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International Climate Change Scenario and its Implications for Nepal: A Mountain Perspective

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Abstract

Climate change has emerged as one of the defining challenges of the twenty-first century, reshaping global development trajectories, geopolitical relations, and the foundations of human security. While climate change is a global phenomenon, its impacts are unevenly distributed, disproportionately affecting vulnerable regions and communities. Mountain regions, particularly the Hindu Kush Himalaya (HKH) region, are among the most sensitive and least resilient to climate-induced stresses. Nepal, located at the heart of the Himalayas, exemplifies this paradox: it contributes negligibly to global greenhouse gas emissions yet bears a disproportionate burden of climate impacts. This article examines the international climate change scenario and its implications for Nepal from a mountain-centric and policy-oriented perspective. It explores global climate trends, mountain-specific vulnerabilities, Nepal's leadership role in advancing the mountain agenda, and the relevance of climate change to sustainable development. Drawing from regional cooperation experiences in the HKH region and insights gained through professional engagement at the International Centre for Integrated Mountain Development (ICIMOD), the paper highlights the importance of climate diplomacy, global negotiations, climate finance, and adaptation strategies. It also addresses emerging issues such as loss and damage, climate-induced disasters, and the need for resilience-building in Nepal. This paper aims to inform policy discourse and contribute to Nepal's strategic engagement in international climate forums and dialogues.

Keywords: climate change, sustainable development, climate finance, mountain, climate-induced disasters

Introduction: Climate Change in the International Context

Climate change is no longer a distant environmental concern; it is a central development, economic, and security issue confronting the global community. Rising global temperatures, changing precipitation patterns, increasing frequency and magnitude of extreme weather events, and sea-level rise are already affecting livelihoods, ecosystems, and national economies across continents (IPCC, 2022). The

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Intergovernmental Panel on Climate Change (IPCC) has repeatedly warned that the window for limiting global warming to safe levels is rapidly closing, and that delayed action will significantly increase costs and risks (IPCC, 2022).

At the international level, climate change has become deeply embedded in diplomatic engagements, multilateral negotiations, and global development frameworks. Agreements such as the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement (UNFCCC, 2015), and the 2030 Agenda for Sustainable Development (United Nations, 2015) reflect collective recognition of the problem. However, tensions persist between developed and developing countries regarding responsibility, equity, finance, capacity, and technology transfer.

For countries like Nepal, the international climate scenario presents both challenges and opportunities. Nepal is highly vulnerable to climate change impacts, yet it has limited capacity and resources to respond, putting strain on Nepal's efforts towards sustainable development (Government of Nepal, 2021a). At the same time, Nepal's geographic position in the Himalayas, its neutral geo-political grounding in South Asia, and its rich experience in community-based adaptation policies and practices provide a strong basis for moral leadership, voice of the mountain communities, and constructive engagement in regional and global climate discourse.

Global Climate Change Impacts and Implications for Nepal

At the global level, climate change manifests through rising average temperatures, intensifying heatwaves, prolonged droughts, and more destructive floods and storms (IPCC, 2022). These impacts disrupt food systems, water availability, public health, and economic stability. Developing countries, particularly Least Developed Countries (LDCs) and Small Island Developing States (SIDS), face the gravest consequences despite contributing the least to global emissions.

Implications for Nepal are both direct and indirect. Direct impacts include changes in temperature and precipitation, increased incidence of floods and flash floods, landslides, droughts, forest fires, and glacial hazards (ICIMOD, 2023). Indirect impacts arise through global economic disruptions, food price volatility, migration pressures, and reduced development finance as countries divert resources to domestic climate responses.

Nepal's economy, heavily dependent on agriculture, hydropower, tourism, and natural resources, is particularly climate-sensitive. Agriculture employs a large proportion of the population and relies on monsoon rainfall, which is becoming increasingly erratic. Further, migration of rural communities has added pressure on agricultural productivity. Hydropower, a cornerstone of Nepal's development aspirations, faces risks from glacial lake outburst floods (GLOFs), sedimentation, and altered river flows (ICIMOD, 2023).

Tourism, especially mountain tourism, is affected by changing landscapes, extreme weather, and safety concerns. Not to mention, climate change presents negative impacts on its rich biodiversity, affecting both flora and fauna (IPCC, 2022).

Melting Glaciers and Cascading Consequences

One of the most visible impacts of climate change in Nepal is the accelerated melting of glaciers. Scientific assessments led by ICIMOD indicate that even under a 1.5°C warming scenario, up to one-third of glaciers in the HKH region could disappear by the end of the century (ICIMOD, 2023). Under higher warming trajectories, glacier loss could exceed two-thirds (ICIMOD, 2023).

