology developed for the literature review was designed to capture the transdisciplinary scope of scholarly on transboundary river systems with a focus on the Jordan River Basin. A multi-database methodology was utilized, encompassing Scopus, Google Scholar, and Web of Science, alongside region-specific repositories focused on Middle Eastern and North African studies. The search strategy incorporated Boolean operators and truncations as a tool to enhance both the comprehensiveness and specificity of the results (for example, “Jordan River AND governance OR hydro politics” and “transboundary river AND cultural landscape”). Principal keywords consisted of “transboundary rivers,” “Jordan River Basin,” “river governance,” “cultural landscape,” “hydro politics,” “place attachment,” and “territorial conflict,” whereas secondary modifications such as “cultural heritage,” “memory,” “identity,” and “symbolism” were applied to identify drivers associated with culture and identity. The time horizon was limited to sources published between 2000 and 2025, hence covering prevailing discussions but including the most recent theoretical as well as empirical developments.

3.1.2. Inclusion and Exclusion Criteria

Following the initial search, sources were filtered according to defined inclusion and exclusion criteria. The inclusion and exclusion criteria were applied to maintain methodological integrity, thematic applicability, consistency with the research objectives, and fulfilment of the study gaps.

Inclusion Criteria

The principal corpus of research comprised peer-reviewed journal articles, monographs, and edited academic compilations. The inclusion of grey research was selective, permitted only where these

sources provided empirically informed insights unavailable through academic channels. The inclusion criteria were achieved through some filters:

(1) Temporal scope: Articles between the years 2000 and 2025, covering current research on transboundary water governance as well as cultural aspects of rivers.

(2) Geographical application: Research focusing on empirical studies examining rivers as political boundaries, with more focus given to the Jordan River Basin. Comparative case studies sampled from other transboundary contexts (e.g., the Nile, Mekong, or Danube) also featured transferable insight on border-region governance along with cultural exchange.

(3) Analytical scope: Research that considers at least one of the five recognized driving forces (political, economic, technological, natural, or cultural) with particular emphasis on cultural influences and their impact on the development of governance, identity, and transformations in the landscape.

(4) Human–environment focus: Research that incorporated symbolic analysis (identity, heritage, memory, place attachment) as well as their material-technical aspects (infrastructure, water allocation policies, ecological change).

(5) Linguistic diversity: To encompass both global academic discussions and narratives rooted in local contexts, sources in English, Arabic, and Hebrew were incorporated.

Exclusion Criteria:

(1) Research not relating to river systems, borderlands, or transboundary governance (e.g., non-riverine terrestrial borders whose studies do not follow the mentioned categories).

(2) Research that fails to provide interdisciplinary connections or applications to the identified driving forces.

(3) Outdated or methodologically weak articles, for example, the grey studies, do not contain scholarly validity or verifiable methodology.

3.1.3. Evaluation of Sources

The assessment focused on the following dimensions:

(1) Study Frequency and Representation of Driving Forces: An evaluation of the frequency with which each river basin has been analysed in selected literature, as well as the degree to which the five driving forces (political, economic, technological, natural, and cultural) are examined.

(2) Comparative and Thematic Examination: A comparative analysis of sources was conducted across various river basins and driving forces to discern patterns, similarities, and discrepancies in governance, environmental management, and cultural importance. Thematic synthesis was utilized to categorize the results based on methodological phases,

research inquiries, and significant variables, thus organizing the insights in accordance with the analytical framework of the study.

(3) Consistency with Research Inquiries and Aims: Assessment took into consideration how far each source presents empirical or conceptual evidence directly relevant to addressing the study's research questions and research objectives.

(4) Contribution to Knowledge Gaps: Sources were reviewed for the potential to reach the gaps in the current research corpus. Research that presents unique insights, marginalized viewpoints, or applicable recommendations on transboundary rivers was recognized and emphasized for incorporation into the synthesis.

3.2. Synthesis Approach and Analytical Stages

3.2.1. Case Study Selection Criteria and Site Selection

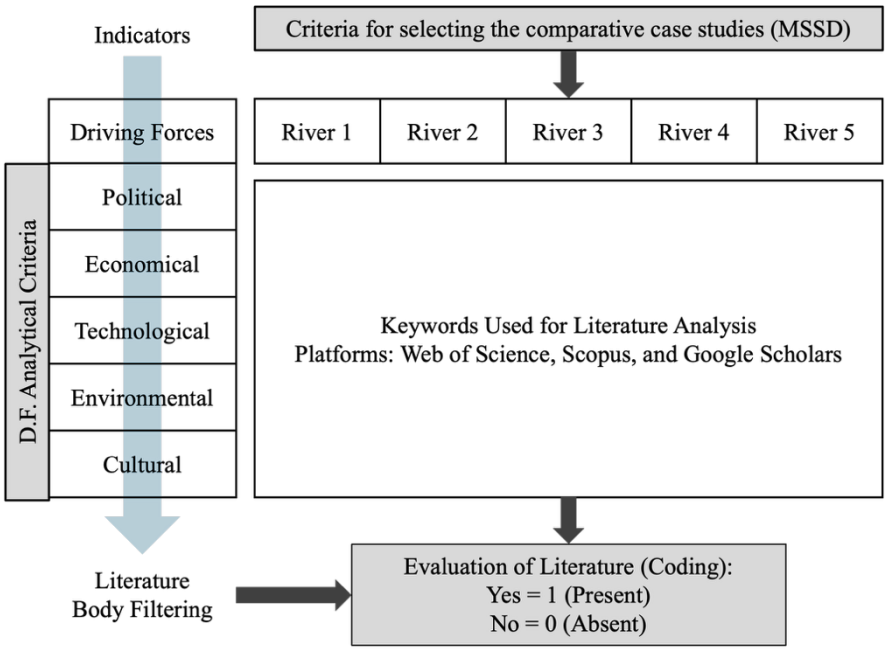


Figure 14: Case Study Selection Visualized Framework (Source: Author)

This stage is related to the research question: "What is the guiding criteria of case study selection when analysing multilayered transboundary river systems?" As illustrated in Figure 14, the framework not only delineates the criteria employed for the inclusion of transboundary river basins but also clarifies the rationale for their comparative relevance within the scope of this research.

The first component of Stage 1 uses a comparative case study approach, rooted in the Most Similar Systems Design (MSSD), a method that is best employed to distinguish deep causes of difference in structurally comparable systems (Hague et al., 1992). The decision to utilize MSSD was driven by the observation that river basins occupy shared transboundary characteristics and exhibit diverging scholarly accounts regarding the political, economic, technological, environmental, and cultural drivers of the systems' development and governance. The case studies included the

Danube, Ganges, Mekong, Colorado, and Jordan rivers, which were selected based on sharply defined criteria as follows: each represents a transboundary river system made up of multiple and/or shared governance; all have experienced political or territorial conflicts linked with water governance and allocation; all have cultural and symbolic value in the regions they inhabit; all have been subjects of systematic interdisciplinary study broad enough to allow systematic comparative analysis; and all ought to exhibit different geographical prominence. The availability of research was thus a necessary condition of inclusion.

Each driving force was then defined and analysed by specific key indicators. Indicators were derived from established transboundary water frameworks and datasets, UN Watercourses Convention principles, treaty and dispute coding (TFDD), and standard global metrics for water use and quality. Cultural indicators adapt validated constructs from place-attachment theory and cultural ecosystem services, while environmental stress aligns with the Falkenmark water-scarcity threshold (Falkenmark, 2013) as shown in Table 1:

Table 1: Driving Forces Analytical Indicators (Source: Author)

Driving Force	Key Indicators
Political D.F.	• Number and intensity of international disputes • Presence or absence of binding treaties • Compliance with water-sharing agreements
Cultural D.F.	• Sacred or symbolic status in religious/ethnic traditions • Role in collective identity and heritage • Place attachment and cultural narratives
Economic D.F.	• Dependence on river for agriculture and irrigation • Hydropower production and contribution to economies • Role in fisheries, trade, or livelihoods
Technological D.F.	• Presence of large water infrastructure (dams, diversions) • Adoption of irrigation and efficiency technologies • Wastewater treatment, desalination, or recycling
Environmental D.F.	• Water scarcity and seasonal variability • Levels of pollution and water quality degradation • Impact on ecosystems and biodiversity

Beyond being an analytical lens into inter-basin comparison, the framework also forms a literature review coding scheme. A systematic review was conducted to select fifty peer-reviewed articles within the five rivers, as the threshold to balance breadth across five basins with depth of coding and qualitative analysis. The final choice of fifty studies was sufficient to allow a balance between coverage and analytical depth, ensuring that a representation was provided for every basin yet permitting systematic cross-case coding.

Through a discussion implicating these opposing rivers, the analysis points up the variable inclusion of the cultural dimension in transboundary river governance and thereby signals a fundamental gap that this dissertation aims to fill. (Table A1 Appendices Chapter: Case Study Keyword Selection).

Each selected study was then manually coded along two dimensions. The first dimension was river coverage, with information on which of the five basins was covered in the study. The second was driving force coverage, recording whether and how each of the five drivers was covered. Coding was, in effect, a binary process (indicating the presence or absence of each driver), with Yes=1 (present) and No=0 (absent), but it was aided by qualitative analysis on depth, nuance, and emphasis on the coverage as needed.

The results of the coding were synthesized into a comparative matrix, in which the five rivers served as the x-axis and the five driving forces as the y-axis. The matrix cells represent the number of studies addressing a particular driver regarding a particular river.

Even though MSSD is traditionally applied to empirical findings, including conflict existence or absence, the dissertation adapts its methodology to fit a comparative inquiry based on literature. The justification of the adaptation is rooted in the perception that systemic similarities among the five river basins, including their transboundary nature, political conflicts, culture, and the bare minimum availability of research, operate as controlling variables.

The second component of Stage 1 involves refining and narrowing down the spatial focus within the selected river system. To facilitate this process, a comparative matrix was developed, with the X-axis representing the principal selected river segments (river basin, river valley, and river tributaries) and the Y-axis comprising the evaluation criteria employed for systematic comparison, as presented in Table 2. The evaluation utilized a standardized ordinal measurement tool, in which the degree of presence of each principle was coded as High (+), Medium (+/–), or Low (–). This provides a structured means of comparing the relative prominence within each segment. The coding was based on a review of relevant papers and supported by photographic site analysis.

Table 2: Case Study Segment Selection (Source: Author)

	Principles of Comparison	River Tributaries	River Valleys	River Basins
	Natural & Environmental			
1	Accessibility to Data Resources			
2	Climate Diversity			
3	Geological & Morphological			
4	Vegetation Diversity			
5	Protected Areas			
6	Water Management			
	Cultural & Human Intervention			
1	Accessibility to Data Resources			
2	Cultural Diversity			
3	Land-use Diversity			

4	Demographical Diversity			
5	Cultural Heritage Sites			
6	Recreational Tourism Sites			
7	Intensity of Use			
8	Accessibility to Visit			
	Political and Management			
1	Accessibility to Data Resources			
2	Jurisdiction Boundaries			
3	Agreements and Cooperations			
4	Shared Ownership			

- **Study Area Overview: The Jordan River Basin**

(1) Geographical and Physical Setting

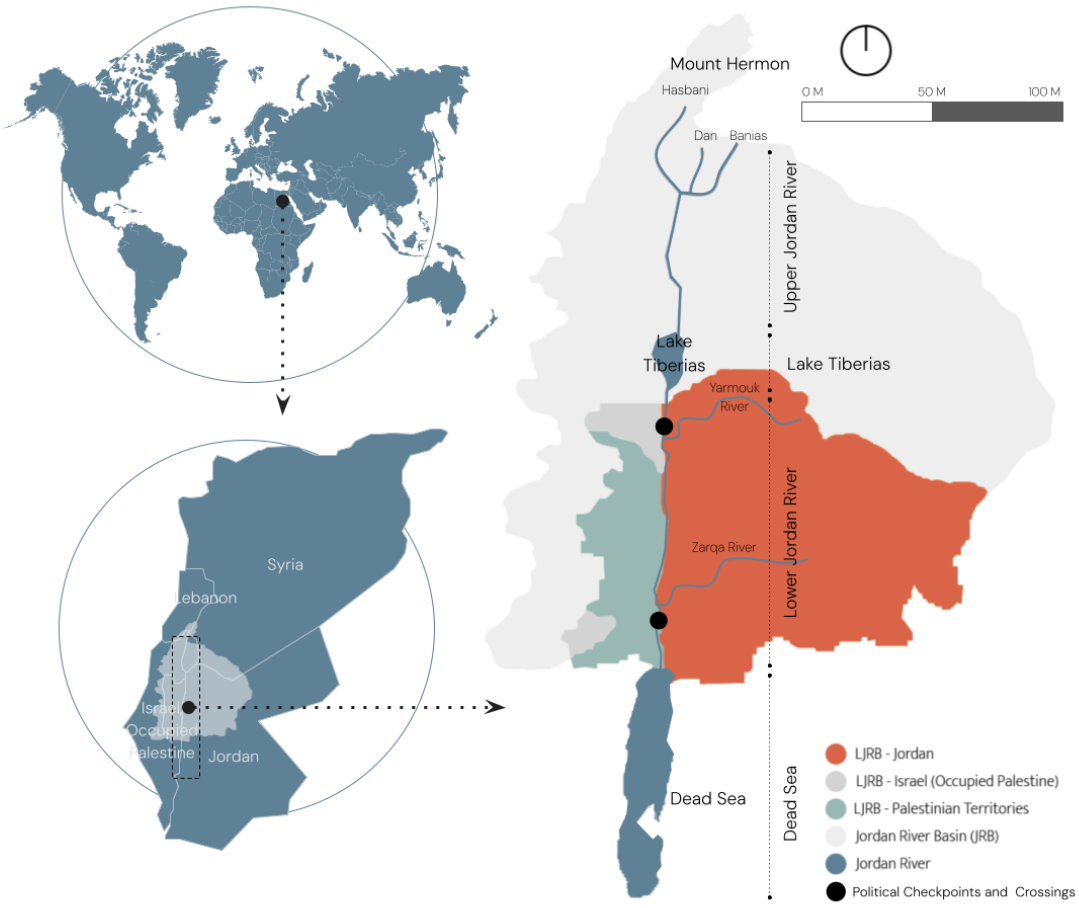


Figure 15: Jordan River Basin Location (Source: Author)

The Jordan River Basin across Israel (Occupied Palestine), Jordan, Palestine, Lebanon, and Syria is among the most contested transboundary water systems in the world, where geography, politics, ecology, and culture intersect in highly complex ways (Brooks et al., 2020). The geography of the basin includes hydro-climatic variations: precipitation levels change from the wet humid north

origin to the dry south lowlands, impacting both ecological habitats as well as human settlement patterns (Hroub et al., 2025). The river rises from three main sources: the Banias in the Golan Heights, the Hasbani in Lebanon, and the Dan in Israel (Occupied Palestine) and confluences in the Hula Valley before entering Lake Tiberias (Sea of Galilee), then continuing southwards, marking the boundary between Jordan and Israel (Occupied Palestine)/Palestine, finally discharging into the hypersaline Dead Sea (Figure 15). Previously supporting rich riparian ecology and forming an important corridor for migratory and local species, the river now suffers from more than 90% loss of natural discharge due to large diversion schemes and groundwater use (Howari and Ghrefat, 2011). These basin-wide hydro-ecological changes are most acute in the Lower Jordan River Basin (LJRB), the downstream reach between the outflow of Lake Tiberias and the Dead Sea. In this section, large-scale withdrawals and flow regulation have reduced the discharge to less than 10% of historical levels, transforming the river channel from a perennial, meandering system into a narrow, highly regulated, and often polluted border stream (Figure 16).

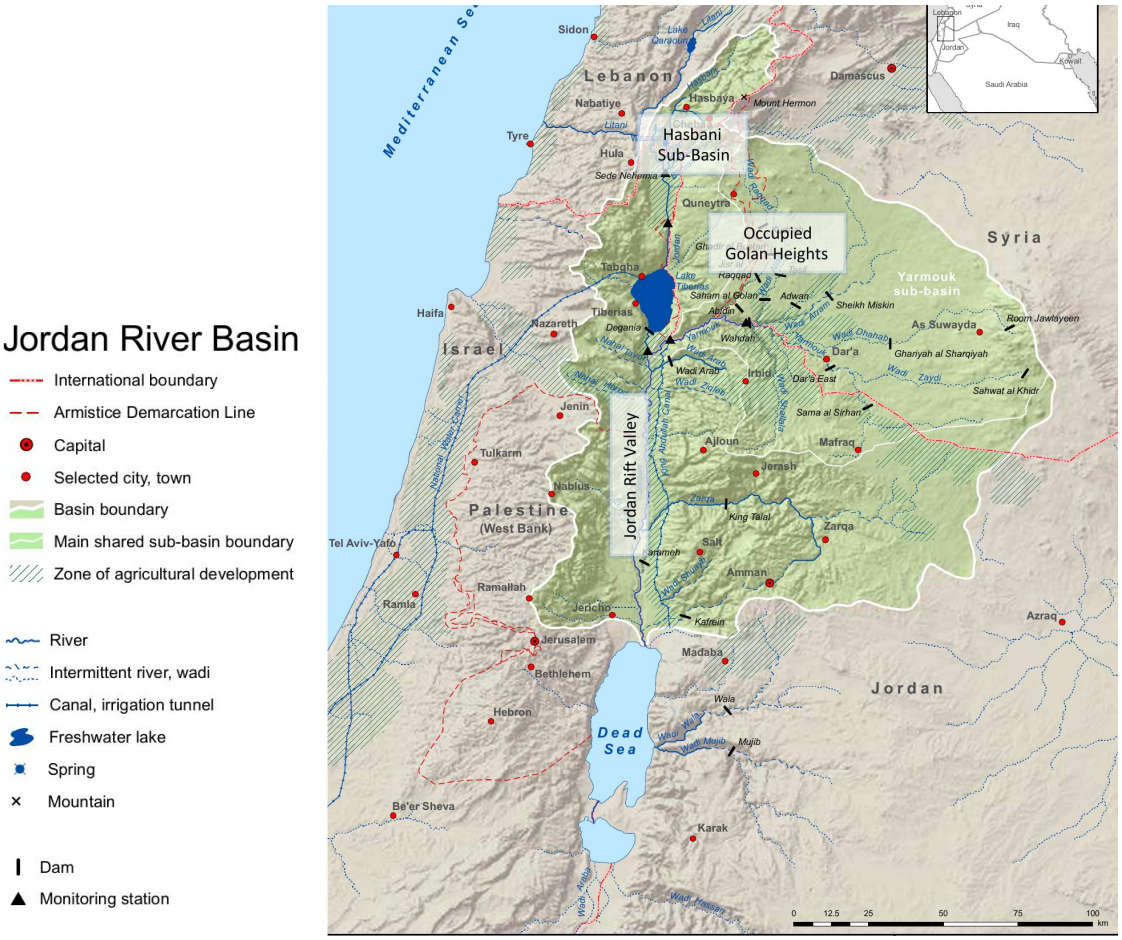


Figure 16: Jordan River Basin Hydrology and Physical Setting (Source: ESCWA-BGR Cooperation Project 2013: 173)

(2) Historical and Political Context (From a Connection to a Border)

Throughout the nineteenth and early twentieth centuries the Jordan River operated largely as a geo-hydrological axis of the Ottoman imperial order but not as a tightly delineated international

boundary: local administrative units (Sancaks and Kazas) acknowledged riverine areas for the use of natural resources and population settlements, but sovereignty and command remained lodged in a multivalent Ottoman governance that gave more weight to administrative continuity than to the 'hard' edgework of border-making (Rogan, 2002). The disintegration of Ottoman central authority after World War I and the secret Sykes–Picot negotiations (1916) opened a decisive geopolitics reordering the Levant: the imperial planners divided the Ottoman provinces into the British and French zones of influence, inscribing the logic of territorial division within the diplomatic cartographies and laying the conceptual foundation for the conversion of natural characteristics into the tools of the state boundary-making (Rogan, 2002).

The post-war League of Nations mandate system (and the British management of Palestine and Transjordan) concretized the use of the river as a boundary marker: the Transjordan communications of 1921–22 and the delimitation practices established an effective border tracing the course of the river in some parts and thus transformed a landscape of rivers and its associated hydrological characteristics into the legal administrative frontier constructing the new political formation of Transjordan out of the shrunk Palestine (Alatout, 2014; Kleinman and Moore, 2014). The institutional decision established the political cartography whereby hydrology gave shape to the exercise of sovereignty.

During the period between the interwar years and the end of the British Mandate, demographic shifts and settler colonial practices significantly reinforced the political significance of the river. The expansion of Zionist settlements coupled with waves of Jewish immigration during the 1930s and 1940s modified the demographic compositions on the Palestinian side of the river, leading to a reconfiguration of land tenure, changes in settlement density, and alterations in the spatial distribution of political claims. These modifications heightened competition over water resources and territorial dominion, rendering the river a central line in the escalating ethno-national conflict (Alatout, 2014). The events of the Arabic Nakba in 1948-49, along with the subsequent armistice agreements, crystallized these developments: the armistice lines established in 1949 resulted in Jordan assuming control over the West Bank and Egypt taking control over Gaza, thus transforming previous demographic and settlement changes into lasting territorial realities and situating the river within a newly defined framework of post-war borders and refugee landscapes. The Six-Day (1967) Arab Israeli War created another rupture in structure: Israel's occupation of the Golan Heights and the West Bank, including headwaters and strategic catchments like the Banias and parts of the Hula/upper system, reorganized physical basin command and militarized the river landscape. The command over diversion structures, springs, and sources meant that hydrological command increasingly reflected the military and administration command such that

the river was no longer just an imaginary line but a secured part of the territorial command (Galgano, 2024).

From the late twentieth century to the current day, the political and geographical significance of the river has been interpreted through a lens of partial institutionalization and ongoing inequalities. Bilateral agreements, such as the 1994 Israel-Jordan Peace Treaty, have established specific resource allocations and mechanisms for cooperation; however, these arrangements perpetuate unequal access and exclude Palestine from comparable sovereign involvement in the governance of the basin (Lucas, 2021). Non-state and transnational entities, including environmental peacebuilding NGOs, have endeavoured to reconceptualize the river as a collective ecological and cultural asset. Nevertheless, the existing institutional framework remains a disjointed collection of bilateral accords, remnants of armistice agreements, and improvised initiatives, a configuration that maintains the river's characterization as a politicized boundary while simultaneously creating spaces for competing claims, ecological disputes, and symbolic mobilization.

Through a series of imperial partitions, the delineation of mandates, demographic transformations driven by settler colonialism, territorial reconfigurations during wartime, and asymmetrical peace processes, the Jordan River has been altered from a geographically significant waterway into a fortified political frontier, especially along the Lower Jordan Valley. In this reach, the river's hydrology, governance, and cultural significance are tightly bound to border infrastructures, asymmetric power relations and displaced communities.

(3) Socio-Economic and Environmental Dimensions

The Basin of the River Jordan is a critical water source for over 15 million people who largely live in urban centres such as Amman, Jericho, and Tiberias; agricultural settlements; and settled refugee camps (Al-Addous et al., 2023). The predominant use of water assets is through irrigation using modern methods, as well as groundwater abstraction from groundwater aquifers in the basin. Concomitantly, the industry, tourism, and habitation place an added strain on the already overcommitted assets. The socio-economic landscape is characterized by extremes: whereas some riparian states have high-level infrastructures in hydraulics, others suffer from perennial shortages, erratic water supply, and poor accessibility to main aquifers. The resulting inequities reflect the complex relationships among equity, justice, and political influence towards the apportionment of the water within the basin (Cheeseman, 2025). Along the Lower Jordan River Valley, these contrasts materialise in a mosaic of high-input irrigated agriculture, settlement blocks, and refugee camps situated next to largely inaccessible riverfront zones, where local communities experience both dependence on, and distance from, the river itself.

The socio-economic dynamics in question run profoundly with the hydro-ecological development of the basin. Today, significantly less than 10% of the historic water discharge from the Jordan

River enters the Dead Sea (Talozi et al., 2025), with a significant portion of this volume being saline return flows and raw waste. The hydrological decline over the course of decades has resulted in salinization and the degradation of the riparian wetlands, as well as reduced biodiversity, while the linking groundwater systems, such as the Mountain Aquifer and the Yarmouk tributary, experience both over-extraction and political conflict at the same time. The effects of climate change exacerbate the above-mentioned repercussions, causing the recharge levels to decrease, the duration of the dry seasons to increase, and the susceptibility of both the ecosystems and the human communities that depend upon the ecosystems (Peppard, 2013). In the Lower Jordan River Basin, this combination of hydrological decline, salinisation, and wastewater inputs creates a visibly degraded river corridor, which residents often perceive as an unhealthy or inaccessible landscape rather than as a living freshwater system (Figure 17: The Jordan River today (left) and in 1918 (right)).

