

Glaciers a common thread throughout new UN climate report

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Mount Kanchenjunga, the third largest mountain in the world, is shared between Nepal and India. Credit: ICIMOD

Glaciers appear in many chapters and sections of the latest report from the Intergovernmental Panel on Climate Change (IPCC), titled the

Working Group II report of the IPCC's Sixth Assessment. Released on 28 February, it offers detailed observations of historical and recent changes, and provides projections of future changes under different levels of greenhouse gas emissions and warming. This report discusses glaciers globally and in specific regions. It presents the linkages of glaciers to many ecosystems and economic and social systems, including adaptation responses and the limits to such responses, and the connection between glacier retreat and conflict.

Physical changes and their impacts on people and ecosystems

The most sustained discussion of glaciers in the [report](#) is found in Cross-Chapter Paper 5, simply titled Mountains. These cross-chapter papers, focused on specific biomes, are a new feature in this working group report, reflecting its close attention to the interactions of ecosystems and the world's climate system, and to the importance of ecosystem-based adaptations in responding to climate risks.

The Mountains paper discusses the loss of glacier mass as a climate change impact in mountain areas, which can be attributed to human influence, and notes that recent research has shown that the pace of this retreat is significantly faster than the levels that were stated in an earlier IPCC report on this subject, the 2019 Special Report on Oceans and the Cryosphere. It notes with high confidence that many low elevation and small glaciers around the world will lose more than half their mass even at 1.5°C warming. And it shows the important difference between lower and higher rates of greenhouse gas emissions scenarios in coming decades, and between the levels of warming that are associated with them. The projections are sufficiently strong to state with medium confidence that low-emission scenarios would preserve around half the current ice mass in low and mid latitude mountains, while higher levels

would bring a loss between two-thirds and over 90%.

This cross-chapter paper states with high confidence that these changes have observable, serious consequences for both human and natural systems in a number of different regions of the world.

It underscores the influence of these changes on the [water cycle](#) in mountains, including the timing and level of stream flow. It notes that both terrestrial and aquatic ecosystems are affected. Pioneer species can colonize the areas of rock and gravel that were formerly covered with ice, allowing new ecological communities to form, while some fish species are negatively impacted by changing [water volume](#), temperature, chemistry and sediment load. Some human systems are affected as well: the impacts on hydropower are complex, since some regions receive a temporary increase in water supply as glaciers rapidly shrink, only to find a decrease once much of the glacier mass is gone—a challenging shift that some regions have already faced, and that nearly all will reach in the present century.

Glacier retreat is likely to impact food security in regions in Asia and South America where agricultural communities rely on irrigation, though this report notes that there are relatively few integrative studies that link changing stream flow, water management, irrigation techniques and the interactions of different user groups in particular watersheds. For example, glacier meltwater is an important source of water for irrigation, but hydropower facilities and tourist enterprises also require water, increasing complex management issues that to date have not been adequately researched.

The list of impacts is long: this cross-chapter paper notes that there is evidence of mental health issues that stem from anxiety and grief over glacial loss, though this evidence remains limited to date. For others, this loss of glaciers is an opportunity, as "last chance tourism" draws visitors,

eager to see glaciers before they disappear, to New Zealand and the Alps.

Climate change, glaciers and conflict

The cross-chapter Mountains paper offers glacier-related examples which bear on the emerging topic of climate change and conflict. It states that the impacts of climate change on mountain water cycles (reflecting shifts in snow cover as well as glaciers) have contributed to increased tensions or conflicts over water resources, particularly in the areas with pronounced dry seasons. It reports that these conflicts can be found at local and regional scales, as well as national and transboundary scales. It notes sociopolitical conditions which contribute to such tensions; in addition to pronounced dry seasons, these include power inequalities among users of water resources and weak regulatory systems, particularly in transboundary cases. It reports cases of these patterns in several glaciated regions, including Central Asia, South Asia and the Andes; this perspective is consistent with the discussion, in Chapter 7 and elsewhere in the report, of climate change as a "threat multiplier" that exacerbates preexisting social and political tensions.

However, the report also notes steps to address these conflicts. Chapter 17, Decision Making Options for Managing Risk, discusses a glacier protection law in Argentina, which served to catalyze action to minimize the incursion of mining and other enterprises into glacier regions, protecting water supplies, at least in the short and medium term. Such discussions of glacier change and conflict is more extensive than the brief mentions in the 2019 Special Report on Oceans and the Cryosphere—a sign that the global community is recognizing the nature of climate change as one of the contributing factors to political tensions.

Adaptation and indigenous knowledge

Chapter 12, Central and South America, notes a loss between a third and half of glaciers in the Andes—with their large populations of Indigenous peoples—since the 1980s, and links this change to impacts on ecosystems, water resources, livelihoods and natural hazards such as floods and landslides.

Chapter 16, Key Risks Across Sectors and Regions notes that shrinking glaciers place communities in a number of regions at risk for water shortages. In South America and elsewhere, they face some limits to improving water management as an adaptive strategy because governance systems are often characterized by distrust, inflexibility, and unequal power relations. Though these limits are characterized as "soft," or ones that can potentially be overcome, the report notes other "hard" or fixed limits, such as the loss of livelihoods and cultural values that stem from the biophysical process of glacier shrinkage. This chapter also presents mountain glaciers as a unique and threatened system whose restricted geographical range and other distinctive properties lead them to be classified as a "reason for concern."

However, the report also discusses some effective responses to these impacts.

Chapter 2, Terrestrial and Freshwater Ecosystems and their Services, contains an extensive case study of the effects of climate change on social-ecological systems in the Andean region. Faced with decline in pasture due to glacier retreat and reduced meltwater, Indigenous Quechua and Aymara pastoralists have increased their mobility, drawn on social and economic ties to access new pastures, constructed canals to irrigate new pastures, and shifted to planted fodder. This case shows the importance of addressing glacier retreat through the incorporation of Indigenous knowledge into planning—linking to the strong presence of Indigenous knowledge and local knowledge throughout the report. However, diversion of water from mountain regions to large-scale highly

capitalized agricultural enterprises in distant coastal areas have further depleted water supplies, while some mining enterprises—weakly regulated in this region—have polluted streams, adding to the pressures on these communities and reducing their capacity to adapt.

The importance of good governance

In sum, this report shows the importance of glaciers in many regions, where they form part of ecological, economic and [social systems](#). It traces new findings from natural science that have emerged in the last few years. And it documents, more clearly than earlier reports, the importance of policy and governance, a critical element in responding to impacts.

The resourcefulness of Indigenous peoples in the Andes, mentioned in the section above, is a telling example. These communities are keenly aware of glacier changes and have found ways to adapt to them—though they are challenged by the disproportionate influence of powerful interests who have seized their [water](#). This power imbalance within South America is paralleled by other power imbalances between the nations and interest groups who seek to reduce emissions sharply and those who prefer to maintain them.

Woven through the report, [glaciers](#) illustrate the report's key theme: the stark differences between a world that has lower emissions and more effective policies, and one that has higher emissions, and is less well governed.

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