Case Illustration: Imja and Tsho Rolpa Glacial Lakes

Glacial lakes such as Imja and Tsho Rolpa have expanded rapidly due to glacier retreat, significantly increasing the risk of glacial lake outburst floods (GLOFs) (ICIMOD, 2023). These lakes threaten downstream communities, infrastructure, and hydropower facilities. Collaborative risk reduction efforts involving the Government of Nepal, ICIMOD, and regional and international partners demonstrate the importance of science-based adaptation and regional cooperation.

Glacier melt has cascading impacts. In the short term, increased meltwater heightens flood risks; in the long term, shrinking glaciers will reduce dry-season water availability, affecting drinking water, irrigation, and energy generation (ICIMOD, 2023). These impacts extend beyond Nepal, affecting millions of people downstream, underscoring the global importance of Himalayan glaciers and the need for robust regional cooperation.

Climate Change and the Sustainable Development Agenda

Climate change is deeply intertwined with sustainable development. It threatens progress across multiple Sustainable Development Goals (SDGs), including poverty reduction, food security, health, clean water, energy, and ecosystems (United Nations, 2015). Conversely, well-designed climate actions can generate co-benefits for development, resilience, and social inclusion. Integrating climate change is a must in the sustainable development agenda.

For Nepal, integrating climate change into the national development agenda is not optional; it is essential. Development gains achieved over decades can be quickly reversed by climate-induced disasters, as demonstrated by numerous recent catastrophic events, such as the Melamchi floods of 2020 and a massive flood in 2024 due to record rainfall. Therefore, climate resilience must be mainstreamed into planning, infrastructure development, and social protection systems (Government of Nepal, 2021).

Nepal has made notable progress in aligning climate and development policies, including the formulation of National Adaptation Plans (Government of Nepal, 2021b), Nationally Determined Contributions (NDCs; Government of Nepal, 2021a), and climate-resilient development strategies. However, implementation remains a challenge due to capacity constraints, fragmented institutional arrangements, poor governance, and limited finance.

Mountains at the Frontline: Vulnerability and Global Significance

Mountain regions occupy a unique position in the climate change narrative. They are often described as “water towers of the world,” providing freshwater to billions of people downstream. At the same time, mountains are warming faster than the global average, leading to rapid glacier retreat, snowline shifts, and ecosystem transformations (IPCC, 2022).

The Hindu Kush Himalayan region, stretching across eight countries, is one of the most climate-vulnerable regions globally. Scientific assessments coordinated by ICIMOD indicate that even if global warming is limited to 1.5°C, the HKH region could lose up to one-third of its glaciers by the end of the century (ICIMOD, 2023). Under higher warming scenarios, glacier loss could exceed two-thirds, with profound implications for water security, biodiversity, and livelihoods (ICIMOD, 2023).

Nepal, with its high-altitude terrain and dense population downstream, often with transboundary implications, faces cascading risks. Melting glaciers increase short-term flood risks and long-term water scarcity (ICIMOD, 2023). Changes in alpine ecosystems threaten biodiversity and traditional livelihoods. Mountain communities, already facing remoteness and limited services, have fewer options to cope with these changes. This is further amplified by the mass migration of rural communities for better economic opportunities beyond the borders.

Despite these vulnerabilities, mountains have historically received limited attention in global climate negotiations. Elevating the mountain agenda is therefore both a scientific necessity and a moral imperative. While Small Island nations have historically received greater attention in the global climate change debate, mountain nations have recently gained some traction. The slogan, “Melting glaciers are as important as sinking islands,” underscores the need for Nepal to ramp up regional and global cooperation in climate negotiations and build momentum from a mountain perspective. To this end, Nepal can play a unique leadership role at the regional and global levels.

Nepal’s Leadership Role in Advancing the Mountain Agenda

Nepal has emerged as a credible and respected voice in advocating for the mountain agenda in both regional and international forums. Nepal can be a living laboratory for the climate change agenda, especially from community-based adaption practices and

resilience building. Its leadership stems not from economic power, but from moral authority, lived experience, unique geo-political location, and strategic partnerships. Nepal has consistently highlighted the disproportionate impacts of climate change on mountain countries and called for greater recognition of mountains in regional and global climate policies.

Nepal's role as a founding member and host country of ICIMOD has been instrumental in generating regional knowledge, fostering cooperation, and amplifying mountain voices globally. Through ICIMOD, Nepal has contributed to landmark assessments, such as the *Hindu Kush Himalayan Assessment*, which have informed global understanding of mountain-specific climate risks (ICIMOD, 2023).

