Source: Lorem Ipsum

UNFCCC Expert Dialogue on Mountains and Climate Change

Informal summary report by the secretariat

United Nations
Climate Change

Chapter I: Key messages

01 Mountains and mountain ecosystems are critical for both highland and lowland socioecological systems and for strengthening climate resilience on a global scale. However, their ability to cope with climate change is increasingly compromised, making it important to prioritize their protection and restoration in order to safeguard our collective future.

Effective management of mountain ecosystems is essential for biodiversity conservation, restoration and management. Enhancing their capacities and potential to support mitigation and adaptation efforts will ensure that mountains can continue to play a vital role in climate-resilient development. These ecosystems offer significant environmental, economic and social benefits, which reinforces their critical role in building a more sustainable and climate-resilient future.

02 The scientific evidence of climate change impacts on mountains is compelling. The risks and impacts of climate change in mountain ecosystems are increasing and are affecting downstream communities. The strong interdependencies between upstream and downstream communities, coupled with the fact that many mountain ranges cross national borders, highlight the critical need for transboundary cooperation in addressing risks and impacts of climate change in mountain ecosystems. By fostering collaboration at the regional level, countries can synergize their efforts to build resilience together.

Scientific knowledge, alongside traditional and local knowledge, is crucial for making inclusive and informed decisions as well as building resilience in key sectors such as agriculture and water resources. However, as mountains are often underrepresented in evidence-based assessments, they are given insufficient attention to inform climate adaptation and mitigation strategies. There is a critical need to use and fully integrate different forms of knowledge and expand the knowledge base of mountain systems at the local, regional and global level.

03 As mountain ecosystems are complex, fragmented and globally distributed, the solutions to address climate risks must be context-specific and tailored, and allocated resources must match the scale of action required.

Efforts to strengthen the resilience of mountain ecosystems and accelerate climate action can be globally applied in some cases, while in others they necessitate region-specific approaches.

Countries and communities have developed innovative solutions that can be further expanded and adapted to inspire transformational adaptation. Key learning points from regional group discussion include:

- Appropriate transformational adaptation must consider the health and functionality of entire ecosystems as part of the solution to strengthen the resilience of mountainous regions;
- Effective transboundary cooperation and regional partnerships are crucial for enhancing collaborative efforts across and within regions, as they enhance the climate resilience of mountain ecosystems and their downstream areas. The sustainable management of mountain ecosystems supports local communities and contributes to global climate stability;
- Recognition of the shared and unique challenges of different mountain regions is vital to promoting regional exchanges of data, experience, and lessons learned. Such exchanges foster innovation and strengthen the development of context-specific climate solutions;
- Engagement among Indigenous Peoples, local communities, the private sector, academia and other stakeholders is key to building the resilience of mountain ecosystems. A multisectoral approach to engagement ensures that all voices contribute to sustaining these vital ecosystems.

04 As highlighted in the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), the current pace, depth and scope of climate adaptation are insufficient to address the escalating risks in mountain regions, especially as global temperatures continue to rise.

Leadership and immediate action are crucial for keeping global warming below the 1.5°C threshold. A temperature rise to 1.5°C presents significant challenges for mountainous regions, where populations are often vulnerable to the impacts of climate change owing to their limited access to essential services. Mountain protection requires leadership at all levels – local, national, regional and international. Policies and action must reflect the unique characteristics of each region while fostering collective global efforts. Leadership must be forward-thinking and incorporate local realities and global aspirations to protect mountain ecosystems.

Scientific knowledge is crucial for informed decision-making and resilience-building, especially in key sectors such as agriculture and water resources, which calls for increased consideration of mountains in scientific reports, such as the cross-chapter paper on mountains published as part of the IPCC Sixth Assessment Report.[1]

Efforts must be intensified to build the resilience of mountain ecosystems in a coordinated and coherent manner. Partnerships must extend beyond mountainous countries to include downstream nations, with an emphasis on sharing knowledge, best practices and synergies for transnational adaptation solutions. A collective and unified understanding of climate impacts and adaptation strategies for mountain ecosystems is necessary, for example through holding targeted science–policy dialogues that can catalyse action and drive sustainable solutions for mountain ecosystems.

[1] IPCC. 2022. Cross-Chapter Paper 5: Mountains. In: H.-O. Pörtner, D.C. Roberts, M. Tignor, et al. (eds.). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY, USA: Cambridge University Press. pp. 2273–2318. Available at https://www.ipcc.ch/report/ar6/wg2/chapter/ccp5/.

