Original Article
ISSN(Online): 3139-6763
https://shikshasamvad.com/

Shiksha Samvad
International Open Access, Peer Reviewed & Refereed Journal
© Shiksha Samvad|Volume-04| Issue-01| September- 2026
DOI: - https://doi.org/10.64880/shikshasamvad.v4i1.17

Himalayan Geopolitics and Climate Change: Emerging Security Challenges, Transboundary Waters and Pathways for Regional Cooperation

Dr. Suman Lata
Assistant Professor Department of Geography
Government Degree College Bhawanipur Kala Itiyathok Gonda UP
Emai drsumanlata8@gmail.com

Abstract:

The Himalaya is simultaneously a climatic system, a water tower, a biodiversity reservoir and one of Asia's most strategically sensitive geopolitical spaces. Climate change is altering this strategic landscape by accelerating glacier loss, reducing seasonal snow persistence, destabilising permafrost, modifying river seasonality and increasing multi-hazard risks. These physical changes intersect with unresolved borders, transboundary rivers, hydropower ambitions, infrastructure expansion and unequal national capacities. This conceptual review examines how climate change is reshaping Himalayan geopolitics, with particular attention to the Hindu Kush Himalaya (HKH), India–China transboundary rivers, the Indus basin, and India's hydropower relationships with Nepal and Bhutan. It synthesises authoritative evidence from ICIMOD, IPCC, the World Bank and official Government of India documents. ICIMOD reported in 2026 that HKH glacier ice-loss rates have doubled since 2000 and that regional snow persistence was 27.8 per cent below the long-term average, the fourth consecutive below-normal year. Nearly two billion people depend directly or indirectly on the major river basins originating in the HKH. The paper argues that climate change does not mechanically cause geopolitical conflict; rather, it acts as a risk multiplier that can intensify uncertainty around water, energy, disasters, infrastructure and border governance. At the same time, shared climatic exposure creates incentives for cooperation. The article proposes a climate-security framework centred on cryosphere monitoring, hydrological data sharing, early-warning systems, resilient hydropower, basin-level dialogue and scientific diplomacy. The future stability of the Himalaya will depend on whether states treat changing mountains primarily as strategic frontiers or increasingly as a shared ecological security system.

Keywords: *Himalaya; geopolitics; climate change; cryosphere; transboundary rivers; water security; hydropower; India–China; Indus Basin; climate security.*

1. Introduction

The Himalayan region occupies a distinctive place in Asian geopolitics. It contains some of the world's highest mountains, the largest concentration of glaciers, seasonal snow and permafrost outside the polar regions, and the headwaters of river systems that sustain a vast share of Asia's population. The Hindu Kush Himalaya extends roughly 3,500 kilometres across all or part of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. ICIMOD identifies the region as the source of ten major Asian river systems and home to around 240 million people in the mountains, while close to two billion people depend on water and ecosystem services connected to these river basins (ICIMOD, 2023).

The same terrain is also strategically sensitive. The Himalaya contains disputed and heavily defended borders, critical transport corridors, hydropower sites and upstream–downstream relationships involving major powers. India and China share transboundary rivers as well as a contested boundary; India and Pakistan remain connected through the Indus system; and Nepal and Bhutan occupy strategically important positions between larger neighbours while possessing substantial hydropower potential.

Climate change adds a new layer to this geopolitical geography. The mountains are not a static backdrop to state competition. Glaciers are losing mass, seasonal snow is becoming less reliable, permafrost is degrading, extreme rainfall and glacial hazards threaten infrastructure, and river seasonality is changing. In March 2026 ICIMOD reported that glacier ice-loss rates across the HKH had doubled since 2000, with up to 27 metres of ice thickness lost since 1975 in the monitoring evidence synthesised by its new assessments (ICIMOD, 2026a). In April 2026 it reported regional snow persistence 27.8 per cent below the long-term average, the fourth consecutive below-normal year (ICIMOD, 2026b).

These changes do not mean that "water wars" are inevitable. Climate effects are mediated by treaties, institutions, technology, domestic politics and diplomacy. The central argument of this paper is therefore more precise: climate change is a geopolitical risk multiplier. It changes the physical conditions within which states manage borders, rivers, energy systems, infrastructure and human security, while simultaneously creating stronger reasons for cooperation.

2. Method and Analytical Framework

This article adopts a conceptual and integrative review method. It does not generate artificial primary data. Instead, it synthesises recent scientific assessments, institutional reports and official agreements. Priority is given to ICIMOD's peer-reviewed and technical assessments of the HKH cryosphere, the IPCC Sixth Assessment, the World Bank's documentation of the Indus Waters Treaty, and official bilateral documents of India concerning China, Nepal and Bhutan.

The analytical framework treats Himalayan geopolitics as the interaction of five elements: physical climate change, cryosphere response, resource and hazard consequences, national interests, and institutions for cooperation or competition. Climate change is therefore not treated as an independent cause of interstate behaviour. A decline in snow persistence, for example, becomes geopolitically important when it affects seasonal water expectations, hydropower planning, agriculture, disaster risk or public perceptions of upstream activity.

This approach also distinguishes water availability from water politics. River discharge is shaped by precipitation, snowmelt, glacier melt, groundwater and human regulation. Political tension may arise from uncertainty and mistrust even when the physical cause of a flow change is climatic rather than deliberate. Reliable observation and transparent data exchange consequently have strategic value.

