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CRYOSPHERE PROJECT | in Central Asia

GEF–UNDP–UNESCO CRYOSPHERE PROJECT

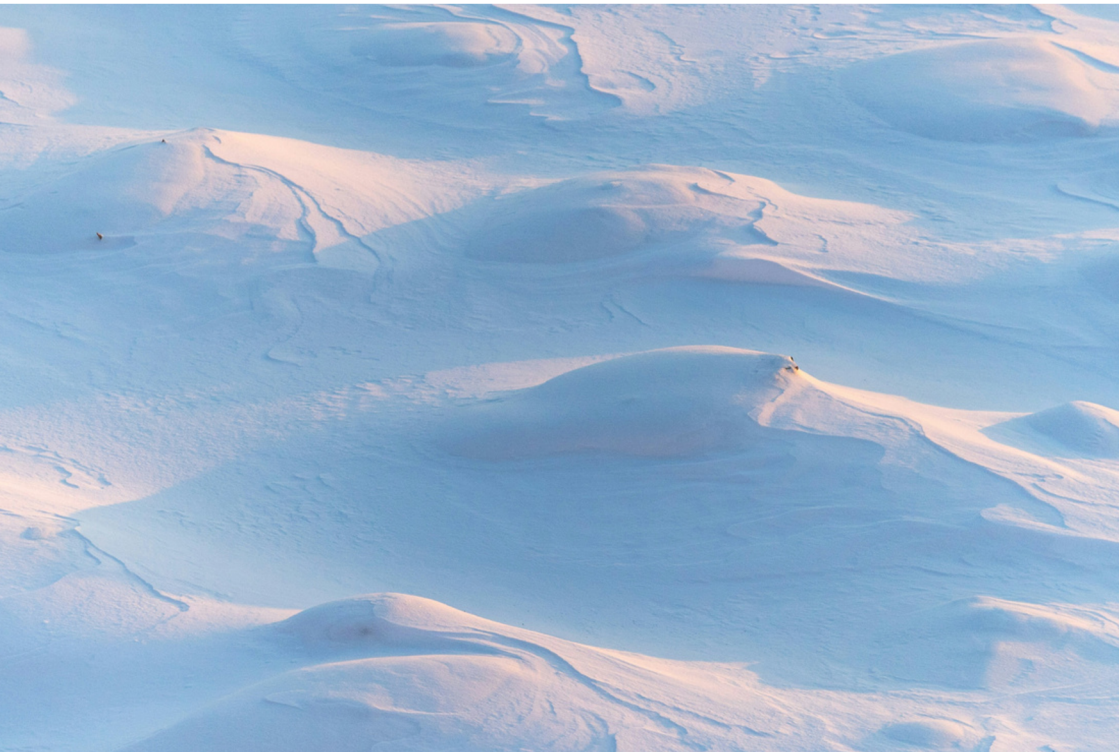
DIAGNOSTIC ANALYSIS OF THE CRYOSPHERE IN CENTRAL ASIA

Defining challenges, driving regional solutions

Water resilience starts in the mountains

Central Asia's water security is increasingly under threat due to rapid and uneven changes in the mountain cryosphere. Shifting snow cover, glacier melt, and permafrost degradation are already altering surface water regimes, posing serious risks to ecosystems, infrastructure, and people.

To support regional adaptation, the GEF–UNDP–UNESCO *"Strengthening the resilience of Central Asian countries by enabling regional cooperation to assess glacio-nival systems to develop integrated methods for sustainable development and adaptation to climate change"* project helps countries strengthen scientific knowledge, enhance cooperation, and connect climate science with policy. As part of this effort, a **Diagnostic Analysis (DA)** was conducted to identify major climate risks, data and capacity gaps, and shared priorities for action. This material summarizes the DA's findings and recommendations and outlines the path forward.



