



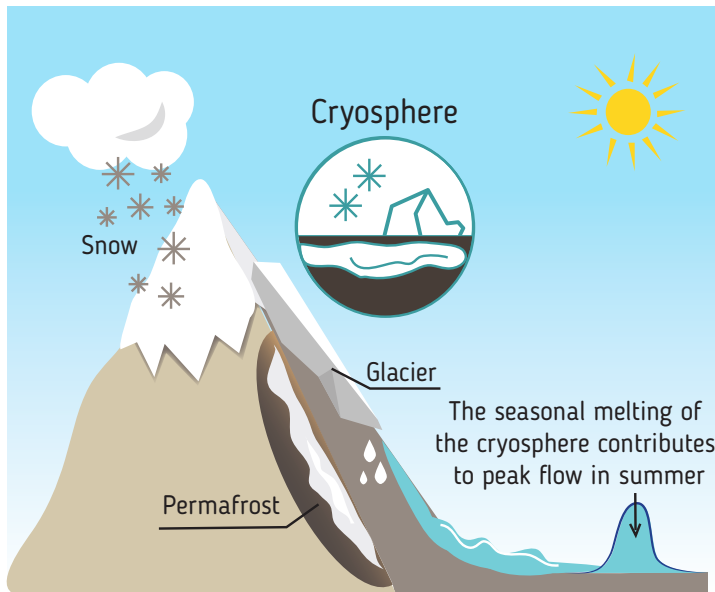
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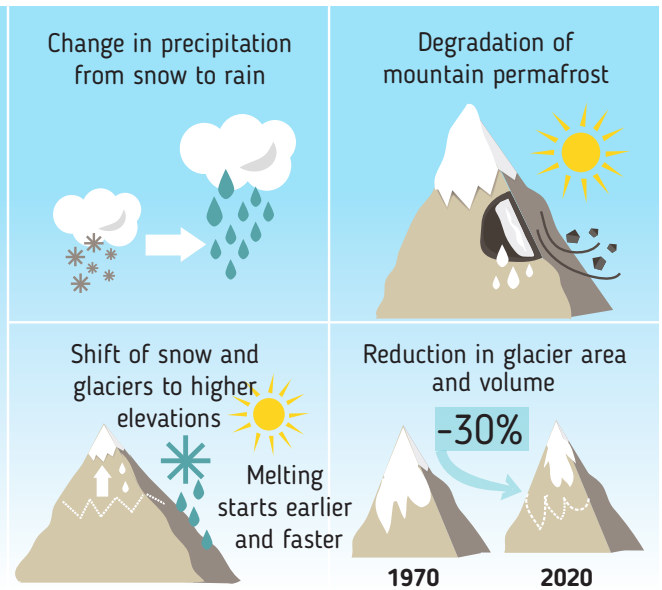
IMPROVING THE KNOWLEDGE OF CENTRAL ASIA GLACIERS AND THE RESILIENCE TO CLIMATE CHANGE