Figure 17: The Jordan River today (left) and in 1918 (right) (Source: https://ecopeaceme.wordpress.com/2010/05/05/jordan-river-conference/)

(4) Cultural and Symbolic Significance

Figure 18: Baptism Site – Jordan River (Source: Yardenit, the baptism site on the Jordan River Facebook Page, www.baptismsite.com)

Aside from its material value, the Jordan River also holds significant cultural and symbolic meaning. Consecrated in Christianity, Judaism, and Islam, the river is associated with rites of baptism, stories of covenants, and icons that are eschatological in nature. For the local communities, the river is not only a source of sustenance but also the site of memory, belonging, and identity. The cultural meaning of the Jordan River generates a site that is ambivalent regarding entangled relations and contested heritage, in which water is at the same time an item that is spiritual, political, and territorial in dimension. In the context of the discussion of peacebuilding, the river is often used as the metaphor of reconciliation but is also that of exclusion and dispossession. In the Lower Jordan River Basin, this ambivalence is visible in the juxtaposition of pilgrimage sites, heritage tourism facilities and heavily monitored riverbanks, where spiritual narratives, local agrarian livelihoods and border security practices intersect in everyday life (Figure 18: Baptism Site - Jordan River).

(5) Study Area Focus: The Lower Jordan River Basin (LJRB)

The empirical focus of this dissertation is the Lower Jordan River Basin (LJRB), defined as the reach between the outlet of Lake Tiberias (Sea of Galilee) and the Dead Sea. This segment functions simultaneously as an international boundary between Jordan and Israel/Occupied Palestine and as a densely inhabited valley with agricultural schemes, rural communities, refugee camps, pilgrimage sites, and security installations. In hydro-ecological terms, it concentrates the effects of basin-wide regulation: flows are reduced to a fraction of historic volumes, wastewater and saline return flows dominate present discharges, and the channel is narrow, incised and ecologically degraded. Politically and socially, access to the river is mediated by checkpoints, fenced zones, and a limited number of official crossings, so that many residents live near the river but rarely reach the water itself. This combination of ecological degradation, border governance, and dense cultural layering makes the Lower Jordan River Basin (LJRB) a particularly suitable setting for the cultural-focused analysis.

3.2.2. Selection Methods for the Factors (Subcategories)

Stage 2 is built on conducting a systematic review of the literature to assess the extent of scholarly interest connected to the factors that comprise the five main driving forces, which are responsible for constructing the transformation of the river basin: natural, cultural, political, economic, and technological. This stage is designed to generate a comparative evidence base that would illuminate what factors are well-documented in the published scholarship and what remains under-investigated and thus offer a compelling argument for the empirical emphasis of the later stages of the research. Figure 19 illustrates a graphical presentation of the Stage 2 phases and the outcomes of each phase together with the main result of this stage, which forms the answer to the second

research question of this research, “What factors should be considered when analysing the driving forces of change in multilayered transboundary river systems?” (Figure 19).

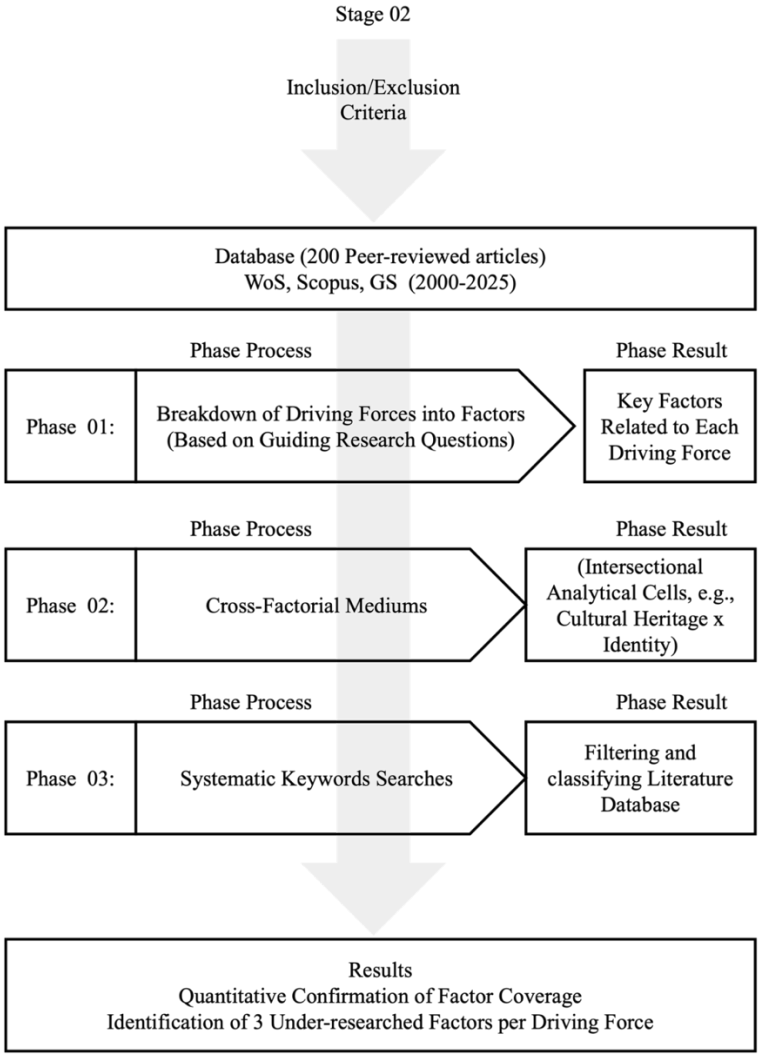


Figure 19: Methodological Stage 2 (Source: Author)

The study was performed on a dataset of 200 peer-reviewed publications, which were reached through thorough keyword searches conducted in platforms like Scopus, Web of Science (WoS), and Google Scholar (GS). The time frame of the search was the period from the year 2000 through 2025. The inclusion criterion covered the articles that directly tackle transboundary river basins as socio-ecological systems, specifically interact with at least one of the identified driving forces or their constituent parts, are published in peer-reviewed publications, books, or edited books, and are written in the English, Arabic, or Hebrew languages. Articles that were excluded were focusing on hydrological investigations related to one nation without the aspect of transboundary reference, the ones that lacked empirical or theoretical understanding concerning landscape changes, or the ones that were submitted as non-peer-reviewed publications, policy briefs, or grey publications.

The methodology was undertaken in three interconnected phases. Firstly, the five driving forces were broken down into their factors as elaborated in the literature review chapter and directed by

the guiding research questions and objectives related to each driving force. For example, the cultural driving force included cultural heritage and tourism, identity and attachment, cultural infrastructure, and so on. Secondly, cross-factorial mediums were constructed for each driving force, whereby factors were systematically intersected to form analytical cells. Each cell represented a potential area of scholarly engagement at the intersection of two thematic domains, such as “cultural heritage and tourism × identity and attachment” or “hydrology and groundwater × human intervention.” Thirdly, systematic keyword searching was conducted for every intersectional cell. The terms were formulated through the combination of the main terminology related to the factors with broader anchor terms such as "transboundary rivers," "river governance," and "landscape change." Each keyword was analysed across the platforms Scopus, Web of Science (WoS), and Google Scholars (GS), and the results of the research were filtered in accordance with the inclusion and exclusion criteria.

To promote replicability and methodological transparency, keyword matrices were constructed for the five driving forces. Table A3 in the appendix chapter provides an overview of the selected keywords related to each factor (Table A3).

3.2.3. The Selection Method of the Driving Force Focus

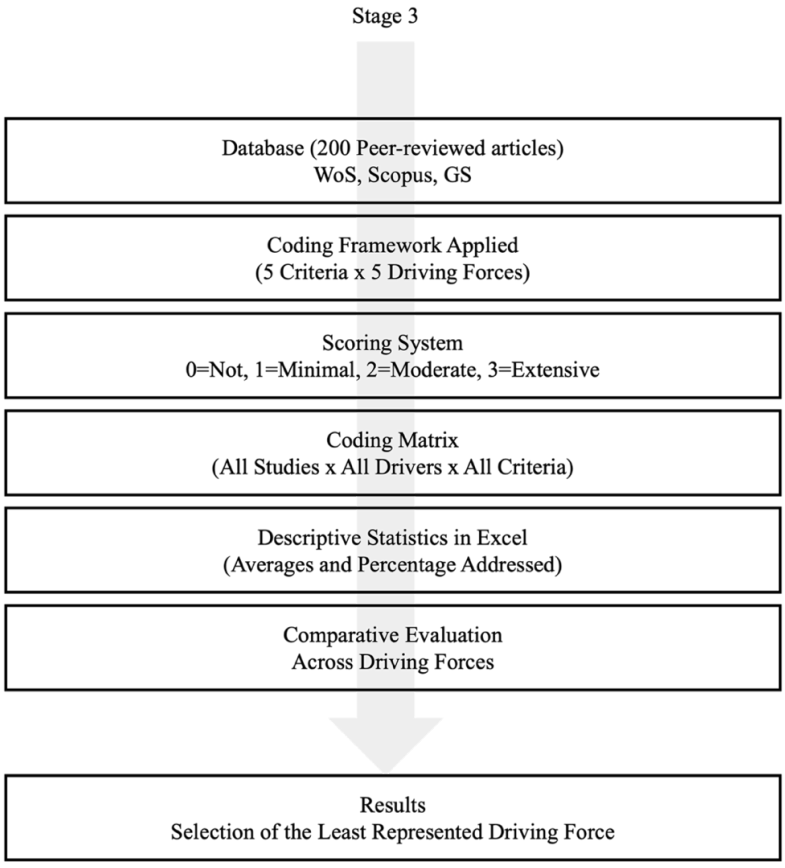


Figure 20: Methodological Stage 3 (Source: Author)

The third stage of the methodological framework involved systematically identifying and validating the cultural dimension as the primary analytical focus of the present study to answer the

third research question: “Which driving force should be the primary focus in multi-layered transboundary river systems?” It is directly derived from the database developed in Stage 2, comprising 200 peer-reviewed articles from journals retrieved through a triangulated search strategy using three major academic databases: Web of Science (WoS), Scopus, and Google Scholar (GS).

The main aim of this phase was to determine the level of representation and academic scrutiny of the five identified driving forces-political, economic, technological, natural, and cultural-relating to transboundary river basins. To achieve such a purpose, a systematic coding and appraisal framework was applied to each study in the database. Such a method is grounded in established practices related to systematic assessments and content analysis, where standardized coding allows for comparability and transparency in the evaluation of different bodies of research (Snyder, 2019). This conceptual framework was derived from five interconnected criteria, themselves encapsulating the multifaceted essence of each driver's database:

1. Conceptual Depth: assessing the extent to which the academic research engages with theoretical and conceptual frameworks relevant to the motivating factor (Castiblanco and Vizcaino, 2019).
2. Empirical Coverage: assessing the coverage, diversity, and methodological strength of the empirical evidence included (Petticrew and Roberts, 2006).
3. Planning and Policy Integration: a consideration of the extent to which research findings are brought into practical application in governance, management, or in the determination of policies (Arksey and O’Malley, 2005).
4. Multidisciplinary Engagement: determining whether the literature engages or adds to various disciplinary viewpoints, highlighting the interdisciplinary nature of water governance and transboundary studies (Pahl-Wostl, 2009).
5. Defining Gaps in Understanding: encompasses the explicit identification of gaps present in the contemporary studies, serving as a mainstay constituent in the methodology utilized in systematic reviews (Booth et al., 2021).

Each study was coded independently on these criteria for each driving force it examined. A four-point ordinal scale was used to standardize ratings: (0 = Not addressed, 1 = Minimally addressed, 2 = Moderately addressed, 3 = Extensively addressed).

The coded data were compiled and analysed with descriptive statistics (means and percentages) in Microsoft Excel to compare the representation of each driving force across the 200 studies.

This multi-criteria assessment both provided a transparent comparison of scholarly attention across the five driving forces and justified the selection of culture as the primary focus for the subsequent empirical analysis of the Lower Jordan River Basin

Table 3 represents a graphical overview of how the comparative matrix of analysis is built and applied. Each cell represents the average of the evaluation coding of 200 studies.

Table 3: Driving Forces Comparative Analysis (Source: Author)

Driving Forces	Conceptual Depth	Empirical Coverage	Planning and Policy Integration	Multidisciplinary Engagement	Knowledge Gaps
Political					
Economical					
Technological					
Natural					
Cultural					

3.2.4. Cultural Driving Force Analysis

Stage 4 of this study was designed to answer the primary question: "What is residents' perception of the Lower Jordan River Basin as a multilayered border landscape, and how do political borders and the river's ecological state shape (a) cultural significance, (b) heritage and tourism access, and (c) identity and attachment across communities?" It reflects the applied use of the cultural analysis framework developed in prior stages, synthesizing understandings from Stage 3, identifying underestimated cultural motivational forces, with the survey foundation elements developed in Stage 2. Cultural factors: Cultural Significance, Cultural Heritage and Tourism, and Cultural Identity and Attachment were identified as key areas of focus owing to their lack of coverage in prior studies.

The spatial scale of the analysis corresponds to the Lower Jordan River Basin (LJRB) based on Stage 1 analysis, chosen for its multilayered border characteristics and cultural heterogeneity. The temporal scope focuses on current perceptions, while the institutional scale considers relevant governance frameworks, policies, and regulations related to the Lower Jordan River Basin (LJRB). To operationalize the analysis, a survey with three thematic sections was developed and distributed simultaneously to the targeted groups. Surveys were developed in Arabic, in Hebrew, and in English to accommodate the linguistic diversity in the region and were distributed in online formats. Every selected factor of the cultural driving force is related to a specific section of the same survey. A purposive sampling plan was utilized to capture responses from local communities, policymakers, and students, targeting participants aged 15 to 65 to encompass the economically active population. A total of 445 participants were represented in the final sample, constituting a comprehensive data set for the investigation of demographic change and sentiment in the region. Based on predetermined criteria, the survey responses were categorized in seven different demographic groups for comparative studies of survey analyses:

(1) Jordanians, Muslims, living in Jordan

(2) Jordanians, Christians, living in Jordan

(3) Palestinians with Palestinian passports, Muslims, living in Jordan

(4) Palestinians with Palestinian passports, Muslims, living in Palestine

(5) Palestinians with Israeli passports, Muslims, living in Israel

(6) Palestinians with Israeli passports, Muslims, living in Palestine

(7) Israeli Jewish, living in Israel.

These demographic groups formed as independent variables in all survey analyses, enabling assessment of cultural perceptions in relation to religion, nationality, and place and duration of residence. This empirical stage is divided into 3 sections related to each selected factor and the research questions attached to it.

1. Cultural Significance

Defined as the strength of shared historic, spiritual, social, aesthetic, and knowledge-based meanings that residents ascribe to the river and its heritage places, conditioned by the extent to which people can physically access these places, encounter credible interpretation, and experience fair, well-communicated stewardship. This stage of the dissertation employed a quantitative, survey-based design to assess residents' perceptions of cultural significance in the Lower Jordan River Basin (LJRB). Building on the conceptual framework outlined in earlier chapters, the empirical analysis was structured around three research questions: (1) How do different communities within the Lower Jordan River Basin (LJRB) perceive the cultural significance of the region? (2) What is the relation between cultural significance and conservation efforts in the Lower Jordan River Basin (LJRB)? and (3) What is the effect of political boundaries on the cultural significance of the Lower Jordan River Basin (LJRB)?

To answer the three research questions, Cultural Significance was operationalised as a composite construct comprising four measurable factors: (i) Cultural meaning, (ii) Cultural awareness, (iii) Conservation, and (iv) National access. (For more details on the survey questions, check appendix chapter 3).

(i) Cultural Meaning: is defined as the strength and type of historic, spiritual, social, aesthetic, and identity-related meanings that respondents attach to the Jordan River and its associated heritage places in their everyday lives.

(ii) Cultural Awareness: refers to how far respondents know about the main river and the stories attached to it.

(iii) Conservation: refers to the ability of the respondents to participate in conservation activities in the river and its relation in how much the river means to them and refers to respondents' perceptions of improvements in the landscape surrounding them.

(iv) National Access: the ability of respondents to access the river or the river sites based on their nationality.

The survey tool was developed in Arabic, Hebrew, and English and distributed in an online format to ensure accessibility across diverse populations. A stratified purposive sampling approach targeted Jordanians (Muslims and Christians), Palestinians with Palestinian or Israeli passports (residing in both Jordan and Palestine), and Israeli Jews. A total of 445 valid responses were collected and analysed. The survey consisted of items directly relevant to this stage of analysis. Cultural Significance was assessed on a five-point Likert scale, while Cultural Awareness, Conservation Involvement, and National access were measured as binary variables (1 = Yes, 2 = No). An additional five-point Likert item measured the perceived Impact of Conservation on Cultural Significance. Demographic group membership served as the principal independent categorical variable, encompassing seven distinct community categories.

Data cleaning and preparation followed established standards for survey analysis. Continuous Likert variables were clipped to valid ranges (1-5). Binary variables were recoded to "Yes/No," and dummy variables were generated for regression models (e.g., Awareness_bin, ConserveInvolve_bin, Politics_bin). Missing and irregular values were minimal and addressed through case-wise deletion.

The analytical strategy was aligned with the three research questions. For RQ1 (between-group differences in Cultural Significance). Assumptions supported the use of classical ANOVA: Levene's test indicated homogeneity of variances ($p = 0.497$), and Shapiro–Wilk on OLS residuals indicated acceptable normality ($W = 0.994$, $p = 0.088$). Accordingly, we estimated a one-way ANOVA using Type-II sums of squares (appropriate for unbalanced designs without interactions), followed by Tukey's HSD for multiplicity-controlled pairwise comparisons. If variance heterogeneity had been detected, Welch's ANOVA and unequal-variance post-hoc procedures would have been used as robustness checks.

For RQ2 (intersection with conservation). Mean differences in Cultural Significance by Conservation Involvement (Yes/No) were tested with Welch's unequal-variance t-test and summarized with Hedges' g for standardized mean differences. The linear association between Cultural Significance and the perceived Impact of Conservation (1–5) was quantified with Pearson's r, with Spearman's ρ as a monotonicity check. To assess unique contributions net of group composition and awareness, we estimated OLS models with HC3 heteroskedasticity-consistent standard errors including group dummies, Awareness, Involvement, and Impact of Conservation. For RQ3 (political boundaries and significance). We compared Cultural Significance across Political-Impact (Yes/No) using Welch's t-test and reported the point-biserial correlation as a complementary effect-size measure. Territorial differences (Jordan, Israel,

Palestine) were examined with one-way ANOVA followed by Tukey HSD under homoscedasticity. Finally, a fully adjusted OLS (HC3) model evaluated the unique association of Political Impact while controlling for conservation predictors and the seven-level group factor. All analyses were conducted in Python, with $\alpha = .05$. ANOVA effect sizes (η^2 and ω^2) and standardized mean differences (Hedges' g) were calculated and interpreted.

2. Cultural Heritage and Tourism

This stage of the research employed a quantitative survey design to assess the role of tourism, economic benefit, and political accessibility in shaping cultural heritage perceptions in the Lower Jordan River Basin (LJRB). The aim was to generate empirical answers to three research questions: (1) How has tourism influenced perceptions of cultural attachment in the Lower Jordan River Basin (LJRB)? (2) What is the relationship between economic development and cultural attachment in the Lower Jordan River Basin (LJRB)? and (3) How do political factors and accessibility of heritage sites affect cultural heritage?

To answer the three research questions, Cultural Heritage and Tourism was operationalised as a composite construct comprising three measurable factors: (i) Cultural Attachment, (ii) Tourism Exposure, (iii) Economic Benefit. (For more details on the survey questions, check appendix chapter 3).

(i) Cultural attachment refers to the emotional bond that respondents feel towards river heritage sites as places they value, wish to visit, and want to see protected for future generations.

(ii) Tourism exposure refers to the extent to which respondents have been able to access, explore, and understand river heritage sites through tourism or pilgrimage, including feeling safe, welcomed, and supported by interpretation and guidance.

(iii) Economic benefit refers to the extent to which respondents, or their households, receive income or livelihood advantages from tourism and pilgrimage related to the Jordan River and its heritage places.

The survey tool was designed to capture both cultural and contextual drivers. Key measures included: Cultural Attachment (Likert scale, 1–5), Tourism Exposure (Likert scale, 1–5), Economic Benefit (binary: 1 = No, 2 = Yes), and Political Restrictions & Accessibility (binary: 1 = Good, 2 = Restricted). Respondents also reported their Demographic Group, allowing community-level comparisons across Jordanians, Palestinians, and Israeli Jews. The survey was translated into Arabic, Hebrew, and English and distributed both online and in paper format to ensure broad accessibility. A total of 445 valid responses were collected and analysed.

The analytical strategy was aligned with the research questions. For RQ1 (Tourism), the primary test was Spearman's rank correlation (ρ) between Tourism Exposure and Cultural Attachment,

which is appropriate for ordinal variables and monotonic associations; we preferred Spearman over Pearson to avoid assuming interval measurement or normality for Likert items. Where group comparisons were useful descriptively, a one-way ANOVA across the five exposure levels with Tukey–Kramer post-hoc comparisons (for unequal n) was used as an optional supplementary summary. For RQ2 (Economic development), Welch's unequal-variance t-test compared Cultural Attachment between respondents reporting Economic Benefit (Yes) versus No; Welch's test was chosen as the default two-sample comparison under possible variance and size inequality, and we reported Hedges' g with 95% CI to quantify standardized effect size.

For RQ3 (Political accessibility), Welch's unequal-variance t-test compared Cultural Attachment for Good versus Restricted access, again reporting Hedges' g and 95% CI. A Chi-square test of independence was used, where needed, to describe associations between access conditions and demographic groups. To evaluate independence of predictors and provide an adjusted check consistent with the design, OLS regression with HC3 heteroskedasticity-consistent standard errors was used as a sensitivity analysis (covariates: tourism exposure, economic benefit, accessibility, and group indicators). HC3 is recommended for robust inference with possible heteroskedasticity. All analyses were performed in Python. Statistical significance was evaluated at $\alpha = 0.05$, with exact p-values, effect sizes (Spearman's ρ; Hedges' g for two-group tests) and 95% confidence intervals reported to support cumulative, transparent interpretation.

3. Cultural Identity and Attachment

This stage of the research employed a quantitative survey design to assess how community membership, the river's ecological state, and political borders shape identity and attachment in the Lower Jordan River Basin (LJRB). The analysis was designed to address three research questions: (1) How do different communities influence emotional attachment to the Lower Jordan River Basin (LJRB)? (2) What role does the Jordan River's ecological state play in shaping residents' cultural identity and sense of belonging? and (3) How do political borders affect residents' sense of belonging in the Lower Jordan River Basin (LJRB), and how does this relate to their emotional attachment?

To answer the research questions attached to this stage, Cultural Identity and Attachment was operationalised as a composite construct comprising four measurable factors: (i) Emotional attachment, (ii) Ecological identity, (iii) Community and territory identity, and (iv) Belonging under borders. (For more details on the survey questions, see appendix chapter 3).

(i) Emotional Attachment: is defined as the strength of affective bonds residents feel toward the Lower Jordan River landscape, formed and renewed through meaningful interaction and belonging, and conditioned by border governance and mobility regimes.

(ii) Ecological identity: is defined as the degree to which residents view the Jordan River's ecological condition as central to their self-understanding and community identity.

(iii) Community and Territory Identity: refers to the extent to which residents see the Lower Jordan River and its surrounding territory as part of who they are, feel proud to show it to others, and experience potential loss if access is reduced.

(iv) Belonging under Borders: refers to how strongly residents feel they belong to the river landscape despite political borders, and how this belonging is reflected in their willingness to stay in or leave the area when opportunities abroad arise.

The survey captured Emotional Attachment (Likert 1–5), Ecological Identity Influence (Likert 1–5), Border-related belonging was measured with a two-level item: 1 = strong sense of belonging across borders and 2 = restricted presence due to borders. For analysis, a binary indicator (Borders_bin) coded 1 for "restricted presence" and 0 for "strong belonging" was created. This 0/1 "dummy (indicator) coding" is standard in regression so that coefficients quantify the expected change in the outcome when restriction is present (1) versus absent (0). Respondents also reported their Demographic Group, enabling community-level comparisons across Jordanians, Palestinians, and Israeli Jews. The survey was administered in Arabic, Hebrew, and English in both online and paper formats to maximize accessibility; n = 445 valid responses were analysed.

Data preparation followed standard protocols. Likert responses were clipped to the valid range (1-5). Border-related belonging was cleaned and recoded into a binary variable for modelling. Descriptive statistics and group-level summaries were produced as a baseline. Analytic choices were aligned with each research question.