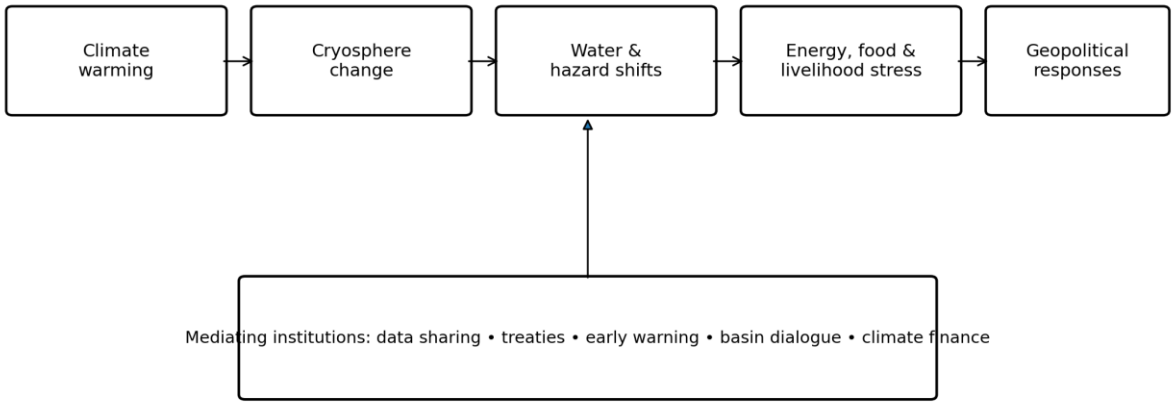

Figure 1. Climate-geopolitics interaction in the Himalayan region

Figure 1. Climate–geopolitics interaction in the Himalayan region.

3. Why the Himalaya Matters Geopolitically

The strategic significance of the Himalaya rests on the convergence of territory, water, energy and connectivity. Mountain borders are difficult to survey and administer, yet they are closely associated with national sovereignty. Roads, tunnels, bridges, airfields and communication systems improve access for civilian development but also possess strategic value. Climate hazards can damage these assets and raise the cost of maintaining them.

Water creates a second layer of interdependence. Major rivers originating in the HKH cross political borders before reaching densely populated plains. Upstream and downstream states therefore share hydrological systems without necessarily sharing political priorities. Dams, diversions, flood management and data collection can become politically sensitive because decisions taken in one jurisdiction may be perceived to affect another.

Energy creates a third dimension. Mountain rivers possess substantial hydropower potential. Bhutan's relationship with India demonstrates how hydropower can support structured bilateral interdependence. India's Ministry of External Affairs reported that by late 2025 five jointly developed major hydroelectric projects in Bhutan totalled 3,156 MW, while additional projects remained under development (MEA, 2025). India and Nepal have likewise adopted a joint vision that identifies hydropower, cross-border transmission and electricity trade as central areas of cooperation (MEA, 2022).

Thus, Himalayan geopolitics is not reducible to military rivalry. It includes cooperative energy markets, development finance, disaster management, ecological security and the movement of people and goods. Climate change touches each of these dimensions.

4. Cryosphere Change and the New Strategic Uncertainty

The cryosphere—glaciers, seasonal snow and frozen ground—is the most direct connection between climate change and Himalayan geopolitics. ICIMOD's 2023 HI-WISE assessment concluded that cryospheric change in the HKH is unprecedented and largely irreversible on human timescales. Under current high-emissions trajectories, glaciers could lose a very large

share of their present volume by the end of the century; the report warned of losses of up to 80 per cent under high-emission conditions (ICIMOD, 2023).

The latest observations reinforce the concern. ICIMOD's 2026 glacier assessments reported accelerating ice loss, while its Snow Update 2026 found snow persistence 27.8 per cent below the long-term average. Ten of the monitored major basins were below normal (ICIMOD, 2026a, 2026b). In 2025 the regional anomaly had already reached a then-record 23.6 per cent below normal, with substantial deficits in the Brahmaputra, Ganges and other basins (Muhammad, 2025).

Seasonal snow is geopolitically relevant because it helps regulate the timing of river flows. On average, snowmelt contributes roughly a quarter of annual runoff across the major HKH river basins, although the contribution differs sharply by basin (Muhammad, 2025). Reduced snow persistence can therefore increase early-summer water stress even where annual precipitation remains substantial.

Glacier retreat produces a more complex temporal effect. Increased melt can temporarily add water to some rivers, but continued ice loss ultimately reduces the long-term buffering role of glaciers. This means that political debate based on a simple assumption of continuously declining river flow can be misleading. The strategic problem is greater variability, changing seasonality and uncertainty.

Permafrost degradation adds another concern. Thawing frozen ground can destabilise slopes and infrastructure. In strategically sensitive high-altitude areas, roads, military logistics, hydropower facilities and settlements may face higher maintenance and hazard costs. Climate change therefore alters not only water security but the physical reliability of the strategic landscape.

5. India–China: Transboundary Rivers, Data and Strategic Trust

India–China relations illustrate how climate uncertainty can interact with an already complex geopolitical relationship. The Brahmaputra, known as the Yarlung Tsangpo in Tibet, originates on the Tibetan Plateau before flowing into India and Bangladesh. The Sutlej also crosses from the Tibetan region into India. Upstream infrastructure and hydrological information consequently attract strategic attention.

Importantly, the bilateral relationship has included institutional cooperation on rivers. Official Indian documents record an Expert Level Mechanism on trans-border rivers and agreements for China to provide flood-season hydrological information concerning the Brahmaputra and Sutlej. A bilateral memorandum explicitly recognised trans-border rivers and related natural resources as valuable to the socioeconomic development of riparian countries and linked cooperation to strategic trust (MEA, 2013).

Climate change increases the value of such mechanisms. If snow, glacier melt and extreme rainfall become more variable, downstream flood forecasting requires timely upstream information. Hydrological data can therefore function as a form of confidence-building.

Conversely, interruptions or uncertainty in data exchange can acquire political meaning beyond their technical significance.

The challenge is to prevent every unusual river event from being interpreted primarily through a security lens. Extreme flows may result from intense rainfall, glacial-lake events, landslides or changing snowmelt. Scientific cooperation can help distinguish natural variability and climate-driven change from infrastructure-related effects.

A stronger India–China climate-water architecture would ideally include standardised observations, real-time flood information, joint scientific workshops and transparent communication about major upstream projects. Such cooperation would not resolve territorial disputes, but it could reduce one source of avoidable mistrust.

6. India–Pakistan and the Indus Basin

The Indus basin represents another critical intersection of Himalayan hydrology and geopolitics. The 1960 Indus Waters Treaty, negotiated with World Bank assistance, created a durable framework for allocating and managing the river system. The World Bank notes that the treaty allocates the western rivers—Indus, Jhelum and Chenab—to Pakistan and the eastern rivers—Ravi, Beas and Sutlej—to India, while permitting specified uses and establishing mechanisms for cooperation and information exchange (World Bank, 2018).

