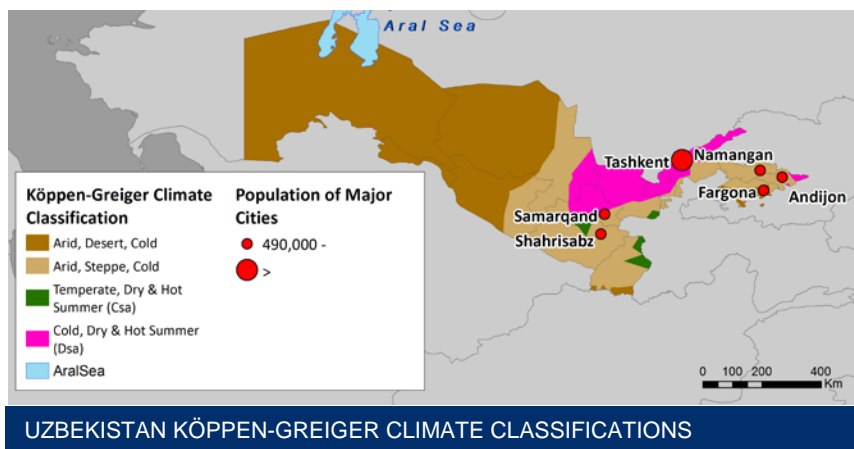


CLIMATE RISK PROFILE UZBEKISTAN

COUNTRY OVERVIEW

The Republic of Uzbekistan is a doubly landlocked country (landlocked and completely surrounded by landlocked countries) with a population of approximately 29.7 million—45 percent of the total population of Central Asia. The country has long relied on its robust agricultural sector, which comprises around 18 percent of total gross domestic product

(GDP) and is primarily based on cotton and wheat. However, the intensive farming practices that were in use until the early 1990s greatly depleted Uzbekistan's water resources and diminished its arable land. Due to extensive overuse of water, the Aral Sea has experienced a severe decrease in water surface area, from 67,000 square kilometers (km²) in 1960 to 4,000 km² in recent years. After the country gained independence in 1991, Uzbekistan implemented agricultural reforms to improve irrigation efficiency and still meet the demand for food. Despite these reforms, Uzbekistan as a whole still faces major challenges with desertification, water scarcity, and further depletion of the Aral Sea that are exacerbated by climate stressors such as increasing temperatures, more frequent and extreme droughts, lower precipitation levels during parts of the year, and changes in weather patterns that shift the growing season. These stressors are projected to intensify in the coming decades, significantly affecting economic sectors and natural resources throughout Uzbekistan. (2,4,19)



CLIMATE PROJECTIONS



2.0-5.4° C increase in annual mean temperatures by 2085



Increased frequency and severity of droughts



Changing precipitation patterns



More frequent and intense heavy rain events

KEY CLIMATE IMPACTS

Agriculture

Reduced crop yields
Lower livestock productivity
Decreased food security



Water

Decreased water availability
Decreased river flows and runoff
Increased salinization and mineralization



Tourism

Damaged tourism sites
Reduced draw for ecotourism
Damaged access to tourism sites



Ecosystems

Decreased biodiversity
Shifting species distribution
Increased desertification



Human Health

Increased heat-related illness
Increased waterborne and infectious diseases



Infrastructure

Increased deterioration and damage
Increased strain and demand, particularly for energy and water



August 2018

This document was prepared under the Climate Integration Support Facility (CISF) Task Order No. AID-OAA-BC-17-00042 and is meant to provide a brief overview of climate risk issues. The key resources at the end of the document provide more in-depth country and sectoral analysis. The contents of this report do not necessarily reflect the views of USAID.

