"FOR INFORMATION PURPOSES" APPROVED BY THE DECISION OF THE REGIONAL FORUM - MEETING OF THE EMERGENCY AGENCIES HEADS OF THE CENTRAL ASIAN COUNTRIES, PROTOCOL, NOVEMBER 5, 2021 , TASHKENT (UZBEKISTAN)

PROFILE OF THE DISASTER RISK IN CENTRAL ASIAN COUNTRIES

(as of February 2025)

PART 1: GENERAL INFORMATION

The Central Asian region includes the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Turkmenistan, and the Republic of Uzbekistan. The region covers approximately 4 million square kilometers and has a total population of over 75 million. The population density in the region is only 18 people per square kilometer.

Geographically, Central Asia is an extremely vast subregion, encompassing powerful mountain ranges such as the Tien Shan, large deserts, and steppe regions. The largest rivers in this region are the Amu Darya and Syr Darya. The largest bodies of water include the Caspian Sea, the Aral Sea, and Lake Balkhash, which form part of the West-Central Asian Closed Basin.

Central Asia's landlocked location within the Eurasian continent determines its sharply continental climate with low, unevenly distributed precipitation. The region is characterized by wide daily and seasonal temperature variations, high solar radiation, and relatively low humidity.

Large differences in geographical location and altitudes from 0 to 7,500 m above sea level explain the diversity of microclimates.

Mountains are located in the east and southeast and are the center of water resource formation and runoff. Although this region often suffers from moist winds, most of the moisture is absorbed by the mountains, leaving little precipitation for the rest of the basin.

Temperature fluctuations are quite significant – from -40ºC to +40ºC. Precipitation in the lowlands and valleys ranges from 80 to 200 mm per year, mostly occurring in winter and spring. The foothills receive 300 to 400 mm of precipitation, while the southern and southwestern mountain ranges receive 600 to 800 mm.

The region possesses many valuable natural resources, primarily large reserves of hydrocarbon raw materials, has a powerful mining, fuel and energy, and chemical industries, and due to the presence of an extensive transport and communications network, the countries of the region utilize their full potential as transit states.

The region's socioeconomic development has historically depended on water and land resources. Agriculture plays a significant role in the Central Asian economy, with farming and livestock farming occupying leading positions.

Rapid population growth and the development of irrigation over the past 40 years have significantly increased the demand for land and water in the region. At the same time, more than 46% of residents live in cities.

The region is most characterized by vast territories with high seismic activity, with probable strong earthquakes of 7-8-9 points and higher, mudflows, floods, landslides, avalanches, flooding, rising groundwater levels, strong, hurricane-force winds and even tornadoes, desertification, dust and sand storms, prolonged and torrential rains, hail, heavy snowfalls and snowstorms, droughts, frosts, avalanches and rockfalls, steppe, forest and mountain fires, extreme temperatures, environmental, man-made industrial and transport accidents, explosions, major fires, epidemics, mass infectious diseases of people and animals, damage to agricultural plants by diseases, weeds and pests, as well as the presence of artificial reservoirs and breakthrough-hazardous reservoirs, waste storage facilities for the nuclear and chemical industries, enterprises with toxic and highly toxic substances, dangerous technological processes.

It is well known that the volume of economic damage does not always correlate with the number of disasters. For example, the number of earthquakes that have occurred in Central Asia is significantly lower than the number of floods, yet the economic damage from earthquakes is significantly greater than that from floods. The quantitative risk assessment conducted in this study confirmed the following risk models:

- **Kazakhstan:** the main risk factor is earthquakes, followed by floods;
- **Kyrgyzstan**: the main risk factor is earthquakes, followed by landslides and floods;

- **Tajikistan**: the main risk factor is floods, followed by earthquakes and landslides;
- **Turkmenistan**: The main risk factor is earthquakes, followed by floods;
- **Uzbekistan**: The main risk factor is earthquakes, followed by droughts.

Country	Square thousand km2	Population in millions	Population density (per km2)	Annual population growth %	Urban population %
Kazakhstan	2,724.9	20.1	6.9	1.5	57.5
Kyrgyzstan	199.9	7.2	36	1.3	34.1
Tajikistan	142.6	10.2	66.6	2.3	27.3
Turkmenistan	488.1	6.3	12.6	1.3	52.0
Uzbekistan	447.4	36.8	77.5	1.5	50.4
Total for the region	**4 00 2 ,9**	**76, 2**	**39.4**	**1.6**	**44.7**

Table 1. Overview of Central Asian countries[1]

PART 2: KEY INDICATORS OF THE DISASTER RISK PROFILE

The Central Asian region is susceptible to virtually all types of emergency situations of natural, man-made, environmental, and biosocial nature.

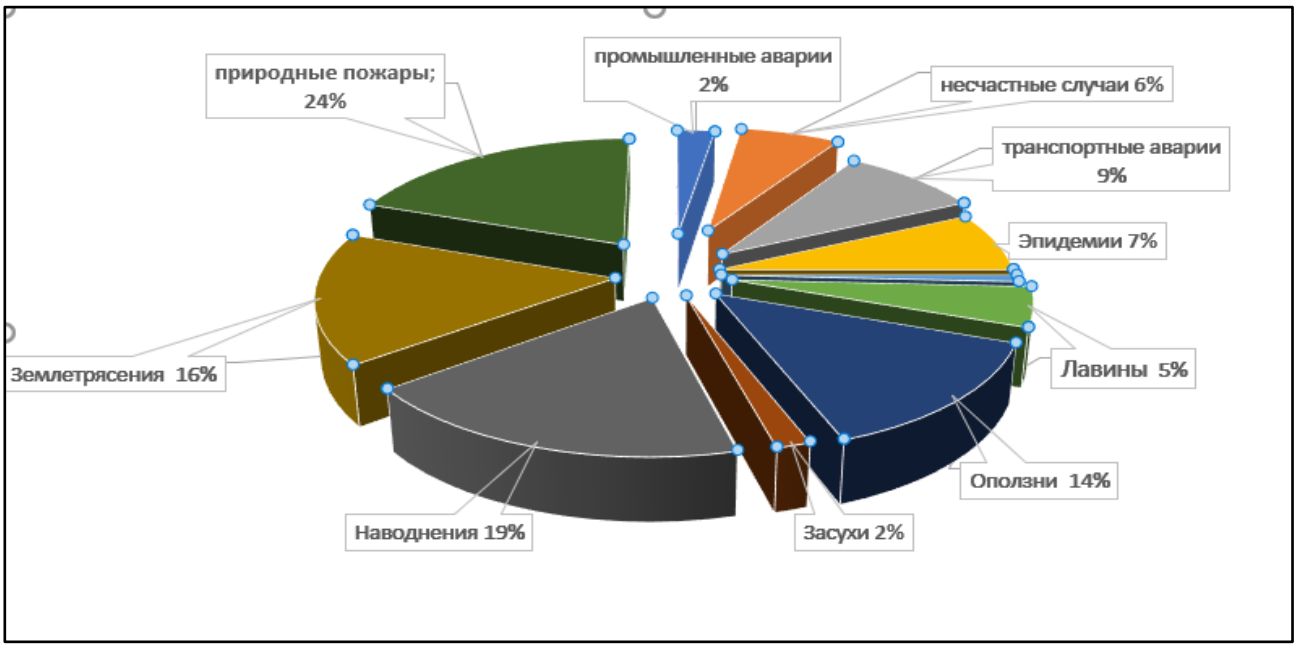


Fig. 1. Percentage distribution of registered disasters in the Central Asian region.[2]

[1] UN Urbanization Rankings 2020 , Asia Population Counter 2022

[2] Initiative on disaster risk management in Central Asia and the Caucasus

[3] Analysis of man-made accidents and natural disasters in Central Asia, analytical report No. 1 (State Agency of the Ministry of Emergency Situations of the Republic of Kazakhstan) 2022

Of all emergency situations occurring in the region, up to 84.2% are man-made accidents , that is, caused by humans.