The treaty was designed in an earlier climatic period. Climate change now introduces stresses that were not central to the original negotiations: altered snow accumulation, glacier change, more variable extremes and changing seasonal demand. The treaty itself contains provisions for data exchange and future cooperation, including hydrological and meteorological observations. These provisions become increasingly valuable in a less predictable climate.

The geopolitical danger lies in confusing scarcity produced by climatic variability with scarcity attributed to the actions of another state. In a low-trust relationship, drought or unusual flows can become securitised rapidly. Scientific transparency is therefore not a secondary technical issue; it is part of conflict prevention.

Climate adaptation in the Indus basin requires better forecasting, efficient irrigation, groundwater management, reservoir coordination where politically feasible, and improved understanding of cryosphere–monsoon interactions. Even where broader political relations are difficult, professional hydrological communication can preserve a minimum level of functional cooperation.

7. Nepal and Bhutan: Hydropower, Development and Climate Risk

Nepal and Bhutan show a different face of Himalayan geopolitics: the possibility of turning mountain water into cooperative economic interdependence. Both possess major hydropower resources and are linked to the Indian electricity market.

India and Nepal's joint vision on power-sector cooperation identifies joint generation projects, cross-border transmission, bidirectional electricity trade, grid coordination and information sharing as areas for mutually beneficial cooperation. It also frames renewable energy, particularly hydropower, as a cornerstone of the partnership (MEA, 2022). Bhutan–India

cooperation is even more institutionalised. By 2025, five jointly developed major projects with 3,156 MW of capacity were operational, and the two governments were pursuing a broader energy partnership that also included renewable technologies (MEA, 2025).

Climate change complicates the assumption that hydropower is a fixed and predictable resource. Changing snow and rainfall patterns can alter seasonal generation. Extreme floods, landslides, sediment loads and glacial hazards can threaten dams, transmission lines and access roads. Hydropower diplomacy must therefore become climate-resilient hydropower diplomacy.

Future project appraisal should incorporate updated glacier, snow, sediment and extreme-event scenarios rather than relying solely on historical hydrology. Cross-border power trade can itself become an adaptation tool by allowing geographically diverse systems to balance seasonal surpluses and deficits. In this sense, regional electricity integration can reduce rather than intensify climate vulnerability.

8. Climate Hazards, Borders and Human Security

Himalayan climate security extends beyond interstate water relations. Mountain communities face landslides, flash floods, glacial lake outburst floods, drought, wildfire and changing ecosystem conditions. These hazards can damage roads, bridges and border infrastructure while isolating communities for long periods.

The geopolitical consequences are indirect but significant. Disaster-damaged transport can disrupt trade and military logistics. Repeated losses can accelerate out-migration from remote border areas, potentially changing settlement patterns. Hydropower and tourism projects can become financially riskier. Emergency response may require cross-border information because hazards do not respect political boundaries.

Climate-related mobility should be approached carefully. It is rarely caused by climate alone. Livelihood decline, market access, education, disaster losses and demographic change interact with environmental stress. Nevertheless, the depopulation of fragile mountain settlements can have strategic implications where states view inhabited border regions as important to territorial administration.

Human security therefore belongs at the centre of Himalayan geopolitics. A road that improves military access but increases landslide exposure, or a dam that produces electricity but overlooks downstream disaster risk, cannot be considered strategically resilient. Security planning must integrate ecological and community resilience.

9. From Strategic Competition to Climate Security Cooperation

The strongest policy implication is that Himalayan states need mechanisms that can function even when political relations are strained. Climate cooperation should not depend on the unrealistic expectation that territorial or strategic disagreements will disappear.

First, cryosphere monitoring must become more systematic and regionally comparable. A 2026 regional cryosphere strategy proposed standardised glacier, snow and permafrost monitoring, shared capacity, interoperable data systems and operational decision-support services

(Muhammad et al., 2026). This is especially important because field monitoring remains sparse and uneven.

Second, hydrological data sharing should be treated as critical regional infrastructure. Real-time information can improve flood warnings, reservoir operation and public trust. Technical protocols should specify data standards, timing and emergency communication.

Third, early-warning systems should be designed across borders. A glacial lake outburst or landslide-dammed river can create downstream danger within hours. Scientific agencies require channels that operate faster than conventional diplomacy.

Fourth, hydropower planning should incorporate climate stress tests. Projects need updated design assumptions for floods, sediment, changing runoff and slope instability. Regional electricity trade should be expanded where it improves system flexibility.

Fifth, basin dialogue should complement bilateral agreements. Not every issue requires a comprehensive river treaty, which can be politically difficult. Practical cooperation can begin with flood forecasting, sediment research, glacier monitoring, ecosystem restoration and professional exchanges.

Finally, scientific diplomacy should be insulated as far as possible from political crises. Shared observation does not imply agreement on sovereignty. It recognises that atmosphere, ice and rivers operate across borders regardless of political disputes.