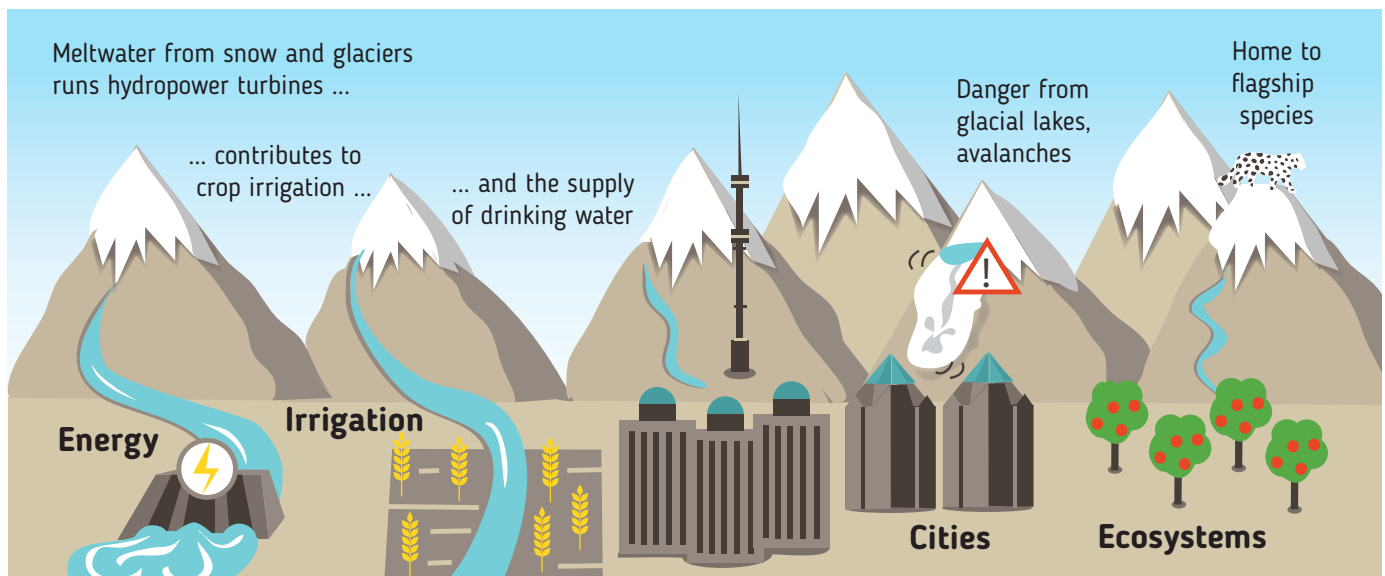
What is the cryosphere?



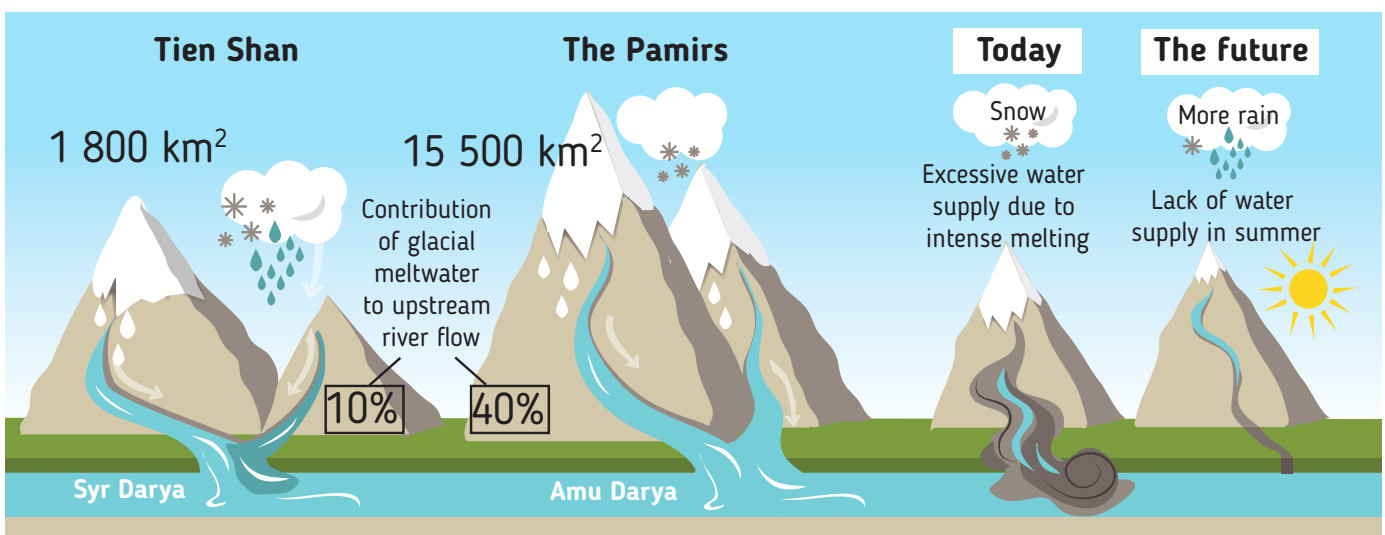
Changes in the cryosphere



The cryosphere in Central Asia



Water and the cryosphere



THE CRYOSPHERE: WHY DOES IT MATTER?