CLIMATE SUMMARY

Uzbekistan has a generally dry climate with long, warm to hot summers and moderate winters. The country can be broadly divided into two climatic zones: the desert and steppe climate in the western two thirds of the country, and the temperate climate, characterized by dry summers and humid winters in the eastern areas. The climate in the southern areas is characterized as arid and subtropical. The terrain of Uzbekistan is mainly sandy desert with dunes (which comprise 78 percent of the country's land), foothills, and parts of the Tien-Shan and Gissar-Alay mountain ranges. The desert plains receive only around 80-200 millimeters (mm) of precipitation annually, while the foothills can get as much as 300-400 mm and the mountainous regions receive up to 600-800 mm per year. Rainfall occurs mostly in late fall through early spring, dropping off significantly during the summer months. The country is prone to large fluctuations in temperature, both seasonally and from day to day. Average monthly temperature for the country is highest in July, at 27.2°C, and lowest in January, at -3.2°C. However, temperature ranges vary across the country. Uzbekistan's desert regions can reach maximum temperatures of 45-49°C, while minimum temperatures in the southern parts of the country can drop as low as -25°C. Uzbekistan is exposed to a range of weather-related extreme events, including dust storms, mudflows, floods, drought, and avalanches. (2,3,11,14,29)

HISTORICAL CLIMATE

Climate trends from the 20th to early 21st century:

- Increased annual average temperature of 0.13°C per decade between 1901 and 2013, with a substantially higher increase of about 0.51°C per decade between 1983 and 2013.
- An increase in precipitation of five percent every 30 years from 1901 to 2013.
- Temperature increase is strongest at low altitudes.
- Temperature increase is strongest during the winter months, particularly November and December. In contrast, spring exhibits a slightly decreased average temperature.
- Annual number of days with frost has decreased by an average of four to five days every decade.
- Average number of days with a maximum of 40°C in the central part of the Kyzylkum desert has increased from 10 days in the 1950s to more than 20 days in 2016. (3,11)

FUTURE CLIMATE

Projected changes include the following:

- Increased annual mean temperature of 1.3 to 2.1°C by 2030, 1.8 to 3.3°C by 2050, and 2.0 to 5.4°C by 2085.
- Increase in annual maximum temperature of 2.1 to 6.3°C and increase in minimum temperature of 2.2 to 5.6°C by 2085.
- Long-lasting heat waves are projected to increase in duration by 3 to 9 days by 2030, between 4 and 17 days by 2050, and between 6 and 43 days by 2085.
- Anticipated change in total annual precipitation ranges from a decrease of three percent to an increase of 12 percent by 2030, and a decrease of 6 percent to an increase of 18 percent by 2085, with most projections showing an increase.
- Likely increased precipitation between November and April, with precipitation in other months remaining stable or decreasing slightly.
- Dry spells are expected to grow longer by up to four days by 2085.
- Overall increase in arid conditions due to changing precipitation patterns and increased temperatures.
- Heavy rain events are projected to increase in intensity by 3 to 11 percent and frequency by 7 to 36 percent by 2030, and in intensity by 7 to 23 percent and frequency by 12 to 74 percent by 2085. (3,11)

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

Uzbekistan’s agricultural industry remains one of its economy’s most important sectors, accounting for around 18 percent of the country’s GDP and employing about 27 percent of the country’s working population. In addition to providing employment for a large proportion of the population, agricultural activities heavily affect the incomes of 49 percent of Uzbekistan’s total population (about 15 million people), especially those in rural areas. The impacts of climate stressors on agriculture are therefore likely to disproportionately affect the rural poor, with negative consequences for nationwide poverty levels. In addition to worsening economic inequality, changing climate conditions and increased climate variability are likely to have adverse impacts on both crop and livestock production¹, thus threatening both food security and nutrition for the country. The country’s most commonly grown crops are wheat and cotton, which accounted for 36 percent and 32 percent (respectively) of all crops on irrigated land (approximately 42,000 km²) in 2013. Increasing temperatures and more variable rainfall will likely combine to result in decreased yields for crops that are sensitive to heat and drought stress, such as wheat and cotton, as well as apples, potatoes, and tomatoes. For example, cotton yield losses due to increasing temperatures may reach 10 to 12 percent for farms in the southern regions of the country, and across the country almost all crops are expected to experience yield reductions of 10 to 25 percent by 2050. Rising temperatures and increased evaporation are expected to both directly affect crop yields and further reduce water supplies, which are likely to also experience stress from changes in precipitation patterns. The deterioration in water supply is also likely to be accompanied by an increase in demand for irrigation water. Current projections estimate that irrigation water demand in Uzbekistan will on average increase by five percent by 2030 and 7 to 10 percent by 2050, with high-impact scenarios suggesting increased demand of up to 25 percent by the 2040s during summer months. Livestock also face a critical concern: projections estimate a reduction in livestock breeding productivity due to increased heat stress and the impact of hotter summers on fodder supply. Rising temperatures and changes in precipitation patterns and humidity may also stimulate livestock disease outbreaks and contribute to outbreaks of agricultural pests, such as locusts. (2,5,8,10,11,14,25,26,27)

