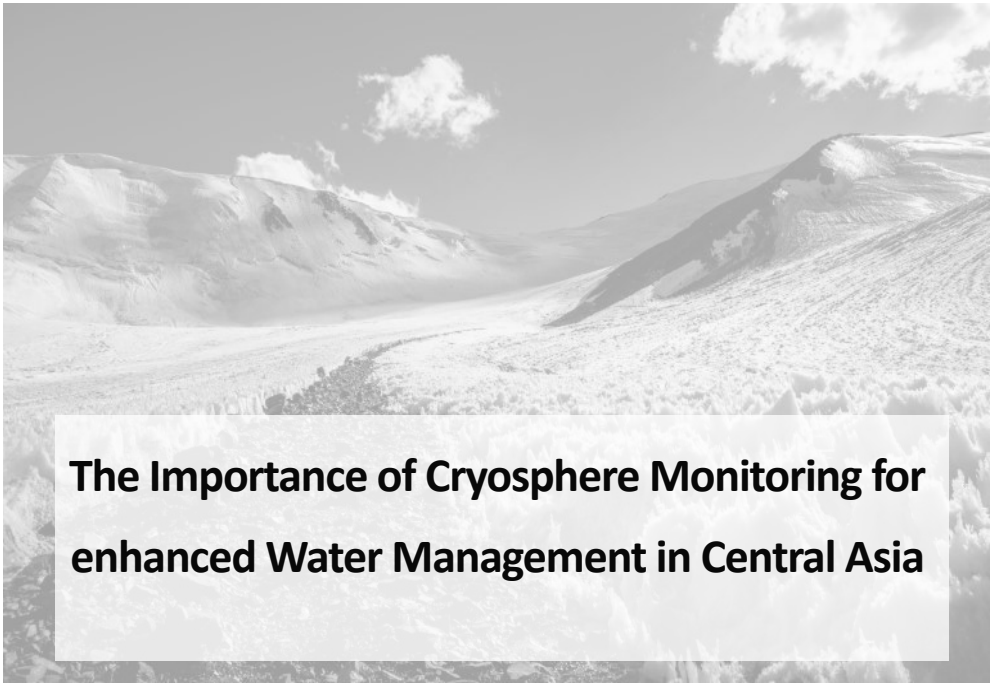

The Importance of Cryosphere Monitoring for enhanced Water Management in Central Asia

This policy brief, prepared by the University of Fribourg (Switzerland) as part of the **Cryospheric Observation and Modelling for Improved Adaptation in Central Asia** (CROMO-ADAPT) project and the **GEF-UNDP-UNESCO Cryosphere** project, highlights the importance of maintaining, updating, and expanding the cryospheric monitoring network and collaborative data exchange mechanisms across Central Asia.

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The Mountain Cryosphere under Pressure

In Central Asia, glaciers, snow cover, and frozen ground or "permafrost" - collectively known as "mountain cryosphere" serve as vital water storage. The seasonal melting of the cryosphere sustains the river system of Central Asia at critical periods, when water demand is highest for irrigation. Climate change is impacting the cryosphere and altering river runoff. It is likely that high water availability until mid-century will be followed by severely less water due to receding glaciers. This will pose risks of **extreme hydrological and associated hazardous events**, threatening infrastructures and human livelihoods.

In the future, there is likely to be an increased risk of

Slope Instability

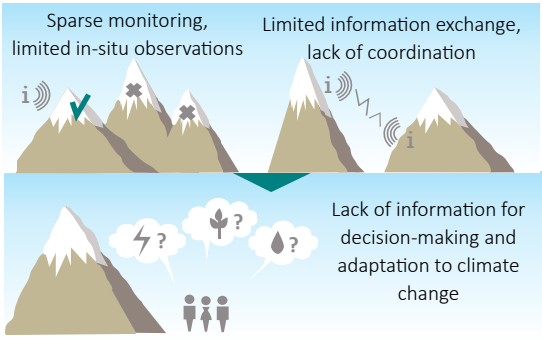
Floods and Inundations

Water Shortages

Water management and Disaster risk reduction strategies are needed to adapt to climate change impacts on the mountain cryosphere and on the water supplies.