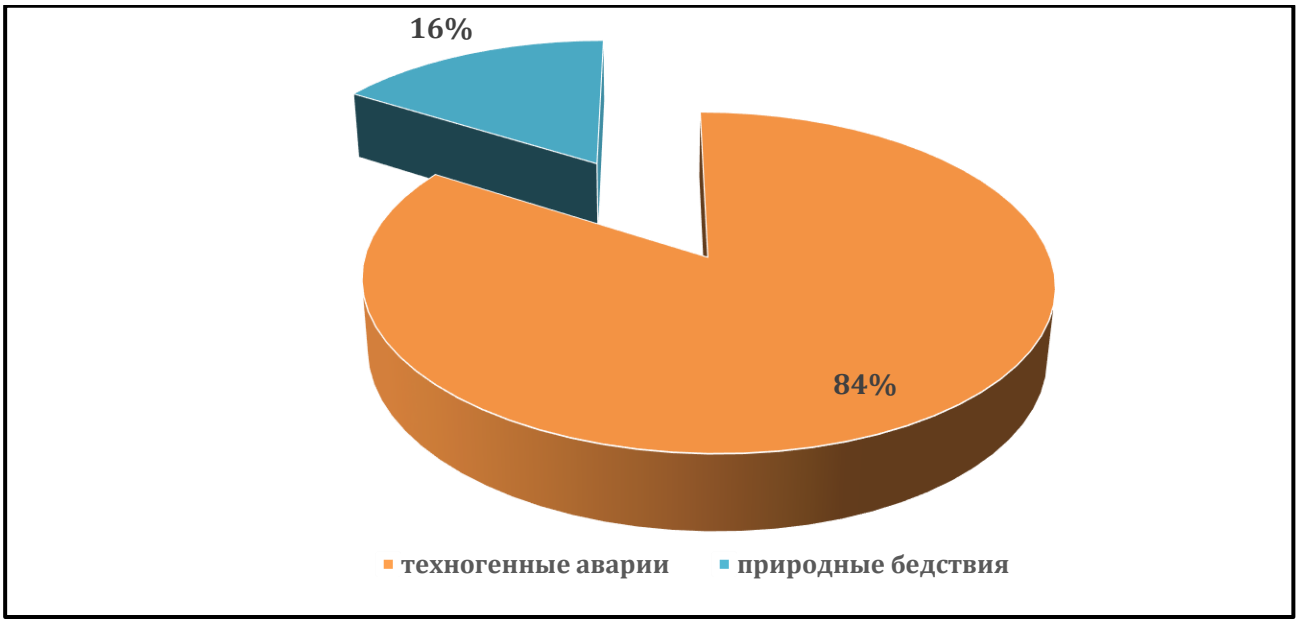


Fig. 2. The ratio of man-made accidents and natural disasters in the countries of Central Asia in the period from 1997 to 2020 [3]

Date	**Type of disaster**	**Number of affected populations**	**Economic damage** *(in millions of US dollars)*
3/01/1911	Kemin earthquake, Kazakhstan, Kyrgyzstan	450	20
5/10/ 1948	Ashgabat earthquake, Turkmenistan	176,000	6,000
26/04/1966	Tashkent earthquake, Uzbekistan	100,000	300
13/10/1985	Earthquake Tajikistan	8,080	200
25/05/1992	Flooding in Tajikistan	63,500	300
19/08/1992	Jalalabad earthquake in Kyrgyzstan	86 806	130
8/05/1993	Flooding near Dushanbe, Tajikistan	75 357	149
/06/2000	Drought in the Central Asian region	3,600,000	107

Table 2. Major disasters in Central Asia over 120 years [4]

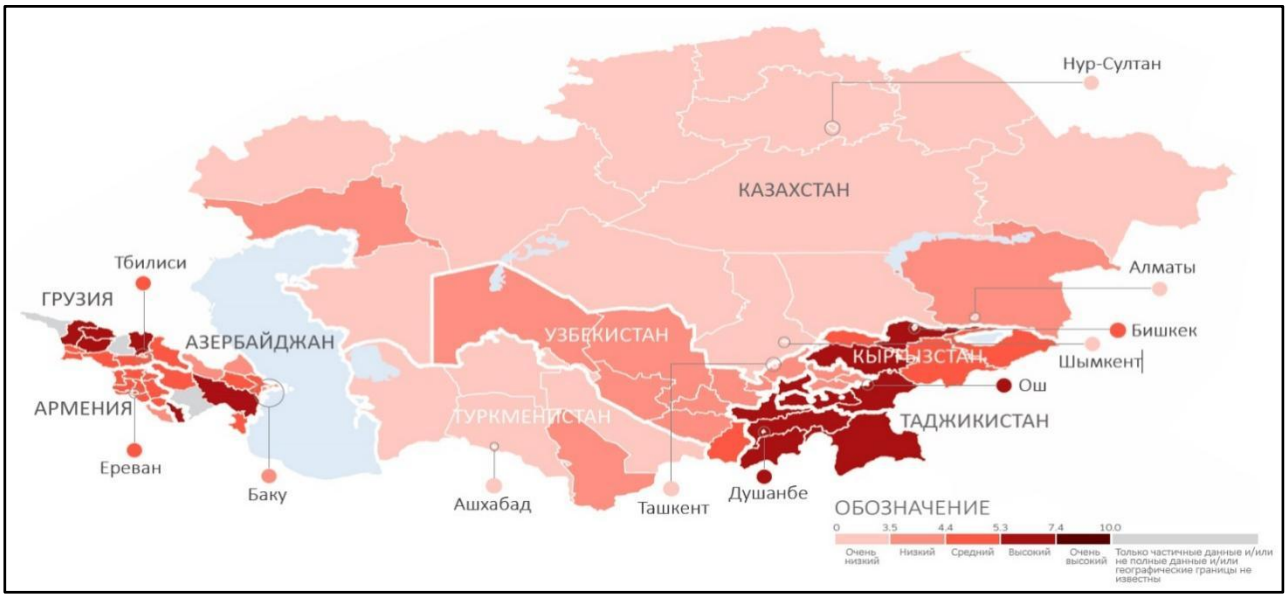


Fig. 3. Risk map for Central Asian countries [5]

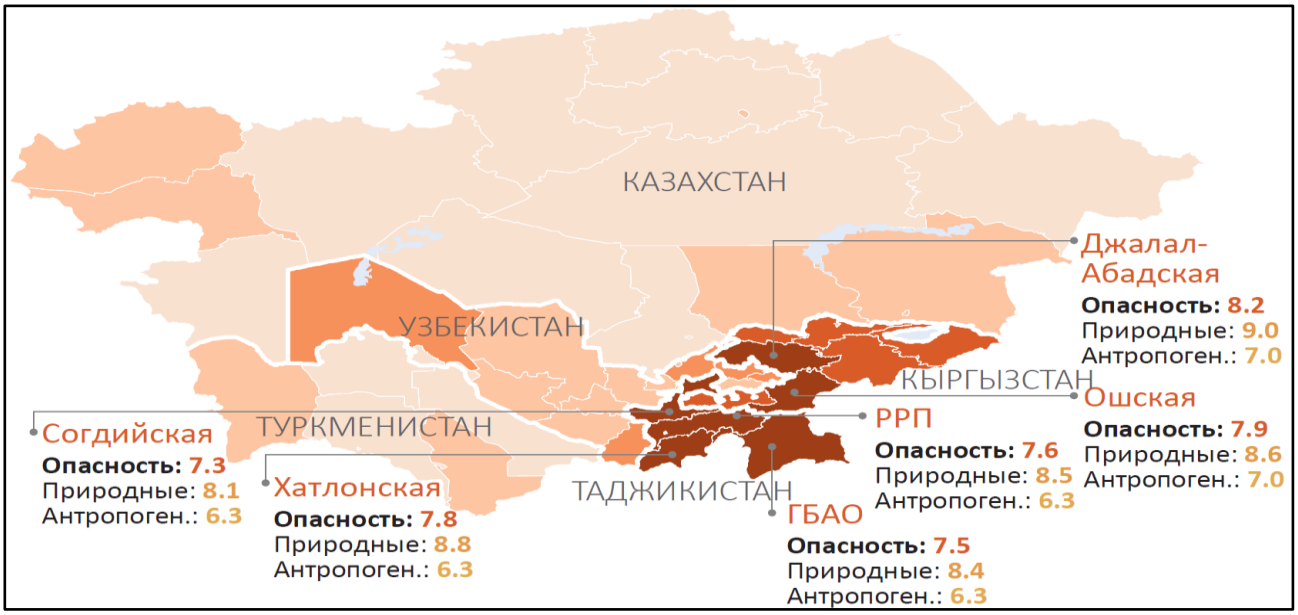


Fig. 4. Hazard and exposure map, average national values for Central Asian countries [6]

The region is most characterized by vast territories with high seismic activity, with probable *strong earthquakes of 7-8-9 points and more on the MSK-64 scale and magnitudes of 5-8 on the Richter scale, mudflows, floods, freshets, landslides, avalanches, flooding, hurricane-force winds and even tornadoes, desertification, dust storms, prolonged and heavy rains, hail, snowfalls and blizzards, droughts, frosts, extreme temperatures, destruction of artificial reservoirs, the presence of waste storage facilities for the nuclear and chemical industries, enterprises with toxic and highly toxic substances, hazardous waste and technological processes, environmental, man-made industrial and transport accidents, explosions, dam breaks and emissions of hazardous substances, major fires, epidemics, mass infectious diseases of people and animals, damage to agricultural plants by diseases, weeds and pests*.

