CRYOSPHERE PROJECT | in Central Asia

gef

UNDP

unesco

UNI FR
UNIVERSITÉ DE FRIBOURG
UNIVERSITÄT FREIBURG

POLICY BRIEF

TRAINING OF SPECIALISTS IN THE FIELD OF CRYOSPHERE IN CENTRAL ASIA:

GAPS AND SOLUTIONS

KEY MESSAGES

- The shortage of specialists in the field of cryosphere is one of the region's three key problems, threatening water security of 75 million people.
- Only one out of nine universities includes a subject such as Geocryology in its curriculum, and Fundamentals of Glaciology are presented at only three out of nine universities.
- 91% of practitioners report poor software literacy as a serious problem among graduates.
- It is necessary to modernize educational programs and to train personnel in the field of cryosphere.
- According to the survey results, 100% of relevant organizations are ready to collaborate with universities, indicating a solid foundation for systemic reform.

SHORTAGE OF SPECIALISTS AS A THREAT TO SUSTAINABLE MONITORING OF CRYOSPHERE

The Cryosphere of Central Asia – glaciers, snow cover and permafrost – is critically important for the region's water supply. In the context of accelerating climate change, the need for qualified specialists capable of exploring and monitoring the cryosphere is becoming strategically important.

Within the framework of the GEF-UNDP-UNESCO Cryosphere project[1], the experts from five countries identified **a shortage of qualified specialists** as one of three key problems along with a lack of data and knowledge about cryosphere[2]. The panel discussion in Almaty (2024)[3] documented the **aging of professional staff with a noticeable shortage of young professionals.**

In order to assess the situation, a regional study was conducted[4] covering 62 respondents from nine universities in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan[5]: practitioners, academic staff and recent graduates. Its results constitute the evidential basis of this policy brief.

MAIN FINDINGS OF THE RESEARCH

Critical Gaps in Curricula

The analysis of curricula of nine universities revealed that while core disciplines (Physics, Hydrology, Geography) are commonly included, specialized courses related to cryosphere are almost absent. Geocryology is taught at only one university, and Fundamentals of Glaciology – at three out of nine. Fieldwork in Glaciology is conducted at only two universities. Among software tools, GIS products prevail (17 references), while programming is mentioned only five times and modeling – three times.

The Gap between Education and Labor Market

91.2% of practitioners report poor knowledge of modern software among graduates as a medium or strong impact on their work. 85.3% of them point to outdated training modules and low technical potential of universities. At the same time, only 29.4% of academic staff recognizes the outdated modules as a problem – the gap in perception between universities and employers is obvious.

63.6% of graduates fully agree that curricula are not in line with the needs of the labor market. 72.7% indicate poor coordination between universities and employers. 82.4% of practitioners report a lack of professional standards in the field of cryosphere.

Systemic Barriers

All groups of respondents unanimously pointed out insufficient government support. Low salaries and inadequate funding make the profession unattractive. The lack of interest among young people in cryosphere is an alarming trend acknowledged by 70.6% of academic staff. The language barrier (insufficient knowledge of English) limits integration into the global scientific community.

---

1 The GEF-UNDP-UNESCO project "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"

2 Diagnostic Analysis of Main Problems in Monitoring, Observation and Research of Cryosphere in CA. GEF-UNDP-UNESCO, 2025.

3 Regional seminar, April 3-4 of 2024, Almaty, Kazakhstan

4 The survey covered 62 respondents of nine universities in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan.

5 Data for Turkmenistan were not available in this research.

Comparison of Labor Market Requirements and Curricula Content

Top 5 Skills and Knowledge Areas Required for Recent Graduates (Practitioner Survey)	Number of Universities Teaching the Disciplines
Glaciology (30 of 34)	3 of 9 universities
GIS and ERS (28 of 34)	9 of 9 universities
Programming (19 of 34)	5 of 9 universities
Geocryology (17 of 34)	1 of 9 universities
Fieldwork in Glaciology (32 of 34)	2 of 9 universities

Country Comparison: Representation of Academic Disciplines

Kyrgyz National University named after Balasagyn leads in coverage: 21 of 23 disciplines, 2 of 3 types of field work. **Tashkent Institute of Irrigation Engineers** – 20 of 23. However, even in leading universities Geocryology, Geophysics and Modeling are not taught. Only **University of Central Asia (Kyrgyzstan)** conducts field work in Geophysics.