WATER RESOURCES

Given the prevalence of desert terrain and arid climate in Uzbekistan, water is one of the country’s most precious resources. Uzbekistan is highly dependent upon its water resources, both for hydropower generation (which accounts for 13.6 percent of the country’s domestic electricity production) and for farm irrigation, which consumes up to 90 percent of the country’s total water withdrawals. Glacial melt dynamics and seasonal snow melt from the mountainous regions provide most of the fresh water resources, largely channeled through the Aral Sea

Climate Stressors and Climate Risks AGRICULTURE	
Stressors	Risks
Increased Temperatures	Decreased access to water for irrigation
	Increased demand for irrigation water
Changes in precipitation patterns	Reduced crop yields and productivity
	Lower livestock breeding productivity
Increased drought	Increased food insecurity
	Increased pest and disease outbreaks for livestock and agriculture

Climate Stressors and Climate Risks WATER RESOURCES	
Stressors	Risks
Increased temperatures	Increased glacial and snow cover melt
	Long-term decreased river flows and runoff
Changes in precipitation patterns	Decreased water available for irrigation
	Increased salinization and mineralization of water resources
Increased drought	Decreased availability of drinking water
	Reduced hydropower productivity

¹ In 2016, crops comprised 61 percent of total agricultural production and livestock accounted for the remaining 39 percent.

basin, which includes the Amu Darya and Syr Darya river basins, various smaller rivers, and underground waters. The long-term viability of the Aral Sea as a source of water for Uzbekistan is a critical challenge for the country, a consequence of intensive water use, particularly for irrigation, contributing to a significant reduction in total area and increased salinization. This issue will likely be exacerbated by climate stressors across Uzbekistan as well as the upper watersheds beyond the country's borders that feed the Aral Sea basin. Projections forecast reductions in overall precipitation, annual snow cover, and glacial mass, signifying a likely decrease in the long-term average runoff of the major rivers throughout the territory. While Uzbekistan is expected to experience a small increase in precipitation during the winter months, the decreases in other months, particularly in the summer, will likely lead to either stable or slightly decreasing total annual precipitation. Combined with increasing temperatures, including in the spring, there will likely be a decline in annual snow accumulation that will contribute to decreased snow melt and river flows. Likewise, current projections suggest the glaciers in the upper watersheds of the Amu Darya river basin will follow the global trend of a general recession in size. Due to higher average temperatures, the low-elevation glaciers are likely to recede, and seasonal glacier melt may be depleted over time. The growing water deficit along with increased year-to-year variability will likely have cascading, adverse effects on multiple other sectors, including agriculture (which requires water for irrigation) and human health (due to shortages in drinking water). Both large and small hydropower stations are expected to experience decreased productivity due to reduced streamflow, particularly during summer and autumn months. (2,8,9,11,23)