According to the INFORM Subnational Risk Index for 2021 year For Central Asian countries, Tajikistan is in the high-risk class, followed by Kyrgyzstan in the medium-risk class, Uzbekistan in the low-risk class, and Kazakhstan and Turkmenistan in the very low-risk class.

The INFORM subnational risk index for this region combines 62 different indicators that measure three dimensions of risk: hazard and impact, vulnerability, and lack of coping capacity.

[3] *Initiative on disaster risk management in Central Asia and the Caucasus*
[5,6] *Caucasus and Central Asia Subnational INFORM risk index 2021*

2.1. NATURAL HAZARDS

2.1.1. Earthquakes

Earthquakes represent the predominant disaster risk factor in Central Asia by almost all major indicators, particularly for cities and densely populated areas.

The housing, service, financial, industrial and trade sectors suffer the most from earthquakes, and they are primarily concentrated in cities and large population centers.

Seismological services in most countries in the region annually record approximately 3,000 tremors of varying intensity.

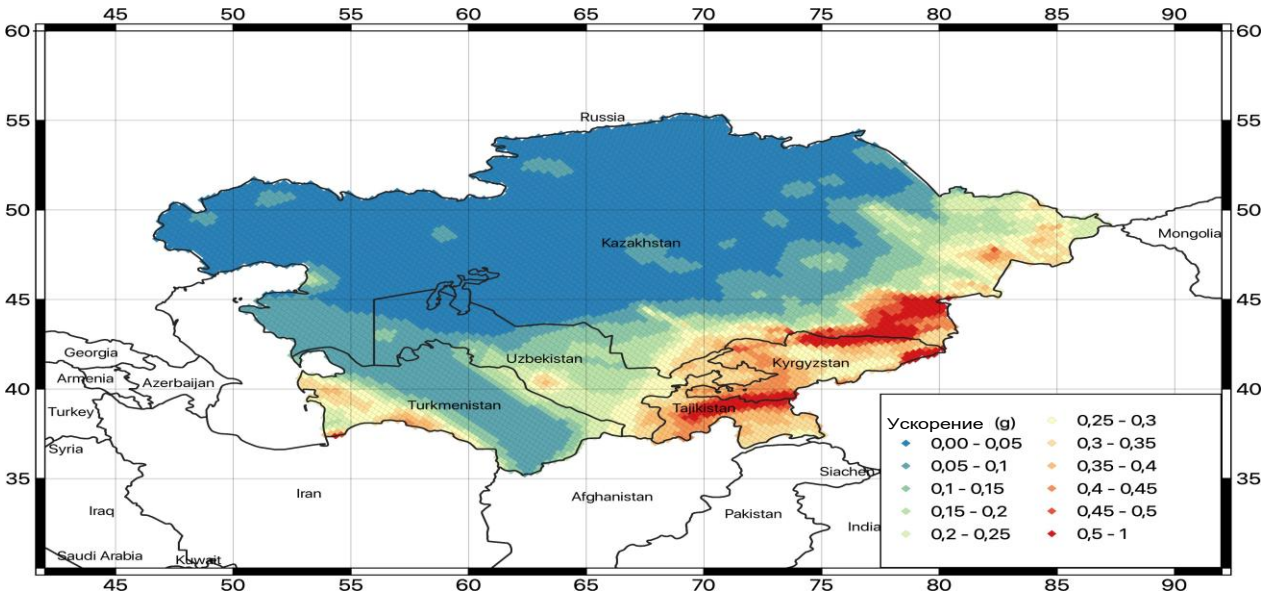
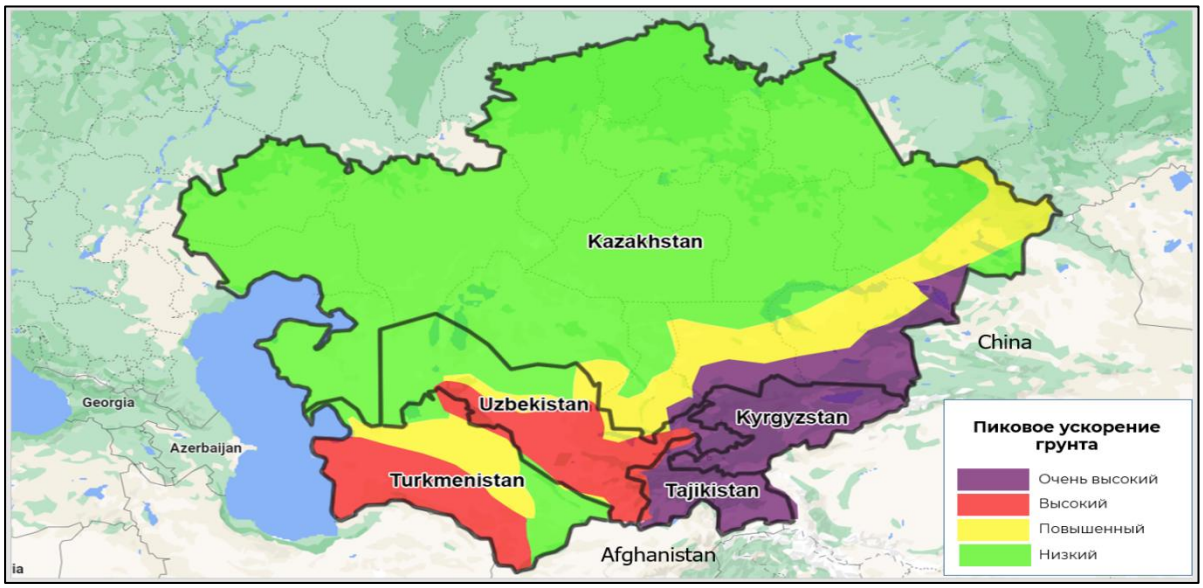


Fig. 5. Map of calculated values of peak ground accelerations (PGA) with a 5% probability of exceeding the values over 50 years [7]

The secondary effects of earthquakes can be quite devastating. Seismic activity can trigger or accelerate other hazards, including landslides, rock falls, mudflows, soil liquefaction, glacial lake formation, and flooding.

Most of them (floods and mudflows due to dam failures, high-mountain lake outbursts and toxic spills) can have serious transboundary consequences.



Seismic hazard map of Central Asia

[Preliminary Seismic Hazard Assessment Report. World Bank 2021]

There is ample convincing evidence of the destructive power of earthquakes and the secondary factors they provoke, for example: landslides, mudflows and mudflows were the main cause of death during earthquakes that occurred in Kazakhstan (Almaty, 1887, 1889 and 1911), Kyrgyzstan (Jalalabad, 1992), Tajikistan (Khait, 1949, Gissar, 1989), Turkmenistan (1948) and Uzbekistan (Tashkent, 1966).

2.1.2. The impact of climate change on disaster risks.

Central Asia faces serious challenges in combating the adverse effects of climate change. In particular, the impact of climate change on water-related disasters in the region has been recognized as a key threat. For example, over the past 45 years, temperatures have increased by 1 degree Celsius in Kyrgyzstan, 1.6 degrees Celsius in Turkmenistan, 1.4 degrees Celsius in Kazakhstan and Uzbekistan, and 0.7 degrees Celsius in Tajikistan.