Around the world, demand for freshwater is rising while scarcity becomes an ever more pressing problem, making water insecurity a major global threat to sustainable development. In Central Asia, meltwater from glaciers, mountain snow and frozen soil – collectively referred to as the cryosphere – turns hydropower turbines, supplies irrigation downstream, and sustains domestic water use, like that for drinking and sanitation, in densely populated valleys and cities. Economic and population growth lead to greater demand, and thereby competition, for water.

The glaciers in the mountains of Central Asia are found at high elevations – 3 000 meters and higher. They vary in size from tiny to massive, some covering many square kilometers. Half of the area of both Kyrgyzstan and Tajikistan is located above the clouds at high altitudes forming the Tien Shan and Pamir Mountains respectively. They are home to unique and emblematic species of plants and animals, most famously the snow leopard. Many of these species and ecosystems, shaped as they are by frequent frosts and freezing temperatures, are adapted to extreme weather, yet they remain sensitive and vulnerable to climate warming.

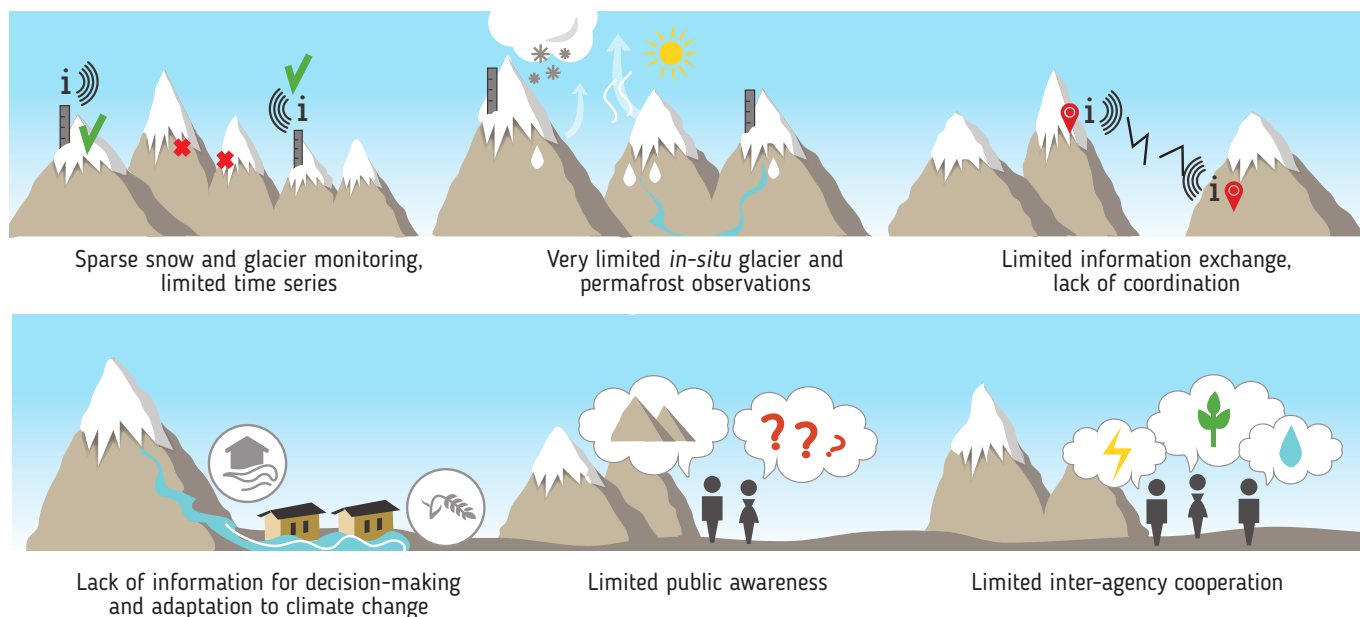
THE CRYOSPHERE, CLIMATE CHANGE, AND WATER LINKAGES

The cryosphere of the Tien Shan Mountains contributes meltwater to the Syr Darya river basin and the Pamir Mountains to the Amu Darya basin. In addition to visible, surface glaciers and snow, the high-elevation cryosphere includes subterranean ice, rock glaciers, moraines, and permafrost. The special report of the Intergovernmental Panel on Climate Change (IPCC) highlights the general decline in snow cover, glaciers, and permafrost due to climate change. Central Asia's glaciers shrank by 20–30% over the last 50 years.