Willingness to Collaborate

100% of organizations engaged in the cryosphere monitoring are interested in partnership with universities. **88%** of academic staff expressed a willingness to conduct joint research. **94%** of academic staff and **85%** of practitioners expressed a willingness to mentor students. This willingness can serve as a foundation for systemic reforms.

RECOMMENDATIONS

SIX MEASURES IN TWO AREAS

Area 1. Modernization of Curricula

1.1 Introduce a mandatory module on the cryosphere fundamentals at the undergraduate level for all relevant specializations. This module should include theoretical components (Glaciology, Geocryology, and Climatology) and practical components (working with satellite data and basic field skills).

1.2 Develop regional vocational training standards based on identified labor market needs, with the following priorities: high priority – Glaciology, GIS, Meteorology, data collection; medium priority – Geophysics, Programming, Geocryology.

1.3 Establish a regional master's program in cryosphere studies by pooling the resources of universities in Central Asia and engaging meteorological services and research institutes to provide internships and training in modern monitoring methods.

1.4. Launch an online knowledge-sharing platform for universities and organizations with curricula, software methodologies, and regular forums to align education with practical needs.

Area 2. Establishment of a Regional Training Center

2.1 Establish an advanced training center offering short-term courses in Python, GIS, sensor and drone operations, glaciology field methods, and snow surveying. The center aims to bridge the gap between university education and practical experience.

2.2 Promote internship programs at meteorological services and research institutes by organizing student and professional exchanges between Central Asian countries, with the support of international partners.

IMPLEMENTATION STRATEGIES

At the national level: incorporate training in National Action Plans (NAP) for cryosphere: provide support to ministries of higher education to update educational standards; increase the attractiveness of the profession through improved working conditions.

At the subregional level: integrate an educational component into Joint Subregional Action Program (JSAP) on cryosphere, Objective 5 – "Improve Training Programs for Specialists".

At the international level: secure funding and develop donor mechanisms; establish partnerships with international universities; provide technical assistance in developing educational standards.

WINDOW OF OPPORTUNITY

Adoption of a Joint Statement by the Central Asian countries at the Regional Environmental Summit in Astana, Kazakhstan (April 2026) will create a political framework for resource mobilization. The statement is prepared within the framework of Joint Subregional Action Programme (JSAP) on Cryosphere and is based on the *Cryosphere Vision 2050: advanced cryosphere monitoring with qualified personnel, accessible data, and informed population with the aim of adapting economic sectors.* Recommendations of this policy brief support the Cryosphere Vision 2050, especially in the field of training qualified specialists.

ABOUT THE POLICY BRIEF

This policy brief is based on the research titled "Assessment of Needs and Gaps in Higher Education Programs in the field of Cryosphere in Central Asia", conducted as part of GEF-UNDP-UNESCO Cryosphere Project "Strengthening the Resilience of Central Asian Countries by Enabling Regional Cooperation to Assess Glaciation Systems to Develop Integrated Methods for Sustainable Development and Adaptation to Climate Change".

Author of the policy brief: Serikzhan Atanov (University of Fribourg, Switzerland), Dilrabo Shukurova (independent consultant).

GEF-UNDP-UNESCO Cryosphere Project is implemented by the Regional Office of UNESCO in Almaty.

Full report: cryosphereca.org

CRYOSPHERE PROJECT | in Central Asia

GEF-UNDP-UNESCO project "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"

Stay up to date with project news:

www.cryosphereca.org
unescoalmaty
unescoalmaty
unescoalmaty
unescoalmaty

gef UNDP unesco UNI FR UNIVERSITÉ DE FRIBOURG UNIVERSITÄT FREIBURG