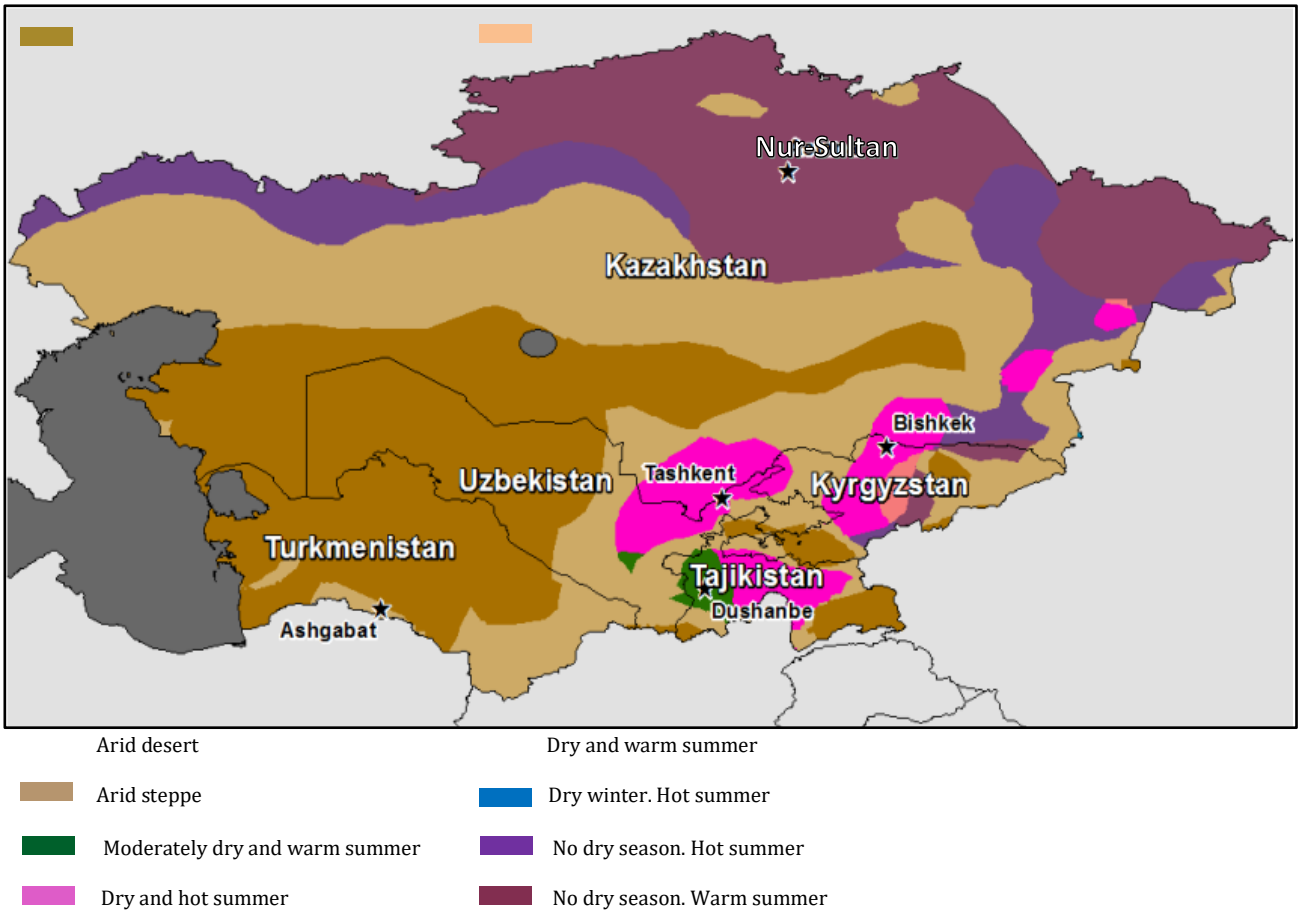


Fig. 6. Climate classification of Central Asia [8]

One of the most significant consequences of global warming in Central Asia is the melting of glaciers and the associated formation of glacial lakes. Current rates of glacier loss in the region are 0.2-1% per year.

Due to glacier melt and subsequent formation of glacial lakes, there is an increased risk of glacial lake outburst floods, which exacerbate water-related threats to mountain communities, their settlements and livelihoods, and threaten infrastructure located in river valleys and downstream areas.

[9] *USAID : Central Asia Climate Risk Profile*

Fig. 7. Changes in precipitation [9]

Changes in precipitation over the past 40–50 years are localized and varied, ranging from slight increases of 1–5% in the northern and eastern regions to slight decreases of 1–5% in the central and southern regions of Central Asia. Precipitation projections in climate change models indicate a possible continuation of these trends: the southwest of the region will become drier, while the northeastern regions of Central Asia will become wetter. The frequency and intensity of precipitation are expected to increase, as will the number of drought days.

Strong winds and rains in the spring of 2020 caused significant damage to agriculture and private property in the southern regions of Uzbekistan and Turkmenistan. Weather factors contributed to the collapse of the Sardoba Dam in Uzbekistan, which led to flooding in the lower reaches of the Syr Darya River. Mudflows—the most common and deadly natural disaster in Tajikistan—damaged communication routes and several settlements. High summer temperatures in Dushanbe and Tashkent added to the heat stress on residents' bodies and health during the pandemic. In the spring, walnut forests in southern Kyrgyzstan suffered frost damage, and their yield was significantly lower than expected by local communities dependent on forest products.

It's worth noting that drought has always been a typical phenomenon for Central Asia, but recently, dry cycles have become more frequent. A zonal shift is occurring, with warm southern climates shifting to the northern region.

Droughts of varying magnitude occur almost every year. Severe meteorological droughts (precipitation deficits of 50% or more) occur in foothill regions approximately three times per century, while moderate droughts (seasonal precipitation deficits of 20-25%) occur at intervals of three to four years. In desert and semi-desert regions, droughts are more frequent (precipitation deficits of 50% or more every 10 years; a deficit of 20% every five years).

[9] *Illustrated Review Climate Change in Central Asia. CAREC 2020*

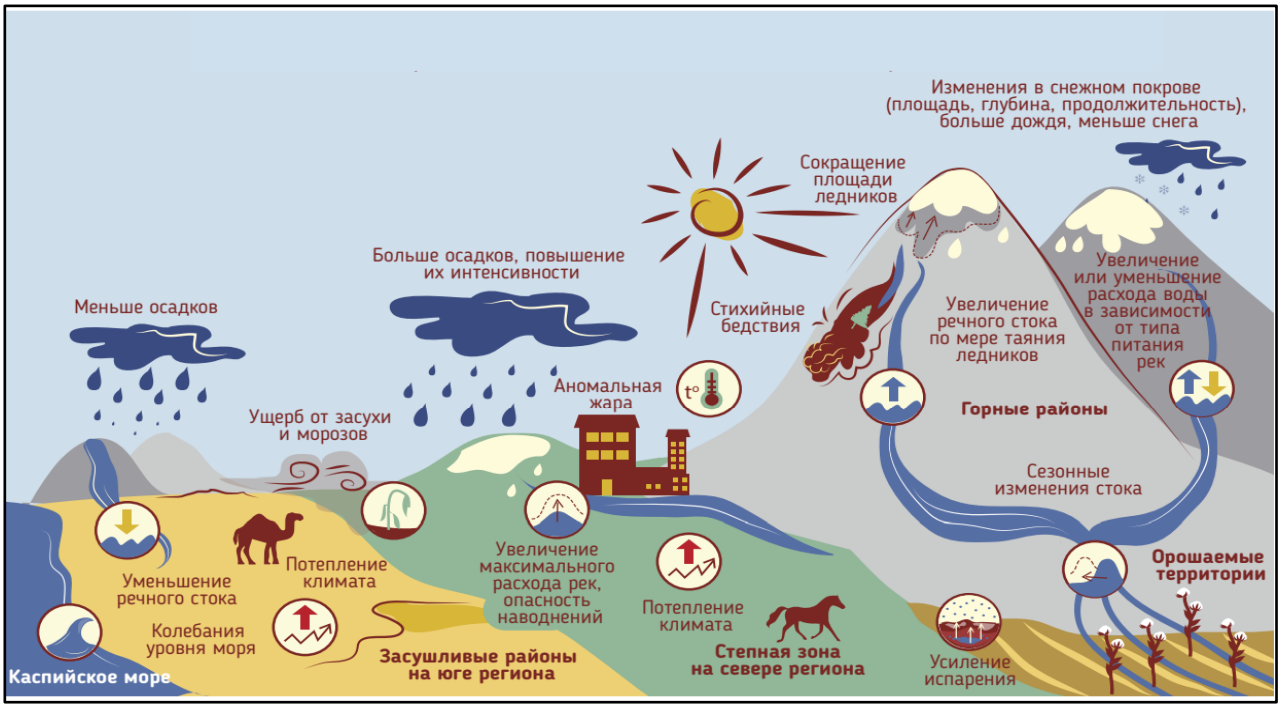


Fig. 9. Climate change trends and forecasts in Central Asia [10]

The impacts of drought are felt more severely in rural areas. The region's socioeconomic vulnerability to drought is primarily related to rural development, agriculture, and water management.