For RQ1 (community differences in attachment), Emotional Attachment scores across community groups were compared using the Kruskal–Wallis H test, an appropriate nonparametric alternative to one-way ANOVA when the dependent variable is ordinal and group sizes are unequal. Post-hoc pairwise Mann-Whitney U tests with Holm correction were used to explore group contrasts. Effect sizes were reported as epsilon-squared for the omnibus test and U-based measures for pairwise comparisons. For RQ2 (ecological identity and attachment), The relationship between Ecological Identity Influence and Emotional Attachment was assessed using Spearman's rank correlation, which is robust for ordinal, monotonic relationships. To test robustness, OLS regression with HC3 heteroskedasticity-robust standard errors and community fixed effects was applied, treating Attachment as approximately continuous (a common practice with large-N Likert data). And for RQ3 (borders and belonging), three analyses were conducted: (a) a chi-square test of independence examined whether border-related belonging varied by community group, (b) a Mann-Whitney U test compared Emotional Attachment between strong belonging and restricted presence groups,

reporting Cliff's δ as effect size, and (c) a logistic regression estimated the probability of strong belonging as a function of Emotional Attachment and Ecological Identity Influence.

3.2.5. Methodological Limitations and Ethical Considerations

Due to logistical and political challenges, direct site visits to the area were not feasible, restricting opportunities for field studies. To compensate for such limitations, surveys were used as the main tool for the acquisition of data. Even though the approach allowed for the incorporation of diversities of viewpoints from the Lower Jordan River Basin, it simultaneously brought along some limitations. The study relied on self-reported information, which can be prone to biases through the recall of memory, individual interpretation, or social desirability, especially where the sensitive issues of religion, politics, and nationhood were concerned. Though the survey was available in Arabic, Hebrew, and English and was distributed both online and in paper form, differences in translation and varying accessibility of the internet could have affected the responsiveness and consistency of feedback among different groups of the population. The method of sample size, though designed for the purpose of having wide coverage, was not probabilistic; hence, the results could not be generalized for the entire population statistically with absolute certainty.

Ethically, the survey followed established principles of informed consent, voluntary participation, and anonymity. Respondents were provided clear information about the purpose of the study, their right to withdraw at any time, and the guarantee of anonymity of their response, such that it could only be used for research. Extra special care was taken to be sensitive when dealing with politically charged or religiously significant topics. To protect privacy, no individual identifiers were inserted into the database, and the presentation of the results was limited to aggregate-level results such that potential re-identification risk could be reduced. The study also followed the ethical clearance guidelines of the institution and conformed to data protection legislation, including the secure storage and restricted accessibility of the raw data.

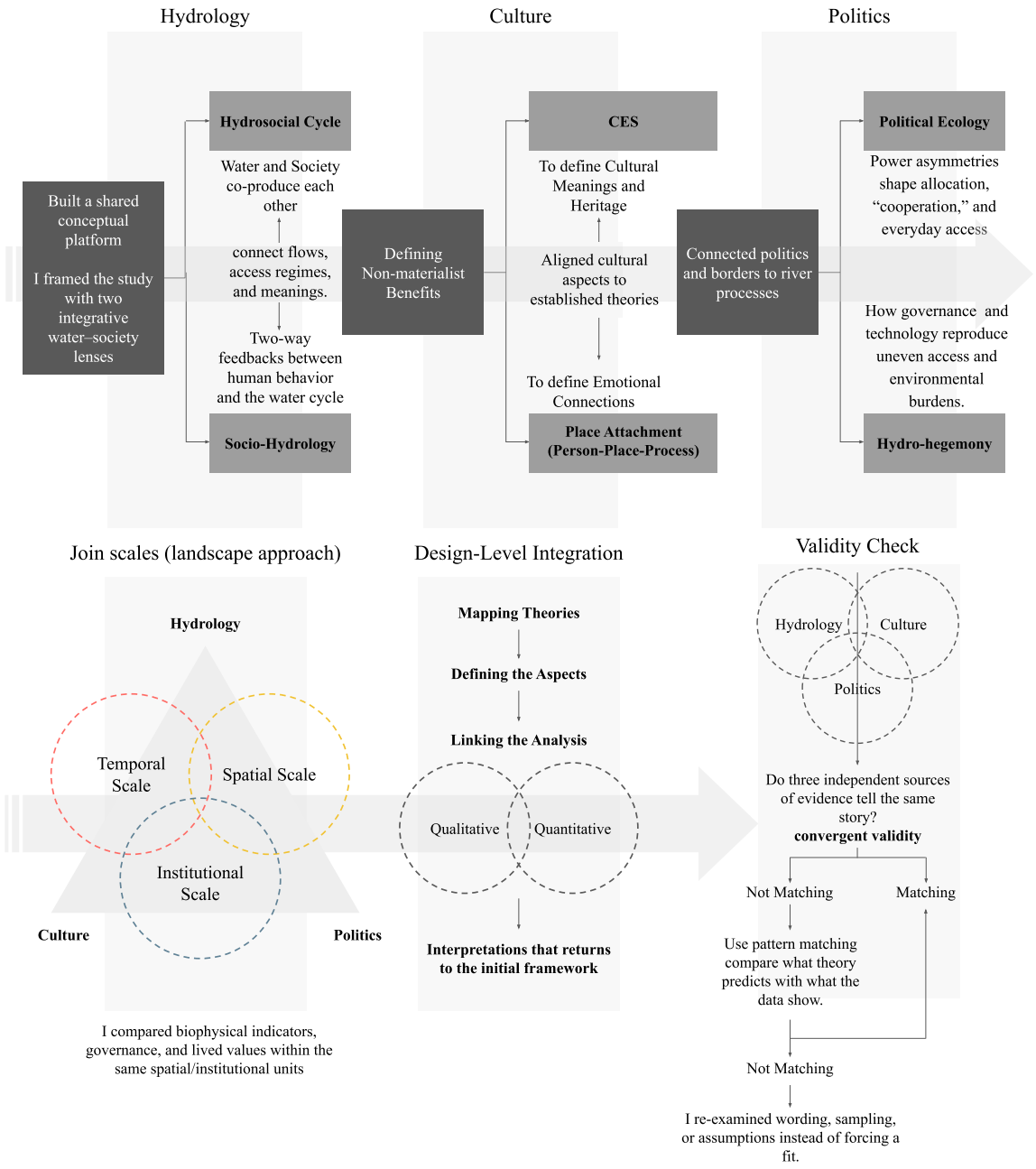


Figure 21: Validity Check in Theories and Scales of Change (Source: Author)

4. RESULTS AND DISCUSSION

Parallel to the sequence created under the Methodology chapter, this chapter presents the research findings under four separate stages, reflecting the methodological framework and maintaining coherence between the framework and the analysis process.

4.1. Case Study Selection

The first component of Stage 1 represents the empirical result and answer for the research question: "What is the guiding criteria of case study selection when analysing multilayered transboundary river systems?". Comparative analysis of fifty peer-reviewed studies on five main transboundary rivers-Danube, Ganges, Mekong, Colorado, and Jordan-provided significant implications on the methodological selection criteria of the case studies. The studies were not evenly distributed; the

Danube contributed the highest share (30%, n = 15), followed by the Mekong (25%, n = 12), the Colorado (20%, n = 10), the Ganges (15%, n = 8), and finally the Jordan River (10%, n = 5). Despite the relatively small share it held, the Jordan River demonstrated a significant deviation: all five driving forces were evident within the selected journal papers, reaching a full inclusion level of 100% for the political, cultural, economic, technological, and environmental variables. In sharp contrast, the Danube showed only a 20% coverage of the five drivers, the Mekong a 33%, the Colorado a 30%, and the Ganges a 38% (Table 4). These results illustrate that although the Jordan River has attracted fewer studies compared with the other rivers, it exhibits an apparent multilayered model of integration within the research of the transboundary rivers domain which establishes the Jordan River as a methodologically robust and conceptually appropriate case for the application of this research framework (Molle, 2009).

Table 4: Literature Results of River Selection (Source: Author)

Selected Rivers	Jordan	Danube	Mekong	Colorado	Ganges
Percentage in Literature	10%	30%	25%	20%	15%
Numbers of Studies (n)	5	15	12	10	8
Political	1	0	1	1	1
Cultural	1	0	0	0	1
Economical	1	1	1	1	0
Technological	1	1	1	1	0
Environmental	1	1	1	0	1
Percentage of D.F.	100%	20%	33%	30%	38%

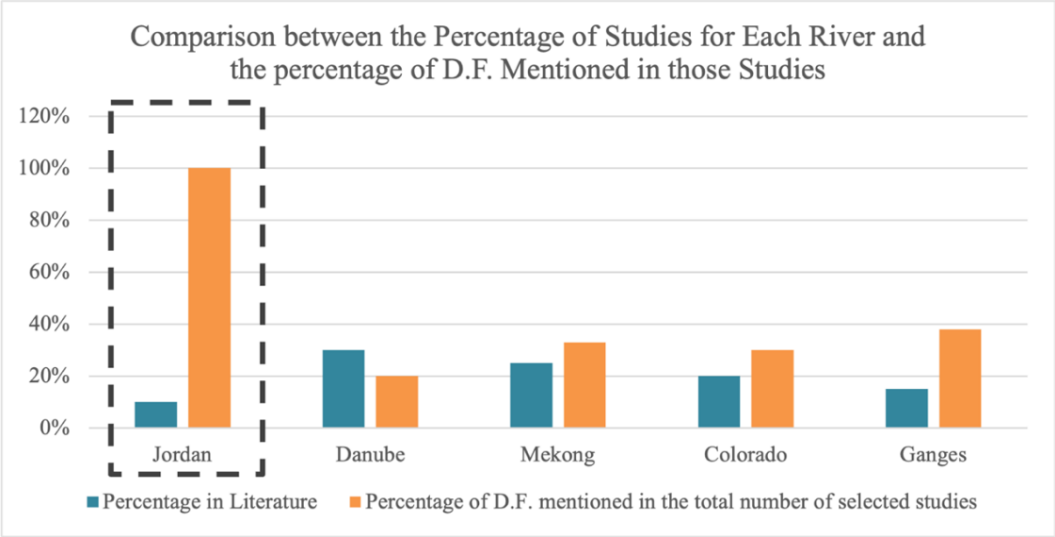


Figure 22: Literature Results of River Selection (Source: Author)

The second component of the study consisted of a focused analysis of the Jordan River, for which was employed to assess the principles of similarity across its three distinct spatial units: the river basin, the river valleys, and the tributary streams. The outcomes of this evaluation are summarized in Figure 23.

Figure 23: Jordan River Spatial Segments Evaluation (Source: Author)

The results for the second component demonstrate that case study selection in multilayered transboundary river systems should be guided by a detailed evaluation of natural-environmental, cultural-human, and political-management principles on a range of spatial scales. The comparative matrix adopted for the case study on the Jordan River showed that, at the basin level, invariably,

the greatest degree of integration was revealed with almost all the principles scoring a 100%. This includes complete representation for climate variability, geology and morphology, vegetation, protected areas, and water management, and therefore stresses the environmental and ecological distinctiveness of the basin scale.

At the valley level of the river basin, the responses were significantly inconsistent. As protected areas, management of watersheds, and accessibility to cultural resources were rated high, a measure of demographic diversity, accessibility for visitors, and boundaries for jurisdictions showed little or no coverage. This implies that valleys are transitional areas where the promise for cultural resources and tourist use is manifest, yet the underlying political and demographic forces are institutionally weak. Conversely, tributary streams showed the lowest performance at the aggregate level, revealing strong performance for vegetation diversity, management of watersheds, and recreational sites for tourist use, yet inadequate representation for protected areas, agreements on jurisdictions, or accessibility for data resources. Therefore, the tributaries represent localized nodes of cultural and ecological richness but lack the broader institutional or governance frameworks seen at the basin level.

Collectively, the assessment underscores three fundamental criteria for the selection of case studies in complex river systems. Initially, the existence of extensive environmental variability-encompassing climate, geology, vegetation, and water management-is crucial for understanding the physical landscape dynamics that instigate change. Subsequently, the representation of cultural and human interactions, which includes aspects such as diversity, heritage sites, land use, and tourism, offers vital insights into the ways societies influence and interpret river landscapes. Lastly, the presence of political and management factors, such as jurisdictional boundaries, agreements, and shared ownership, guarantees that the river is situated within governance frameworks that address the complexities of transboundary management.

The Jordan River Basin uniquely fulfils these three predetermined criteria. The coding test validated that it embeds natural, cultural, and political elements across a range of scales, at the basin scale, where political governance structures, demographic diversity, and environmental nature intersect. Compared to the other basins tested in Stage 1, the Jordan River, while crossing international borders and being vulnerable to political contention, is also heavily embedded within cultural and religious identity, while simultaneously being faced with severe environmental and technological barriers. This interconnection makes the Jordan River a methodologically appropriate and conceptually robust case study and thereby justifies its being the core focus for the remainder of this dissertation. The representative example of selected research is shown in table A2 in the appendix section.

4.2. The Selection of Factors for each Driving Force

The systematic review of 200 peer-reviewed publications provided a comparative database that enabled the quantitative assessment of scholarly attention devoted to the five main driving forces and their internal factors. Each percentage value reported within the matrices represents the proportion of the 200 studies that addressed a cross-factorial intersection, thus providing a measure for the relative importance of scholarly attention. The results show that though political and natural forces are dominant within the literature, significant gaps continue to exist within the areas of cultural, economic, and technological factors, particularly at points where these intersections of factors overlap. The gaps are important as they point to areas where the academic discussion has failed to present integrated accounts for the dynamics of transboundary waters.

Regarding the cultural factor, the weakest level of engagement was registered at the interconnections between cultural significance and identity and attachment (22.1%), identity and attachment and cultural heritage and tourism (25.7%), and between cultural heritage and cultural significance (28.5%). Fewer than a third of the engaged studies within this review addressed those interconnections. Conversely, those factors such as cultural infrastructure and socio-economic dimensions captured almost half of the studies available. This indicates that while the institutional and structural elements within culture are recognized, the deeper interconnections that communities have with rivers, enacted upon the ideas of attachment, symbolic meaning, and heritagization stories, are often overlooked (Strang, 2005). This oversight has a risk in neglecting those cultural factors crucial to the formation of a collective sense of belonging, assertion of identities, and community robustness within disputed river basins. Table 5 presents the proportion of studies that addressed each factorial intersection, expressed as percentages of the total dataset. These distributions are further visualized in Figure 24, where the selected factors and their intersectional coverage are represented in comparative bar graphs.

Table 5: Cultural Factors Research Availability (Source: Author)

	Cultural Significance	**Historical Context**	**Cultural Heritage and Tourism**	**Identity and Attachment**	**Cultural Infrastructure**	**Socio-Economy**
Cultural Significance		35,20%	28,50%	22,10%	41%	39,80%
Historical Context	35,20%		37,40%	30,50%	44,60%	48,20%
Cultural Heritage and Tourism	28,50%	37,40%		25,70%	38,90%	42,50%
Identity and Attachment	22,10%	30,50%	25,70%		35%	36,80%
Cultural Infrastructure	41%	44,60%	38,90%	35%		50,10%
Socio-Economy	39,80%	48,20%	42,50%	36,80%	50,10%	

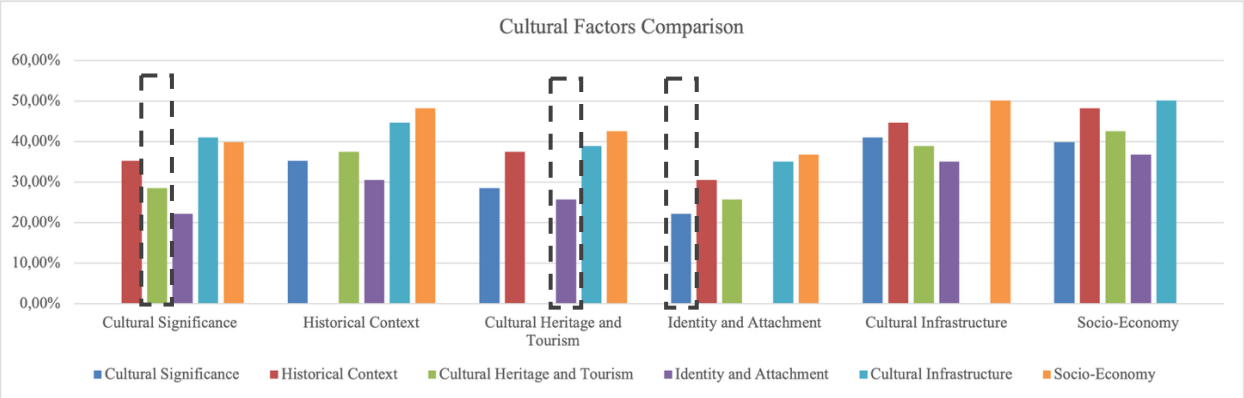


Figure 24: The Least Represented Cultural Factors (Source: Author)

The natural driving force, though strongly represented in a general sense, is severely underrepresented at integrative intersections. Human interventions and hydrology received 32.8% coverage, geology and topography a mere 33.5%, and the combination of topographic and climatic diversity 32.2%. Although autonomous physical variables, such as climatic variability and geomorphology, frequently surpass 80% representation, studies that link natural processes and human activity are significantly uncommon. This illustrates a dominant discipline division in the literature, in that the natural sciences dominate the viewpoint on river systems almost exclusively, while the interdependent socio-ecological feedback mechanisms that initiate perceptible landscape changes are inadequately underexplored (Falkenmark, 2013; Folke et al., 2016). Table 6 reports the reviewed publications that engaged with each factorial intersection of the natural driving force, expressed as percentages of the total dataset. Figure 25 provides a graphical representation of these distributions, illustrating the comparative coverage of the selected factors and their intersections in the form of bar charts.

Table 6: Natural Factors Research Availability (Source: Author)

Natural D.F.	Climate Diversity & Precipitation	Geology, Morphology, & Soil Type	Topography & Flow	Vegetation (LULC)	Hydrology & Ground Water	Human Intervention & Activities
Climate Diversity & Precipitation		52,50%	87,00%	73,90%	65,90%	39,40%
Geology, Morphology, & Soil Type	39,40%		33,50%	82,00%	66,10%	72,50%
Topography & Flow	31,20%	88,20%		79,90%	42,70%	40,90%
Vegetation (LULC)	41,00%	48,30%	61,50%		55,90%	47,50%
Hydrology & Ground Water	66,70%	38,40%	47,50%	52,00%		57,40%
Human Intervention & Activities	77,10%	42,00%	60,90%	65,50%	32,80%	

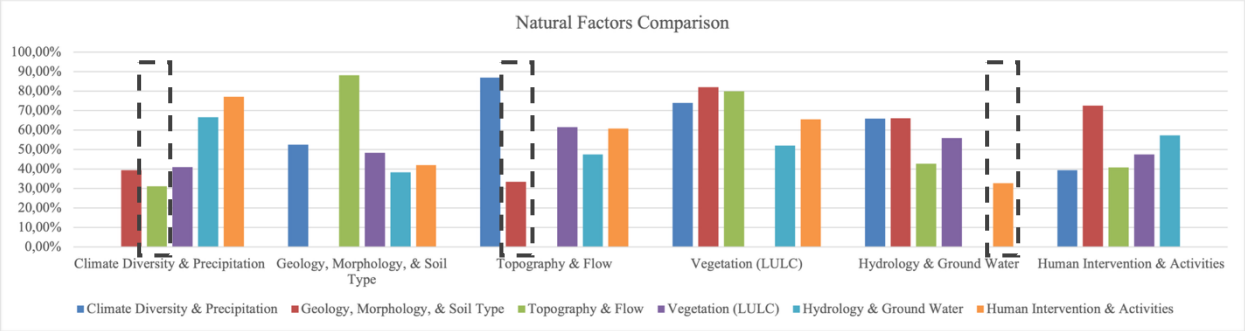


Figure 25:The Least Represented Natural Factors (Source: Author)

Political factors were covered broadly, and both jurisdictional boundaries and water management figured in greater than 60% of the research. Participation, however, registered the weakest relationships: the correlation between jurisdiction and participation was registered for a mere 36%, between water management and participation for 41%, and between international associations and participation for 42%. The lack of these dimensions leaves contemporary research prone to constructing a top-down history of governance that fails to register how political procedures are experienced by those at a ground level, and how grassroots dynamics contribute to stability versus conflict (Pahl-Wostl et al., 2012). As shown in Table 7, the proportion of studies engaging with each factorial intersection of the political driving force. These distributions are further illustrated in Figure 26, which visualizes the comparative extent of coverage for the selected political factors and their intersections.

Table 7: Political Factors Research Availability (Source: Author)

Political D.F.	Water Management Policies	Jurisdiction Boundaries	International Relations	Public Participation
Water Management Policies		61%	55%	41%
Jurisdiction Boundaries	61%		47%	36%
International Relations	55%	47%		42%
Public Participation	41%	36%	42%	

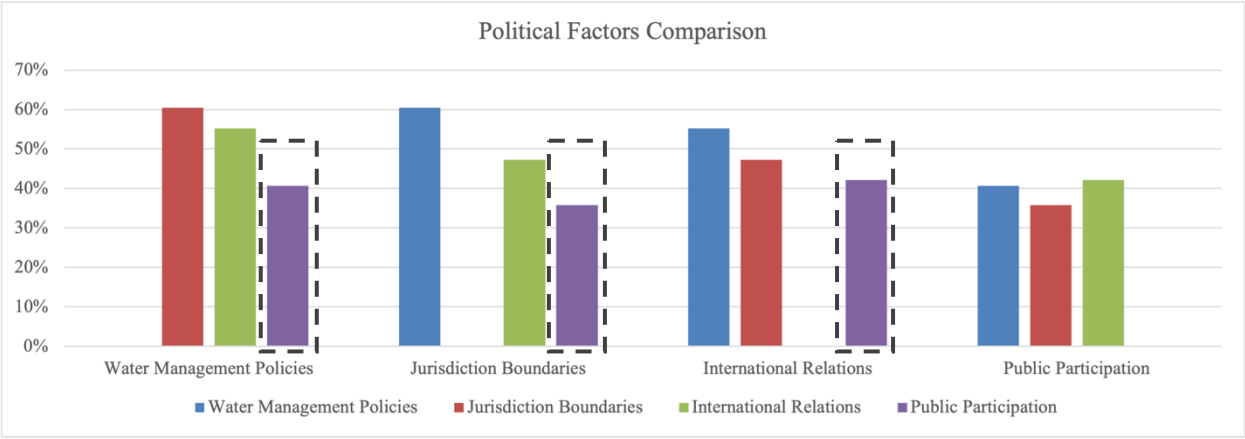


Figure 26: The Least Represented Political Factors (Source: Author)

The economic factor showed similar gaps. Whilst development strategies and policies were accounted for in just over 50% of the publications under study, relationships addressing

agricultural dependency were persistently weak: trade-offs for agriculture and land use were found in just 33.4%, agriculture and inequality in 35.7%, and agriculture and tourism and industry reached 37.6%. This indicates that agriculture is the leading water-consuming activity within most transboundary systems and a key driver for allocation conflict; it should occupy a central place in the research. Yet, its absence points to macroeconomic plans being valued daily livelihood practices and thus compromises the ability for the academic work to engage with equity, vulnerability, and social justice concerns in the governance of river system (Molle, 2009). Table 8 summarizes the share of the publications that examined each factorial intersection of the economic driving force. Figure 27 complements this by providing a graphical depiction of the distribution, enabling a comparative view of how different economic factors and their intersections have been represented in the literature.