05 At the policy level, governments must prioritize the unique needs of mountain communities while recognizing the diverse challenges and opportunities for adaptation across regions. Unified and ambitious action plans for mountainous countries, including national adaptation plans (NAPs) and new nationally determined contributions (NDCs), are crucial for highlighting the inclusion of distinct plans related to mountain ecosystems, including risks, vulnerabilities, and loss and damage, while safeguarding the distinct environments and livelihoods that depend on mountain ecosystems.

Additional ways to enhance consideration of mountains under the UNFCCC process shared during the event include:

- Engaging in dialogues on mountain-based climate action to ensure that mountain ecosystems are fully represented in adaptation and resilience strategies, as well as to enhance consideration of the matter under and outside the UNFCCC process;
- Recognizing that the outcome of the first global stocktake, as part of the United Arab Emirates Consensus, offers a road map that lays out the actions needed to stay below a 1.5°C increase through 2030 by reducing emissions, while acknowledging that enhancing mountain resilience to climate change is crucial to boost implementation of the actions;
- Contributing to achieving the targets under the global goal on adaptation, within the context of the United Arabic Emirates Framework for Global Climate Resilience, with a specific focus on mountain ecosystems, and addressing the transboundary nature of climate change impacts and risks;
- Promoting the exchange of evidence-based knowledge and fostering the development of context-specific insights and know-how tailored to the unique challenges of mountain ecosystems in the context of the Nairobi work programme on impacts, vulnerability and adaptation to climate change.

Chapter II: Context


Source: Flickr, Photographer Sam Hawley

Mountains, with their rich biological diversity, play a crucial role in supporting the livelihoods of millions of people. Mountain ecosystems provide essential services, particularly with regard to regulating the water cycle, not only for local communities but also for downstream areas.

Science has provided compelling evidence that mountains and mountain ecosystems are critical for strengthening climate resilience. However, their capacity to cope with the adverse impacts of climate change has become increasingly strained. The IPCC reports, "Climate-related hazards, such as flash floods and landslides, have contributed to an increase in disasters affecting a growing number of people in mountain regions and areas further downstream". It also notes that overshooting 1.5°C will result in irreversible adverse impacts on certain mountain ecosystems.[2]

Climate change impacts on mountains do not adhere to national borders, which creates significant transboundary implications. The IPCC indicates, "*Adaptation responses to climate-driven impacts in mountain regions vary significantly in terms of goals and priorities, scope, depth and speed of implementation, governance and modes of decision-making, and the extent of financial and other resources to implement them*".[3]

The UNFCCC has long recognized the fragility of mountain ecosystems. Both the preamble to, and Article 4, paragraph 8, of, the Convention identify mountains as fragile ecosystems. COP 27 emphasized the need to address systematic observation gaps, particularly in developing countries and for ocean, mountain, desert and polar regions and the cryosphere.[4] In 2021, the Subsidiary Body for Scientific and Technological Advice (SBSTA) called for improving the performance, development and application of regional and subregional climate models and other downscaling methods in order to improve understanding of local climate-related risks and inform regional, national and local decision-making, including in developing countries with mountain areas, particularly the least developed countries and small island developing States.[5]

In recent years, mountainous countries have increasingly advocated for dedicated discussions under the UNFCCC on the unique vulnerabilities of mountain ecosystems to climate change. The focus of these discussions has been to explore opportunities for enhanced action and support to strengthen mountain resilience.

Recognizing the critical role of mountains, the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement, at its fifth session, requested the SBSTA Chair to hold this expert dialogue. This request reflects the acknowledgement by the UNFCCC governing bodies of the importance of mountain ecosystems in conserving, protecting and restoring nature, fostering ecosystem-based approaches and implementing resilience measures.[6]

[2] IPCC. 2022. Cross-Chapter Paper 5: Mountains. In: H.-O. Pörtner, D.C. Roberts, M. Tignor, et al. (eds.). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY, USA: Cambridge University Press. pp. 2273–2318. Available at https://www.ipcc.ch/report/ar6/wg2/chapter/ccp5/.

[3] See footnote 1 above.
[4] Decision 22/CP.27.
[5] FCCC/SBSTA/2021/3, para. 72(e).
[6] Decision 1/CMA.5, para. 56.