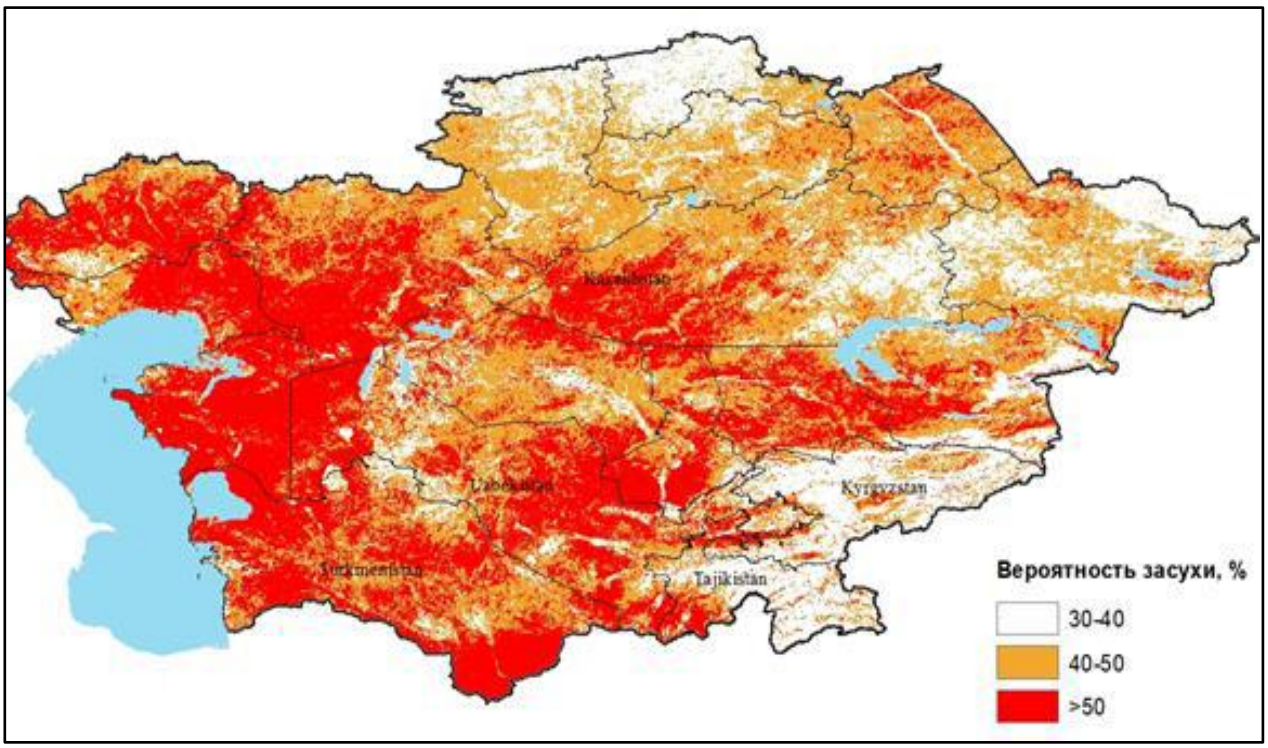


Fig. 10. Assessment of drought conditions in Central Asia over the past 10 years based on satellite data. in CA [11]

[10] *Illustrated Review: Climate Change in Central Asia. CAREC 2020*

[11] *Regional Strategy for Drought Risk Management and Mitigation in Central Asia for 2021–2020. CAREC 2021*

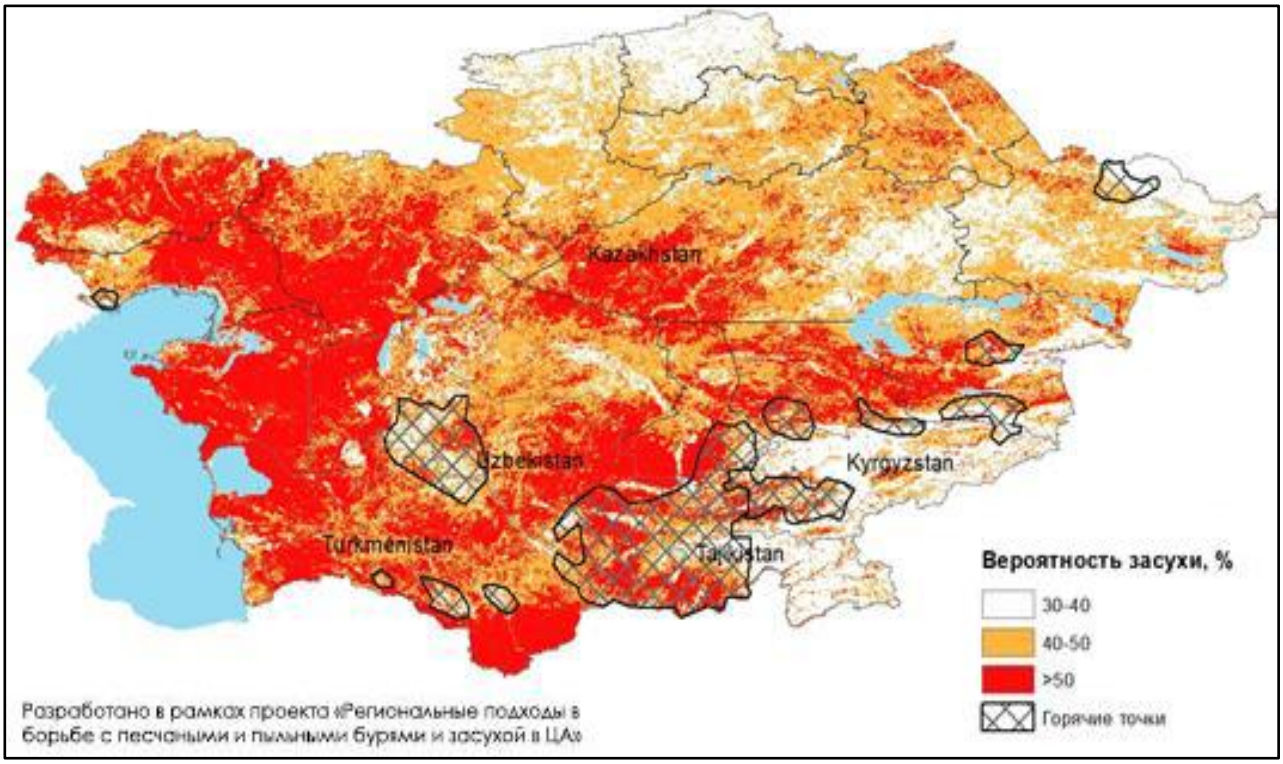


Fig. 11. Territories socially vulnerable to drought [12]

The health impacts of climate change include increased rates of respiratory and cardiovascular diseases. As temperatures rise, the prevalence of food- and water-related illnesses and infectious diseases may shift, including their geographic distribution. Heat stress poses a threat to the health of outdoor workers and urban populations. Climate disruptions impact food security. The poor and those who are malnourished suffer the most. As the frequency and intensity of severe weather events, including floods, landslides, and mudflows, increases, damage to healthcare and vital services, including hospitals, roads, water and electricity infrastructure, is possible, leading to worsening sanitary and epidemiological conditions.