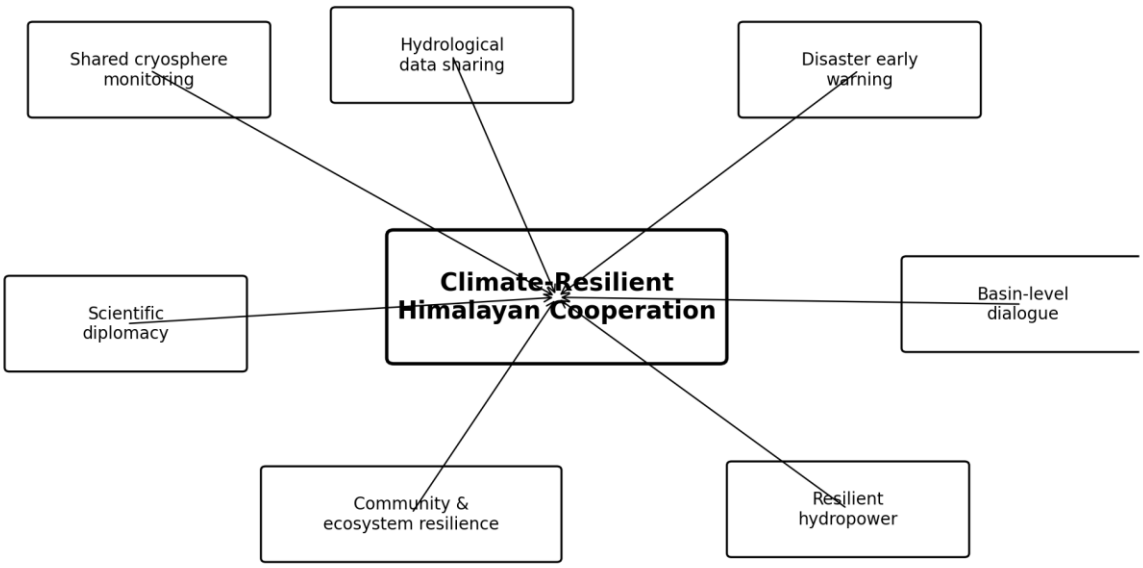

Figure 2. A cooperative framework for climate security in the Himalaya

Figure 2. A cooperative framework for climate security in the Himalaya.

10. Discussion

Climate change is transforming the meaning of strategic geography in the Himalaya. Classical geopolitics emphasised altitude, passes, borders, military access and territorial control. Contemporary Himalayan security must add glaciers, snow persistence, permafrost, river seasonality, disaster exposure and infrastructure resilience.

The evidence does not support simplistic predictions of inevitable climate conflict. Water relationships are mediated by institutions. The Indus Waters Treaty demonstrates that formal arrangements can persist across periods of severe political tension. India–Bhutan hydropower cooperation shows that shared rivers can generate durable economic interdependence. India–China hydrological mechanisms show that even strategic competitors can identify limited technical areas of mutual interest.

Yet climate change raises the cost of weak cooperation. When hydrological baselines become less reliable, states require more—not less—information. When extreme events become harder to anticipate, early warning becomes more valuable. When hydropower and roads face new hazards, shared scientific knowledge becomes strategically important.

The emerging geopolitical divide may therefore be between regions that successfully institutionalise climate information and those that allow uncertainty to deepen mistrust. In this context, data are not merely scientific outputs. They are strategic public goods.

The Himalaya should consequently be understood as a shared ecological security complex. Sovereignty remains important, but no state can independently stabilise glaciers, control monsoon variability or prevent every transboundary hazard. Regional resilience requires national preparedness combined with selective cooperation.

11. Policy Implications for a Climate-Secure Himalaya

Finally, Himalayan policy must treat local communities as security actors rather than passive beneficiaries. Residents possess detailed knowledge of changing springs, snowfall, pasture, river behaviour and hazard locations. Combining such observations with remote sensing and instrumental monitoring can improve risk identification. A climate-secure Himalaya therefore requires a layered model of governance: strong national preparedness, empowered local institutions and carefully designed cross-border cooperation.

Fourth, regional institutions should invest in sustained professional networks among hydrologists, glaciologists, disaster managers, engineers and universities. Political dialogue can stop during crises; professional scientific relationships can preserve communication and provide a foundation for later diplomatic engagement. This is particularly important in a region where environmental processes cross borders faster than formal negotiations.

Third, climate finance for mountain regions should recognise the asymmetry between their ecological importance and their fiscal capacity. Mountain communities protect watersheds, forests and biodiversity that benefit large downstream populations, yet often have limited resources for resilient infrastructure. Adaptation finance should support local early-warning systems, slope stabilisation, climate-resilient livelihoods, ecosystem restoration and safer public infrastructure.

A second priority is open and interoperable environmental information. States will understandably retain restrictions on genuinely sensitive strategic data, but basic snow, glacier, precipitation, river-flow and hazard information has strong public-good

characteristics. Shared technical standards can make national datasets comparable without requiring countries to surrender sovereign control over monitoring networks.

A climate-secure Himalayan policy must connect national security planning with ecological risk reduction. The first requirement is to move from fragmented project-level assessment towards cumulative mountain-risk assessment. Roads, dams, settlements and transmission systems interact with slope stability, river sediment, glacier hazards and changing precipitation. Evaluating each project in isolation can underestimate the combined pressure on a basin or mountain corridor.

12. Conclusion

The Himalaya is entering a period in which physical and political geography are becoming more tightly connected. Accelerating glacier loss, repeated snow deficits, permafrost degradation and changing hydrological extremes are altering the environmental foundations of water, energy, infrastructure and livelihoods. These changes intersect with some of Asia's most sensitive borders and river relationships.

Climate change should not be presented as an automatic cause of interstate conflict. Its more defensible geopolitical role is that of a risk multiplier. It increases uncertainty, magnifies the consequences of poor governance and can intensify existing mistrust. But the same shared exposure can also create incentives for cooperation.

The policy choice is therefore not between geopolitics and climate policy; climate change is becoming part of geopolitics. Himalayan security strategies must include cryosphere science, hydrological transparency, disaster preparedness, resilient infrastructure and community protection alongside traditional concerns of sovereignty and territorial defence.

A practical regional agenda should prioritise standardised glacier and snow monitoring, reliable hydrological data exchange, cross-border early-warning systems, climate-resilient hydropower, basin-level technical dialogue and sustained scientific diplomacy. Such measures do not require states to resolve every political disagreement before cooperating.

The future of Himalayan geopolitics will depend partly on whether the mountains are viewed only as frontiers to defend or also as an interconnected ecological system to manage collectively. In a rapidly warming century, regional stability will increasingly depend on recognising that climate security and geopolitical security are no longer separate questions.

References

International Centre for Integrated Mountain Development (ICIMOD). (2023). Water, ice, society, and ecosystems in the Hindu Kush Himalaya: An outlook (HI-WISE). ICIMOD. https://doi.org/10.53055/ICIMOD.1028

International Centre for Integrated Mountain Development (ICIMOD). (2026a). HKH glaciers losing ice at double the rate since 2000: New glacier assessments. ICIMOD.