Overcoming Data Drought to improve Water Management

There are barriers to the development of effective water and risk management strategies in Central Asia. Gaps in the cryosphere monitoring networks, limited data exchange and lack of coordination limit the knowledge of ongoing and future changes in the cryosphere. As a result, forecasts and predictions for water supplies are unreliable, leading to inefficient and disconnected management practices.



The Solution: A 3 Phased Approach to develop Water Management Strategies

The set up of a monitoring network of glaciers, snow and permafrost

to build long-term records of variables

The conversion into user-oriented cryospheric information services

to feed models and predict future conditions

The development and testing of strategies in pilot projects

to refine and validate effective policies

Collaborative efforts are now essential to establish a joint approach to science-based water resource management. CROMO-ADAPT (2021-2025) and GEF-UNDP-UNESCO Cryosphere project (2022-2026) assist national and regional institutions in this endeavor by developing a cryosphere monitoring network and data exchange mechanisms.

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Enhancing Cryosphere Monitoring in Central Asia

Since 2010, significant efforts have been made to establish a modern cryosphere monitoring strategy in Central Asia. The initiatives started with the German government-funded CAWa (2008-2011), followed by the Swiss government-funded CATCOS (2010-2017) and CICADA (2017-2020) projects. These projects laid the groundwork by investing in capacity-building and infrastructure development.

Independent Operations: These investments have resulted in the establishment of a robust glacier monitoring network, which is now managed almost independently by local institutions. This network provides high-quality data that is crucial for understanding and responding to cryospheric changes.

Expansion to Snow and Permafrost Monitoring: The ongoing **CROMO-ADAPT project (2021-2025)** is further enhancing the network by incorporating snow and permafrost monitoring. This expansion ensures a comprehensive understanding of the cryosphere.

Supporting Regional Adaptation

In parallel, the **GEF-UNDP-UNESCO Cryosphere project** (2022-2026) builds knowledge and capacity for effective adaptation to cryospheric changes. By providing training and resources, the project empowers local decision-makers and environmental agencies to develop and implement informed strategies for climate resilience and adaptation.

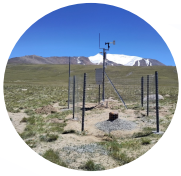
The Monitoring Network

The cryosphere monitoring network in Central Asia uses remote sensing, permanent ground-based stations, and annual measurement campaigns