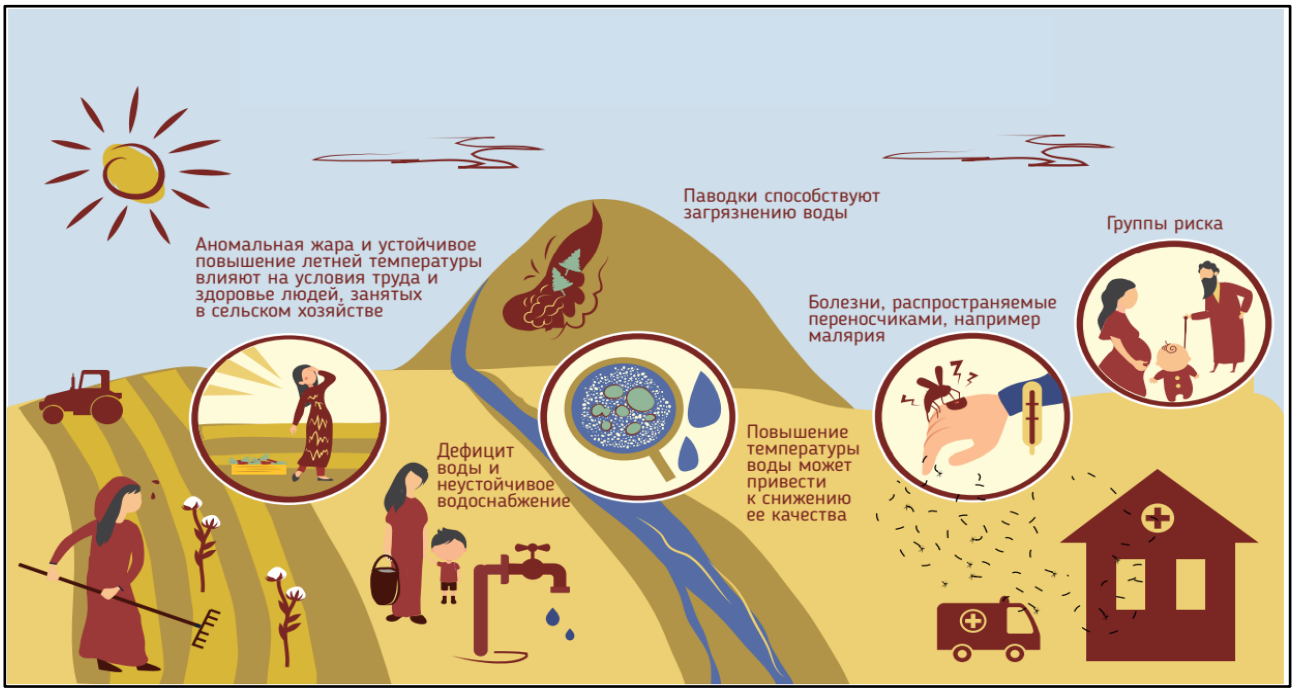


Fig. 12. Climate change and health risks [13]

[12] *Regional Strategy for Drought Risk Management and Mitigation in Central Asia for 2021–2020. CAREC 2021*

[13] *Illustrated Review: Climate Change in Central Asia. CAREC 2020*

The findings of the Intergovernmental Panel on Climate Change *(2021),* based on updated global greenhouse gas emissions scenarios and new ways of integrating results from dozens of climate models, confirm and reinforce

the information on projected climate change trends globally and in Central Asia. Under a high-emissions scenario, the average temperature in the Amu Darya basin will increase by 5 ˚C compared to today's by the end of the century. The number of days with maximum temperatures above 40 ˚C, which currently stands at about 20 per year, will increase to 60 by 2100. Changes in precipitation remain uncertain, but the frequency and intensity of heavy rainfall will also increase. Experts from the Asian Development Bank have determined that the average damage from climate change in Central Asian countries by 2050 will approach $507 million per year.

2.1.3. Floods, freshets and mudflows

The threat of mudflows, freshets, and floods is the second most significant hazard in the Central Asian region. The region has mountainous terrain and is crossed by several hundred large and small rivers and their tributaries. Flooding on these rivers is often accompanied by large mudflows.

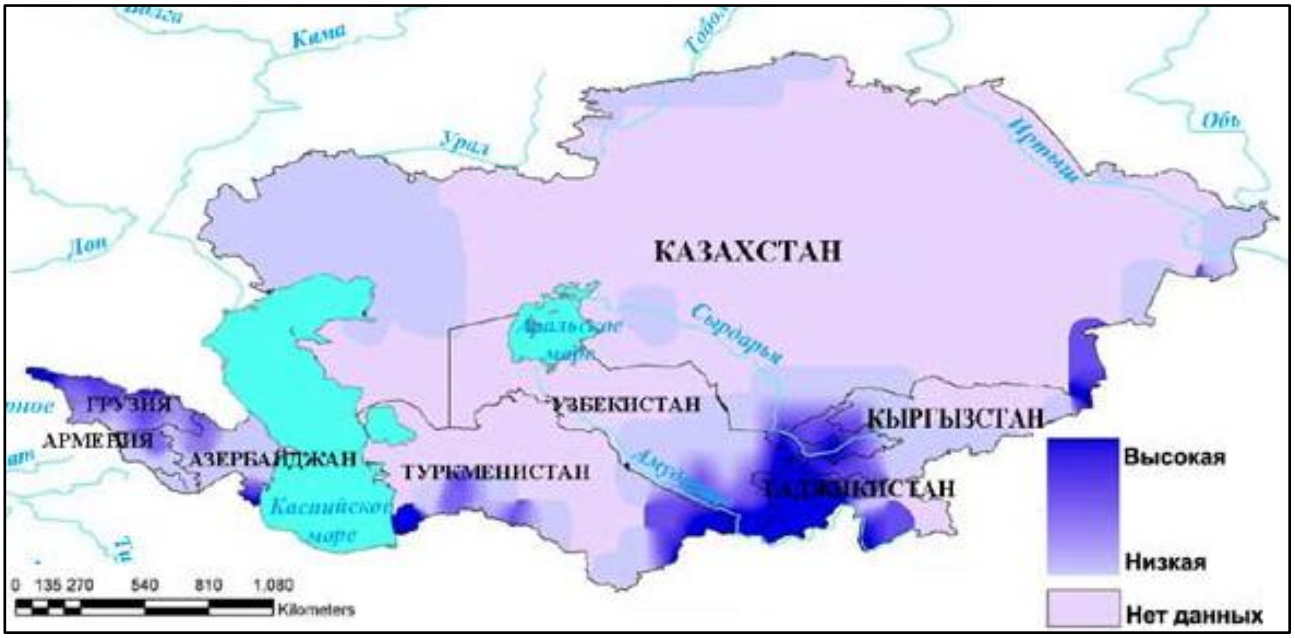


Fig. 13. Flood hazard map in Central Asia [14]

Floods, flash floods and mudflows are the most common natural disasters in Central Asia, particularly in the basins of the region's largest rivers, the Amu Darya and Syr Darya , and they cause significant damage to housing, infrastructure and agriculture, primarily in rural areas.

Although the overall volume of water resources remains fairly stable, annual and seasonal hydrological variability in these river basins has become more pronounced. Since 2005, the number of years with high water levels has increased by 1.2-1.4 times, and those with excessively high water levels by 2.0-2.5 times.

In recent decades, there has been an increase in the number of mudflows, the frequency of their recurrence is directly related to the cycles of rainy and dry years.

The mountains of Central Asia are home to thousands of lakes and artificial reservoirs. Dams and levees breached can trigger floods, mudflows, and flash floods caused by intense snowmelt and glacial lake overflows, often resulting in damage to settlements and infrastructure in downstream areas. The large volumes of water released by dams and levees breaching glacial lakes and large reservoirs can cause floods, flash floods, and mudflows, often leading to large-scale, transboundary emergencies.

[14] *Initiative on disaster risk management in Central Asia and the Caucasus*

Fig. 15 Dynamics of melt-rain floods that occurred in the countries of Central Asia in the period from 2019 to 2021

Figure 15 indicates that in recent years, an increase in the number of melt-rain floods has been observed in the Central Asian countries (*Academy of Civil Defense of the Ministry of Emergency Situations of the Republic of Kazakhstan, 2023*).

The dynamics of mudflows that occurred in Central Asian countries from 2019 to 2021 is presented in Figure 16.

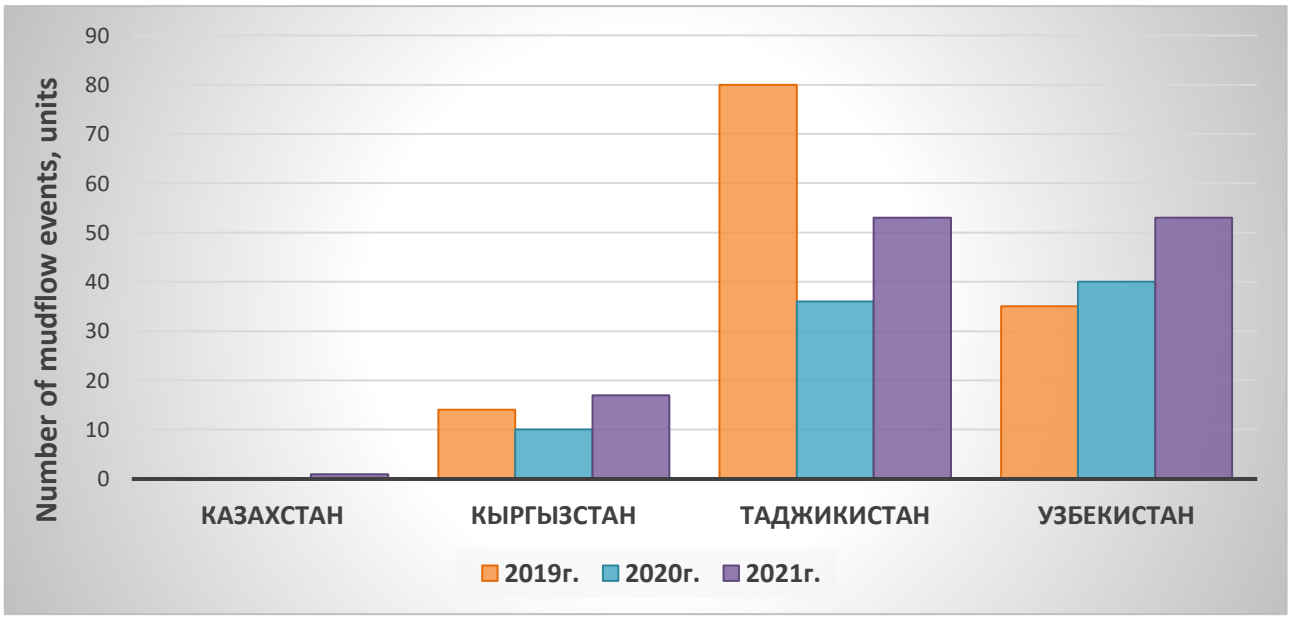


Fig. 16 Dynamics of mudflows that occurred in Central Asian countries from 2019 to 2021