Key Issues Identified

The Diagnostic Analysis highlights three core challenges:

- Insufficient quality, limited availability or absence of cryosphere data
- Knowledge gaps on cryosphere dynamics and climate change impacts
- Shortage of qualified specialists in cryosphere research, monitoring and management

Projected Pressures: Demographics and Water Resources

Subregional scenario modeling indicates that **by 2070**:

- Central Asia's *population* may ***exceed 150 million***
- Available *water resources* may ***initially increase to 135 billion m^3*** by 2050
- But could **decline *to 110 billion m^3 by 2070*** due to climate impacts on the cryosphere
- This could ***reduce*** per capita *water availability* to ***below 700 m^3***, a level indicating high water stress

IMPLICATION:

This would require major investments in water efficiency and structural changes in water use, especially in irrigation practices.

Key Findings

- All countries in Central Asia are highly dependent on water, with fast-growing populations (1–2% annually) and GDP growth of 3–5% over the past 20 years (except the COVID-19 period).
- Surface water regimes are shifting due to changes in snow cover, glacier melt, and permafrost degradation.
- The cryosphere's contribution to water systems differs across river basins, but no regional assessment exists yet.
- While water availability may rise short-term due to glacier melt, it will likely decline significantly by 2070.
- Both upstream and downstream countries will be affected, facing shared risks to ecosystems, livelihoods, and infrastructure.
- Each country must improve observation systems, research, and knowledge products to enable early adaptation.

Key Recommendations

- Strengthen national monitoring systems and harmonize cryosphere observation and research methods across the region.
- Reduce water dependency per capita and per GDP unit, especially through improved irrigation efficiency.
- Enhance regional cooperation in science, adaptation, and water governance.
- Jointly monitor changes and share knowledge to inform coordinated adaptation policies.
- Establishing early warning systems based on continuous knowledge exchange and risk communication is extremely important.
- Form technical teams at national and subregional levels to develop National Action Plans (NAPs) and a Joint Action Programme (JAP) by 2025.

Vision 2050 & Goals

At the 2025 Project Subregional Workshop in Samarkand, Central Asian countries endorsed the Diagnostic Analysis and agreed to develop action plans based on a common vision:

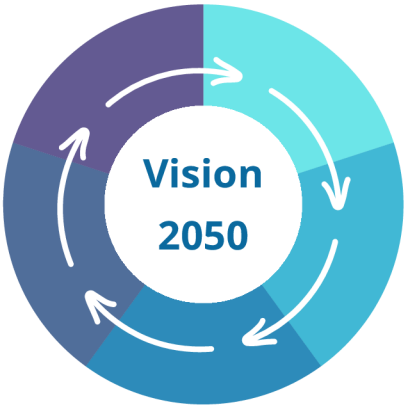
VISION 2050

A well-developed cryosphere monitoring system with sustainable funding, qualified personnel, accessible data, and an informed public, supporting adaptation across all sectors.

SHARED GOALS

Goal 1: Adapt and use unified cryosphere monitoring and research methods
Goal 2: Expand, restore, and improve the monitoring network
Goal 3: Develop joint scientific research
Goal 4: Make sure everyone involved understands how cryosphere changes affect their work and industries
Goal 5: Improve education in all relevant fields

Countries agreed to nominate technical expert teams in 2025 to prepare the NAPs and JAP, to be submitted for national endorsement by 2026. UNESCO will continue to provide technical support.



How the DA Was Developed

The DA was developed using the GEF's TDA/SAP methodology and UNESCO's scientific networks. It includes:

- Thematic Reports prepared by the University of Fribourg and partners:
  - Climate change scenarios for glaciers
  - High-resolution snow cover modeling
  - Cryosphere education needs assessment
- Multistakeholder inputs from national and subregional workshops (2023–2024)
- Baseline reviews of institutional frameworks, socio-economic trends, stakeholder landscapes, and water management data

The DA provides a shared technical foundation for the development of National Action Plans and a Joint Action Programme to guide future cooperation and investment.

The project titled "Strengthening the resilience of Central Asian countries by enabling regional cooperation to assess glacio-nival systems to develop integrated methods for sustainable development and adaptation to climate change" is funded by Global Environment Facility (GEF), implemented by UNDP and executed by the UNESCO Regional Office in Almaty.

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