International Centre for Integrated Mountain Development (ICIMOD). (2026b). Hindu Kush Himalaya snowpack crashes to record low for fourth straight year. ICIMOD.

Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Cambridge University Press.

Ministry of External Affairs, Government of India. (2013). Memorandum of Understanding on strengthening cooperation on trans-border rivers between India and China.

Ministry of External Affairs, Government of India. (2022). India–Nepal Joint Vision Statement on Power Sector Cooperation.

Ministry of External Affairs, Government of India. (2025). India–Bhutan Relations: Bilateral brief.

Muhammad, S. (2025). HKH Snow Update Report 2025. International Centre for Integrated Mountain Development. https://doi.org/10.53055/ICIMOD.1087

Muhammad, S., Azam, M. F., Jackson, M., & Zhang, Q. (2026). Regional cryosphere strategy for the Hindu Kush Himalaya. Journal of Mountain Science.

World Bank. (2018). Fact Sheet: The Indus Waters Treaty 1960 and the Role of the World Bank.

1. Introduction

The Himalayan region occupies a distinctive place in Asian geopolitics. It contains some of the world's highest mountains, the largest concentration of glaciers, seasonal snow and permafrost outside the polar regions, and the headwaters of river systems that sustain a vast share of Asia's population. The Hindu Kush Himalaya extends roughly 3,500 kilometres across all or part of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. ICIMOD identifies the region as the source of ten major Asian river systems and home to around 240 million people in the mountains, while close to two billion people depend on water and ecosystem services connected to these river basins (ICIMOD, 2023).

The same terrain is also strategically sensitive. The Himalaya contains disputed and heavily defended borders, critical transport corridors, hydropower sites and upstream–downstream relationships involving major powers. India and China share transboundary rivers as well as a contested boundary; India and Pakistan remain connected through the Indus system; and Nepal and Bhutan occupy strategically important positions between larger neighbours while possessing substantial hydropower potential.

Climate change adds a new layer to this geopolitical geography. The mountains are not a static backdrop to state competition. Glaciers are losing mass, seasonal snow is becoming less reliable, permafrost is degrading, extreme rainfall and glacial hazards threaten infrastructure, and river seasonality is changing. In March 2026 ICIMOD reported that glacier ice-loss rates across the HKH had doubled since 2000, with up to 27 metres of ice thickness lost since 1975 in the monitoring evidence synthesised by its new assessments (ICIMOD, 2026a). In April 2026 it reported regional snow persistence 27.8 per cent below the long-term average, the fourth consecutive below-normal year (ICIMOD, 2026b).

These changes do not mean that "water wars" are inevitable. Climate effects are mediated by treaties, institutions, technology, domestic politics and diplomacy. The central argument of this paper is therefore more precise: climate change is a geopolitical risk multiplier. It changes

the physical conditions within which states manage borders, rivers, energy systems, infrastructure and human security, while simultaneously creating stronger reasons for cooperation.

2. Method and Analytical Framework

This article adopts a conceptual and integrative review method. It does not generate artificial primary data. Instead, it synthesises recent scientific assessments, institutional reports and official agreements. Priority is given to ICIMOD's peer-reviewed and technical assessments of the HKH cryosphere, the IPCC Sixth Assessment, the World Bank's documentation of the Indus Waters Treaty, and official bilateral documents of India concerning China, Nepal and Bhutan.

The analytical framework treats Himalayan geopolitics as the interaction of five elements: physical climate change, cryosphere response, resource and hazard consequences, national interests, and institutions for cooperation or competition. Climate change is therefore not treated as an independent cause of interstate behaviour. A decline in snow persistence, for example, becomes geopolitically important when it affects seasonal water expectations, hydropower planning, agriculture, disaster risk or public perceptions of upstream activity.

This approach also distinguishes water availability from water politics. River discharge is shaped by precipitation, snowmelt, glacier melt, groundwater and human regulation. Political tension may arise from uncertainty and mistrust even when the physical cause of a flow change is climatic rather than deliberate. Reliable observation and transparent data exchange consequently have strategic value.

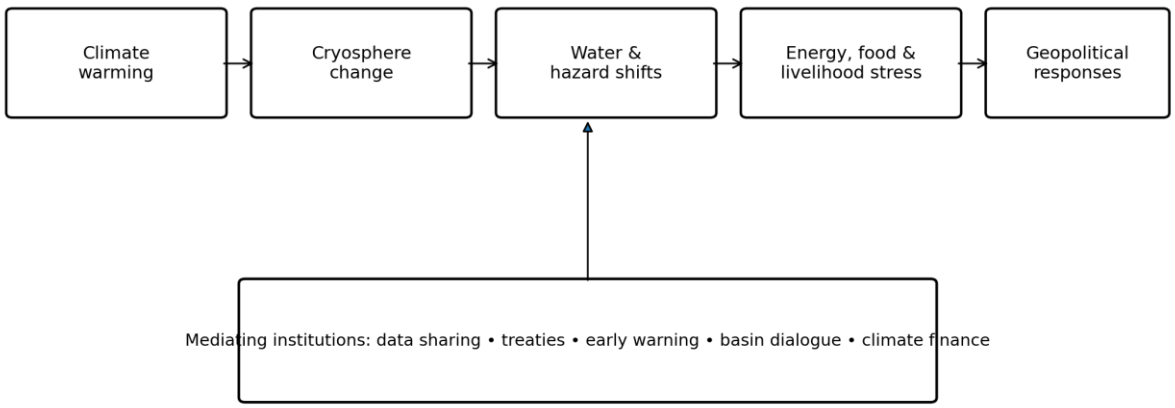

Figure 1. Climate-geopolitics interaction in the Himalayan region

Figure 1. Climate–geopolitics interaction in the Himalayan region.

3. Why the Himalaya Matters Geopolitically

The strategic significance of the Himalaya rests on the convergence of territory, water, energy and connectivity. Mountain borders are difficult to survey and administer, yet they are closely associated with national sovereignty. Roads, tunnels, bridges, airfields and communication systems improve access for civilian development but also possess strategic value. Climate hazards can damage these assets and raise the cost of maintaining them.