From Figure 16 it can be seen that the largest number of mudflow events during the period under review occurred in the Republic of Tajikistan and the Republic of Uzbekistan (*Academy of Civil Defense of the Ministry of Emergency Situations of the Republic of Kazakhstan, 2023*).

2.1.4. Landslides

Landslides are common in the mountainous regions of Central Asia and are one of the most widespread natural disaster risks (Fig. 8). The largest of these are often triggered by earthquakes and floods. They are triggered by steepening slopes, seismic events, meteorological and hydrological anomalies, and various anthropogenic processes. Landslides most frequently occur in foothill and mountainous areas at altitudes of 1,000 to 2,400 meters above sea level on slopes of 19 degrees or more.

Landslides primarily affect housing and infrastructure in rural areas. Landslides can have transboundary consequences due to the destruction of tailings ponds, waste dumps, and the release of toxic substances contained therein, particularly in the Fergana Valley.

Fig. 17. Map of landslide hazards in Central Asia [15]

The dynamics of landslide processes in Central Asian countries in the period from 2019 to 2021 is presented in Figure 18.

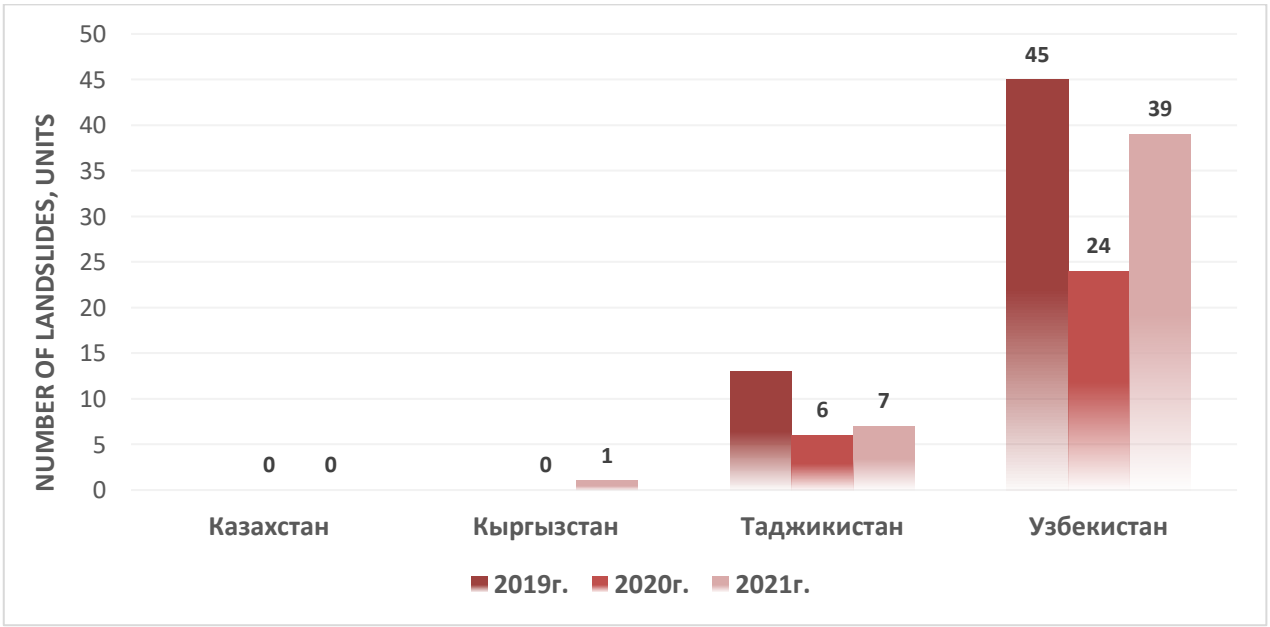


Figure 18 – Dynamics of landslides that occurred in Central Asian countries from 2019 to 2021

[15] Initiative on disaster risk management in Central Asia and the Caucasus

Figure 18 indicates that the largest number of landslide processes during the period under review occurred in the Republic of Uzbekistan.

2.1.5. Snow avalanches. Rockfalls.

Snow avalanches are considered particularly dangerous hydrometeorological natural phenomena, posing a danger to people, structures, transport communications, energy bridges and communication lines.

Modern mountain roads in the Central Asian region are generally poorly planned and designed due to the difficult terrain, sparse population, and meager state budgets for road construction. This is especially true in the Tien Shan and Pamir mountains, which encompass much of Kyrgyzstan and Tajikistan, with their extremely rugged terrain, where many local transport corridors consist of dirt roads, trails, animal tracks, and motorcycle routes.

Snow avalanches, rock slides, and rockfalls block roads, often leading to emergency situations. Cutting roads through mountainous terrain increases rockfalls, especially where the bedrock contains natural cracks along which the road is built. And these dangers are not limited to roads cut into mountain slopes. Roads in the valleys of the Pamirs and Tien Shan often cross large alluvial fans, which periodically collapse onto large sections of the road network, blocking them.

Figure 18 – Dynamics of snow avalanches that occurred in Central Asian countries from 2019 to 2021

From Figure 18 it can be seen that the largest number of snow avalanches during the period under review occurred in the Republic of Tajikistan (*Civil Defense Academy of the MES of the Republic of Kazakhstan, 2023*).

2.2. MAN-MADE RISKS

The region is home to numerous tailings ponds and mine waste dumps, as well as poorly managed municipal landfills, pesticide storage facilities, and hazardous chemical waste storage facilities, mostly located in densely populated areas. Some of these facilities are located in border areas, thus posing a risk of cross-border contamination of soil, air, and water.

Central Asia's water management infrastructure consists of hundreds of reservoirs, dams, irrigation systems, and pumping stations, numerous canals, and dozens of integrated hydroelectric power plants. This includes the world's tallest rockfill dam, the Nurek Dam, at 300 meters on the Vakhsh River in Tajikistan, and one of the world's longest canals, the Karakum River, at over 1,100 kilometers long, which supplies Turkmenistan with approximately half of the country's water from the transboundary Amu Darya River.

Of the more than 1,200 dams in the region, 110 are classified as major hydraulic structures. Many of these dams are located in transboundary river basins such as the Amu Darya, Syr Darya, Ili, and Irtysh, and are of international significance. For the territories of countries located downstream of rivers, the failure of any dam can have the most devastating consequences.

The presence of industrial enterprises in the region, including metallurgical, oil and coal mining facilities, mineral extraction, as well as transport vehicles, in particular the multiple increase in passenger cars and trucks, has led to a sharp increase in man-made emergencies: transport accidents (disasters), fires and explosions, accidents with the release of hazardous chemical substances, sudden collapses of structures, accidents in electrical and energy systems or public utility systems, accidents at industrial wastewater treatment plants, road transport accidents.

2.3. ENVIRONMENTAL RISKS

The region's most serious environmental risks are associated with inefficient use of water resources, problems with transboundary water management, high levels of energy and natural resource consumption, as well as extensive development of the industrial sector, and water shortages as a direct consequence of climate change.

Climate change in the region has become a real threat to human life and livelihoods, which inevitably has social consequences—a decline in living standards, loss of property, the need to abandon homes, etc.

The worsening degradation of biodiversity, natural habitats and ecosystems due to climate stressors increases the vulnerability of poor and rural areas, which largely lack the financial or political capacity to cope with growing challenges, particularly the slow-onset hazards and threats from climate change.