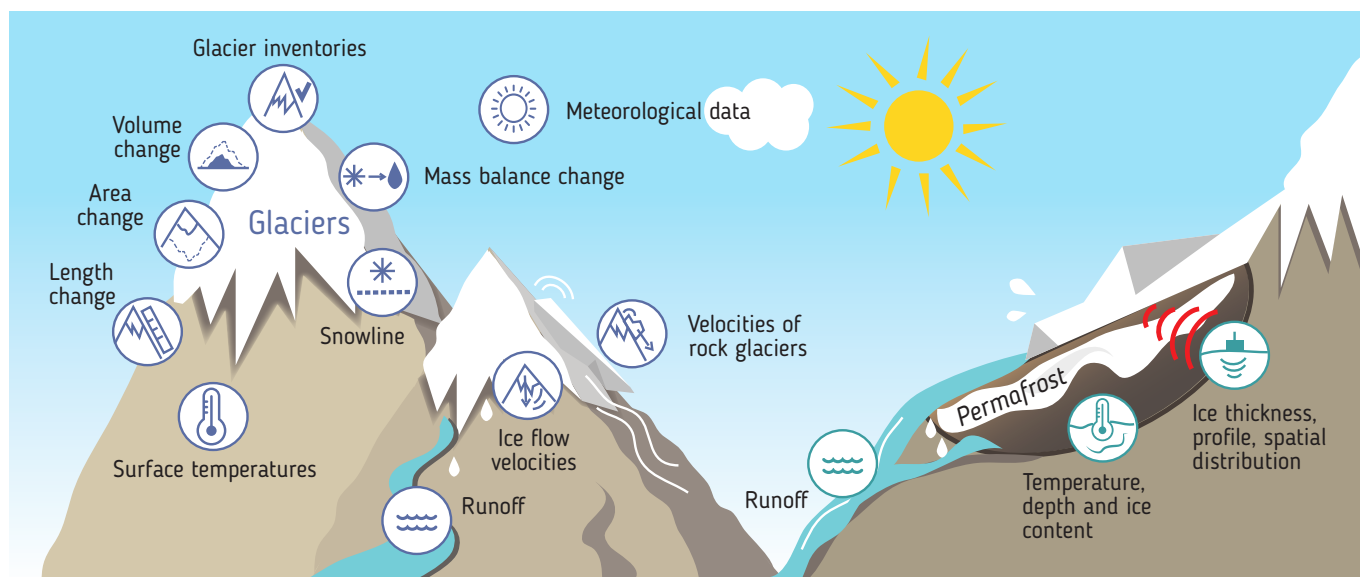
Climate change is impacting the supply of water from glaciers. As they melt, glaciers initially supply larger quantities of water with a gradual decline in flow as their volume decreases. Due to global warming, more precipitation will fall as rain rather than as snow. As a result, the monthly water flow of rivers will change, and they will face more pronounced year-to-year water variability. Such a change can intensify ecological problems, exacerbating the lack of water for irrigation when it is most needed.

For Central Asia, glaciers are vital long-term natural reserves of freshwater that provide critical water not only in drought years but every summer, when water is most in demand for irrigation. The main river systems of Central Asia are dependent on the melting of snow and ice in their headwaters. Downstream countries with hot and dry climates such as Turkmenistan and Uzbekistan are highly dependent on water which originates in the upstream zones beyond their borders.