Water creates a second layer of interdependence. Major rivers originating in the HKH cross political borders before reaching densely populated plains. Upstream and downstream states therefore share hydrological systems without necessarily sharing political priorities. Dams, diversions, flood management and data collection can become politically sensitive because decisions taken in one jurisdiction may be perceived to affect another.

Energy creates a third dimension. Mountain rivers possess substantial hydropower potential. Bhutan's relationship with India demonstrates how hydropower can support structured bilateral interdependence. India's Ministry of External Affairs reported that by late 2025 five jointly developed major hydroelectric projects in Bhutan totalled 3,156 MW, while additional projects remained under development (MEA, 2025). India and Nepal have likewise adopted a joint vision that identifies hydropower, cross-border transmission and electricity trade as central areas of cooperation (MEA, 2022).

Thus, Himalayan geopolitics is not reducible to military rivalry. It includes cooperative energy markets, development finance, disaster management, ecological security and the movement of people and goods. Climate change touches each of these dimensions.

4. Cryosphere Change and the New Strategic Uncertainty

The cryosphere—glaciers, seasonal snow and frozen ground—is the most direct connection between climate change and Himalayan geopolitics. ICIMOD's 2023 HI-WISE assessment concluded that cryospheric change in the HKH is unprecedented and largely irreversible on human timescales. Under current high-emissions trajectories, glaciers could lose a very large share of their present volume by the end of the century; the report warned of losses of up to 80 per cent under high-emission conditions (ICIMOD, 2023).

The latest observations reinforce the concern. ICIMOD's 2026 glacier assessments reported accelerating ice loss, while its Snow Update 2026 found snow persistence 27.8 per cent below the long-term average. Ten of the monitored major basins were below normal (ICIMOD, 2026a, 2026b). In 2025 the regional anomaly had already reached a then-record 23.6 per cent below normal, with substantial deficits in the Brahmaputra, Ganges and other basins (Muhammad, 2025).

Seasonal snow is geopolitically relevant because it helps regulate the timing of river flows. On average, snowmelt contributes roughly a quarter of annual runoff across the major HKH river basins, although the contribution differs sharply by basin (Muhammad, 2025). Reduced snow persistence can therefore increase early-summer water stress even where annual precipitation remains substantial.

Glacier retreat produces a more complex temporal effect. Increased melt can temporarily add water to some rivers, but continued ice loss ultimately reduces the long-term buffering role of glaciers. This means that political debate based on a simple assumption of continuously declining river flow can be misleading. The strategic problem is greater variability, changing seasonality and uncertainty.

Permafrost degradation adds another concern. Thawing frozen ground can destabilise slopes and infrastructure. In strategically sensitive high-altitude areas, roads, military logistics, hydropower facilities and settlements may face higher maintenance and hazard costs. Climate change therefore alters not only water security but the physical reliability of the strategic landscape.

5. India–China: Transboundary Rivers, Data and Strategic Trust

India–China relations illustrate how climate uncertainty can interact with an already complex geopolitical relationship. The Brahmaputra, known as the Yarlung Tsangpo in Tibet, originates on the Tibetan Plateau before flowing into India and Bangladesh. The Sutlej also crosses from the Tibetan region into India. Upstream infrastructure and hydrological information consequently attract strategic attention.

Importantly, the bilateral relationship has included institutional cooperation on rivers. Official Indian documents record an Expert Level Mechanism on trans-border rivers and agreements for China to provide flood-season hydrological information concerning the Brahmaputra and Sutlej. A bilateral memorandum explicitly recognised trans-border rivers and related natural resources as valuable to the socioeconomic development of riparian countries and linked cooperation to strategic trust (MEA, 2013).

Climate change increases the value of such mechanisms. If snow, glacier melt and extreme rainfall become more variable, downstream flood forecasting requires timely upstream information. Hydrological data can therefore function as a form of confidence-building. Conversely, interruptions or uncertainty in data exchange can acquire political meaning beyond their technical significance.

The challenge is to prevent every unusual river event from being interpreted primarily through a security lens. Extreme flows may result from intense rainfall, glacial-lake events, landslides or changing snowmelt. Scientific cooperation can help distinguish natural variability and climate-driven change from infrastructure-related effects.

A stronger India–China climate-water architecture would ideally include standardised observations, real-time flood information, joint scientific workshops and transparent communication about major upstream projects. Such cooperation would not resolve territorial disputes, but it could reduce one source of avoidable mistrust.

6. India–Pakistan and the Indus Basin

The Indus basin represents another critical intersection of Himalayan hydrology and geopolitics. The 1960 Indus Waters Treaty, negotiated with World Bank assistance, created a durable framework for allocating and managing the river system. The World Bank notes that the treaty allocates the western rivers—Indus, Jhelum and Chenab—to Pakistan and the eastern rivers—Ravi, Beas and Sutlej—to India, while permitting specified uses and establishing mechanisms for cooperation and information exchange (World Bank, 2018).

The treaty was designed in an earlier climatic period. Climate change now introduces stresses that were not central to the original negotiations: altered snow accumulation, glacier change,

more variable extremes and changing seasonal demand. The treaty itself contains provisions for data exchange and future cooperation, including hydrological and meteorological observations. These provisions become increasingly valuable in a less predictable climate.

The geopolitical danger lies in confusing scarcity produced by climatic variability with scarcity attributed to the actions of another state. In a low-trust relationship, drought or unusual flows can become securitised rapidly. Scientific transparency is therefore not a secondary technical issue; it is part of conflict prevention.

Climate adaptation in the Indus basin requires better forecasting, efficient irrigation, groundwater management, reservoir coordination where politically feasible, and improved understanding of cryosphere–monsoon interactions. Even where broader political relations are difficult, professional hydrological communication can preserve a minimum level of functional cooperation.

7. Nepal and Bhutan: Hydropower, Development and Climate Risk

Nepal and Bhutan show a different face of Himalayan geopolitics: the possibility of turning mountain water into cooperative economic interdependence. Both possess major hydropower resources and are linked to the Indian electricity market.