Nepal has also played an active role in climate diplomacy through the LDC Group, the Climate Vulnerable Forum, and coalitions advocating for adaptation finance and loss and damage mechanisms. These platforms have allowed Nepal to align its national concerns, such as those outlined in its Nationally Determined Contributions (Government of Nepal, 2021a), with broader global movements, enhancing its influence despite limited resources.

The following section presents a brief account of analyses and discussions regarding Nepal's effort towards international climate change scenarios and its implications for Nepal from a mountain-centric perspective.

Adaptation and Building Climate Resilience in Nepal

Adaptation is a top priority for Nepal. Community-based adaptation approaches, ecosystem-based adaptation, and traditional knowledge have demonstrated effectiveness in enhancing resilience. Scaling up these approaches requires supportive policies, sustained finance, and institutional coordination and capacity building at the community level (Government of Nepal, 2021b). Building resilience also involves strengthening infrastructure, improving early warning systems, and integrating climate risk into development planning. Urban areas, in addition to rural and mountain communities, are increasingly vulnerable and require targeted attention. Nepal's experience shows that adaptation is not merely a technical exercise, but a social and institutional process that must be inclusive, participatory, and context-specific.

Case Illustration: Climate Smart Village (CSV)

The Climate Smart Village (CSV) approach in Himalayan communities, as part of ICIMOD's adaptation initiatives adapted from FAO's climate-smart agriculture framework, equips farmers with practical, locally tailored techniques to cope with shifting climate patterns and build resilient livelihoods (ICIMOD, 2023). Interventions include nutrient-smart practices, sustainable water management (like rainwater harvesting and simple irrigation), and low-cost technologies to increase crop

productivity and food security while reducing vulnerability to climatic stresses. The CSV model is designed to be affordable and replicable, helping mountain farmers adapt to unpredictable weather, water scarcity, and other climate impacts while enhancing sustainable development in rural areas.

Case Illustration: Community-Based Flood Early Warning Systems to Reduce Disaster Risk

Another prominent example is ICIMOD's work on community-based flood and glacial lake outburst flood (GLOF) early warning systems across the Hindu Kush Himalaya (ICIMOD, 2023). Recognizing that climate change is accelerating glacier melt and increasing flood risk, ICIMOD has supported the development and installation of early warning systems that monitor water levels and provide timely alerts to vulnerable communities. These systems — co-designed with local authorities and technical partners — have helped villages detect rising waters early and evacuate or take protective measures, significantly reducing loss of life and damage during extreme events. By integrating science-based monitoring with community engagement and risk preparedness, this work builds resilience against some of the most immediate climate-related hazards in mountain regions.

Global Climate Negotiations and Raising the Mountain Agenda

Global climate negotiations under the UNFCCC framework are complex and often contentious. Issues of mitigation ambition, adaptation finance, and equity dominate discussions. Within this space, mountain-specific concerns have historically been underrepresented. In recent years, there has been growing recognition of the need to highlight mountains in global climate forums. Side events, ministerial dialogues, and thematic coalitions have begun to bring mountain issues to the fore. Nepal has actively contributed to these efforts, advocating for dedicated attention to mountain ecosystems, cryosphere research, and adaptation needs.

Raising the mountain agenda requires sustained diplomacy, strategic alliances, and credible scientific evidence (ICIMOD, 2023). Nepal's experience demonstrates that small countries can influence global narratives by combining science, policy, and moral persuasion. Nepal's commitment to achieve carbon neutrality by 2029 represents a strategically important response to the climate crisis, particularly in the context of loss and damage faced by mountain countries. At COP26 (2021), Nepal announced a world-leading climate goal to remain net zero in carbon emissions from 2022 to 2045 and then become carbon negative after 2045 — meaning it would remove more greenhouse gases than it emits overall (Government of Nepal, 2021a).

Attracting Climate Investments for Nepal

Climate finance is a critical enabler of action. Globally, trillions of dollars are required to support mitigation and adaptation, yet flows to vulnerable countries remain insufficient. Accessing climate finance is particularly challenging for LDCs due to complex procedures and limited institutional capacity.

Nepal has accessed resources from multilateral funds such as the Green Climate Fund, Adaptation Fund, and the Global Environment Facility, but the scale remains inadequate relative to needs (Government of Nepal, 2021b). To attract greater investment, Nepal must strengthen project preparation, improve coordination among institutions, enhance institutional capacity, and create an enabling environment for private sector engagement.