Table 8: Economic Factors Research Availability (Source: Author)

Economical D.F.	Agricultural Dependency	Industrial and Tourism Development	Land Use and Economic Trade-offs	Development Strategies and Policies	Economic Inequality and Access
Agricultural Dependency		37,60%	33,40%	38,60%	35,70%
Industrial and Tourism Development	37,60%		44,70%	41,10%	39,20%
Land Use and Economic Trade-offs	33,40%	44,70%		39,30%	41,10%
Development Strategies and Policies	38,60%	41,10%	39,30%		50,20%
Economic Inequality and Access	35,70%	39,20%	41,10%	50,20%	

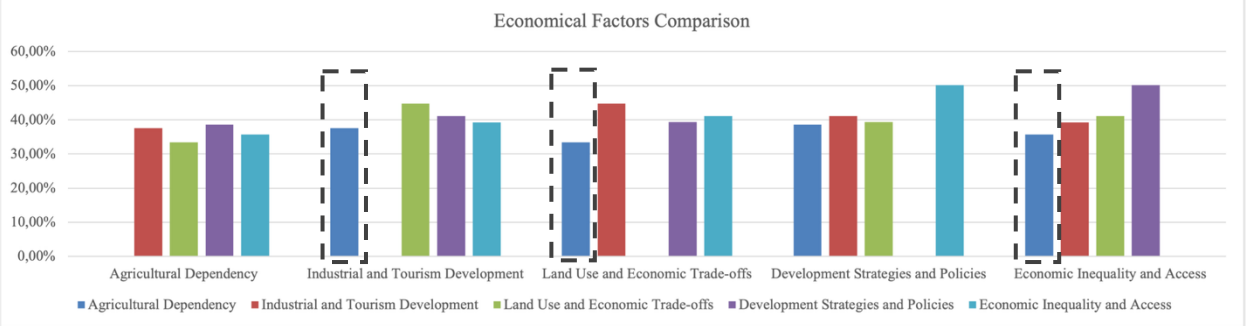


Figure 27: The Least Represented Economical Factors (Source: Author)

And finally, the technological drivers are the least well-covered category among the areas studied. Although hydraulic infrastructure, such as dams, is heavily covered (46.2%), other technological interconnections cover significantly lower percentages and are below 40%. Individually, research on wastewater and irrigation technologies contributes to just 33.6%, on wastewater and access to 34.5%, and on agriculture and infrastructure to 35.7%. The absence of a comprehensive study of

these technologies within current database perpetuates the view of technology as a background condition rather than a contested driver of change. Table 9 details the studies that addressed each factorial intersection of the technological driving force. The patterns of coverage are further conveyed in Figure 28, which displays the comparative distribution of technological factors and their intersections across the literature.

Table 9: Technological Factors Research Availability (Source: Author)

Technological D.F.	Hydraulic & Water Management Infrastructure	Wastewater & Water Treatment Systems	Technological Access and Capacity	Agricultural & Irrigation Technologies
Hydraulic & Water Management Infrastructure		46,20%	39,30%	35,70%
Wastewater & Water Treatment Systems	46,20%		34,50%	33,60%
Technological Access and Capacity	39,30%	34,50%		36,40%
Agricultural & Irrigation Technologies	35,70%	33,60%	36,40%	

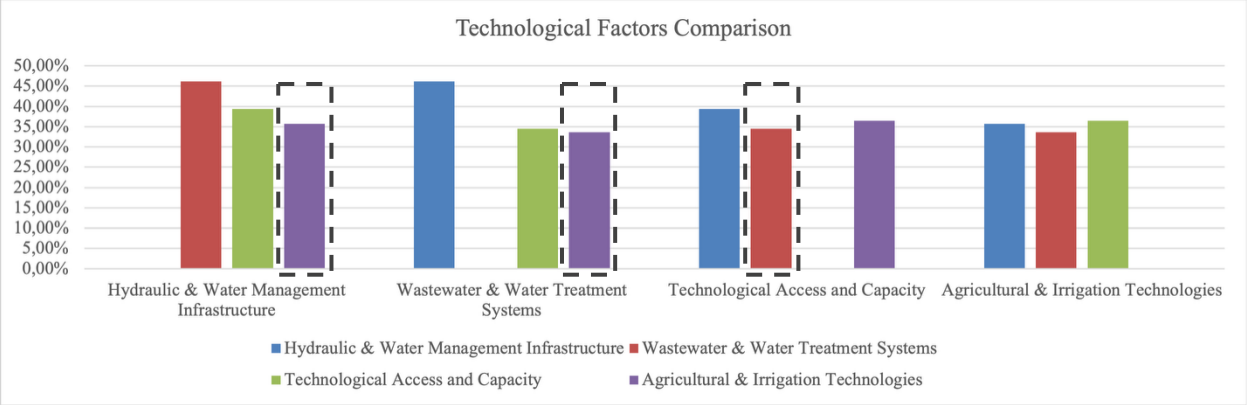


Figure 28: The Least Represented Technological Factors (Source: Author)

Taken as a whole, these findings show that research on transboundary river systems focuses heavily on political and environmental drivers, while cultural dimensions, socio-ecological linkages, participation, agricultural dependency and inequality, and technological change are consistently underrepresented. These neglected areas are precisely the factors that must be considered in multilayered river systems

4.3. The Selection of the Driving Force Focus

Stage 3 results are directly built on the coding procedure outlined in the methodology. The 200 peer-reviewed articles were carefully assessed using a standardized ordinal scale (0 = Not addressed, 1 = Minimally addressed, 2 = Moderately addressed, 3 = Extensively addressed). The framework, modelled on conventional methodologies for systematic literature reviews and evidence synthesis, allowed for the qualitative results about scholarly engagement with the five

acknowledged driving forces-political, economic, technological, natural, and cultural-to be transformed into a comparative dataset.

The four evaluation criteria (Conceptual Depth, Empirical Coverage, Integration in Planning and Policy, and Multidisciplinary Engagement) established a rigorous multidimensional basis for identifying which drivers are theoretically substantiated, empirically validated, relevant to policy, and cross-disciplinary in nature. Through this systematic approach, the third stage of the research directly addressed Research Question 3: "Which driving force should be the primary focus in multi-layered transboundary river systems?" by shedding light on the degree to which various driving forces are represented within the research and, importantly, giving priority to the cultural dimension as a key research priority. The findings demonstrate that a multilayered analysis of landscape change can be effectively operationalized by coding the five drivers and comparing their relative coverage. This comparative framework makes it possible to move beyond a single-lens interpretation of transboundary rivers and instead to examine them as composite landscapes shaped simultaneously by political, economic, technological, natural, and cultural forces. Table 10 shows the Evaluation framework results for the five driving forces (n = 200), followed by figure 29 that illustrates this data.

Table 10:The Evaluation framework results for the five driving forces (Source: Author)

Driver	Criterion	Average Score	Percentage Addressed	Criteria Average
Political	Conceptual Depth	2.52	95%	2.56
	Empirical Coverage	2.58	95%	
	Integration in Planning	2.58	95%	
	Multidisciplinary	2.56	95%	
Economic	Conceptual Depth	1.10	75%	1.06
	Empirical Coverage	1.03	75%	
	Integration in Planning	1.06	75%	
	Multidisciplinary	1.06	75%	
Technological	Conceptual Depth	2.42	90%	2.45
	Empirical Coverage	2.46	90%	
	Integration in Planning	2.47	90%	
	Multidisciplinary	2.46	90%	
Natural	Conceptual Depth	2.42	92%	2.47
	Empirical Coverage	2.50	92%	
	Integration in Planning	2.44	92%	
	Multidisciplinary	2.52	92%	
Cultural	Conceptual Depth	0.32	30%	0.34
	Empirical Coverage	0.34	30%	
	Integration in Planning	0.34	30%	
	Multidisciplinary	0.36	30%	

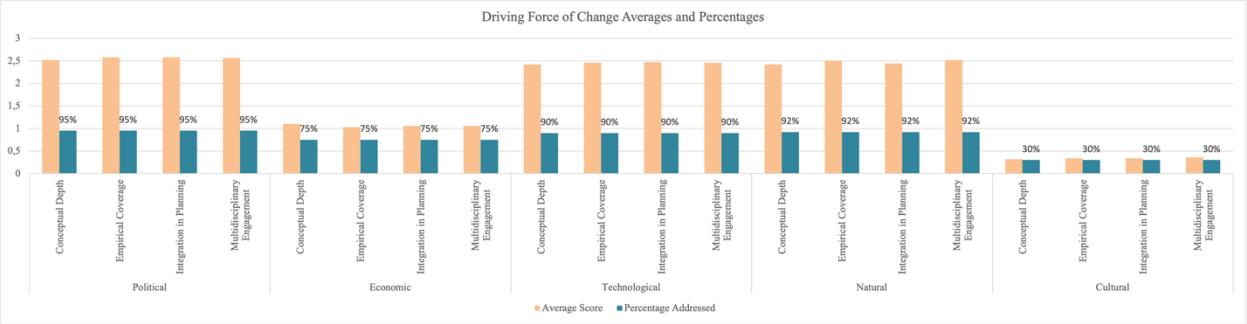


Figure 29: The Evaluation framework results for the five driving forces (Source: Author)

The comparative analysis highlights significant differences in the representation of the five driving forces on transboundary rivers. Political drivers exhibited a score exceeding eight times that of cultural drivers (2.56 compared to 0.34), while natural and technological drivers showed an approximately seven times greater score (2.47 and 2.45 versus 0.34). Even the relatively underdeveloped economic driver achieved coverage that was three times that of cultural drivers (1.06 versus 0.34). In absolute terms, cultural driving force was discussed in merely 30% of the examined studies, compared to 95% for political drivers and over 90% for both natural and technological drivers. These figures confirm that the cultural dimension is not only inadequately represented but is systematically marginalized within the academic discourse surrounding transboundary river basins.

(1) Dominance of Political, natural, and Technological Frameworks

The predominant emphasis on political, natural, and technological factors illustrates what has been historically characterized as the hydro-political framework in the governance of water resources (Wolf, 1998; Zeitoun and Mirumachi, 2008). Transboundary rivers are frequently perceived as resources subject to conflict, with management influenced by intergovernmental relations, hydrological limitations, and technological solutions. This framework favours measurable and institutionally established factors, consistent with positivist approaches to the management of water resources.

(2) Partial Engagement with Economic Dimensions

Economic drivers occupy an intermediate position. Present in approximately three-quarters of the literature, their treatment is often descriptive rather than analytical, focusing on trade, agriculture, or industry without embedding these topics within broader theoretical or interdisciplinary frameworks. This is consistent with (Grey and Sadoff, 2007), who emphasize that while economic issues such as trade and agriculture are frequently acknowledged, they are rarely integrated into the core analytical frameworks of basin management.

(3) Systematic neglect of Cultural Aspects

The most important finding is that for cultural driver, there is systematic neglect. The results for coding are that culture is virtually absent from both a conceptual and an empirical perspective,

with means barely exceeding 0.30. The exclusion is especially striking because rivers often carry symbolic, spiritual, and identity-related meanings that directly shape conflict, cooperation, and community strength. This neglect may be seen as both a discipline bias and a policy gap as values that are strongly embedded in culture are frequently harder to measure, thus being less central to positivist, policy-focused frameworks. This cultural gap in literature, however, deprives both research scholarship and governance fairness, as these are particularly valuable areas in places such as the Jordan River basin, where religious symbolism and common identity are central to the environmental dimension (Feitelson and Fischhendler, 2009).

By systematically evidencing the lack of attention to cultural drivers, Stage 3 formally answers Research Question 3 by showing that the analysis of landscape changes in transboundary rivers largely took a material, institutional, and technical approach, while cultural interpretations have often been limited. The findings reflect the lack of rigorous theoretical and empirical analysis of cultural elements in transboundary contexts. While research addresses hydro-politics, institutional collaboration, and economic trade-offs, very few systematically incorporate cultural landscapes, symbolic geographies, or border identities. Stage 3, therefore, provides quantitative proof of this gap by transforming what was qualitatively revealed in the literature review through systematic coding.

Research implications are two-fold. First, cultural prioritization is grounded in a discernible, replicable, and evidence-based coding technique. Second, recognising culture as the least acknowledged driver fills a methodological gap in the discipline. This positions the dissertation as a pioneering and up-to-date contribution by making a claim for the importance of culture, identity, and attachment in the examination of the Lower Jordan River Basin.

4.4. Cultural Driving Force Key Findings

4.4.1. Cultural Significance of Lower Jordan River Basin (LJRB)

1. Descriptive Statistics

Descriptive statistics show clear variability in Cultural Significance (1-5) across Lower Jordan River Basin (LJRB) communities. The highest mean is observed among Jordanians (Christians) living in Jordan (M = 4.749, SD = 0.237). Elevated values are also recorded for Palestinians with Palestinian passports living in Jordan (M = 4.192, SD = 0.282) and Israeli Jewish living in Israel (M = 4.124, SD = 0.257). Jordanians (Muslims) living in Jordan (M = 3.699, SD = 0.290), Palestinians with Israeli passports living in Israel (M = 3.698, SD = 0.250), and Palestinians with Palestinian passports living in Palestine (M = 3.672, SD = 0.334) occupy the middle range. The lowest mean appears among Palestinians with Israeli passports living in Palestine (M = 3.223, SD = 0.350). Group means with 95% confidence intervals are provided in Table 11.

Table 11: The Cultural Significance by Demographic Group (Source: Author)

Group	N	Mean	SD	95% CI (Lower)	95% CI (Upper)
Jordanians, Christians, living in Jordan	30	4.74	0.23	4.66	4.83
Palestinians with Palestinian passports, Muslims, living in Jordan	25	4.19	0.28	4.07	4.30
Israeli Jewish, living in Israel	40	4.12	0.25	4.04	4.20
Jordanians, Muslims, living in Jordan	250	3.69	0.29	3.66	3.73
Palestinians with Israeli passports, Muslims, living in Israel	50	3.69	0.25	3.62	3.76
Palestinians with Palestinian passports, Muslims, living in Palestine	30	3.67	0.33	3.54	3.79
Palestinians with Israeli passports, Muslims, living in Palestine	20	3.22	0.35	3.05	3.38

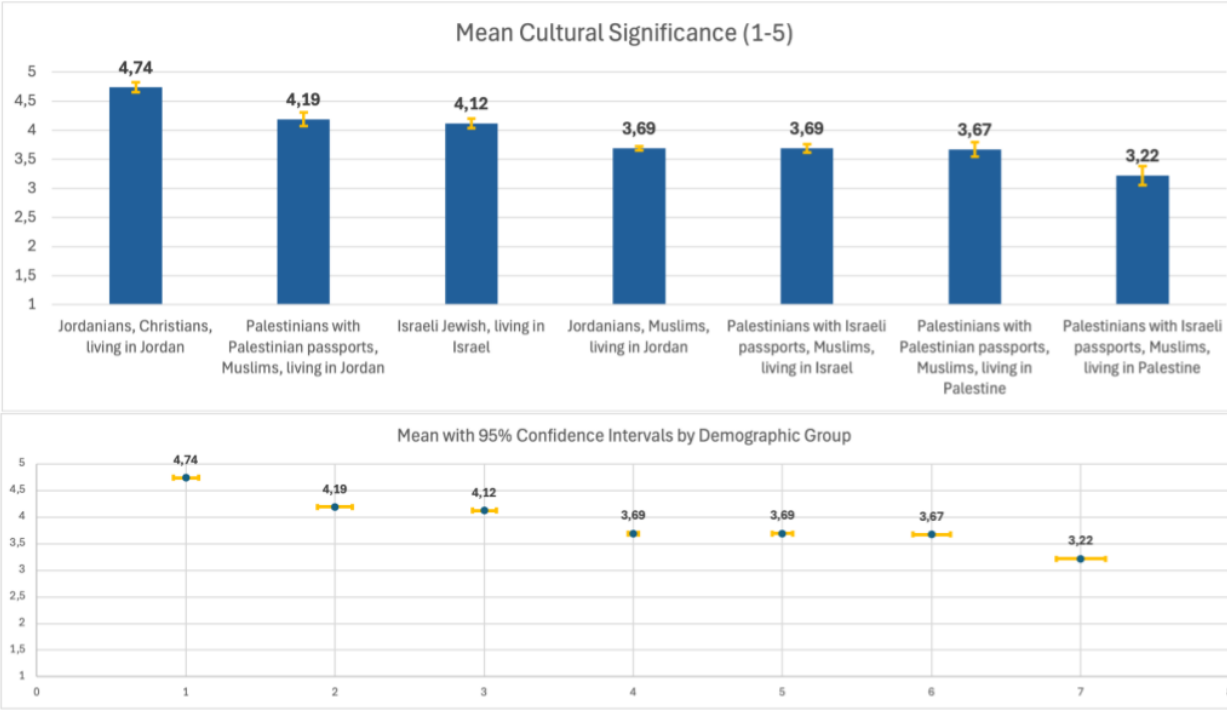


Figure 30: Cultural Significance by Demographic Group (Source: Author)

2. RQ1: How do different communities within the Lower Jordan River Basin (LJRB) perceive the cultural significance of the region?

- Step 1: Assumption checks. Prior to omnibus testing, Levene's test indicated homogeneity of variances across the seven groups ($p = 0.497$), satisfying the equal-variance assumption for classical ANOVA. Normality of residuals was evaluated with Shapiro-Wilk on the OLS residuals and was acceptable ($W = 0.994$, $p = 0.088$).
- Step 2: Omnibus test. A one-way ANOVA (Type II sums of squares) showed a highly significant group effect on Cultural Significance, $F(6,438) = 92.52$, $p < 1\times10^{-16}$. Effect sizes were $\eta^2 = 0.559$ and $\omega^2 = 0.552$, indicating large differences between groups (as summarized in Table 12).

Table 12: One-way ANOVA (Source: Author)

Test	F-statistic	df1	df2	p-value	Levene p-value (equal variances?)
One-way ANOVA	92.52041	6.0	438.0	1×10^{-16}	0.49734

- Step 3: Pairwise differences. With the omnibus test significant and homoscedasticity satisfied, Tukey HSD post-hoc comparisons were conducted. Multiple contrasts were significant. Notably, Jordanians (Christians) and Jordanians (Muslims) rated cultural significance higher than Palestinians with Israeli passports living in Palestine (all $p < .001$), among other significant gaps (as listed in Table A5 in the Appendices Chapter).

Communities differ significantly in perceived cultural significance. The pattern peaks for Jordanians (Christians), remains elevated for Palestinians in Jordan and Israeli Jews, and is lowest for Palestinians with Israeli passports living in Palestine.

The analysis shows large and systematic differences in Cultural Significance across the seven Lower Jordan River Basin (LJRB) communities (one-way ANOVA: $F(6, 438) = 92.52$, $p < 1\times10^{-16}$; partial $\eta^2 = 0.559$), indicating that community identity is a major determinant of how the Jordan River basin is valued culturally. As reported in Table 11, the highest mean score appears among Jordanians (Christians) living in Jordan ($M = 4.749$, $SD = 0.237$), followed by Palestinians with Palestinian passports living in Jordan and Israeli Jews, while the lowest mean is among Palestinians with Israeli passports living in Palestine ($M = 3.223$, $SD = 0.350$). Post-hoc comparisons (Tukey HSD) confirm many of these gaps. This pattern suggests that religion, nationality/passport status, and place of residence interact with lived access, heritage narratives, and governance to shape cultural valuation.

The elevated valuation among Jordanian Christians is consistent with the recognized global Christian pilgrimage significance of sites on the eastern bank of the Jordan River, especially the UNESCO-inscribed Baptism Site "Bethany Beyond the Jordan" (Al-Maghtas) which Jordan has developed and protected as a World Heritage property for its association with the baptism of Jesus and early Christian pilgrimage traditions. These institutional recognitions and site developments plausibly reinforce local salience and pride, contributing to the high Cultural Significance scores observed here.

The intermediate means for Palestinians with Palestinian passports living in Jordan and for Israeli Jews also fit broader religious and historical narratives of the river. In Judaism and Christianity, the Jordan River is densely layered with sacred stories, rites, and pilgrimages, in contemporary practice, multiple baptismal venues (e.g., Yardenit in Israel, Qasr al-Yahud in the West Bank, and Al-Maghtas in Jordan) serve overlapping publics and ritual uses. The existence of parallel sites on

both banks, and cross-border religious tourism, help explain higher baseline valuations in populations for whom the river figures prominently in religious identity and practice.

While Israeli citizenship formally provides wider freedom of movement compared to Palestinian Authority documents, the daily realities of living in the West Bank subject individuals to a regime of checkpoints, restricted military zones, and territorial divisions that override formal mobility rights. UN OCHA (2023) documents more than 500 permanent obstacles across the West Bank, which collectively constrain access to heritage landscapes, river corridors, and sacred sites. These limitations directly reduce opportunities for embodied engagement with the Jordan River as a cultural and spiritual landscape. By contrast, Palestinians residing inside Israel with Israeli passports can access curated river sites, pilgrimage routes, and heritage areas more freely, although still not without structural inequalities. The results therefore underscore that cultural valuation of the river is not determined by citizenship status alone, but rather by the compound effect of territorial control, mobility regimes, and border politics. In this sense, residence in Palestine acts as a structural determinant that reduces cultural attachment and significance, even for those holding Israeli passports, consistent with broader research linking restricted access to diminished place-based meaning.

Environmental psychology helps interpret these patterns. Place attachment, the affective, cognitive, and behavioural bond with a setting, arises at the intersection of person, place, and process. The tripartite framework suggests that where religious narratives and accessible ritual practices converge (e.g., UNESCO-recognized Al-Maghtas, well-serviced baptismal facilities), stronger attachment and higher cultural valuation are expected. Conversely, where legal-political process constrains routine access, the attachment process is hindered, depressing cultural valuation despite shared symbolic texts. This theoretical framing maps closely onto our empirical gradient across groups (Scannell and Gifford, 2010).

Interpretation should consider several limitations. First, the design is cross-sectional, differences are associations, not causal effects. Second, group sizes are unbalanced (e.g., n = 250 for Jordanian Muslims vs. n = 20 for Palestinians with Israeli passports in Palestine), which was addressed statistically (Levene's test supported homoscedasticity, then classical ANOVA with Tukey HSD were used), but which can still affect precision for smaller groups. Third, the outcome is a Likert-type 1-5 scores treated as approximately interval, an assumption common and generally robust in large number of applications, but still an approximation. Finally, the discussion draws on contextual case studies about sites, borders, and access to interpret mechanisms, direct mediation (e.g., measured access frequency) was not tested here and would be a valuable extension.

3. RQ2: What is the relation between cultural significance and conservation efforts in the Lower Jordan River Basin (LJRB)?

- Step 1: Mean difference by Conservation Involvement (Yes/No). Using Welch's t-test (robust to unequal variances and n), the mean difference in Cultural Significance between respondents reporting involvement = Yes (M = 3.870, SD = 0.379, n = 55) and No (M = 3.804, SD = 0.433, n = 390) was not significant: t = 1.183, df = 75.33, p = 0.241; Hedges' g = 0.154 (small), as shown in Table 13.

Table 13: Cultural Significance by Conservation Involvement (Welch t-test; Hedges' g) (Source: Author)

Group	Value
Yes	n=55, M=3.870, SD=0.379
No	n=390, M=3.804, SD=0.433
Welch t	1.183
Welch df	75.33
p-value	0.241
Hedges' g	0.154

On average, people who participate in conservation do not rate the river's cultural significance higher than those who do not, the small effect size indicates any difference is likely trivial in practical terms.

- Step 2: Linear association with perceived Impact of Conservation (1–5). Pearson's correlation indicated a moderate positive association between Impact of Conservation and Cultural Significance, r = 0.537, p = 1.28×10^{-34}; a Spearman's ρ = 0.452, p < 10^{-24} robustness check confirmed the monotonic relationship (Table 14).

Table 14: Association and Parsimonious Regression (Source: Author)

Statistic	Value
Pearson r	0.537
Pearson p	1.28×10^{-34}
Spearman rho	0.452
Spearman p	9.51×10^{-24}
OLS slope (Impact)	0.454
OLS SE	0.034
OLS p-value	1.28×10^{-34}
R-squared	0.288

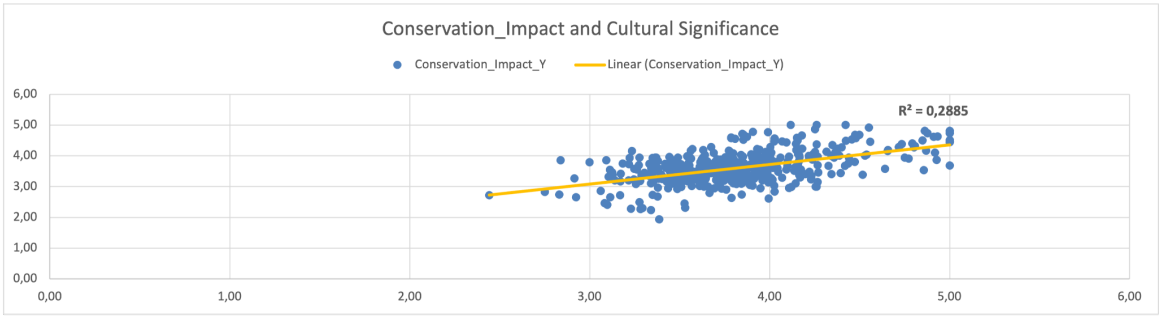


Figure 31: Correlation between Conservation Impact and Cultural Significance (Source: Author)

As respondents perceive conservation to be more impactful/beneficial, their Cultural Significance ratings increase in a consistent and meaningful way. The Spearman result shows this relationship holds even without assuming strict linearity.