India and Nepal's joint vision on power-sector cooperation identifies joint generation projects, cross-border transmission, bidirectional electricity trade, grid coordination and information sharing as areas for mutually beneficial cooperation. It also frames renewable energy, particularly hydropower, as a cornerstone of the partnership (MEA, 2022). Bhutan–India cooperation is even more institutionalised. By 2025, five jointly developed major projects with 3,156 MW of capacity were operational, and the two governments were pursuing a broader energy partnership that also included renewable technologies (MEA, 2025).

Climate change complicates the assumption that hydropower is a fixed and predictable resource. Changing snow and rainfall patterns can alter seasonal generation. Extreme floods, landslides, sediment loads and glacial hazards can threaten dams, transmission lines and access roads. Hydropower diplomacy must therefore become climate-resilient hydropower diplomacy.

Future project appraisal should incorporate updated glacier, snow, sediment and extreme-event scenarios rather than relying solely on historical hydrology. Cross-border power trade can itself become an adaptation tool by allowing geographically diverse systems to balance seasonal surpluses and deficits. In this sense, regional electricity integration can reduce rather than intensify climate vulnerability.

8. Climate Hazards, Borders and Human Security

Himalayan climate security extends beyond interstate water relations. Mountain communities face landslides, flash floods, glacial lake outburst floods, drought, wildfire and changing ecosystem conditions. These hazards can damage roads, bridges and border infrastructure while isolating communities for long periods.

The geopolitical consequences are indirect but significant. Disaster-damaged transport can disrupt trade and military logistics. Repeated losses can accelerate out-migration from remote border areas, potentially changing settlement patterns. Hydropower and tourism projects can become financially riskier. Emergency response may require cross-border information because hazards do not respect political boundaries.

Climate-related mobility should be approached carefully. It is rarely caused by climate alone. Livelihood decline, market access, education, disaster losses and demographic change interact with environmental stress. Nevertheless, the depopulation of fragile mountain settlements can have strategic implications where states view inhabited border regions as important to territorial administration.

Human security therefore belongs at the centre of Himalayan geopolitics. A road that improves military access but increases landslide exposure, or a dam that produces electricity but overlooks downstream disaster risk, cannot be considered strategically resilient. Security planning must integrate ecological and community resilience.

9. From Strategic Competition to Climate Security Cooperation

The strongest policy implication is that Himalayan states need mechanisms that can function even when political relations are strained. Climate cooperation should not depend on the unrealistic expectation that territorial or strategic disagreements will disappear.

First, cryosphere monitoring must become more systematic and regionally comparable. A 2026 regional cryosphere strategy proposed standardised glacier, snow and permafrost monitoring, shared capacity, interoperable data systems and operational decision-support services (Muhammad et al., 2026). This is especially important because field monitoring remains sparse and uneven.

Second, hydrological data sharing should be treated as critical regional infrastructure. Real-time information can improve flood warnings, reservoir operation and public trust. Technical protocols should specify data standards, timing and emergency communication.

Third, early-warning systems should be designed across borders. A glacial lake outburst or landslide-dammed river can create downstream danger within hours. Scientific agencies require channels that operate faster than conventional diplomacy.

Fourth, hydropower planning should incorporate climate stress tests. Projects need updated design assumptions for floods, sediment, changing runoff and slope instability. Regional electricity trade should be expanded where it improves system flexibility.

Fifth, basin dialogue should complement bilateral agreements. Not every issue requires a comprehensive river treaty, which can be politically difficult. Practical cooperation can begin with flood forecasting, sediment research, glacier monitoring, ecosystem restoration and professional exchanges.

Finally, scientific diplomacy should be insulated as far as possible from political crises. Shared observation does not imply agreement on sovereignty. It recognises that atmosphere, ice and rivers operate across borders regardless of political disputes.

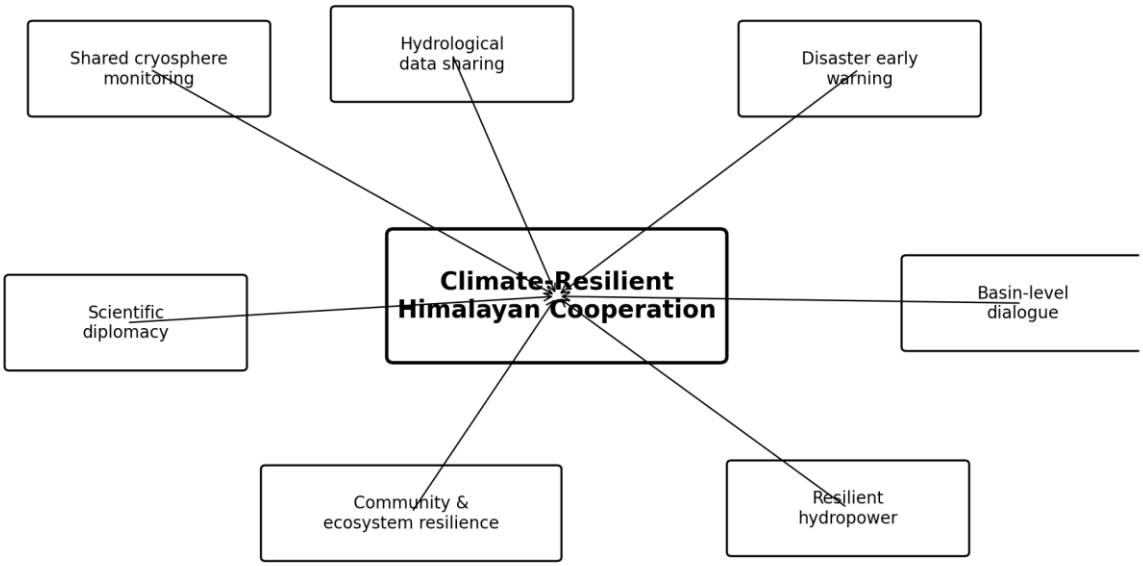

Figure 2. A cooperative framework for climate security in the Himalaya

Figure 2. A cooperative framework for climate security in the Himalaya.

10. Discussion

Climate change is transforming the meaning of strategic geography in the Himalaya. Classical geopolitics emphasised altitude, passes, borders, military access and territorial control. Contemporary Himalayan security must add glaciers, snow persistence, permafrost, river seasonality, disaster exposure and infrastructure resilience.