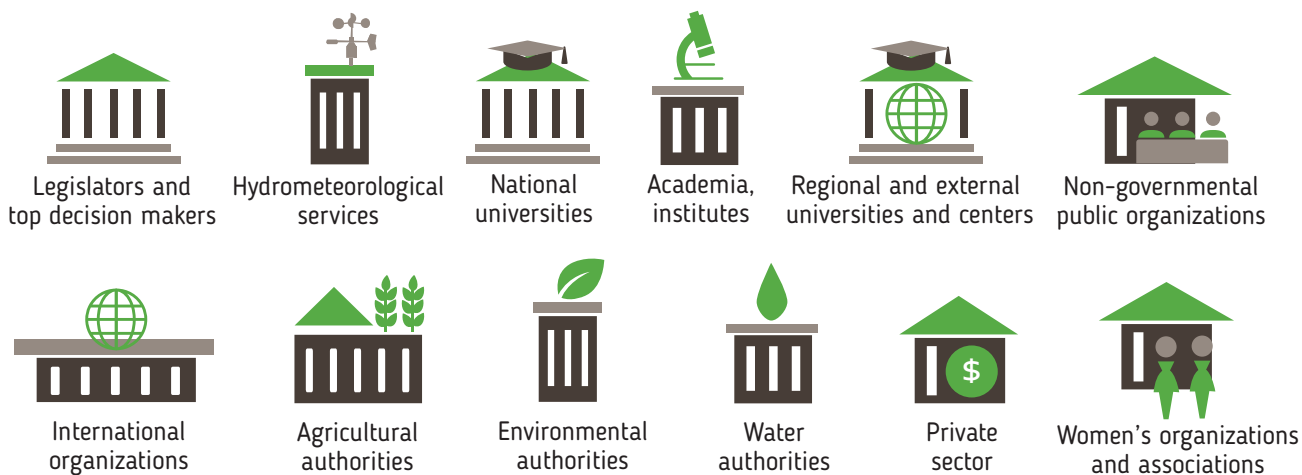
Gaps in knowledge and monitoring of the cryosphere



Key elements of cryospheric monitoring



Beneficiaries



BARRIERS AND LIMITATIONS

Monitoring glaciers is key to understanding and mitigating the risks to Central Asia's changing cryosphere, but this task faces several barriers.

The key gaps to overcome are:

- **Lack of information for decision-making:** We lack adequate data on glacier mass balance, snow coverage, permafrost, and their contributions to the availability of water for the region as a whole. Besides, the capacity to gather this data is distributed unevenly across the nations of Central Asia. Although actions are being taken to improve the situation, large amounts of data remain disputed, or absent.
- **Lack of coordination:** The existing network of glacier monitoring is incomplete and inadequate for assessing changes in glaciation, other aspects of the cryosphere, and their possible influence on water resources. There are no standard monitoring protocols.
- **Lack of an effective mechanism for regional cooperation:** While there are channels for regional dialogue on a variety of topics, including water, there is no specific mechanism for addressing glaciers.
- **Lack of awareness:** Without outside support to maintain the domestic and regional capacity on glacier monitoring, the outlook for the management of water originating from high-mountain areas in Central Asia is poor.

BENEFITS OF GLACIER MONITORING

The planned project under the Global Environment Facility and jointly with the UN Development Programme aims to improve the knowledge and monitoring of all key components of the cryosphere: glaciers, snow and permafrost, and support practical climate adaptation measures in the five nations of Central Asia.

Data and research on glaciers present various benefits for different stakeholders. About 1 500 people will directly benefit from the GEF project implementation. At least 50 people per country, involving youth and women, will benefit from the training on research, analysis, and cryosphere monitoring provided by the project. An additional 250 people in each country, at least half of which will be women, will benefit from the skill-development and awareness-raising involved in demonstration projects on climate change adaptation. Further, thousands of people will indirectly benefit from the data digitalisation, institutional enhancements, policies, and projects aimed at improving water management in Central Asia.