- Step 3: Parsimonious regression. A univariate OLS model (Cultural Significance and Impact of Conservation) yielded a slope = 0.454 (SE = 0.034), $p < .001$, with $R^2 = 0.288$. Each 1-point increase (1-5 scale) in perceived conservation impact is associated with 0.45 higher Cultural Significance (1–5 scale).
- Step 4: Adjusted model with group and controls (HC3). A multivariable OLS with HC3 robust SEs including Impact of Conservation, Conservation Involvement (Yes/No), Awareness (Yes/No), and C(Group) achieved $R^2 = 0.565$. In this adjusted model, Impact of Conservation was not a significant unique predictor ($\beta = -0.021$, SE = 0.046, $p = 0.657$); Conservation Involvement and Awareness were also non-significant, while several group contrasts remained significant (as listed in Table A6 in the Appendices Chapter). Thus, the bivariate overlap between conservation and cultural significance appears explained by group differences (and awareness), not by participation status or perceived impact per se once controls are included. Reporting HC3 is standard for heteroskedastic survey data and improves inference reliability.

Conservation participation does not correspond to higher cultural-significance ratings, perceptions of conservation impact correlate positively with significance in bivariate analyses, but do not add unique explanatory power once demographic group and awareness are controlled. The "intersection" between conservation and cultural significance is therefore contextual (group-dependent) rather than general.

Across the sample, conservation involvement does not translate into higher perceived cultural significance: the mean difference between respondents who report participation and those who do not is small and non-significant (Welch's $t = 1.183$, $p = 0.241$, Hedges' $g = 0.154$), an appropriate test choice under unequal group sizes/variances. In contrast, perceived impact of conservation shows a moderate bivariate association with Cultural Significance (Pearson $r = 0.537$, Spearman $\rho = 0.452$), and a parsimonious OLS indicates that a one-point increase in perceived impact

corresponds to around 0.454 higher Cultural Significance ($R^2 = 0.288$). However, in an HC3-robust multivariable OLS adjusting for community group, awareness, and involvement, the perceived impact coefficient is small and non-significant ($\beta = -0.021$, $p = 0.657$), while several group contrasts remain significant (model $R^2 = 0.565$). Reporting HC3 is standard practice for heteroskedastic, unbalanced survey data.

Taken together, these results indicate that the intersection between conservation and cultural significance is perceptual but not general: people who believe conservation is effective tend, on average, to assign higher cultural value to the river, yet this association does not persist once community context is considered, suggesting it is largely structured by group-specific histories, meanings, and experiences rather than a uniform within-group mechanism. This pattern is consistent with work on cultural ecosystem services, which links stewardship outcomes to nonmaterial values such as identity, heritage, and spiritual meaning, and with place-attachment theory, which posits that cultural valuation emerges from the interplay of person, process, and place. Practically, the findings argue for visible, outcome-focused conservation (cleaner water, restored access, improved heritage-site condition) and for community-tailored engagement that aligns messages and co-designed actions with group-specific narratives, rather than relying on generic "involvement" alone.

4. RQ3: What is the effect of political boundaries on the cultural significance of the Lower Jordan River Basin (LJRB)?

Part A: Individual perception of political impacts (Yes/No).

- Step 1: Mean difference (Welch). Respondents reporting Political Impact = Yes rated Cultural Significance lower than those reporting No: $t = -4.214$, $df = 22.64$, $p = 0.00034$; Hedges' $g = -0.564$ (moderate), as shown in Table 15.
- Step 2: Point-biserial correlation. The association between Cultural Significance and Political Impact (0/1) was $r = -0.111$, $p = 0.0192$ (small, direction consistent with the t-test) (Table 15).

Table 15: Political Impact (Yes/No): Welch t-test, point-biserial (Source: Author)

Statistic	**Value**
Welch t	-4.214
Welch df	22.64
p-value	0.00033
Hedges' g	-0.564
Point-biserial r	-0.111
Point-biserial p	0.0192

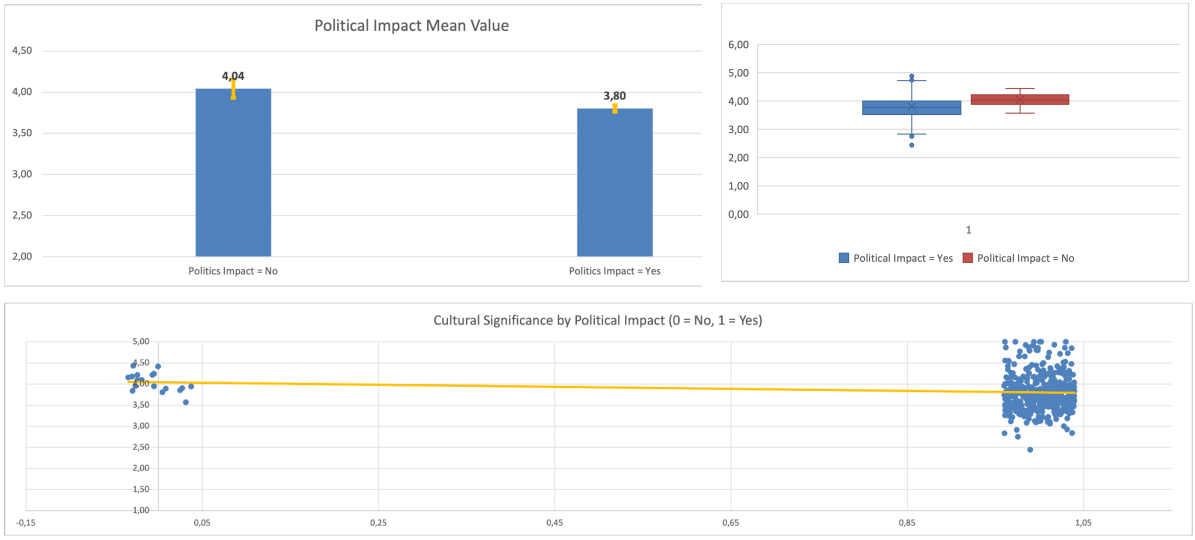


Figure 32: Correlation between Cultural Significance and Political Impact (Individual Perception)(Source: Author)

Part B: Territorial residence (Jordan, Israel, Palestine).

- Step 1: Omnibus test (ANOVA). A one-way ANOVA by territory indicated significant differences, $F(2, 442) = 17.429$, $p = 5.18\times10^{-8}$, with $\eta^2 = 0.073$ and $\omega^2 = 0.069$ (small-moderate), as summarized in Table 16.

Table 16:Territory ANOVA (Source: Author)

Effect	F	df1	df2	p-value	eta^2	omega^2
Territory	17.429	2	442	5.18×10^{-8}	0.073	0.069

- Step 2: Post-hoc (Tukey). Cultural Significance scores were higher in Jordan than in Palestine ($p < .001$) and higher in Israel than in Palestine ($p < .001$). There was no significant difference between Israel and Jordan ($p = 0.638$). (Table 17).

Table 17: Territory Tukey HSD (Source: Author)

group1	group2	meandiff	p-adj	lower	upper	reject
Israel	Jordan	-0.04	0.63	-0.16	0.07	FALSE
Israel	Palestine	-0.39	0.0	-0.56	-0.22	TRUE
Jordan	Palestine	-0.35	0.0	-0.49	-0.20	TRUE

Part C: An OLS model with HC3 robust SEs including Political Impact (Yes/No), Impact of Conservation (1-5), Conservation Involvement (Yes/No), Awareness (Yes/No), and C(Group) yielded $R^2 = 0.562$ (Adj. $R^2 = 0.548$). After adjustment, the Political Impact coefficient attenuated to marginal ($p = 0.0565$), Impact of Conservation was not significant ($p = 0.667$), and Conservation Involvement and Awareness were also not significant ($p = 0.194$ and $p = 0.270$, respectively), group dummy coefficients were included with Israeli Jewish, living in Israel as the reference category.

Table 18: Adjusted OLS (HC3): Cultural Significance ~ Politics + Impact + Involvement + Awareness + C(Group) (Source: Author)

Term	Coefficient	Std. Error	t	p>|t|	Lower 95% CI	Upper 95% CI
Intercept	4.20	0.19	21.65	5.64	3.82	4.58
C(group)[Jordanians, Christians, living in Jordan]	0.51	0.08	6.37	1.80	0.35	0.67
C(group)[Jordanians, Muslims, living in Jordan]	-0.54	0.07	-7.34	1.99	-0.69	-0.40
C(group)[Palestinians with Israeli passports, Muslims, living in Israel]	-0.54	0.07	-7.01	2.36	-0.69	-0.39
C(group)[Palestinians with Israeli passports, Muslims, living in Palestine]	-1.05	0.13	-8.01	1.10	-1.31	-0.79
C(group)[Palestinians with Palestinian passports, Muslims, living in Jordan]	-0.03	0.08	-0.37	0.70	-0.21	0.14
C(group)[Palestinians with Palestinian passports, Muslims, living in Palestine]	-0.58	0.09	-6.28	3.33	-0.76	-0.40
pol_bin	0.15	0.07	1.90	0.05	-0.01	0.30
impact_cons	-0.01	0.04	-0.43	0.66	-0.11	0.07
cons_bin	-0.06	0.04	-1.29	0.19	-0.16	0.03
aware_bin	-0.03	0.035	-1.10	0.26	-0.10	0.03

Item	Value
Dependent variable	Cultural Significance (1–5)
N	445
R-squared	0.565
Adj. R-squared	0.548
Estimator	OLS
Covariance (SE) type	HC3
Reference group	Israeli Jewish, living in Israel

Part A: Individual perception of political impacts (Yes/No)

Individuals who reported that politics affects cultural significance rated the river's cultural significance lower than those who did not (Welch t = - 4.214, df = 22.64, p = 0.00034; Hedges' g = - 0.564, moderate). The point-biserial correlation between the binary political-impact indicator

and Cultural Significance was small but significant (r = - 0.111, p = 0.0192), consistent in direction with the mean difference (Table 18).

Welch's t-test is the appropriate two-sample mean comparison when groups may have unequal variances and/or unequal sizes, the significant result here indicates a real average gap in cultural valuation between "politics = Yes" and "politics = No" respondents. The moderate Hedges' g (-0.56) indicates a practically meaningful difference in standard-deviation units, while the small point-biserial r (-0.11) reflects a modest bivariate association between the dichotomy and the continuous outcome.

The pattern suggests that perceived political constraints (e.g., checkpoints, permits, or border formalities) are associated with cultural valuation. In the West Bank context, roadblocks, checkpoints, gates can inhibit access to river-related sites and rituals, plausibly weakening everyday engagement with the landscape's cultural layers. Reduced access and interrupted practices are well understood to erode place-based bonds in environmental psychology.

Part B: Territorial residence (Jordan, Israel, Palestine)

Cultural Significance differs by territory (ANOVA: $F(2, 442) = 17.429$, $p = 5.18\times10^{-8}$; $\eta^2 = 0.073$, $\omega^2 = 0.069$, small-moderate). Tukey HSD shows Jordan > Palestine ($p < .001$) and Israel > Palestine ($p < .001$), while Israel and Jordan (ns, $p = 0.638$).

The omnibus ANOVA tests any mean differences across the three territories; the significant F indicates at least one pair differs. Tukey's HSD then localizes the differences while controlling error across all pairwise comparisons. The effect sizes (η^2, ω^2) indicate that territory explains a non-trivial but not dominant share of variance.

The lower average valuation in Palestine relative to Jordan and Israel is consistent with a more restrictive mobility regime along and toward river corridors on the West Bank side, which constrains regular contact with river spaces, heritage venues, and associated practices. Jordan and Israel both host formalized, serviced access points and visitor infrastructures to river-related pilgrimage/heritage sites, where access is predictable and curated, cultural meanings are more readily performed and reinforced, yielding higher significance ratings.

Part C: Adjusted model with politics, conservation, and group (HC3)

In an OLS model with HC3 robust standard errors controlling for Political Impact (Yes/No), Impact of Conservation (1-5), Conservation Involvement (Yes/No), Awareness (Yes/No), and community group (dummy-coded), model $R^2 = 0.562$ (Adj. $R^2 = 0.548$). The Political Impact coefficient attenuates to marginal ($p = 0.0565$). Impact of Conservation is not significant ($p = 0.667$) in this fully adjusted specification, Involvement and Awareness are also non-significant. (Table 18).

The reduction of the political-effect p-value from clearly significant (Part A) to marginal after adjustment signals shared variance (overlap) with other predictors especially community group and perceptions of conservation. For example, once group composition is out, the residual (unique) political effect is smaller and less certain. This is a common pattern in socio-spatial data where politics, access, and identity are intertwined.

The adjusted model implies that political perceptions, group identity, and (to a lesser extent) conservation perceptions are structurally entangled. Political boundaries and mobility rules shape who can access which river sites, how often group membership correlates with territorial residence and institutional interfaces, and perceived conservation "impact" likely reflects experiences with managed access points and interpretive programming, which are themselves distributed unevenly across borders. Once these correlated pathways are considered together, the unique association of political perceptions with Cultural Significance becomes marginal, suggesting that politics exerts its influence partly through territorial and group-mediated access mechanisms.

This study's observational, cross-sectional design means associations should not be interpreted causally, and unmeasured factors (e.g., local security events, socioeconomic status) may confound estimates. Group sizes are unbalanced across territories and communities. Although we mitigated this with Welch's t and HC3 robust standard errors, small cells reduce precision for some contrasts. Measurement is based on single items for Cultural Significance and perceived political impact; multi-item scales would improve reliability and enable latent-variable modelling. Finally, substantive overlap among politics, territory, and community group introduces collinearity, limiting the unique contribution identifiable for any single predictor in the adjusted model.

4.4.2. Cultural Heritage and Tourism of Lower Jordan River Basin (LJRB)

1. RQ1: How has tourism influenced perceptions of cultural attachment in the Lower Jordan River Basin (LJRB)?

A nonparametric association test between Tourism Exposure (1-5) and Cultural Attachment (1-5) using Spearman's ρ found a small, positive association: $\rho = 0.124$, $p = 0.0089$, $N = 445$. Interpreting ρ^2 as an approximate share of rank variance, the association accounts for 1.5% ($0.124^2 = 0.015$) of the variability in ranks, consistent with a weak monotonic trend (Table 19) (Table 20).

Table 19: Correlation Results for Tourism Exposure and Cultural Attachment (Source: Author)

rho	P value	n
0.1239585157500825	0.0089	445

Table 20: Descriptive Data of Cultural Attachment by Tourism Exposure (Source: Author)

Tourism Exposure	n	mean	SD	se	95% CI low	95% CI high
1	87	2.943	1.252	0.134	2.676	3.209
2	88	3.205	1.166	0.124	2.957	3.452
3	92	3.087	1.145	0.119	2.850	3.324
4	91	3.396	1.154	0.121	3.155	3.636
5	87	3.379	1.048	0.112	3.156	3.603

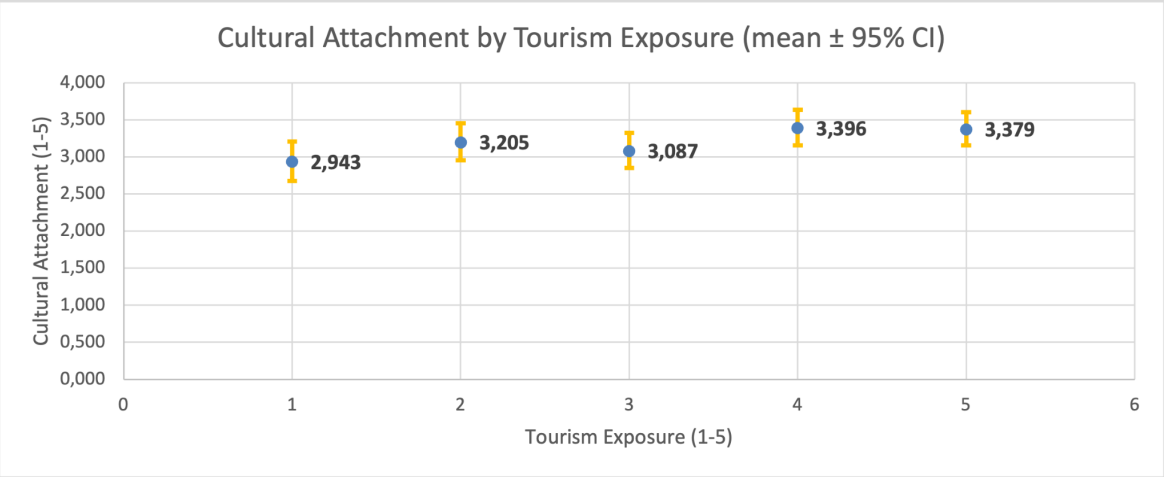


Figure 33: Cultural Attachment by Tourism Exposure (Source: Author)

Means are generally higher at greater exposure, with a minor irregularity at level 3 consistent with a weak monotonic trend and sampling noise typical of small effects.

Substantively, greater tourism exposure is associated with slightly higher cultural attachment. The effect is statistically reliable but small in magnitude, suggesting that while tourism relates to attachment, most variance in attachment is driven by other factors. Because the variables are ordinal and potentially non-normal, Spearman's ρ is an appropriate choice to assess monotonic association, treating Likert-type outcomes with robust parametric methods often yields similar inferences in large samples. Interpretation should prioritize effect size and uncertainty over p-values alone.

Tourism works as a contact-mediated pathway to cultural value: more chances to visit, participate in rituals, hear stories, and encounter interpretation produce incremental gains in place attachment. This aligns with place-attachment theory, which holds that bonds form through repeated, meaningful interactions that affect (feeling for place), cognition (meanings and memories), and behaviour (use, stewardship). In short, even modest increases in opportunities to be with the river and its sites can strengthen attachment. This supports interpretation, guided experiences, and community-led storytelling over passive sightseeing, approaches long recommended in heritage tourism guidance.

The design is cross-sectional, so the association is not causal, unmeasured covariates (e.g., heritage salience, education, mobility regimes) could confound the relation or produce reverse causation (people already attached may seek tourism). Future work can probe mechanisms with longitudinal or seemingly experimental designs.

2. RQ2: What is the relationship between economic development and cultural attachment in the Lower Jordan River Basin (LJRB)?

A two-group comparison using Welch's unequal-variance t-test compared Cultural Attachment for Economic Benefit (Yes = 2) versus (No = 1). The Yes group reported higher attachment (mean = 3.304) than the No group (mean = 3.019), a difference of Δ = +0.285 Likert points. The test indicated a reliable small effect: t = 2.450, df = 309.048, p = 0.0148, with Hedges' g = 0.247 and a 95% CI for the difference (0.056, 0.514) (Tables 21-23).

Table 21: Welch's t-test and effect size for Economic Benefit vs. Cultural Attachment (Source: Author)

n_x	n_y	mean_x	mean_y	diff_mean	welch_t	df	p_value	hedges_g	ci_diff_low	ci_diff_high
286	159	3.30	3.01	0.28	2.45	309.04	0.01	0.24	0.05	0.51

Table 22: Descriptive statistics for Cultural Attachment by perceived Economic Benefit (Source: Author)

econ_label	level_1	Cultural Attachment
No	n	159.0
	mean	3.018
	sd	1.203
	se	0.095
	ci95_low	2.830
	ci95_high	3.207
Yes	n	286.000
	mean	3.304
	sd	1.127
	se	0.066
	ci95_low	3.172
	ci95_high	3.435

Table 23: Mean difference in Cultural Attachment by perceived Economic Benefit (Source: Author)

contrast	diff_mean	ci95_low	ci95_high	welch_df
Yes − No	0.28	0.05	0.51	309.04

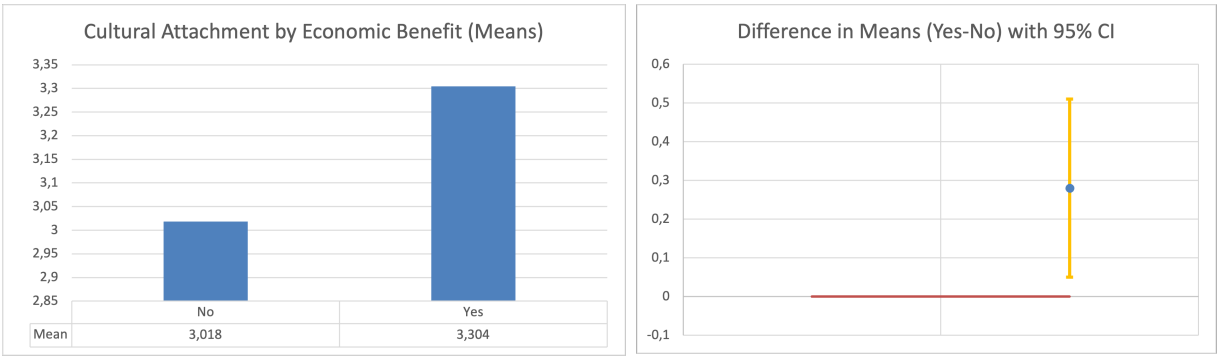


Figure 34: Cultural Attachment by Economic Benefit (Source: Author)

Respondents who perceive economic benefits from heritage/tourism report a higher cultural attachment, a small but practically noticeable uplift. Substantively, this fits social exchange theory (Cook, 2015): communities are more willing to value, support, and identify with heritage where exchanges feel beneficial and fair (e.g., local jobs, procurement, microenterprise demand, visible reinvestment). In this sense, attachment is not merely sentimental, it is also relational and instrumental, strengthened when residents see that cultural assets contribute to well-being and dignity. Policy levers that broaden benefit-sharing (local concessions, paid roles for culture-bearers, youth apprenticeships, revenue earmarks for cultural transmission) are therefore likely to raise cultural valuation alongside equity. These directions are consistent with international heritage guidance that centres communities as key actors in safeguarding and transmitting living heritage.

3. RQ3: How do political factors and accessibility of heritage sites affect cultural heritage?

A two-group comparison using Welch's unequal-variance t-test compared Cultural Attachment for Accessibility (Good = 1) versus (Restricted = 2). The Good-access group reported higher attachment (mean = 3.282) than the Restricted group (mean = 2.942), a difference of $\Delta = +0.339$ Likert points. The test indicated a reliable small – to small + effect: $t = 2.569$, $df = 165.361$, $p = 0.0111$, with Hedges' $g = 0.293$ and a 95% CI for the difference (0.079, 0.600) (Tables 24-26).

Table 24: Welch's t-test and effect size for Accessibility vs. Cultural Attachment (Source: Author)

contrast	n_good	n_restricted	mean_good	mean_restricted	diff_mean	welch_t	df	p_value	hedges_g	diff_ci95_low	diff_ci95_high
Good – Restricted	341	104	3.28	2.94	0.33	2.56	165.36	0.01	0.29	0.07	0.59

Table 25: Descriptive statistics for Cultural Attachment by Accessibility (Source: Author)

access_label	level_1	Cultural Attachment
Good	n	341.0
	mean	3.281
	sd	1.144
	se	0.061
	ci95_low	3.159
	ci95_high	3.403
Restricted	n	104.000
	mean	2.942
	sd	1.189
	se	0.116
	ci95_low	2.711
	ci95_high	3.173

Table 26: Mean difference in Cultural Attachment by Accessibility (Source: Author)

contrast	diff_mean	ci95_low	ci95_high	welch_df
Good − Restricted	0.33	0.07	0.59	165.36

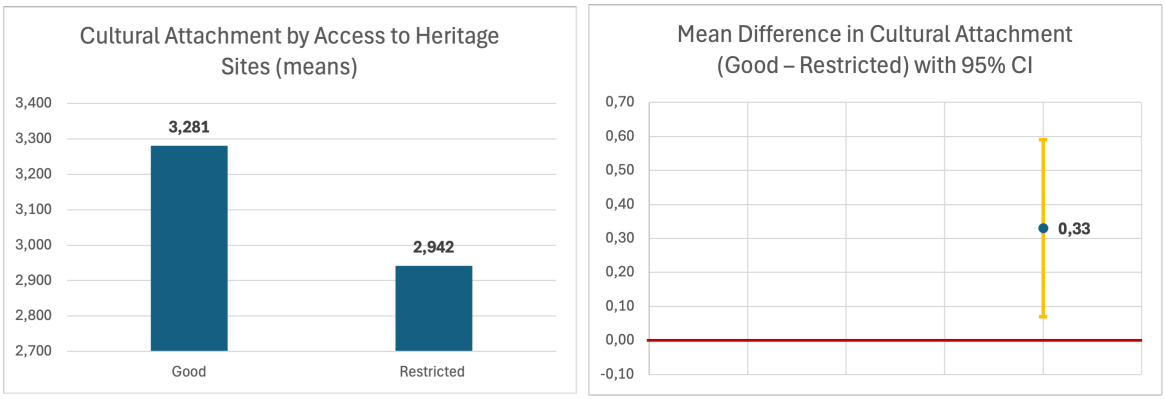


Figure 35: Cultural Attachment by Accessibility to Heritage Sites (Source: Author)

Respondents with good access to heritage sites reported significantly higher cultural attachment than those with restricted access, with a mean difference of $\Delta = +0.339$ Likert points. Although modest in absolute terms, this difference is statistically reliable ($t = 2.569$, $df = 165.361$, $p = 0.0111$) and corresponds to a small but meaningful effect size (Hedges' $g = 0.293$). The pattern supports the theoretical expectation that accessibility functions as a key mediator of cultural valuation. Where communities can visit, perform rituals, and engage in interpretive practices, the lived experience of heritage landscapes reinforces attachment and meaning. Place-attachment theory (Lewicka, 2011) underscores that affective bonds with place emerge through repeated encounters, memory formation, and ritualized practices. The present results empirically validate this mechanism: improved access increases opportunities for embodied interaction, which in turn strengthens attachment to the Jordan River as a cultural landscape.