The evidence does not support simplistic predictions of inevitable climate conflict. Water relationships are mediated by institutions. The Indus Waters Treaty demonstrates that formal arrangements can persist across periods of severe political tension. India–Bhutan hydropower cooperation shows that shared rivers can generate durable economic interdependence. India–China hydrological mechanisms show that even strategic competitors can identify limited technical areas of mutual interest.

Yet climate change raises the cost of weak cooperation. When hydrological baselines become less reliable, states require more—not less—information. When extreme events become harder to anticipate, early warning becomes more valuable. When hydropower and roads face new hazards, shared scientific knowledge becomes strategically important.

The emerging geopolitical divide may therefore be between regions that successfully institutionalise climate information and those that allow uncertainty to deepen mistrust. In this context, data are not merely scientific outputs. They are strategic public goods.

The Himalaya should consequently be understood as a shared ecological security complex. Sovereignty remains important, but no state can independently stabilise glaciers, control monsoon variability or prevent every transboundary hazard. Regional resilience requires national preparedness combined with selective cooperation.

11. Policy Implications for a Climate-Secure Himalaya

Finally, Himalayan policy must treat local communities as security actors rather than passive beneficiaries. Residents possess detailed knowledge of changing springs, snowfall, pasture, river behaviour and hazard locations. Combining such observations with remote sensing and instrumental monitoring can improve risk identification. A climate-secure Himalaya therefore requires a layered model of governance: strong national preparedness, empowered local institutions and carefully designed cross-border cooperation.

Fourth, regional institutions should invest in sustained professional networks among hydrologists, glaciologists, disaster managers, engineers and universities. Political dialogue can stop during crises; professional scientific relationships can preserve communication and provide a foundation for later diplomatic engagement. This is particularly important in a region where environmental processes cross borders faster than formal negotiations.

Third, climate finance for mountain regions should recognise the asymmetry between their ecological importance and their fiscal capacity. Mountain communities protect watersheds, forests and biodiversity that benefit large downstream populations, yet often have limited resources for resilient infrastructure. Adaptation finance should support local early-warning systems, slope stabilisation, climate-resilient livelihoods, ecosystem restoration and safer public infrastructure.

A second priority is open and interoperable environmental information. States will understandably retain restrictions on genuinely sensitive strategic data, but basic snow, glacier, precipitation, river-flow and hazard information has strong public-good characteristics. Shared technical standards can make national datasets comparable without requiring countries to surrender sovereign control over monitoring networks.

A climate-secure Himalayan policy must connect national security planning with ecological risk reduction. The first requirement is to move from fragmented project-level assessment towards cumulative mountain-risk assessment. Roads, dams, settlements and transmission systems interact with slope stability, river sediment, glacier hazards and changing precipitation. Evaluating each project in isolation can underestimate the combined pressure on a basin or mountain corridor.

12. Conclusion

The Himalaya is entering a period in which physical and political geography are becoming more tightly connected. Accelerating glacier loss, repeated snow deficits, permafrost degradation and changing hydrological extremes are altering the environmental foundations of water, energy, infrastructure and livelihoods. These changes intersect with some of Asia's most sensitive borders and river relationships.

Climate change should not be presented as an automatic cause of interstate conflict. Its more defensible geopolitical role is that of a risk multiplier. It increases uncertainty, magnifies the consequences of poor governance and can intensify existing mistrust. But the same shared exposure can also create incentives for cooperation.

The policy choice is therefore not between geopolitics and climate policy; climate change is becoming part of geopolitics. Himalayan security strategies must include cryosphere science, hydrological transparency, disaster preparedness, resilient infrastructure and community protection alongside traditional concerns of sovereignty and territorial defence.

A practical regional agenda should prioritise standardised glacier and snow monitoring, reliable hydrological data exchange, cross-border early-warning systems, climate-resilient hydropower, basin-level technical dialogue and sustained scientific diplomacy. Such measures do not require states to resolve every political disagreement before cooperating.

The future of Himalayan geopolitics will depend partly on whether the mountains are viewed only as frontiers to defend or also as an interconnected ecological system to manage collectively. In a rapidly warming century, regional stability will increasingly depend on recognising that climate security and geopolitical security are no longer separate questions.

References

International Centre for Integrated Mountain Development (ICIMOD). (2023). Water, ice, society, and ecosystems in the Hindu Kush Himalaya: An outlook (HI-WISE). ICIMOD. https://doi.org/10.53055/ICIMOD.1028

International Centre for Integrated Mountain Development (ICIMOD). (2026a). HKH glaciers losing ice at double the rate since 2000: New glacier assessments. ICIMOD.

International Centre for Integrated Mountain Development (ICIMOD). (2026b). Hindu Kush Himalaya snowpack crashes to record low for fourth straight year. ICIMOD.

Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Cambridge University Press.

Ministry of External Affairs, Government of India. (2013). Memorandum of Understanding on strengthening cooperation on trans-border rivers between India and China.

Ministry of External Affairs, Government of India. (2022). India–Nepal Joint Vision Statement on Power Sector Cooperation.

Ministry of External Affairs, Government of India. (2025). India–Bhutan Relations: Bilateral brief.

Muhammad, S. (2025). HKH Snow Update Report 2025. International Centre for Integrated Mountain Development. https://doi.org/10.53055/ICIMOD.1087

Muhammad, S., Azam, M. F., Jackson, M., & Zhang, Q. (2026). Regional cryosphere strategy for the Hindu Kush Himalaya. Journal of Mountain Science.

World Bank. (2018). Fact Sheet: The Indus Waters Treaty 1960 and the Role of the World Bank.

Cite the Article:

Lata, Dr. Suman. (2026). Himalayan Geopolitics and Climate Change: Emerging Security Challenges, Transboundary Waters and Pathways for Regional Cooperation. Shiksha Samvad International Open Access Peer-Reviewed & Refereed Journal of Multidisciplinary Research, 4(1) 136-146, ISSN: 2584-0983 (Online), Volume 04, Issue 01, September-2026. DOI: - https://doi.org/10.64880/shikshasamvad.v4i1.17