Chapter III: Introduction

01. Mandate

The Conference of the Parties serving as the meeting of the Parties to the Paris Agreement, at its fifth session, requested the SBSTA Chair to hold an expert dialogue on mountains and climate change at SBSTA 60.[7]

> Climate change risks and impacts in mountainous ecosystems are transboundary in nature and impact downstream communities and countries. There is a value in building synergy and efforts at transboundary and regional level.
> ***Mr. Harry Vreuls, SBSTA Chair***

02. Objectives

The objectives of the expert dialogue were to provide a unique opportunity to convene relevant experts and stakeholders with the aim of:

- Enhancing understanding of climate change impacts on mountains and downstream communities, including in a transboundary context;
- Showcasing solutions that contribute to the resilience of mountain ecosystems to climate change;
- Discussing ways to accelerate climate action at scale and at all levels in order to contribute to the resilience of mountain ecosystems.

The dialogue focused on understanding past and advocating for possible forward-looking actions across critical thematic areas, including research and systematic observation, dimensions of the iterative adaptation cycle and loss and damage, mitigation strategies, means of implementation and support (financial support, capacity-building, and technology development and transfer).[8]

The dialogue provided space for scientists, policymakers and members of frontline communities to come together and share knowledge, experience and insights aimed at strengthening the resilience of mountain ecosystems.

> The choices and actions implemented in this decade will have impacts now and for thousands of years.
> ***Mr. Robert Vautard, Co-Chair, Working Group I of the IPCC Sixth Assessment Report***

> 1.5 is just too hot for the mountains – this will trigger disasters on an unprecedented scale.
> ***Ms. Izabella Koziell, Deputy Director General, International Centre for Integrated Mountain Development***

03. Scope

The informal summary report captures key messages and provides an overview of the outcomes from the expert dialogue.

> We must allow regional mountain communities to talk to each other and learn from each other like it is happening for communities in coastal areas and cities.
> ***Mr. Luis Daniel Llambí, Coordinator, Andes of the Adaptation at Altitude Program (CONDESAN-SDC)***

[7] Decision 1/CMA.5, para. 181.
[8] Thematic topics are outlined in a concept note for the expert dialogue, available at https://unfccc.int/documents/638026.

04. Methodology

The expert dialogue convened over 100 experts, policymakers, members of frontline communities and stakeholders to discuss the impacts of climate change on mountain ecosystems and to explore solutions for enhancing their resilience. The dialogue featured a combination of plenary sessions, breakout group discussions and a high-level panel that summarized key findings and recommendations. Further details, including the concept note, agenda, presentations and key messages from the breakout group discussions, are available on the dialogue web page.[9]

> The mountains are not only our home but they are also our guardians or protectors. Only through collaboration and recognition of our ancestral wisdom can we ensure a sustainable future for humanity.
> ***Ms. Camilla Romero, Asociación Indígena Trem Tem Mapu***

In the spirit of inclusivity, the SBSTA Chair actively engaged Parties,[10] experts and key stakeholders[11] in organizing the dialogue. The steps taken included:

- **Reviewing national reports:** national reports, including NAPs, national communications and NDCs of countries in mountain regions, were reviewed by the secretariat to identify thematic areas and cross-cutting issues for the dialogue.
- **Soliciting inputs on case studies from organizations:** in response to the secretariat's call for inputs through a survey, 52 organizations submitted inputs that resulted in 100 case studies on various topics related to mountain ecosystems. The case studies addressed issues such as data accessibility, vulnerability of forest ecosystems, knowledge transfer for decision-making and financial support for adaptation. The survey also helped identify experts to participate in the dialogue.
- **Convening a virtual meeting ahead of SBSTA 60:** the SBSTA Chair convened a virtual meeting[12] that brought together over 70 participants, including Parties and expert organizations. The technical discussions at that meeting covered topics such as the impacts of climate change on hydrology, agriculture and livelihoods; the integration of traditional knowledge; and the importance of healthy mountain ecosystems. Participants emphasized the need for transboundary cooperation, the potential contribution to the United Arab Emirates Framework for Global Climate Resilience and the importance of sharing region-specific best practices for advancing resilience in mountain ecosystems.


Source: UN, Photographer Kibae Park

[9] https://unfccc.int/event/expert-dialogue-on-mountains-and-climate-change.
[10] See the message to Parties and observer States, available at https://unfccc.int/documents/638352.
[11] See the message to United Nations organizations, admitted intergovernmental organizations and admitted non-governmental organizations, available at https://unfccc.int/documents/638353.
[12] A recording of the virtual meeting is available at https://www.youtube.com/watch?v=OUXNEEdlYHY.

Chapter IV: Outcomes

1 Determining the role of mountains and mountain ecosystems in building resilience to climate change

Mountains and mountain ecosystems are critical for both highland and lowland socioecological systems and for strengthening climate resilience on a global scale. However, their ability to cope with climate change is increasingly compromised, making it important to prioritize their protection and restoration in order to safeguard our collective future.