Heritage policy frameworks converge on this finding. The ICOMOS Charter for the Interpretation and Presentation of Cultural Heritage (2008) emphasizes the importance of access and interpretation in sustaining community meaning, identity, and intergenerational continuity of value. Within the Lower Jordan River Basin (LJRB), access is unevenly distributed, constrained by territorial regimes, checkpoints, and security restrictions, meaning that not all communities can benefit equally from these reinforcing processes. The observed gap between good-access and restricted groups, therefore, reflects not only individual perception but the structuring power of political and territorial conditions in enabling or limiting cultural heritage valuation.

4.4.3. Cultural Identity and Attachment of Lower Jordan River Basin (LJRB)

1. RQ1: How do different communities influence emotional attachment to the Lower Jordan River Basin (LJRB)?

Full descriptive statistics by group are reported in Table 27. Mean emotional attachment scores ranged from 2.90 among Palestinians with Israeli passports living in Israel to 3.88 among Palestinians with Palestinian passports living in Jordan. The median scores were generally clustered around 3-4, suggesting shared attachment across communities, though variability (SD = 0.83-1.40) reflects both within-group diversity and contextual differences.

Table 27: Descriptive statistics for Emotional Attachment by Community (Source: Author)

group	n	mean	sd	median	q1	q3	se	ci95_low	ci95_high
Israeli Jewish, living in Israel	40	3.35	1.23	3.0	2.0	4.0	0.19	2.96	3.73
Jordanians, Christians, living in Jordan	30	3.40	1.22	3.0	3.0	4.0	0.22	2.96	3.83
Jordanians, Muslims, living in Jordan	250	3.42	1.30	4.0	2.0	4.75	0.08	3.26	3.58
Palestinians with Israeli passports, Muslims, living in Israel	50	2.90	1.40	3.0	2.0	4.0	0.19	2.51	3.28
Palestinians with Israeli passports, Muslims, living in Palestine	20	3.10	1.11	3.0	2.75	4.0	0.25	2.60	3.59
Palestinians with Palestinian passports, Muslims, living in Jordan	25	3.88	0.83	4.0	3.0	4.0	0.16	3.55	4.20
Palestinians with Palestinian passports, Muslims, living in Palestine	30	3.03	1.12	3.0	2.0	4.0	0.20	2.62	3.43

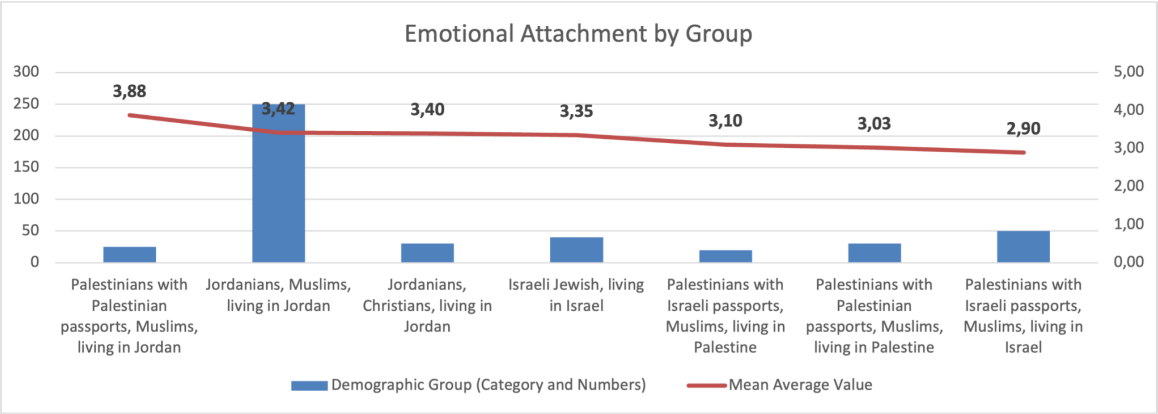


Figure 36: Emotional Attachment by Demographic Group (Source: Author)

A nonparametric omnibus test (Kruskal–Wallis H) was used to compare Emotional Attachment (1-5) across seven community groups. Because the dependent variable is ordinal and the groups are independent but unequal in size, this test provides a distribution-free analogue to one-way ANOVA. The test indicated a statistically significant difference: H (6) = 13.856, p = 0.0313, with an epsilon-squared effect size of 0.018, consistent with a small effect in the context of ordinal group comparisons (Table 28).

Table 28: Kruskal-Walli's Omnibus Test Results for Emotional Attachment Across Communities (Source: Author)

Test	H	df	p_value	epsilon_sq
Kruskal–Wallis	13.85	6	0.03	0.01

To identify which community pairs differed, pairwise Mann-Whitney U tests with Holm correction for multiple comparisons were conducted. Before correction, several contrasts showed nominal significance (e.g., Jordanians, Muslims vs. Palestinians with Israeli passports in Israel, U = 7598.5, p = 0.014; Palestinians with Palestinian passports in Jordan vs. Palestine, U = 537.0, p = 0.0045). However, after Holm adjustment, no pair remained significant at α = .05 (Table A7 in the Appendices Section).

Community membership is associated with small, but statistically significant, variations in emotional attachment. These variations, however, are diffuse not focal; no comparison of individual communities does a large discrepancy when adjusted for familywise error. This tendency indicates that attachment to the Lower Jordan River is broad, crossing national, ethnic, and religious boundaries. There are, however, subtle variations:

Palestinians with Palestinian passports in Jordan exhibited the highest mean level of attachment, signifying a strong spiritual proximity and connections to cultural heritage.

The Palestinians who have Israeli passports in Israel reported the lowest attachment, which could reflect mobility constraints, socio-political tensions, and limitations in accessing cultural and religious sites.

From a theoretical point of view, this finding is consistent with place-attachment theory, which points out that feelings of attachment to landscapes are not constrained by political frontiers yet remain sensitive to contextual inequalities (Lewicka, 2011). The moderate-sized effect shows that attachment is a broadly held cultural invariant, subject to rather than defined by membership in a community. These findings underscore the need to consider both communal cultural identity and systemic barriers when examining residents' attachments to transboundary landscapes like the LJRB.

2. RQ2: What role does the Jordan River's ecological state play in shaping residents' cultural identity and sense of belonging?

A Spearman rank correlation assessed the relationship between Ecological Identity Influence (1-5) and Emotional Attachment (1-5). The result showed a small, positive association: $\rho = 0.110$, $p = 0.0199$, $N = 445$ (Table 29).

Table 29: Spearman correlation between Ecological Identity Influence and Emotional Attachment (Source: Author)

Spearman_rho	p_value	N
0.11029922901360634	0.01	445

To test robustness, an OLS regression (HC3 robust errors, with community fixed effects) treated Attachment as approximately continuous. Ecological identity remained significant: $\beta = +0.134$, 95% CI (0.039, 0.230), $p = 0.0058$ (Table 30).

Table 30: OLS regression of Emotional Attachment on Ecological Identity with community fixed effects (Source: Author)

	coef	ci_low	ci_high	p_value
Intercept	2.93	2.46	3.39	0.0
C(group)[T.Jordanians, Christians, living in Jordan]	0.06	-0.51	0.63	0.8319
C(group)[T.Jordanians, Muslims, living in Jordan]	0.10	-0.29	0.50	0.6141
C(group)[T.Palestinians with Israeli passports, Muslims, living in Israel]	-0.42	-0.95	0.10	0.1182
C(group)[T.Palestinians with Israeli passports, Muslims, living in Palestine]	-0.26	-0.88	0.34	0.3951
C(group)[T.Palestinians with Palestinian passports, Muslims, living in Jordan]	0.54	0.03	1.05	0.0368
C(group)[T.Palestinians with Palestinian passports, Muslims, living in Palestine]	-0.36	-0.92	0.20	0.2098
eco_ident	0.13	0.03	0.22	0.0058

Residents who perceive the ecological condition of the Jordan River as central to their cultural identity report slightly higher emotional attachment. The effect is statistically reliable but small in magnitude, accounting for just over 1% of variance in attachment. This is consistent with identity theory (Stets and Burke, 2000), which emphasizes the role of environmental quality in shaping belonging and self-concept. Substantively, it suggests that ecological degradation or restoration of the river can gradually influence attachment by reinforcing or weakening identity narratives tied to the landscape.

3. RQ3: How do political borders affect residents' sense of belonging in the Lower Jordan River Basin (LJRB), and how does this relate to their emotional attachment?

(a) Community x Belonging (independence test):

A chi-square test of independence assessed community membership against border-related belonging (1 = strong belonging, 2 = restricted presence). Results indicated an association: $\chi^2(6) = 13.037$, $p = 0.0425$ (Table 31) (Table 32).

Table 31: Community x Belonging Crosstab (Source: Author)

group	Restricted (0)	Strong (1)
Israeli Jewish, living in Israel	16	24
Jordanians, Christians, living in Jordan	13	17
Jordanians, Muslims, living in Jordan	95	155
Palestinians with Israeli passports, Muslims, living in Israel	26	24
Palestinians with Israeli passports, Muslims, living in Palestine	13	7
Palestinians with Palestinian passports, Muslims, living in Jordan	6	19
Palestinians with Palestinian passports, Muslims, living in Palestine	16	14

Table 32: Chi-square Test Summary for Community × Belonging (Source: Author)

chi2	df	p_value
13.03	6	0.04

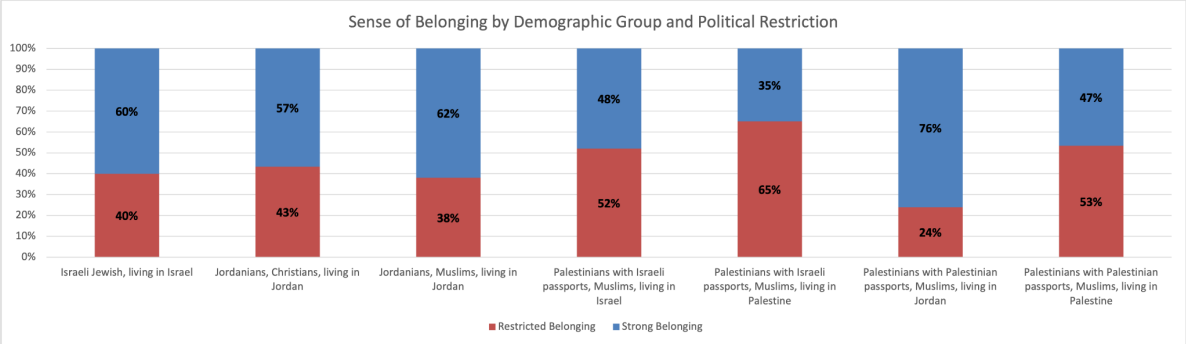


Figure 37: Sense of Belonging by Demographic Group and Political Restriction (Source: Author)

The distribution of strong belonging versus restricted presence varies significantly by community, although the effect is modest. This indicates that political borders shape how different groups perceive their ability to belong in the Lower Jordan River Basin. The pattern reflects structural inequalities of access and residence: for example, Jordanians (Muslims and Christians) report higher rates of strong belonging compared to Palestinians living under more restrictive territorial regimes. The absence of extreme residuals suggests that the variation is systemic rather than concentrated in a single outlier group. These findings align with borderlands theory (Brunet-Jailly, 2005), which holds that political boundaries do not simply divide space but mediate social attachments and belonging through mobility regimes and access rights.

(b) Attachment difference x belonging category.

A Mann-Whitney U test compared Emotional Attachment between strong belonging (n = 260) and restricted presence (n = 185). Results showed a small but significant effect: U = 26,617, p = 0.0489, Cliff's δ = 0.107. Mean attachment was higher among those reporting strong belonging (M = 3.44) than those reporting restricted presence (M = 3.21) (Table 33) (Table 34).

Table 33: Descriptive statistics of Emotional Attachment by Belonging Category (Source: Author)

Belonging Category	n	Mean	SD	Median
Restricted (0)	185	3.21	1.27	3.0
Strong (1)	260	3.44	1.27	4.0

Table 34: Mann–Whitney U test results for Attachment by Belonging Category (Source: Author)

U	p_value	n_strong	n_restricted	Cliff's δ
26,617	0.04	260	185	0.10

Figure 38: Emotional Attachment by Belonging (Source: Author)

Respondents who reported strong belonging also reported slightly higher emotional attachment compared to those reporting restricted presence. Although the difference is modest (Δ = +0.23 Likert points), it is statistically reliable and consistent with place-attachment theory, which

emphasizes that affective bonds to place are reinforced by a sense of inclusion and belonging. Restricted presence, often shaped by political boundaries and mobility constraints, weakens these bonds by limiting opportunities for sustained interaction with the river landscape.

(c) Probability of strong belonging (logistic model):

A logistic regression was conducted to estimate the probability of reporting strong belonging as a function of Emotional Attachment and Ecological Identity Influence. Results showed that Attachment was a significant predictor: OR = 1.165 per +1-point, p = 0.0459. Ecological Identity was directionally negative (OR = 0.897, p = 0.186) and nonsignificant when included jointly (Table 35).

Table 35: Logistic Regression of Strong Belonging on Attachment and Ecological Identity (Source: Author)

	OR	95% CI_low	95% CI_high	p_value
Intercept	1.17	0.59	2.31	0.64
Emotional Attachment	1.16	1.00	1.35	0.04
Ecological Identity	0.89	0.76	1.05	0.18

Attachment emerged as the key driver of strong belonging, increasing the odds of affirming belonging even under border restrictions. By contrast, ecological identity influence did not significantly predict belonging once attachment was accounted for, suggesting attachment is the more proximal correlate of border-related presence. This pattern underscores the resilience of emotional ties to place: residents with stronger attachment are more likely to maintain belonging despite political and territorial constraints. These results reinforce theoretical perspectives that emphasize attachment as both a buffer and a mediator in contested landscapes.

5. NEW SCIENTIFIC RESULTS

The new scientific findings from the present dissertation results are summarized in the following theses:

THESIS 1: Integrated framework for site selection, factor gap-mapping, and cultural prioritization in transboundary river basins

I developed an integrated evaluation framework that (a) uses the Driver-Forces Coverage Index (DFCI) check to justify site selection and spatial focus, (b) applies cross-factor gap-mapping to identify systematically underexplored factor combinations within each driving force, and (c) employs a criteria-based 5x4 evaluation matrix to prioritise drivers of change. Applying this framework, I found that the Jordan River Basin is uniquely treated as a multilayered system across political, economic, technological, natural, and cultural drivers, I identified three persistently underexplored intersections, for each driving force, and I found that the cultural

driving force consistently ranks lowest across evaluation criteria, while political, natural, and technological drivers rank higher and the economic driver occupies an intermediate position. On this basis, I selected the cultural driving force as the main substantive focus of the study.

According to the analysis, I identified the following key components and findings:

1. DFCI-based site selection across major transboundary rivers

I coded each of the 50 sampled articles on the Danube, Ganges, Mekong, Colorado, and Jordan for the presence or absence of five drivers (political, cultural, economic, technological, and environmental) and computed a river-level Driver-Forces Coverage Index (DFCI) as the proportion of studies that mention all five. Although the Jordan River contributes only 10% (n = 5) of the corpus, it achieves DFCI = 100%, whereas the Danube, Mekong, Colorado, and Ganges record 20%, 33%, 30%, and 38%, respectively. This step shows that the Jordan River Basin is the only basin treated as fully multilayered in existing research. I then applied a compact evaluation High (+), Medium (+/–), or Low (–) within the Jordan River, which indicated high concordance at the basin scale, transitional conditions in the valleys and tributaries with strong local ecological and cultural values but clear governance and data gaps, confirming that the Lower Jordan River Basin is an appropriate spatial focus for the subsequent analysis.

2. Cross-factor gap mapping within each driving force

I developed factor x factor matrices and applied a structured evidence and gap mapping protocol to the 200-paper database, quantifying coverage at every matrix intersection and identifying, within each driver, three persistently underexplored intersections. This revealed that cultural gaps cluster at low coverage levels (22.1-28.5%) in links between cultural significance, identity and attachment, and heritage and tourism, natural gaps at 32.2-33.5% in socio-ecological feedbacks connecting human interventions, hydrology/groundwater, morphology, topography/flow, and climate diversity, political gaps at 36-42% around public participation across jurisdiction, water management, and international relations, economic gaps at 33.4-37.6% around agriculture's relations to land-use trade-offs, inequality/access, and tourism/industry, and technological gaps at 33.6-36.4% in interactions between wastewater and treatment systems, agricultural and irrigation technologies, hydraulic and water-management infrastructure, and technological access and capacity. Together, these patterns define a targeted, cross-driver roadmap for future research.

3. Criteria-based prioritisation of driving forces and elevation of culture.

I constructed a 5x4 cross-matrix that scores each driving force (political, economic, technological, natural, cultural) against four criteria (Conceptual Depth, Empirical Coverage, Integration in Planning and Policy, and Multidisciplinary Engagement) using standardised 0-3 coding for each article and summarising results by driver and criterion. This implements established scoping and evidence-gap logic, making coverage and gaps quantifiable and transparent. The results showed

that cultural scores (criteria average 0.34; 30% of studies addressed) are around eight times lower than political (2.56; 95%) and seven times lower than natural (2.47; 92%) and technological (2.45; 90%), while even the economic driver (1.06; 75%) scores roughly three times higher. These disparities confirm a structural bias toward hydro-political and techno-managerial framings and provide a rigorous basis for prioritising culture as the central analytical focus of the study and for rebalancing future river-basin research and governance around cultural dimensions.

THESIS 2: Determinants of cultural significance: demographics, national access, institutional recognition

Based on the survey analysis, I demonstrated that perceptions of cultural significance vary systematically across demographic communities, following a gradient shaped by religion, nationality/passport status, and place of residence. I reached that communities with greater national access to the river sites report the highest cultural value, while those facing political and territorial restrictions, regarding their nationality, report the lowest. This shows that, in contexts such as the Lower Jordan River Basin, cultural significance is primarily structured by access opportunities and institutional recognition rather than being an inherent or uniformly shared attribute of place.

According to the survey results, I identified the following ordering of perceived cultural significance:

1. Jordanian Christians reported the highest cultural significance, reflecting the influence of UNESCO-inscribed pilgrimage sites such as Al-Maghtas (Bethany Beyond the Jordan), which reinforce local pride and global religious recognition.
2. Palestinians with Palestinian passports living in Jordan and Israeli Jews showed elevated scores, consistent with both religious narratives and active pilgrimage practices supported by accessible and curated sites on both banks of the river.
3. Jordanian Muslims, Palestinians with Israeli passports living in Israel, and Palestinians with Palestinian passports living in Palestine occupied the middle range, reflecting more constrained connections to river sites and narratives. This suggests that accessibility, coupled with spiritual heritage, mediates cultural valuation beyond physical proximity alone.
4. Palestinians with Israeli passports living in Palestine reported the lowest cultural significance, aligning with political restrictions, mobility barriers, and uneven access to riverfront sacred and heritage areas.

THESIS 3: Contextual mediation of conservation and cultural significance in river basins

Based on the survey analysis, I found that conservation efforts and cultural significance do not intersect in a uniform or direct way. Participation in conservation does not, by itself, raise

cultural significance. By contrast, I found that perceptions of the impact of conservation showed a clear positive association with cultural significance at the bivariate level as respondents who believed that conservation was effective tended to value the river more highly. However, once demographic group and cultural awareness were included in the model, this association disappeared, showing that conservation's role in shaping cultural meaning is not universal but mediated by community identity and context.

According to the survey results, I identified the following ordering of findings:

1. Conservation involvement did not produce significant differences in cultural significance, indicating that participation alone is not sufficient to increase cultural valuation.
2. Perceived impact of conservation was moderately correlated with cultural significance, suggesting that conservation is most meaningful when people believe it produces visible results.
3. Adjusted models showed that group identity (e.g., Jordanian Christians scoring much higher than Palestinians with Israeli passports living in Palestine) explained the largest share of variation, while conservation involvement and perceived impact became non-significant once these group differences were accounted for.

THESIS 4: Political boundaries as structural mediators of cultural significance in river basins

Based on the survey analysis, I demonstrated that political boundaries significantly shape how communities perceive the cultural significance. Respondents who perceived political influence rated the river's importance lower, indicating that restrictions and limited access depress cultural valuation. I reached that territorial comparisons reinforced this pattern: communities in Jordan and Israel reported higher levels of cultural significance, while those in Palestine reported the lowest, reflecting the impact of restricted mobility and limited access to heritage sites. However, the direct effect of political perceptions weakened, once demographic group and awareness were included, while group differences remained strong, resulting that politics operates through territory, border regimes, and community identity rather than in isolation.

According to the survey results, I identified the following ordering of findings:

1. Perceptions of political influence lowered cultural significance, showing how everyday barriers such as checkpoints, permits, and restricted access weaken cultural bonds with the river.
2. Territorial residence shaped outcomes: Jordan and Israel sustained higher cultural significance through serviced heritage and pilgrimage sites, while Palestine's lower ratings reflected mobility barriers and fewer opportunities for access.

3. Adjusted models showed that group identity explains more variation than individual political perceptions. For example, Jordanian Christians reported much higher cultural significance than Palestinians with Israeli passports living in Palestine, demonstrating how political boundaries and access regimes intertwine with community identity to determine cultural meaning.

THESIS 5: Cultural attachment shaped by heritage tourism and perceived economic benefit

I demonstrated, based on the survey analysis, that both tourism exposure and perceived economic benefit are modestly but significantly associated with cultural attachment. I found that tourism contributes incrementally to strengthening cultural bonds, indicating a limited yet reliable contact-mediated pathway to cultural value. I reached that communities perceiving tangible economic returns from heritage and tourism report stronger attachment than those that do not, showing that attachment is not purely sentimental but also relational and instrumental, shaped by perceptions of fairness, reciprocity, and visible reinvestment.

According to the survey results, I identified the following patterns of association:

1. Tourism exposure: A small yet significant Spearman correlation with cultural attachment ($\rho = 0.124$, $p = 0.0089$, $N = 445$); attachment generally rose with higher exposure levels, with minor irregularity at level 3 consistent with small-effect sampling variability; $\rho^2 \approx 0.015$ indicates limited variance explained.
2. Perceived economic benefit: A Welch unequal-variance test showed higher attachment among those perceiving benefit ($M = 3.30$, $n = 286$) versus those not perceiving benefit ($M = 3.02$, $n = 159$), $\Delta = +0.285$, $t = 2.450$, $df = 309.048$, $p = 0.0148$; effect size Hedges' $g = 0.247$ (95% CI [0.056, 0.514]). This effect is practically meaningful as an incremental uplift in attachment where benefits are perceived.
3. Interpretation: Tourism functions as a contact-mediated mechanism (visits, rituals, interpretation, storytelling), while economic benefit operates through Social Exchange Theory, fairness, reciprocity, and visible reinvestment. Together they provide incremental uplift in attachment but remain secondary to structural drivers (politics, access regimes, group identity). These patterns align with place-attachment theory (for contact-mediated bonding) and Social Exchange Theory (attachment strengthened when benefits are perceived as fair and reciprocal). In this sense, perceived economic benefit functions as an enabling factor.

THESIS 6: Political accessibility as a mediator of cultural attachment

Based on the survey analysis, I found that political accessibility to heritage sites is significantly associated with cultural attachment in the Lower Jordan River Basin. The survey results indicate that restricted access, often shaped by political and territorial boundaries, reduces

attachment to the river, while good access reinforces it. This shows that cultural attachment in the Lower Jordan River Basin (LJRB) is not uniformly distributed but is mediated by mobility regimes and opportunities for lived engagement with heritage landscapes.

According to the survey results, I identified the following patterns of association:

1. A Welch's unequal-variance t-test comparing respondents with good versus restricted access showed a significant mean difference (Δ = +0.339 Likert points, t = 2.569, df = 165.361, p = 0.0111), with a small but meaningful effect size (Hedges' g = 0.293, 95% CI [0.079, 0.600]).
2. Descriptive statistics confirmed this pattern: respondents with good access (n = 341, M = 3.28) reported higher cultural attachment than those with restricted access (n = 104, M = 2.94), underscoring that mobility constraints dampen cultural valuation.
3. Substantively, the results support place-attachment theory (Lewicka, 2011), which emphasizes that affective, cognitive, and behavioural bonds with place are formed through repeated, meaningful interaction. Restricted access interrupts these processes, while open access enables them.
4. The findings are also consistent with international heritage guidance, such as the ICOMOS Charter for the Interpretation and Presentation of Cultural Heritage (2008), which stresses that equitable access and interpretive opportunities are essential for sustaining cultural meaning and intergenerational continuity of value.