TOURISM

Uzbekistan's cultural and historic sites are critical drivers of its tourism industry, particularly given its position along the ancient Silk Road trade route. In addition to four UNESCO World Heritage sites² and 754 landmarks, environmental attractions are a main draw for tourists visiting the country. The country's clement weather, scenic landscapes, and diverse wildlife habitats have made Uzbekistan a destination for ecological tourism. The varied ecosystems and natural features, however, are expected to become increasingly fragile in the face of increased climate

stressors and changing climate patterns. Increasing aridity due to rising air temperatures and decreased precipitation threaten the aquatic, forest, and wetland habitats that are home to a diverse array of plant and animal species, including 26 endangered species of bird. Shrinking biodiversity and broader climate-related impacts on ecological systems in Uzbekistan may act as a deterrent to ecotourists, while increased incidence or severity of extreme weather-related events such as droughts, floods, and mudslides could negatively affect tourism more broadly. The expected increase in average temperatures combined with a rise in precipitation during the cold season are likely to increase the number of mudflows and floods at the end of winter and beginning of spring. Such extreme events can threaten not only the physical integrity of sites and landmarks themselves, but also the ability to access the sites and the tourist infrastructure developed to support the industry (e.g., hotels and mountain ecotourism facilities). Increased duration and intensity of heat waves along with the impacts of increasing temperatures and drought on drinking water demand and availability could diminish tourism demand. (11,15,18)

Climate Stressors and Climate Risks TOURISM	
Stressors	Risks
Increased temperatures	Damage to sites of historical, cultural or ecological importance
More frequent or intense extreme weather events	Decreased access to tourist sites
Changes in precipitation patterns	Decreased biodiversity and ecological conditions
	Less amenable weather conditions for tourism

² The cities of Ichan-Kala and Samarkand, and the historic centers of Bukhara and Shakhrisabz

ECOSYSTEMS

Uzbekistan boasts many biologically diverse ecosystems. In addition to mountains, foothills, and desert regions, the country’s territory includes tugai (riparian) woodland forests, fruit forests, and wetland habitats. Combined, these ecosystems are home to approximately 714 distinct vertebrate species (including fish, amphibians, reptiles, birds, and mammals), as well as 4,300 species of plants. Changing climate conditions may exacerbate the existing degradation of these species and their habitats, mostly due to changing water regimes and insufficient water resources. Changing precipitation patterns combined with increased drought accelerate land degradation in the already arid country. This threatens biodiversity, particularly in the Usturt Plateau, Kyzylkum desert, and Aral Sea region. Uzbekistan’s forests, which provide an essential wildlife habitat, prevent erosion, improve the quality of water flowing into rivers, and absorb carbon dioxide, are projected to deteriorate as a result of changing climate conditions. Reduced runoff from the Amu Darya and Syr Darya rivers is expected to reduce the annual flooding events upon which tugai woodland forests rely for their survival, potentially leaving this habitat endangered. In addition to reduced water availability to sustain these ecosystems, increasing air temperatures contributing to a corresponding rise in water temperature along with increased salinity can be expected to damage aquatic habitats and their various fish species. Increased air temperatures are also projected to shift certain species’ habitats upward in the mountainous regions of the country, especially insect and plant species. Shifts in seasonal temperatures and changing rainfall patterns may also threaten the survival of some plant species, thereby harming the insect species that rely on those plants. Birds and large mammals may also face negative consequences as a result of increased competition for water and pasture sites. (5,6,7,11,12)

Climate Stressors and Climate Risks ECOSYSTEMS	
Stressors	Risks
Increased temperatures	Increased land degradation and desertification
Changes in precipitation patterns	Reduced biodiversity
	Change in species composition and distribution
Increased drought	Increased stress for aquatic species due to higher water temperatures
More frequent or intense extreme weather events	Increased ecosystem fragmentation