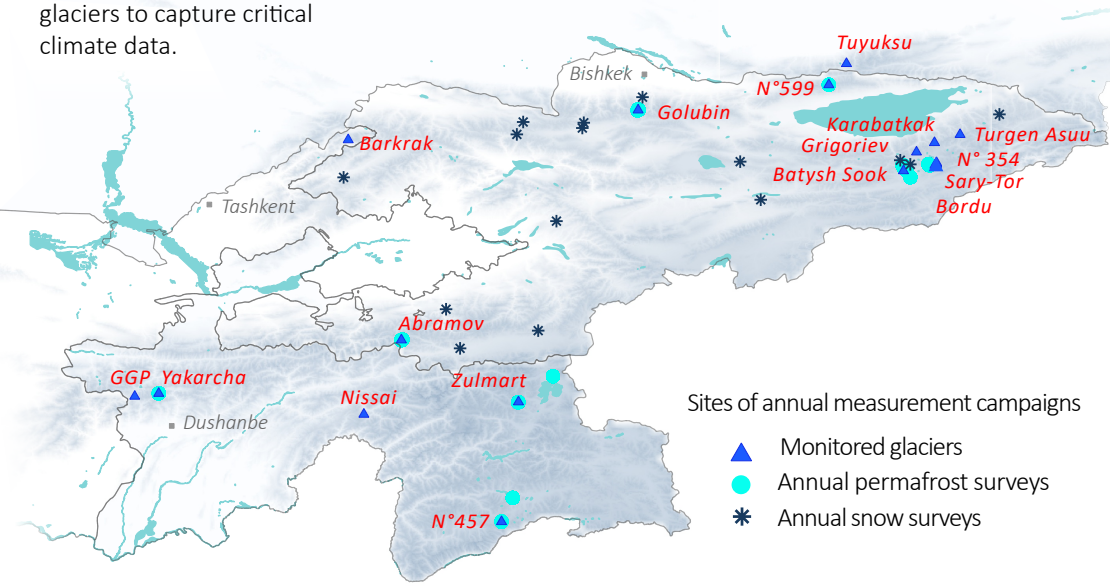
Monitoring Infrastructure

8 Meteorological Stations: Strategically located near glaciers to capture critical climate data.

5 Permanent Permafrost Monitoring Setup: Providing continuous data on permafrost conditions.



30 Snow Survey Sites: Ensuring detailed snow cover and melt data.



Capacity Building (2010 - 2023)

Local scientists have been trained to monitor the cryosphere according to international standards. Training began in 2010 for glaciers and in 2021 for permafrost and snow.

Key achievements

400 Local Scientists Trained: Equipping them with the skills to perform high-quality monitoring.

60 Participants in Summer Schools: Offering intensive, hands-on learning experiences.

14 Study Visits to Switzerland: Providing students with international exposure and advanced training.

11 PhD Students Supervised: Ensuring the next generation of cryosphere experts is well-prepared.




Gender Balance in Capacity Building: Promoting the involvement of women in science through the "Adventure of Science: Women and Glaciers in Central Asia" program (https://www.inspiringgirls.org/homeru).

Future Goals:

In the coming years, extensive cooperation among Central Asian stakeholders will be crucial to 1) **Sustain the Monitoring Network:** Ensuring continuous and reliable data collection 2) **Develop Knowledge Products**: Transforming collected data into actionable insights. 3) **Integrate Knowledge into Policy-Making**: Informing effective environmental policies.

A total of **$4.1 million** will be invested within the CROMO-ADAPT project (2021-2025) and GEF-UNDP-UNESCO Cryosphere project (2022-2026) between 2021 and 2026 to support these initiatives and ensure their long-term success.

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Recommendations for Stakeholders in Central Asia

Policy-relevant Knowledge about the Cryopshere of Central Asia

Establish, maintain, and regularly update monitoring networks for the cryosphere.

Develop and expand cryospheric data exchange platforms and mechanisms.

Ensure the systematic conversion of cryospheric data records into user-oriented cryospheric infomration services.

Promote the use of cryospheric services to generate policy-relevant knowledge.

Promote Science-based Policy-making for Water Management

Organize round-tables between the scientific community and stakeholders involved in water management issues.

Integrate the knowledge of the cryosphere into the development of water management policies and practices.

Enhanced local and national Expertise in Cryospheric Research

Allocate resources to enhance the capacity of stakeholders involved in cryospheric monitoring.

Enhance collaboration with national and international institutions involved in cryospheric research.

Encourage the participation of the public in citizen science initiatives.

Raise Awareness on the Importance of the Cryosphere

Increase public outreach to raise awareness about the current and predicted changes of the cryosphere and its impacts on communities and livelihoods.

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Expected benefits

Relevant Knowledge

- Improved understanding of ongoing changes in the Central Asian cryosphere.
- Increased access to cryospheric data for national and international researchers.
- Increased local expertise in the collection and production of high-quality cryospheric data.
- Improved river runoff predictions with more solid climate services.

Informed Community

- Facilitated access to relevant cryospheric information services for stakeholders, such as policymakers, resource managers, and the public
- An informed and engaged community of stakeholders , local organizations and local residents

Science-based Decision-making

- Science-based decision-making for water resource management, disaster risk reduction, and adaptation strategies in Central Asia.

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