Over the past 50 years, rising temperatures have significantly reduced both mountain snow cover and glacier volume. The climate in the region has become noticeably warmer. Across all countries, the average annual temperature has increased by between 0.10ºC and 0.31ºC per decade. This is far higher than the global trend (0.06ºC).

One of the largest global environmental disasters in recent history, experienced by the countries and populations of Central Asia, is the Aral Sea tragedy. Its ecological, climatic, socioeconomic, and humanitarian consequences pose a direct threat to the region's sustainable development, health, gene pool, and future of the people living there.

A direct consequence of the sea's drying up has been dramatic climate change, felt not only in Central Asia but also in other regions. The Aral Sea crisis zone directly encompasses Turkmenistan, Kazakhstan, and Uzbekistan, and indirectly Tajikistan and Kyrgyzstan.

2.4. BIOLOGICAL AND SOCIAL RISKS

The region is susceptible to local outbreaks and epidemics of infectious diseases in humans and animals, as well as crop damage from diseases, weeds, and pests. Some Central Asian countries experience minor outbreaks of infectious diseases such as cholera, malaria, anthrax, meningococcal meningitis, measles, and others.

The COVID-19 pandemic, a new and completely unexpected systemic risk of a biosocial nature worldwide, led in the countries of Central Asia in 2020-2021 to an outbreak of a potentially severe acute respiratory disease affecting over 1.47 million people, the deaths of approximately 22.6 thousand people, and the disruption of normal life for almost the entire 75 million population of the region. It has caused and continues to cause serious damage to the socio-psychological state and public health of the population, extremely negatively affecting the quality of life and standard of living of tens of millions of people, especially the most vulnerable segments of the population, including women and children, a significant decrease in the rate of economic growth and progressive sustainable development, and the emergence of numerous political, socio-economic and environmental problems.

Indicative indicators of morbidity and mortality from the COVID-19 pandemic per 100 thousand people are clearly shown in Tables 4 and 5.

No.	Country	Population in millions	Number of cases in thousands	Rates per 100,000 people
1.	Republic of Kazakhstan	19.4	1,070.6	**5,787**
2.	Kyrgyz Republic	6.7	184.6	2,886
3.	Republic of Tajikistan	9.5	17.0	180
4.	Turkmenistan	6.1	0.0	0
5.	Republic of Uzbekistan	34.5	198.5	593

Central Asia		**76, 2**	**1,470.7**	**1987**

Table 3. Indicative rates of COVID-19 incidence per 100,000 people [16]

No.	**Country**	**Population** in millions	**Number of deaths,** in thousands	**Rates per 100,000 people**
1.	Republic of Kazakhstan	19.4	14.8	**76.2**
2.	Kyrgyz Republic	6.7	2.8	**43.0**
3.	Republic of Tajikistan	9.5	0.12	**1.3**
4.	Turkmenistan	6.1	0.0	0
5.	Republic of Uzbekistan	34.5	1.5	**4.5**
Central Asia		**76, 2**	**5,420.0**	**72.2**

Table 4. Indicative mortality rates from COVID-19 per 100,000 people [17]

The COVID-19 pandemic has led not only to a health crisis, but also to a significant decline in economic activity in all Central Asian countries in 2020-2021, a decline in productivity, exports and imports, tax revenues, external and internal receipts, payments, remittances, a decrease in income, investment, currency devaluation, increased expenditure, higher prices for energy, industrial and other goods, food, increased unemployment and poverty, and other negative processes. This, in turn, has led to a decrease in the rate of economic growth, and therefore, to a decrease in sustainable development, with all the ensuing negative consequences for both states and the entire population, especially the poorest and most vulnerable, including the elderly, women, and children.

The World Bank estimates that the economic shocks of 2020 will push between 1.4 and 1.9 million people in Central Asia below the $3.20 a day poverty line.

At the same time, it must be noted that the sharpest decline in key economic indicators was observed in 2020, precisely during the most difficult period of the widespread spread of coronavirus infection and the introduction of a state of emergency and strict restrictive measures.

In 2021, Central Asian governments have already brought the COVID-19 situation under control, improved economic management processes, gradually eased restrictions, and achieved a revival of economic activity, including through stimulating, establishing, and restoring trade and production ties, importing and exporting goods, attracting investment, supporting entrepreneurs, introducing tax breaks, partially writing off debt, providing social support to the most vulnerable segments of the population, and other socioeconomic measures.

[16,17] *Report on the assessment of the impact of COVID-19 on disaster risk management and resilience building in Central Asian countries . OSCE, UNDRR, CEDRR 2021.*

PART 3: VULNERABILITY

The vulnerability assessment results show that only Tajikistan is in the higher-risk category, while the remaining countries face a lower risk of vulnerability. Tajikistan's elevated vulnerability risk is a result of its high risk in the vulnerable groups dimension (extremely low food access), while the risk in socioeconomic vulnerability is lower.

The Kyrgyz Republic is at high risk of vulnerability due to its very high dependence on aid (remittances and international assistance), which results in a high value for the socio-economic vulnerability component of the measurement.

On the other hand, Uzbekistan and Turkmenistan are in the medium vulnerability risk zone due to a significant increase in risk in both vulnerability dimensions, while the values for Kazakhstan indicate a low vulnerability risk.

The vulnerability risk classes at the national level are shown on the map (Figure 8) and the values are presented in the Table below.

Fig. 19. Vulnerability of Central Asian countries [18]

3.1. Economic vulnerability

The Central Asian economy is highly vulnerable to natural disasters. The World Bank estimates potential losses for Central Asian countries ranging from 5% to 70% of GDP.

Several factors increase the vulnerability of Central Asian economies to natural disasters. Most countries have specialized, export-dependent economies, making them vulnerable to external shocks. This exacerbates the funding gap for implementing comprehensive DRR measures.

According to the INFORM subnational model, indicators on development, inequality, and social assistance dependence were considered in the socioeconomic vulnerability category. The following population groups were considered vulnerable: stateless persons, individuals applying for citizenship, ethnic diversity, groups with various diseases (HIV, tuberculosis, COVID-19), children under 5, food availability, and recent shocks (populations affected by emergencies in the past three years).

The region's economy is particularly vulnerable to meteorological hazards associated with climate change. The region's climate has become noticeably warmer. Across all countries, the average annual temperature has increased by 0.10–0.31°C per decade, above the global trend of 0.06°C.

[18] *Caucasus and Central Asia Subnational INFORM risk index 2021*

Overall, due to rising temperatures, aridity has increased. Precipitation variability has increased both yearly and seasonally. Heavy rainfall (15-20 mm or more in 24 hours) has become more frequent and irregular.

Industries directly dependent on weather conditions, such as agriculture, account for between 40% and 60% of GDP in Central Asian countries. Their importance is compounded by the fact that the majority of the region's population lives in rural areas and, due to a lack of employment outside the agricultural sector, remains heavily dependent on agricultural production as the source of their livelihoods.

In 2020, alongside with the coronavirus, Central Asian countries faced a massive locust infestation, the largest disaster of such scale in 20 years. Due to favorable weather conditions, Turkmenistan, Uzbekistan, and Tajikistan were hit by the locust plague. The locusts destroy crops across the regions by devouring vegetation in their path. The damage caused by the pests, coupled with reduced food production and the decline in global trade as a result of the coronavirus pandemic, has raised concerns about possible food shortages. According to the FAO, a swarm of insects covering just one square kilometer can accommodate "about 40 million locusts, which can consume the amount of food, that can feed 35,000 people, in a day"

3.2. Structural vulnerability

Structural vulnerability is primarily associated with housing and infrastructure. A strong earthquake can cause significant damage to housing and utilities.

Infrastructure, particularly for water drainage, distribution, and storage, remains vulnerable. In all countries, dams and other hydraulic structures built during the Soviet era have deteriorated significantly, and protective structures on many riverbeds have suffered significant wear.

Similar to the construction of buildings, for example, a building is considered vulnerable to earthquake shocks if its structure does not include elements that would withstand the impact of such shocks.

The high vulnerability of the population and territory of countries in the region to strong earthquakes and their secondary effects is often determined not by the threat or occurrence of strong earthquakes themselves, but by the physical condition and seismic stability of residential buildings, public buildings, and structures. People are injured and killed not by the earthquakes, but by earthquake-susceptible buildings and structures that collapse as a result. For example, the region faces a problem with large cities located in high-seismic hazard zones, where strong earthquakes can cause catastrophic situations. This is because these cities contain a significant amount of dilapidated, earthquake-susceptible housing, built between the 1940s and 1960s, including both single-story residential buildings and multi-story buildings (Stalin-era buildings, Khrushchev-era buildings).