Besides, various components of the project will attract different types of beneficiaries. For example, capacity strengthening activities related to glacier monitoring and analysis will target researchers and policy-makers, while activities to demonstrate adaptive technologies and practices in water management will involve upstream and downstream communities. High-mountain communities will be engaged in the activities as, in rural and remote localities, they have limited options for making a living. They are also host to some particularly vulnerable members, such as households headed by women, the elderly, and residents with disabilities. The project team will engage a gender expert and a safeguards expert, who will monitor the equitable and meaningful participation of community members in demonstration projects and in both the regional strategic action plan and the national action plans. All of the project's activities and outcomes will be monitored for compliance with the UN pledge that "no one will be left behind."

ABOUT THE GEF PROJECT

The **objective** of this UNDP implemented, UNESCO executed project is to “Strengthen the adaptation capacity of Central Asian countries to the impact of climate change on the cryosphere through assessment, the promotion of regional cooperation, and stakeholder engagement.” The project will strengthen regional cooperation, cooperation among scientists and institutions, and knowledge-sharing and dialogue. The glacier monitoring will inform climate adaptation actions to increase the resilience both of populations and of downstream areas that face climate risks.

A platform will be developed in which Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan will share their knowledge and experience in cryosphere monitoring and the impact of melting glaciers on water availability while providing scientific basis to national and regional strategies on climate adaptation.

The project contributes to one of the objectives of the GEF Strategy “Enhance regional and national cooperation on shared freshwater surface and groundwater basins” and is aligned with key national strategies and plans, including the commitments

on international environmental agreements.

The project has five components that address different needs and each has their own expected outcomes.

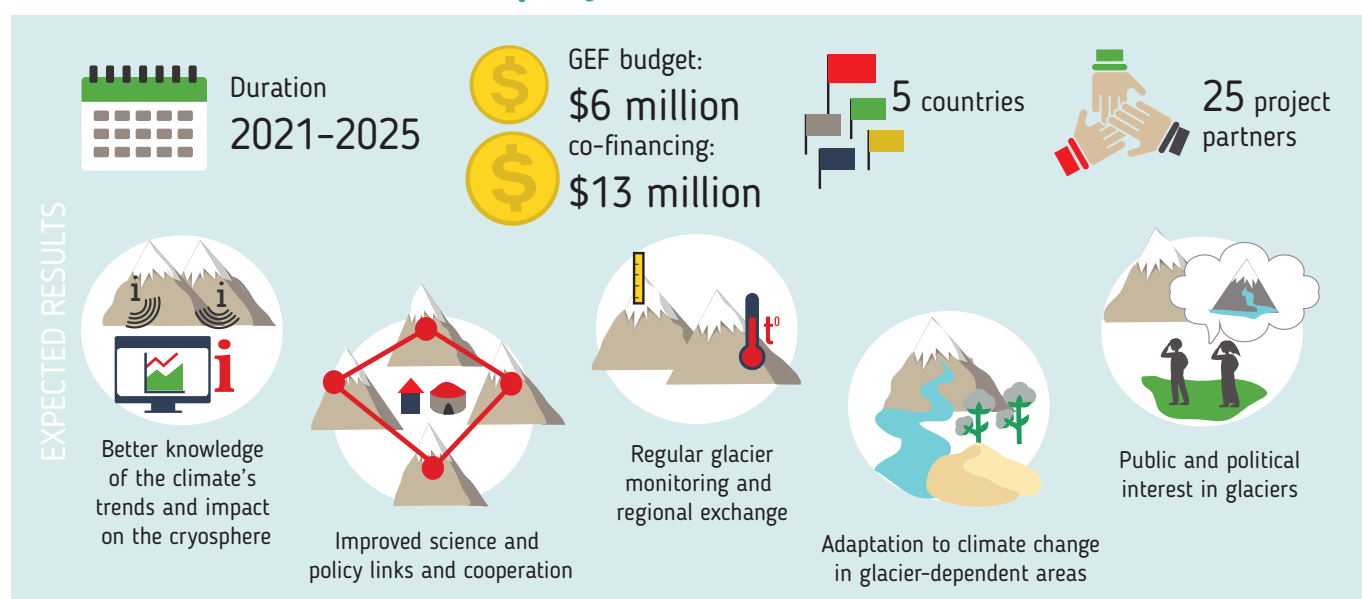
Component #1: Consolidating shared knowledge in a unified database of cryosphere information

Joint fact-finding and exchange of information between the participating countries will lead to a science-based consensus on the key problems and trends involving high-elevation glaciers, snow, water, and permafrost. This component will focus on broadening the knowledge base both on the dynamics of the region’s cryosphere and on the expected impact climate change will have on the cryosphere and the resulting impact on the availability of water resources.