Effective management of mountain ecosystems is essential for biodiversity conservation, restoration and management, and enhancing their capacities and potential to support mitigation and adaptation efforts will ensure that mountains can continue to play a vital role in climate-resilient development. These ecosystems offer significant environmental, economic and social benefits that reinforce their indispensable role in building a more sustainable and climate-resilient future.

As natural 'water towers', mountains store and supply fresh water, which helps regulate water flow and reduce the risk of floods and droughts. For example, Lesotho relies heavily on its mountains for water provision, while changes in mountain ecosystems in countries such as Armenia and Nepal impact global weather patterns and sea levels, affecting coastal communities far beyond their borders.

Economically, mountains support agriculture and tourism. For example, the Alps benefit from year-round tourism while the Himalayas similarly attract trekkers and climbers, which creates jobs and supporting services for local communities. Mountains also play a crucial role in global food security, with agricultural practices such as terrace farming in the Andes enabling the cultivation of diverse high-altitude crops. In addition, mountain regions provide water for a significant portion of the world's irrigated land.

Mountainous regions are biodiversity hotspots and essential for ecological resilience. They are home to unique flora and fauna that contribute to the stability of mountain ecosystems and support climate change mitigation. Sustainable management practices, such as traditional irrigation techniques and forest conservation, are crucial for maintaining the health of these ecosystems and ensuring their continued contribution to global resilience.

2 Understanding climate change impacts on mountains and downstream communities, including in transboundary contexts

The scientific evidence is compelling. The risks and impacts of climate change in mountain ecosystems are increasing and are affecting downstream communities. The strong interdependencies between upstream and downstream regions, coupled with the fact that many mountain ranges cross national borders, highlight the critical need for transboundary cooperation. By fostering collaboration at the regional and cross-border level, countries can synergize their efforts to build resilience together.

Mountain ecosystems cover approximately one quarter of the Earth's land surface and provide a home to over 1 billion people[13] (see figure 1). These ecosystems are especially vital because of their water resources, which are crucial for sustaining downstream communities. The Hindu Kush Himalaya region, for instance, spans eight countries and holds the world's third-largest ice mass that provides water to 10 major river systems across Asia and supports billions of people.[14]

[13] See footnote 1 above.
[14] International Centre for Integrated Mountain Development. 2019. Sustaining Biodiversity and Ecosystem Services in the Hindu Kush Himalaya. In: Wester, P., Mishra, A., Mukherji, A., et al. (eds.). The Hindu Kush Himalaya Assessment. Springer, Cham. pp. 127-165. Available at https://link.springer.com/book/10.1007/978-3-319-92288-1.

However, climate change is increasingly impacting mountain ecosystems, with significant consequences for water resources, livelihoods, biodiversity, agriculture, food production and local economies (see box 1). Mountain ecosystems are particularly vulnerable owing to elevation-dependent warming, with rising global temperatures pushing freezing levels higher. The Hindu Kush Himalaya region is warming faster than the global average and faces stark projections: by 2100, it is estimated that only 50% of glacier ice masses will remain if warming reaches 2°C, with this estimate dropping to 25–45% at 3°C and 20–30% at 4°C.[15]

Moreover, the reduction in snow cover and shorter snow seasons at lower altitudes are altering seasonal stream flows, reducing water availability and increasing the frequency of glacial lake formation and outburst floods. These changes pose significant risks to water security and the livelihoods of millions, making the need for climate action in mountain regions more urgent than ever.

Scientific knowledge, alongside traditional and local knowledge, is crucial for making inclusive and informed decisions, as well as for building resilience in key sectors such as agriculture and water resources. However, as mountains are often underrepresented in evidence-based assessments, they are given insufficient attention in the supporting knowledge used to inform climate adaptation and mitigation strategies. There is a critical need to use and fully integrate different forms of knowledge and expand the knowledge base of mountain systems at the local, regional and global level.