THESIS 7: Demographic context and ecological identity as determinants of emotional attachment in transboundary river landscapes

I demonstrated, based on the survey analysis, that emotional attachment is broadly shared across communities yet varies modestly by demographic context and is not confined by political borders. I found that perceiving the river's ecological state as central to identity is a small but statistically significant positive predictor of attachment. I showed that attachment intensity is co-produced by cultural proximity, residence and mobility conditions, heritage engagement, political/territorial context, access opportunities, and ecological salience indicating a transferable model for understanding cultural belonging and self-concept in contested river landscapes.

According to the survey results, I identified the following ordering of emotional attachment:

1. Demographic ordering of attachment:
    a. Highest: Palestinians with Palestinian passports living in Jordan (M = 3.88), reflecting spiritual proximity and cross-border cultural memory.

b. Middle-high cluster: Jordanian Muslims, Jordanian Christians, Israeli Jews (M = 3.35-3.43), indicating broadly shared attachments grounded in overlapping religious narratives and periodic ritual practices.
c. Lower: Palestinians with Palestinian passports living in Palestine and Palestinians with Israeli passports living in Palestine (M = 3.03-3.10), suggesting symbolic connection tempered by constrained access to heritage spaces.
d. Lowest: Palestinians with Israeli passports living in Israel (M = 2.90), consistent with structural marginalization, mobility restrictions, and socio-political tensions limiting embodied interaction.

2. Ecological identity-bivariate association: A small but significant Spearman correlation between ecological identity salience and emotional attachment ($\rho = 0.110$, $p = 0.0199$, $N = 445$).
3. Ecological identity-multivariable confirmation: Robust OLS with HC3 errors and community fixed effects retained ecological identity as a significant predictor ($\beta = +0.134$, 95% CI [0.039, 0.230], $p = 0.0058$).
4. Magnitude and consistency: Effects are modest (just over ~1% variance explained) yet consistent across methods, indicating ecological quality is a meaningful, identity-linked contributor to attachment.

THESIS 8: Political borders, belonging, and attachment

Based on the survey analysis, I demonstrated that political borders significantly influence residents' sense of belonging in the Lower Jordan River Basin, and this, in turn, shapes emotional attachment to the river landscape. The survey results indicate that while belonging is broadly shared, its distribution varies by community and is systematically constrained by political and territorial regimes. This shows that place attachment in the Lower Jordan River Basin (LJRB) is not only a matter of cultural or ecological identity but is also directly mediated by border governance and mobility restrictions.

According to the survey results, I identified the following patterns of association:

1. A chi-square test of independence showed a significant association between community membership and border-related belonging (χ^2 (6) = 13.037, $p = 0.0425$), indicating that strong belonging is more frequently reported among Jordanians (Muslims and Christians) and less among Palestinians living under restrictive territorial conditions.
2. A Mann-Whitney U test revealed that respondents reporting strong belonging (M = 3.44, n = 260) also reported higher emotional attachment compared to those reporting restricted presence (M = 3.21, n = 185), $\Delta = +0.23$ Likert points, U = 26,617, $p = 0.0489$, Cliff's δ =

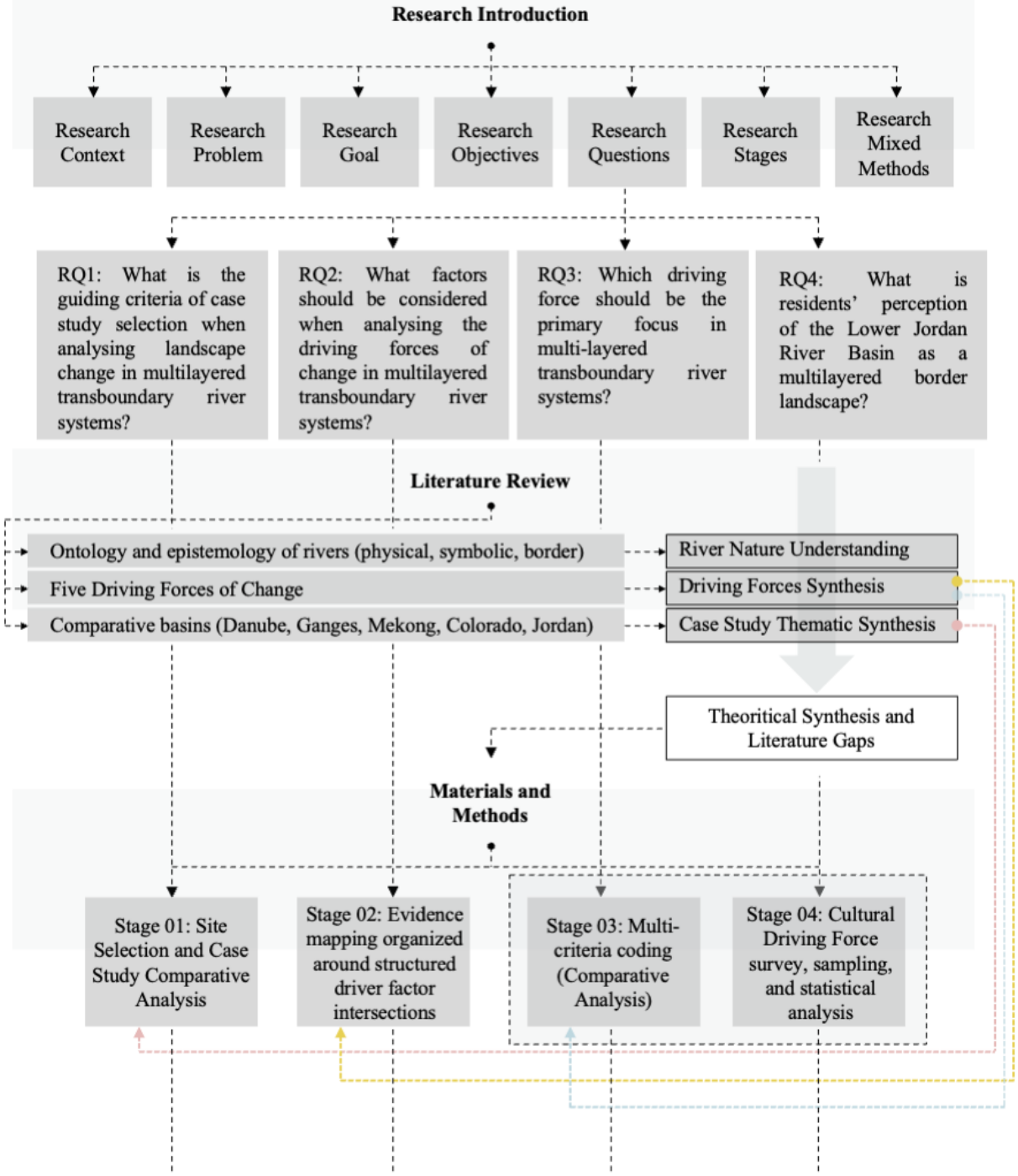
0.107. This confirms that perceived belonging reinforces attachment, even if the effect is modest.

3. A logistic regression model further identified emotional attachment as a significant predictor of strong belonging (OR = 1.165 per +1-point, p = 0.0459), while ecological identity influence was nonsignificant once attachment was controlled. This demonstrates that attachment functions as the more proximal driver of belonging under contested border conditions.

Based on the scientific analysis of survey results, I concluded that political borders mediate cultural belonging in the Lower Jordan River Basin (LJRB) by structuring who can remain, move, and participate, thereby influencing place attachment. Residents with stronger attachment are more likely to sustain belonging despite constraints, while those facing restrictive border regimes report weaker bonds. These findings reinforce borderlands theory (Brunet-Jailly, 2013), showing that borders do not simply divide space but actively shape social attachment, inclusion, and exclusion in transboundary cultural landscapes.

Research Main Question

How can transboundary river systems be systematically analyzed, and how can cultural drivers be examined in relation to political and ecological conditions?



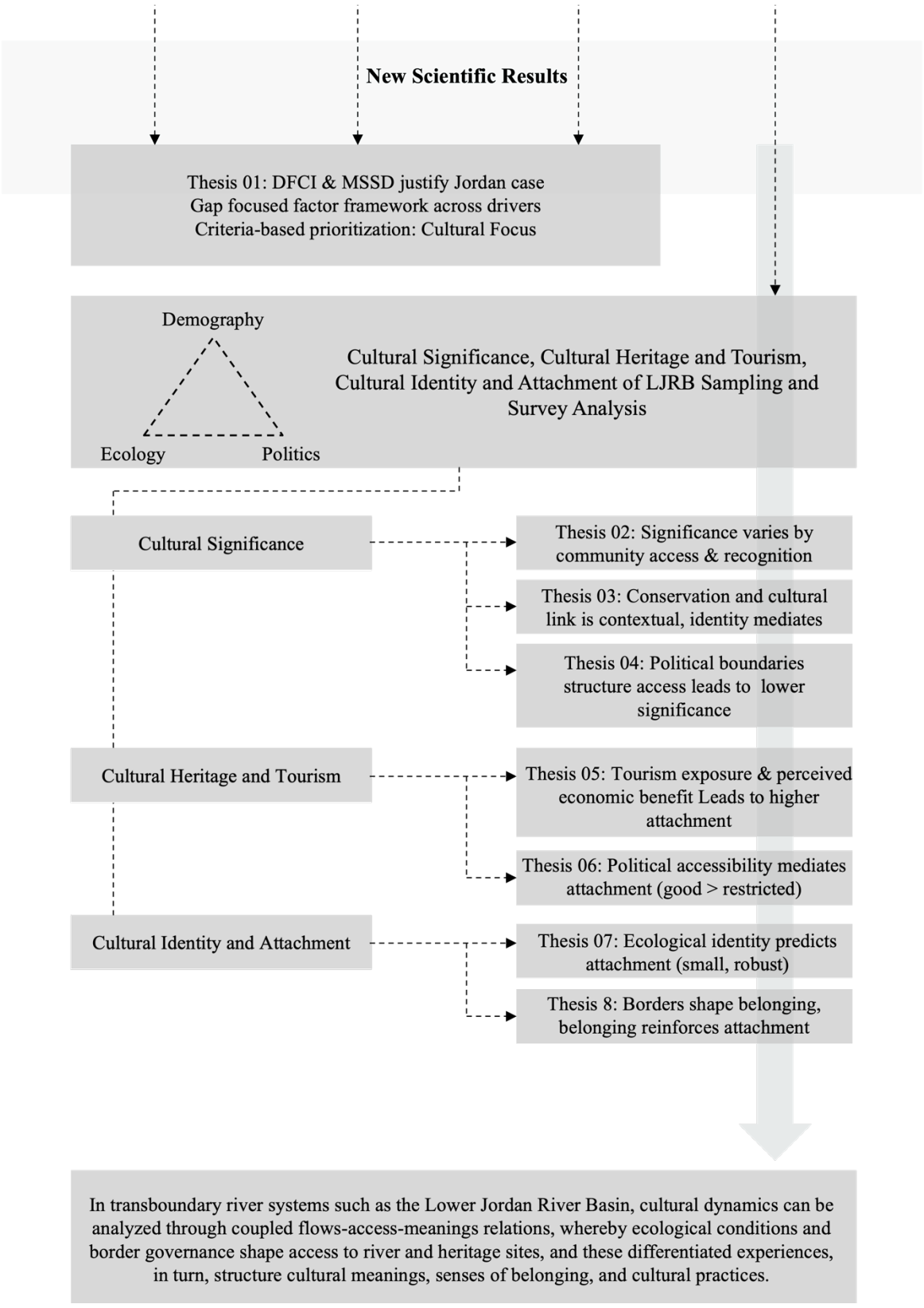


Figure 39: Thesis Analytical Framework Flowchart (Source: Author)

6. CONCLUSION AND PROSPECTS

6.1.Summary of the Dissertation

This dissertation formulates and tests a four-stage integrated framework for systematically analysing multilayered transboundary river systems and applies it to the Lower Jordan River Basin (LJRB) to interrogate the interplay among cultural, political, technological, economic, and environmental drivers. The framework links comparative synthesis (Stages 1-3) with empirical perception analysis (Stage 4) and shows that flows, access, and meanings are co-produced: ecological conditions and border governance configure access regimes, which in turn shape cultural meanings, belonging, and stewardship.

- **Research Main Question: How can transboundary river systems be systematically analysed, and how can cultural drivers be examined in relation to political and ecological conditions?**

In transboundary river systems such as the Lower Jordan River Basin, cultural dynamics emerge within flows-access-meanings relations: ecological conditions and border governance define who can access river and heritage sites, those unequal experiences shape cultural meanings, belonging, and stewardship, and therefore planning strategies that link ecological restoration with more equitable cross-border access are best aligned with how cultural relations to the river are actually produced.

Stage 1: Comparative design

- **Research Question 1: What is the guiding criteria of case study selection when analysing multilayered transboundary river systems?** A criteria-based Most-Similar-Systems screening (securitization, heritage salience, hydro-ecological change, evidentiary depth) and the Driver-Forces Coverage Index (DFCI) provided an overt rationale to privilege the Lower Jordan River Basin (LJRB) and a falsifiable procedure to select and order cases within border-river analysis. A screening matrix and keyword strategy ensured comparability across the Danube, Ganges, Mekong, Colorado, and Jordan rivers while retaining sensitivity to basin-particular salience.

Stage 2: Drivers and Factors

- **Research Question 2: What factors should be considered when analysing the driving forces of change in multilayered transboundary river systems?** Structured evidence and gap mapping across 200 peer-reviewed sources for each driving force, the least researched factors, thus the priority domains for subsequent analysis. In the cultural driver specifically, the scoping revealed the lowest empirical coverage, prompting the elevation of Cultural Significance, Heritage and Tourism, and Identity and Attachment as focal factors for the dissertation's empirical testing.

Stage 3: Integrated Analytical Framework

- **Research Question 3: Which driving force should be the primary focus in multi-layered transboundary river systems?** An integrative cross-driver framework that combines legal/governance baselines and hydro social/hydro-hegemony constructs with operational cultural constructs renders culture open to measurement as part of the set of ecological and institutional indicators. The framework institutionalizes the flows, access, and meanings grammar to first diagnose, then verify, the transformation of border regimes and environmental states into cultural results. Gap and Evidence/mapping identify a formal under-representation of cultural (mean 0.34, ~30% of research). However, political (2.56; ~95%), natural (2.47; ~92%), technological (2.45; ~90%), and economic (1.06; ~75%). Three cultural issues emerge as strong candidates for empirical inspection as a result: Cultural Significance, Heritage and Tourism, and Identity and Attachment.

Stage 4: Empirical Perception in the Lower Jordan River Basin (LJRB)

- **Research Question 4: What is residents' perception of the Lower Jordan River Basin as a multilayered border landscape, and how do political borders and the river's ecological state shape (a) cultural significance, (b) heritage and tourism access, and (c) identity and attachment across communities?**

1. Conclusion (a) The cultural significance is systematically differentiated by community and geographical region, primarily influenced by access frameworks and institutional acknowledgment rather than mere proximity. Adjusted analyses reveal that greater variance is ascribed to group identity and residence in comparison to individual political perceptions, suggesting that political factors operate indirectly through access and territorial context.
2. Conclusion (b) Heritage & Tourism exposure is modestly, significantly related to attachment, while perceived economic benefit is aligned with stronger attachment, as would be expected based on the contact & reciprocity pathways. Effects are modest in size but policy pertinent. In addition, good access to heritage sites is linked to higher attachment than restricted access.
3. Conclusion (c) Identity & Attachment: Community aligns with border-related belonging. Attachment increases the possibility of strong reportage of belonging, while ecological identity possesses a moderate, significant correlation with attachment. At the individual level, the results suggest that environmental rehabilitation, as well as equitable/serviced access, reflect cultural strategies that retain stewardship and belonging.

Taken together, the four stages demonstrate that ecological objectives must be co-designed and co-scheduled with access-governance measures (crossings, serviced heritage sites, multilingual

interpretation). It is the interaction of these levers that generates cultural outcomes, notably attachment and belonging, which, in turn, mediate compliance, stewardship, and the social legitimacy of restoration.

6.2.Recommendations for Future Research

Additional research would then extend this dissertation via the following pragmatic and realistic directions that even further extend the staged design, again within the remits of the Lower Jordan River Basin (LJRB):

1. Comparative replication of the synthesis stages. Application of the same screening introduction and driver factor matrix to other basins or sub-basins would be a method to determine whether the patterns being observed, specifically the cultural under-coverage and lowest-studied factor intersections, occur elsewhere. Publication of the coding guide, as well as the summary matrices, would allow other individuals to compare results freely
2. Follow-up surveys. Re-administration of the Lower Jordan River Basin (LJRB) perception survey after significant governance or environmental shifts would indicate the change over time in attachment, being part of, and access. Re-administering the same instruments, including translations, would allow results to be comparable.
3. Scenarios focusing on “flows, access, and meanings” in a planning-oriented context are proposed. Basic scenarios that connect objectives related to ecological rehabilitation with specific access arrangements, such as serviced heritage sites and designated visiting times, may be utilized to predict cultural responses and to synchronize social valuation with the goals of restoration.
4. Institutionalizing the use of participatory processes that integrates local details about routes, checkpoints, and site servicing could help identify points where small improvements to access would yield great cultural benefits.
5. Equity-based analysis. Decomposing future data on gender, age, income, and migrant origin would determine who benefits from heritage and access to tourism and where inequality persists, with short interviews or focus groups being consulted to determine the reasons behind the trends.
6. Institutional process tracing. Tracking the participation commitments back to site-level change and tracing these along with cultural-ecological measures would isolate those bureaucratic steps that do improve daily life.
7. Robustness and transparency of measurements. Reuse of the current instruments, keeping multi-language consistency checks, and making codebooks and anonymous summary tables publicly available would allow comparability as well as cumulative learning across studies.

6.3.Research Constrains and Limitations

These guidelines expand the stepwise structure of the thesis and abide by the practical limitations outlined in the dissertation. They also exhibit an analytical nature regarding the dynamic relationship between access governance and ecological change that shapes cultural interpretation across border-river landscape.

In the following sections, I delineate four primary constraints of this research, accompanied by concise strategies for addressing these limitations in future studies. The objective is to elucidate the parameters of inference and to suggest practical methodological decisions that could enhance future research efforts.

1. Relevance, external validity, internal validity

Though the methodological framework itself is transferrable to other basins or sites, the replication process itself may yield different results or cause a very different research experience. Institutional structure, access policies, and security situations vary considerably, both affecting the execution as well as the findings.

Implications for future research: the necessity of employing the same driver factor framework across diverse contexts, alongside the public dissemination of coding materials to facilitate systematic comparisons and cumulative synthesis.

2. Cross-sectional methodology

It measures attitudes as they stand at a point, so it cannot reflect change over time, nor enable strong causal statements.

Implication for future research: Re-administrate the same questionnaire to the same panels and languages (panel or repeated cross-sections), preferably aligned to policy or environmental changes, to simulate dynamics and trajectories.

3. Sampling and Representativeness

The reliance on non-probability, volunteer participation generates an undetected selection bias and limits population-level generalizability. Better research practice implication for future research: Use probability-based sampling whenever possible, where there is no alternative, use documented adjustments, for example, benchmarking, calibration, propensity weighting, and clearly report inference limits.

4. Political sensitivity and response bias in securitized or sensitive settings, respondents may self-censor or provide socially acceptable answers, which can distort measured attitudes. Recommendation for future research: Strengthen anonymity protections and consider indirect questioning protocols on sensitive commodities to reduce falsification of preferences and other biases.

6.4.Practical Implementation:

The results guide basin planning by linking citizens' perceptions of value, sense of belonging, and limitations to tangible levels of management, environmental flow recovery, and heritage/access management. The system places recommendations within universally accepted standards: the UN Watercourses Convention on equitable and reasonable use and the duty to cooperate, and the Aarhus Convention on access to environmental information, public involvement, and access to justice in the environment (Kaufmann, 2021).. In the case of the Lower Jordan, the assessment covers rehabilitation plans in environmental flows of water, as well as salinity targets that seek to restore ecological integrity, as well as access that carries cultural value.

This dissertation develops a transferable research program that translates analytic understanding into operation studies and policy-relevant experimentation. The Driving Forces Coverage Index (DFCI) codifies case selection. By binary-coding political, cultural, economic, technological, and environmental integration across a basin's literature, the DFCI substitutes ad-hoc case selection with an auditable process. In practice, research groups can re-run the DFCI across any transboundary system to spotlight high-integration locations worthy of intensive study as well as medium-integration locations apt for comparative testing. In this project, the DFCI identifies the Lower Jordan River Basin (LJRB) as the lead empirical venue while holding a secondary reach in reserve to allow for external validity. This step ensures that the resultant research starts where the questions of integrative governance are most manageable and most impactful.

The cross-factor gap-mapping transforms synthesis into a pipeline of executable studies. Crossing the factors of each driver on both axes and measuring coverage at their intersections, the procedure produces a ranked set of neglected questions (e.g., cultural significance x access, jurisdiction x public participation, technology x capacity). In practice, each intersection becomes a brief with a testable hypothesis, data needs, ethical considerations, as well as an analysis plan. The literature review then operates not as fixed background but as a programmatic generator of decision-relevant research, ready for funding opportunities and agency commissions.

The empirical findings require culture to be treated as an entry condition, as opposed to a residual category. The future research will accordingly be organized around three cultural workstreams that run in parallel with hydrology, infrastructure, and policy: (i) Significance & Recognition (audit of access to sites, designation, and servicing), (ii) Heritage & Tourism (balanced benefit-sharing, standard of interpretation, visitor management), and (iii) Identity & Attachment (cross-boundary co-design of participation, cross-border programming of youth & education, youth & education). The survey evidence points to implementable levers recognition and serviced access, co-designed micro-restoration with tangible consequence, time-limited cultural corridors across borders, fair

return of local benefit, accessibility by design, and identity-commensurate ecological restoration that can be ethically trailed with causality assessed.

The program standardizes measurement and learning to facilitate cumulative evidence. Culture significance and attachment are operationalized through valid five-point indices that are disaggregated across the major demographic strata adopted in this research. Analysis plans are pre-specified to couple pooled effects with equity-sensitive endpoints that monitor whether interventions reduce between-group disparities, rather than increase averages. Embedded with the quantitative change is a mixed methods to interpret quantitative change in terms of meaning, recognition, and belonging. This architecture can be inserted into multi-site consortia, monitoring frameworks, and Ph.D. projects that aim to achieve comparability across cases as well as over time.

Portability is ensured with the use of replication kits. The materials can be used by other researchers to reproduce the method in other basins, enable cross-case meta-analysis, and give implementers easily usable tools that adhere to ethics as well as methodology.

Sequencing the work as integrative case selection, gap-driven hypotheses, culture-first levers, standardized metrics, replication kits present a pragmatic route to research under realistic political constraints. This allows the field to proceed beyond single domain constructing by generating studies that are institutionally possible, ecologically mindful, and culturally readable, to put out findings that possess external validity, and to assist basin groups in operationalizing multilayered governance with evidence that travels. The framework of the dissertation then stands not as a critique of what is extant practice, but as a usable method to generate, test, and scale solutions in contested transboundary river landscapes.

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In a world defined by ongoing injustice, where thousands of Palestinians are being starved and killed with deliberate intent, and the world watches silently, I have spent five years producing a work that will change nothing. Despite the countless books, journals, and conferences claiming to make the world a better place, this thesis, like so many before it, will not save lives, educate minds, nor halt the machinery of oppression. The educated fail to admit the genocide and continue to profit from it, and the world remains cruel, hypocritical, and unfair.

Yet, amid this awareness, I have been fortunate to receive guidance, support, and encouragement that made this journey possible. I dedicate this work to my mother, my solid pillar and source of motivation; to my late father, whose presence I sorely missed during this process; to my supervisor, Valánszki István, for his guidance and care; to Martin Van Den Toorn, for teaching me how to inspire, teach, and unapologetically believe in a cause and defend it; to the healthcare professionals who supported me through illness; to my life partner and friends, for making the unbearable bearable with laughter; and finally, to myself, for completing a task that often felt meaningless while my people were being erased.

This thesis is a product of obedience, perseverance, and survival; it is not for hope. May the reader understand it as such.

Thank you, Hungary.

Köszönöm Szépen

APPENDICES

A1 REFERENCES

The references used in the analysis are organized into multiple sections in the appendix.