Climate investments in Nepal should prioritize adaptation, resilience, and nature-based solutions, while also leveraging opportunities in renewable energy and sustainable tourism. Transparent governance and alignment with national priorities will be essential to build investor confidence.

Climate Finance and Carbon Financing

While Nepal has accessed multilateral climate funds, the scale remains insufficient. Strengthening institutional capacity and creating an enabling environment for private investment are key priorities. Carbon financing offers significant opportunities. Nepal's forest resources, hydropower potential, and renewable energy initiatives position it well to benefit from carbon markets.

Case Illustration: REDD+ in Nepal

REDD+ initiatives in Nepal have demonstrated how forest conservation can generate carbon revenues while supporting community livelihoods, providing a practical model for climate mitigation and sustainable development (Government of Nepal, 2021a).

In January 2026, Nepal signed a landmark Emission Reductions Purchase Agreement with the LEAF Coalition, coordinated by Emergent, positioning the country to sell up to 4 million tons of verified emission reductions and secure up to USD 40–55 million in climate finance for protecting and restoring forests across Gandaki, Bagmati, and Lumbini provinces. This deal marks Nepal's first formal entry into large-scale carbon markets and makes it the first Asian government to offer correspondingly adjusted carbon credits for compliance use, with proceeds designed to flow to local communities, Indigenous Peoples, and forest user groups while reinforcing robust monitoring, safeguards, and benefit-sharing mechanisms.

Loss and Damage and Climate-Induced Disasters

Loss and damage have emerged as one of the most sensitive and important issues in global climate negotiations. It refers to impacts that cannot be avoided through mitigation or adaptation, such as loss of lives, livelihoods, cultural heritage, and ecosystems (UNFCCC, 2015).

Nepal experiences significant loss and damage from climate-induced disasters, including floods, landslides, and glacial hazards. These events impose high economic and social costs, particularly on poor and marginalized communities. While international recognition of loss and damage has increased, translating commitments into effective support mechanisms remains a challenge.

Case Illustration: Melamchi Floods 2020

Intensified monsoon rainfall—consistent with climate change projections for the Hindu Kush Himalaya (ICIMOD, 2023)—triggered flash floods and debris flows that devastated Melamchi Bazaar and surrounding settlements, destroying homes, farmland, bridges, and critical infrastructure, including the Melamchi Drinking Water Project. While economic losses were substantial, the most profound impacts lay in non-economic loss and damage: loss of lives, displacement of communities, long-term livelihood disruption, degradation of productive land, and psychological trauma.

Nepal's experiences, such as the above, provide compelling evidence for the urgency of operationalizing loss and damage finance. Documenting impacts, strengthening data systems, and engaging strategically in negotiations are critical steps to accessing finance through a loss and damage mechanism.

Regional Cooperation in the Hindu Kush Himalayan Region

Climate change transcends national boundaries, particularly in interconnected regions such as the HKH. Rivers, glaciers, ecosystems, and weather systems are shared across borders, making regional cooperation indispensable. Unilateral approaches are insufficient to address shared risks such as floods, droughts, and biodiversity loss.

Regional cooperation in the HKH region has evolved through scientific collaboration, data sharing, and joint capacity-building initiatives (ICIMOD, 2023). ICIMOD has played a central role in fostering dialogue among its member countries, even in politically sensitive contexts. These efforts demonstrate that climate change can serve as a common platform for confidence-building, constructive engagement, and easing political tensions through science diplomacy. For Nepal, strengthening regional cooperation enhances early warning systems, disaster risk reduction, and water management. It also reinforces Nepal's position as a neutral ground, bridge-builder, and knowledge hub in the region.

Conclusion

Climate change defines the international landscape of our time, reshaping development pathways and global relations. For Nepal, a country at the frontline of climate impacts yet rich in experience and moral authority, the challenge is immense but not insurmountable. By leveraging its mountain identity, regional partnerships, and diplomatic engagement, Nepal can continue to play a constructive role in regional and global climate discourse.

Integrating climate change into sustainable development (United Nations, 2015), strengthening regional cooperation in the HKH region (ICIMOD, 2023), advancing the mountain agenda in global forums, and mobilizing climate finance are central to Nepal's future resilience (Government of Nepal, 2021a, 2021b). Drawing from decades of regional engagement and institutional learning, including experiences from ICIMOD, Nepal's journey offers valuable lessons for the regional and international community and a unique model for community-based adaptation and resilience building. Ultimately, addressing climate change is not only about managing risks but about reimagining development pathways that are equitable, resilient, and sustainable for present and future generations.

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