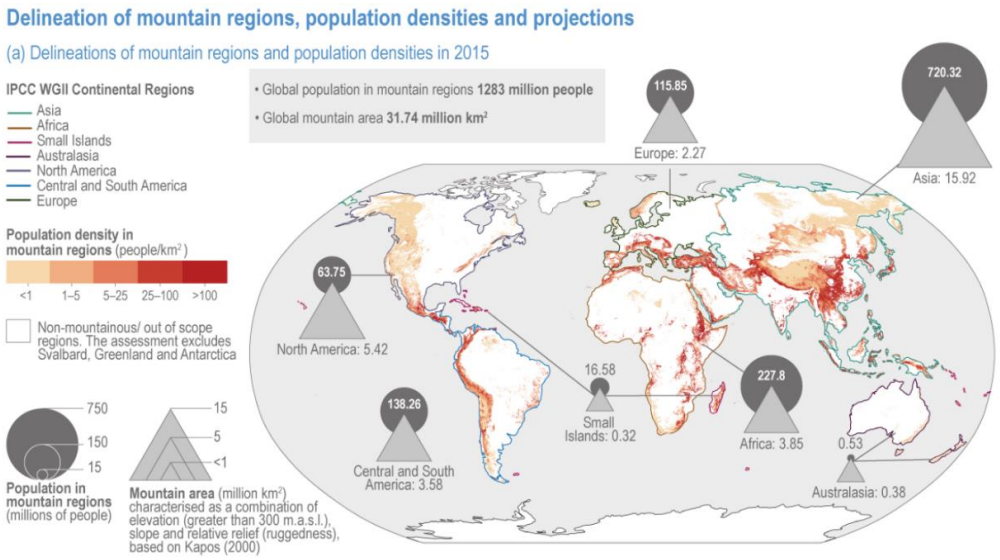

Figure 1. Population density in mountainous regions. Source: Figure CCP5.1 in Adler, C., P. Wester, I. Bhatt, C. Huggel, G.E. Insarov, M.D. Morecroft, V. Muccione, and A. Prakash, 2022: Cross-Chapter Paper 5: Mountains. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2273–2318, doi:10.1017/9781009325844.022.[16]

[15] See footnote 1 above.
[16] See footnote 1 above

Box 1: Climate change impacts on mountains and downstream communities

Livelihoods

The impacts of climate change – such as warming temperatures, glacier melt, permafrost thaw and extreme weather events – have cascading effects on billions of people, including both mountain residents and downstream communities. In the Sápmi region, reindeer herders face challenges such as freezing rain, and permafrost thaw threatens traditional food sources and leads to increased rates of injury, starvation and death among their herds.

Biodiversity

Climate change alters the biophysical attributes of mountainous ecosystems. Changes in snow cover, glacial extent and water availability in both upstream and downstream areas heighten the risk of species extinction. Mountains often serve as climate refuges for low-elevation species, but upward movement of species owing to warming increases the risk of infestation by invasive species. Limited understanding of ecosystem interactions and lack of management of invasive species could exacerbate biodiversity losses in mountainous areas.

Agriculture and food security

Changes in water availability and climate conditions directly impact agriculture and food production in mountainous regions. For example, farmers and herders in Kenya and other African countries have had to adapt by shifting to more climate-resilient crops and livestock, such as moving from raising cattle to raising camels owing to decreasing water availability and shifting seasonal patterns.

Economic impacts

The economic impacts include damage to infrastructure from hazards such as landslides and floods, and disruptions to income-generating activities.

3 Accelerating climate action at scale and at all levels to increase the resilience of mountain ecosystems

Recognizing that mountain ecosystems are complex, fragmented and globally distributed, the solutions to address climate risks to these ecosystems must be context-specific. Resources allocated must match the scale of action required. Countries and communities have developed innovative solutions that can be expanded and adapted to inspire transformational adaptation.

During the dialogue, participants discussed various strategies to accelerate climate action at all levels while focusing on enhancing the resilience of mountain ecosystems. The discussions were organized around key thematic topics: research and systematic observation, the iterative adaptation cycle and loss and damage, mitigation strategies, means of implementation and cross-cutting topics.

Efforts to strengthen the resilience of mountain ecosystems and accelerate climate action can be globally applicable in some cases, while in others they necessitate region-specific approaches. The exchange of experience, data and lessons learned is key to fostering innovation and learning between regions. Breakout session discussions during the dialogue allowed participants to explore solutions tailored to the unique challenges and opportunities within each region.

Several common themes emerged across regions. Under research and systematic observation, all breakout group discussions emphasized the need to improve scientific understanding and monitoring of mountain ecosystems. Discussions related to the iterative adaptation cycle and loss and damage emphasized the critical role of the ecosystem, water and protection forests in maintaining the health and resilience of mountain ecosystems. Under means of implementation, synergies were identified in capacity-building and financial support. Multisectoral approaches to developing capacity-building strategies were noted as effective, while increased financial support was deemed essential to ensuring the successful implementation of adaptation action in mountain ecosystems. Under cross-cutting topics, the involvement of Indigenous Peoples, local communities and multiple sectors in climate adaptation strategies was stressed as important across all regions. Additionally, transboundary governance and cooperation, as well as the inclusion of mountains in national plans and policies, including NAPs, were highlighted as vital to achieving long-term, sustainable solutions for mountain ecosystems.