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A2 Raw Data Analysis

1. Stage 01: Case Study Analysis

    1.1. Stage 01: Case Study Keyword Selection (Table A1)

Table A1: Case Study Keyword Selection (Source: Author)

	Danube	Ganges	Mekong	Colorado	Jordan
Political	("Danube River" AND (governance OR treaty OR diplom* OR "EU water policy" OR ICPDR))	("Ganges River" AND (governance OR "water-sharing" OR disput* OR treaty OR conflict))	("Mekong River" AND (governance OR "Mekong River Commission" OR hydropolitic* OR China))	("Colorado River" AND (governance OR "Colorado River Compact" OR allocat* OR "US–Mexico treaty"))	("Jordan River" AND (treaty OR "Palestinian water rights" OR cooperat* OR conflict OR governance))
Economic	("Danube River" AND (navigat* OR hydropower OR trade OR "economic integration"))	("Ganges River" AND (agricultur* OR irrigation OR livelihood* OR "economic dependence"))	("Mekong River" AND (hydropower OR dam* OR fisheries OR trade OR livelihood*))	("Colorado River" AND (water pric* OR irrigat* OR "hydro-economics"))	("Jordan River" AND (agricultur* OR tourism OR inequality OR "water pricing"))
Technological	("Danube River" AND (wastewater OR "monitoring technolog*" OR "EU standard*"))	("Ganges River" AND (irrigation technolog* OR "flood control" OR infrastructur*))	("Mekong River" AND (dam* OR hydropower technolog* OR monitoring))	("Colorado River" AND ("water transfer*" OR infrastructur* OR desalination))	("Jordan River" AND (desalination OR "wastewater reuse" OR pipeline* OR irrigation technolog*))
Environmental	("Danube River" AND (pollut* OR biodivers* OR "ecosystem services" OR "Water Framework Directive"))	("Ganges River" AND (pollut* OR climat* OR monsoon OR degrad*))	("Mekong River" AND (biodivers* OR fisheries OR deforestation))	("Colorado River" AND (drought OR "climate change" OR salinit* OR "endangered species"))	("Jordan River" AND (scarcity OR "Dead Sea" OR climat* OR pollut*))

Cultural	("Danube River" AND (heritage OR symbol* OR identity OR "cultural narrative*"))	("Ganges River" AND (sacred OR ritual* OR pilgrimage OR identity))	("Mekong River" AND (indigenous OR "cultural value*" OR narrative*))	("Colorado River" AND (indigenous OR "cultural landscape*" OR heritage))	("Jordan River" AND (religious OR heritage OR identity OR attachment))

1.2. Stage 01: Case Study Selection Representative References (Table A2)

Table A2: Case Study Selection Representative References (Source: Author).

Selected Rivers	Jordan	Danube	Mekong	Colorado	Ganges
Percentage in Literature	10%	30%	25%	20%	15%
Numbers of Studies	5	15	12	10	8
Political	(Katz, 2022)	0	(Vu and Nguyen, 2024)	(Wahal et al., 2024)	(Crow et al., 1995)
Cultural	(Sarsour and Nagabhatla, 2022)	0	0	0	(Singh and Singh, 2020)
Economical	(Phillips, 2012)	(Probst et al., 2024)	(Morovati et al., 2024)	(Wahal et al., 2024)	0
Technological	(Hassan et al., 2022)	(Haidvogl et al., 2025)	(Green and Baird, 2020)	(Cleland et al., 2023)	0
Environmental	(Al-Addous et al., 2023)	(Zessner et al., 2025)	(Xu and Zhang, 2024)	0	(Sigdel et al., 2023)
Percentage of D.F. mentioned in the total number of selected studies	100%	20%	33%	30%	38%

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2. Stage 02: Driving Forces Factors Analysis

2.1. Table A3: Keyword Selection for Driving Force Factors Intersection (Table A3)

Table A3: Keyword Selection for Driving Force Factors Intersection (Source: Author)

Natural D.F.	Climate Diversity & Precipitation	Geology, Morphology & Soil Type	Topography & Flow	Vegetation (LULC)	Hydrology & Groundwater	Human Intervention & Activities
Climate Diversity & Precipitation	–	"climate divers*" AND "river basin geolog*" "precipitat* variability" AND "morpholog*"	"climate variab*" AND "river flow*" "precipitat* change" AND "hydrolog* regime*"	"climate change*" AND "land use land cover*" "precipitat*" AND "vegetation pattern*"	"precipitat* variability" AND "groundwater recharg*"	"climate change*" AND "human water use*" "precipitat* pattern*" AND "anthropogenic impact*"
Geology, Morphology & Soil Type		–	"river morpholog*" AND "flow dynamic*" "soil type*" AND "hydrolog*"	"geomorpholog*" AND "LULC change*" "geolog*" AND "groundwater system*"	"soil type*" AND "aquifer*"	"morpholog*" AND "human intervention*" "soil degrad*" AND "land use*"
Topography & Flow			–	"topograph*" AND "vegetation cover*" "river gradient*" AND "LULC*"	"topograph*" AND "groundwater flow*"	"flow regulation*" AND "human activit*" "topograph* change*" AND "settlement pattern*"
Vegetation (LULC)				–	"LULC change*" AND "aquifer recharg*" "vegetation cover*" AND "groundwater*"	"land use change*" AND "human activit*" "agricultur* expansion*" AND "vegetation loss*"
Hydrology & Groundwater					–	"groundwater abstract*" AND "human activit*" "hydrolog* regime*" AND "anthropogenic change*"
Human Intervention & Activities						–

Cultural D.F.	Cultural Significance	Historical Context	Cultural Heritage & Tourism	Identity & Attachment	Cultural Infrastructure	Socio-economy
Cultural Significance	–	"cultural signific*" AND "historical narrativ*" "sacred river*" AND "histor*"	"cultural signific*" AND "tourism*" "heritage landscap*" AND "sacred river*"	"cultural meaning*" AND "place attachment*" "river symbolism*" AND "identity*"	"cultural signific*" AND "infrastructur*" "ritual site*" AND "facilit*"	"cultural values*" AND "livelihood*" "cultural identity*" AND "socio-econom*"
Historical Context		–	"historical narrativ*" AND "heritage tourism*" "historical memory*" AND "identity*"	"colonial histor*" AND "place attachment*"	"historical context*" AND "cultural infrastructur*"	"historical econom*" AND "river communit*"

Cultural Heritage & Tourism			–	"heritage tourism*" AND "identity*" "tourism*" AND "place attachment*"	"cultural heritage*" AND "infrastructur*" "tourism facilit*"	"tourism econom*" AND "cultural identity*"
Identity & Attachment				–	"place attachment*" AND "infrastructur*" "identity*" AND "public space*"	"identity*" AND "socio-economic practic*"
Cultural Infrastructure					–	"cultural infrastructur*" AND "livelihood*" "heritage site*" AND "community econom*"
Socio-economy						–

Political D.F.	**Water Management Policies**	**Jurisdictional Boundaries**	**International Relations**	**Public Participation**
Water Management Policies	–	"water govern*" AND "boundar*" "water allocation*" AND "jurisdiction*"	"water policy*" AND "transboundary relation*" "hydropolitic*" AND "international law*"	"water govern*" AND "public participation*" "policy*" AND "stakeholder engagement*"
Jurisdictional Boundaries		–	"border*" AND "water treaty*" "jurisdiction*" AND "international conflict*"	"boundar*" AND "local participation*" "jurisdiction*" AND "community involvement*"
International Relations			–	"diplomac*" AND "stakeholder participation*" "transboundary negotiation*" AND "civil societ*"
Public Participation				–

Economic D.F.	**Agricultural Dependency**	**Industrial & Tourism Development**	**Land Use & Trade-offs**	**Development Strategies & Policies**	**Economic Inequality & Access**
Agricultural Dependency	–	"agricultur*" AND "tourism development*"	"agricultur*" AND "land use change*"	"agricultur* policy*" AND "development strateg*"	"agricultur*" AND "inequal* of water access*"

		"irrigation*" AND "industry*"				
Industrial & Tourism Development		–	"industrial development*" AND "land use*" "tourism*" AND "economic trade-off*"	"industry*" AND "development strateg*" "tourism policy*"	"industrial econom*" AND "inequal*" "tourism development*" AND "access*"	
Land Use & Economic Trade-offs			–	"land use*" AND "development strateg*"	"land use change*" AND "economic inequal*"	
Development Strategies & Policies				–	"economic policy*" AND "access to resourc*" "development strateg*" AND "equity*"	
Economic Inequality & Access					–	

Technological D.F.	**Hydraulic & Water Infrastructure**	**Wastewater & Water Treatment**	**Technological Access & Capacity**	**Agricultural & Irrigation Technologies**
Hydraulic & Water Infrastructure	–	"hydraulic infrastructur*" AND "wastewater treatment*" "dam*" AND "treatment system*"	"infrastructur*" AND "technolog* access*" "hydraulic capacit*"	"hydraulic infrastructur*" AND "irrigation technolog*"
Wastewater & Water Treatment		–	"treatment technolog*" AND "capac*" "wastewater system*" AND "technolog* access*"	"wastewater reuse*" AND "irrigation technolog*"
Technological Access & Capacity			–	"technolog* transfer*" AND "irrigation*" "capac* building*" AND "agricultur* technolog*"
Agricultural & Irrigation Technologies				–

2.2. Table A4: Driving Forces Factors Representative References (Table A4)

Table A4: Driving Forces Factors Representative References (Source: Author)

Natural Driving Force	Climate Diversity & Precipitation	Geology, Morphology & Soil Type	Topography & Flow	Vegetation (LULC)	Hydrology & Groundwater	Human Intervention & Activities
Climate Diversity & Precipitation	-	(Kayitesi et al., 2022)	(Gudmundsson et al., 2021)	(Ougahi et al., 2022)	(Taylor et al., 2013)	(Jaramillo and Destouni, 2015)
Geology, Morphology & Soil Type	-	-	(Simon and Rinaldi, 2006)	(Tarolli and Sofia, 2016)	(Marti et al., 2023)	(Kondolf et al., 2014)
Topography & Flow	-	-	-	(Nepf, 2012)	(Condon and Maxwell, 2015)	(Grill et al., 2019)
Vegetation (LULC)	-	-	-	-	(Scanlon et al., 2005)	(Foley et al., 2005)
Hydrology & Groundwater	-	-	-	-	-	(Scanlon et al., 2012)
Human Intervention & Activities	-	-	-	-	-	-

Cultural D.F.	Cultural Significance	Historical Context	Cultural Heritage & Tourism	Identity & Attachment	Cultural Infrastructure	Socio-economy
Cultural Significance	-	(Chronis, 2005)	(Poria et al., 2003)	(Scannell and Gifford, 2010)	(Miles and Paddison, 2005)	(Daniel et al., 2012)
Historical Context	-	-	(Hein et al., 2024)	(Lewicka, 2008)	(Grodach and Loukaitou-Sideris, 2007)	(Brooks et al., 2023)
Cultural Heritage & Tourism	-	-	-	(Ramkissoon et al., 2013)	(Rasoolimanesh et al., 2017)	(Su et al., 2016)
Identity & Attachment	-	-	-	-	(Francis et al., 2012)	(Manzo and Perkins, 2006)
Cultural Infrastructure	-	-	-	-	-	(Kalfas et al., 2024)
Socio-economy	-	-	-	-	-	-

Political D.F.	Water Management Policies	Jurisdictional Boundaries	International Relations	Public Participation
Water Management Policies	-	(Zhou et al., 2025)	(Vasani, 2023)	(Megdal et al., 2017)
Jurisdictional Boundaries	-	-	(De Stefano et al., 2017)	(O'Reilly and Dhanju, 2012)
International Relations	-	-	-	(Offutt, 2022)
Public Participation	-	-	-	-

Economic D.F.	Agricultural Dependency	Industrial & Tourism Development	Land Use & Trade-offs	Development Strategies & Policies	Economic Inequality & Access
Agricultural Dependency	-	(Fleischer and Tchetchik, 2005)	(Dade et al., 2019)	(Bastidas-Orrego et al., 2023)	(Owens et al., 2022)
Industrial & Tourism Development	-	-	(Baloch et al., 2023)	(Aiginger and Rodrik, 2020)	(Bhatt et al., 2024)
Land Use & Economic Trade-offs	-	-	-	(Zhang et al., 2023)	(Gourevitch et al., 2021)
Development Strategies & Policies	-	-	-	-	(Pouw and Gupta, 2017)
Economic Inequality & Access	-	-	-	-	-

Technological D.F.	Hydraulic & Water Infrastructure	Wastewater & Water Treatment	Technological Access & Capacity	Agricultural & Irrigation Technologies
Hydraulic & Water Infrastructure	-	(Fletcher et al., 2015)	(Grigg, 2025)	(Balta and Kulat, 2024)
Wastewater & Water Treatment	-	-	(Singh et al., 2023)	(Partyka and Bond, 2022)
Technological Access & Capacity	-	-	-	(Pérez-Blanco et al., 2020)
Agricultural & Irrigation Technologies	-	-	-	-

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3. Stage 4: Survey questions related to each factor

- **Cultural Significance: survey items by factor**

Items for Cultural Meaning were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Items for Cultural Awareness, Conservation, and National Access were coded as binary variables (Yes = 1, No = 2).

(i) Cultural Meaning: survey items:

a. "When the river is clean and healthy, it feels more meaningful and important to me."
b. "The river has spiritual or religious meaning for us."
c. "The river area is aesthetically valuable to me/us."
d. "The river is socially important for gatherings, rituals, or traditions."
e. "The river contributes to our identity and continuity."
f. "Interpretations and stories I encounter about the river help me understand its importance."

(ii) Cultural Awareness: survey items:

a. "I know the main important places along the Jordan River."
b. "I know why these places along the Jordan River are important for culture or religion."

(iii)Conservation: survey items:

a. "I have noticed improvements in site condition and cleaner water."
b. "These improvements show the river's value is being respected."
c. "The river has more value, because I can see results."
d. "I have personally taken part in activities to clean or protect the river."

(iv)National Access: survey items:

a. "My nationality does not stop me from visiting important places along the Jordan River."
b. "My nationality makes it difficult for me to reach some important places along the Jordan River."

- **Cultural Heritage and Tourism: survey items by factor**

All items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), except for the main Economic benefit item, which was coded as a Yes/No question.

(i) Cultural attachment: survey items:

a. “I feel emotionally attached to heritage places along the Jordan River.”
b. “Losing access to these heritage places would feel like losing part of myself or my community.”
c. “I would feel upset if river heritage places were damaged or closed to the public.”
d. “It is important to me that future generations can visit and experience these river heritage places.”
e. “When I visit river heritage places, I feel proud of their cultural and religious importance.”

(ii) Tourism exposure: survey items:

a. “I could visit heritage places without restrictions.”
b. “I felt safe and welcomed at river heritage places.”
c. “I could access guides or signage in a language I understand.”
d. “Guides or stories at the sites helped me grasp their meanings.”
e. “I recommended these places to others because of their cultural value.”

(iii)Economic benefit: survey items:

The primary economic benefit item was measured as a Yes/No variable:

a. “My work or household income is directly linked to tourism or pilgrimage around the Jordan River and its heritage places.” Response options: Yes / No

Perception of tourism-related benefits was captured with a Likert item:

b. “Tourism and pilgrimage around the Jordan River create important economic opportunities for me or my household.” (5-point Likert scale: 1 = strongly disagree, 5 = strongly agree)

- **Cultural Identity and Attachment: survey items by factor**

(i) Emotional attachment: survey items:

a. “I feel a strong emotional attachment to the Lower Jordan River and its landscapes.”
b. “I would feel that something important is missing in my life if I had to move away from this region.”
c. “When I am away from the Lower Jordan River area, I miss its landscapes and places.”
d. “I feel at home in the Lower Jordan River landscape.”

(ii) Ecological identity: survey items:

a. “I feel that my identity is connected to the river’s ecological state.”
b. “When the river is damaged or restored, it affects how I feel about myself and my community.”
c. “I feel a sense of unity with the river as a living system.”
d. “The river’s ecological health matters to who we are as a people.”
e. “Because the river’s ecological condition is part of my identity, I feel more attached to it.”

(iii)Community and territory identity: survey items:

a. “I feel emotionally connected to the Lower Jordan River as part of my community’s land.”
b. “I would feel a personal loss if access to the river were reduced.”
c. “I feel proud to show the river landscape to others.”
d. “The river is part of who I am.”

(iv)Belonging under borders: survey items:

a. “I experience a strong sense of belonging to the river landscape, despite borders.”
b. “Borders and checkpoints do not change the fact that I belong to this river landscape.”

In addition, intention to stay or leave under border conditions was captured with a separate question:

c. “If you received a good opportunity to live abroad, would you prefer to continue living in this area?” Response options:

Yes, I would prefer to stay here

No, I would prefer to leave

I am not sure

4. Stage 04: Statistical Results

4.1. Cultural Significance Analysis (RQ1-Step3)

Table A5: Tukey HSD Pairwise Comparisons (Source: Author)

5. **Group2**	**Group1**	**meandiff**	**p-adj**	**lower**	**upper**	**reject**
Israeli Jewish, living in Israel	Jordanians, Christians, living in Jordan	0.62	0.0	0.42	0.82	TRUE
Israeli Jewish, living in Israel	Jordanians, Muslims, living in Jordan	-0.42	0.0	-0.56	-0.28	TRUE
Israeli Jewish, living in Israel	Palestinians with Israeli passports, Muslims, living in Israel	-0.42	0.0	-0.60	-0.24	TRUE
Israeli Jewish, living in Israel	Palestinians with Israeli passports, Muslims, living in Palestine	-0.90	0.0	-1.13	-0.67	TRUE
Israeli Jewish, living in Israel	Palestinians with Palestinian passports, Muslims, living in Jordan	0.06	0.96	-0.14	0.28	FALSE
Israeli Jewish, living in Israel	Palestinians with Palestinian passports, Muslims, living in Palestine	-0.45	0.0	-0.65	-0.24	TRUE
Jordanians, Christians, living in Jordan	Jordanians, Muslims, living in Jordan	-1.04	0.0	-1.21	-0.88	TRUE
Jordanians, Christians, living in Jordan	Palestinians with Israeli passports, Muslims, living in Israel	-1.05	0.0	-1.24	-0.85	TRUE

Jordanians, Christians, living in Jordan	Palestinians with Israeli passports, Muslims, living in Palestine	-1.52	0.0	-1.76	-1.28	TRUE
Jordanians, Christians, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Jordan	-0.55	0.0	-0.78	-0.32	TRUE
Jordanians, Christians, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Palestine	-1.07	0.0	-1.29	-0.85	TRUE
Jordanians, Muslims, living in Jordan	Palestinians with Israeli passports, Muslims, living in Israel	-0.0013	1.0	-0.13	0.12	FALSE
Jordanians, Muslims, living in Jordan	Palestinians with Israeli passports, Muslims, living in Palestine	-0.47	0.0	-0.67	-0.27	TRUE
Jordanians, Muslims, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Jordan	0.49	0.0	0.31	0.66	TRUE
Jordanians, Muslims, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Palestine	-0.02	0.99	-0.19	0.13	FALSE
Palestinians with Israeli passports, Muslims, living in Israel	Palestinians with Israeli passports, Muslims, living in Palestine	-0.47	0.0	-0.69	-0.25	TRUE
Palestinians with Israeli passports, Muslims, living in Israel	Palestinians with Palestinian passports, Muslims, living in Jordan	0.49	0.0	0.28	0.70	TRUE
Palestinians with Israeli passports, Muslims, living in Israel	Palestinians with Palestinian passports, Muslims, living in Palestine	-0.02	0.99	-0.22	0.16	FALSE
Palestinians with Israeli passports, Muslims, living in Palestine	Palestinians with Palestinian passports, Muslims, living in Jordan	0.96	0.0	0.71	1.22	TRUE
Palestinians with Israeli passports, Muslims, living in Palestine	Palestinians with Palestinian passports, Muslims, living in Palestine	0.44	0.0	0.20	0.69	TRUE
Palestinians with Palestinian passports, Muslims, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Palestine	-0.51	0.0	-0.74	-0.29	TRUE

3.2. Cultural Significance Analysis (RQ2-Step 4)

Table A6: Multivariable OLS HC3 coefficients (Source: Author)

Term	Coefficient	Std. Error	t	p>|t|	Lower 95% CI	Upper 95% CI
Intercept	4.28	0.19	22.17	6.33	3.90	4.66

C(group, Treatment (reference="Israeli Jewish, living in Israel"))[T.Jordanians, Christians, living in Jordan]	0.59	0.06	8.58	8.97	0.45	0.72
C(group, Treatment(reference="Israeli Jewish, living in Israel"))[T.Jordanians, Muslims, living in Jordan]	-0.47	0.05	-8.02	9.85	-0.59	-0.36
C(group, Treatment(reference="Israeli Jewish, living in Israel"))[T.Palestinians with Israeli passports, Muslims, living in Israel]	-0.47	0.06	-7.45	9.10	-0.60	-0.35
C(group, Treatment(reference="Israeli Jewish, living in Israel"))[T.Palestinians with Israeli passports, Muslims, living in Palestine]	-0.98	0.12	-7.98	1.42	-1.22	-0.74
C(group, Treatment(reference="Israeli Jewish, living in Israel"))[T.Palestinians with Palestinian passports, Muslims, living in Jordan]	0.037	0.07	0.47	0.63	-0.11	0.19
C(group, Treatment(reference="Israeli Jewish, living in Israel"))[T.Palestinians with Palestinian passports, Muslims, living in Palestine]	-0.51	0.08	-6.24	4.24	-0.67	-0.35
impact_cons	-0.02	0.04	-0.44	0.65	-0.11	0.07
cons_bin	-0.05	0.04	-1.19	0.23	-0.15	0.03
aware_bin	-0.04	0.03	-1.17	0.24	-0.11	0.02

3.3.Cultural Identity and Attachment Analysis (RQ1)

Table A7: Post-hoc Mann-Whitney U with Holm correction (Source: Author).

4. **group_1**	**group_2**	**U**	**p_raw**	**p_holm**	**signif**
Israeli Jewish, living in Israel	Jordanians, Christians, living in Jordan	584.0	0.85	1.0	No
Israeli Jewish, living in Israel	Jordanians, Muslims, living in Jordan	4767.5	0.62	1.0	No
Israeli Jewish, living in Israel	Palestinians with Israeli passports, Muslims, living in Israel	1187.5	0.12	1.0	No

Israeli Jewish, living in Israel	Palestinians with Israeli passports, Muslims, living in Palestine	444.0	0.48	1.0	No
Israeli Jewish, living in Israel	Palestinians with Palestinian passports, Muslims, living in Jordan	378.5	0.09	1.0	No
Israeli Jewish, living in Israel	Palestinians with Palestinian passports, Muslims, living in Palestine	685.0	0.30	1.0	No
Jordanians, Christians, living in Jordan	Jordanians, Muslims, living in Jordan	3650.0	0.80	1.0	No
Jordanians, Christians, living in Jordan	Palestinians with Israeli passports, Muslims, living in Israel	907.0	0.11	1.0	No
Jordanians, Christians, living in Jordan	Palestinians with Israeli passports, Muslims, living in Palestine	342.0	0.39	1.0	No
Jordanians, Christians, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Jordan	291.5	0.14	1.0	No
Jordanians, Christians, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Palestine	527.5	0.24	1.0	No
Jordanians, Muslims, living in Jordan	Palestinians with Israeli passports, Muslims, living in Israel	7598.5	0.01	0.25	No
Jordanians, Muslims, living in Jordan	Palestinians with Israeli passports, Muslims, living in Palestine	2925.5	0.19	1.0	No
Jordanians, Muslims, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Jordan	2602.5	0.15	1.0	No
Jordanians, Muslims, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Palestine	4485.5	0.07	1.0	No
Palestinians with Israeli passports, Muslims, living in Israel	Palestinians with Israeli passports, Muslims, living in Palestine	452.5	0.53	1.00	No
Palestinians with Israeli passports, Muslims, living in Israel	Palestinians with Palestinian passports, Muslims, living in Jordan	370.5	0.01	0.07	No
Palestinians with Israeli passports, Muslims, living in Israel	Palestinians with Palestinian passports, Muslims, living in Palestine	700.0	0.61	1.00	No
Palestinians with Israeli passports, Muslims, living in Palestine	Palestinians with Palestinian passports, Muslims, living in Jordan	149.0	0.02	0.29	No

Palestinians with Israeli passports, Muslims, living in Palestine	Palestinians with Palestinian passports, Muslims, living in Palestine	311.5	0.82	1.00	No
Palestinians with Palestinian passports, Muslims, living in Jordan	Palestinians with Palestinian passports, Muslims, living in Palestine	537.0	0.01	0.09	No