HUMAN HEALTH

Since the early 2000s, Uzbekistan has implemented sweeping reforms to modernize its public healthcare system, transitioning from a centralized government-financed system to a combination of public and out-of-pocket payments. While these reforms have coincided with marked improvements in certain health indicators (e.g., decline in overall child and maternal mortality rates), the country still faces significant public health challenges. More than 30 percent of Uzbekistan’s households lack quality drinking water, leaving them vulnerable to bacterial and microbial diseases which spread more widely during warmer weather. Incidence of bacterial dysentery already increases three-fold in summer months, and incidence is expected to increase as temperatures rise. In addition, decreased streamflow and water volumes could lead to an increased concentration of pathogens in water sources, further compounding the risk of disease. Health complications related to more frequent and severe heat waves also pose an increased risk for Uzbekistan, particularly for vulnerable populations including the elderly and those suffering from hypertension and cardiovascular disease, which is already the leading cause of death in the country. Reduced rainfall and rising temperatures also contribute to aridity and desertification, which are likely to increase the occurrence of dust storms. Over 5.5 million people in Uzbekistan have already become increasingly affected by dust storms, which constitute a major health concern for children and those at risk of respiratory diseases. Shifting climatic patterns are also expected to exacerbate the incidence of communicable diseases, which poses an especially high risk for women, children, and the elderly. Although the country has undertaken successful measures to eradicate malaria (once one of the most widespread diseases in Uzbekistan), warmer temperatures that are more favorable to the mosquitoes that transmit malaria create the possibility of a resurgence. (11,13,17,21,22,27)

Climate Stressors and Climate Risks HUMAN HEALTH	
Stressors	Risks
Increased temperatures	Increased incidence of water-borne disease
Increased heat waves and other extreme weather events	Higher prevalence of heat-related medical conditions
Changes in precipitation patterns	Favorable conditions for infectious diseases
	Increased dust storms and higher risk of respiratory disease

INFRASTRUCTURE

Changing climate conditions may adversely impact multiple components of Uzbekistan’s infrastructure, including for transportation, communication, water resources and energy. These are all susceptible to damage from increased frequency and/or intensity of extreme weather events, particularly flooding and mudflows. Increasing temperatures and extended heat waves can deteriorate transportation infrastructure as well as water and irrigation infrastructure, which are expected to experience increased demand due to those same climate stressors and drought. Such impacts to infrastructure can be expected to negatively affect economic growth, tourism, and provision of critical services (e.g. health and emergency services). Energy infrastructure is expected to experience particularly high climate risk, particularly due to increasing demand for fuel and energy. Thanks to a rich abundance of hydrocarbon resources, Uzbekistan has built a robust energy sector that accounts for seven percent of the economy’s GDP and has allowed the country to achieve complete energy independence. Increasing temperatures, changing precipitation patterns, and decreased water availability are likely to reduce energy production and transmission, which will have cascading effects on other infrastructure systems that rely on electricity to function. Warming temperatures can not only stress the electrical grid, reducing the reliability of the electrical supply, but also diminish productivity of gas turbines in the country’s thermal power stations. Increasingly frequent and intense drought along with reduced streamflow are likely to

Climate Stressors and Climate Risks INFRASTRUCTURE	
Stressors	Risks
Increased temperatures	Deterioration of and damage to hard infrastructure
More frequent or intense extreme weather events	Increased demand and stress for water resources, including for irrigation
Increased drought	Decreased productivity of thermal power and hydropower
Changes in precipitation patterns	Higher demand for electricity
	Increased heat stress and need for power plant cooling systems

both decrease water available for power plant cooling systems and threaten productivity of Uzbekistan's hydropower stations. (1,11,24,27)

POLICY CONTEXT

Uzbekistan has taken deliberate steps to incorporate climate change considerations into their national strategies, plans, and governmental decrees. The country has also submitted three National Communications to the United Nations Framework Convention on Climate Change (UNFCCC) and their Intended Nationally Determined Contribution. However, Uzbekistan still lacks a comprehensive, nationwide framework for climate change adaptation. Legislative actions have mainly consisted of decrees issued by the president and various cabinet ministers regarding climate change mitigation measures for individual sectors (e.g., energy, water, agriculture). As of 2016, Uzbekistan was in the process of developing a National Adaptation Plan. (14)

INSTITUTIONAL FRAMEWORK

Efforts to address climate change in Uzbekistan are largely dispersed throughout sector-specific entities. For example, the main government ministries responsible for implementing Uzbekistan's obligations under the UNFCCC include: the Centre of Hydrometeorological Service (Uzhydromet) at the Cabinet of Ministers of the Republic of Uzbekistan, the Ministry of Economy, the Ministry of Agriculture and Water Resources, and the Ministry of Health. The State Committee on Nature Protection also plays a key role in ecological education and human health initiatives. However, Uzbekistan does not have a single lead ministry or committee solely responsible for coordinating climate change initiatives for the country. (11, 20)