The annex contains a summary of the key synergies across regions, as well as region-specific solutions and strategies for accelerating climate action, aligned with the relevant thematic topics discussed during the dialogue.

4 Building a collective vision

The current pace, depth and scope of climate adaptation are insufficient to address the escalating risks in mountain regions, especially as global temperatures continue to rise. With warming projected to exceed 1.5°C, the need for urgent adaptation measures in mountains and mountain ecosystems is becoming increasingly critical.[17] Partnerships for joint action need to extend beyond mountainous countries to include downstream countries. The focus should be on sharing knowledge, best practices and synergies related to transnational adaptation solutions.

[17] See footnote 1 above.

Leadership and immediate action are crucial for keeping global warming below the 1.5°C threshold. A temperature rise to 1.5°C presents significant challenges for mountainous regions, where populations are often vulnerable to the impacts of climate change owing to their limited access to essential services. Many mountainous countries are developing countries whose overall contributions to emissions have historically been minimal and who should not be expected to bear the full burden of limiting temperature rise alone, as this could exacerbate loss and damage. Leadership in mountain protection must operate at the local, national and international level, taking into account the unique characteristics of each region and implementing mountain-specific policies and actions while fostering collective efforts. Leadership must be forward-thinking and incorporate local realities and global aspirations to protect mountain ecosystems. Unified and ambitious action plans that address risk, vulnerability, and loss and damage are essential for protecting the unique nature, environment and livelihoods of mountainous regions.

Effective leadership involves mobilizing collective efforts, as exemplified in global frameworks and initiatives. The United Nations General Assembly proclaimed 2023–2027 the Five Years of Action for the Development of Mountain Regions in order to focus on increasing the awareness of the international community of the problems of mountain countries and on addressing the challenges they face.[18] The International Year of Glaciers' Preservation, 2025, led by the United Nations Educational, Scientific and Cultural Organization and the World Meteorological Organization, in cooperation with United Nations Member States and relevant organizations of the United Nations system, aims to raise global awareness of the critical role of glaciers, snow and ice in the climate system and the hydrological cycle, and the economic, social and environmental impacts of the impending changes in the cryosphere, as well as to encourage the exchange of knowledge and best practices regarding glacier preservation and adaptation strategies. Other initiatives include the Mountain Partnership,[19] an international voluntary alliance dedicated to improving the lives of mountain peoples and protecting mountain environments around the world, and existing regional mountain governance frameworks such as the Alpine Convention,[20] the Carpathian Convention[21] and the Andean Mountain Initiative.[22]

Scientific knowledge is crucial for ensuring informed decision-making and resilience-building in key sectors such as agriculture and water resources. Research and systematic observation and scientific reports often overlook the specific needs of mountain ecosystems. Integrating socioeconomic dimensions into spatial observations of mountains could help address data and observation gaps by increasing consideration of mountains in scientific reports and taking into account regional and local contexts. Prioritizing in situ and remote sensing for monitoring mountain terrains is crucial for generating data and knowledge that help inform mitigation and adaptation decisions.

Efforts must be intensified to build the resilience of mountain ecosystems in a coordinated and coherent manner. Partnerships must extend beyond mountainous countries to include downstream nations, with an emphasis on sharing knowledge, best practices and synergies to develop transnational adaptation solutions. Leadership in adaptation action in mountain ecosystems must transcend national borders, with mountainous countries forming alliances to emphasize the unique climate challenges they face.

[18] United Nations General Assembly document A/RES/77/172.
[19] See https://www.fao.org/mountain-partnership/about/secretariat/.
[20] See https://www.alpconv.org/.
[21] See http://www.carpathianconvention.org/.
[22] See https://iam-andes.org/.

The sparse populations and remote locations of many mountain regions often make it difficult for their inhabitants to be a part of decision-making processes. Leadership must ensure community involvement and the targeted dissemination of information to protect these vulnerable ecosystems. Diversifying adaptation and mitigation measures is essential for supporting livelihoods in these mountain communities and empowering conservation efforts. Integrating local knowledge with scientific data will provide robust socioecological insights. Collaborative planning involving Indigenous Peoples, local communities, women and youth is critical for addressing climate-induced vulnerabilities in mountain regions.

A collective and unified understanding of social, environmental and economic roles of mountains and climate impacts and adaptation strategies for mountain ecosystems is necessary, for example through holding targeted science–policy dialogues that can catalyse action and drive sustainable solutions for mountain ecosystems.