Outcomes:

- A science-based consensus among the Central Asian nations on the major challenges from melting glacial snow and permafrost, particularly water availability both upstream and

The project in a nutshell



downstream within the region

Asian countries

- Stakeholders have a greater understanding of changes in the cryosphere and the implications that climate change is expected to have for the region

A visioning process and an agreement on priorities for action open the way for systematic cooperation on the cryosphere in Central Asia. This will lead to the preparation of national action plans and the endorsement of a regional strategic action program (SAP).

Component #2: Building a foundation for regional cooperation on the cryosphere among Central

Project activities and outcomes

1. Knowledge and information database

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Diagnostic analysis (DA): changes in the cryosphere



National databases on the cryosphere



Glacier vulnerability and hazards



Climate, glacial and water scenarios

2. National and regional cooperation and centres

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National action plans (NAPs)



Regional Strategic action plan (SAP)



Inter-agency cooperation



National and regional centers and forums

3. Capacity for cryospheric monitoring

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The regional glacier monitoring protocol



Regional knowledge exchange and training



National cryospheric monitoring programs



Assessment and forecasting of the climate's impact on the cryosphere

4. Training and demonstrating adaptation to climate change

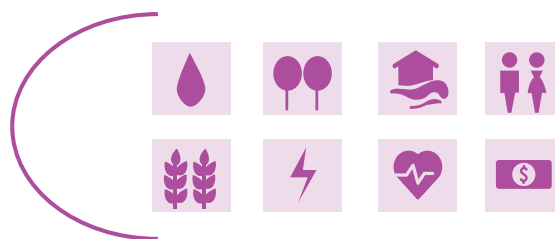
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Trainings



Projects in 5 countries



5. Public awareness and engagement

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Virtual reality tours of glaciers



The project website, linked to IW:LEARN



Events and conferences



Stakeholder engagement

the impact of climate change on the cryosphere.

Outcomes:

- Countries have national action plans and a regional strategic action program (SAP)
- National and regional institutions are in place to make national action plans and the SAPs a reality

Component #3: Strengthening the capacity in Central Asian countries to monitor the cryosphere

This component will result in a coherent and coordinated monitoring program covering all countries of the region and their improved capacity to conduct advanced monitoring. Glacier monitoring will be developed in cooperation with Swiss and international initiatives, such as Glacier Monitoring of Switzerland (GLAMOS), Permafrost Monitoring of Switzerland (PERMOS), Global Terrestrial Network for Glaciers (GTN-G) coordinated by the World Glacier Monitoring Service (WGMS) and the Global Terrestrial Network for Permafrost (GTN-P).

Outcomes:

- Countries use international good practice and apply a standard approach to monitor the cryosphere in Central Asia
- Countries have a better capacity to undertake monitoring and apply skills in water management and the resilience to cope with cryosphere hazards

Component #4: Demonstrating technologies and best practices for integrated water resource management and adaptation to climate change in glacier- and snow-fed river basins

Cooperation on the assessment of the cryosphere in Central Asian countries will be strengthened by piloting new technologies and sound approaches suitable to the local ecosystems. All of the countries will benefit from measures for adapting to

Outcome:

- Countries use innovative technologies and best practices for integrated resource management in the cryosphere

Component #5: Increasing awareness and involvement of key stakeholders

A range of activities will be implemented to engage the general public, water users and the private sector into implementation of solutions and raise awareness among decision-makers. Virtual reality visualization of selected Central Asian glaciers and simulation of climate change impacts will be used for interactive presentations to school and university students and the general public to demonstrate climate sensitivity of glaciers. A project website, information materials and special events will contribute to greater dissemination of project findings.

Outcome:

- Decision-makers and the public are aware of the economic and social impacts of the changing cryosphere