NATIONAL STRATEGIES AND PLANS

- [Third National Communication of the Republic of Uzbekistan to the UNFCCC](#) (2016)
- [Intended Nationally Determined Contribution](#) (2017)
- Program of Measures for Reduction in Energy Consumption, Introduction Energy Saving Technologies in Economy Sectors and Social Sphere for 2015-2019 (2015)
- Program of Actions for Environmental Protection of the Republic of Uzbekistan for 2013-2017 (2013)
- Program for Further Development of Agricultural Production for 2015-2019 (2015)
- Program for Further Irrigated Lands Improvement and Rational Use of Water Resources for 2013-2017 (2013)

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Map resource: Global Precipitation Climatology Centre (GPCC). 2015. GPCC Normal Version 2015 0.25 degrees. <https://kunden.dwd.de/GPCC/Visualizer>

SELECTED ONGOING EXPERIENCES⁴

Current or recently completed development efforts related to climate change in Uzbekistan. Projects were selected through review of USAID, other donors’, and implementing partner project databases.

Selected Program	Amount	Donor	Year	Implementer
Piloting Climate Change Adaptation to Protect Human Health in Uzbekistan	\$550,000	UNDP	2011-present	Ministry of Health – Uzbekistan, WHO, UNDP-GEF
Reducing Pressures on Natural Resources from Competing Land Use in Non-Irrigated Arid Mountain, Semi-Desert and Desert Landscapes of Uzbekistan	\$2.5 million	UNDP	2014-2018	The State Committee of the Republic Uzbekistan on Land Resources, Geodesy, Cartography and State Cadaster, UNDP
Developing climate resilience of farming communities in the drought prone parts of Uzbekistan	\$5.4 million	UNFCCC Adaptation Fund	2014-2020	UNDP, Uzhydromet
Namangan Water Project	\$60 million	EBRD	2018-present	State Unitary Enterprise Namangan Suvokova
Livestock Sector Development Project for Uzbekistan	\$236.5 million	World Bank	2017-2022	Ministry of Agriculture and Water Resources of the Republic of Uzbekistan

⁴ This “Selected Ongoing Projects” section lists a selection of ongoing development projects and interventions directly or indirectly relevant to climate risk management and adaptation in Uzbekistan. Projects were identified primarily via desk review of USAID, multi-lateral development bank, and other international donor programming. Projects listed are not meant to be comprehensive.

Selected Program	Amount	Donor	Year	Implementer
Climate Adaptation and Mitigation Program for Aral Sea Basin	\$38 million	World Bank	2015-2021	EC-IFAS, Tajikistan and Uzbekistan, Executive Committee for International Fund for Saving the Aral Sea
Uzbekistan: Power Generation Efficiency Improvement Project	\$1 billion	ADB	2017-2023	Ministry of Finance of the Republic of Uzbekistan, Unitary Enterprise Talimarjan TPP
Supporting Environmental Safeguards in the Central and West Asia Region	\$750,000	ADB	2018-2019	ADB (Technical Assistance)
Smart Waters	\$9.5 million	USAID	2015-2020	Regional Environmental Centre for Central Asia
Regional programme on integrative and climate sensitive use of land resources in Central Asia	\$6.6 million	GIZ	2017-2020	German Federal Ministry for Economic Cooperation and Development (BMZ)
Sustainable and Climate Sensitive Land Use for Economic Development in Central Asia	\$7.2 million	GIZ	2014-2018	German Federal Ministry for Economic Cooperation and Development (BMZ)
Integrated Natural Resources Management in Drought-prone and Salt-affected Agricultural Production Systems in Central Asia and Turkey (CACILM2)	\$75.7 million	UNDP	2017-2021	UNDP, Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, Centre of Hydro-meteorological Services under the Cabinet of Ministers of the Republic of Uzbekistan
Agricultural Value Chain Activity in Uzbekistan	\$17 million	USAID	2015-2020	DAI