5 Enhancing consideration of mountains under and outside the UNFCCC process

At the policy level, governments must prioritize the unique needs of mountain communities while recognizing the diverse challenges and opportunities for adaptation across regions. Unified and ambitious action plans for mountainous countries, including NAPs and new NDCs, are crucial for highlighting the inclusion of distinct plans related to mountain ecosystems, including risks, vulnerabilities, loss and damage, while safeguarding the distinct environments and livelihoods that depend on mountain ecosystems. Policies should provide targeted adaptation solutions and initiatives to mitigate climate impacts that acknowledge that mountains are fragile ecosystems experiencing higher warming rates than the global average, with potentially disastrous effects. Mountainous countries should form regional alliances to address their unique climate challenges. Incorporating specific consideration of mountains and addressing the vulnerability and importance of mountains in NAPs is crucial for fostering adaptation action in countries. NDCs should include adaptation and resilience strategies for mountain ecosystems in relation to other United Nations conventions, such as those on desertification and biodiversity, as well as for financial mechanisms that align with the 1.5°C limit. Undertaking mapping of how considerations of mountains have been included in existing NDCs could be helpful, for example, in identifying good adaptation practices in relation to implementing emission pathways and guiding the development of the next round of NDCs.

Additional ways to enhance consideration of mountains under the UNFCCC process shared during the expert dialogue include:

- Engaging in dialogues on mountain-based climate action to ensure that mountain ecosystems are fully represented in adaptation and resilience strategies, as well as to enhance consideration of the matter under and outside the UNFCCC process;
- Recognizing that the outcome of the first global stocktake, as part of the United Arab Emirates Consensus, offers a road map that lays out the actions needed to stay below a 1.5°C increase through 2030 by reducing emissions, while acknowledging that enhancing mountain resilience to climate change is crucial to boost implementation of the actions;
- Contributing to achieving the targets under the global goal on adaptation, within the context of the United Arab Emirates Framework for Global Climate Resilience, with a specific focus on mountain ecosystems, and addressing the transboundary nature of climate change impacts and risks;
- Promoting the exchange of evidence-based knowledge and fostering the development of context-specific insights and know-how tailored to the unique challenges of mountain ecosystems in the context of the Nairobi work programme.

Annex: **Overview of key synergies across regions and region-specific solutions and strategies**[23]

	Thematic topics				
Regional coverage	*Research and systematic observation*	*Dimensions of the iterative adaptation cycle and loss and damage*	*Mitigation strategies*	*Means of implementation*	*Cross-cutting topics*
All regions	Scientific coverage of mountain ecosystems needs to be improved regionally and globally. Enhanced scientific coverage should include monitoring and evaluation of mountain areas, in addition to impact and risk assessments.	Conserving ecosystems and biodiversity and practising sustainable agriculture and forestry are critical parts of an effective adaptation effort. Management of rivers, snowpacks and glaciers offers solutions to accelerate climate action.	Conserving forest resources and advancing clean energy technologies are key mitigation strategies used in mountainous regions.	*Financial support*: priority for funding was placed on improving scientific coverage of mountain ecosystems during group discussions for Africa, Asia and the Pacific, and Eastern Europe. Economic diversification was the funding priority for Western Europe and other States, while discussions for Latin America and the Caribbean prioritized the need to consider financial support and institutional aspects for strengthening regional and national decision-making platforms. *Capacity-building*: multisectoral approaches that include Indigenous Peoples and local communities, and the private sector lead to strong climate adaptation strategies. For example, the Pyrenean Climate Change Strategy exemplifies an integrated approach that unites specialists in economics, social systems and resource management to develop scalable adaptation solutions.	Local community engagement and the integration of Indigenous knowledge with scientific research are crucial for implementing effective climate action. Indigenous Peoples living in mountain regions help with adaptation and resilience measures by conserving globally important biodiversity hotspots using ancestral knowledge systems, values, and conservation practices as well as customary laws. There is a crucial need for transboundary governance, regional cooperation and knowledge-sharing across borders.

Presentations from group discussions are available at https://unfccc.int/event/expert-dialogue-on-mountains-and-climate-change

Africa	Scientific coverage of mountain ecosystems needs to include comprehensive risk assessments covering vulnerabilities in the region.	Adaptation solutions should focus on the relationship between well-functioning ecosystems and the economic viability of communities' livelihoods.	Mitigation strategies have focused on large-scale plantations.	*Financial support and technology development and transfer*: investment in developing scientific forecasting technology is needed to facilitate monitoring and evaluation of risk reduction interventions.	New livelihood opportunities can be transformative when they support ecological conservation or agricultural sustainability. For example, a non-governmental organization in Uganda promotes beekeeping as a new livelihood opportunity that empowers women, supports the local economy and bolsters food systems. There is a need for effective transboundary action. For example, Lesotho's Orange River basin, a vital water source for southern Africa, requires transboundary adaptation strategies.
Asia and the Pacific	Owing to an increase in the scientific coverage and adaptation efforts taking place, a collective regional database should be created to increase data-sharing. To ensure a balanced representation of matters relating to mountains in research and assessment, it is crucial to nominate experts on mountains to relevant bodies, such as the IPCC.	There is an urgent need to address gender disparities relating to climate change impacts and adaptation in mountain ecosystems. Adaptation solutions should focus on the relationship between well-functioning ecosystems and the economic viability of community livelihoods.	The clean energy transition is being prioritized as a means of climate change mitigation in mountain ecosystems. For example, collaborative efforts among governments, private companies, and local communities have led to the development of sustainable hydropower projects that provide clean energy and support local livelihoods in the Hindu Kush Himalaya region.	*Capacity-building*: climate education is needed to change behaviors in communities and governments at the local, regional and global level.	Engagement of local communities, such as a community-based forest management regime, has resulted in increased forest cover and subsequent carbon sequestration in Nepal.

Eastern Europe	Research and modelling of mountain ecosystems should be conducted across a range of emission pathways. Observation systems should be widely covered in mountain ecosystems to increase understanding, particularly for monitoring glacial changes.	Industrial activities, such as mining, pose a challenge by degrading mountain ecosystems. Climate adaptation plans for mountain regions need to integrate consideration of these activities to ensure comprehensive protection and sustainable management. Gender considerations should be prioritized in adaptation planning. For example, in Azerbaijan, women bear the responsibility for collecting water from glacial streams. As glaciers recede, women are forced to travel greater distances, which increases their workload and reduces the time available for other activities.		*Capacity-building*: capacity-building efforts for multisectoral stakeholders are essential for enhancing data-collection systems to support effective adaptation and restoration efforts.	The Carpathian Convention provides a legal and operational framework for the protection and sustainable development of the Carpathian mountain range shared by seven Eastern European countries.
Latin America and the Caribbean	Large-scale climate adaptation projections and scenarios should be adapted to the local level to accommodate the heterogeneity and specificity of local contexts.	Infrastructure should be considered an important topic within risk management. Greater emphasis should be placed on addressing gender disparities in climate impacts and adaptation.	Quantifiable and standardized data on mountainous vegetation have been used to demonstrate the role of forests in mitigation.	*Financial support:* funding is crucial for building and managing infrastructure that can help mediate climate change impacts. Given the challenges for local communities to engage in decision-making processes, funding is also essential to ensure their participation and representation in negotiation spaces.	Water provision across mountains in Puerto Rico and Peru serves both mountain and downstream communities. Examples of ecosystem-based adaptation include water management, traditional technologies (e.g. irrigation, cochas), grazing systems and pasture management, and participatory approaches for monitoring (e.g. mountain fires in Colombia).

Latin America and the Caribbean					There is a crucial need for transboundary governance, regional cooperation and knowledge-sharing across borders. Regional platforms such as the Andean Mountain Initiative and dialogues such as the Minga de la Montaña in Ecuador have fostered transboundary collaborative efforts in the Andes.
Western European and other States	Indigenous knowledge and scientific observations should be compared and used to complement each other in support of mountain communities. For example, collaboration between the Woodwell Climate Research Center and the Sámi people has been mutually beneficial: the Sámi gained technical knowledge and improved snowpack projections for reindeer husbandry, while Woodwell received real-time data on snowpack and land-cover changes. Climate projects relating to mountain ecosystems should be translated from the local to the global level and from the global to the local level.	Adaptation solutions should focus on the relationship between well-functioning ecosystems and the economic viability of community livelihoods. Regional knowledge-sharing and cross-border collaboration grounded in research observations should be prioritized to advance adaptation efforts in mountain ecosystems.	Strategies are needed to increase the focus on preventing maladaptation in mountain ecosystems.	*Capacity-building*: climate education needs to be expanded to mountain communities, mountain-dependent cities and downstream areas to build capacity and change behaviors related to both mitigation and adaptation. *Technology development and transfer*: enhanced observation systems are needed to broaden the scope and coverage of monitoring the impact of climate change on the complex dynamics of mountain ecosystems.	Transformational adaptation was defined in the breakout group discussion for this region as action that makes significant changes in how communities use land. These changes may include shifting the focus of economies and Indigenous Peoples in decisions relating to land use and using replacements for fossil fuels.